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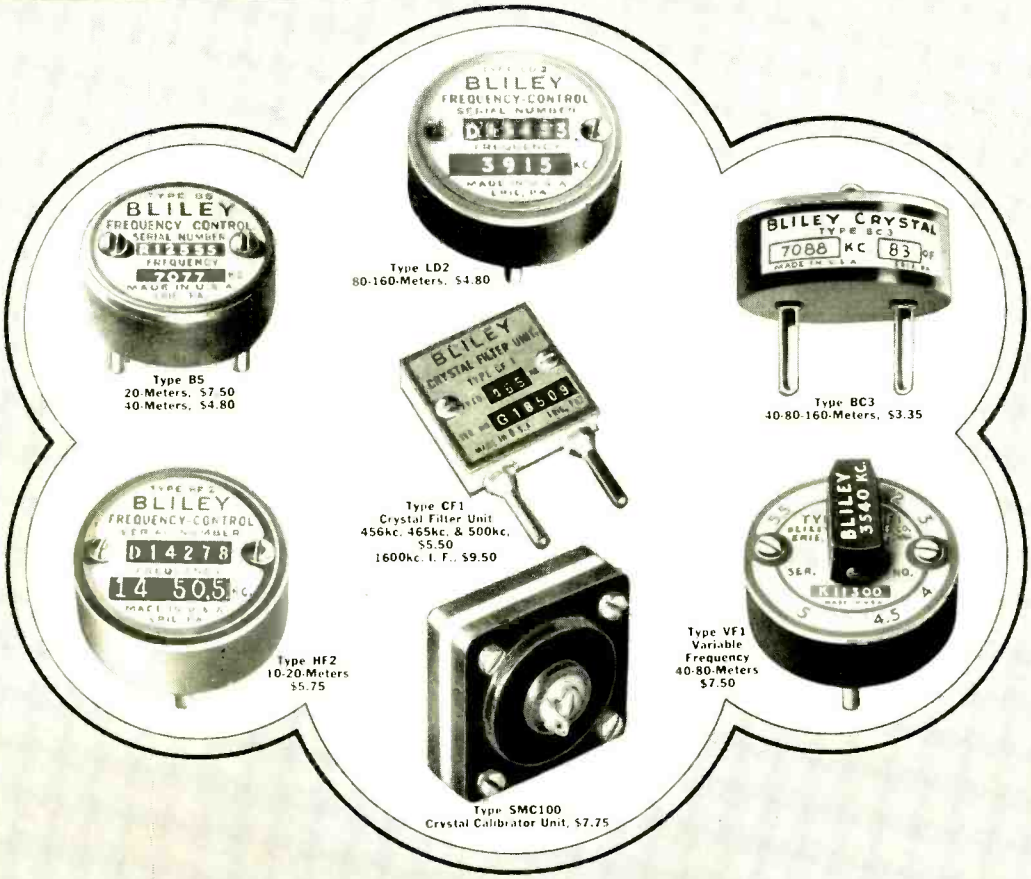

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The Editors . . . . . of "Radio"

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The Worldwide Technical Authority of Amateur, Shortwave, and Experimental Radio

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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 this month has been produced at a printing plant some 3000 miles from its editorial and business offices! To the best of our knowledge this constitutes some sort of a record, though there are some close runners-up (several of the Fawcett publications, edited in Hollywood, are printed in Louisville).

From Los Angeles all editorial copy goes 3000 miles eastward by air mail or teletype to our managing editors in New York, thence 100 miles (straight back toward Los Angeles!) to the plant of the Hughes Printing Company at East Stroudsburg, Pa., where RADIO is now printed and from which it is distributed.

Never happy in its inability to reach its eastern readers (who constitute the great majority) at what they consider as "on time," RADIO has completed these arrangements in the hope of delivering copies more promptly both to subscribers and dealers.

And now let us introduce to you our managing editors. Our managing editor for the past two years, M. M. Lloyd is now in New York, for we wish to take no chances of backsliding from the improved appearance of RADIO which has lately caused so much comment.

The other managing editor is R. P. Turner, W1AY, (formerly "Radioddities" Editor) who will particularly watch out for those "boners" unlikely to be caught by non-technical proofreaders, in addition to performing the usual duties of a managing editor. And in his spare time, if any, Mr. Turner will be a sort of editorial Diogenes with light in hand, ear to the ground, and nose in the air (quite a feat!) in search of likely editorial material in the metropolitan area.

And back in Los Angeles "The Editors of RADIO" will be anxiously scanning page proofs for the "final OK", and wondering whether or not the whole idea will work.

ALL PUNCHED CHASSIS GIVEN

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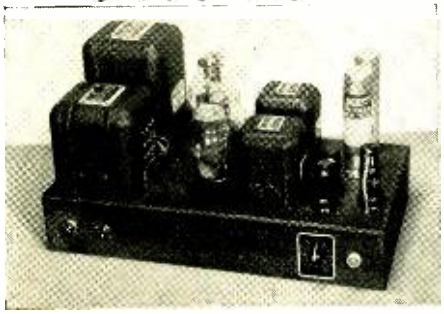

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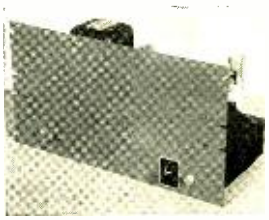

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Oct. · 1938 Number 232

RADIO

In this issue "Radio" presents:

ARTICLES

MISCELLANEOUS FEATURES

DEPARTMENTS

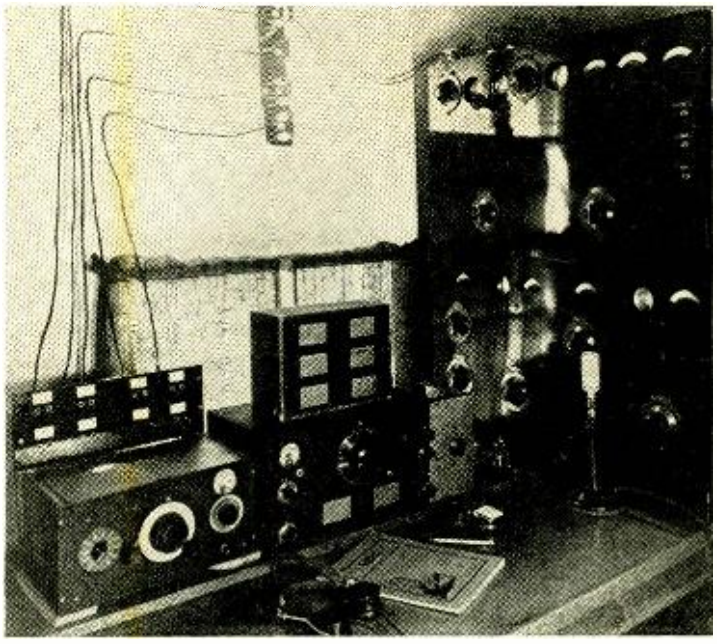
FRONT COVER—HOWARD HUGHES PLANE (KHBRC) FLYING OVER NEW YORK

(Photo, Copyright Intl. News Photos, Inc.)

THE WORLDWIDE TECHNICAL AUTHORITY OF AMATEUR, SHORTWAVE, AND EXPERIMENTAL RADIO

Flight Headquarters

W2GOQ's operating position at Flight Headquarters on the World's Fair Grounds, Flushing, Long Island, N. Y. W6CUH is at the key, working KHBRC, then four hours out of Floyd Bennett Field and heading over the Atlantic. Weatherman Wm. (Rocky) Rockefeller standing by. Note patch panel for the six receiving antennas in upper left-hand corner. Clocks show Greenwich mean time.



W2UK at Quogue, Long Island, N. Y., was one of the ground stations.

Amateur Radio and the Hughes Flight

By R. P. TURNER,* W1AY/2

July 14th was a red-letter day for aviation. Air history was made on that midsummer afternoon when Howard Hughes brought his plane down at Floyd Bennett Field, where he and his four assistants had taken off only three days, nineteen hours and eight minutes before to fly over 14,000 miles around the world. Colonel Lindbergh's New York-to-Paris record and the globe girdling mark set by Wiley Post both had been shattered.

The day was no less one of triumph for amateur radio. The ham had chalked up another good score for himself by maintaining contact with the speeding Hughes plane as it signed KHBRC around the world. The three U. S. amateur stations comprising the ground communication net had edged through at times when the commercials found the sledding rough.

Information regarding weather conditions had been collected and transmitted to the crew in flight, messages had been exchanged, reports regarding the operation of the plane received, and the broadcast chains had been supplied with a running account of flight progress between their regular rebroadcasts. Ninety percent of the attempted QSO's had been successful.

To Richard R. Stoddart, radio engineer of the crew, and his assistant, Charles D. Perrine, W6CUH goes the credit for the year-long design and development of special radio equipment used on the Hughes flight. D. H. (Dave) Evans, W4DHZ, also associated with the Hughes Company, assisted in the installation. But to Perrine particularly goes the credit for the careful preparation and phenomenally successful operation of the amateur ground station setup.

The amateur rank and file knew nothing of the preparations. From the start, secrecy was the keynote of all operations. It was deemed necessary for the sake of coordination, reliability, and

* Managing Editor, RADIO.

ease of control to avoid participation by a large number of hams. We understand too on good authority that the radio amateur was given somewhat of a black eye with the aviation people as a result of the questionable reports he made during the Earhart disaster.

The three stations comprising the ground station net were W2GOQ, headquarters station located at Wayne, N. J. and keyed by means of land-wire remote control from the World's Fair Flight Headquarters at Flushing, Long Island, N. Y.; W2UK, operated by Ralph (Tommy) Thomas at Quogue, Long Island; and W6CUH, Perrine's home station at Hermosa Beach, Calif., operated by Dave Evans, W4DHZ. Each transmitter was operated with a kilowatt input on the confidential frequencies 7000.-005 kc. for night use and 14000.01 days.

During the two weeks prior to the flight, the network was put through its paces carefully. For practice, weather data was handled by the operators, each of whom has been prominent in several recent dx contests.

Perrine was stationed at the flight's communication center—the radio room at the World's Fair Flight Headquarters at Flusing, L. I. From that point for four days and three nights he and four commercial operators keyed W2GOQ by remote control, contacting the Hughes plane or supervising the ground net. Direct land wire was available twenty-four hours a day between headquarters and W2UK. This line was kept buzzing daily when W2UK was called upon to copy weather reports unreadable at the headquarters station because of the poor receiving location. Invariably, Tommy came through with hundred-percent copy, due in large part, no doubt, to his experience in copying numbers in dx contests. W2UK was assisted by John M. Etter, formerly W1DHE.

There were two communications receivers in constant use at each station. One was kept tuned to the frequency in use by the net, the other used to locate the plane on any of its eighteen operating frequencies.

Shortly after the take-off, the plane, KHBRC was in contact with W2GOQ on 7000.005 kc., maintaining the QSO halfway across the Atlantic. W2UK made several contacts beyond that point. At one time, to offset effects of the Atlantic skip zone, W6CUH was detailed to call KHBRC and worked the plane at the first crack. The varied message content included reports regarding operation of the plane, weather data and arrangements for chain rebroadcasts.

Stoddart found it difficult to keep definite schedules with the amateur ground stations, more direction finding work than anticipated having become necessary. During the first part of the flight, the ground stations awaited calls from KHBRC whenever contact was desired, but this plan did not measure up to expectations. A new procedure was adopted later, the ground stations calling KHBRC continuously during the first five minutes of each quarter-hour period, announcing their best listening frequencies. The reasonably long calls gave Stoddart, on board, sufficient time to shift the transmitter frequency.

While flying over Europe and Russia, KHBRC maintained no contact with either of the ham stations, comunicating mostly with foreign ground stations. During this period, the amateurs forwarded weather reports to the various landing points by way of the land communication services.

Hughes required daily weather forecasts for the entire northern hemisphere, and the majority of the receivers at Flight Headquarters were used to gather information for the forecasts. The official international weather reports are transmitted in number code at thirty to thirty-five words per minute from NAA, Arlington, Va.; NPG, San Francisco; GFA, London; FLJ, Paris; DDX, Berlin; IMB, Rome; RNO, Moscow; NPM, Honolulu; and NPO, Cavite. The reports received by the ham ground stations amounted at times to thirty pages of material which had to be condensed to fifty-word forecasts by Weatherman W. C. Rockefeller (soon to be a ham after this exposure).

A recording Teleplex was available at Flight Headquarters but the boys there had no occasion to use it because of inability to copy the fast "weather."

At W6CUH Dave Evans gathered most of the Siberian weather reports and made schedules with K7PQ at Ketchikan, Alaska who assembled all his local weather data and passed it on to Dave to be relayed to Flight Headquarters where the forecasts were prepared. On one occasion this enabled the forecast to include weather data only a few minutes old. Several plane messages were relayed to the headquarters station less

than one minute after they had been received.

KHBRC heard W6CUH calling while the plane was on the hop from Moscow to Omsk but could not raise him. Later, however, while one hundred miles out of Yakutsk (five-thousand miles from Hermosa Beach) on its way to Fairbanks, KHBRC was in two-way QSO with W6CUH, the former using both phone and c. w.

In this first QSO from Siberia, crew members inquired about their wives, and Perrine at Flight Headquarters telephoned each in New York City and relayed the messages to the plane by way of W6CUH.

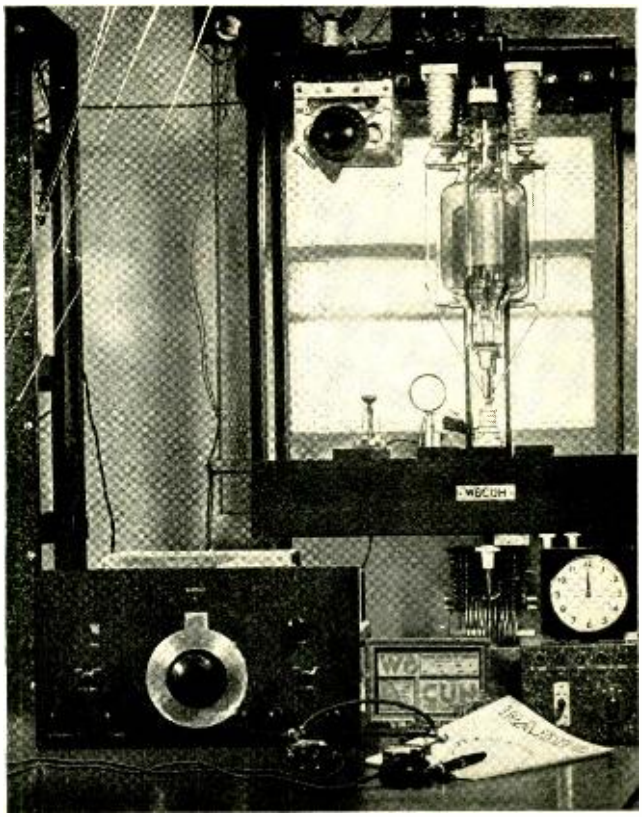
The only U. S. contact made on the way down from Fairbanks was with W6CUH. The only other contacts were with a few Coast Guard and airways stations along the route.

The several contacts maintained when the plane was between Yakutsk and Fairbanks were the only ones made with the United States, since the commercials had difficulty hearing the plane.

At this point, when press reports concerning the contacts out of Yakutsk were circulated, reporters and broadcast men descended upon Perrine's shack at Hermosa Beach. The piazza was teeming with newsmen. Representatives of CBS and MBS lost no time setting up their remote equipment.

R. f. from the W6CUH transmitter found its way into the broadcast audio channels, thence out over the nation-wide hookup. One ham heard W6CUH's c.w. signals pouring out of his car radio R9 plus and drove home forthwith to sober up!

At W2UK the final was a push-pull 250TH stage, the antennas a lazy-H for West Coast operation and a V for Europe. At W6CUH separate finals were used on 7000.005 and 14000.01, both operating with one kilowatt input. The 20-meter final used 250TH's in push pull and the 40-meter stage, push-pull WE251A's. On twenty meters a lazy-H pointed into Canada and toward the Atlantic. The second antenna was a four-wavelength wire stub-fed from a 600-ohm line and tilted down a hill which



W6CUH at Hermosa Beach, Cal.

slopes in the direction of Siberia. This antenna was ninety feet high at one point, twenty feet high at the other. The W6CUH transmitter contained Perrine's own automatic frequency shifting apparatus.

The plane carried three transmitters, four receivers and six antennas, comprising the most complete and flexible aircraft installation yet attempted.

The main transmitter and emergency unit were of chief amateur interest. The former was a 100-watt c.w. and plate-modulated rig, operated on eighteen frequencies from 333 kc. to 23,100 kc. with complete bandswitching. This transmitter was used in all communications and broadcast work.

The 34-lb. emergency unit contained a transmitter, receiver, battery supply for both, and all accessories completely self-contained in a 15"x10"x8" case. The entire unit was waterproofed in order that it might be operated while floating in water if the plane was forced down in the ocean. Fifteen watts of c.w. or i.c.w. on four crystal frequencies between 500 kc. and 16,000 kc. were avail-

[Continued on page 96]

Last Minute Notes from the

The first A.R.R.L. National Convention since 1925 was held in Chicago during the Labor Day week-end. Two thousand amateurs registered, with some additional ones attending the technical meetings. Among those coming from far away were PK3AT, ZL2JQ, XE1GE and XE2FC.

After a morning of squinting at calls on badges and recognizing old friends, the technical talks got under way. There appeared to be as many candid cameras present as "hams."

Marshall Wilder, W2KJL, demonstrated a British television receiver using a twelve-inch kinescope tube. A single picture on a monotron tube was used in the transmitting apparatus. Wilder mentioned his Berlin meeting with Dr. Hollman who has a novel means of demonstrating antenna radiation patterns. Using two shallow wooden boxes placed one inside the other, with distilled water in the inner one, and salt water between the two, a scale model of an antenna is submerged in the distilled water. The antenna is excited at the proper frequency, determined by the scale used, and a small doublet with a light bulb connected to it is run back and forth in the water. An overhead camera records the light intensity at all points and shows the antenna pattern on the developed film. Metal house models have been placed in the water to demonstrate how the theoretical pattern is distorted by actual surroundings.

John Reinartz, W1QP, demonstrated his harmonic generator and transmitter using two 6L6's and an 814. The first tube runs on the crystal frequency; the second tube has its output inductively coupled back to its input at the harmonic frequency in order to boost up the harmonic power. This arrangement works up to the fourth harmonic of the crystal frequency, the 40- to 10-meter output being just sufficient to excite the 814 final. An 802-807 combination works up to the 11th harmonic with 10 watts output on the 8th. John bet pennies with the audience on points such as self oscillation, the effect of removing the crystal, etc. He nearly lost a nickel when running straight through on 80 with no shielding; but showed that if the heavy excitation is controlled by detuning the driver, there is no oscillation in the final even when keying the crystal tube cathode.

T. R. McElroy, W1JYN, demonstrated high speed telegraphy for an NBC broadcast.

John Kraus, W8JK, reviewed antenna and flat-top beam theory. He also discussed the extended variety antenna and Dr. Hollman's suggestion of using three half waves, suppressing the central half wave by continuing the second feeder wire along the antenna for a short distance.

Saturday evening was given over to a fun session, which must have been well attended judging from the low attendance at the technical meetings the next day.

Naval Communication Reserve and Army Amateur meetings ran concurrently with the u.h.f. discussion on Sunday morning. Frank Lester reviewed his experiences while trying to get a commercial receiver to operate as well as a broad, acorn resistance-coupled superheterodyne, from a sensitivity standpoint. The circuit finally selected used a Sylvania 1231 television pentode in a regenerative r.f. amplifier ahead of a 6K8 converter with 3.5-Mc. output. Ross Hull said that recent measurements on a receiver using a 10-Mc. i.f. indicated that the 6K8 is far superior to the acorn tube as a converter.

We presented our paper trying to explain 56-Mc. dx. Some ninety per cent of those present at the meeting had worked beyond 400 miles on the five-meter band, but only W8VO and W5EHM had made contacts beyond 1200 miles.

Ross Hull and Marshall Wilder spoke at an amateur television meeting. They pointed out that experiments might be started without the r.f. end in either transmitter or receiver, by using an ordinary oscilloscope tube for receiving. For transmitting, a white field with a dark band across it (a wire across the screen) might be used for test purposes.

Wilder has transmitted actual scanned pictures on amateur frequencies above 112 Mc. over a distance of several miles, and promises relatively inexpensive television tubes (kinescope and iconoscope) at an early date. The Indianapolis gang already is placing a single-picture monotron signal on the air for test and edu-

A.R.R.L. National Convention

cational purposes. The Chicago gang promised that a local 2½-meter transmitter will soon be putting out a monotron picture signal in their area.

Sunday afternoon was devoted to the discussion of League business. Mr. Warner explained that in Europe the attitude of numerous countries is to cut amateur bands to one-third to one-half their present size, ultimately eliminating the amateur altogether· that some concessions may eventually be necessary in the U. S. Complete reasons for this possibly were enumerated in an earlier talk.

The discussion period later in the afternoon included the usual dog-fight. We understand that no important business was transacted. There was some comment on the rule that a director must have held a license for four years —aimed, it is rumored, at a director who holds no license and who has not owned a station since "spark" days. For reasons of mental balance and matrimonial bliss, we cut the business meeting in favor of a few hours of tennis.

The main speaker at the banquet was Richard Stoddart who circled the globe with Howard Hughes.

The code speed awa d was given to John Huntoon, W9KJY, who was not pushed, as he was two years ago, by competition above 50 w.p.m. The Taylor T200 tube was drawn by the Eimac family!

At the first Monday tecnnical meeting, Professor Hartig of the University of Minnesota demonstrated antenna and transmission line theory by means of motor driven waves on a string and a neon-tube stroboscope to "stop" the motion of traveling and standing waves. Transmission line termination, impedance match, and such things were made visible in this demonstration.

Fritz Franke illustrated aircraft radio apparatus with lantern slides, including pictures of band-switching transmitters of various types.

Ross Hull reviewed his work of comparing 100-200-mile 56-Mc. dx with temperature changes at various altitudes in the lower atmosphere due to weather conditions. He pointed out that longer dx is fun, but that the 100-200-mile range will be much more consistent and reliable for amateur work, regardless of sunspots.

Boyd Phelps, W9BP, demonstrated a 75-centimeter concentric-line oscillator resembling a beer mug with a short antenna wire protruding from the top. With an acorn superregenerative receiver, he showed how reflectors and directors altered the strength of the received signal. The fact that the reflector did not work as well as predicted may have been due (1) to the changed antenna tuning necessary when a conductor is brought up close, or (2) to the possibility that the adjustable wire would not quite reach the correct length for reflector operation.

The convention broke up at about 1:30 p.m. Monday, with everyone in good spirits but a little sleepy.

E. H. C.

●

NEW HAM CALLS

For many months the American hams have wondered what was going to happen in the fabulous Ninth Call Area where three-letter calls exhausted the alphabet sometime ago. Now we have the answer.

Additional amateur and experimental call letters will be provided wherever needed in the future by placing the district numeral in the third position instead of the second, as WA9AA.

The first change in amateur and experimental call letters since 1928, when the W prefix was authorized, this arrangement will afford 17,576 new two-letter calls and 456,976 new three-letter ones for each call area, or 4,270,968 for the entire Country.

●

Amateurs who pick up spare change building and selling sundry equipment are warned that the currently popular carrier-current two-way intercommunication systems are capable of interference with radio reception unless adequate r. f. filtration is provided.

In a press release the Federal Communications Commission has requested the cooperation of all manufacturers of such equipment in eliminating interference with radio services resulting from the use of the wired wireless type of phone. The Commission has offered its opinion on the type of filter which may be used and agreed to test samples of such equipment sent to its offices at Washington, D. C.

A DIRECTION INDICATOR

For Rotary Antennas

By L. C. WALLER,* W2BRO

Many solutions to the problem of a satisfactory direction indicator for rotatable beams have been suggested. This one, to our way of thinking, is the most satisfactory arrangement suggested to date.

When the excellent article by W3CHO on a compact, rotary-beam antenna appeared in the January, 1938, issue of RADIO, the writer lost no time in making a Chinese copy for his 10-meter rig. That is, it was about as much of a Chinese copy as an amateur can ever achieve. The W2BRO version uses brass pipes instead of aluminum, a square pole instead of a round one, a ¼-h.p. motor instead of a 1/40-h.p., and so on.

On one point of his description W3CHO did not go into much detail—and that was on the electrical direction indicator. He stated that a rheostat was connected in an ohmmeter circuit in series with a battery and a low-current milliammeter; also, that this was one part of the antenna layout which had given trouble and needed improving. Hence, this story.

Ohmmeter vs. Voltage Divider

Inasmuch as the W3CHO rotary beam is so exceedingly simple to construct and gives such truly fine results, the writer decided that it certainly deserved a sure-fire direction indicator. A little study of the problem showed that any ordinary commercial rheostat or potentiometer was not suitable, due to the large gap at the ends of the resistance element. In addition, an *ohmmeter* is not desirable because of its nonlinear scale. In any case, a battery or an ordinary a.c. power pack is not well suited for the voltage supply because batteries wear out and because neither type of supply provides a permanently fixed voltage, which is quite essential if the meter calibration is to stay put week after week.

The question of the linear scale is easily solved by using a potentiometer, instead of a rheostat, with a high-resistance d.c. voltmeter for the indicating meter.

Stable Voltage Supply

The problem of the stable d.c. voltage supply is simplified by a new voltage-regulator tube, the OA4-G. This tube is a cold-cathode "triode" having (see figure 1) a cathode K, a starter-anode P_1 and an anode P_2. It contains argon gas and works very much like the old familiar type 874, except that the tube drop in the OA4-G is about 70 volts instead of 90. The new gas triode, connected as shown in figure 1, provides a really stable voltage for the potentiometer, R_1, regardless of wide variations in the line voltage. At W2BRO the 250-volt power supply is the same one that powers the speech amplifier, for the simple reason that it is left turned on whether the station is transmitting or receiving—an obvious advantage.

* RCA Mfg. Co., Inc., Harrison, N. J.

The Special Potentiometer

The potentiometer R_1 in figure 1 is of a special design and is homemade. It consists of 31 100-ohm, ½-watt carbon resistors; each resistor is connected between two adjacent contact points, starting with the point marked N. This figure shows only 8 points and 7 resistors, merely to simplify the sketch. Thus, the actual potentiometer has a point for each of the 32 major points of the compass. Expressed in degrees rotation, each successive point represents 11¼ degrees, which is a sufficiently small shift for the W3CHO beam (and most others).

The 32 contact points are mounted on a piece of ¼-inch bakelite cut 7 inches square. The circle on which the contact point holes are drilled has a radius of 2 inches. The 11¼-degree points around the circle can readily be laid out by drawing in the vertical and horizontal diameters and then bisecting each 90-degree angle thus formed. This provides 45-degree angles, and the new angles thus formed are bisected twice more to provide the 11¼-degree points on the circle. The points should be very carefully laid out and drilled so that the final job will not look like the trail of a sailor on shore leave. The square piece of bakelite is mounted at the four corners by means of ¼-inch carriage bolts. The diameter of the top of the contact points is ¼ inch. This makes the spacing between the points about ⅛ inch on a 4-inch-diameter circle, so that the contact arm "rides" smoothly from point to point.

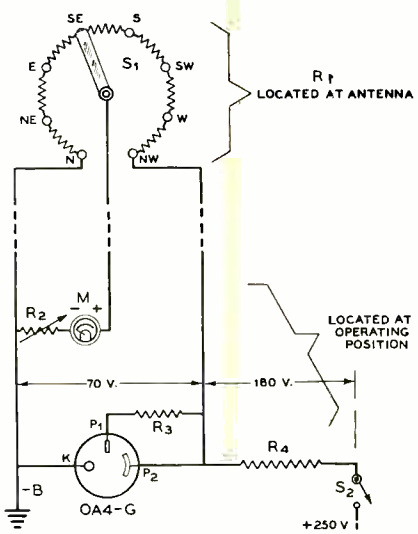


FIGURE 1

Waller Indicating System

R_1—Thirty-one 100-ohm, ½-watt resistors (double dipped in hot paraffin) located at the antenna
R_2—70,000 ohms (approx.), ½ watt
R_3—50,000 ohms, ½ watt
R_4—5000 ohms, 15 watts
M—0-1 d.c. milliammeter
S_1—Indicator switch, see text
S_2—S. p. s. t. toggle switch (to prevent overloading the OA4G, do not close this switch until R_1 is connected)

Figure 2 shows the important details of the potentiometer, the pole support, thrust bearing, etc. The 1-inch steel rod serves as a centering shaft for the V pulley, the thrust bearing, the pole support and the potentiometer, named in the order in which they are put together.

No *iron* nuts, washers or other parts are used except for the steel shaft, the ball bearing and the carriage bolts fastening the potentiometer to the "box" which supports the pole. The potentiometer arm is made of phosphor bronze while most other parts are of brass. The ball bearing is kept generously coated with heavy transmission grease.

The Indicating Instrument

To return to figure 1, it should be noted that the total resistance of R_1 is 3100 ohms. With 70 volts d.c. from the OA4-G circuit, the bleeder current through R_1 is 22.6 milliamperes. Therefore, a 0-1 ma. d.c. milliammeter connected as a voltmeter will draw so little current that the meter calibration will be substantially unaffected, regardless of the point on which the contact arm may be resting. The potentiometer is "dead-shorted" when the movable arm contacts both the last point west of north and the north point. This simply shorts the OA4-G, deionizing it for an instant, but causing no harm. The resistor R_4, in series with the OA4-G, protects the power supply. Where the d.c. voltage supply E has a value other than 250 volts, the equation for calculating the new value of R_4 is: $R_4 = 1000\ E/36$.

Calibration

The indicating meter at W2BRO is calibrated by pasting a semicircular arc

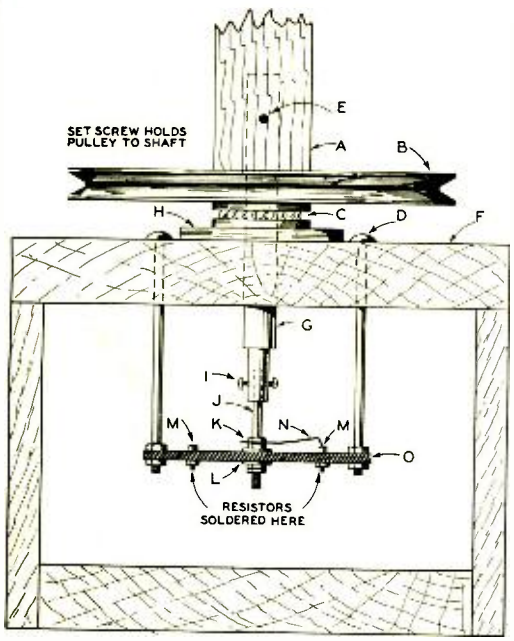


FIGURE 2

Pulley and mounting base for antenna with direction indicator

A—Base of 3" by 4" pole, supporting array
B—12" V pulley leading to drive system
C—Ball thrust bearing
D—Carriage bolts (four required)
E—Steel locking pin through pole and shaft
F—Wooden box, 2" x 12" and 1" x 12"
G—One-inch steel shaft
H—Bearing plate
I—Set screws
J—¼" threaded brass shaft
K—Lock nuts
L—Brass washers
M—Contact points
N—Contact arm
O—Bakelite base for contact points

of paper across the top of the meter concentric with the original scale. All 32 points are marked with radial lines, but only the 8 major points of the compass are lettered on the scale. Thus, the antenna position can be read as north, northeast, east and so on, with 11¼- or 22½-degree steps in between. Some amateurs may prefer to divide the circle into 36 points, making each one represent 10 degrees. This would be a more convenient unit in which to measure rotation but would call for 35 resistors in the potentiometer. In addition, a true NE setting (45 degrees east of north) could not be obtained with the 10-degree increments.

The direction indicator, essentially as described, has been in service at W2BRO for several months and has never given the least sign of trouble. It is interesting to watch the OA4-G as the antenna rotates because, as each new resistor is cut in, at R_1, there occurs a slight flicker in the glow discharge. And, as stated before, the glow ceases entirely as the antenna swings past the north point, due to the temporary shorting of R_1.

There is nothing like a rotary beam to raise the *locals*, as well as the dxers. Just turn the motor on, disguise your voice slightly and call CQ as the antenna turns. How they do stop and listen to those *fading* signals!

●

Ten Years Ago . . . In October

●

Regulation designating the W prefix for U. S. hams becomes effective.

●

Amateur Extra First Grade license restored.

●

Ham television authorized in the 160- and 5-meter bands.

●

Alabama transferred from the Fifth to Fourth Call Area.

●

The signal QST abandoned.

●

First British-American QSO on ten meters.

●

Scandinavian-American short wave tests held.

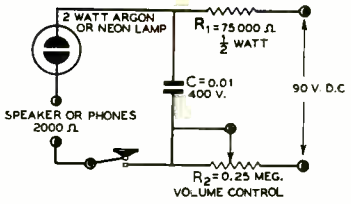


FIGURE 1

Circuit diagram of a typical relaxation code-practice oscillator to run from 90 volts of B battery. A volume control is included in this arrangement.

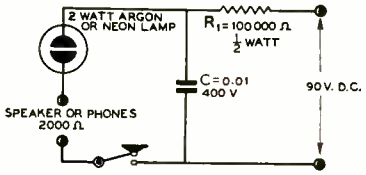


FIGURE 2

Simplification of the arrangement of figure 1. The volume control and limiting resistor have been combined to reduce the cost still further.

THE RELAXATION OSCILLATOR

and Streamlined Code Practice Sets

By A. W. FRIEND,* W8DSJ

A new era in code practice oscillators has arrived. Not a new oscillator nor a new circuit, but a new idea. Why not use our old friend—the relaxation oscillator—for driving either headphones or speaker? Will it work? The answer is, "Yes."

The relaxation oscillator using common two-watt neon or argon lamps, which can be purchased in any local electric shop, is the cheapest, easiest to build and the most satisfactory circuit for code practice sets.

Figure 1 shows the circuit diagram of a typical relaxation type code practice oscillator. Table I lists the required parts and their approximate costs.

By combining R_1 and R_2 in one fixed resistor of value between about 90,000 ohms and 150,000 ohms, the cost may be reduced to *92 cents* for a steady oscillator requiring no adjustments and having no parts to wear out. Of course, the cost to the average experimenter will probably be practically nothing, since all of these parts will no doubt be available in the stock of extra parts or the well-known junk box. The simplified version would be connected according to the circuit diagram of figure 2.

The wave shape of voltage generated across the phones consists of a series of pulses, a typical example of which is shown in the oscillogram of figure 3. This type of wave is generally considered more desirable than a pure sine wave due to the more melodious sound produced by the addition of several harmonic frequencies. The result is a note which is not so tiresome to the ear during long periods of practice.

Adjustment and Operation

If the values of components listed are rigidly adhered to, it may be necessary to try several lamps from the dealer's stock before one will be found which

* Asst. Prof., West Virginia Univ., Morgantown, W. Va., W8DSJ, W8KIU, W8XNR, W8XAW.

gives maximum output and smooth operation. This is due to the fact that it is difficult in manufacturing these gas-filled lamps to maintain their characteristics very uniformly when operation in this type of service is considered.

In testing several lamps of both the neon and argon types, it was found that the argon lamps were generally more satisfactory and gave much higher power output from the speaker. This may have been due to a greater range between the ignition and extinction potentials of the argon lamps as compared with the neon lamps. It may or may not hold true in all instances. In our case, however, the argon lamps were clearly superior. Neon lamps glow with the familiar orange-red light seen in most gaseous discharge advertising signs. The argon lamps have a sort of violet glow in operation but appear exactly like the neon lamps when not lighted.

If all of the available lamps light but refuse to oscillate, the value of the resistance R_1 should be increased slowly until oscillation starts and, then, slightly decreased until the note is as high-pitched as the operator desires. Reducing the value of C will cause the generated frequency to increase as will also an increase in the applied voltage. The former of these will also decrease the amplitude of the signal.

If none of the available lot of lamps ignite with the applied 90 volts potential, this voltage may be raised to a slightly higher value which will then produce normal operation. The voltage may be carried up to almost any convenient

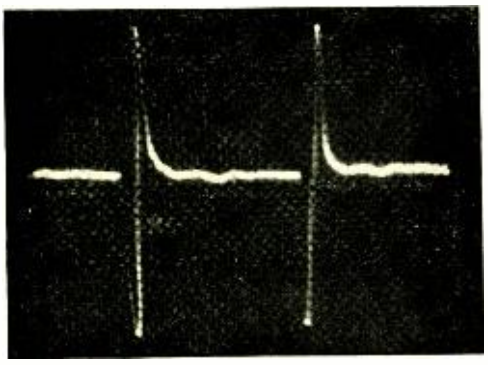


FIGURE 3

Typical waveform of the audio output of the oscillator as heard in the phones or speaker. The richness in harmonics makes the tone pleasing to the ear.

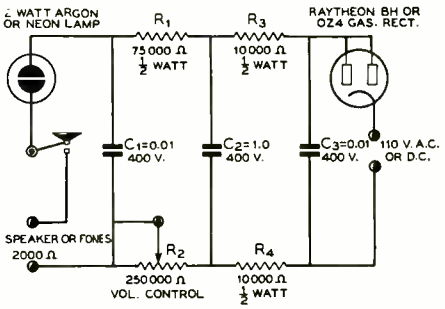


FIGURE 4

Circuit diagram of the oscillator to operate from 110-volt a.c. or d.c. line. A gaseous rectifier is used to eliminate a power transformer or line-cord resistor.

available value, providing the amount of resistance is correspondingly increased so as to prevent failure of oscillation. If very low frequencies are desired, any value may be obtained by increasing the capacitance of the condenser C. By using several microfarads of capacitance and a high value of resistance, the frequency may be made so low that one cycle will require several minutes for its completion. While this frequency would obviously be absurd for code practice work, it may be useful for some other special purpose. At least a trial of this slow rate of oscillation will serve to demonstrate very vividly the principle of operation.

Theory of Operation

The operation of any relaxation oscillator depends upon the fact that the potential of extinction of an arc discharge is lower than the igniting potential. The condenser C charges at a rate inversely proportional to the product of the values of R and C. When the ignition potential of the lamp is reached by the charging condenser, the gaseous discharge in the lamp will be initiated, and the charge on the condenser will be reduced rapidly until the voltage reaches the extinction potential of the lamp. The rate of discharge will be determined by the resistance in the base of the lamp and the resistance and reactance of the headphones or speaker used. It is necessary that the sum of these values be considerably less than the value of the charging resistance used.

In the circuit of figure 1, it was found

FIGURE 5

Photograph of a complete battery model for portable use.

that the average current drawn from the source varied between 0.04 ma. and 0.12 ma., depending upon the frequency, when the frequency was controlled by the variable resistor R_2. The current was highest for the higher frequencies (when R_2 was adjusted for a low value of resistance). The fixed resistor R_1 is desirable in addition to the variable resistor R_2 in order that the entire scale of variation may be made useful for frequency control. If R_1 is omitted, one end of the variable resistor scale will be of no value since no oscillation can occur.

The headphones or speaker may be inserted either in series with the lamp or the condenser with no noticeable difference in results. The key may be used in either power supply lead with very little difference in results except that when very short dots are being sent, the condenser C is already charged and ready to go at the first instant the key contacts close provided that the key is in series with the lamp as in figures 1 and 2. Needless to say, the condenser should be of high quality to avoid leakage and its consequent waste of power and poor operation.

Due to the low value of current required from the 90-volt source, the power supply may very readily consist of the smallest size of dry cell B or C batteries such as the Burgess type Z60BP 90-volt B battery. These small batteries and the absence of other heavy parts makes possible the construction of a really portable practice set.

If battery operation is not desired, the necessary power may easily be obtained from the receiver power supply circuit at a point of suitable voltage. If one must build a power supply to operate the device from 110-volt a.c. or d.c. power lines, the circuit diagram of figure 4 may be followed. The rectifier-filter circuit is not elaborate since the power to be used by the oscillator is not in excess of 1/100 watt.

If the device does not operate when connected to a d.c. line, the line plug should be reversed to obtain the proper polarity, or the rectifier tube should be short-circuited so as to allow the flow of current to proceed in reverse from the normal direction. This power supply, using the power lines, is not recommended due to the slight possibility that the operator might receive an electric shock by contact between the headphones or key and some other object which may be grounded. This hazard has been reduced as much as possible by the use of resistors in series with both sides of the line. If one side of the power line is grounded, this side may be connected to the headphones by the proper insertion of the line plug into the receptacle.

Figure 5 is a photograph of a battery model complete with the battery mounted on the base for portable use. The battery is Burgess type Z60BP. When using an ordinary magnetic speaker or a permanent-magnet dynamic speaker, the volume from this small set is quite satisfactory for code practice for 20 people in a fairly large room.

Use with External Amplifier

For convenience in operation and construction and for use where greater volume is desired, connections may be made to operate any radio receiver or audio-frequency amplifier having resistance

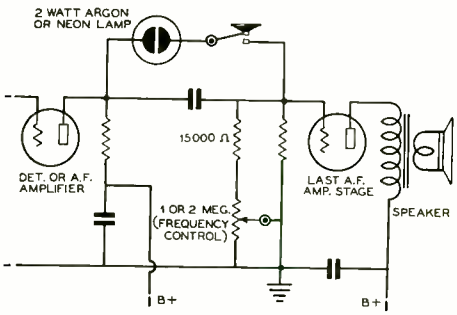


FIGURE 6

Hookup diagram for use with external amplifier for giving code practice to large groups.

coupling as a relaxation oscillator-amplifier combination. All that is required in some cases is a neon or argon lamp and a telegraph key. These devices are to be connected in series, from the plate of a detector or audio-frequency amplifier tube to the grid of the following a.f. amplifier tube. This arrangement gives a resistance-condenser combination consisting of the plate and grid resistors of the circuit and the coupling condenser between the two stages. If the coupling condenser happens to have a capacitance of 0.01 μfd. or less, oscillation will probably take place at a desirable audio frequency. If the pitch is too high, an extra coupling condenser may be shunted from plate to grid. If it is too low for satisfaction, an extra resistor of high value may be connected from grid to ground.

Figure 6 shows how the connections could be made for use in the average receiver or amplifier circuit. When making these connections, no part of the amplifier circuit need be disconnected. All connections can be made by winding the bare ends of fine insulated wire leads around the appropriate prongs for the connections to the tubes. If a ground connection is required, it may be made by contact with the chassis at any point.

TABLE I

1—R_1—75,000-ohm ½-watt resistor	$0.12
1—R_2—¼-megohm volume control	0.59
1—2-watt G. E. neon or argon lamp	0.45
1—C_1—0.01-microfarad 400-volt condenser	0.15
1—Edison-base type lamp socket	0.05
6—Fahnestock clip binding posts	0.15
Total	$1.51

If, for any reason, satisfactory operation is not obtained by the use of the connections of figure 6, the amplifier circuit may be temporarily changed as shown in figure 7, for the purposes of code practice or tone generation. The only circuit change involved is the disconnection of the grid lead to the a.f. amplifier tube and the connection of the relaxation oscillator to this grid terminal as shown. This arrangement permits the substitution of the required values of resistance and capacitance for correct operation of the oscillator.

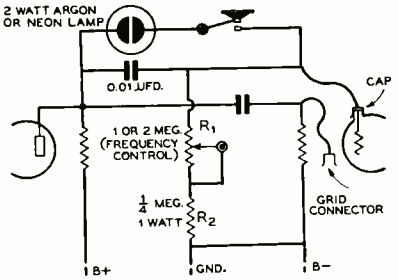


FIGURE 7

Alternative connection arrangement for use with external amplifier when circuit of figure 6 does not give satisfactory results.

These devices will produce as much power output as the connected amplifier is capable of handling. In some cases, it may be necessary to provide an auxiliary volume control circuit if the output is too great or if the amplifier is overloaded by the oscillations. This matter may be taken care of in the usual manner.

It is quite evident that the connections with amplifier circuits make possible code practice for groups of any required number of persons, and at the same time they provide very simple circuit arrangements involving little expense. By the use of several such oscillating circuits and keys, an electric organ may be constructed.

For use as a modulator in 5-meter i.c.w. work, the oscillator may be wired directly into the speech channel of a 5-meter transmitter and it will produce quite a desirable note for cutting through superregenerative receiver or auto QRM.

Let's put the relaxation oscillator to work. It is undoubtedly the cheapest, lightest and least complicated of all audio-frequency oscillators.

•

A good *ondometer* is necessary in every shack—the law requires its use.

•

The trailer housing WBBM's new mobile transmitter carries a license plate numbered 410. WBBM operates on 410 kc.

INDUCTIVE TUNING

By FRANK S. McCULLOUGH,* W5HBU, Ex W6BE]

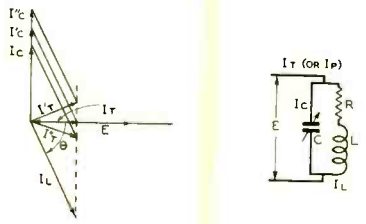


FIGURE 1

With the introduction of vacuum condensers for final tank circuits, many stations will be switching to inductive tuning. In many instances the change from variable C to variable L will not alter the tuning procedure. However, there are a few points in which these two methods of tuning are different. It is the purpose of this article to delineate by vector diagrams these two methods of tuning. Before going further, let it be understood that unity power factor and resonance are used synonymously.

Glasgow, in his book, "Principles of Radio Engineering," lists the various equations for variable L and variable C. These equations give the values of C and L that are needed for the conditions of maximum impedance, resonance, etc. Immediately, one thing becomes evident: for variable C one equation satisfies the conditions of maximum impedance and resonance, while inductive tuning requires two equations for impedance and resonance. This, then, means that the usual indication of a dip I_p is the true indication of Z max. and resonance only when using capacity tuning. This is not the case for inductive tuning. The vector diagrams illustrate these points much more clearly.

Figure 1 is the diagram for capacity tuning. E is the reference vector. I_c, the current in the condenser, leads by 90°. I_L, the current in the coil, lags by 90°, less some angle θ. This angle θ is due to the R of the coil and the reflected load. The different lengths of

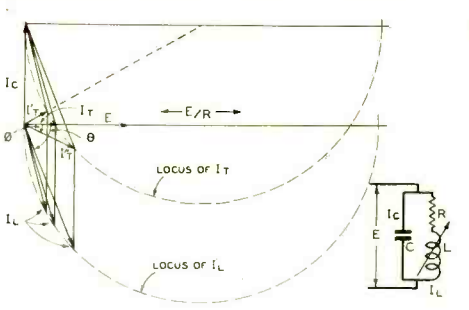


FIGURE 2

I_c, as I'_c and I''_c, are for two settings of condenser. On completing the vector parallelograms, we get the three resultants I_t, I'_t and I''_t (total current or I_p). Inasmuch as these are vectors and length represents magnitude, we see that minimum I_t is coincident with the vector E and represents unity power factor. Hence, by tuning for plate current dip, resonance and maximum impedance are indicated. In all cases a constant Q is assumed.

[Continued on page 78]

* 3819 Tennyson, Houston, Tex.

Dial Phone REMOTE CONTROL

By GEORGE M. GRENING,* W6HAU

The idea of controlling radio equipment over a distance is a fascinating one to contemplate. At some time or other all of us have wanted to locate our transmitter and antenna "in the clear" and to control them from our operating position. Such locations always seem to be a considerable distance from the base of operations.

Assuming that we have our location picked and available, we immediately are confronted by the problem of turning the transmitter off and on, of keying it or of sending voice to it. If the distance is short, a multitude of connecting wires is the answer. Perhaps we have two or more rigs for different bands. The problem becomes more complicated, and if the distance is very great we throw up our hands in despair.

It is at this stage that we must turn to telephone practice and methods to do the job. Fortunately, they are easily applicable to radio control.

For the c.w. man, it is easy. Figure 1 shows a method of selecting your transmitter and keying it over two wires of any length, using a ground return.

SW_1 turns the filaments of transmitter no. 1 on. SW_2 operates relay A which keys the set. When SW_3 is thrown to the opposite position, the polarized relay reverses its contacts and closes the filament circuit of the no. 2 transmitter.

If two keying relays are actuated by relay A or if this relay has two sets of contacts, we can key either set.

For short distances the relays can be either 110-v.-a.c.-or 6-volt-d.c.-operated, but for longer distances it is advisable to use more than 6 volts to overcome the voltage drop in the lines. Of course, if a standard telephone line is being used, it will be necessary to operate the relays on d.c. regardless of distance.

Simplex Operation

Figure 2A illustrates the basic principle of sending voice and a control current over a single pair of wires. The control current in any case must be well filtered d.c. or d.c. from a battery. As can be seen, the current divides in the center of the transformers and the two line wires are effectively in parallel with respect to the d.c. if the resistances of each of the transformers from center-tap to outside are the same. If so, the d.c. control current will have no effect on the voice transmission.

The transformers can well be of the standard plate-to-500-ohm and 500-ohm-to-grid type, providing they have center-tapped line windings. Also, regular telephone repeating coils are made for this work.

In the event that center-tapped audio transformers are difficult to locate, the problem may be solved by using two resistors in series across the line windings of the transformers with their mid-points connected to the control current This is illustrated in figure 2B.

A value of 500 ohms is usually satisfactory for each resistor, although, if undue voice attenuation occurs, the values

* Radio Supervisor, Police Dept., Santa Barbara, Calif.

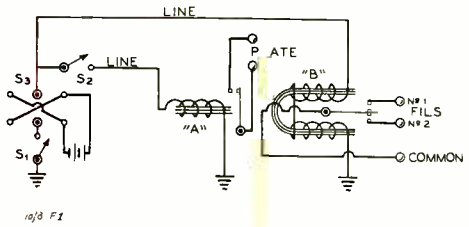


FIGURE 1

Operation of two-wire line for selection of transmitter by polarized relay and keying of either one. A relay to operate on selected voltage, B relay, polarized type.

of resistance may be increased. However, the relay that is used must have low current requirements or else the control voltage must be increased. One particular system is in operation at the present time over a distance of 13 miles with a 45-volt B battery as the supply voltage and with a pair of 500-ohm resistors across the two line windings. It is essential, of course, that the resistors be noninductive; carbon resistors are well suited to the job.

When manufactured simplex coils or center-tapped audio transformers are used at each end of the line, 6 volts will usually be sufficient control voltage. Twelve volts of battery with reasonably sensitive relays will allow positive control over a good many miles.

The simplex coils commercially available must be connected so that the fields set up by the control current will cancel due to the split windings on the transformer. This is accomplished by connecting their windings as shown in figure 2C.

Carrying Two Control Currents

Figure 3 shows the usual method of sending two control currents over a single pair. In this case, we must have transformers with their center terminals brought out so that the winding can be divided. This is also aptly met by telephone simplex coils which cost but little more than audio transformers. SW_1 will operate relay A and turn the filaments on, while SW_2 through relay B will turn the plate voltage on. The control current from each switch is sent over one wire and ground.

To eliminate any possibility of the control current affecting the voice transmission, each relay must have the same resistance. Condenser C blocks the d.c. control current but offers a low impedance to voice frequencies.

Phantom Voice Circuits

In figure 4 we almost get something for nothing. This grounded phantom circuit gives us two voice channels and a control circuit. The full metallic circuit can be used for sending voice to the transmitter and the grounded phantom for any other voice circuit desired, either to the transmitter or from it. Unfortunately, grounded phantom circuits are often noisy and are particularly apt to pick up power line hum. They are always worth a try, however.

The size and characteristics of transformers T_3 and T_4 will depend upon what apparatus is connected to each end. Again audio transformers may be used.

A use of four wires is shown in figure 5. We now have three voice circuits, one of which is phantom, together with either one or two controls if the idea of figure 3 is incorporated. No crosstalk or interference should be experienced on any of the voice circuits.

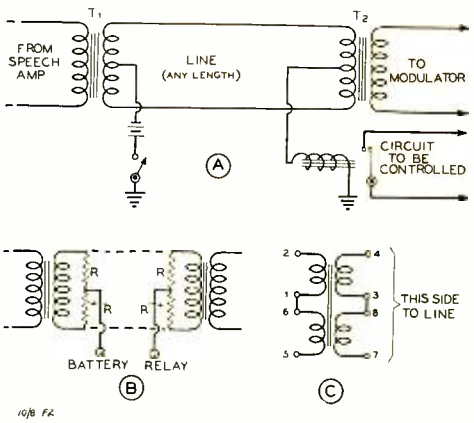


FIGURE 2

(A) Two-wire line with voice and control over same wires (phantom control circuit). T_1—Plate-to-500 ohms, T_2—500 ohms-to-grid. (B) Same as A except that resistors are used to determine mid-point on transformers without a center-tap. R—500 ohms (see text). (C) Method of making connections to numbered posts of manufactured simplex transformers to balance out control current in windings.

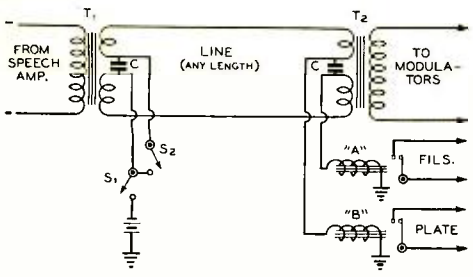


FIGURE 3

Operation of two-wire line with one voice and two control circuits. T_1, T_2—Telephone repeater coils (simplex). C—2 to 4-μfd. paper condenser.

The polarized relay shown in figure 1 can of course be used in any of the other circuits, giving one more control.

Still another control can be gained by having a relay in series with the main control relay shown. This second relay will operate on an increase in current over that necessary to trip the first one. This can be accomplished by cutting in a few more volts with a switch at the control end. Even a grounded phantom may be added.

Four voice and three controls. Not bad, eh?

Two or three voice circuits appear to be sufficient for amateur work, although more can be added but at considerable increase in cost.

Additional Control Circuits

Our most pressing need is for additional control circuits. Possibly we have two or three transmitters. Maybe we want to change frequency or switch antennas. The diagram of figure 6 shows how all this and many more things can be accomplished by means of an ordinary telephone dial and selector. With sufficient apparatus, we can control or switch circuits running up into the millions over one pair of wires.

We know of one system whereby the owner of a mountain cabin, 60 miles away, dials a number to turn his lawn sprinkler on or off and another number to turn the electric heaters on so the place will be warm when he arrives!

We do not hesitate to say that there is no switching problem which cannot be accomplished by a pulsing dial, nor any electromechanical operation which cannot be remotely controlled. The possibilities are limitless. To attempt to give all radio applications would be impossible. The circuit is accordingly given with the idea in mind that its application is wholly dependent upon the constructor.

Expense? Not what you'd think. The dial selector mechanism should run around $27.00 less dial.* To connect each additional number in will cost under $10.00 per number. For less than the cost of a fair receiver, you can have a remote control system that would assuredly be the envy of any ham.

The practical operation of the system is as follows: A switch alongside the dial is thrown to connect the control circuit. Suppose number 6 turns on the filaments of the particular transmitter we want to use. We dial six, and one to two seconds after the dial has returned to its normal position, our filaments go on. We then open the dial switch and the system is ready to be used again on another number. In the meantime, circuit number six will stay on until such a time as number six is again dialed.

Assuming all nine circuits are on, they can all be released simultaneously by dialing the "master release" number zero.

A few explanations before passing on to the theory of operation. A pilot light system can be incorporated at the control point by duplicating the selector mechanism and electrical lock-in features at the control. In this case we connect another A relay to point X on the diagram. The resistance in series with the A relay is equal to the line resistance. This is to prevent the control current from taking the path of least resistance and flowing through the A relay in our pilot light system, instead of both through it and relay A in the remote.

Additional Control Locations

A dial and switch are shown both at the control and remote point. As many more dials as desired may be connected in parallel with these, affording numerous control locations.

For keying a transmitter, the split simplex coil method may be used as shown in figure 3. If the control line is long, a 6-volt battery may be used at either end, giving a 12-volt control cur-

* Used dials can usually be picked up with ease. A new one costs $4.50.

rent and permitting the use of 6-volt relays at either end. Telephone practice is to ground the positive of the battery as well as one terminal of each set of contacts if it breaks a battery circuit.

For convenience, figure 6 is drawn showing separate batteries. These may, however, all be the same battery or 110 v. a.c. except for relay A which must be d.c. operated.

Sources of Relays

It is difficult to find reasonably priced radio relays with the proper number and type of contacts for such circuits. Regular telephone relays are accordingly recommended. These relays can be obtained in both a.c. and d.c. types and for operating voltages from 2 to 110. They can be obtained with contact assemblies to open or close up to 13 circuits per relay. Any combination of contacts can be obtained on one relay. Their price seems to run the same as radio relays or a little less.

Western Electric, Kellogg and Automatic Electric Co. are the largest manufacturers of this equipment. They are as glad to sell to radio men as to telephone companies. Also, it is advisable to secure the corresponding dust cover when the relay is purchased. The entire selector mechanism and electrical locking apparatus can be mounted on a small relay rack of compact size.

Going a step further, a French-type handset or "monophone" may be used. When the handset is lifted, the dialing switch it holds open is automatically closed and the dial connected. A single-button microphone designed for radio use is available for these handsets. These microphones give excellent quality on voice.

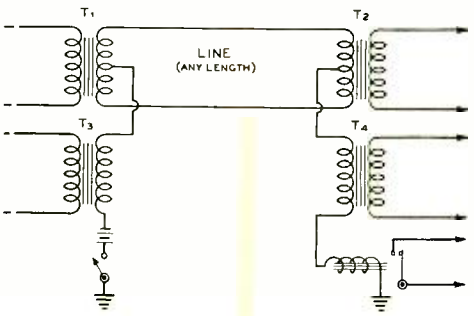


FIGURE 4

Operation of two-wire line with two voice circuits (one grounded phantom) and one control circuit. Simplex or plate-to-line and line-to-grid transformers used at T_1 and T_2. See text concerning T_3 and T_4.

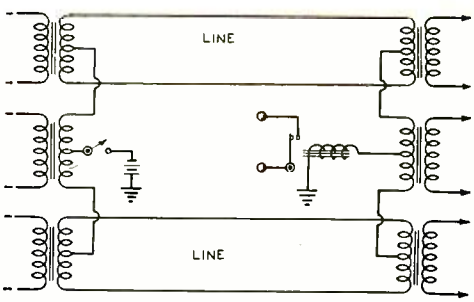


FIGURE 5

Four-wire line with two phantom circuits. Three voice circuits (one phantom) and one phantom control circuit.

"Stepping" or Rotating Selector Switch

The heart of the system is the rotating selector switch. This ten-position type, chosen for simplicity, is called a "minor" switch and incorporates both the rotating step and release magnets, together with the "off normal" springs.

Automatic Electric Co. and the Guardian Electric Co., both of Chicago, Ill., are commercial manufacturers of these switches. They may be obtained in 25, 50 and 100 contacts as well, necessitating the dialing of two numbers. Imagine being able to accomplish even 100 operations from the control point!

Closing the dial switch connects the control circuit in and operates relay A. The circuit to relay B is then closed. Both relays B and C are slow releasing relays which hold their position for a short interval after the operating current is removed.

When the dial is spun, it opens this control circuit the number of times indicated on its plate—six times for number six, etc. This accordingly releases relay A rapidly six times.

On its first release, since relay B will hold closed momentarily, the circuit through relay C and the stepping magnet is closed and the movable arm advances one contact. The "off normal" springs are operated by the stepping relay and remain closed after the first pulse until the release magnet is operated. With these six pulses, the step-

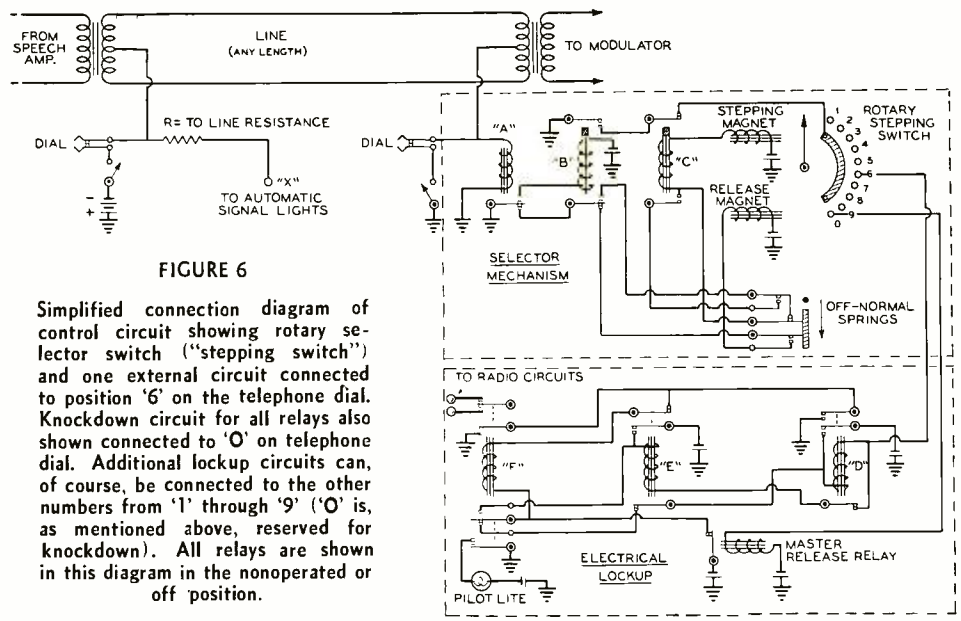


FIGURE 6

Simplified connection diagram of control circuit showing rotary selector switch ("stepping switch") and one external circuit connected to position '6' on the telephone dial. Knockdown circuit for all relays also shown connected to 'O' on telephone dial. Additional lockup circuits can, of course, be connected to the other numbers from '1' through '9' ('O' is, as mentioned above, reserved for knockdown). All relays are shown in this diagram in the nonoperated or off position.

ping switch advances six contacts.

It will be noted this switch is in the form of a movable shorting bar which grounds contacts one to six in turn. Since this would operate the apparatus connected to these six contacts as the bar moves around, relay C, a slow release relay, is incorporated to hold the ground off these contacts until a second or two after the last dial pulse, when contact six is then grounded, operating the circuit controlled by it.

The stepping switch will remain on contact six until the dial switch is opened, when the release magnet is actuated, disengaging the ratchet pawl on it and allowing a spring to return it to the off position, ready for the next number.

This procedure may not be immediately apparent but if the circuits are carefully traced, remembering that relays B and C are slow releasing and the dial pulses are quite fast, it should become clear.

The Final Control Circuit

We now have a ground on contact six and the problem remains to have this ground either switch on or off the desired radio circuit on this number. The procedure is accomplished by the interesting electrical lockup circuit shown.

When a ground is first put on this circuit, relay F will close and stay closed even if the ground is removed since it locks itself in electrically.

Relay E, however, is then ready to operate when a ground is once again put on, and this relay accordingly opens the circuit to relay F which in turn opens the desired radio circuit or circuits.

This electrical locking circuit might even find favor in local control stations to control all the apparatus in the shack by simply sending a ground to each piece of equipment.

The term "ground" as used in the text applies to a common return circuit with the exception of the actual earth ground necessary to operate relay A.

An additional "master release" relay has been incorporated on O. When this number is dialed, it opens the coil circuit of all the F relays which might be on and everything is turned off.

Possible Variations

Endless variations of this remote control idea are possible. For example, if it is desired solely to turn on or off up to ten transmitters and key or modulate

one at a time, the electrical locking circuits can be eliminated and a relay attached to each selector contact of the stepping switch which will have one set of contacts to close the filament circuit of the desired transmitter and another set to connect the voice line. A third set could connect the keying circuit.

Audio Level Required

Incidentally, very little audio volume is necessary to send voice over several miles of wire. An amplifier ending in a single 56 tube or its equivalent will drive a pair of 45's at the remote point with ease. Telephone companies usually balk at a level of more than plus 3 or 4 db on their lines anyway. Plus 2½ db is the commonly accepted limit.

Private Lines

Where remote control over a considerable distance is desired, it is probably cheaper to rent a direct line from the local phone company. Such private lines usually cost from $2.00 to $5.00 per *circuit* mile per month. If one is fortunate enough to have the phone exchange close by or in line with the remote point, the charge for the leased wire should not be exorbitant.

A Practical Application

For a practical application of such a dial-controlled system, one that worked for the Santa Barbara Police Dept. may be of interest. All the equipment is unattended three miles from the control point, nothing but a monophone and signal light board being at the station.

FIGURE 7

Monophone with three base and one push-button switch (notice below dial lower right) suitable for remote control and voice transmission and reception.

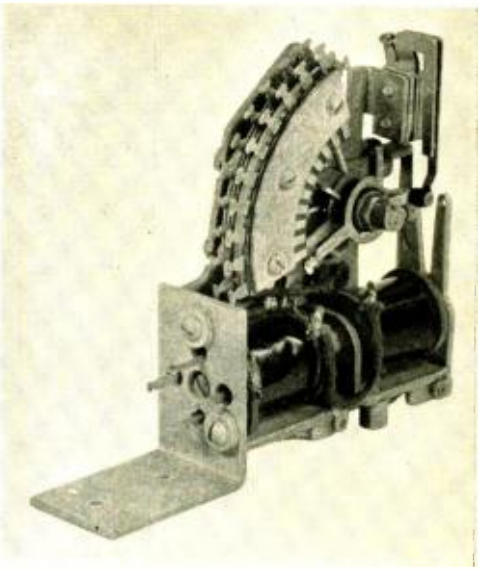


FIGURE 8

Ten-position automatic selector or "minor" switch, showing operate and release magnets, mounting plate and two circuit paths. One path may be grounded or both may be used.

Figure 5 with variations, using two pairs, is used. Lifting the handset transfers the car transmissions from a loud speaker to the handset and also automatically decreases the volume. Because our cars are always the same signal strength up to three times our necessary coverage area, no volume control is necessary.*

The main phone transmitter is turned on by a switch in the monophone base. Voice is sent to it through the microphone in the handset, while a calling tone is put on by a second switch. The third switch connects in the dialing circuit, which can be used even while calls are being sent or received.

This dial controls receivers, switching from one to another, turning them on or off, changing frequency on a 5-channel intercity c.w. transmitter (by means of padder relays) which can also be keyed, cuts off everything at the remote point and cuts in a local emergency transmitter and receiver, cuts in or out a direct talking circuit for conversation between the control and remote and has, in addition, provisions for plugging in addi-

[*Continued on page 76*]

* Described in April, 1937, RADIO.

A 100-Watt Bandswitching Exciter

A description of a well-designed, well-laid out 100-watt exciter enabling full output to be obtained at the flick of the switches on any of the bands from 10 through 160 meters. Since the tank circuits are not pretuned, it is possible to operate upon any frequency within these above bands merely by changing the crystal selector switch and, if necessary, touching up the final tank circuit.

By CHARLES W. HUNTER,* W6BFC

Some time ago the writer decided that the present exciter, which had been used for over two years to drive a 250-watt final, no longer met the requirements of the station as regards output and flexibility of operation. It was, therefore, decided that a new exciter unit should be built which would give a reasonable output, in the neighborhood of 100 watts, and which would operate on the 10-, 20-, 40-, 80- and 160-meter amateur bands. In meeting the requirements of flexibility and ease of band changing, it was necessary that the unit employ some form of bandswitching and that the number of adjustments be reduced to a minimum. After due consideration, it was decided that the ability to tune easily to any frequency in any band is preferable to being limited to pretuned spot frequencies, even though a slightly longer time is required to make the change. Even so, the time required to change to any frequency is less than 10 seconds, which is fast enough under all ordinary conditions.

Tube Line-Up

The tube line-up consists of a 6A6 oscillator-doubler, an 802 buffer or doubler and a 35-T amplifier. The 6A6 oscillator-doubler is entirely conventional. This form of oscillator was chosen because of the high harmonic output obtainable without regeneration. While regeneration may be desirable in many cases, its use was considered inadvisable in this instance because a bandswitching oscillator must be stable and at the same time not too critical of circuit adjustments. The 6A6 has proved highly satisfactory.

The 802 was chosen because of its low excitation requirement and because, with careful circuit design, it does not have to be neutralized. It is quite possible that the new 807 with its improved shielding would operate just as satisfactorily as the 802 even though the grid-to-plate capacity is somewhat higher.

The 35-T seemed a logical choice for the amplifier because of its low excitation requirements, moderate output, excellent efficiency on the higher frequencies and its ability to handle the same plate voltage as the final amplifier. Because the lower interelectrode capacities make for better efficiency on the higher frequencies, a triode was used in preference to a pentode, in spite of the fact that it complicated the switching arrangement somewhat.

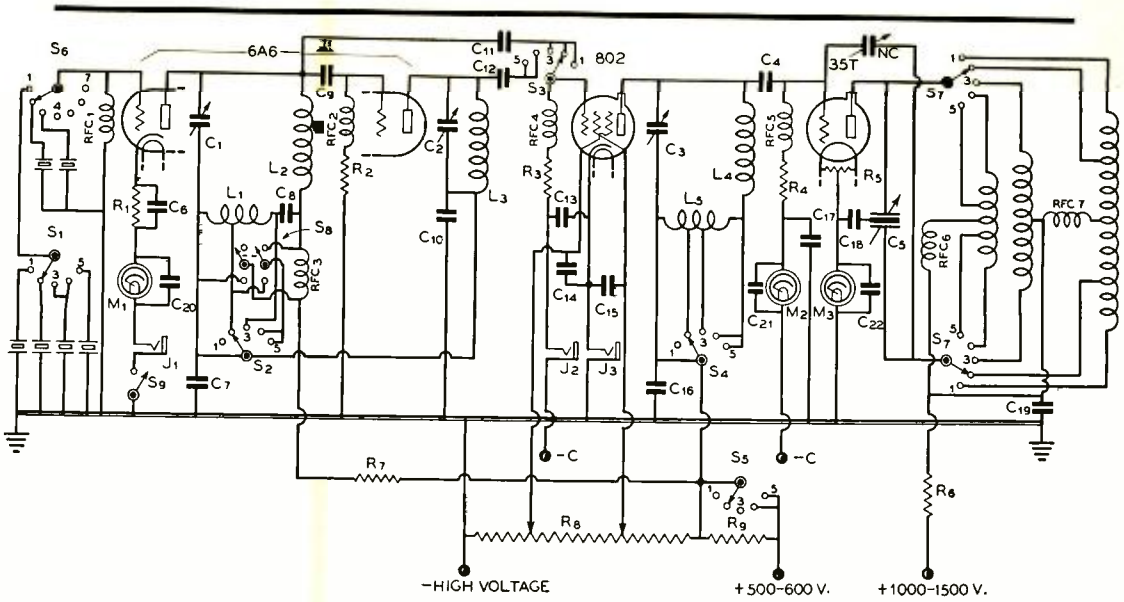
Switching Arrangement

The circuit diagram gives a good idea of the method followed in changing bands. The heart of the circuit is the 6-circuit 5-position band-change switch seen in the center of the chassis in the bottom view picture. This switch changes the crystal, shorts portions of the oscillator and 802 plate tanks, connects excitation around the doubler section of the 6A6 for 40-, 80- and 160-meter operation and changes the plate voltages on the 6A6 and 802 tubes to values necessary to maintain required excitation to the 35-T.

The Oscillator Circuit

The plate tank is the only portion of the oscillator circuit which is unusual. In this case the coil is split into two

* 2035 Ruston Ave., Riverside, Calif.



HUNTER 100-WATT BANDSWITCHING EXCITER

C_1—250-$\mu\mu$fd. midget (150-$\mu\mu$fd. may be used)
C_2—150-$\mu\mu$fd. midget variable
C_3—150-$\mu\mu$fd. variable condenser
C_4—150-$\mu\mu$fd., preferably variable (shown in the diagram as being fixed)
C_5—100 $\mu\mu$fd. per section, 3000-volt variable
C_6—.01-μfd. mica
C_7—.002-μfd. mica
C_8—.01-μfd. mica
C_9—70-$\mu\mu$fd. mica trimmer
C_{10}—.002-μfd. mica
C_{11}, C_{12}—70-$\mu\mu$fd. dual mica trimmer
C_{13}, C_{14}, C_{15}, C_{16}, C_{17}, C_{18}—.002-μfd. mica
C_{19}—.00025-μfd. 5000-volt mica
C_{20}, C_{21}, C_{22}—.002-μfd. mica
R_1—400 ohms, 10 watts
R_2—15,000 ohms, 10 watts
R_3—25,000 ohms, 1 watt
R_4—2000 ohms, 10 watts
R_5—50-ohm c.t. resistor
R_6—2500 ohms, 75-100 watts
R_7—4000 ohms, 50 watts
R_8—30,000-ohm, 50-watt divider
R_9—3000 ohms, 50 watts
S_1, S_2, S_3, S_4, S_5—All one 6-circuit, 5-position tap switch
S_6—Single-circuit, 7-position switch
S_7—2-circuit, 5-position band-change switch
S_8—D.p.d.t. toggle switch
S_9—S.p.s.t. toggle switch
M_1, M_2, M_3—External Milliammeters
$RFC_{1,2,3,4,5,6,7}$—2.5 Mh.

sections, the 40-meter section L_2 being mounted on top of the chassis and the remaining section L_1 underneath the chassis. A .01-μfd. condenser C_8 is used to isolate the two sections of the coil as far as the d.c. current is concerned. This makes possible the automatic shutting off of the buffer section of the 6A6 when it is not being used for 40-, 80- and 160-meter operation. For 20- and 10-meter operation, a 40-meter crystal is ordinarily used and, as seen in the diagram, the coil L_1 and the condenser C_8 are completely shorted-out by the switch. By including the condenser in the shorted portion, the voltage applied to the plate of the oscillator is also applied through the switch to the buffer portion of the 6A6. The coil is split into two sections and separated by the chassis in order to reduce the inductive losses in the shorted section.

For 40-meter operation, a 40-meter crystal is again used, but in this case only the section L_1 of the tank circuit is shorted-out and not C_8, thus blocking the voltage off the buffer section. For 80-meter operation, a portion of L_1 is shorted-out, while for 160 meters the complete tank circuit is used.

The d.p.d.t. switch S_8 shown in the diagram makes it possible to use an 80-meter crystal, if desired, for 20-meter operation and also for 10 meters if the 35-T is used as a doubler. The thought behind this feature was to make it possible to use one of the variable-frequency crystals which are becoming so popular.

The 6A6 Doubler Circuit

The doubler circuit of the 6A6 is entirely conventional. However, the coil L_3 is cut so that with the 150-$\mu\mu$fd. condenser C_2 both the 40- and 20-meter bands may be covered. Ordinarily, this tank circuit operates only on 20 meters, in which case C_2 is tuned near minimum capacity, thus giving the best efficiency where most needed. The only exception is when an 80-meter crystal is used for 20- or 10-meter operation in which case it is tuned to 40 meters merely by swinging the condenser to near maximum capacity. As this condenser is seldom used except for minor adjustments, it is not brought out as a main tuning control but is varied by means of a knob fitted with a small scale plate. This condenser is shown mounted underneath the chassis beside the band-change switch.

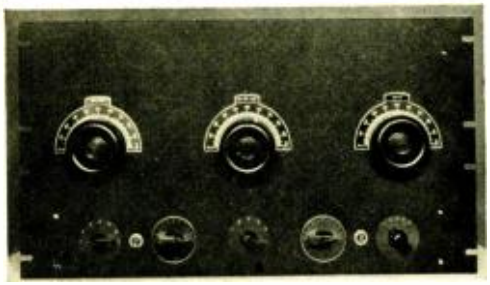
The 802 Buffer-Doubler

The 802 tank circuit arrangement is quite similar to that used in the oscillator. In this case, both portions of the coil are placed on top of the chassis but at right angles to each other. The section L_4 is used for 20- and 10-meter operation, the remaining section being shorted-out for these bands. Again a 150-$\mu\mu$fd. condenser is used for tuning, 10 meters being reached near minimum capacity while 20 meters is reached near maximum. The section L_4 is mounted directly behind C_3 on small butt-ins through the chassis, the section L_5 being wound on an XP-53 coil form mounted in a socket placed beside the 6A6.

The 802 is capacity-coupled to the 35-T. At first it was planned to use link coupling between these two stages, but the ease with which the 35-T drives made this procedure unnecessary and so the simpler capacity coupling was used.

The 35-T Output Circuit

The output circuit of the 35-T consists of three separate coils and a Communication Products two-pole 6-position band-change switch for proper coil selection. The coil used for 10- and 20-meter operation is shown mounted directly on the back of the switch. The 40-meter coil is mounted underneath the chassis near the rear, and the 80- and 160-meter coil is mounted on standoff insulators on top of the chassis. A better description of these coils will be found in a later paragraph.

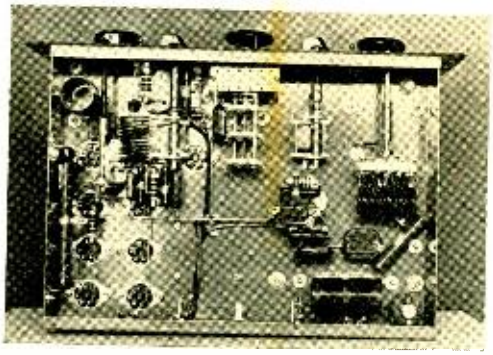


Front view of the bandswitching exciter mounted on a standard rack panel. The controls along the bottom of the chassis are: crystal selector switch, 6A6 doubler plate condenser, exciter bandswitch, final grid excitation control and final plate bandswitch.

The arrangement of the two r.f. chokes and the by-pass condenser used in the 35-T tank circuit may require a little experimentation. RFC_7 should be tried in the common B+ lead to the 20- and 40-meter coils in addition to the way shown. In some cases this change will result in more stable operation on 20 meters.

Low-Level Power Supply

The first two stages of the exciter are run from a single 500- to 600-volt pack. The full voltage is used on the plate of the 802 with the screen and suppressor voltages being tapped off the bleeder R_8. The suppressor voltage is adjusted to about 40 volts maximum and the screen to about 250 volts maximum. The resistor R_7 is used to drop the voltage under 350 volts for the 6A6. The resistor R_9 is used to drop the voltages still further when 40-, 80- and 160-meter output is desired, as the full voltage is not required to give sufficient excitation on these bands. This resistor is shorted-



Bottom view of the chassis with all the components mounted but before the major portion of the wiring process has been begun.

out for 20- and 10-meter operation by means of a section of the band-change switch.

Bias Provision

Bias for the exciter is obtained from the combined use of grid resistors and a bias pack. About 50 volts of external bias is used on both the 802 and 35-T to provide protection for the tubes, the remainder coming from the resistors in the grid leads.

Mechanical Construction

The exciter is laid out on a steel chassis 12"x19"x3". The split-stator condenser C_5 and condenser C_1 are mounted on butt-in insulators which give the condensers the right height and also insulate the rotors from the chassis, making possible the use of a blocking condenser between the rotor of C_5 and ground. Condenser C_3 is mounted directly on the crackle-finished panel although insulated from it. Condenser C_2 is mounted on a small standoff insulator underneath the chassis in such a position that its shaft projects through the panel at a point 1½ inches from the bottom edge of the panel and midway between the condensers C_1 and C_3. C_4 is mounted in like manner near the 35-T socket. The crystal switch, S_6, is mounted on a small panel placed just back of the two sockets for the 6A6 and the oscillator plate coil. A metal bracket is used to mount the main band-change switch which is seen in the center of the chassis with a terminal strip, supported by brass pillars, just in front of it.

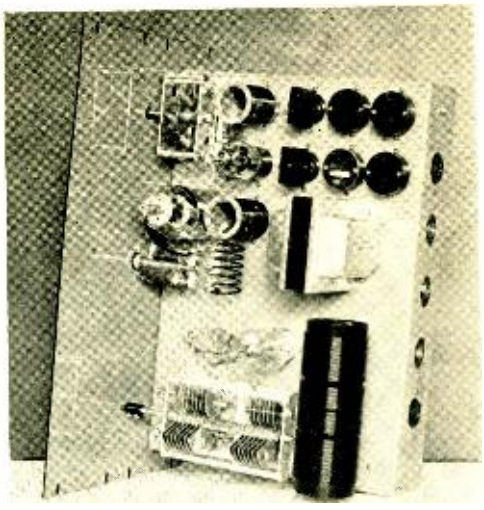
When looking at the under-chassis view of the exciter, the three left-hand sections of the band-change switch are used to connect the 802 to either the oscillator or the buffer, short portions of the oscillator plate coil, and to switch crystals. In accordance with the diagram, the upper section (closest to panel) is S_3, the middle section is S_2 and the lower section is S_1. The upper right-hand section is the switch S_4 and the middle section is S_5. The lower section is unused. The isolantite socket for the 35-T is placed a short distance below the chassis in order to shorten the plate connection as much as possible. The neutralizing condenser, made up of two small pieces of aluminum mounted on standoffs of different heights, is placed just in front of the tube.

The band-change switch is held in position by a small angle-bracket fastened to the chassis. A filament transformer is also included on the chassis.

It will be noticed that certain leads in this transmitter are quite long. However, great care was taken in the layout to make the 10- and 20-meter leads as short as possible. The 10-meter coil, L_4, as mentioned before, is mounted directly behind C_3 on butt-ins feeding through the chassis, the underneath side being connected directly to the adjacent section of the band-change switch which has been so positioned that only about a half-inch lead is necessary to make the connection. The switch for the 35-T is mounted directly under the split stator tank condenser with the 10- and 20-meter coil bolted directly to the taps of the switch. The pigtail connection of the switch closest to the metal chassis is left as is with a connection being made through a feed-through insulator directly to one section of the split stator condenser. The other pigtail was removed and a new one put on leading directly from the switch arm through a feed-through insulator to the other section of the condenser. This procedure makes the connections external to the switch very short although the overall lengths including the switch are somewhat longer than if bandswitching were not used. However, the 35-T operates very nicely on 10 meters with this arrangement and the efficiency is very good.

Crystal Switching

The longest leads in the transmitter are those joining the band-change switch to the crystals. When the unit was first contemplated, some doubt was felt as to whether the crystals could be changed



Top view of the chassis of the completed bandswitching 100-watt exciter. The 80-160-meter coil can be seen at the rear of the chassis behind the 35-T and its plate tank condenser. The final 10-, 20- and 40-meter coils are mounted below-chassis where they will be nearer the bandswitch.

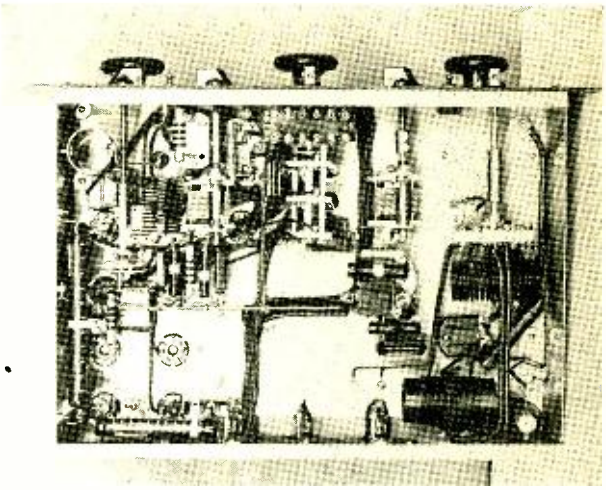
by the main switch satisfactorily, and the use of the special crystal switch on the left of the panel for all crystal switching was considered. However, before actual construction was started, a 6A6 experimental oscillator, which used long crystal leads, was built. In this oscillator it was found that the losses in the crystal leads were very small and their length did not materially affect either the output or operation of the oscillator. The crystals were, therefore, changed with the main switch in the exciter unit and results obtained were very satisfactory. The arrangement shown in the diagram makes possible the changing of four crystals by means of the main band-change switch, one crystal being used for both the 40-and 20-meter bands. This combination was used because the writer had no intention of using the 40-meter band and a special frequency for 40 meters was not considered necessary. Operation in this band was provided merely to make the unit an all-band exciter. The separate crystal switch makes possible the choice of other frequencies when desired. The six crystal sockets which are provided, combined with the crystal switch and the main band-change switch, enable the use of almost any combination of frequencies which the individual may desire.

Metering

The under-chassis view of the exciter shows a terminal strip in the center near the front to which are brought all meter connections, thus making it very simple to connect meters mounted on a separate panel. Three jacks are also provided on the back of the chassis to read the 6A6 plate current, 802 grid current and the 802 plate current in case separate meters are not provided for these circuits. After the transmitter has once been adjusted, these readings are of little importance although the 6A6 plate meter is handy to indicate crystal oscillation. In the writer's station, meters are provided to read the 6A6 plate current and the 35-T grid and plate currents. The meter used for reading the plate current of the 35-T is placed in the cathode circuit, and when the connections are made as shown in the diagram, it will read both plate and grid currents. One must be sure to remember when taking plate current readings to subtract the grid current from the plate meter reading in order to get the plate current.

Coil Specifications

In giving a description of the coils, the oscillator will be considered first. The section L_2 is the small coil mounted underneath the chassis in the upper left-hand corner. It consists of 11 turns of no. 18 enameled wire on a bakelite form 1½ inches in diameter with turns spaced to make the coil ¾ inch long. The section L_1 consists of 40 turns closewound on an XP53 coil form and tapped at the 14th turn from the cold end. A space of about ⅛ inch is left in the winding at the point where the tap is connected in order to make the connection a little easier.



Bottom view of the completely wired exciter. The terminal strip in the upper center of the chassis is for connection to the indicating milliameters.

The coil L_3 has 13 turns of no. 12 wire with a diameter of 1¼ inches. This coil is mounted directly on the terminals of the condenser C_2 and the spacing is adjusted until 20 meters is reached with the plates of the condenser nearly all the way out.

The coil L_4 consists of 6 turns of no. 12 wire with a diameter of 1¼ inches and a length of about 2 inches. Here again the length is varied until the 10-meter band is reached with the plates almost all the way out.

L_5 consists of 49 turns of no. 18 wire closewound on an XP53 coil form and tapped at the 13th turn and the 32nd turn from the cold end. A small space in the winding is again left at the points at which the taps are made.

The 10-20 meter coil for the plate circuit of the 35-T is somewhat complicated in construction. It consists of 20 turns of no. 12 wire 1¼ inches in diameter and spacewound to occupy a length of about 2¼ inches. The middle 9 turns of this winding are used for 10 meters. However, the taps are not made in the usual way. Instead, the central portion of the coil is a separate winding, the ends of which are bolted directly to the 10-meter contacts on the band-change switch. The outer portions of the coil are then bolted to the switch between the 10- and 20-meter contacts. This procedure improved the 10-meter efficiency considerably over a coil with 10-meter taps soldered to the windings, and the efficiency is very nearly as good as with a separate 10-meter coil.

The 40-meter coil consists of 32 turns of no. 16 wire closewound on a 1½-inch diameter bakelite form and is mounted on small insulators. The 80-160 meter coil mounted on top of the chassis has 80 turns of no. 14 wire closewound on a 2½-inch bakelite form and is tapped 26 turns from each end. A space of ¼ inch is left in the winding at the tapped points.

Output Link Circuits

Separate links are used for each coil and are brought out to a six-prong socket mounted on the back of the chassis. A six-prong plug and cable make a neat arrangement for transferring the power from this chassis to the final. Each of the links consists of two turns of heavy wire wound around the center of the corresponding tank coil. At the time the photographs were taken, the permanent link had not been placed on the 80-160-meter coil. The 10-20-meter link is wound with no. 12 enameled wire and is supported around the tank coil by its own terminals which are bolted to the bandchange switch. Two holes were conveniently present in the switch, making this arrangement possible.

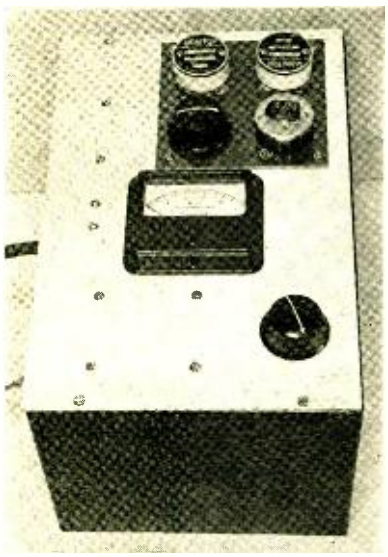
Tuning Procedure

The tuning of this transmitter, after it has once been adjusted, is simplicity itself. To tune up on 10 meters the procedure is as follows: Place both band-

[Continued on page 76]

Remote Frequency Control

By FRANK C. JONES,* W6AJF



Looking down on the remote control unit. The three crystals, two fixed and one variable-frequency type, along with the selector switch can be seen in the upper left-hand corner with the plate milliammeter just below them.

The unit illustrated in the photographs was designed to allow quick frequency change over a good portion of the 20-meter band. Crystal control by means of three variable or fixed crystals will allow a good choice in attempting to find an unused portion of the 20-meter band. Eighty-meter crystals were selected for use in a Pierce crystal oscillator, and a high-mu triode serves as a doubler to 40 meters. The output circuit is then link-coupled to a special 40-meter tank coil which plugs into the crystal socket in the main transmitter unit. A 6C5 or 6C5G is used as crystal oscillator and a 6J5G acts as doubler or unneutralized buffer.

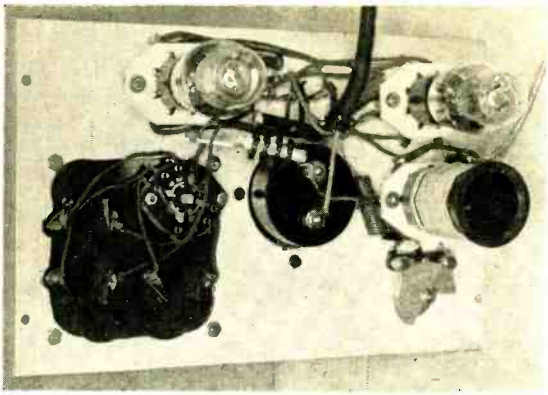
This small exciter can be located beside the radio receiver and a frequency shift can be made over quite a range without retuning any portion of the main radio transmitter. A variable 80-meter crystal which will provide from 3 to 5 kc. shift on 80 will give from 12 to 20 kc. change on 20. A switch selects any of three crystals.

The unit shown was designed to connect into a Pierce 6C5 crystal oscillator in a relay-rack phone transmitter. The power cord terminates in an octal plug which has a 2½-mh. r.f. choke connected in the plate lead at the octal plug. This allows the plus and minus 250-volt and the 6.3-volt leads to be taken from the old 6C5 crystal oscillator tube socket. This furnishes 6.3 volts at 0.6 amp. and 250 volts at 20 to 25 ma. for the remote control unit. The power supply could be obtained from a radio receiver power pack if necessary, in which case no r.f. choke would be needed at the far end of the power supply cable.

The two tank coils (the one in the transmitter and the one in the control unit) are link-coupled together with 8 to 10 feet of shielded rubber-covered conductor; the flexible sheathing should be grounded. This type of conductor is more effective than a twisted pair and prevents feedback from the antenna system. The coil which plugs into the transmitter crystal holder socket has a small .001-μfd. mica condenser in series with one lead so that this coil can be plugged into any standard type of crystal oscillator circuit. The output is about one watt, which is enough to drive most small buffer or doubler stages such as the 6A6 or 6L6G type. When it is plugged into a *Pierce* circuit, the triode oscillator tube should be *removed* from the main transmitter. In other standard oscillator circuits, the oscillator tube should be used as a doubler in all cases unless its plate circuit can be rearranged for neutralization.

The two coils have 17 turns of no. 22 d.c.c. wire on 1½-inch diameter forms with a winding length of nearly 1½ inches. The number of turns on the plug-in coil at the main transmitter position will depend upon the shunt capacities.

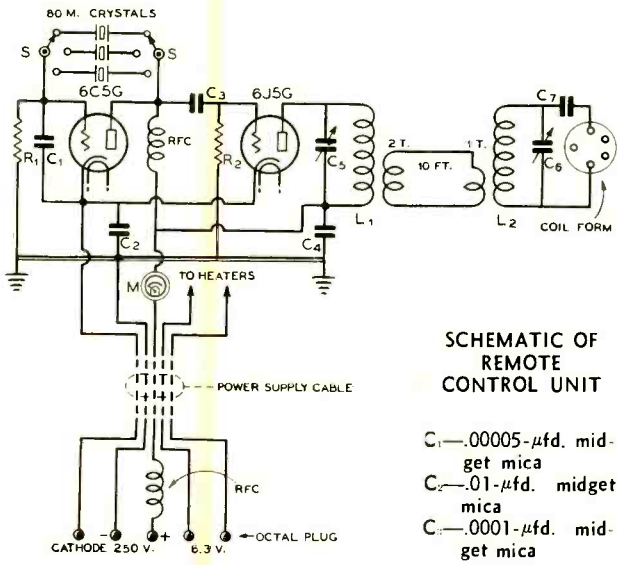
* Engineering Editor, RADIO.



Under-chassis view of the unit. The homemade multiple crystal holder, made from a micarta plate and holder clips, can be seen in the lower left corner.

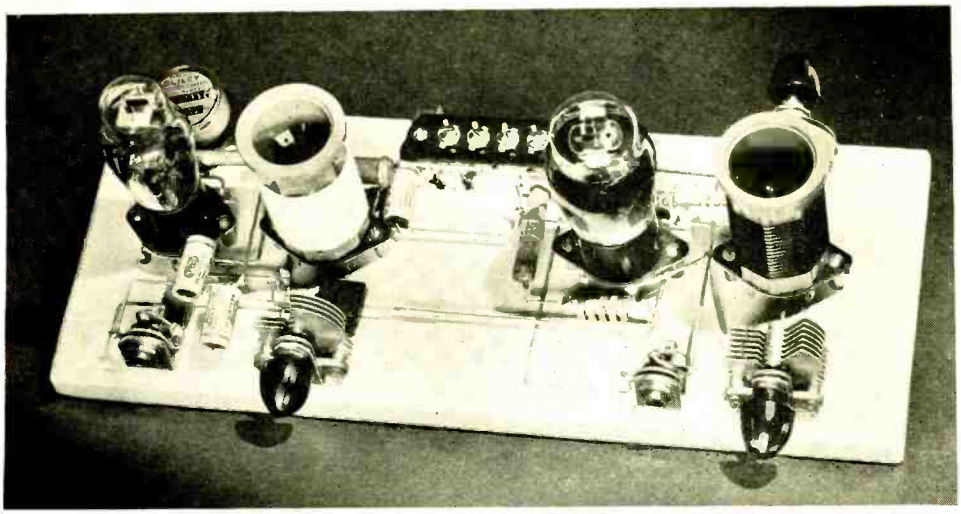
A 3-30-$\mu\mu$fd. mica trimmer condenser directly across the coil inside of the coil form allows this circuit to be tuned to resonance (40 meters for the above coils). It should be trimmed to drive the next doubler stage hardest in the middle of the desired range of frequencies. The unit shown is to drive a 6L6G doubler which drives a 35-T buffer which in turn excites a pair of T200 tubes in a plate-modulated rig.

The unit was built into a can 7"x7"x 11", though these dimensions could have been made considerably less. A milliammeter measures the plate current to both tubes and indicates a dip for tuning the 6J5G doubler. The plate current reads from 20 to 25 ma. with a 250-volt power supply. The cathodes of both tubes connect back to the ground circuit in the main transmitter. The crystal switch and three crystal holder sockets were made from old UX socket springs. These sockets and a three-position double-pole switch are mounted on a 4"x4"x1/8" piece of natural colored bakelite. Regular 5-prong porcelain or bakelite sockets could have been used for the crystal holders.



SCHEMATIC OF REMOTE CONTROL UNIT

C_1—.00005-μfd. midget mica
C_2—.01-μfd. midget mica
C_3—.0001-μfd. midget mica
C_4—.01-μfd. midget mica
C_5—50-$\mu\mu$fd. midget variable
C_6—3-30-$\mu\mu$fd. mica trimmer
C_7—.001-μfd. midget mica
R_1—50,000 ohms, 1/2 watt
R_2—100,000 ohms, 1 watt
RFC—2.2-mh. 125-ma. r.f. choke
S—Cryst l selector switch
M—0-25 d.c. milliammeter
L_1, L_2—17 turns, 1 1/2" dia., 1 1/2" long (7.0 Mc. band), links wound integral



Top view of the Newcomer's transmitter showing the simplified layout. One of the 80-meter coils is shown in the oscillator and the 40-meter coil is shown in the amplifier. The neutralizing condenser is mounted behind the amplifier tank coil.

The Newcomer's Special

By JACK ROTHMAN,* W6KFQ

The problem of an adequate crystal-controlled transmitter for the newcomer who wishes to come on the air for the first time on c.w. has never been very effectively solved for the amateur who has but a small amount of capital to invest in the first rig. The majority of the beginners now coming on the air use some type of a keyed crystal oscillator coupled directly to the antenna system. We all well know the results of this kind of operation. If the crystal is anything but the very best and most active type, the arrangement is capable of almost no usable power output. If the crystal happens to be an especially active one, it will be possible to obtain a respectable amount of power output but bad keying chirps are likely to be present, dots are very often not present if rapid keying is used, or, the rig may frequently become temperamental after having lain idle for a few hours or days and refuse to key at all until it is retuned.

Then, if the crystal does operate well and key cleanly, there is always the temptation to raise the plate voltage to increase the power output. This may be fine until the antenna accidentally or intentionally becomes uncoupled some fine day with the result that we will usually be in the immediate market for another crystal "as close as possible to the frequency of the last one."

Of course, there have been a number of excellent beginner's rigs described, but they have almost without exception been too inexpensive either of components or of power supply or they were of too meagre of power output to be capable of anything like consistent work.

The simple rig to be described, we believe, has effectively surmounted these drawbacks and, in addition, it has the advantage that operation on twice the crystal frequency may be had with the same power output as on the fundamental; also, some power output on the fourth harmonic may be obtained. Both tubes, all components and the power supply are inexpensive receiver parts. Hence, they are easy to obtain in the first place and to replace when the need arises.

* Laboratorian, RADIO.

The Tube Lineup

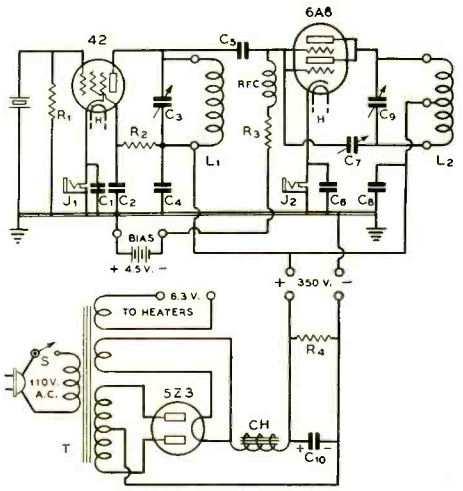
Nominally, the tube complement of the little rig consists of a 42 straight crystal oscillator followed by a 6A6 with the grids and plates in parallel as a neutralized class-C amplifier. While these tubes are recommended as having some slight advantage in one respect or another, there are a number of other similar tubes that may be substituted should they be more readily available or more suited to a particular mechanical arrangement. A 41, 2A5, 6F6 or 6F6G, 6V6 or 6V6G, or a 6K6G could be substituted for the 42. The 41 and the 6K6G are identical except for their basing, the 6K6G being octal, and both draw 0.4 ampere of filament current as compared to 0.7 for the 42 and the 6F6 and 0.45 ampere for the 6V6. The 2A5, of course, should be used where a 2.5-volt filament supply is available. If a 6.3-volt transformer is available for filament supply (which, of course, will be the usual case), filament drain will be of little matter and the 42 is recommended as shown in the diagram; for battery operation the lower filament drain of the 41 and 6V6 makes them more advisable.

The 6A6 may be substituted by a 53 for 2.5-volt operation or by a 6N7 or 6N7G if metal tube or octal-base tube is desired. The use of any of these tubes will require no change in the values of components as given in the circuit diagram.

Power Supply

Any power supply capable of supplying about 350 volts at 125 ma. will be suitable for the operation of the rig. If battery operation is desired, one of the large Mallory Vibrapacks that supply 300 volts at 100 ma. will be suitable when operating into the filter shown if 8 mmfd. is added across the input. The filament supply can of course be another winding on the same transformer, a separate filament transformer or a storage battery if the Vibrapack is used. The lower voltage of the vibrator supply will permit of a smaller current capability in it.

With a full 350 volts applied to the plates of the oscillator and the amplifier the final will draw about 80 ma. under full load and the power output will be about 15 to 18 watts into the antenna.



SCHEMATIC DIAGRAM

C_1, C_2—.01-μfd. 400-volt tubulars
C_3—50-μμfd. midget variable
C_4—.01-μfd. 400-volt tubular
C_5—.00004-μfd. midget mica
C_6—.01-μfd. 600-volt tubular
C_7—25-μμfd. midget variable
C_8—.01-μfd. 600-volt tubular
C_9—100-μμfd. midget variable
C_{10}—8-μfd. 450-volt electrolytic
R_1—25,000 ohms, 1 watt
R_2—25,000 ohms, 3 watts
R_3—7500 ohms, 10 watts
R_4—50,000 ohms, 20 watts
Coils—See coil table
J_1—Oscillator cathode closed-circuit jack
J_2—Amplifier cathode closed-circuit jack
T—880 v. c.t., 125 ma.; 5 v., 3 a.; 6.3 v., 3 a.
CH—9.5 hy. at 110 d.c. ma. choke

With the lower voltage, 300 volts on both plates, the power output will be reduced somewhat more than proportionately; 12 to 15 watts output can be expected.

Tuning Up

Two coils are required for both the 80 and the 40-meter bands when a crystal fundamental to the band is used. In other words, when operating on 80 meters with an 80-meter crystal two 80-meter coils will be required. The same thing will be true when operating with a 40-meter crystal on 7.0 Mc. However, when using an 80-meter crystal on 40 or a 40-meter crystal on 20, obviously only one additional coil will be required for

COIL TABLE

Band	Turns	Spaced
20	12	1½"
40	16	2"
80	36	Closewound

All coils wound on 1½" forms with #18 enamelled

the band that is harmonically related to the crystal.

It will be best to tune up the rig for the first time on the 40-meter band with a 40-meter crystal. With 40-meter coils in both coil sockets, with a milliammeter in the crystal oscillator cathode jack and with an open plug in the amplifier jack, tune the crystal plate condenser through resonance. As the capacity in this condenser is decreased from maximum a point will be reached where there will be a sharp drop in plate current on the oscillator. Tune this condenser slightly to the low-capacity side of minimum plate current and leave it at this setting.

Neutralizing the Final

With the oscillator still running and with the open plug still in the cathode jack of the amplifier, couple a flashlight lamp with two or three turns of wire across it to the plate coil of the amplifier. As the amplifier plate condenser is tuned through resonance a point should be reached where the lamp will light brightly. Peak up the indication on this lamp and then proceed to rotate condenser C_7 slowly until the lamp begins to diminish in brilliancy. If at any time during this procedure the crystal stops oscillating, it should be peaked up to give maximum indication in the pickup lamp. The amplifier plate condenser C_9 should also be peaked to maximum brilliancy of the pickup lamp.

Tune condenser C_7 until the lamp reduces in brilliancy, goes out, and then begins to light up again. Then reset this condenser to the point halfway between where the lamp went out and where it began to light up again. This is the approximate neutralizing adjustment. The fine adjustment can be obtained by removing the pickup lamp from the amplifier plate coil and noting the reading of the milliammeter in the oscillator cathode circuit. Small readjustments in neutralizing condenser C_7 should be made as the amplifier plate condenser C_9 is tuned from maximum to minimum capacity until the crystal cathode milliammeter does not flick as the amplifier is tuned through resonance. When this point is reached, the amplifier is neutralized.

As a check for neutralization and possible parasitics, remove the open plug from the amplifier plate jack and insert the milliammeter plug after having removed it from the crystal stage. Apply the plate voltage to both tubes, dip the amplifier plate condenser to minimum plate current or resonance, and couple a 25-watt lamp with about 6 turns of wire connected to it to the amplifier plate coil. Couple the lamp tightly enough so that the amplifier draws about 75 to 80 milliamperes of plate current after its plate condenser has been dipped to resonance. Now, listen to the note emitted by the rig by tuning in the signal on a set from which the antenna has been disconnected. See if the note remains satisfactory as the crystal is tuned in and out of oscillation and as a key, inserted into the oscillator jack, is opened and closed. This check should be made both with and without the lamp dummy load coupled to the amplifier tank. If the note remains good throughout these tests, if the crystal is on frequency and if the rig will key well, it is ready to go on the air.

Coupling to the Antenna

Any type of conventional antenna system may be used with this transmitter with good success. The coupling arrangement will of course depend to a large extent upon the particular type in use. A highly effective and comparatively inexpensive antenna is the ½-wave doublet, cut to operating frequency, fed by twisted-pair feeder line such as EO-1 cable. With an antenna feed system such as this it is only necessary to connect a one- or two-turn link to the end of the transmission line and to couple this link to the output tank circuit until the final amplifier draws 75 to 80 milliamperes. It is always advisable to retune the tank circuit slightly after making a change in the antenna coupling to insure that the tank is dipped to minimum plate current on the amplifier.

The rig may be keyed either in the

[Continued on page 66]

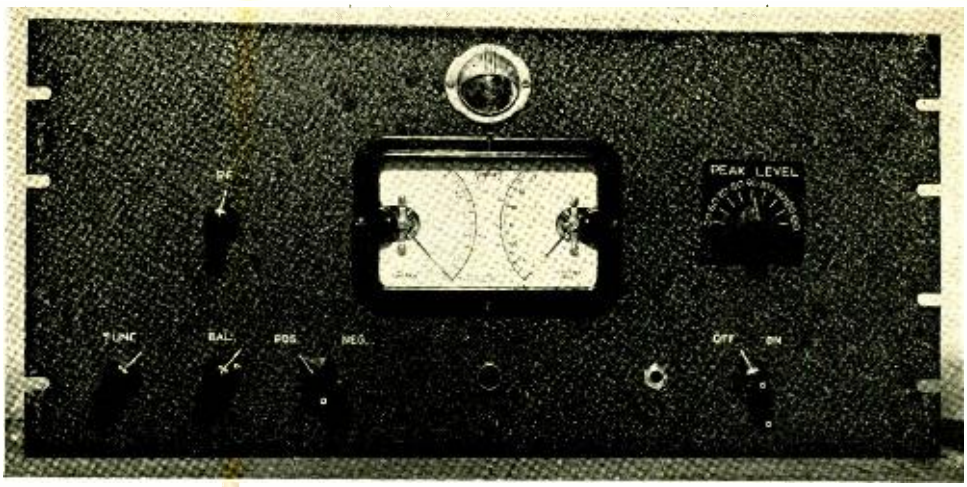


Figure 1. Panel view of the rack-mounting type modulation indicator.

A Broadcast-Type

MODULATION INDICATOR

By HENRY G. JONES *
W6GCT

In this day of frequent air checks by F.C.C. monitoring stations, it is quite essential that amateur stations be operated correctly—unless, of course, the amateur has the short-lived hobby of collecting pink and green tickets. Good modulation indicating equipment is excellent insurance on the life of the amateur phone station, and will relieve the phone man of a lot of worry when the rig is being operated.

Most modulation indicating devices commonly used by amateurs are lacking in the ability to register accurately the type of modulation peaks of short pulse duration that result from the varying, complex waveforms of speech sounds. Some are so highly damped in order to avoid overswing of the indicating instrument that they miss speech peaks entirely, and others are so fast that they go far beyond the actual modulation percentage. In both cases, definite and reliable indication of actual peaks is usually lacking. Oscilloscopes are fine business for initial adjustments and tuning up, but critical to handle for the continuous monitoring necessary nowadays. They also lack definite peak indication, for which reason the F.C.C. does not approve them for broadcast use.

If you are satisfied with the usual run of ham-station measuring devices, do not visit a first-class broadcast station as the writer of this article did, or you will start figuring on some new equipment immediately. The broadcast types of modulation indicators provide good measuring. Ease of adjustment, a percentage-calibrated instrument that has a rapid upswing but does not go too far on the peaks, the same instrument having a slow return to keep from bouncing, and a means for instantaneous indication of peaks over any desired modulation percentage are their common features. These are the requirements we desired in our modulation meter. We obtained them by constructing one similar to those commercially available to broadcast stations.

* 3680 Bayside Walk, Mission Beach, Calif.

General Operation

The r.f. signal to be monitored is fed into the meter through a low impedance link circuit L_1 to a tuned circuit comprised of L_2 and C_1. The amount of r.f. input is controlled by R_1, which is isolated from the d.c. circuit by condenser C_2 and RFC. This r.f. is rectified by the first diode, a 1-V, and the signal is filtered out by C_7-RFC-C_8 allowing a pulsating direct current to flow in the first diode load resistor R_{20}-R_{21}. The carrier meter M_1 reads the average value of this direct current, which is proportional to the average carrier input voltage. The average component of the voltage across this load resistor excites two indicating devices—one an instrument, M_2, calibrated directly in modulation percentage, the other a flasher circuit for providing warning when a certain degree of modulation is exceeded.

The modulation indicating instrument operates as follows: The audio component previously referred to is rectified by the second diode detector, a 76, and charges a condenser C_9. Since this condenser has only a 40-megohm load, R_{14}, across it, appreciable time is required for it to be discharged. The voltage across this condenser is impressed across the grid circuit of a voltmeter tube (another 76) which has the modulation meter M_2 in its cathode circuit. This voltmeter tube circuit is indifferent to plate voltage changes. The resistor-condenser combination R_{14}-C_9 gives the modulation meter the characteristic of rapid increases and slow decreases in indication, which makes for better reading and also reads peaks of short duration much more accurately.

For the flasher circuit, the same audio component is impressed across the grid circuit of a triode detector (a 76). The output of this detector appears across the cathode resistor R_3 and is impressed upon the grid circuit of an 885 discharge tube. The bias on the 885 is controlled from the front panel, this control being calibrated from 50 to 130, representing per cent modulation. The 885 is normally biased to cutoff and when the audio voltage exceeds a value determined by the peak-level control R_{10} the tube passes current and operates the neon lamp N_2 in its plate circuit.

Construction

As shown in the photographs, the unit is designed to fit in a standard 19-inch rack; in our case it is mounted with the transmitter speech equipment on the operating desk. The panel is standard 1/8" steel 8¾"x19", to which is fastened an 8"x17"x3" chassis. The parts are arranged for symmetry, short leads where needed, and r.f. isolation; nearly all of the wiring is subpanel. The input circuit components L_1, L_2, RFC, R_1 and C_2 are mounted on the top left-hand side of the chassis to the rear. A shaft extension is run back to R_1 to permit short leads. C_1 is mounted below the chassis directly under these parts, the leads running to it using small feed-through insulators.

In line to the rear of the chassis are mounted the 1-V first diode (shielded), 76 triode detector, 885 discharge tube (shielded), fuse and power transformer. In the middle row are located the 76 second diode detector, the 76 voltmeter tube and the 84 rectifier. N_1 the neon-lamp voltage stabilizer, is mounted toward the

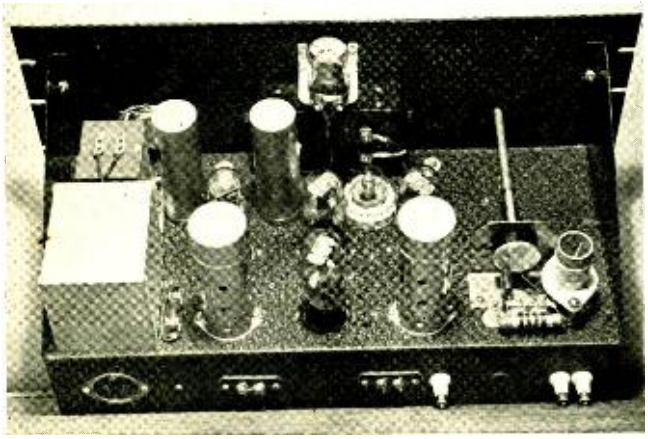


Figure 2. Rear view showing the shielded input circuit on the right, the various other components in the center and the special power transformer and choke alongside the left edge of the chassis.

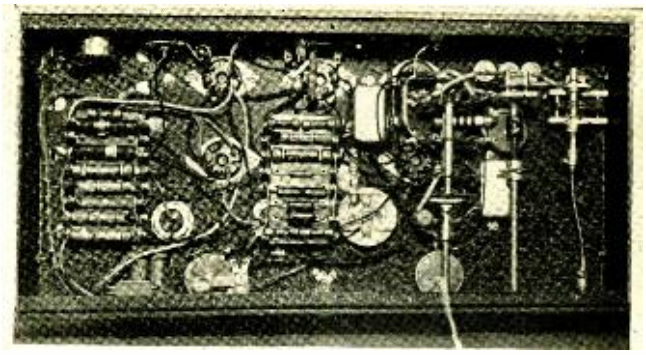


Figure 3. Under-chassis view showing placement of components and the mounting of the majority of the resistors upon resistor plates.

front of the chassis in a standard sign receptacle lined up with C_{10}, C_{11} and the filter choke. The audio calibration control R_{20} and the flasher calibration control R_{11} are mounted below the chassis near the front, R_{20} to the left and R_{11} to the right. These are standard potentiometers with their shafts cut off and slotted for screwdriver adjustment.

The peak indicator tube N_2 is located in the top center of the panel, utilizing an Amphenol eye assembly and a molded bakelite lamp socket for mounting purposes. The twin instrument can be seen in the center, with the r.f. input control R_1 to the left and the peak level control R_{10} to the right. Along the bottom from left to right are lined up the input tuning control, C_1 balancing condenser control, C_3, the polarity switch control, S_1, pilot lamp, monitor jack and power switch.

Below the chassis, C_3 and S_1 are mounted toward the rear by using shaft extensions. Since many resistors are required, neat wiring was obtained by mounting most of them on two thin bakelite cards. On the card in the center are R_2, R_3, R_{22}, R_{14}, C_9 and R_{15}. The other card has R_{19}, R_4, R_7, R_6, R_{17}, R_{16}, R_8 and R_9 mounted on it. This leaves a few additional components, which are mounted directly on the parts with which they are associated. Filament leads are twisted, and cabled with power supply leads, but r.f. and audio leads are run directly and as short as possible.

The a.c. input is run in the back of the chassis through a recessed male receptacle, and r.f. and ground through small feed-in insulators which extend out from a dust cover. Two terminal strips are shown in the photograph but they are not ordinarily used. One of them was intended to bring out leads so that additional percentage modulation meters could be placed in the circuit for remote operation and also calibration; the other for placing a 4-ohm shunt across the carrier meter, changing the range. This may be used when utilizing the modulation meter as an output meter in reading small levels.

Parts

In some cases, to get the proper value of condensers and resistors, several stock sizes had to be connected in series or parallel as the case demanded. For example: To get the plus or minus 10% .007 μfd. required for C_9, standard tolerance .005-μfd. and .002-μfd. mica condensers were paralleled and checked on a capacity bridge. R_{14}, the 40-megohm plus-or-minus 5% resistor, was ordered special from the S. S. White Co. Several companies lately have started marketing high-resistance accurately calibrated resistors, so that it should not be very difficult to obtain one. However, if access is had to a high-range accurate ohmmeter, this value may be obtained by checking two 20-megohm stock resistors and using them in series.

The polarity switch connections look rather foolish at first glance, but are necessary to prevent the meters from banging their pointers against the pins when switching from positive to negative peaks while in operation. A three-section six-pole four-throw nonshorting switch, a stock item, was employed; one pole of it is not used.

N_1 and N_2 are standard GE screw-base one-watt neon lamps with a little work done on them. These lamps have a

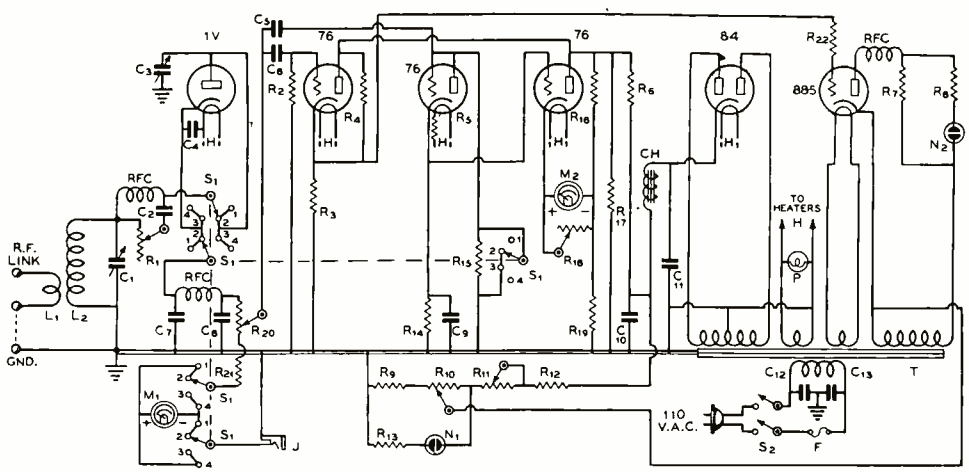


FIGURE 4. SCHEMATIC DIAGRAM

C_1—50-$\mu\mu$fd. midget variable
C_2—.0001-μfd. mica
C_3—35-$\mu\mu$fd. ultra midget var.
C_4—.00001-μfd. mica
C_5, C_6—0.25-μfd. 400-volt paper, can type
C_7, C_8—.00025-μfd. mica
C_9—.007-μfd. mica ± 10% type
C_{10}, C_{11}—8-μfd. 450-volt elect.
C_{12}, C_{13}—.05-μfd. 400-v. tubular
R_1—500-ohm pot.
R_2—560,000 ohms (½- and .06-meg. ½ watt in series)
R_3—70,000 ohms, ½ watt
R_4—700,000 ohms, ½ watt
R_5—10 ohms, 10 watts
R_6—56,000 ohms (50,000, 2-watt and 6000, ½-watt in series)
R_7—10,000 ohms, 10 watts
R_8—1000 ohms, 1 watt
R_9—15,000 ohms, 1 watt
R_{10}—15,000-ohm pot.
R_{11}—30,000-ohm pot.
R_{12}—40,000 ohms, 2 watts
R_{13}—15,000 ohms, 1 watt
R_{14}—40 megohms, ±5% (see text)
R_{15}—560,000 ohms (½- and .06-meg. ½ watt in series)
R_{16}—700,000 ohms, 1 watt
R_{17}—27,000 ohms, 1 watt
R_{18}—1000 ohms, 10 watts, semi-fixed
R_{19}—70,000 ohms, ½ watt
R_{20}—3000-ohm pot.
R_{21}—8000 ohms, 2 watts
R_{22}—22,500 ohms, ½ watt
RFC—2½-mh., 125-ma. r.f. chokes
M_1—0-5 d.c. milliammeter
M_2—0-0.5 d.c. milliammeter
S_1—5-pole, 4-throw tap switch
S_2—D.p.s.t. a.c. line switch
N_1, N_2—1-watt neon glow lamps
T—Special power trans. See text
CH—40-hy., 1500-ohm, 10-ma. choke
L_1, L_2—Tuning coil (see text)

series resistor of fairly high value in the base, which must be removed. Use the old and tried tube-base removal method: heat the bulb in boiling water, unsolder the leads, remove the base and clip out the resistor. Replace the base on the bulb while still hot and resolder the leads; usually no additional cement will be required to hold them together.

The high-voltage power supply requirement is very low; the direct current required for the entire unit is around 10 milliamperes at 350 volts. The power transformer used as shown in the photographs is an RCA replacement part number 16766 which can be ordered through your local jobber. The use of this particular transformer insures having correct voltages on the various components and makes it possible to get all the required voltages in one compact unit. However, should it be desired to use a standard replacement type transformer, the following ratings will be necessary: one 2½-volt 1.4-amp. winding for the 885, one 6.3-volt 1.7-amp. winding for the 1-V, 76's and 84, a high-voltage winding to put out 350 volts d.c. at 15 milliamperes (approximately 600 volts a.c. center tapped with condenser input will do this), and a winding having 160 volts a.c. for the flasher circuit.

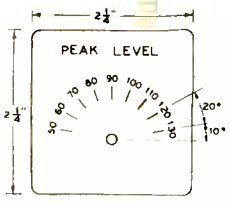


FIGURE 5

Layout of dial scale used with peak level flasher control. White engraving on black bakelite is suggested for this scale.

It will probably be difficult to find a small transformer with both a 2½-volt and 6.3-volt winding, in which case an 884 can be substituted for the 885, the only difference being the 6.3-volt filament of the 884. All tubes can then be run on a single 6-volt winding. The real catch in substituting transformers comes in getting the 160-volt winding. This would best be obtained by using a separate transformer which could very easily be constructed by the amateur. Small wire can be used in this winding as the current demand for the flasher circuit is quite low. Some of the early types of sets have windings which from center tap to one side of the high voltage will give close to the value needed, and perhaps one of these can be found in the overworked junk box.

The filter choke used, an RCA part number RT331, was ordered with the transformer. This choke has an inductance of 40 henries and a d.c. resistance of approximately 1500 ohms. Substitution here is easy as the choke has to carry only about 10 milliamperes. One such as Thordarson T74C30 should be quite satisfactory. In making voltage checks on the complete unit, 350 volts should be measured from the filter choke to ground, 115 volts from plate to ground on the flasher amplifier, and 115 volts from plate to ground on the voltmeter amplifier.

Choice of Resistors

In the choice of variable resistors, it is a good idea to use wirewound ones since they will maintain calibration where bleeder current is running through them. An exception to this is the r.f. input control R_1, where a non-inductive type should be used since r.f. is being handled. R_{10} is a Yaxley M15MP 4-watt wirewound linear-taper potentiometer.

Choosing the Instruments

Care should be taken in the choice of the percentage modulation meter, as the unit to be used should have a high-speed movement with a minimum of overthrow. Quite a few different types were tried before a satisfactory one in the reasonably low-price class was found. Weston makes a meter for this purpose that is really marvelous to watch in operation, seeming nearly as fast as an oscilloscope picture and yet overswinging very little. This meter would be ideal but is really too high-priced for the average amateur, since it sells for around $35. In testing different types of 500-microampere meters, we fortunately tried the d.c. movement of a 1200A Triplett tester and found it to be just what we were looking for. This meter is quite fast and has good action, due partly to having a light knife-edge pointer which reduces the momentum and also gives an air damping effect on the peaks of rapid swings. This type of pointer travels through the air broadside, creating enough air resistance when moving rapidly to give the required retarding effect on peaks.

The carrier meter M_1 is a standard d.c. milliammeter having a range of 0 to 5 milliamperes. In ordering the meters special the twin instrument type was decided upon for appearance and convenience. These can be furnished in any combination desired. Specify the meter as follows: left side to be 0-5 milliamperes marked carrier; right side to be 0-500 microamperes, same type movement as in 1200A tester, knife-edge pointer, scale divisions marked 0-120, and labeled per cent modulation. Submit a drawing of the scale desired.

This meter is later shunted to the required 0-600 microamperes by the semi-variable resistor R_{18}. To do this put the shunted meter in series with an accurate 0-1 milliammeter, battery and variable resistor. Adjust the current flow to 0.6 ma. on the 1-ma. meter, and set the shunt to give full scale deflection on the percentage meter. For convenience, a line should be made on the M_1 meter scale at the 3.8-ma. carrier reference point.

The peak-level dial scale shown was made of a good grade dull black poster cardboard with white drawing ink lettering. Three or four coats of thin clear varnish give a nice finish and provide protection for the lettering. This of course could be made to order by a bakelite engraving company if so desired. The dimensions are given in the drawing.

Coils

The plug-in r.f. input coil L_1-L_2 is wound on a one-inch coil form. L_2 is wound to hit the desired frequency, and L_1 to give sufficient coupling, depending on the line impedance and the amount of r.f. available from the transmitter. The number of turns in L_2 is quite critical and is affected by the coupling to L_1, so some cutting and trying will probably be necessary. For the 80-meter band, L_2 has 35 turns of no. 28 d.c.c. wound 60 turns per inch; for 20 meters, 7¾ turns of no. 22 d.c.c. wire spaced to ⅝ inch; for 10 meters, 4 turns of no. 22 d.c.c. spaced to ¾ inch. A two-turn link interwound at the cold end should be sufficient in most cases. After the coils have been wound and tested to hit frequency and coupling, give them a good coat of coil dope.

Adjustments

Set meters M_1 and M_2 to read zero with the power on but with no r.f. being fed in. An r.f. link circuit with a twisted-pair line should be run either to the final tank circuit or to the antenna tank if one is used. The amount of coupling necessary will of course vary with the amount of power being run in the transmitter. Ordinarily, very loose coupling can be employed as normally only about a quarter of a watt of r.f. is needed to operate the meter. With the polarity switch set in the negative position and the r.f. input control R_1 at maximum (minimum resistance), feed in r.f., tune C_1 to give maximum reading on the carrier meter M_1 and adjust the coupling link at the transmitter to increase this reading to approximately full scale. Now reduce this to the 3.8-milliampere carrier reference value with input control R_1 and throw the polarity switch to positive. If the carrier meter does not read the same, adjust balancing control C_3 to compensate for asymmetry of the r.f. voltage so that with the same r.f. input the meter reads the same with the polarity switch thrown in both positions. This does not affect the calibration of the modulation meter or peak indicator.

Calibrating for Modulation Percentage

To calibrate the modulation percentage meter, set the polarity switch to negative and feed sufficient signal to the transmitter (constant-frequency modulation) to cause over 100% modulation. Adjust r.f. input to the 3.8 reference value and vary the audio calibration control R_{20} until the modulation meter reads 100%. This calibration depends upon the transmitter's working properly so that negative peaks reach 100% on overmodulation. If possible, an oscilloscope should be used in conjunction with this calibration to see that the transmitter is modulating properly.

To set the control tube, have sufficient carrier and modulation to give a reading of 100% on the modulation meter, turn the peak level control knob until the neon lamp just flashes and note position of pointer. Reduce the modulation meter reading to 50% by either reducing the r.f. input or reducing the transmitter per cent modulation, and again rotate the peak level control knob until the neon lamp just flashes. Measure the distance between the positions at 100% and 50% modulation which should be the same as 100% to 50% on the pointer scale. If not, it will be necessary to change the position of the calibration control R_{11} until this condition results. When this condition has been satisfied, loosen the nut holding the peak-level control on the panel and rotate the control itself until the neon lamp just breaks down with the pointer on 50, with the modulation meter still reading 50%. Check back on 100% modulation and see that the neon lamp just flashes when the control is set at 100. These adjustments sound quite complicated, but once they are learned they can be done quite rapidly.

With the arrangement shown for aural monitoring, calibration will be disturbed when the headset is plugged in. This could be remedied by reducing R_{21} by an amount equal to the resistance of the headset, and switching in another resistor of this value with the mounting jack. However, this was not deemed necessary since these checks are infrequent and only of short duration.

In addition to the general monitoring for which the meter was intended, am-

[Continued on page 76]

For Amateur Phones . . . .

INVERSE FEEDBACK

By WILL A. BELL,* W6JXS

Many hams who operate phone and who have limited pocketbooks will be interested in an inexpensive system whereby distortion in the audio system and peaks throughout the audio range will both be reduced to a small percentage of their former values. A simple inverse feedback regenerator can be applied to the majority of audio systems without seriously altering the general lineup to accomplish the above result.

The complete feedback regenerator shouldn't cost more than $1.50 to $2.00 if all the components are purchased new, and since most amateurs will be able to obtain a majority of the parts from the "spare parts department" the cost will probably be somewhat below the quoted figure. The regenerator is diagrammed in figure 1 and consists of an input circuit tuned to the operating frequency, a full-wave rectifier, a filter circuit, a high-audio-frequency trap circuit and an output voltage divider.

The rectifier, an 84, 83V, or a pair of 27's with plates and grids in parallel for suggested examples, detects all modulation on the transmitter carrier. To be sure that the tuned circuit is picking up only from the output of the transmitter and not from one of the buffer stages it is best that the tuned circuit of the regenerator be coupled by a link to the antenna circuit of the rig. After the signal has been detected the r.f. is filtered from the audio components by C_2, RFC and C_3. Then, C_4 and CH act as a series-resonant trap circuit the function and need of which will be described later.

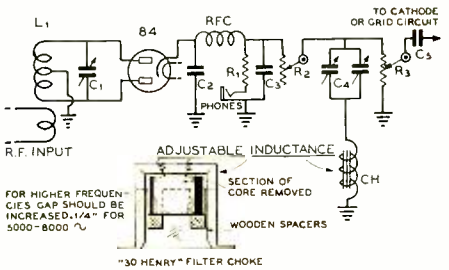


FIGURE 1

ELECTRICAL HOOKUP OF THE FEEDBACK UNIT.

C_1—Midget variable to tune L_1 to operating frequency
C_2, C_3—.0001-μfd. mica
C_4—2-gang .00035-μfd. per section b.c.l. variable
C_5—1.0-μfd. 400-volt tubular
R_1—5000 ohms, 1-watt carbon
R_2—5000-ohm potentiometer
R_3—15,000-ohm potentiometer
CH—Rebuilt midget filter choke
RFC—2.2-mh. 125-ma. r.f. choke
L_1—Plug-in coil to tune to operating frequency with C_1

R_2 and R_3 act as output controls to determine the amount of feedback voltage that is fed into the audio amplifier stages.

The largest bugaboo of inverse feedback is oscillation occurring between 4000 and 15,000 cycles in the audio amplifier and modulator circuit. This oscillation is caused by the cumulative phase shifts in the various stages and components of the audio system. Ordinarily, for perfect inverse feedback action, the phase angle of the feedback

* 608 W. Elk St., Glendale, Calif.

voltage should be 180° behind that of the audio signal at the point where the feedback is being inserted. In any properly operating inverse feedback system there is some frequency or band of frequencies where this is the case. But, as the frequency is raised or lowered from this optimum value (which, incidentally, is usually in the vicinity of 1000 cycles) the phase angle existing within the amplifier from the point of feedback injection to the output circuit varies over a wide range. As the phase angle varies from 180° and passes 90° toward the inphase condition both above and below the optimum value (near 1000 cycles), the combined amplifier and feedback circuit takes on a tendency toward oscillation. The frequency at which this oscillation takes place is determined by the degree of feedback and by the design of the amplifier.

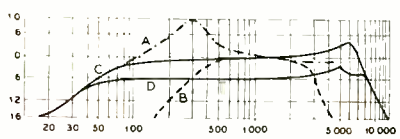


FIGURE 2

(A) Approximate power-frequency distribution of average male voice.
(B) Conventional speech amplifier with band-pass filter in operation.
(C) Overall frequency response of same amplifier with no feedback.
(D) Frequency response of same amplifier (two audio transformers in circuit) with 6 db of feedback.

Sources of Phase Shift

Audio transformers are usually the prime offenders in regard to phase shift in an amplifier, although insufficient capacity in coupling and by-pass condensers also contributes its share. For instance, if one high-grade transformer is used the amplifier will usually take off and oscillate at some frequency from 10,000 to 18,000 cycles as the magnitude of feedback is increased. Any combination of transformer- or resistance-coupled stages can be used for speech work as long as the oscillation frequency occurs above 5000 cycles. This usually will limit the feedback loop to the enclosure of three high-quality transformers or two of the ordinary good-quality type.

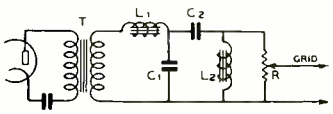


FIGURE 3

Simple band-pass filter for 500-2600 c.p.s. response to be inserted between two transformer-coupled single-ended stages. Composite response of amplifier and this filter is shown in figure 2B. Values of components not particularly critical.
C_1—.0005-μfd. 400-volt tubular
C_2—.00075-μfd. 400-volt tubular
R—100,000-ohm potentiometer
L_1—"30-henry" filter choke, midget size
L_2—Same as L_1

In conventional amplifiers we need only worry about the high frequency where the phase shift becomes such that oscillation can exist, as this point is usually reached before that at which low-frequency oscillation can take place. In other words, the gain of the amplifier is usually greater at the high frequency at which oscillation can occur than it is at the low frequency at which the same phase angle exists. For this reason it is an axiom that the higher the frequency at which oscillation will occur, the more feedback it will be possible to use and the more will be the attenuation of harmonic and frequency distortion.

Installation and Operation

Determining the point at which to feed the degenerative energy into the speech amplifier is one requiring an evaluation of a number of factors. First, it is seldom advisable to feed back around more than two audio transformers; this is especially true when those two transformers are the class-B input and output. Next, it is advisable to feed back into the grid circuit of a single-ended stage. For these reasons it is usually conceded that the best place

to return the voltage in a class-B modulated rig is into the grid (or cathode) circuit of the single-ended driver for the class-B modulator. Or, if a push-pull driver is used, it is best to use a phase inverter between the speech amplifier and the push-pull driver and to feed the energy into the cathode circuit of the phase inverter tube that receives a.f. input from the preceding stages. This necessitates the use of a phase inverter tube with two separate cathodes.

When the feedback is being coupled into the cathode circuit (and this is recommended over coupling directly into the grid circuit as the coupling coefficient is higher) the cathode by-pass condenser is removed and the coupling condenser C_5 is connected to the cathode of the tube. With the 84 tube rectifying enough carrier to provide a current of 10 ma. or so through the potentiometer R_3, the latter is advanced until the higher frequencies are brought up but not to the point of oscillation or instability.

If a series-resonant trap circuit is placed in the feedback line between the r.f. filter and the control potentiometer (CH, C_4, figure 1), and if this trap is tuned to the oscillation or peak frequency, the feedback can be advanced more. All frequencies above this point can be by-passed to ground. Don't try to stop oscillation by by-passing the highs to ground in the audio amplifier itself because this produces phase shift and the feedback will not cancel distortion at high frequencies.

It should be remembered also that phase shift at low frequencies can occur if the blocking condensers are too small (under 1.0 μfd). We will admit that the bass will be "booped" up but it will be of an artificial nature due to the voltage lag and will introduce serious phase shift and distortion at frequencies below 70 cycles.

Now, if it is desired to reduce phase shift in a transmitter on the high audio frequencies (8000 cycles and up) to allow better fidelity to be obtained, it will be necessary first to replace any skimpily designed or saturated transformers. Also, inductively-wound filter condensers and dried or corroded electrolytics in the plate and bias supplies can always be suspected for trouble. Insufficient by-passing in power-supply filters, condensers with insufficient capacity to offer low reactance to audio current in low-impedance positions and an oversize plate blocking condenser in the plate-modulated class-C stage, all can cause enough phase shift to produce difficulties.

To return to modulation systems, feedback is most easily applied to low-level modulated transmitters because the audio power levels required are low and because the energy usually will be required to pass through a minimum of transformers between the input of the amplifier and the antenna output. Grid or grid-bias modulation is particularly good in this respect and for this reason feedback is most successfully applied to transmitters so modulated. Twenty-four to thirty db of feedback have been applied to this type of transmitter as compared to the practical maximum of 12 to 15 db to plate-modulated transmitters.

The amount of feedback being employed in a transmitter is determined by noting first the audio level required to give a certain percentage of modulation with the feedback circuit disconnected, then the feedback is applied and the increase in audio level required to modulate the transmitter the same percentage with the feedback is noted. This increase in level, measured in decibels, is numerically equal to the amount of feedback that is being employed.

If you are interested only in phone dx instead of high-fidelity transmission, the modulated carrier power may be used most efficiently by restricting those frequencies that do not contribute to the understandability of the signal. By excluding the frequencies below 500 c.p.s. and over 3000 c.p.s. 95% intelligibility can still be attained, but the audio level can be 6 to 12 db higher than before without overmodulation since 70% of the power in the average male voice is below 500 c.p.s. By eliminating the frequencies above 3000 c.p.s. the sideband width of the rig will be reduced, thus allowing it to be tuned in and out more sharply. The inexpensive band pass system which is illustrated will do the job. It is recommended that such a system have a switch to select band pass or standard fidelity as the band pass quality isn't so pleasant to listen to and is not necessary for local contacts.

●

The *California Kilowatt* is neither Californian nor a kilowatt.

An installation of one of the self-contained mobile transmitter-receiver units as made in the rear deck of one of the new patrol cars of the Beverly Hills, Calif., Police Department. The covers have been removed from the various sections so that they may be seen more clearly. The fishpole antenna with its insulating block can be seen mounted upon the bumper.

• A Modern U. H. F.

By F. R. GONSETT,* W6VR

The 9-10-meter mobile transmitter described by the above author in the July, 1938, RADIO was in reality a step in the design of a new series of mobile transmitter-receiver units for use by one of the west-coast police and fire departments. Since the publication of that article the old-type self-excited, modulated-oscillator transmitters and superregenerative receivers have been replaced by the modern crystal-controlled transmitter and superheterodyne receiver units shown in the accompanying photographs.

While a fixed-frequency receiver was used in the installations shown, by installing a standard, battery-operated 28-Mc. superhet in place of the 30- to 41-megacycle one shown, an excellent ten-meter mobile installation would be had.

The Transmitter

To obtain absolutely reliable coverage of the area desired from the mobile cars in which these units were installed, the output power of the transmitter was increased somewhat over that shown in the original article. The power increase was obtained by using 6L6's in place of the 6V6G's in the amplifier and modulator stages and by increasing the plate voltages on the entire unit. The main problem in obtaining the increased power output was to find a suitable power supply for the transmitter that would not exact too heavy a drain from the car battery. A Carter type 520A dynamotor was finally chosen and was used with the filter recommended for it. The rated output of the generator is 500 volts at 200 ma., but because of the voltage drop in the cables from the battery to the power supply the actual delivered voltage is in the vicinity of 425 volts. In the particular installation cited, with very heavy cables from the battery to the transmitter (the size of the standard battery supply cables can be seen in the installation in the trunk of the patrol car) and with the car frame as the return circuit the actual voltage delivered to the dynamotor is 5.5 volts. With the rather light 6.3-volt leads used in many amateur rigs it will often be found that the actual battery voltage is in the vicinity of 5 volts. Low supply voltage can really play havoc with the efficiency of a dynamotor as well as reduce its output voltage.

A standard duty car battery is used to supply the car's ignition system, the lights and the u.h.f. transmitter and receiver. An oversized car battery is not required for the normal number of transmissions per hour made by a cruising police patrol car. The batteries installed in cars at the present time are designed to carry a number of additional loads of no mean magnitude in addition to the ignition system and the lights. The standby load of the u.h.f. installation is within this permissible drain.

* Laboratorian, RADIO.

A vertically-mounted installation of one of the units behind the front seat of the Fire Chief's car. The appearance of the units with their covers in place can be seen in this view.

Mobile Installation

Usually, in common amateur practice the car is *not* running when the majority of the operating is done so that the generator does not have a chance to bring the battery up to charge. For this reason it is advisable to use a heavy-duty battery in amateur automobile installations of this power capability. Or, if desired, two standard car batteries may be paralleled to give the desired ampere-hour rating.

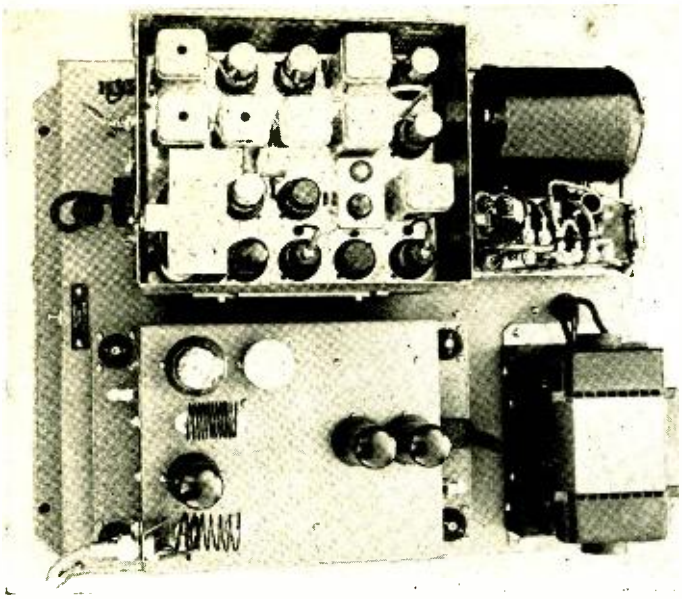
However, in police use with a standard automobile battery, in order to maintain a proper charge to the battery a special generator is used. In patrol-car service it is the usual thing to run the car at a speed of 10 to 15 miles per hour for long periods of time. Therefore, it is necessary to install a special generator to deliver the required charging rate at this low rate of speed. The generators finally selected were especially designed to be operated at this low speed for police work. The output current delivered is 25 to 30 amperes from 12 to 15 miles per hour on up. Due to the high charging rate, there is a special cutout relay to reduce the charging rate to a moderate value when the battery approaches full charge.

For ordinary amateur work, intermittent as it is, the standard generator should be ample providing it is set at its maximum charging rate. It will then have a chance almost to balance the drain when the car is moving and to build up the charge between transmissions or when moving from one location to another. Incidentally, take a tip and park the car on an incline when operating from that hilltop location; in case the battery should become too depleted this expedient may save a lot of pushing.

Transmitter Circuit Alterations

The transmitter design was altered only slightly from the original design given in July RADIO in order to compensate for the increase in plate voltage that is employed. The main change was the addition of screen dropping resistors in each of the respective screen circuits. In the case of the r.f. circuits the screens were each fed through 20,000-ohm resistors, with a 50,000-ohm resistor placed from screen to ground on the crystal-oscillator tube. The reason for placing this resistor to ground on the oscillator was to reduce the possibility of sudden surges of screen voltage which easily could damage the crystal. The screens of the modulators were fed from B plus through a 15,000 ohm resistor, and the cathode resistor was increased to 600 ohms. All resistors are two watt except the one in the cathode of the modulators which is 10 watts.

Under normal conditions the 6V6G oscillator draws about 40 ma. fully loaded. Since the actual plate voltage is only 425 volts, the 6V6 will operate very safely. One thing to remember in operating the regenerative oscillator is the fact that the crystal current depends to a large



A top-of-chassis view of one of the complete units with the various covers removed. The RCA receiver with its associated power supply can be seen along the top and the four-tube transmitter, mounted upon shock insulators, with its dynamotor can be seen below.

extent upon the voltage applied to the screen grid of the tube and if the voltage is too high, damaged crystals will be the result. The capacity of the regeneration condenser is .0005 μfd. which gives ample output without too much regeneration.

Crystals

Some trouble was encountered with the crystals used in the oscillator circuit. The majority of the present day high-frequency crystals are of the harmonic operated type. These cuts will not work satisfactorily in the circuit shown so be sure and use only an X or an AT which will be operated on its fundamental.

Note that the final r.f. stage operates as a doubler. However, the efficiency is so high that in comparing it with a straight amplifier under similar conditions the output was about the same. The plate current drops to about 20 ma. in resonance and rises to about 80 to 100 ma. out of resonance. The plate current is run at about 60 ma. fully loaded by the antenna. With the plate voltage at 425 volts and the plate current at 60 ma. 25 watts input may be obtained. The measured output is in the neighborhood of 15 watts.

All resistors are mounted on a resistor strip to insure stability with regard to vibration. The tubes are mounted in sockets with tight fitting pins to make them stay firmly in place. Rubber shock mounts are used in the four corners of the chassis to make the entire unit as free from shocks due to car vibration as possible.

The antenna is a quarter-wave vertical mounted on the rear bumper and insulated from it. The base of the antenna is connected to the inner conductor of the feed line while the outer conductor of the line is grounded. The feed line used is made up of ordinary shielded wire with rubber insulation. Tests were run on several different transmission lines and it was found that with a line this short (only about 3 feet are used) there was no appreciable difference insofar as loss was concerned. The antenna is used for both receiving and transmitting and is switched by means of a relay which also transfers the storage-battery voltage to the transmitter generator.

For amateur communications the receiver used herein will not be satisfactory in that it is pre-tuned in the rear of the car; however, for police communications it is highly satisfactory. If the unit is to be used for amateur work, a

[Continued on page 74]

● A rush article goes over the teletype to RADIO'S production office, 3000 miles away.

Departments

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DX AND OVERSEAS NEWS

HERB. BECKER, W6QD

Readers are invited to send monthly contributions for publication in these columns direct to Mr. Becker, 1117 West 45th Street, Los Angeles, Calif.

Here we are again, and listen my pals, you're really in for a big session. You had better tip yourself back in that easy chair, and for this one time you can put your feet on the desk. Remember, I'm warning you, and you had better be able to take it as this month's column is going to cover a little of everything, including the color of shirt Oscar wore on night of June 14th. Possibly I should have mentioned there will also be a bit of dx news squeezed in here and there.

Third Anniversary

I am glad to say that this issue of RADIO marks the Third Anniversary, and the beginning of the fourth year of "DX." This department, "DX," was first introduced in RADIO for October, 1935. Previous to that time there wasn't a medium anywhere that the dx man could call his own. It is true that here and there would appear squibs of extraordinary "goings on" of dx men but there was no department set aside exclusively for them. It was at this point that the present writer "went to work." Since then not an issue has been missed.

It is extremely gratifying to see the strides made in hams becoming dx minded, and I think it is pretty safe to say that there are ten times the number of dx conscious operators today, than there were a few years ago. I think it would be interesting to pick a few items out of the October, 1935, issue of RADIO. See if you remember any of the following:

"ZL4AI has packed up and moved to England."

"W8CRA, W6GRX, G5BD and VS1AJ had a lot of fun a few weeks ago in a 4-way QSO."

"ZS2A, our old friend Pye, says he will be back on the air again soon."

"OK2AK is going in for a little power; just recently purchased an HK-354 and a couple of 866's."

"G5BD and W6GRX have contacted exactly 101 times."

"W6CXW works his second YL . . . it being YL2BQ. CXW says, 'That makes two YL's I've worked, blonde and brunette'."

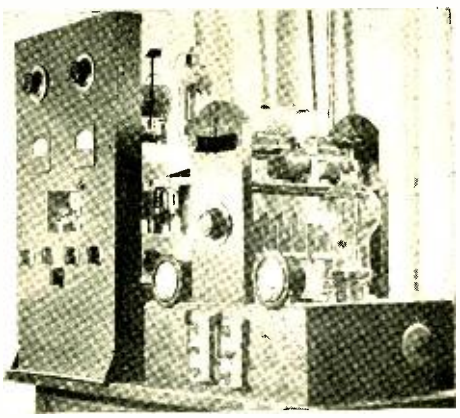
"F8EX had his eye on a girl which was why he wasn't on the air."

After looking over these excerpts, let's see what some of those fellows are doing now. ZL4AI is still in England; W8CRA is now a poppa; W6GRX has moved and no longer can use a Rhombic; G5BD has married; ZS2A (Where is he? Does anyone know?); OK2AK is no longer active, but is engaged in the Telefunken Lab. in Berlin; W6CXW is still on the air, though married, and F8EX is married and has a Jr. op.

Since the inception of "DX" three years ago, we have tried to present a complete, interesting department for the dx man. We have talked a little about what went on then . . . let's see what's going on NOW.

For the benefit of all concerned, I am going to do my best to group all dx news of phone and c.w. separately. There is a great batch for each and when we are all through . . . you be the judge as to who wins the "Handle."

I'm leading with a fast one when I tell you that ol' W6CXW logs his 150th country worked. Two weeks ago Henry gave me his last few countries and they totaled 149, so says I, "You'd better get busy and get that No. 150 by the time RADIO goes to press." Always obliging, CXW really went to work and as a matter of fact started to get up in the morning before breakfast. This was of course with the consent of the xyl. Anyway, just the other day the phone rings and here's Henry with the info that he had just hooked VS7RP on 14270 kc. for No. 150. Now he says bring on Zone 23.



W6CXW showing his new final amplifier with turret tank. The tubes are the same 150T's and the entire exciter and driving unit is behind the panel on the left. Henry used this rig when he worked his 150th country.

FREQUENCY LIST

The list of c.w. and Phone frequencies as shown below is compiled from this month's DX department. You will remember that these frequencies are not supposed to be exact but merely a general average as reportd by the DX men.

C.W. Stations		Phone Stations	
AC4YN	14106	CN1AF	14290
AR8MK	14460	HA8N	14090
CR9A	14385	I1MG	14120
CT2BM	14421	K7AOC	14180
EA7AV	14420	HC2HP	14260
FQ8AB	14418	J2MI	14100
HI6Q	14309	J5CC	14320
K6OVN(Guam)	14305	J7CB	14100
		HK1JC	14090
LX1AW	14405		
LZ1ID	14300	LA1F	14260
OQ5AQ	14427	LX1AI	14080
OY2A	14425	OK1SZ	14253
OY4C	14380	OZ2EA	14108
PJ1BV	14420	PK1RI	14360
PK1MF	14380	PK2WL	14310
ST2CM	14335	PK6XX	14005
SV1RX	13985		14300
TA1AA	14347	SP1ZK	14120
TF2X	14000	SP2HH	14100
TF3C	14410		14300
TF5B	14423	SP1MR	14040
U5HE	14405	ST2PB	14310
U5KN	14360	SU1GP	14080
UK5KJ	14415	SV1KE	14000
VK4KC	14390	TG5	14065
VO6D	14398		14135
VP2AB	14404		14290
VP4TP	14300	TG9AA	14100
VP6YB	14070		14380
VP8AD	14400	U3BX	14300
VP8AF	14435	VK6SS	14105
VP9X	14100	VK6MW	14110
VS2AE	14365		28220
VS7MB	14080	VP1BA	14110
VS7RF	14340	VP1DM	14105
VS7GJ	14125	VP7NS	14085
	14390	VP7NU	14168
VQ2FJ	14020	VP9L	14090
VQ3HJP	14410	VQ2HC	14312
VQ8AI	14305	VQ4KTB	14200
VQ9AA	14390	VS2AE	14110
XU8CM	14398	VS2AL	14285
XU8WR	14410	VS6AF	14285
ZC6AQ	14330	VS7RA	14200
ZC6NX	14300	XU8NY	14300
ZD2H	14285	XZ2DX	14010
ZD4AA	14166	ZS1AW	14020
ZD4AB	14345	ZS5WA	14095

Tom Arnold's station VU2AN at Fort Sandeman, Baluchistan, India, which is in Zone 21.

Zone 23

Speaking of Zone 23 . . . we may as well get this over with. A thrill that doesn't come every day happened to several of the boys the early part of August when they hooked up with AC4YR. On the night of August 3rd, W6TI connected at 8:14 p.m. p.s.t. This station signing AC4YR said that he was in the same town as AC4YN . . . Lhasa, Tibet. Frequency is about 14415 kc., T7. On August 8th at 11:00 p.m. c.s.t. W9UQT breaks out and hauls him down, and reports his frequency as around 14425. Harry says that W9BPU worked him also. To make this thing complete, W9QOE in Denver hooked him at 8:53 p.m. m.s.t. and this was apparently on August 14th.

Now then without trying to be om Gloom in person, I've tried to inquire into this AC4YR and from the sources which should know, he is still in the doubtful column. By that I don't mean that the guy is definitely a BL and not in Tibet but from what a couple of K6's and KA's say . . . it looks bad. They haven't heard of such a station, and they do hear the original AC4YN and then another one or two which you will hear about in the phone section. Anyway, gang, let's all hope for these fellows; it would sure be swell to have some one open up in Tibet to take up where AC4YN leaves off.

Forgot to tell you that AC4YN is going to pull out of there in the near future. So to W6TI, W9UQT, W9QOE, W9BPU and a couple of others whom I know to have worked him we hope he kicks through with a confirmation.

About W6TI, he is QSL manager for this district and therefore should get his confirmation as soon as anyone . . . or sooner. He has promised to let us know. W6TI, whose full name is Horace R. Greer, really has the snappiest system for handling the QSL cards. While going

through Oakland, we stopped off and I was surprised how readily he can put his fingers on the cards belonging to any one call. I might add, though, that there are actually thousands of cards lying there that are never even called for. If all the QSL bureaus throughout the country have as many uncalled-for cards, I think the gang should awaken to the fact and shoot in their No. 10 envelopes and get their cards. Pass the word around to your pals who may not be very active, and have them send in an envelope. It's ten to one he will have some cards there waiting for him.

W9QOE, who is ex-W6NDB, has worked other good dx from his new home in Denver: UK8IA, VQ8AA, OY4C, J8CD, CR7AW, FI8AC, J2CG, VK9VG, VP2AB, YR5VX, HI6Q, HJ7AI. W9UQT landed FG8AB, FO8AC, ZD2H, VQ2HC, TF2X and a guy signing AH2BU who says he is on Annobon Island just off French Equatorial Africa. W6AM also worked him and said he was in the 20-meter fone band on c.w. with a T7 signal, and was using 5 kw . . . AH2BU, I mean, not W6AM. W3EVW hooked up with ZA1C who gave his QRA as Box 15, Valona, Albania. It's too bad that TF3AG isn't OK as W1AB needs him very much, but if it will make him feel better there are plenty of others who are in the same boat . . . including "yours truly."

W3TR adds three countries: VP4TI, ZD2H, VP2LB. W8LYQ gives one to shoot at AR8MK and who says to QSL as follows: Don Lunnon, Posts and Telegraph, Damas, Syria. The frequency is 14460 with lots of sock.

W8OXO takes issue with the crack made in July about "W8OXO pops up from nowhere." He insists that West Virginia is

W9PGS and XE2N/XE1A holding the rig that the latter used in the contest.

CT3AN on the Island of Madeira, operator is Jose L. de Brito Gomes.

somewhere. I agree with him. The argument is over. Of more importance is the item that he has added another zone making 35 and 99.

W3GAU, who is in town for the summer, finally got OQ5AQ for his 38th zone and 115th country. N9SUC passes along word that I1IR in Milano, Italy, is supposed to be on daily from 0530, to 0645 G.m.t. at the high frequency end of 20. He needs Nevada, N. & S. Dakota, Wyoming and New Mexico . . . and don't forget, I1IR is 100% QSL station.

W6PKA, who is an ex-W2 and who took to heart the crack, "Go west, young man," has been going to town on Asians. He says he had such a famine of them while in N. Y. that now they are all he wants to work, hi. One early a.m. while working XU6AW, he was told to QRX a moment. When XU6AW came back on, he asked to be excused for the delay as there was an air-raid in Canton and they had turned off the A.C. He was back on using a generator.

New ones for W3DDM are VS2AE, ZD4AB, VR4HR making him stand at 38 and 116. At present Wilmer Allison, W5VV, is engaged in tennis wars all over the east coast. Before he left he said he was going to sit in his hotel room all summer and practice hearing weak sigs . . . the said practice consisting of sticking his head under the pillow and then imagining he is hearing AC4YN, R1. I hope he doesn't carry this practice out on the courts. Now then, Tom Caswell, W5BB, who is Wilmer's brother-in-law, and lives next door to him, is cleaning up since 5VV is out of the way for a while. Tom takes his time to tell us that the VP4 he worked was on 40 meters, and that he is seriously thinking of going on phone to work some W9's. Tom added OQ5AQ for his 120th.

Zone List

If some of you fellows find that your to-

"WAZ" HONOR ROLL

C.W.

	Zones	Countries
ON4AU	40	148
G2ZQ	40	139
W6CXW	39	150
W6ADP	39	140
W6CUH	39	140
W6GRL	39	140
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
XE1BT	39	90
K6AKP	39	67
G6VP	39	
W3ANH	39	
W4DHZ	39	
W7BB	39	
W8BTI	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
W3EDP	38	121
W8LEC	38	121
W5BB	38	120
W8DFH	38	119
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
W2AAL	38	109
W2GT	38	108
W8OQF	38	108
W8BOX	38	106
W9ADN	38	106
W9KG	38	106
W2GN	38	104
W3EVW	38	104
W8AU	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	109
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
W8EUY	37	95
W7BYW	37	93
W5CUJ	37	93
W3AYS	37	92
W6ITH	37	92
VK2AE	37	90
W6GCB	37	81
W9UBB	37	77
G6NJ	37	
W2BSR	37	
W2DTB	37	
W4AH	37	
VK3EO	36	112
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
W2BJ	36	71
G6CL	36	
U1AD	36	
W2BJ	35	105
W2OA	36	
W6KBD	36	
W8KKG	36	
W9ARL	36	
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	75
W2AIW	35	
W2IOP	35	
W3BBB	35	
W6NHC	35	
SU1WM	34	109
W3TR	34	100
W8BSF	34	100
W8DOD	34	96
VK2AS	34	94
W6EPZ	34	93
W8HGA	34	93
W6HJT	34	92
W3GHD	34	90
VE2EE	34	88
W2IYO	34	88
W6HEW	34	86
W6GHU	34	83
VK2TF	34	81
W6MJR	34	81
ON4SS	34	80
VK2TI	34	75
W4ELQ	34	74
W8JK	34	74
W6LHN	34	71
VK2EG	34	70
VK2VN	34	63
W9QOE	34	56
K6JPD	34	
W2FAR	34	
W3EGO	34	
W8CNZ	34	
W1RY	33	92
W4IO	33	91
W2BMX	33	90
W5KC	33	88
W6CEM	33	88
W3RT	33	86
W6LEE	33	85
W9LQ	33	84
W2WC	33	83
W6NAE	33	83
LU3DH	33	81
W6LCF	33	78
W6MVQ	33	77
VE4LX	33	69
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
W8AQT	32	97
W5ASG	32	90
W6DIO	32	90
W6KUT	32	85
W9FLH	32	80
ON4NC	32	79
W8QDU	32	79
W9PGS	32	78
W3CIC	32	75
W6AX	32	74
W3GAP	32	70
W6CQI	32	70
W6KZL	32	67
W6LPR	32	67
VE5MZ	32	66
W9DEI	32	66
ZU1T	32	65
W6KRM	32	62
W8BTK	32	
W8HYC	32	
W4MR	31	92
W6DRE	31	86
W6GNZ	31	85
W8FJN	31	85
W9LW	31	82
W1APU	31	81
W1BGC	31	78
CI6TK	31	76
SM6VX	31	76
W6NNR	31	74
G5VU	31	73
VK2VA	31	62
W6OFC	31	62
W8JSU	31	58
W6IES	31	57
W6CLA	31	51
W6OAQ	31	45
I1TKM	31	
VK2QL	31	
W3DCG	31	
W6HXU	31	
W9YGC	31	
VE2GA	30	84
W3KT	30	81
G6WB	30	80
W4DCZ	30	80
W1APA	30	79
W3CDG	30	78
W3UVA	30	76
W2HVM	30	74
W1AB	30	73
W3GMS	30	72
W4DMB	30	71
W8MFB	30	71
W6NLZ	30	70
W4DTR	30	68
W8MPD	30	66
W9VKF	30	66
W6OEG	30	61
W6KEV	30	58
W9VLQ	30	58
W8PHD	30	57
W8DPY	30	53
VE5ZM	30	52
W3EMA	30	
W6JJA	30	

W7AVL	30	
W8DED	30	
W8MAH	30	
W9IWE	30	

PHONE

KA1ME	35	79
W6ITH	34	72
W6OCH	33	81
W3FAM	33	68
W6NNR	32	73
W6MLG	31	72
W6LLQ	31	68
F8KI	31	53
W6AM	31	
W4AH	31	
VE1CR	30	68
W9NLP	30	64
W4DSY	30	
W2IXY	29	81
W3EMM	29	76
W6EJC	29	64
W9YGC	29	
W9QI	28	72
F8VC	28	58
W9BVC	28	58
VE2EE	28	56
W8LAC	27	72
G6BW	27	68
W8RL	27	58
G8MX	27	56
W6FTU	27	53
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
W6FTU	26	53
W2IKV	26	52
W7BVO	26	38
W6IKQ	26	36
W6BGH	26	
W8JK	25	47
W6GAL	26	45
W7AMQ	25	40
W6LYM	25	39
W6LEE	25	34
W6MXD	25	34
VK2ABG	25	
W3SI	25	
YV5AK	24	59
W1BLO	24	50
W9RBI	24	46
W6LPR	24	45
W6NLS	24	45
W2IUV	24	41
W6MVQ	24	32
VE5OT	24	
W1HKK	23	60
W6GRX	23	43
W9ORL	23	38
W7EKA	23	31
W7ALZ	23	27
W6AAR	23	
W6OI	23	
W7ESK	23	
W8QDU	22	47
W6FKK	22	26
W6NCW	22	23
W7AO	22	
XE1BT	22	
W2HCE	21	55
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
W1COJ	20	
W4BMR	20	

If you have worked 30 or more zones and are ready to produce confirmation on demand, send in your list of zones and official countries on a post-card.

Phone stations need work but 20 zones, but stations must be raised on phone. Stations worked may be either c.w. or phone.

(DX continued on page 75)

Calls Heard

Numeral suffix indicates "R" strength. Send Calls Heard to Calls Heard Editor, not to Los Angeles.

William Gaffney, 42 Bridge Street, S. Hadley Falls, Mass.
(March 3 to May 25, 1938)

(14 Mc.)

CM—2AF; 2AO; 2AZ; 2BA; 2BC; 2BH; 2BK; 2BZ; 2DO; 2MZ; 2RL; 2WD; 6RC; 7AC. CN8AR; CO2WM; CO5EO; CT1QH; CX1BG; CX1CG; CX2AJ; D4GAD; D4SIG; D4WER; D4XQF; EI2M. **F**—3AD; 3AI; 3AM; 3CX; 3CY; 3HG; 3KH; 3MN; 8AI; 8AM; 8BF; 8EX; 8FK; 8GQ; 8JI; 8NR; 8RJ; 8SJ; 8WB; 8WW. FA8BG. **G**—2DF; 2DK; 2GO; 2JT; 2KM; 2LA; 2MF; 2PU; 2UV; 3AY; 3BI; 3CN; 3GX; 3LI; 5HI; 5IV; 5KT; 5MS; 5MW; 5ND; 5NS; 5PN; 5TO; 5UG; 5UO; 5XC; 5YH; 6GH; 6GN; 6KP; 6KS; 6LF; 6MC; 6NF; 6RO; 6SQ; 6UP; 6WB; 6WY; 6XQ; 6XT; 6ZO; 8AP; 8DL; 8GB; 8GP; 8HH; 8HI; 8HN; 8IK; 8IM; 8IP; 8KI; 8NX; 8PI; 8RI; 8TC; 8UF; 8UG; 8UZ. GI3IA; GI5SJ; GI5TK; GI6TK; GM5SC; GM6HZ; GM6RT; GW5KJ; GW5UO; GW8CT; G3INP; HA1G; HA1P; HA2D; HA2N; HA3D; HA6A; HA8Q; HB9AJ; HB9AK; HB9AT; HB9BG; HC1IB; HC1JW; HH2S; HH2X; HI2T; HK1DG; HK3AL; HK3LDC; HK4AG; HK4EA; HR5C; I1EC; I1KN; I1LD. **K**—4DTH; 4EGZ; 4ESH; 4EVD; 4FAB; 4FCG; 4KD; 5AA; 5AC; 5AF; 5AH; 5AN; 5AU; 6BNR; 6M0J; 60QV; 6PAH; 7BQE; 7GIE. LA1G; LA7W; LU2CA; LU3DH; LU3EV; LU4BH; LU4DJ0; LU4EF; LU6BK; LU7AZ; LU7BK; 0A4R; 0H1BA; 0H30I; 0K1BC; 0K1CG; 0K1CX; 0K1PZ; 0K2BC; 0K2KJ. **ON**—4B0; 4BW; 4DI; 4FE; 4FL; 4FQ; 4GQ; 4GZ; 4IW; 4LR; 4NW; 4PW; 4QZ; 4Y0; 4VU; 4ZC; 4ZQ. 0Z2AA; 0Z3J; 0Z4H; 0Z7G. **PA**—CX; DA; EA; EP; KW; MS; ON; PA; RN; SS; UW; XG; ZB. PY1DT; PY1DW; PY2HN; PY5QG; PY5QJ; SM5UM. **SP**—1BC; 1CD; 1DC; 1DE; 1GZ; 1JB; 1KM; 1LP; 1MJ; 1MR; 1DL; 1QM; 2HH. TG9AA; TI2FG; TI2RC. **VK**—2AFN; 2AHE; 2DK; 2EO; 2HV; 2NS; 2UY; 2VF; 3FF; 3WO; 3XB; 3XU; 4RF; 4RY; 5LW; 5WR; 7LG. V030; V03P; V03X. **VP**—2AB; 2AT; 2LB; 3TEST; 4DL; 4GA; 5RS; 6LD; 7NT. VQ4CHS; VR6AY; XE1AA; XE1AG; XE1AM; XE1AV; XE1CM; XE1FS; XE2CG; XE2FG; YN10P; YN3BG; YR5KW; YR5ML; YV1AK; YV1AP; YV1AQ; YV3C0; YV4RA; YV5ABT; YV5AK; YV5AP. **ZL**—1AN; 1MQ; 1MR; 2CW; 2FR; 2GN; 4AC; 4DQ; 4FB.

●

Louis Wisniewski, W3QM,
2443 East Indiana Ave., Philadelphia, Pa.
(February, 1938)
(28 Mc.)

CM2AP; CN8AV; CT3AB; CX1CG; D3CSC; D4BUF; D4FND; D4GJ0; D4QBT; D4XJF; D4XQF; EI6G; EI7F; EI8B; EI8M; F8BS; F8JI; F8RR; F8TQ; F8YZ; F8ZF; FA8IH; G2DH; G2I0; G2TK; G2XC; G50J; G6QS; G6QX; G6RB; G8SA; GI6TK; GM6IZ; GM6RV; GM8FR; GM8MJ; GW2GV; HA4H; HA8D; J2MB; K4KD; K5AN; K7FNE; K7PQ; LU3DH; LU5AN; LU7AZ; LU9BV; 0A4J; 0E3AH; 0H50D; 0K1BC; 0K1CX; 0K1FF; 0K2LA; 0K2MV; ON4AU; ON4FE; ON4IF; ON4LU; ON4NW; 0Z9Q; PA0AZ; PA0EA; PA0GN; PA0LF; PA0PN; PY1AZ; SM5UM; SU1CH; V01N; XE1A; YL2BB; ZE1JR; ZS1AH; ZS1AN; ZS2AL.

[Continued on page 94]

East Works West on 56-Mc.

By E. H. CONKLIN*

The big news of the summer, unless the reported contact between W3GLV and HR4Z is confirmed, is the five-meter work from the west coast to the eastern districts. It isn't the first time that signals have been exchanged beween the Pacific and the Atlantic coasts—the winter cross-band QSO of W6DOB and W3AIR should get some credit—but it does represent the first known two-way all five-meter dx well beyond 1200 miles.

The most noteworthy day was July 24, on which five or more sixth district stations pushed their signals beyond the Mississippi. Best of all was the QSO between W6DNS in San Diego and W1EYM in Fairfield, Conn., nearly 2500 miles. It also permitted four stations—W8CIR, W8JLQ, W8VO and W9ZHB—to contact their eighth district on 56 Mc!

At nine o'clock Central time, on the morning of the 24th, the band opened to permit nearly three hours of contacts between W5's and the eighth and ninth districts. Somewhat later, W5EEX in Houston heard W9TOZ in Minneapolis, W8CIR worked W5EHM, and W6OIN heard W7FDJ periodically during the afternoon. The first evening opening of the band in the east was reported at 6:15 p.m. Central time when W9USI worked W8CIR, following which things opened up rather generally. But let's follow what was going on at W6DNS in San Diego, who writes as follows:

"July 24th will go down in the history of five meters for me. I got home from work at 3:15 p.m. Pacific time and listened in on five meters for about 30 minutes. The band seemed very dead and I became sleepy. I went to sleep and didn't wake up until the phone rang at 4:20 p.m. Being awake, once more I decided to listen on "five." What a shock I got! The band sounded more like "ten" than "five." W1's, 2's, 3's, 5's, 6's, 7's, 8's, and 9's were coming through. The QRM was terrific, especially on the low frequency end of the band. I started my first QSO on i.c.w. but I had 'buck fever' so badly that I had to switch to phone.

"Conditions were changing slowly and east coast stations were varying from R4 to R9. I noticed that as one station, say a W2 or W1, would fade part way down, a W8 would come up through and as the fade continued still farther, a W9 would come up and then out he would go and the first station would come banging through again. This would all take place within five or ten seconds.

W1EYM, Nat Bishop, Fairfield, Conn., who worked W6DNS in San Diego on 56 Mc. last July is discussing the pros and cons of beams and stuff for 56-Mc. operation with W1IJ who is also active on five meters. W1EYM is on the left; W1IJ, Owen Shepard, Madison, Conn., is on the right. Photo taken by C. W. Wight, W1BRL, Bridgeport, Conn.

"I have checked with several of the fellows in Los Angeles and find that San Diego must have been on the very north edge of the effective layer because none of these heard W1's, 2's, 3's, or 9's. They did hear one W8 and two (W6IOJ and W6RR) contacted. They also worked several W7s. All districts except the 4th were heard here. I contacted W1EYM, W8AGU, W8CIR, W8JLQ, W8NED, W5ASU, W5EHM, W7FDJ and W6IOJ. W6OIN heard a W9, 3, and 2 call me but I was too busy at the low frequency end fighting QRM and missed them.

"I have received QSL cards from every district except the 4th, as follows: W1EYM, W1KOE, W1KBQ, W2AMJ, W2JCY, W3EZM, W3HNT, W3HJT, W3EET, W3HPD, W3HG, ex-W3WG (Trenton, N. J.), W5EHM, W5CSU,

* Associate Editor, RADIO.

W1BRL the station of Wink Wight, taken by the OM. 27 watts input, crystal controlled, fone and c.w. on 56.096 Mc. The receiver is a resistance-coupled superhet.

W6PIV, W6IOJ, W7FDJ, W8AGU, W8JLQ, W8CIR, W8NED, W9QET, W9CKO, W9WYX, W9VXX (reports from W9's were R9 plus—all in Denver, no doubt the first skip). I heard W9CLH about R4 but don't believe he heard me. No doubt, he was just on the east edge of the second silent zone."

The band stayed open for W6DNS until 7:00 p.m. for eastern districts and 7:30 for W7's. During this time, W8CIR's contact (about 2120 miles) was heard by Clyde Criswell in Phoenix, Arizona (approx. 1820 miles) who was also hearing W9ZJB in Kansas City (1040 miles). W9ZJB heard W8CIR working W6PEX a few moments later, while W1, 2, 3 and 8 stations were all getting into Kansas City on the usual 400 to 1200 mile hop. In fact, communication in this range was taking place quite generally in the U. S. except possibly east from the seventh district and west from the fourth district.

In Colton, California, W6AVR raised W7FDJ just after five p.m., and picked up a fast fading phone calling W8PT, signing W5? on about 56.1 Mc. Then W8JLQ was heard, fading badly, for an hour before contact was made at 6:32. Eight minutes later the band folded up for east-west work but stayed open for the seventh district. W6AVR was heard in Bridgeport, Conn., by W1BRL along with every other district but the seventh. W1AVV also sent a report.

W6RR in Santa Monica raised W8JLQ twice, at 5:50 and 6:20 p.m.; and W5EHM at 6:07. He points out that W6DNS has clear sailing to the north and east, whereas farther north the hills cut off very low angle radiation.

In Alameda, up near San Francisco, W6PEX did the second best work for the west coast, between 8:25 and 10:20 p.m. Eastern time, by working W8VO, W8CIR, W8JLQ and W9ZHB. He was reported heard by W8NED in Pittsburgh and by W9CKO and W9IBB in Colorado.

W8JLQ was heard by W6FPV in Van Nuys, Calif., for an hour following 5:15 p.m. Pacific time while working W9's. The signals were weak and fading on a 28-Mc. superhet with just a five-meter tuned circuit in the first detector.

Wes Edmonds, W1KNM, Milford, Connecticut, "The Squire of Milford." Five meters exclusively, 57.464 Mc. Taken at the Horse-trader Association Get-Together, August 7, 1938 by Wink Wight, W1BRL.

W6OIN and W6VQ had left a good location to return to San Diego, but heard some of the eastern districts at home. A Denver station came in as late as 8:30 p.m. Pacific time., the single-hop signals apparently lasting longer than the long distance two- or three-hop signals.

Cockaday, W2JCY, was working W9AHZ and heard W6DNS alongside during his contact with W1EYM. Larry also heard W6MEP's second harmonic and a station signing W6HP or W6HT.

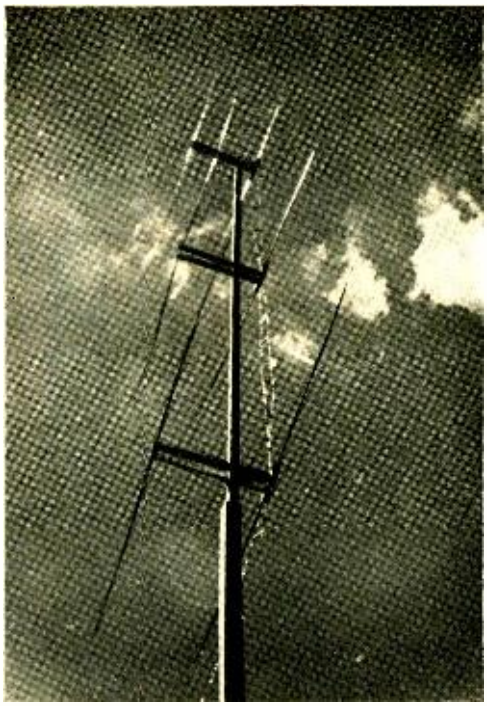
W8AGU in western New York gives the earliest time for a contact with W6DNS, 7:35 p.m. Eastern time, the signals lasting a half hour. A peculiar thing is that the "six" was the only signal coming in at the time, although W5's and W9's were heard shortly after, and W6's were getting through on ten meters.

W8CIR worked stations in South Dakota, Missouri, Oklahoma, Kansas and Texas. Then W5EHM called to say that there was double hop on, and a W6 might be worked from the eighth district. A half hour of looking around resulted in contacts with W6DNS and W6PEX at 9:30 and 9:45 p.m. e.d.s.t., leaving only W7 unworked. He received heard reports from eight W6's in California, one from Arizona, and two from Colorado.

W8NED doesn't mention working W6DNS but says that the band opened for W6DNS and W6PEX just fifteen minutes after W5 and W9 stations started coming through. "Dutch" says that a rumor is that a W1 worked a VE5, and that W7's have been heard locally.

In Akron, W8VO raised W6PEX for his eighth district on 56 Mc., adding this comment: "As for who are hearing the 7th district, and when, no confirmations have been received though they have been heard by Akron stations on July 15, 19 and 24 just as the band folded up for dx. Also a Cuban station."

The operating position at W9ARN showing the OM to the right and the unfinished direction indicator for the rotatable beam at the top of the picture. The crank for turning the beam can be seen just below the mike.



The insulatorless beam, a la RADIO, in use as a five-meter array at W8JLQ, who was another of the east coast stations to work W6's on July 24, last.

W8JLQ holds the eastern record for sixth district QSO's, listing five—W6DNS, W6PEX, W6RR, W6IOJ and W6AVR. He raised W5EHM, W5AJG and W9ZJB on one hop that evening also.

Among others reporting the W6's are W8KG (who heard W6PEX, W6DNS and W6AVR), W5EHM, W8BDG, W8JHW, W8MST (listing W6DNS and W6PEX), and W9ZMG, all of whom heard W6DNS. W9USI heard W6IOJ at 9:12 p.m. central time.

Equipment Used

The transmitters used by those participating in the long dx on July 24 lend strength to the argument for stability, and yet the rig used at W6DNS shows that stability *can* be obtained by methods other than crystal control. An HK54

The sectionalized bamboo portable tower mounted on the front of W8KG's car. Notice the license plate; they do that in Ohio.

concentric-line grid circuit oscillator drives two HK54's in the final with 175 watts input. The oscillator furnishes much more power than necessary to drive the final but there is much less frequency modulation on high voice peaks when coupling the oscillator very loosely to the final. The modulator uses four 6L6's. The speech and power supplies are located in a weatherproofed house on the roof under the antenna, along with the rest of the transmitter. The antenna is changed with a magnetic switch. The antenna consists of three co-linear vertical half waves in phase with directors spaced one-tenth wave, and is hung on a 50 foot pole.

W8AGU puts 250 watts on a pair of 35T's in the final, feeding a vertical "J" type antenna. The receiver is home-made with an acorn 956 r.f., 954 detector, 955 oscillator, and 3000-kc. intermediate frequency. All dx worked has been crystal controlled (except W6DNS, who has comparable stability). A very few self-excited stations are heard, but not at all well.

W6PEX had 70 watts input to a T-20 final feeding an 8JK rotary beam 50 feet high. The receiver was a resistance-coupled i.f. superheterodyne.

W6RR uses an HF100 with 130 to 250 watts input, driven by a 6J5G crystal tube on 28,028 kc., and a 6L6 doubler. The receiver is an Ultra Skyrider with an 1851 in the r.f. stage. The antenna is a "J" with a director spaced one-tenth wave.

W1EYM uses a converter with two 1851 tubes and a 6K7 ahead of his regular receiver.

W9ZHB uses crystal control and a rotary array. Most of the rest of the successful stations were described in RADIO for July.

The rather extensive layout of W2GHV is shown in this photograph. In the vertical relay rack at the left can be seen the secondary frequency standard with the 100-kc. crystal on the top panel along with its multivibrator, etc. The next lower panel houses the voltage regulated power supply for the frequency standard. Below this is the electron-coupled interpolation oscillator. On the operating desk is the oscilloscope and the 56-mc. receiver. To the extreme right is the rack containing the crystal-controlled 56-Mc. transmitter with 175 watts input to a pair of WE-304B's in the final.

Other Interesting Reports

On July 1, W9CCY heard W6XAO, Don Lee, Inc., on 55.8 Mc. for eight minutes. This was confirmed. W6DNS heard "XE2MI" on c.w. for 25 minutes on August 5, but we haven't located the station. An XE1P and another in Tampico were reported to us but ex-XE1AY in Mexico City checked without locating any Mexican stations active on 56 Mc. Some of these may have been harmonics.

[Continued on page 88]

Pitcairn Island

A card from Mason Shaw, W6LFD, brings the following useful information to those lucky souls who have had the honor of contacting VR6AY, Pitcairn Island.

"Any station sending International Reply Coupons to VR6AY may expect long delay in reply as these coupons are worthless on the Island. They must be sent to the U. S. or to New Zealand for redemption and there is a loss of about four cents on each one so handled. If you are in the U. S. A., U. S. stamps are acceptable; New Zealand stamps should be sent from all other countries. Do *not* send reply coupons."

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Inches to Centimeters

While discussing the measurement of the frequency of the 90-cm. transceiver described in the May RADIO, mention was made of the conversion of measured inches into centimeters. The formula for this conversion was incorrectly given. It read: cm. = 0.3937 x inches when it should have read, cm. = 2.54 x inches or, inches = 0.3937 x cm. Of course, the presence of this error was obvious when an attempt at conversion was made; it is quite general knowledge that a centimeter is somewhat less than one-half inch, and the incorrect expression would have given fewer cm. than inches.

●

Boston Hamfest and Mass. State Convention

The Boston Hamfest and Massachusetts State Convention, sponsored by the Eastern Massachusetts Amateur Radio Association and the South Shore Amateur Radio Club, will convene at the Hotel Bradford, Boston, on Saturday, October 15, 1938. The registration fee is $1.00 and the charge for registration and the banquet is $2.50. Interesting speakers, special meetings and contests are promised. A turkey supper and plenty of prizes are to be additional features of the entertainment. Remittances can be made to W1ALP, Frank L. Baker, 233 Atlantic Street, Quincy, Massachusetts.

●

Call Letters on Auto Plates

Michigan ham tourists in 1939 easily may be identified on the highways by their license plates which will bear their call letters, according to members of the Detroit Section of the Central Division Radiophone Association. Michigan is the first state to recognize the amateur by issuing to him a special automobile license plate bearing his federally-assigned station call letters. Others, no doubt, will follow suit in the near future.

In order to secure these special tags, amateurs throughout the state must make application for them at an early date. The Radiophone Association, with headquarters at 3-523 General Motors Building, Detroit, is compiling a list of those desiring them which it will forward to the secretary of state's office in the near future. When these plates are ready, they will be delivered to the nearest branch office along with the regular ones for assignment to the general public. There will be no additional charge for this service.

●

POSTSCRIPTS... and Announcements

Lecture Course in Radio over W1XAL

World Wide Broadcasting Foundation, operators of educational broadcast station W1XAL, announces that there will be presented over this station a lecture course in modern radio to begin on the first Monday in October and to extend until the second week of June, 1939. This is the third consecutive season for the lectures and they will be presented as before by Dr. C. D. Belcher of the "World University of the Air."

This year's operating schedule includes a lecture each Monday evening at 8:00 p.m., eastern standard time, on a frequency of 6.04 Mc., beginning the first Monday in October (October 3) and continuing for thirty-two consecutive Monday evenings at the same time,

same frequency, until June 12, 1939. The course will be repeated each Friday evening at 5:00 p.m., eastern standard time, on 11.79 Mc., by transcription. Through the use of these two frequencies and two transmission times on different days of the week it is felt that the largest number of listeners, both domestic and foreign, will be able to profit by the broadcasts.

In connection with his radio course Dr. Belcher has prepared a series of four illustrated booklets, each designed to cover eight lectures of the course. These booklets, containing diagrams and other material invaluable to the course, are available from the Foundation for the cost of printing and mailing. This is in keeping with the station's non-profit, non-commercial character. The price of the course is moderate—one dollar for each booklet, three and a half dollars for the complete course including all four booklets. Students enrolling in the beginning for the entire course will receive a complimentary binder designed to hold all the lecture notes. All supplementary literature is available at W1XAL, The University Club, Boston, Massachusetts.

Schedule of Lectures from W1XAL

Mon.— 6.04 Mc. 8:00 p.m. e.s.t.	Fri.— 11.79 Mc. 5:00 p.m. e.s.t.	Each lecture lasts one hour Subject of lecture
Sept. 12	Sept. 16	Introductory lecture
Sept. 19	Sept. 23	Introductory lecture
Sept. 26	Sept. 30	Introductory lecture
Oct. 3	Oct. 7	1. Evolution of Radio
Oct. 10	Oct. 14	2. Structure of Radio Tubes
Oct. 17	Oct. 21	3. How Radio Communication Operates
Oct. 24	Oct. 28	4. Atoms and Electrons
Oct. 31	Nov. 4	5. Operation of Vacuum Tubes
Nov. 7	Nov. 11	6. Alternating Current
Nov. 14	Nov. 18	7. Amplifier Principles
Nov. 21	Nov. 25	8. Speech Amplifiers.
Nov. 28	Dec. 2	Review of Section One
Dec. 5	Dec. 9	9. Rectifiers
Dec. 12	Dec. 16	10. Radio-Frequency Oscillators
Dec. 19	Dec. 23	11. Crystal Oscillators
Dec. 26	Dec. 30	12. Radio-Frequency Amplifiers
Jan. 2	Jan. 6	13. Radio-Telegraph Transmitters
Jan. 9	Jan. 13	14. Plate Modulation
Jan. 16	Jan. 20	15. Grid Modulation
Jan. 23	Jan. 27	16. Radio-Telephone Transmitters
Jan. 30	Feb. 3	Review of Section Two
Feb. 6	Feb. 10	17. Transmission and Reception
Feb. 13	Feb. 17	18. Detection
Feb. 20	Feb. 24	19. Autodyne Receiver
Feb. 27	Mar. 3	20. Tuned-Radio-Frequency Receiver
Mar. 6	Mar. 10	21. Superheterodyne Receiver
Mar. 13	Mar. 17	22. Superregenerative Receiver
Mar. 20	Mar. 24	23. Radio Waves in Space
Mar. 27	Mar. 31	24. Automatic Volume Control
Apr. 3	Apr. 7	Review of Section Three
Apr. 10	Apr. 14	25. Automatic Frequency Control
Apr. 17	Apr. 21	26. Antenna Systems
Apr. 24	Apr. 28	27. Direction Finding
May 1	May 5	28. Frequency Measurement
May 8	May 12	29. Facsimile Transmission
May 15	May 19	30. Cathode-Ray Tube
May 22	May 26	31. Television Transmission
May 29	June 2	32. Television Reception
June 5	June 9	Review of Section Four
June 12	June 16	Review of Entire Course

(Schedule subject to change)

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Massachusetts State Convention

The Eastern Mass. Amateur Radio Association and the South Shore Clubs of Boston will sponsor the 1938 Boston hamfest and Massachusetts State Convention at Hotel Bradford, Boston, October 15. Ed Greenwood, W1EAU, is chairman; Don Meserve, W1FL, vice chairman.

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International 56-Mc. DX Tests

With the co-operation of British amateurs who feel quite "left out" of the summer five-meter dx, some international tests are proposed for the month of November, 1938. That will probably

[Continued on page 71]

The Open Forum

Taxing the Ama eur

Grand Forks, N. D.

Sirs:

What's wrong with W6KTY (June, 1938, Open Forum)? Is he a Federal tax collector, or is it just the weather? His idea on taxing the amateur is simply crazy.

It seems to me that imposing a tax on our favorite pursuit would lessen the number of licensed amateurs due to their inability to pay a tax.

If 6KTY thinks that radio stations should be taxed, why not tax those stations which make plenty of money in the broadcasting field, instead of the amateur?

ARNOLD TANGEN

●

Young Squirt v. O.T.

Indianapolis, Ind.

Sirs:

For the last ten years, I have gone by the axiom that it is wiser to read than be read. I very likely would have continued, had I not happened to read an article in the June, 1938, issue by C. Chester Stephen, Jr., which I must confess touched a sore spot.

Mr. Stephen takes great pains in trying to stress the point (in his opinion) that code classes are the bunk; further, that they are operated purely on a profit basis, which is ridiculous. At least they are not conducted that way out here in Indiana.

He goes ahead to say, "When yours truly started in radio, back in 1912 along with a lot of other old timers, there weren't any lids. (Nuts!) We had our code practice by listening to ship-to-shore traffic and copying from NAA, and in this way developed some good operators and radio men" Granted, Mr. Stephen, that is a fine method (generally speaking) for learning code and operating procedure, but if you can give me a plausible explanation of just how "good radio men" were developed by that procedure, or how it helped in getting a ticket aside from the code, I will refill that bottle of Old Crow for you. We always thought good operators didn't drink? While we are on the subject of drinking, how many drunken brawls have you heard the youngsters of our ranks put on the air?

We now come to the part that deals with distinguishing between the fellow with the fat purse and the fellow with the not-so-fat purse. I imagine that Aubrey gets just as much thrill out of his ten-buck, two-tube blooper and his 6L6 transmitter as the O.T. does with his RME 69 and his T200 Taylor-built job, and probably is learning more about what makes it tick than is the O.T. But then the O.T. knows it all anyway, or at least he did back in 1912.

Now for a little constructive thinking. Would it not be more logical to limit our power input to 100 watts, since almost anyone can afford a rig of that size, and give every one a chance, an equal chance, to work that long-sought-and-hoped-for ZL or VK? Then if the power hog wants a kw., let him work a few inches off that protruding part of his anatomy, commonly known as his Bay Window, and put up a beam antenna that will give him a power gain of ten. Then he will have accomplished something worthy of mention.

True, there are many arguments pro and con, but I am convinced from many contacts that more fellows are for a 100-watt limit than are against it.

PAUL WRIGHT, W9OHM

●

Unnecessary QSZing

Bendigo, Australia

Sirs:

With the progress being made in the last decade in amateur apparatus and the efficiency of signals and their reliability, I think it is high time a lot of operators realized the unnecessary use of QSZing (sending double).

Only today, after giving a chap some 7000 miles away an RST579 report, he comes back at about ten w.p.m., repeating everything. On looking at the HANDBOOK, we find that for a readability of 5, it is 100 per cent copy, and as such it's wasted effort to send double; furthermore, that time could be used for more talking or working some dx. Even with a readability of 4, there is no need for repeating if the receiving chap is anything like an operator.

ROTH JONES, VK3BG

New Books AND TRADE LITERATURE

Wholesale Radio Service Company announces the release of its new 1939 Fall and Winter "master" Catalog Number 73. The new 188-page book lists a full new line of Lafayette receivers, public address equipment, sound systems and recording equipment.

An entire section is devoted to the latest in short-wave transmitting and receiving equipment. Two perfected television kits appear for the first time and there is the usual section devoted to the needs of the serviceman and set builder. A supplementary camera section also is included for those who are interested in photographic equipment.

Copies of the catalog may be obtained by calling at or writing to Wholesale Radio Service Company, Inc., 100 Sixth Avenue, New York, N. Y., or any of the other branches of the company throughout the East.

●

The new 1938 Meissner Catalog, which received quite an enthusiastic reception at the Chicago Trade Show, is now available either from parts jobbers or direct from the Meissner Manufacturing Company, Mount Carmel, Illinois.

The large-size, 44-page catalog contains a large number of listings of complete receiver kits, tuner kits, adapters, coils, coil sets, dials, band-switches, push-button switches, tuning condensers, chassis and shield cans. These listings should be of considerable interest to the set constructor. The catalog is gratis.

●

P. R. Mallory and Company, Inc., have announced a new catalog, R-610, describing a new line of dry-disc rectifiers which they are now manufacturing. Types are available for outputs from one to twenty volts, and one-half to twenty amperes. Higher outputs may be obtained by series or parallel connection. Rectifier banks capable of handling several thousand amperes have been constructed from the individual units.

These new rectifiers are of magnesium-copper sulphide construction, this type of rectifying junction having been found to be especially adapted to heavy-duty applications. The catalog is available on request from the manufacturer, P. R. Mallory and Company, Inc., Indianapolis, Indiana.

●

Allied Radio Corporation, Chicago, has just released its new 1939 catalog. A 180-page book, the catalog features many new listings in receivers, service instruments, public-address and amateur-experimenter equipment and general radio parts. The amateur section of the new catalog includes several new transmitters (both factory-built and kit form), many new ham receivers and an expanded listing of experimental television equipment.

A copy of the new Allied Catalog may be obtained by writing to Allied Radio Corporation, 833 West Jackson Boulevard, Chicago, Illinois.

●

A new catalog featuring all RCA parts, test equipment and antennas has been prepared by the RCA Parts Division for distribution to amateurs, dealers and servicemen through its parts distributors. The 16-page catalog lists more than 100 items, many of them appearing for the first time in this catalog.

Two of the new instruments being announced in the catalog are the 2-inch cathode-ray oscilloscope and the new beat-frequency audio oscillator. The catalog is available gratis from any RCA parts distributor.

The Newcomer's Special

[Continued from Page 40]

cathode circuit of the crystal oscillator or in the cathode circuit of the amplifier stage. The inclusion of the 4½-volt C battery in the grid return of the amplifier stage allows the oscillator to be keyed without the amplifier plate dissipation exceeding the rated limit when excitation is removed. Keying the oscillator is very much more effective when break-in operation is desired but if break-in is not desired it is best to key in the amplifier cathode circuit.

NO "GETTER"
NO GAS
NO FAILURES

5 ESTABLISHED FACTS . . . (1) Most tube failures are caused by gas released internally. (2) Excessive heat releases gas from certain types of tube elements . . . especially internal insulators. (3) High anode temperatures alone do not destroy emission. (4) The use of a chemical agent or "getter" is not necessary to obtain good vacuum. (5) "Getter" may release gas that *will* destroy emission.

EIMAC DEVELOPMENTS . . . (1) Plates and grids made of tantalum because it has the smallest original gas content of any known metal. (2) Eimac developed a new process which removes this small gas content from tantalum . . . renders it completely degassed. (3) Eimac tubes undergo a long, severe exhaust . . . NO "GETTER" is employed. (4) New, radical design greatly reduces inter-electrode capacities and entirely eliminates the use of internal insulators. (5) A new type thoriated tungsten filament possessing the highest possible thermionic efficiencies, longer life and uniformity. (6) ***Eimac tubes are conservatively rated as to plate dissipation and are unconditionally guaranteed against tube failure caused by gas released internally.*** Momentary overloads of from 400% to 600%, which are sufficient to cause the anode to become incandescent, will positively not release gas.

KY21 GRID CONTROL RECTIFIER *Net Price* $10

KY21 is a mercury vapor rectifier to which has been added a control electrode, or grid. Used as a rectifier and as a power control tube. Very small control power is needed and when properly handled KY21 tubes will eliminate "key clicks," permitting high power operation in congested areas. D.C. output 3500 volts at 1.5 amperes.

RX21 RECTIFIER . . . . . *Net Price* $7.50

A mercury vapor rectifier possessing unusually high inverse voltage capabilities. D.C. output 3500 volts at 1.5 amperes.

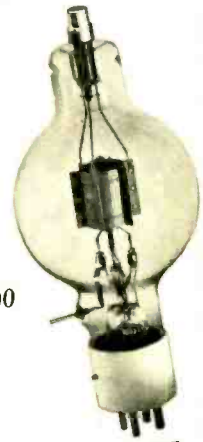
VC6
VC12
VC25
VC50

The new VACUUM TANK CONDENSER

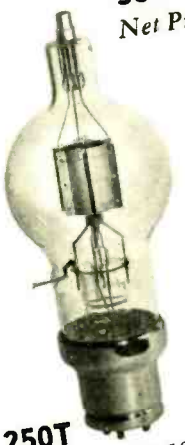
This new condenser eliminates the use of the old fashioned open plate type, provides a positive, accurate means to determine the optimum "Q" of your tank circuit, assures proper load balance on each of the tubes and minimizes "splatter" on phone signals. No loss of power on a stray harmonic, no loss of efficiency. The single units are available in 6, 12, 25 and 50 mmfd capacities . . . priced net at $7.50, $8.50, $10.50 and $12.50 respectively.

For purposes of illustration all tubes are shown the same size. Physical dimensions are as follows: 35T, overall height 5½ inches; 100T, 7½ inches; 250T, 9¾ inches; 450T, 12½ inches; 750T, 16½ inches. Vacuum Condensers are 6½ inches long, KY21 and RX21 tubes 7½ inches high.

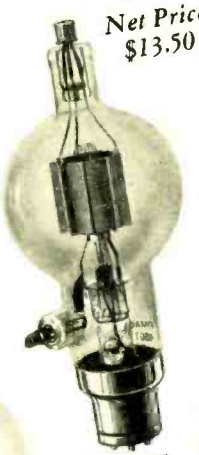
35T
Net Price $6.00



100T
Net Price $13.50



250T
Net Price $24.50



450T
Net Price $75.00

750T
Net Price $175.00

For information about Ultra High Frequency tubes see your dealer or write **EITEL-McCULLOUGH, INC., SAN BRUNO, CALIF**

What's New . . . .

IN RADIO

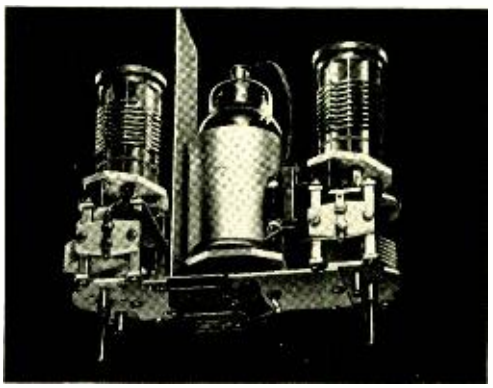
OSCILLATOR-DOUBLER AND BUFFER-DRIVER FOUNDATION UNITS

Two associated foundation units have been announced by the Hammarlund Mfg. Co., Inc., to go with the PA-300 amplifier unit described in the May, 1938, RADIO. The first, the OD-10, is a tuned-cathode-coil oscillator-doubler using either a 6L6 or a 6L6G tube. The complete assembly, shown in the photograph, is built around the two tuning condensers employed in the cathode and plate circuits of the oscillator. The tube socket is mounted between the two condensers and the two coils are mounted atop their associated condensers. The crystal is plugged into the top of the cathode coil form. The unit is designed either for use as a separate low-powered transmitter or as an exciter for the BD-40 buffer-doubler unit.

OD-10 Oscillator-doubler unit.

The second of the two new foundation units is the BD-40 as mentioned above. It uses an 807 or RK39 as a shielded buffer or driver and is built up in the same general style as the oscillator-doubler unit. It is capable of an output of 30-40 watts when operated at rated plate voltage on the tube. This is ample excitation for the PA-300 final amplifier unit when it is operating at its full input of 300 watts.

Either foundation unit is available as a



BD-40 buffer-driver unit.

group of parts and a foundation kit consisting of all the necessary hardware, screws, lockwashers, spacers, etc. required to construct the unit.

●

LOW-LOSS BANDSWITCHES

A line of bandswitches specifically designed for coil switching in the medium- and low-powered stages of transmitters has been announced by P. R. Mallory and Co. Features of the line of switches are: (1) Low-loss ceramic insulation, impregnated magnesium silicate composition; (2) Heavy silver plating on all current-carrying parts to insure permanent low resistance; (3) Convenient contact spacing permitting short, direct leads; (4) Continuous rotation —the switch can be mounted in any position; (5) Smooth wiping contact action to keep contacts bright and clean without cutting away the silver.

○

RADIO WORLD-TIME INDICATOR "GADGET"

An inexpensive, printed, cardboard, world-time indicator has been announced by the Radio and Technical Publishing Co., pub-

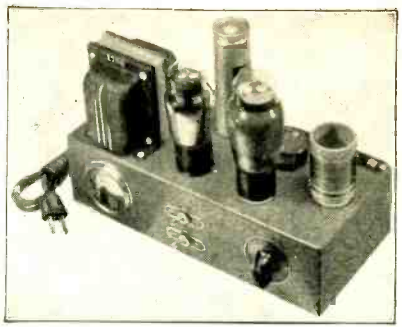
lishers of A. A. Ghirardi books. By rotating the inner disc until the local time is lined up with the particular time zone in which the station is located, the standard time in all of the other time zones is shown. The particular deviations of individual countries within those zones are also indicated upon the chart. The chart also shows whether the time in the desired location is today, yesterday or tomorrow and whether it is day or night at that position.

The "Gadget" or a descriptive card concerning it is available from the publisher at 45 Astor Place, New York, N. Y.

●

A Pee Wee Portable

The recently announced G. T. C. Pee Wee transmitter, which is illustrated in the accompanying photograph, now has a counterpart—the Pee Wee Portable, a complete transmitter and its associated d.c.-operated power supply on a small battleship gray chassis. The external appearance is almost identical to that of the a.c.-operated unit shown; this unit, however, operates from a standard 6-volt storage battery. Primarily intended for rural service where a.c. is not available, it can well serve as a portable-



mobile or emergency transmitter. Metal tubes are supplied with the d.c. portable because of their greater ability to withstand hard usage as compared to the glass ones used with the a.c.-operated unit.

The current drain is 9 amperes fully loaded with the key down and 1.4 amperes at standby. Full details may be obtained from General Transformer Corp., 1270 W. Van Buren Street, Chicago, Illinois.

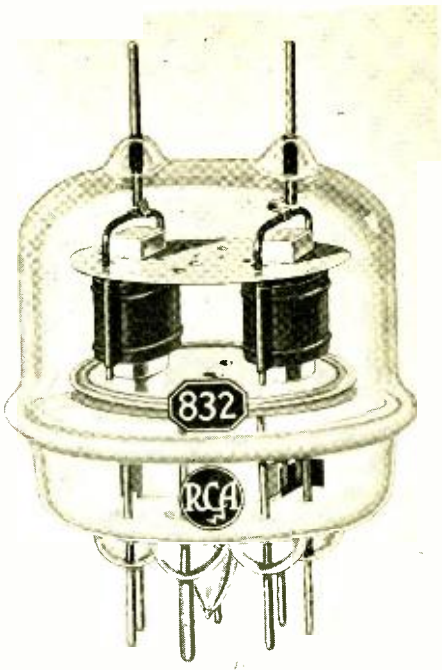
●

RCA-1852 and 1853

Two new television amplifier pentodes of the same general classification of the

1851 have been announced by RCA in connection with its aggressive policy regarding experimental television development.

The first of these, the 1852, has an almost identical electrode assembly to that of the 1851, the only difference being that in the 1852 the control grid terminal is brought out to an especially shielded pin on the base. Through very careful shielding of this lead, plate-to-grid capacity of this tube is as low as that of the 1851 wherein the control-grid lead is brought out to a top cap. From a circuit standpoint, the proximity of the grid pin to the cathode pin simplifies wiring and decreases the size of the inductance loop comprising the input circuit of the tube. These factors are important at the high frequencies



employed in television work as they provide for decreased feedback and improved circuit stability. The ratings of the tube are essentially the same as those of the 1851; the newer tube has the same high transconductance (9000 micromhos) and high amplification factor (6750) of the 1851.

The other television pentode is the 1853. It is similar in external appearance to the 1852 inasmuch as its control grid is brought out to a base pin instead of being connected to a top cap. The tube is designed to have an extended cutoff characteristic to suit it especially for use in the r.f. and i.f. stages of television receivers where a.v.c. will be used. Due to the variable-mu characteristic, the effective transconductance of the 1853 is reduced somewhat (5000 micromhos) although it is still quite high—especially when compared to conventional receiver pentodes with Gm's in the vicinity of 1100.

RCA-832

The accompanying photograph illustrates the unusual design of the new u.h.f. beam power tube, the 832. The tube comprises two medium-power beam-tetrode units and a screen by-pass condenser for the two tubes, all in the one envelope. It is designed primarily for service as a push-pull r.f. power amplifier for operation at maximum ratings on frequencies as high as 150 Mc.

Operation at wavelengths as short as 1 meter, 300 megacycles, is permissible at reduced ratings.

An unusual feature of the double tube is the self-contained screen by-pass condenser of about 65 $\mu\mu$fd. in capacity. This condenser can be seen in the photograph of the tube as a pair of metal discs separated by a layer of mica and mounted just below the tetrodes themselves. The use of this directly connected condenser from the screens to ground provides an unusually low-impedance path from the screens to ground. This is necessary in operating any screen-grid tube as a self-neutralized amplifier at frequencies in this vicinity.

Maximum Ratings and Typical Operating Conditions as Push-Pull R.F. Power Amplifier—Class C Telegraphy

D.c. plate voltage	400 max. volts
D.c. screen voltage (grid no. 2)	250 max. volts
D.c. grid voltage (grid no. 1)	—100 max. volts
D.c. plate current	90 max. ma.
D.c. grid current	6 max. ma.
Plate input	36 max. watts
Screen input	5 max. watts
Plate dissipation	15 max. watts

Typical Operation

D.c. plate voltage	300	400 volts
D.c. screen voltage	200	250 volts
D.c. grid voltage	—30	—60 volts
Peak r.f. grid-to-grid voltage	66	124 volts
D.c. grid current (approx.)	2.6	3 ma.
D.c. plate current	90	90 ma.
D.c. screen current	24	18 ma.
Screen resistor	4200	8300 ohms
Grid resistor	10,000	20,000 ohms
Driving power (approx.)	0.08	0.18 watt
Power output	14	22 watts

Postscripts

[Continued from page 64]

be the month of maximum F_2-layer ionization for the balance of this year.

The basic schedule for transatlantic work is to concentrate operations in the

[Continued on page 74]

YARN *of the* MONTH

An Evening With a Ham

Ham anxiously rushes home from work to find RADIO has finally come. Reads DX department while supper gets cold. Is greatly intrigued by DX apparently worked by everyone but himself and W6QD. Resolves to devote entire evening in an effort to snare something really good, ignoring fact that W4 is his greatest DX to date. Casually wonders if antenna has anything to do with it. Hastily devours supper and retires to shack with unusual enthusiasm.

Checks up for the nineteenth time in four days and finds that he still needs 18 states for W.A.S. Turns on receiver and gets violent shock from exposed switch. Rummages in junk-box for a replacement switch of safer design and while same is not present, succeeds in finding 6F7 which might prove very useful for new receiver, the construction of which has been contemplated for eight months. Idly wonders where 6F7 came from and what, if anything, is the matter with it. Sets 6F7 down on table and continues search for switch. Crash announces fact that the tube is no longer on the table top. Ham consoles self by concluding that the tube very likely had a cathode-grid short or similar undesirable characteristic anyhow.

Is suddenly aware that receiver, turned on some five minutes previous, shows no signs of action. Examination of same reveals '80 rectifier missing. Recalls removing '80 for use in b.c.l. set downstairs after the original tube had expired. Rushes downstairs shouting, "Gimme my tube!" only to find family enjoying Amos 'n' Andy. Family stoutly refuses to part with the '80 until such time as the b.c.l. program is over. Ham returns to shack grumbling profusely about his "rights."

Turns on transmitter and is rather surprised to see that it operates with relatively little effort, finding it necessary only to tap the buffer tube twice to produce results. Shout from downstairs announces fact that '80 is now available should he desire to come and get it. Calls back to bring it up. Didn't he take it down? Several minutes of arguing and finally father appears with tube. Ham crams it into empty socket of his receiver. Sudden fireworks indicate something haywire. Withdraws tube only to find that it is, or rather was, a '45. Takes remains of tube downstairs, retrieves '80 from b.c.l. set and puts back '45 to be "discovered" later.

Eventually gets his own receiver going and commences to look over 7-Mc band. Hears a weak signal and listens with great interest. Station finally signs call of a ham nine blocks away. Ham suddenly notices all signals are weak and finally discovers no antenna on receiver. Remedies situation and continues tour of 7 Mc. Encounters terrific signal almost blocking receiver. Stops and registers disgust at apparent new nearby ham. Wishes ham would key signal so he could learn call. Concludes there are too many hams now without newcomer as near as this one. Waits several minutes but nothing happens except that signal drifts slightly and changes from T7 to T6. Ham heartily condemns such an undesirable signal and resolves to work newcomer and tell him a thing or two. Is suddenly aware that the mysterious signal is his own oscillator which he neglected to shut off. Realizes that he should feel ashamed but doesn't.

Continues tour of band for three more minutes and is about to launch a lusty CQ when a faint signal attracts his attention. Delighted to find it is a W6. W6 signs and Ham is just about to call him when he realizes that his rig is on 20 meters. Feels annoyed but puts 20 meter coils in receiver and

ERIC ADAMS, VE3ALG

searches that band. Hears no DX so idly listens on 49-meter B.C. band. General mess strongly suggests 160 fone except that quality of 49-meter QRM is somewhat better. Ham wonders if he should put his rig on 160 fone. Recalls having considerable fun on that band last year but also recalls ultimatum delivered by next-door neighbor, after finally finding out the cause of his disturbed reception. Ham decides b.c.l. sets are the ultimate in poor design, especially the one next door, but doesn't think it wise to suggest same to owner, who weighs 215 pounds.

Plugs in 160-meter coils and decides to listen anyway. Hears local announcing that he is running 200 watts. Ham concludes the 200 watts refers to audio judging by the general sound of things. Hears C.W. station and wonders if b.c.l.'s would prefer key-clicks to fone interference. Decides it all depends on the mood the b.c.l. is in and anyway, 160-meter C.W. wouldn't appeal to him. Ham wanders from 160-meter band into the police frequencies. Hears local cops announcing description of gentleman wanted for several reasons, each one of which is good enough. Tries hard to see if he knows of any ham with, "a black beard and wearing a green checked suit." Ham finds he doesn't and concludes that hams are too fine a bunch of upright citizens to run afoul of the police, at least until such time as that department should take charge of R.A.C., overmodulation, etc. Police station returns to the air to announce a fire several blocks away. Ham is not interested as there are no other ham shacks in that immediate vicinity; hence little prospect of any competitive QRM being suddenly put off the air.

General lack of interest on all bands disgusts Ham and he decides hamming is the bunk. Thinks it would be much better to be a Great Social Success, and idly contemplates best method for arriving at this state. Realizes he is an awful dancer, first essential to Great Social Success. Wonders if he could sell final to raise sufficient funds to take dancing lessons. Decides to keep final in case he changes his mind about relative desirability of hamming versus social activities. Realizes he is not in the mood for hamming and leaves shack to visit nearest hamburger joint. Devours two hamburgers and in a moment of recklessness orders another one and a malted milk. Decides to heck with the b.c.l.'s; he will erect an enormous beam and startle readers of RADIO by working VK on 160 fone.

Wishes he hadn't eaten that last ham-

burger. Wonders if Susie is home Wishes he had told them to hold the onions on all three of the hamburgers.

Decides to go home and take a listen over the 40-meter band.

Postscripts

[Continued from Page 71]

hour between 10:00 and 11:00 a.m. e.s.t. on Saturdays and Sundays in November. We suggest ten minute transmitting and listening periods as follows:

Dx transmit 10:00 to 10:10 a.m. Eastern time
W's transmit 10:10 to 10:20
Dx transmit 10:20 to 10:30
W's transmit 10:30 to 10:40, etc.

The object is to have numerous transmitters on the air. If signals are heard. an immediate attempt to QSO can be made without further regard to the schedule. There is no objection to transmitting during the full hour if no receiver is available, or if no operator is in attendance.

The same schedule can be maintained on week days and at earlier or later hours if time permits. However, it is pointed out that communication may be most likely when the time at the midpoint between the transmitting and receiving stations is noon or a little later, local time, for essentially east-west transmission.

The most likely time for a European contact was selected above. Australia, New Zealand and Hawaii stations are active in attempts to work this country, and a schedule is being arranged with them. The most likely time is around 4:00 p.m. local time here on Friday through Sunday, for which the transmitting schedule can be similar to the transatlantic one, with the first ten minutes being devoted to listening in the U. S. The same schedule will also be approximately correct for South America.

It may be quite unlikely that anything will be heard on 56 Mc. unless the 28-Mc. band is open to the same point, but good 28-Mc. dx conditions are likely to last through next winter at least.

If you do hook up with some dx, don't be surprised if a request is made that you complete the contact on unmodulated c.w. for a score in the R.S.G.B. International Contest. Relatively little two-way straight c.w. work has been done so far this year—a few contacts across an ocean may yet produce a winner.

A Modern U.H.F. Mobile Installation

[Continued from Page 52]

receiver may be mounted in the front of the car so that it may be tuned from that position. An RCA type MI 7802 receiver is used for the police work. Among its many advantages is the fact that it has an inclosed squelch circuit which shuts the audio system off while no station is being received. The squelch may be cut in and out by means of a switch mounted on the receiver. At any rate the receiver that is employed should have a good noise silencer incorporated in it. It is also advisable to use a single suppressor at the top of the distributor of the car itself.

When the transmitter is running, the battery consumption for the entire unit will be around 35 amps., at 6 volts. The

actual plate current consumed by the transmitter is around 180 mills.

For those who do not desire to work mobile, the transmitter with a power supply capable of delivering 400 volts at 200 ma. will make this an ideal home station. The author has made many fine contacts on the ten-meter band with one of these outfits.

DX

[Continued from Page 58]

tals in the Zone List haven't been corrected or, in the case of the newcomers, added to the list, it is because you have just sent in a note saying to increase your zones and countries to a certain figure, but without mentioning what the new ones are. In the case of the newcomers, we require a list of the 30 zones worked showing the call of at least one station in each zone. For the phone section, of course, only 20 are necessary. So, fellows, please watch this and when you send in a card or note saying that we can now increase your standings, show the new ones worked.

W8DOD adds J2KJ, ZD2H, LX1AG and U5HE; W8DWV worked K6BAZ, U5KN, VR4AD, K6NVJ and now has 38 and 118. W9MXP is puzzled about hooking FP8PX, but he shouldn't worry as he is OK. W6KIP lands his 38th zone by hooking up with OQ5AQ and to insure it the next day he worked VQ2MI. W6MVQ finally got W1OXAB . . . but I shouldn't have mentioned this just now as it was on phone. MVQ is on c.w. too, so I hope it's all right with you fellows. W8AQT felt lucky and got himself two new ones in FT4AG and ZD2H.

W6MGZ says that ZL2BE and ZL2BT will be on 10-meter phone every day with 100-watt rigs. W3EDP has been fooling around on phone for the past year and is now back on c.w., consequently has a few new things to offer, YV2CU, FI8AC, VQ2GW, VR3A, LZ7AN, XU8OL, KA1AX, J2LU, U5HE, U6WB, TF2AX, TF5B, VP1JR, VP3NV, VR4AD and after all this he now supports 38 zones and 121 countries.

W2FAW went out and got U6WB for his 34th zone which also makes 73 countries. Ray says that the operators of VE5ACS, Broderick and Baxter, have been relieved by two fellows named Hopkins and Ginn. They will be crystal controlled and on both c.w. and phone. During the winter Baxter had an attack of appendicitis which, we are glad to say, cleared up. Then Broderick had a narrow escape when a small boat which he was in got caught in a heavy tide and nearly carried him to sea. They managed to get ashore on a small island over the ice floes.

It looks as though W2GFF has his commercial ticket and will soon breath the salt air. W2JRP hooked ZC6NX two days in a

[Continued on Page 79]

Dial Phone Remote Control

[Continued from Page 29]

tional controls for the sheriff and highway patrol to operate the transmitter from their own offices. This also has an automatic interlock system to enable one station to cut out the other one if necessary for an emergency.

From these latter offices, lifting the handset turns the transmitter on and automatically sends out over the transmitter a prearranged series of tones, showing that the broadcast which follows applies only to the cars of those offices.

The system can be extended indefinitely. It is even perfectly possible to locate automatically and indicate a circuit defect in any piece of apparatus by one type of selector switch which operates as a "homing" switch or circuit seeking mechanism.

One can even see possibilities of having a dial in a car, which will operate a tone in the car transmitter, while at the receiving end a relay in the plate circuit of the receiver could act as the pulsing relay A and one could dial anything while cruising around!

The idea is here. The application is up to you.

(Type numbers of the relays of one manufacturer are given in the Buyer's Guide.)

Broadcast-Type Modulation Indicator

[Continued from Page 46]

plitude and frequency characteristics of the transmitter may be taken if a suitable audio source is available. An overall amplitude characteristic may be taken by using the modulation meter as an output meter and impressing measured audio voltage on the input of the speech amplifier.

The phone man constructing such a unit will have a valuable addition to his station, and will be fully repaid for his effort and outlay by the performance and security to be derived from a broadcast-type modulation indicator. That trip to the broadcast station will put you to work.

A 100-Watt Bandswitching Exciter

[Continued from Page 35]

change switches in the 10-meter position, the crystal switch of course remaining in the number 1 position. Rotate the oscillator condenser until the plate current of the 6A6 kicks up from the nonoscillating value of 15 or 20 mils. Tune C_2 until the meter in the grid of the 802 shows a reading. This should take place with the condenser near minimum. Then tune C_3 near minimum capacity until grid current flows in the 35-T. At this point the plate current of the 35-T should be watched very carefully, and as soon as an appreciable reading exists, the condenser C_5 should be tuned for the dip. Finally, all condensers should be slightly retuned for maximum grid current to the 35-T with

the exception of C_5 which is tuned to minimum plate current. The transmitter is then ready for operation. After this initial tune-up, the condenser C_2 will seldom need any further adjustment as its tuning is very broad. The only exception is when an 80-meter crystal is used for 20-meter operation.

Initial Adjustments

The first time the exciter is tuned up it will also require a few additional adjustments, the principal one being the neutralization of the 35-T. This is carried out in the usual manner and needs no further description. The coils L_3, L_4 and L_6 may need some slight adjustments to make them hit resonance at the proper setting of the condensers. This is accomplished by squeezing the turns of the coil together or pulling them apart —depending upon whether more or less inductance is needed. The coupling condensers C_9 and C_{12} are varied until the proper amount of grid excitation to the 35-T is obtained on 10 meters. The best procedure is to use as small an amount of coupling capacity as possible and still maintain the excitation. This same adjustment is satisfactory for 20 meters although a compromise setting might prove beneficial. For the lower frequencies, C_{11} must be adjusted for satisfactory operation on 40, 80 and 160 meters. These adjustments are not at all critical and, after once made, they never need to be changed.

For 20-meter operation, the only changes necessary are the placing of the switches on the 20-meter positions and the tuning of the condenser C_3 near maximum. Of course, condensers C_1 and C_5 may need slight readjustments for different frequencies. For the other bands, the procedure is the same. On 40 and 80 meters, C_3 is tuned near minimum capacity while 160 meters is reached with the condenser plates almost all the way in.

For the use of an 80-meter crystal on 20 meters, the switch S_8 is snapped on from the normal off position, and C_2 is tuned near maximum. All other adjustments are the same as for normal 20-meter operation.

C. W. Operation

If c.w. operation is desired, the switch S_9 may be opened and a key placed across its terminals. This allows keying of the oscillator and, as all following stages are fixed biased to cutoff, no other changes are necessary.

Trouble Shooting

It might be well to mention two

sources of trouble which were encountered at the start. The first was the lack of excitation to the 35-T on 10 meters when capacity coupling was first tried. It was soon found that the grid choke was not choking. After trying two or three different chokes, one was found to be very satisfactory and the drive increased enormously. It is best to be very careful in the choice of chokes, particularly the grid chokes.

The second source of trouble was a resonant condition in the 40-meter plate coil of the 35-T, when the transmitter was being operated on 20 meters. The absorption was so bad that very little output could be obtained on 20 meters, and the r.f. was far greater on the ends of the 40-meter coil than on the ends of the 20-meter one. The removal of 4 turns from the 40-meter coil removed this trouble completely.

This exciter, in the past two months, has proved itself to be well worth the time and trouble involved in its construction. It is a real pleasure to be able to switch to any frequency in any band in less than 10 seconds and do it with ease.

Inductive Tuning

(Continued from page 23)

Let us now look at figure 2 which is the vector diagram for inductive tuning. Because the C is fixed, I_c is constant and I_L varies; but the locus of I_L is a semicircle. After reading Frank Jones' article in March RADIO on "Tank Capacities" and substituting the I_c for the proper value of C ($I_c = jE\omega C$), a diagram is obtained similar to the one shown.

Again, we choose points to show the effect of altering the tuning element, L in this case. It is noticed at once that the shortest length and so the minimum I_i occurs in this diagram when the vector is aligned with the radius of the semicircle. However, this can be many degrees from unity power factor. Now we have a dip in I_i, meaning Z max., but not resonance. This difference in points of Z max. and resonance may or may not be important because with high Q the actual difference is small. But with a loaded push-pull circuit of low Q this effect can become very large. Of course, that also means any circuit of low Q, as when too much of a load is placed upon a final with supposedly normal Q output circuit. By choosing a few values of circuit constants and substituting them in the diagram, it is readily seen how abruptly the power factor diminishes for small differences of I_L (angle ϕ increasing). One thing also is apparent: we can correct for this error by increasing I_L from the I_c dip.

For the practical side, we can borrow from broadcast procedure and read the current in the tank circuit with a thermal meter or its equivalent. If no such meter is at hand, decrease L somewhat. This is, of course, an inefficient way as the exact amount is not known and the desired point may be passed through and

we may end with a lower power factor than before. Consequently, if you use inductive tuning, employ some method to indicate maximum circulating current for the best results, especially if the Q is known to be low. Incidentally, this diagram demonstrates clearly the effect of too high or too low a capacity to resonate without regard to conditions of voltage, frequency, etc.

DX

[Continued from Page 75]

row. W2FAW was the first W2 contact for UX1CJ in Franz Josef Land. W6BAX added a few with VQ8AA, FT4AT, VK9DM, ZD2H, ZS3F, TF5B etc. Sometime ask BAX how he is getting along with his beams. W8AU is in again and this time he's passing out cigars . . . a Jr. op. and he says the R.I. came right over and wanted to know if he had a ticket yet. Hi. Lou tells about one of W2BMX's tricks of climbing trees to put up antennas and if the trees are like the ones on their field day outing, he does a real hair-raising high dive into a damp rag. This dive in particular was about 122 feet and says he had the boys breathless. Lou says though, that Posey's Doc won't let him dive more than twice a week now as his head is getting so flat he can't wear the phones.

W9PGS of Boulder, Colorado, had a swell trip to Mexico where he met over 50 XE hams. He had a fine talk with XE2N-XE1A—about dx, of course. Incidentally, note the photo of these two dx men elsewhere in this section, and the rig that XE2N is holding is the one he used in the last DX contest. Rig consists of four 6L6G tubes and an HF-100, with complete band-switching and break-in. W6DOB hasn't been idle on his brass-pounding as his new total of 38 and 131 will show. Lloyd had three weeks' vacation and started on a trip. At the end of the first week, they had a hunch dx was calling them so DOB and his family turned back to L.A. and arrived home just in time to start gathering in the new ones. Here are some of them: VP8AD, VP8AF, HI6Q, OQ5AQ, VP2AB, OY5C, CT2BM, VP4TP, FG8AB, TF5B, LX1AG, PK5KF, VO6D. Lloyd said it was nice to get a lot of new ones, and he also had a good case of fanny-itis for sitting so long.

W2GTZ has not been exactly in hiding. Since January first, Reeve has had 71 Asian QSO's. The latest countries are ZC6AQ, VK9VG, VR4AD which makes him 38 and 130. W8OQF has been looking for a new zone for a long time and his wish was answered when he got VQ2HC. New countries for Ralph are many, some of them being U6ST, U8ID, U2NE, VP2LB, ZS3F, CT3AN, VP7NT, VR2FF, YV2CU, VR6AY, VK9BM, VR4AD, UX1CN,

LX1AG, OY4C, ZD2H. He now adds them up to 38 and 122. Ralph also says that he worked VP8B in February, 1937, and has a nice card, letter and photographs from him. Then too, he finally received a card from ZC6AQ after waiting over a year for it. So-o-o, fellows, don't give up . . . it's never too late.

W3EMM heard W8KKG calling or working AC4YN sometime ago and he nearly twisted the vernier dial off his receiver hunting for him. Anyway, since we last heard from W3EMM, he has collected 15 new countries for himself among which are ZC6AQ, ZD4AB, VQ8AI, OY4C, LX1AW, K6OVN, VR4AD, YV2CU, VK9VG.

W7EYB and W7GFE have a wire 280 feet long with an insulator in the center. The shack of EYB is on one end and the shack of GFE on the other. EYB says he has worked 14 countries from his end but doesn't know how GFE has snagged from his half. Oh yes, he has other antennas too.

Charley Pine, W9CWW, has been rebuilding and with the finished product he went out and got a few new zones. He now has 36 and 91. Some of the better ones for him are LA7W, ZB1U, VP4TI, W10XAB LX1AG, VK9VG. VP6LN, SV1RX, ZD2H, GW6YQ and GI5SJ. Another ham in Leavenworth, W9VWV, is doing all right too, by putting down in black and white, CT2BC, VQ8AA and HP1A.

W9CWW has a darn good thought which I want to bring out. It is regarding the boys who go around lifting dx with their variable frequency control units such as EC oscillators, conversion exciters, etc. Charley has been doing a great deal of listening lately and has found plenty of the big dx men climbing on some guy with a less powerful signal, and taking the dx station away from him. It is a pretty tough thing to know where to draw the line, but let's all try and be reasonably sure that a fellow has signed off before clamping down on the same frequency to work the same station. At times it is hard to tell exactly when a man is really through, as some of them keep on coming back and they give their 73 a half dozen times, in as many transmissions. Then, too, there are the fellows who insist upon holding on to a fairly rare dx station so long that the gang feel like hopping on to that frequency, so they, too, may get him before he fades out.

W6MHH now has 35 and 91 . . . some of those who helped are VR4AD, VR6AY, VP5JB, W1OXAB, K6NVJ, K6GNW and ZD2H. MHH is running a kilowatt into a pair of 100TH's . . . into a VEE beam. W8PQQ has worked 24 zones and 54 countries in the 6 weeks from April 21st to the first part of June, which is going to town. It should be interesting to know that K6AKP now has 39 zones, needing only Zone 2 for WAZ. Sure, he's worked AC4YN for no. 23. And, while I think of it, K6CGK says that somewhere somebody

reported K6GNW as being heard on 5 meters. Well, K6GNW is on Enderbury Island in the Phoenix group and he says to tell the gang that he has *never* been on 5 meters anywhere. W6NNV has only been after dx a short time and has accumulated 23 zones and 29 countries. W8LYQ kicks through with 38 zones and 98 countries, the latest one being VQ2GW.

With the Phone Men

Cast your eyes upon this, this and then this. First, on the morning of April 4th at 7 p.s.t., W6ITH worked a station signing XU9RP located at Kanchowfu in Kansu Province. To those of you who have an atlas, you will see that this is well in the interior of China and furthermore, in Zone 23. The only catch is that he usually operates around 8 to 9 Mc. Every once in a while he gets on 20 meters, 14500 kc. to be exact. He is one of a small net of Missionary stations who work each other. He has had some cards printed and to complete the picture he sent one to Reg via a missionary, Dr. Roberts, who returned to the States on leave. Dr. Roberts delivered the card in person.

XU9RP's name is Rene Pastre, and the rig uses a pair of 112A tubes. The antenna is a 166-foot zepp. Reg got in touch with him by tracing the origin of messages back to their source, and accordingly got him on 20. While on W6ITH, I might mention he now has 34 zones and 72 countries on phone: total 37 and 92.

Following is some news Reg has collected that will be interesting to the phone man . . . KA3KK is on 14300 kc., at Baguio which is 150 miles north of Manila. Uses VEE beam and the op is the same as KA1YL. J2MI has rebuilt and is better than before. J2MI says that 10 meters is getting good, as he is hearing K6 phones at 1 p.m. Tokyo time, and W stations are being heard from 3 to 6 p.m. Tokyo time. J5CC is putting through a loud signal with good quality. J2NG is busy with studies . . . J8CF is working LU stations and getting good reports. He and J8CG are on quite often from 4 to 6 p.m. Tokyo time, which would be from 5 to 7 a.m. p.s.t. W6ITH received his card from CN8AV which states he was the W6 to QSO CN8 on 14 Mc. In a note from XU6TL he said, "Very sorry for my last QRT this is because of air raids. 5000 people in Canton killed and 6000 wounded by bombings. Signed, T. L. Shen." XU6TL gives two addresses . . . Box 132, Canton, and Box 15, Changsha. VS6AG will be on 10 phone as soon as the band opens up. W6ITH will arrange skeds for W phones with XU9RP . . . he has just received an OK from XU9RP to this effect.

Here's another one to make your mouth water. Our friend W6OCH seems to be making use of his new and ideal location, because during the latter part of July around 7 a.m. p.s.t. he was listening around the band and it sounded rather dead in regard to W stations. He heard a weak station calling "Test DX" on 14200 kc. Larry

thought it was a VS6 or VS2 but when the station signed it was AC4AN. OCH clamped down on him right then and during the QSO he learned that AC4AN was located about 150 miles north of Lhasa, Tibet, using a portable rig with 7 watts, which he had been using for communication between mining properties. Their work about finished, he wound coils for the 20-meter band and that's what happened. The sad part of it is that he was returning to Hong Kong soon. AC4AN is VS6AN when in Hong Kong and he said he would shoot a confirmation to Larry as soon as possible. Don't think there is any doubt about the guy, as K6CGK passed along word that he had heard (or worked) him but doubted whether with his low power of 7 watts we would ever hear him. It was right after this word was received from W6OCH. An SWL in Hollywood heard both ends of the QSO and so did W6IKQ in Oakland. Gosh, these fellows and zone 23. Ho-hum. After all this, Larry took a powder or something and came to three days later . . . and now his totals look like 33 zones and 81 countries.

W1JCX, Herb Cole, is a new one for the clan, with his 21 and 42. W1JCX uses a pair of 800's in the final at 250 watts input. Another one is Gale Sells, W7AMQ, who has 25 zones and 40 countries . . . which were all worked in a 3½-month period after he put up two 8JK beams. He says since that time he has had more fun out of ham radio and won't trade it for anything. A list of 127 dx contacts over this period of time shows that Gale is getting some nice ones. Power is always 525 watts

W9VYD sends in a nice list of 21 zones and 36 countries . . . rig is a T200 with 300 watts grid-modulated . . . and the antenna is an 8JK. W4TS, Hal Justice, worked KA1ZL at 11:07 a.m. e.s.t. and KA1ME at 11:20 a.m. which is mighty unusual. Hal has 21 and 45.

Another W9 into the picture and who should it be but W9ZTO . . . W Nine Zed Ted Oh . . . and with 27 zones and 49 countries. In a little over a year he has had over 750 dx contacts. The final uses a 250TH with 600 watts input. W6LPR uses a single HK54 and has done all right with 24 zones and 45 countries. W6MXD has worked himself some good dx and accounts for it with 25 zones and 33 countries. Out of Seattle comes W7EKA with his 23 and 31 . . . and Al uses a single 50T with 150 watts input. One antenna is a "Q" and the other is a VEE beam for Europe. W3EMM, who is always a high man in the contests, has 29 zones and 76 countries. Rod Richards, W6FKK, has 22 zones and 26 countries.

W2IXY, Dot Hall, is still at it and has added to her total which now makes 29 and 81. W2IXY pours a wicked sig out around this world.

W9RBI worked PK6XX and CE3BH for two more zones and two more countries . . . and W6FZL has 21 and 40 on phone.

It so often happens when a fellow makes a statement in good faith that he is the first W6 to work so-and-so, someone else comes along and beats it by a day or so. Such is the case with W6NLS who was reported to have been the first W6 to work SV1CA on a 10-meter phone. After this was in print along comes W6GUQ saying he worked SV1CA on April 2nd, but of course, he doesn't know if there was someone ahead of him or not. We'll probably find out during the month. This is nothing unusual, it's happened time and again, but at least it's one way of finding out who "maybe" did work a station first. Anyway, ol' W6NLS has received a phonograph recording of his entire QSO with SV1CA, from G6GO who did a fine job of it, too. Both ends of the QSO are in it.

Before Dana Atchley, W1HKK, left for Europe he took time to drop us a note saying he was working a few stations now and then, and to prove it he has 23 zones and 60 countries. Yes, I would say that represented a little dx all right Dana says he and other east coasters can't figure out how some of the gang out here can work so many zones and so few countries. In de-

fense to this old question, I should merely say, "Just come out west sometime and try for yourself." However, just in case a few others can't figure the thing out try this . . . take a zone map and see how many countries there are in Europe and Africa which are not too hard for the east coast dx man to grab. Then look at Asia and see how many countries there are around. If you take some of the top-notchers out here with plenty of soup and beam antennas you will find their countries are *more* than some of the east coast boys. This thing is really answered in all DX Contests where the multipliers are higher in the East. The Zones were made up so that they would be as equal as possible from all parts of the world for a ham to work.

In Other Countries

There is a good phone station coming through fairly consistently from Guatemala . . . call is TG5, and frequency about 14040 kc. Send cards to Mr. Juan Guillen and Mr. Julio Caballeros Sr. P. O. Box 12, Guatemala City, Guatemala. TG9AA gets on 20 every once in a while too, and says there are new stations just licensed which should be heard later . . . TG9AB, TG9AC and TG9AD. From K4KD we hear that ol' "Maw" is still after 'em. He has not hit 30 zones yet but has 25 and 78, which isn't so bad. Needs Wyoming and Nevada. K4KD has worked ON4AU on four bands and is going to try this winter to land him on 160 meters. Look out, when you get up there, "Maw"; that 160 phone bug might bite.

VE5ZM, Bill Wadsworth, has got his 30 zones and 52 countries . . . watch his smoke from now on, he's putting up a rotary on top a 104-foot tower . . . 'way up there. Jack Lees, G2IO, isn't wasting time . . . he got that baby AC4YN and VO6D making 36 and 94. The time AC4YN seems to work most G stations is around 1700 to 1900 G.m.t. How about all you buzzards over in G asking him to get on earlier in the day so we poor W's can get a crack at him? I would say from 1300 to 1700 G.m.t. would do the trick. Our friend Gene, F8KI, is keeping the power meters buzzing and now has 31 zones on phone. New ones are KA1CS, XU8ET, OQ5AQ, TF3C, ZE1JA . . . and Gene is taking a month's vacation . . . the lucky guy. He'll be on 10 as soon as it opens up, too.

"Looking Over the Band"

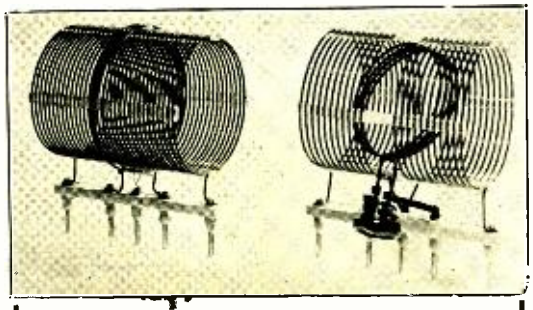
W9YNB sends a clipping from a local newspaper which tells about a guy breaking into a man's parked car and stealing just a steering wheel. W9YNB adds his view by saying, "Must have been a ham wanting the wheel for his rotary beam." Not bad! ! ! YNB also works dx including ZB1U, HR7WC, YR5ML etc. W5DNV worked VP7NC on phone using 5 watts input. LU7AZ, who writes the dx column for R. C. A. (the official magazine of the Argentina Radio Club), worked VQ8AS twice and he is the first LU to make w.a.s. One of the oddest things heard in months was when ON4DI tossed out between 60 and 65 CQ's before signing his call. I

thought for a minute a new kind of a contest was on.

From "Ham" Whyte's column in the *T & R Bulletin* we see this . . . "2AOU, a listening station in Jersey, C. I., suggests an explanation for VP3TEST. He says this must be the same as VP3NV who is heard on 28-Mc. phone, in Georgetown. This is most probable because most G stations send 'NV' for 'TEST' so why shouldn't he send 'TEST' for 'NV'." It's a fair guess anyway. It's good news from Gibraltar as we have found that ZB2A and ZB2B are genuine and we are now in a position to send cards to them. From Italy we learn that I1IR was married on April 21st. And now, speaking of G6WY, he deserves a hand for conducting such an interesting column as it always contains news worth while.

A welcome is extended to VE1CR, who is C. R. Rogers of Sydney, Nova Scotia. He sent in a list of 30 zones and 68 countries . . . all on phone. Rig has an HF-200 in the final. W6GCT is coming along with his brasspounding and phone. He now has 27 and 49. Fairly new ones are VR6AY, CT1AY, W1OXAB. Henry says that while dx is bad he is taking up fishing for a hobby. Hope fishing isn't bad too.

What's this . . . another G getting AC4YN . . . this time it's G2QT. Hey, this isn't fair! G2QT is getting there and to make it seem better he has OQ5AA salted away. G2QT raises up to 36 and 98. He wants to know where the XE's, K6's and UO's are. Keep up the good work, Frank, and if you work AC4YN again . . . just



LA4K, Lorenskog, Norway. The transmitter uses an RK-20A in the final with 100 watts input on c.w. Operator is a policeman and 34 years of age.

wave at him for me, because that's as close as I'll get. W5FPY and W5FPS are rooming together in Lubbock, Texas, and up to a couple of months ago they were on 160 meters. They used all their influence to get their 203A on 20 meters and it finally did ok. Since then they have been having a picnic working dx.

Lindy, W2BHW, finds dx has been spotty during the summer, but has managed to increase his countries to 143 . . . zones still 38. Some of the newest are G8IA (Isle of Man), PX1A, ZD4AB, VS2AE, VP8AF, TA1AA and ZA1B. Lindy was paid a visit by W6CUH a few weeks ago. Ren Collins, W8EUY, never gives up and although he hasn't worked AC4YN, he has knocked off these new ones . . . ZC6AQ, LX1AO, SV1RX, OY4C. FY8AA, U6WB, VS7RP, UK5KJ, and VQ3HJP . . . countries now 102. W8KZL is now W6QAP and located in Tucson, Arizona, during school. He says that W8KPB is in Europe for the summer. W9YQE worked VK9DK on 7175 kc., time was 5 a.m. c.s.t.

W8LEC has not been idle and now has about 10 new countries. K6TE, VR6AD, VK9BW, LX1AG, K6BAZ, ZD2H, OY4C, VQ3HJP. VQ2FJ, LZ1ID and ST2CM. W8ERZ has been using only 75 watts but has stacked 30 zones and 80 countries. Some of his best are HA8C. HR7WC, UK3AH, TF5B, LX1AG, YL2BB. U6WB and YR5VV. W6HJT also pounds brass between dates with his yl's and now has 34 and 92. Newest for countries are CN8AV, VR4AD, VR6AY, VO6D, FI8AC. Newest in yl's are Mary, Flo and Sarah. Ask his pal, W6HZT . . . he knows all about HJT and women. In fact HZT is almost a "goner." With all of this he has 38 zones and 110 countries . . . and 1 yl. He uses 2 8JK beams and they work out ok.

A few visitors during the past couple of months have been most welcome . . . VK4JP. VE5MZ. W9DNP, W5BRR. W3GAU, W8HWE, W1ZB, KA1QL and ZL2JQ. Bob "Racehorse" Haas, W8HWE, almost bought out the racetracks here,

then too, there was that certain yl interest. We'll know just where to find him hereafter if the racing season is on. Jim Wells, KA1QL, who is now back in the states, had a tough break just after he got back. He came down with tropical fever which laid him low for a month. Jim is doing fine now and has a good job on the west coast, so will be back as W6QL before long. On the way back to U. S. A., he and his wife had a swell visit in Japan and Hong Kong. They saw the crater of Kaleua in the land of K6.

ZL2JQ, Johnny Shirley, has been having a swell time with the gang around here. Johnny had a 6½-hour QSO with his own station in New Zealand from QD's and I think he had everybody he knew on the air at his place. So Johnny said, "It was a bit of all right." At home he uses a pair of 35T's with about 150 watts input, but after seeing the way those tubes are usually run he says, "You just wait 'till I get home, I'll pour it on." Ah, a New Zealand kw. in the making.

One of the neatest jobs done in the last few years, as far as ham radio is concerned, was during Howard Hughes' flight around the world. Charlie Perrine, W6CUH; Tommy Thomas, W2UK, and Dave Evans, W4DHZ, represent a lot of DX and were the fellows who did the job. Charlie worked from W2GOQ at the New York World's Fair Flight Headquarters, Tommy from his own 2UK, and Dave from W6CUH at Hermosa Beach—this three station net handled most of KHBRC's traffic with the U. S. A. No more details as RADIO tells all elsewhere in the magazine. Of course, I can't slip by without mentioning the fast trip CUH made with Hughes from Los Angeles to New York via the substratosphere . . . 20,000 feet up . . . 2500 miles in 10 hrs. 32 min.

W3FAM is a boy who has done mighty fine on phone and has 33 zones and 68 countries to show for it. Some of the best are YI5AA, KA1ME, J2KG and J2NT. He uses a pair of 250THs in the final. W6NNR has not been especially active but did manage to get a new country in hooking VK4HN who is in Papua. Guy now has 31 and 72 . . . and yes, he too, is keeping a "once a week" sked with PK6XX. Speaking of PK6XX . . . he is on 14006 and 14300 kc.

An item of interest to many of the boys across the pond as well as around here is that G5SA who has been here in L.A. for some time, has had a deuce of time with one of his pet "molars." It required a tricky operation to get him fixed up, but Dave is out of the hospital now and is gradually getting back to normal. He says his head still feels as though a truck backed into it. G5SA is leaving around the middle of September for home. Many of the Japanese gave KA1QL a real time when he stopped in Japan for a while. I know J2KG, J2KN, J2IX, J2HI, J2NG, J2MI, J2JJ, J2GX, J2HJ and others are still talking about "when KA1QL was in Japan."

G6WY passes along a nice bit of information . . . in the form of a letter from Reg

Fox, AC4YN. Quoting parts from AC4YN's letter . . . "I am proposing to erect a close-spaced flat-top beam in two sections. There is one difficulty, and I do not know what effect it will have. A huge mountain of sheer rock rises out of the valley. The valley is down 12,000 feet and the wall of rock tops easily 19,000 feet. At present I am using a 14 Mc. half-wave zepp almost entirely covered in by trees, two feet from the side of the roof and hardly any effective height at all, yet the sigs seem to get to England all right. The transmitter now is just a 35T oscillator coupled through a pi to the aerial—crystal is a 14 Mc. 14106 kc., and with approx 35 watts input. Yes, if I leave, I'm afraid there will be no one with the will to operate an amateur station in this zone, or Tibet and "AC4" will have to call it a day. I may succeed in rousing someone however. AC4UU should be treated with caution as he is unknown to us, and unauthorized to be in Tibet by the Govt., and no doubt actually operating in China. I actually hold the record for a white man in Tibet—16 months—very few others have lasted as many weeks, even then not allowed to visit Lhasa. I am even allowed to attend ceremonies and when I am a guest I eat with chop sticks, such food as sharks fins, sea slugs, dried raw meat and about a dozen other dishes, all at one sitting. Tea is made with rancid butter. Spend most of my time playing Mah Jong—gambling—at which they are all masters. Well, I'll close . . . etc. . . ."

OK1AW is on a holiday and he took along his rig, which proved a good thing for he worked Zone 2, now making his total 35 and 96. G6YR is a new one to our fold and his 36 zones and 94 countries look fine. G6YR says that TF5F is ok and to QSL to Box 284, Reykjavik, Iceland. J2JJ wrote a nice letter to us saying he had 36 zones and 100 countries. J2JJ is using a pair of 100TH's in the final . . . with plenty of soup. He informs us about various Japanese prefixes . . . J7A- to J7O- is for Hokkaido, and J7P- to J7Z- is for Karafuto, and he thinks it should count as another country. J8A- to J8O- is Chosen (Korea), and J8P- to J8Z- is the prefix for Kantoshu, both of which he says should be separate countries. J9A- to J9O- is set aside for Taiwan, and J9P- to J9Z- is for Caroline Islands, Marshall Islands and other Japanese Mandated Islands. There are not supposed to be any licensed stations in J7P- or J8P- districts except some that may be under cover.

Here's F8VC, Jean Ramond . . . or just Gene to you. Both he and F8KI are Gene and on phone so you won't go wrong when you work either of them and say, "Hello Gene." Anyway Gene, F8VC, has gone to town since we last heard of him and now has a fine total of 28 zones and 58 countries . . . all on phone. Says he, "I will send you photo of station and crazy operator who speaks English like a cow can speak (hi!)." All I have to say is that I wish I could toss out the French like he does the English. F8VC is considering a trip to U. S. A. to see the Exposition in 1939; if he does, he will be given a fine time as the boys all over the country will surely welcome him. How about it Gene, better get your tickets now! ! !

Ben Wallich, G6BW, apparently leaves no stones unturned as he is also piling them up. Ben is on phone and now has collected 27 and 68. Often wondered what had happened to LY1J, but here he is now and says he is up to 38 zones and 110 countries. The two zones Pete needs are nos. 19 and 23.

SM6VX is a brand new one to the zone list and we welcome him, too, along with all the other newcomers. SM6VX has checked into his logs and found his to be 31 zones and 76 countries. Nice going, and let's hear from more SM's. G6GH hasn't been heard from recently but all of a sudden kicks through with his revised list which makes him now 37 and 102. VE2GA wants to be included with his 30 and 84, and asks the exact QSLing QRA of YI2BA. Speaking of VE's, here's VE2EE with a new zone, it being CE3BK. This brings Stan's up to 28 zones on phone.

Here is an official list of the stations licensed in Trinidad and Tobago, B. W. I.

** VP4TC—Diogo Serrao, 1 Broome St., Port of Spain.
* VP4TF—Frank A. Herbert, 163 Tragerete Rd., Port of Spain.
** VP4TH—Ethelbert G. Gibbs, 52 Duke St., Port of Spain.
* VP4TI—Stanley E. Knowles, 2D Dere St., Port of Spain.
** VP4TJ—J. A. Dos Santos, 45 French St., Port of Spain.

W7AMX points out elusive Zone 23 to "ye DX Editor" while on a recent visit to Art's station.

** VP4TK—Paul Alonzo, 74 Duke St., Port of Spain.
** VP4TL—Neville W. Robertson, 15 Fitt St., Woodbrook.
* VP4TM—Peter Leicester (ex-PK5PL) Vistabella, San Fernando.
* VP4YN—Eric Robert Duff, 28 Deverteuil St., Woodbrook.
* VP4TO—D. Gordon Bagg (ex-G6BD) Bungalow 60, Pointe A Pierre.
* VP4TP—Colin Fraser, 62 Mucurapo Rd., St. James.

*Markings: * C.W. only. ** C.W. and Telephony.*

VK2EG pops up with another one for him . . . it being K7GSC, and now he has 34 zones and 70 countries. He was about to give up hope of ever working a K7 when this one came along. G6CL added one in CE1AO, now making 37 and 109. Another one I am glad to see is G6WB with his 31 and 81. When he started writing his note to me, he had 30 and 80 and then took time out for a listen . . . and lo and behold! here was OQ5AQ . . . just the guy G6WB had been calling for weeks. Needless to say, he was "tickled pink" when he came back.

VE4RO has been trying his best to boost his zones beyond 38 but no luck as yet . . . anyway he has hauled down a few new countries such as ZS3F, VR4AD, HC2HP, HR4AF, CN8MS, HK1JB and HH4AS. The countries now stack up to 94. YV5AK says that we listed his frequency wrong a few months ago so will correct according to his wishes. On phone he uses 14075 and on c.w. it is 14289, and when on ten meters his frequencies are just doubled. YV5AK has 24 zones and 59 countries on phone and needs Wyoming, New Mexico and Nevada . . . so if any of you w.a.s. boys want him, look around the above frequencies from 5:30 p.m. to 7:30 p.m. e.s.t. Also, YV5AK will be glad to handle any QSL's for other YV's as he is the QSL manager. If you hear or work VR2FF during the next few months, the chances are he will be on Canton Island, as he had intentions of going there when last heard from. From G3DO we learn that he has 21 zones and 47 countries on phone. Still another from England is G8MX who adds three in K7FBE, XU8RB, and VP1BA making his now 27 and 56.

G2LB Works All Zones

Tom Martin has just sent through word that he has contacted all 40 zones at last but is lacking QSL's from two of them . . . U9AB and U9AF. As soon as Tom gets those other two, he will join G2ZQ and ON4AU "up on top." He wants to know if anyone knows how to get the cards out of the above stations. Yes, pardner, G2LB has a card from AC4YN, and in his own words he said, ". . . and now I am going out and buy a large size hat." He says in the excitement of working AC4YN he forgot to call his pal G5BJ on the land line, so that he might work him too. G5BJ just about lynched him.

VE5MZ, who visited me recently, is back on the brass again and sends a list of 32 zones and 66 countries. Some of his best are CN8AV, FT4AG, FA8BG, FB8AB, ZE1JN, ZE1JG, LA4K, YL2CD, I1IV, I1TKM, SV1RX. ON4AU, the first to make w.a.z., now has piled his already imposing list of countries up to 152. The ol' boy can still find new ones to drag in. Bill Marsh, SU1WM, now in England says that ZC6AQ is a pal of his and that all who QSO him are sure to receive a QSL. ZC6AQ, however, complains of a lot of "gate crashing" from fellows trying to get a card. He, too, was supposed to go to

England in August, so the ZC burden will be left to ZC6RP on 7226 kc. T9X and ZC6AA on 14 Mc. SU1WM now has 34 zones and 109 countries, and will be back in Egypt sometime in October. In the June issue of RADIO, a photo of VP7NT was shown and a little description of his station. In noting the address for mailing an error was made in his name. It should have been Harold K. North . . . we put it down as Worth. Anyway, the address still is Box 471, Nassau, Bahamas.

Not that you're interested, but activities of W6QD and x.y.l. during the summer included a trip up through Oregon. A visit was made to Art Bean's shack and we saw just how W7AMX does it. Art has a nice spot and uses no fancy beams to get all those countries. We saw some of that Oregon timber country, and I tried to get one of nature's antenna poles into the car but it wouldn't fit . . . it was about 90 feet too long. After returning to Manhattan Beach, a certain amount of plain and fancy "beaching" was done. And, oh yes, as for ham radio I've been "rejuvenating" my 250TL final with one of those new vacuum condensers. With this "modernization" move completed, I feel no further changes will be made for at least . . . let's see, oh, about a week or so. A few stray nines were picked off so I feel that the summer wasn't altogether lost. Anyway gang, if you're still wading through all this, you deserve a medal or something for endurance. Keep those transformers humming, those relays clattering, power meters buzzing, the filaments lit and the plates red hot . . . but don't let the filter condensers "sputter." If you do all this you're bound to make a good haul. Hope you all had a swell vacation (holiday in G, VK, ZL, etc.) this summer. See you next month.

56 Megacycles

[Continued from Page 62]

On July 25, W8RKE in Grand Rapids, Michigan, heard a "W7FHN." We haven't attempted verification of this as yet. On the same evening, W7FDJ in Houlton, Oregon, while working W7AQJ, heard some ninth district stations on the high frequency end of the band. He swung his beam east and called CQ for W9's and heard three replies on the same frequency. One was a YL but she faded down and W9WYX in Denver came through best. He was worked for five minutes, after which the band closed. This appears to be a single-hop contact, but with the band open in the east, two-hop signals were a possibility.

Summer Summary

At this writing, the last reported opening of the band was August 15. From July 1 up to that day, it was open every day somewhere in the U. S. except July 4, 5, 21 and 22. Many stations worked dx on consecutive days for about two weeks. In all, 56 Mc. has been much more interesting than last year, in large part due to better equipment and more active stations at a distance of 800 to 1200 miles from active areas, especially the W4's and W5's, and the W9's west of the Mississippi.

In order to provide a quick idea of the amount of activity on each day, we are listing the calls of stations reporting the band open on each day, but not the stations heard or worked. Later, we shall review all the reports, who was heard or worked, when the band was open, what equipment was used, and what interesting comments and observations were made. We want to thank each of these for their letters.

May

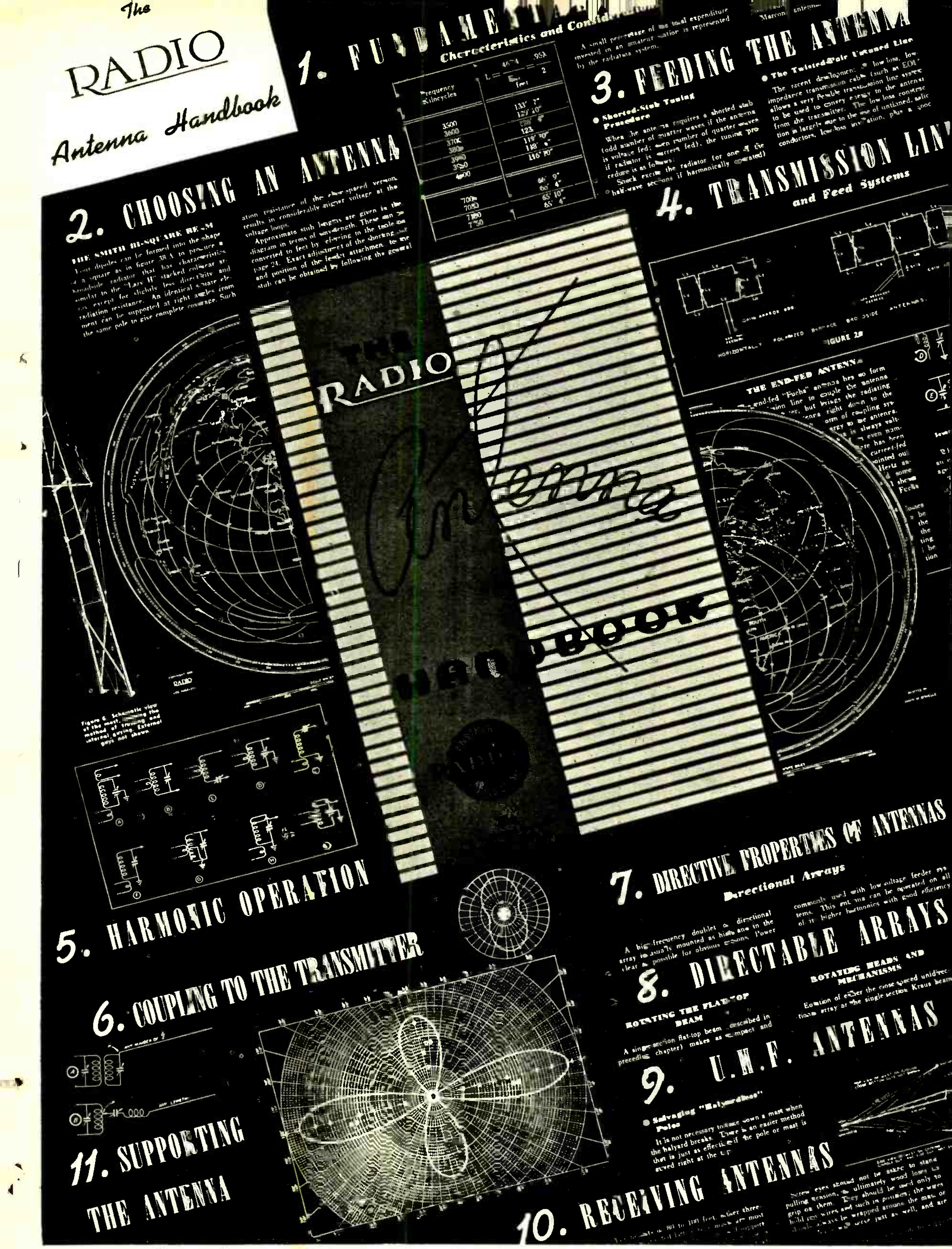
May 9: W5EHM.

May 11: W8CIR, W9ZGD.

May 12: W6DNS AVR GE IOJ OIN, W7AQJ.

May 13: W5EHM.

May 15: W1EYM, W2FQM LAH JCY AMJ HWX GZC BHD ISY KXH, W3GMZ EZM, W4EDD, W5EHM,



W8KG CIR NED MST RSS PTG VO KAY, W9WLX.

May 16: W5EHM, W8KAY.

May 18: W8NSS.

May 19: W1KTV, W3GIO GMZ, W4EDD, W5EEX ZZF EHM ALK AJG FYS, W8NSS QDU RKE OQJ RSS PEJ KG CIR PTG, W9ANA TZQ CLH WLX CVQ YFQ SQE ARN ZGD CX.

May 20: Single report from W8KG, earlier reported as May 28.

May 22: W5AJG gives this date but earlier card, and letter from W5EHM, give the date as May 23 when two W9's were heard.

May 23: W4EDD, W5AJG (also reported as May 22).

May 26: W1JUJ KTV KXK KEX, W3ATR, W8NKJ NSS QKF, W9CCY.

May 27: W1KTV, W2HWX FZA KLO, W3DBC GIO RL AFJ GQS EET AIR GEF ATR, W5EHM, W8EGQ KG NKJ NOB NSS OPW, W9CCY UJE YFO QCY HPP SQE ZXD AUQ ZCN VVE CX YLV NY.

May 28: W8KG (may be May 20).

May 29: W4EDD, W5EHM (heard someone working W4EDD), Criswell (Phoenix, Arizona, who heard W5EHM).

May 30: W5EHM, W8MSK NSS QDU QFV RYJ, W9UJE.

May 31: W1JP EYM, W3AIR, W5EHM, W9QEI NY RBK ZUL.

June

June 1: W3RL, W5AJG EHM, W8JLQ KG NKJ OPO RVT, W9RBK UJE.

June 2: W3AIR ATR, W8QFV RYJ.

June 3: W8QFV says he worked W1IZY, heard W2 and W3, but date may be wrong month. W9UIZ heard W8XKA on 55.5 Mc., and unidentified carriers.

June 4: Ferrell (N. J.), W3DBC GIO, W9UIZ heard, "Hello Holland Lake Tower," sounding like the VE9's reported later.

June 5: Numerous; not tabulated yet.

June 6: W1IJ KOE, W2KHR LAH, W5EHM, W8EGQ KG PCR PTG RXE RSS RVT QFV.

June 7: W1KTV reported signals but date may be July. W1SS reported W5DRN (who is not on air) and W4EDD. W5EEX reported W9CLH and W9ANA.

June 8: W9CCY says a local heard W8ANT and W8AGE in QSO for five minutes.

June 9: W5AJG EHM, W7AMX, W8KG NKJ NSS, Storz (Kansas City).

June 10: W5AJG EHM EEX, W8KAY RUJ OPO NSS QKF VO MST JLQ QDU NKJ OPW AGU KG, W9CLH FEN RBK UJE QCY.

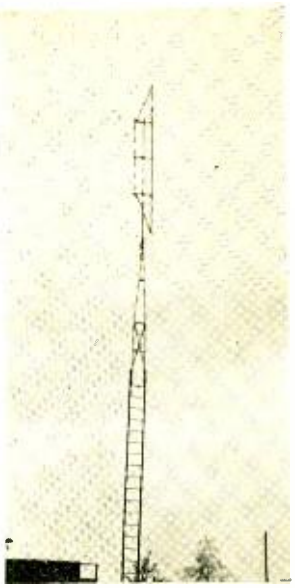
June 11: W5EHM, Criswell (Arizona), W8KG PTG.

June 12: W5EHM, Criswell, W8KG NOA.

June 13: W3BAI/4 in Miami Springs heard W9ANA in morning.

June 18: W3DBC RL, W5AJG EHM, W8CIR JLQ NOB NKJ QDU.

June 19: W1IJ, W2LAH, W3EZM GQK DBC RL DOD, W4EDD, W5EHM AJG, W8OPO MST RIO JLQ OPW NOA CIR QDU KNE, W9LNV ZUL.



The co-phased, co-linear vertical array in use at W8VO, Akron, Ohio. W8VO was successful in contacting W6PEX in Alameda, California, for his eighth district on 56 Mc.

June 21: W7AMX reported band open from W7 to W6.

June 26: W1CSR reports working W9NY but latter was active on following day.

June 27: W5EHM, W8MST KWD NOB CIR QDU, W9ARN CLH CCY NY ZJB TOQ ZUL UOG.

June 28: W5EEX, W9CLH ZHB.

June 29: W5AJG EHM, W8QKF, W9USI.

June 30: W9NY reports fading carrier at 1:14 p.m.

July

July 1: W5EEX EHM, W8BDG MST QDU CIR, W9CCY NY.

July 2: W8CIR KG MST.

July 3: W8MST RIO CIR OPW NOB.

July 5: Originally listed as open but no reports located.

July 6: W5EHM, W8NED, W9NY.

July 7: W1KOE KTV, W2HYJ IUN, W3DBC RL DYE EZM, W5EHM AJG, W8NED KG OPW CIR QDU BSM RIO, W9SQE ARN YSV USI NY UOG UIZ VFO ZUL.

July 8: W1IJ BRL JRY JNX, W2IUN ETN FQM LAH, W3EZM DBC RL AIR. W5EHM, W8NED OPW NKJ CIR KWD RIO, W9ARN YSV USI NY QEI UOG UIZ VFO IZQ AHZ QCY.

July 9: W4MS, W5EHM, W8CIR IUD NED, W9USI.

July 10: VE1FL, W1HXE IJ KEE KBM JP JLI SS (says heard G2M something) JUE JUJ, W3RL, W8NED RQG AGU NOB OPW NOA RKE QDU, W9SQE CLH LNV BCF IZQ QCY USI (heard automatic key, unidentified).

July 11: W1HXE KEE ELP JNX JP JUE KOE BRL JFF KZL (heard two-hop signals), W2FQM LAH LAD Ferrell (N. J.), W3FZA EZM AIR RL (heard VE1 harmonic working W8 on 28 Mc., and was reported in VE1), W4EDD AUU, W5EHM, W8CDM EGQ KWD RQG RIO BDG NED OKC RUE BSM JLQ NOR QDU KG AGU NOB OPW NOA NKJ QFV, W9VFO CLH FEN CCY TOQ LNV ARN ZUL UIZ BCF IZQ AHZ USI QCY.

July 12: VE1FL, W1ELP JNX JUE KOE KZL, W2LAD, W3RL, W5EHM, W8RUE NED RQG FPH PBX NOB OPW CIR, W9SQE CLH TOQ USI VFO AHZ.

July 13: W5EHM who worked W6OIN, W6MKS and W6MLA, all confirmed (single hop, probably, with distance close to 1200 mile maximum).

July 14: W5EHM, W9USI.

July 15: W1IJ CSR KOE, Ferrell (N. J.), W3EZM FZA RL DOD AIR DYE, W4MS EDD, W5EHM EEX, W8RUE MST NED PTG BDG OJN KG OPW NKJ CIR QDU NOR JLQ FPH

VO, W9SQE CLH LNV IZQ AHZ BFW RBK FEN.

July 16: W1IJ KOE, W3AIR, W4MS EDD, W5EHM AJG, W8MST FPH CIR, W9SQE TOQ CCY UJE.

July 17: VE3ADO, W2LAH, W5AJG EHM ZZF, W8MST PTG BDG FPH CIR NKJ KG, W9TOQ RBK USI.

July 18: VE3DC, W1IJ LIG JFF, W2LAH, Ferrell (N. J.), W3AIR, W4AUU, W5ZZF, Criswell (Arizona), W8PTG BDG NOR QFV, W9TOQ (who reports hearing XE station announcing in Spanish) ZJB RBK ARN UIZ UJE AHZ.

July 19: VE3DC, W1HXE IJ KDW LIG KEX JNX JP JUJ JMT JUE (says best day) CSR KZL JFF, W2IFU FQM Ferrell (N. J.) IUN HQD GHV KLX LAH LAD, W3AXR GQK EZM DYE DBC RL AIR, W4AUU, W5EHM AJG ZZF, W8OKC MST RV NED KWD RIO MSK OJN PTG FPH JHW JLQ QDU KG AGU NOB OPW NOA NKJ QAM VO CIR QFV, W9SQE LNV ZJB NY RBK ZGD KXU ZUL UIZ BCF QVP IZQ AHZ ARN USI.

July 20: VE3ADO, W1IJ LIG JFF, W2FQM KLX LAH, W3AIR DYE EZM DBC, W5EHM, W7AMX, W8NMA RUE MST RV NED PTG ZGD CIR FPH BSM

Honor Roll

The accompanying table lists a number of stations and the districts worked by each. Canadian contacts have not been included as additional districts. The list is not complete but includes mainly those who have provided totals in their letters. It is obvious that many others should be included, and they will be when their totals of states and districts worked are known accurately.

HONOR ROLL

(exclusive of Canada)

	Districts Worked	*States Worked*
W8CIR	8	
W8JLQ	8	
W8VO	8	
W9ZHB	8	
W1EYM	7	
W2JCY	7	
W3AIR	7	9
W3EZM	7	24
W4EDD	7	
W5CSU	7	
W5EHM	7	
W8QDU	7	
W9CLH	7	
W9WAL	7	
W2LAH	6	
W3RL	6	11
W8OJF	6	
W9ARN	6	10
W9NY	6	13
W9USI	6	13
W9ZUL	6	10
W1JMT	5	9
W1LFI	5	
W2GHV	5	8
W3GLV	5	
W6DNS	5	
W8RVT	5	7
W9UOG	5	8
W9ZJB	5	9
W1JNX	4	
W3FPL	4	
W8AGU	4	8
W8NOB	4	
W8NOR	4	7
W9QCY	4	7
W6AVR	3	4
W6OIN	3	3
W8OEP	3	

RIO MSK BDG NOA NOB KG, W9ZJB NY AHZ ARN RBK FEN CCY UJE UIZ USI. W9ZJB found band as good for him as June 5.

July 21: Listed as open but no reports located.

July 23: W1BRL, W3DBC RL, W4EDD, W5EHM, W8RUE QJP OKC MST NED PTG BDG FPH QDU RKE CIR KG NOB OPW NKJ, W9ZGD ZUL ARN UIZ ZJB AHZ.

July 24: VE3DC, W1KDW LIG JRY BRL KBQ EYM, W2JCY GHV, W3AXR EZM RL, W4AUU, W5EHM AJG EEX, W6AVR FPV RR OIN PEX DNS Criswell (Arizona), W7FDJ EMP, W8OKC MST NED PTG BDG FPH BSM KWD RQG RIO JHW JLQ QDU RKE CIR KG AGU NOB NOA NKJ VO QFV KNE, W9ZGD ZMG YFO FEN CCY ZUL UIZ ZJB ZHB AHZ USI, Storz (Kansas City).

July 25: W1KDW HXE BKG JNX JRY KOE BRL JFF, W2IUN GHV, W3DYE EZM AIR DOD RL DBC, W4EDD, W5EHM EEX, Criswell (Arizona), W7FDJ, W8OKC PCQ MST PTG BDG RKE NOR KWD RQG RIO MSK CIR NKJ KG, W9LNV NY ZGD CCY YFO FEN ARN AHZ UIZ BCF ZJB USI, Storz (Kansas City).

July 26: W3RL, W5EHM, W8BDG CIR KG MST.

July 27: W3AIR DYE, W4EDD, W6DNS, W8KG PTG.

July 28: Ferrell (N. J.), W3AIR, W6DNS OIN, W7EMP, W9ZGD (who heard W5AJG for a few minutes—W5AJG reported nothing this day but worked some stations on July 29).

July 29: Ferrell (N. J.), W3DOD, W5AJG, W6OIN DNS, W7EMP FDJ, W8VO.

July 30: W3DOD, Criswell (Arizona), W6DNS, W7EMP. Only eastern report was W3DOD who heard W4FLH in Miami.

July 31: W1KDW JRY KOE BRL, W6OIN Criswell (Arizona), W8AGU CDM JHW, W9SQE.

•

August 1: W4AUU, W6OIN, W7FDJ. Only eastern report was from W4AUU who heard W8CDM and W8EID after 9:00 p.m.

August 2: W5EHM EEX, W8CIR, W9SQE ZGD ZUL.

August 3: W1KOE KZL, W3EZM, W4AUU, W5EHM, W6RR DNS, W7FDJ EMP, W8NOR NOB KG, W9ZGD USI.

August 4: Ferrell (N. J.) reported W8's and says that a local worked one in Pittsburgh.

August 5: W6DNS reported "XE2MI" on c.w.

August 6: W6DNS heard W6ZE in San Francisco.

August 7: W7EMP says band opened, apparently to W6.

August 8: W1HXE JP JFF, W8OJF KG, W9USI.

August 9: W4AUU, W8CIR.

August 10: W7EMP, W9ZUL.

August 11: W1JNX GYT KOE KZL, W9SQE ARN.

August 12: W8NOR worked W1GUY at 8:20 a.m.

August 13: W3DBC worked W5EHM who also was reported to work W3EZM, W3HKM and W3CUD. W3DYE also heard W5EHM.

August 14: Criswell in Arizona heard W7FDJ testing and W7EMP calling a W6 in the evening.

August 15: W3DBC says that at 2:37 p.m. Eastern time, W3GLV made direct contact with HR4Z in Honduras, who was heard in Washington and Baltimore by W3DBC, W3BR and W3CGF. HR4Z

reported hearing W6's without making contact.

We don't find any record of an HR4Z, but the same holds good for HR4AF, an old stand-by on 28 Mc. phone, who is currently active.

Normal One-Hop Distance

Most of the summer dx is within a maximum distance of about 1200 miles, though Texas W5's on a few days were heard in New England on what appears to have been two-hop work, with W9's in between working both the W1's and the W5's. Some fellows mention having worked 1400 or 1500 miles but a careful check of the distance often reveals that it is actually close to 1200 miles when calculated for a great circle path or checked on a very large conic projection wall map.

Some past reports appeared incorrect to us due to being beyond 1200 miles on days when two hops were not evident. These cases and others led us to check calls, resulting in this list of stations which say that they are not on 56 Mc: W1KPU W1KWH (28 Mc.) W5DRN W5FO (portable per W1KZL) W5FOH W6DQH W6KFE W7EYM (mail returned) W8NSL W8QLH (28 Mc.) W9IZO (IZQ?) W9PQA (PQH?) W9QYI W9TMN (TMM?) W9YLD W9ZBS W9ZDE.

CALLS HEARD

[Continued from page 58]

Ben Tylka, VE4SH,
1016 Burrows Ave., Winnipeg, Man.
(April and May, 1938)
(14 Mc.)

CM2AF; CM2AZ; CM2BH; CM2PW; CX1BG; CX2AJ; G5MY;

[Continued on page 97]

By the "Editors of Radio"

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RADIO LIMITED *Technical Publishers* 7460 Beverly Boulevard, Los Angeles

Advertising Index

(Continued from Page 13)

able through bandswitching. The two-tube receiver covered the same frequency range. The batteries were capable of supplying power to the transmitter for four hours and to the receiver for thirty-two hours and the hand generator included in the emergency equipment could supply power for land operation as long as a man was able to crank it. A hydrogen-filled balloon was taken along to keep the emergency unit's 100-ft. vertical antenna aloft.

On August 20th, Hughes again landed his round-the-world Lockheed at Floyd Bennett Field, N. Y., completing a transcontinental hop from Glendale, Calif., in ten hours and thirty-two minutes to break the old record for transport planes. This time Perrine was on board, carrying on for Stoddart, and was in uninterrupted QSO with W6CUH and W2UK from the staggering altitude of 16,000 to 20,000 feet.

At some remote date, undoubtedly, the flying of planes around the world will be an everyday occurrence provoking no more comment than today's matter of fact transcontinental motor trips. The pioneer is not forgotten altogether, however, and we believe that men of another day looking down the corridors of time will call the Hughes achievement to memory as long as a plane roars in the skies. To have contributed to the success of this milestone in aviation history has been to give added reason for amateur radio's being. To have carried on in an efficient and orderly manner is proof of what we can do when we start out right.

In his speech at New York's reception, Howard Hughes said of his flight, "It functioned because it was carefully planned." Careful preparation, we understand, is a Hughes principle. Certainly that principle dominated amateur activities in connection with the Flight from the very start.

Little difficulty was experienced as a result of ham QRM. We learned, much to our satisfaction, that the few stations that did skate too close to the flight frequencies moved out of range promptly when requested to do so by the net stations.

From all of this the ham can learn a big lesson and record another job well done.

●

I. F. Crystal lives in New York.

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W6KX prints QSL's. Keith LaBar, 1123 North Bronson Ave., Hollywood.

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LISTEN for High Frequency Broadcast Station. W9XA, 26.450 Kilocycles, Kansas City, Missouri.

QSL'S—HIGHEST QUALITY—LOWEST PRICES. RADIO HEADQUARTERS, FT. WAYNE, INDIANA.

SACRIFICE: Breting 14AX Receiver, A1 condition, used only 4 months, $75. W9PGS, 915—15th St., Boulder, Colo.

BARGAINS—Radio Apparatus—Stamp or your list brings mine.—W1GPU.

WILL exchange station photographs. W5ACA, Box 615, University, Louisiana.

TWO 20-acre gold placer claims, Kenai Peninsula (big game, district), Alaska. Bedrock estimate $1.50 per square yard. Highway connects railroad. Reason for selling: need money. Best offer takes them. T. Pauley, W6LIQ, Tunnel, Alaska.

QSL's, SWL's: one color, 45c; two colors, 60c hundred, postpaid. Samples. W1FTM, 268 Piedmont, Waterbury, Conn.

TRANSFORMER SPECIALS: 5000-volt, center tapped at 300 mils—$10.00. 3000-volt, center tapped at 300 mils—$8.50. 866 filaments only $1.00. All types of PRECISION transformers. Michigan Electrical Laboratory, Muskegon, Michigan.

RACKS. Cabinets. Shields. Panels. Chassis. Specials. R. H. Lynch, 970 Camulos, Los Angeles, Calif.

COMPLETE, modern-type, high-power phone station. For sale or trade for boat. W6CIF.

CALLS HEARD

[Continued from Page 94]

HH4AS; HS1BJ; J2GV; J2HQ; J2JJ; J2KG; J2KJ; J2KN; J2LL; J2OV; J3FK; K5AF; K5AU; K6HQI; K6LNW; K6MZQ; K6OPV; K6PLZ; K6PTY; KA1CW; LU2CW; LU3FB; LU4BH; LU7AZ; NY1AD; PK1MF; PK1PK; SY1AZ; SP1BC; SP1KM. VK—2AFN; 2AHA; 2AHP; 2AIB; 2BR; 2CB; 2CL; 2GV; 2HF; 2JO; 2NS; 2QL; 2UY; 2VN; 2VU; 3DM; 3FF; 3FM; 3HG; 3IW; 3NG; 3NS; 3NW; 3QD; 3QK; 3UM; 3VJ; 3VQ; 3WO; 3XN; 3ZR; 4AW; 4CG; 4EL; 4UR; 5DW; 5FL; 5JS; 5JT; 5LW; 5ML; 5WK; 5WR; 6AF; 6SA; 7WX; 9DM; 9VG. VR4AD; VR6AY; VS6AG; VU2CQ; XU8RL; XU8XA; ZL1A; ZL4DQ

(28 Mc.)

K6LCV; K6MVV; K6OQE; K6PCS; LU1DJ; LU7BF.

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.

GRENING REMOTE CONTROL SYSTEM

Types of relays used in control circuits as manufactured by Automatic Electric Co. Similar relays of other manufacturers would be equally suitable.

"A"—AQA1A
"B"—ASR1A1C
"C"—ASR1A1B
"D"—AQA2A1B
"E"—AQA1A2B
"F"—AQA2A2C
Selector switch—RA701A1D
Dial mechanism—24A36
Dial mounting cup—AK16
Simplex coils—Western Electric 77-A or Automatic Electric 1-D
Telephone transmitters—Western Electric E3B or Automatic Electric AA22 (complete)
Microphone unit—Automatic Electric 35A7

THE BEGINNER'S SPECIAL

T—Thordarson T-74R28
CH—Thordarson T-57C53
Coupling and by-pass condensers—Solar Sealdtite
C_{10}—Solar DAA-708
Crystal—Bliley HF-2
Tuning condensers—Hammarlund Star

HUGHES PRINTING CO.
EAST STROUDSBURG, PA.

IMITATED · COPIED · BUT NEVER DUPLICATED

THE ANSWER IS IN THE RECORD

SINCE 1910

STANDARD OF QUALITY FOR AMATEUR X'MTRS

"Finished work shows no trace of work." Only in its extra long-life and surviving economy does the modern C-D capacitor reveal the 28 years of precision engineering behind it. New Catalog 161 now available.

Features of Types 4 & 9

1. Low power-factor; high Q; long life. 2. High factor of safety—affords high voltage breakdown. 3. Low loss; high insulation resistance—reduces losses at all frequencies. 4. Practically constant capacity over wide range of temperature.

Features of Type 86

1. Patented series mica stack; Eliminates corona or losses. 2. Special low loss filter; Reduces stray losses. 3. Short heavy brass stud terminals; Low resistance connection. 4. Black glazed porcelain dehydrated case; Low R.F. losses.

Features of Type TJ-U

1. Hi-purity aluminum foil; Results in lower r.f. resistance; light weight construction. 2. Hi-purity multi-laminated kraft tissue; Affords high voltage break down; minimum leakage. 3. Dykanol (chlorinated diphenal) impregnated and filled; Non-inflammable and non-explosive; long life; small size; lower power factor. 4. Hermetically sealed; Not affected by moisture, time or temperature.

Features of Type TL-A

1. Sturdy aluminum container; Extremely small size—convenient shape for simplified installation. 2. Dykanol impregnated and filled; Fire proof; Extra hi-dielectric strength. 3. Hermetically sealed.

MICA - PAPER - DYKANOL

CORNELL-DUBILIER ELECTRIC CORPORATION
South Plainfield, New Jersey
Cable Address: "CORDU"

WET & DRY ELECTROLYTIC

PRODUCTS OF THE WORLD'S LARGEST MANUFACTURER OF CAPACITORS!

SAVE MONEY

By Using RCA Transmitting Tubes

HERE'S WHY WITH THE RCA-809

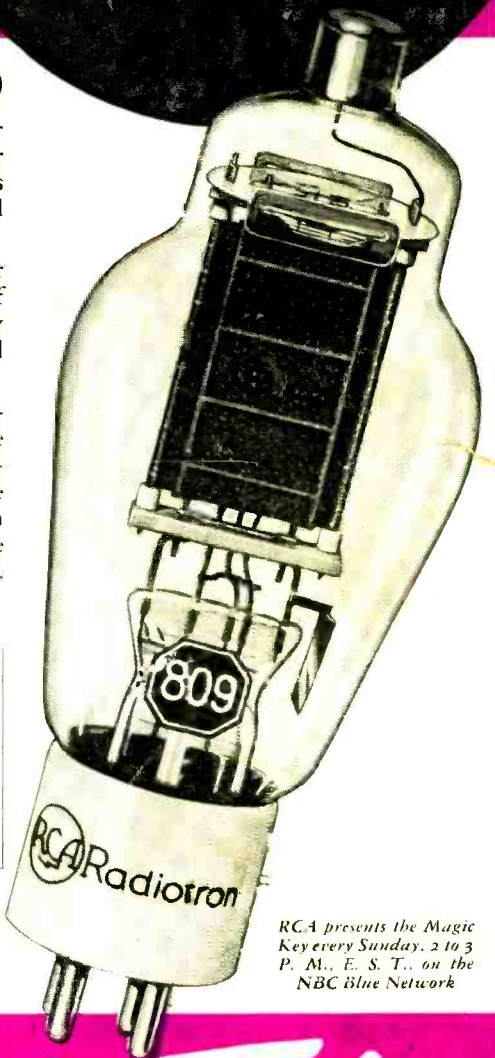
YOU SAVE because your driver stage costs less. For class "C" Telegraphy, two RCA-809's have a power output of more than 100 watts with only 5 watts driving power. An RCA-802 Crystal Oscillator will easily drive two RCA-809's.

YOU SAVE because your power supply and amplifier equipment cost less. Since the RCA-809 is a tube of high perveance, you get good performance with low plate voltage. Your transformers, capacitors, and other power-supply equipment cost less.

YOU SAVE because the RCA-809 costs less. The RCA-809 is a precision-manufactured Transmitting Tube having exceptionally long life that gives you outstanding performance at a Receiving Tube price: Price $2.50. Ask your distributor for full information regarding this winner and money-saver, or write to Commercial Engineering Section, Harrison, N. J.

RCA MANUFACTURING CO., INC., Camden, N. J.
A Service of the Radio Corporation of America

TYPICAL OPERATION *(Class "C" Telegraphy—per tube)*			
Filament Voltage	6.3	6.3	Volts
D-C Plate Voltage	500	750	Volts
D-C Grid Voltage	−50	−60	Volts
D-C Plate Current	100	100	Milliamperes
Plate Dissipation	25	25	Watts
Driving Power (Approx.)	2.5	2.5	Watts
Power Output (Approx.)	35	55	Watts



Ask your distributor for the new TT-3 Transmitting Tube Manual—Price 25 cents. Contains 192 pages of complete information on all RCA Air-Cooled Transmitting Tubes.

RCA presents the Magic Key every Sunday, 2 to 3 P. M., E. S. T., on the NBC Blue Network

RCA Radio Tubes

FIRST IN METAL—FOREMOST IN GLASS—FINEST IN PERFORMANCE