RADIO

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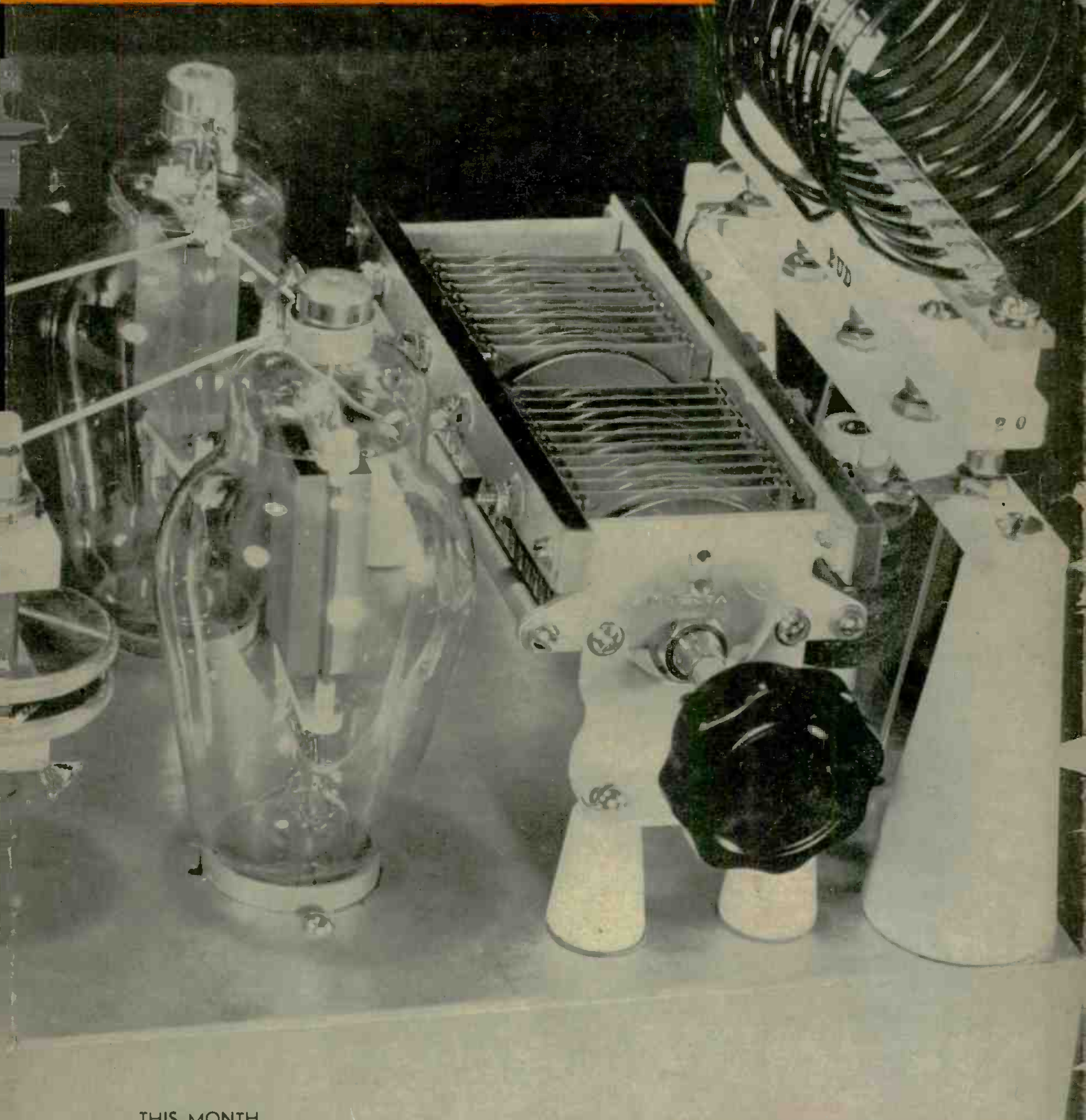

THIS MONTH

- PUTTING THE 811 AND 812 TO WORK
- CARRIER OPERATED REMOTE CONTROL
- THE MULTIPLE WIRE FLAT TOP BEAM

The Worldwide Authority of Amateur and Shortwave Radio

★

November 1939

NUMBER 243

30c IN U.S.A. AND CANADA

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."

Apologies to Visitors

During the summer now ending an unusually large number of readers visited our former offices in Los Angeles. At that time a shorthanded editorial department was working furiously on a belated constructional and writing program for the forthcoming edition of the RADIO *Handbook,* and just could not spare the time to welcome all visitors.

We present our humblest apologies to all those whom we could not welcome in person. Contemplated increases in our staff and the probability of a smaller volume of visitors in Santa Barbara makes us hopeful that we can again act like human beings and fellow-hams to those kind enough to drop in.

Why Santa Barbara?

A number have expressed curiosity as to the reasons for our move to Santa Barbara. A number too have commented that for business reasons we should have moved east.

Well, we're all Californians (with the transplanted easterners more rabid than the native sons) and just too darned obstinate to move away from our favorite state as long as we can continue to eat here. Good advertising representatives in New York and Chicago plus the fact that our major publications are printed in and distributed from Pennsylvania (for time-saving reasons) combine to offset most of the disadvantages which might otherwise result from operating a nationwide publishing business from this coast.

For more spacious quarters, for a pleasant place in which to work, and for plenty of room for long experimental antennas, the company long cast about for a suitable location in Los Angeles at a price which seemed warranted by our proposed uses. All otherwise suitable places which turned up were so far from town that it seemed as if another town with air mail service would do just as well.

Santa Barbara was chosen because several of our staff come from this county, because all persons we have ever met that have lived here want to come back, and because a ten-acre tract was offered us at a very reasonable price in an unusually good radio location—and scenic, to boot—on top of a hill overlooking the Pacific Ocean on one side and the city of Santa Barbara and the Santa Barbara Mountains on the other.

A residence-type office building and laboratory will eventually be erected on this tract. In the meantime visitors will find us in the Benjamin Franklin Life Building in the business section of the city.

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

• This RCA "Consolette" control desk used in the Broadcast and Public Address Center at the New York World's Fair suggests a design for a de luxe medium-power amateur transmitter.

TWIN-THREE FLAT-TOP

Beam Antenna

By JOHN D. KRAUS,* W8JK

A description of a simple single-section flat-top beam antenna employing three-wire doublets instead of dipoles as the radiating elements. The radiation resistance of the elements of the array is greatly increased and the feed system is considerably simplified by making this substitution. The improved beam is in tune over a wider frequency range, is easier to adjust and feed, and is almost unaffected by climatic conditions.

The flat-top beam antenna[1] consists basically of two parallel closely-spaced half-wave elements driven in opposite phase. This arrangement is shown by figure 1. Suitable values of the spacing, S, range from about one-eighth to as much as one-half wavelength. This antenna provides a substantial gain, the maximum radiation being in both directions in the plane of the elements and perpendicular to them.

The flat-top beam shown in figure 1 is of the single-section type. Greater gain can be obtained by adding extra sections colinear to the first section of the flat-top, each section consisting of a pair of half-wave elements. However, the most compact form of flat-top beam is the single-section type. For this type the gain is high in proportion to the antenna size and the horizontal coverage is very broad.

Application of 3-Wire Doublets

This article describes a new and improved type of single-section flat-top beam antenna in which a pair of 3-wire half-wave doublets are used for the radiators in place of the conventional single-wire elements, hence the name "twin-three" flat-top beam.

Advantages of the new arrangement are: (1) the antenna matches directly to a 600-ohm matched impedance line, no adjustments being required, (2) the antenna has a broad frequency response and operates with uniformly high effectiveness over an entire amateur band, (3) the radiating efficiency is increased, (4) the antenna performance is relatively unaffected by weather changes, i.e., dry to wet or vice versa, and (5) the antenna can also be readily adapted for 2-band operation.

The radiation resistance at the current loop of either element of a single-section flat-top

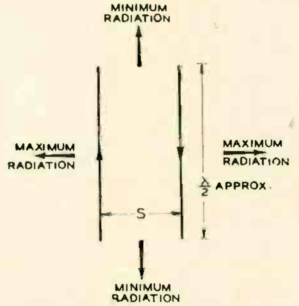

Figure 1. Arrangement of single-section flat-top beam with single-wire elements. Feed system not shown.

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* Arlington Blvd., Ann Arbor, Michigan.

[1] J. D. Kraus, "Small but effective flat-top beam," RADIO, March 1937, p. 56, also June 1937, p. 10; "Rotary flat-top beam antennas," RADIO, Dec. 1937, p. 11; "Directional antennas with closely-spaced elements," *QST*, Jan. 1938, p. 21; "Flat-top beam antennas," *Television and Short-Wave World* (London), Feb. 1938, p. 101; "New design data on the flat-top beam," RADIO, June 1938, p. 15.

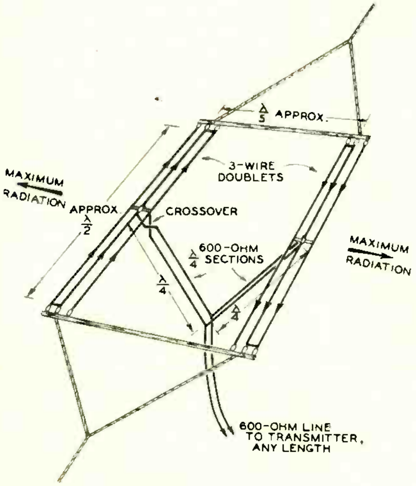

Figure 2. General view of "twin-three" beam or single-section flat-top beam with 3-wire doublets.

beam with single-wire elements is relatively low. The exact value in any specific case depends on the spacing used and also on the height of the antenna above ground.[2] For example, the loop radiation resistance of each element of a horizontal single-section flat-top beam antenna with 0.2 wave spacing and a height of 0.5 wave above ground is 23 ohms. This resistance can be increased by using wider spacing between the elements. It also can be increased by adding extra sections to the flat-top. Still another method by which the feed point radiation resistance of each element may be increased is by the application of multi-wire doublets, such as described in the May and June issues of RADIO.[3] The 3-wire half-wave doublet is particularly well suited for this purpose.

Figure 2 shows in perspective view a horizontal single-section flat-top beam in which a pair of 3-wire half-wave doublets are used as the radiating elements. Thus, the antenna consists of 2 closely-spaced doublets driven *out-of-phase*, each doublet being constructed of 3 ultra-close-spaced *in-phase* conductors.

A spacing between the doublets of approximately 0.2 wavelength is employed. As mentioned in RADIO for June the resistance at the feed point of a 3-wire half-wave doublet in free-space is about 900 ohms. When used in a flat-top beam with 0.2 wave spacing as shown in figure 2, the feed point resistance of each doublet is about 300 ohms, which is very large compared to the 23 ohms for the single-wire element.

Impedance Matching

Open wire lines of the 600-ohm type (number 12 wire spaced 6 inches) are used throughout for feeding the antenna. A quarter-wave transformer or Q-section* of 600-ohm line connects to the feed point of each doublet. Both transformers are connected together at their lower ends as shown in figure 2. A 600-ohm matched-impedance line is connected between this point and the transmitter. This line may be of any length. The quarter-wave transformer converts the 300 ohms at the doublet end to 1200 ohms at the lower end. Since the two transformers connect in parallel at the lower end, the resistance at the junction becomes 600 ohms. This then forms a proper termination for a 600-ohm matched impedance transmission line.

One of the quarter-wave transformers has a cross-over or transposition in order that the doublets be driven in opposite phase. The arrows on the wires, as illustrated in figure 2, indicate the direction of the currents on the antenna at a given instant.

The currents and voltages in the flat-top beam with 3-wire doublets are much less than in a flat-top beam with single-wire elements having the same power input. This results in an increased antenna radiating efficiency. In addition the flat-top beam with 3-wire doublets is much less influenced by changes in weather and it possesses a broad frequency response.

The use of 600-ohm open-wire lines throughout for delivering energy to the radiators makes for a feed system which is both very light in weight and easy to construct. Olander[4] has recently described a system for feeding a single-section flat-top beam antenna which uses a pair of quarter-wave transformers or Q-sections in an arrangement similar to that shown in figure 2. However, in this case the radiators used were single-wire elements and this required Q-sections of a relatively low characteristic impedance for matching a 600-ohm line. To provide this low impedance, it was necessary to construct the Q-sections of tubing one-half inch in diameter.

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[2] J. D. Kraus, "Characteristics of antennas with closely-spaced elements," RADIO, Feb. 1939, p. 9.
[3] J. D. Kraus, "Multi-wire type antennas," RADIO, June 1939, p. 21, also May 1939, p. 24.

* The terms "quarter-wavelength transformer" and "Q-section" are both commonly used although the I.R.E. standards, recently adopted, describe the device as a quarter-wave length transformer.
[4] L. W. Olander, "The Q-beam antenna," *QST*, Feb. 1939, p. 24.

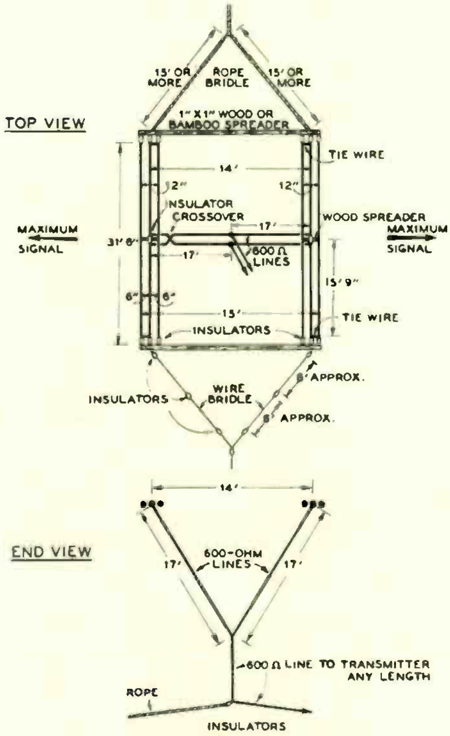

Figure 3. Twin-three flat-top beam with dimensions for the 14.0 to 14.4 Mc. band.

Construction

Figure 3 shows the top view of a horizontal flat-top beam with 3-wire doublets or elements in which the dimensions are given for the 14.0 to 14.4 Mc. band. Actually, the dimensions given are optimum for a frequency of about 14.2 Mc. but the response is sufficiently broad that an antenna cut to the dimensions given can be used with equal effectiveness over the entire band without any readjustments of the antenna.

For fundamental operation on 28 to 29 Mc., the dimensions should be divided by 2, i.e. the dimensions of the doublets, both length and spacing of the 3 wires, and also the distance between the doublets. The length of the quarter-wave transformers are also halved, but the spacing remains 6 inches, the same as for 14 Mc. In a corresponding manner, for the 7-Mc. band the dimensions are multiplied by 2.

The cross-over on one of the quarter-wave transformers can be made conveniently by means of a transposition insulator. This transposition insulator should be situated in the line close to where it connects to the 3-wire doublet.

All wires of the 3-wire doublets are in the same horizontal plane. These wires are 31 feet 6 inches long and it is important that this length be accurately adhered to. The spacing between the individual wires is 6 inches. The overall width of each doublet is 1 foot. The spacing between the center wires of each doublet is 14 feet, so that the total overall width of the antenna is 15 feet. Spreaders 15 feet long of wood (1x1 inch) or of bamboo are used at each end of the doublets to maintain the proper separation. The insulators for the doublets are fastened to these 15 foot spreaders. Either rope or wire bridles can be tied to the spreaders at each end of the antenna in order to permit the suspension of the antenna between two supports or towers. In figure 3 the arrangement of a rope bridle is illustrated at one end of the flat-top and a wire bridle at the other. It is helpful to make the bridle fairly long so that any tendency of the spreader to bend is minimized. This can be accomplished if each branch of the bridle is at least 15 feet long. With bridles of this length, the overall length for the 14-Mc. antenna of figure 3 is about 60 feet including the bridles at both ends. Where the space between the supporting towers is less than 60 feet, the bridles may be shortened, but somewhat stiffer 15-foot spreaders may then be necessary.

If wire is used for the bridles, it should be broken up with small strain insulators (egg type) approximately as shown in figure 3. Insulator spacings such that the wire lengths between insulators in the bridle are about 6 feet will be satisfactory for an antenna used on 14 and 28 Mc.

For best results under ordinary conditions, the antenna should be suspended so that both doublets are at the same height and parallel to the ground. The effect of tilting such an antenna was described in Radio for February.[2]

In installations where it is not possible to lead the 600-ohm line vertically downward for some distance away from the antenna, the system shown in the end-view of figure 3 can be employed. This arrangement keeps the tension on the two quarter-wave transformers equal and assists in holding the flat-top level.

At the center of each doublet a wooden spreader about 1 foot long is used to keep the wires separated. An insulator is tied to the center of this spreader and is inserted in the middle of the center wire, as shown in the top view of figure 3. This insulator is, thus, at the feed point of the doublet and the quarter-wave transformer also connects across

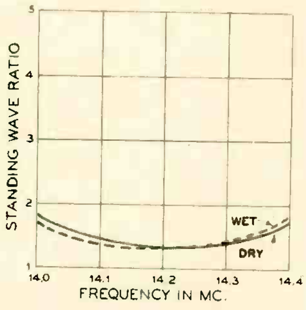

Figure 4. Measured standing wave ratio on the transmission line feeding a twin-three flat-top beam with 3-wire doublets over the frequency range of the 14 Mc. band. The solid curve gives the results with the antenna dry, and the dashed curve with the antenna wet as following a rain.

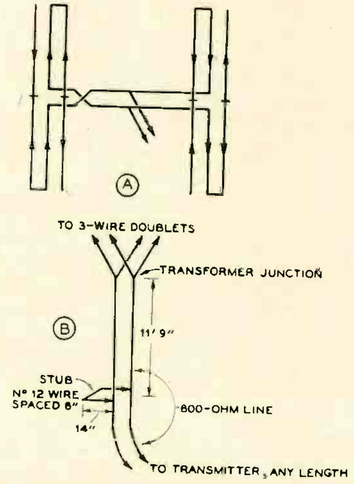

Figure 5. Current distribution on the two 3-wire doublets when used on the second harmonic (A). Dimensions and location of matching stub for 28 Mc. or second harmonic operation (B).

the ends of the insulator. Four 6-inch feeder spreaders are sufficient for separating the wires of each 17-foot quarter-wave transformer. Number 12 wire is used throughout, both in the doublets and quarter-wave transformers. Coating the wooden spreaders used in the antenna with spar varnish is desirable.

Performance

An antenna having the dimensions given in figure 3 was constructed and tested at W8JK. The standing wave ratio on the transmission line was measured under a wide variety of operating conditions. These transmission line measurements were made as described in RADIO for June[3]. As was discussed, the measured standing wave ratio is a significant indication of the match of the antenna to the transmission line.

The results of a test in which the standing wave ratio was measured over the 14-Mc. band is shown by the solid curve in figure 4. The antenna was operating under dry weather conditions and at a height of about 35 feet above ground. This curve indicates that the response of the antenna is quite uniform over the entire band. It is, in fact, extremely good for an antenna of the close-spaced type. The maximum standing wave ratio measured was considerably less than 2. Even with a ratio of 3 or 4, the overall efficiency of the system would be reduced very little. The transmission line used was actually of the 570-ohm type (number 10 wire spaced 6 inches). The resulting standing waves are in part due to this fact, since a somewhat superior match would be obtained with a 600-ohm line. The line was over 200 feet in length and made several right angle turns in this length.

Many beam antennas using closely-spaced elements are seriously detuned by the presence of water on the antenna as during a rain. Accordingly, to test the effect of such a condition on the twin-3 flat-top beam, the antenna was lowered and the entire system given a thorough soaking by means of a garden hose. Following this, the antenna was pulled back to its original height and the standing wave ratio over the 14 Mc. band measured again. The results of this run are shown by the dashed curve of figure 4. This curve is almost identical with the curve obtained under dry conditions, and shows that the antenna is very little affected by such a change in conditions.

It is interesting to note that the "wet" curve of figure 4 is nearly an exact displacement of the "dry" curve toward lower frequencies. This indicates that the effect of the water on the antenna is very similar to that obtained by a slight lengthening of the elements.

The small change in performance under the "dry" and "wet" conditions is of particular significance in the case of the antenna tested, since the construction used was not of an especially low-loss type. The insulators employed were of an inexpensive receiving type, about 4 inches long. Also the wooden spreaders used were in a badly weathered condition following long exposure to the elements.

The change in transmitter loading at the various frequencies and under the "dry" and

[*Continued on Page 81*]

CLASS C GRID EXCITATION

By FRANK C. JONES,* W6AJF

An article giving the derivation of a series of empirical formulas for the determination of the approximate excitation requirements for the operation of conventional tubes as class C amplifiers on the various amateur bands.

The problem of determining the proper amount of grid drive or grid excitation for a class C r.f. amplifier is the cause of more trouble and guesswork than any other consideration in the design of a radio transmitter. Too little grid driving power will result in low efficiency, excessive plate dissipation and low r.f. output in any amplifier or doubler whether it's in a c.w. or phone transmitter. Too much grid driving power will result in tube failures, power waste and uneconomical transmitter design. The problem of getting the right amount involves so many considerations that there are no set rules for designing and constructing grid driving circuits. In the following discussion these considerations are brought out and some simple rules suggested for arriving at suitable values of grid excitation.

The grid of a class C amplifier is driven strongly enough so that its instantaneous plate current flows in short pulses of less than 180° or one-half cycle. The shorter the impulses of plate current flow, the more time the plate of the tube has to cool off between pulses. In some cases the tube is operated with as little as 60° plate current flow out of the 360° time of a complete r.f. cycle. This type of operation requires large amounts of grid excitation and high grid bias voltages so is not very economical or conducive to long tube life. Most r.f. amplifiers used by radio amateurs are driven to a point where plate current flows from 120° to 150° of the 360° cycle, with efficiencies of from nearly 80% to about 65%. Operation in this way does not involve large amounts of grid drive and the power gain through the class C r.f. amplifier may be from 10 to 20.

The d.c. grid bias for class C may be anywhere from slightly above to six or more times the cutoff value. Cutoff bias is the value generally considered as the d.c. plate supply voltage divided by the μ or amplification constant of the tube. Normally the d.c. grid bias is run at about 2 to 3 times cutoff. For plate modulation where the plate supply varies from zero to twice the d.c. value, at least twice cutoff bias must be applied to the grid to insure class C operation. The latter is necessary for distortionless operation. Low-μ or medium-μ tubes normally run at 2¼ to 2½ times cutoff bias for plate modulation and from 1½ to 3 times cutoff for c.w. transmission. High-μ tubes in plate modulation need from 2½ to 5 times cutoff bias for linearity or distortionless output.

*Associate Editor, RADIO.

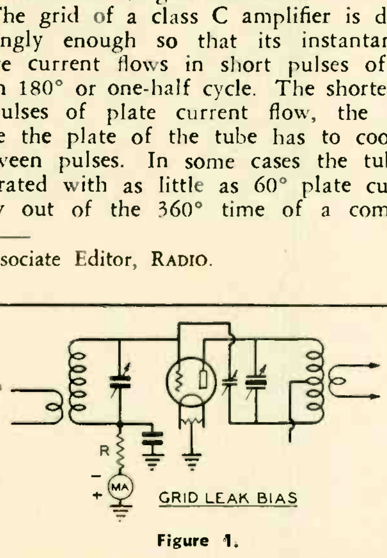

Figure 1.

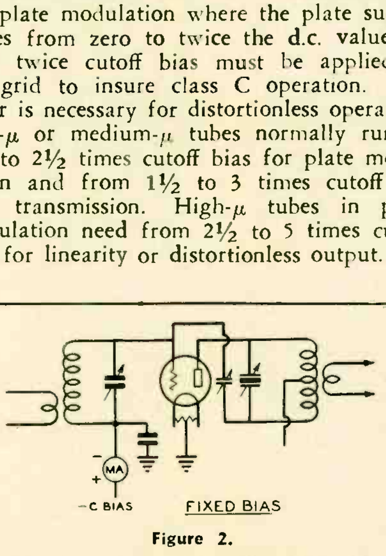

Figure 2.

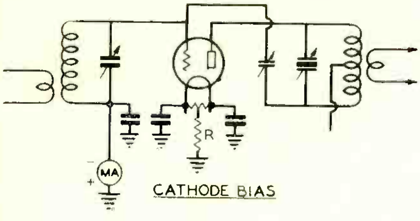

Figure 3.

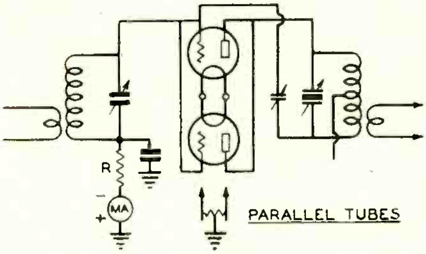

Figure 4.

Tube manufacturers always provide data on the d.c. grid current for normal operation of each of their transmitting tubes and in general this value should be used in practical operation of any class C amplifier.

Bias Supply Power Loss

The grid bias voltage may be obtained in any of the three methods shown in figures 1, 2, and 3 or by combinations of these methods. In figure 1, the d.c. grid bias is obtained from the rectified grid driving voltage developed across the grid to filament or cathode of the tube. The grid of the tube acts as a rectifier on the positive peaks of r.f. voltage and the rectified current flowing around through the grid leak results in an effective d.c. voltage drop across the resistor. The applied r.f. voltage is always greater than the d.c. grid bias in order to drive grid current through the tube. A d.c. milliammeter in series with the grid circuit will indicate a steady value of direct current. In figure 2 the grid bias is obtained from a fixed source such as C batteries or C bias power supply, while in figure 3, the bias is obtained from the cathode resistor through which flow the combined d.c. grid and plate currents. In any case the bias supply power loss is equal to $I_{go} \times E_c$, where I_{go} is the current read on a d.c. meter and E_c is the total d.c. negative bias voltage. In the case of figure 1, this can also be expressed as $P_{go} = I^2_{go} \times R$ where P_{go} is the power lost in the bias supply or resistor.

Total Grid Driving Power

The actual grid driving power is in an alternating form at a radio frequency expressed as $P_g = \frac{E_g I_g}{2}$, where P_g is the total power supplied to the grid, E_g is the amplitude of the r.f. voltage and I_g is the maximum amplitude of r.f. grid current. The r.f. grid current flows during even a shorter part of the cycle than the plate current so the term $\cos\theta$ in the formula

$$I_g = \frac{1}{\pi}\int_{-\pi}^{+\pi} i_g \cos\theta \, d\theta$$

approaches unity and a good approximation is

$$I_g = \frac{1}{\pi}\int_{-\pi}^{+\pi} i_g \, d\theta.$$

Since

$$I_{go} = \frac{1}{2\pi}\int_{-\pi}^{+\pi} i_g \, d\theta,^*$$

then $I_g = 2I_{go}$ and $P_g = E_g I_{go}$, and E_g can be measured with a peak v.t. voltmeter and I_{go} read on a d.c. milliammeter. The peak value E_g is usually from 1½ to 3 times the d.c. grid bias voltage. This allows the amateur to figure quite easily the required grid driving power at relatively low radio frequencies such as those in the 80- and 160-meter bands. Simply divide the available d.c. plate supply voltage by the μ of the tube for cutoff bias, multiply by five times the manufacturer's d.c. grid current normal value to obtain the grid driving power in watts.

For 80 and 160 meters $P_g = \frac{5E_b I_{go}}{\mu}$

where E_b = plate supply voltage
I_{go} = d.c. grid current
μ = amplification factor of tube
P_g = watts grid driving power

The factor "5" is obtained by multiplying twice cutoff grid bias by about 2½ since the r.f. peak voltage is about 2½ times the d.c.

*Everitt, "Communication Engineering."

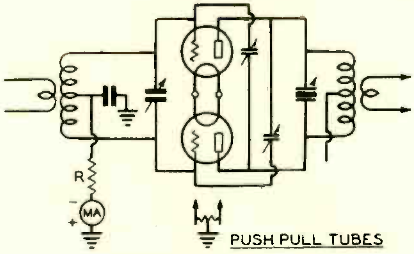

Figure 5.

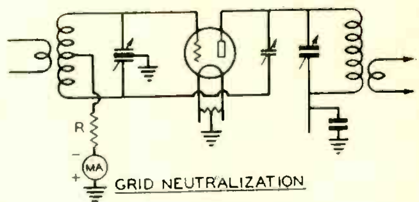

Figure 6.

grid bias voltage. These values are average and can be varied but serve as a basis for 80- and 160-meter amplifier design.

A typical problem would be to determine the excitation for an HK254 at 2000 volts plate supply. This tube has a μ of 25 and a normal grid current rating of 40 ma. or .04 ampere. $P_g = \dfrac{5 \times 2000 \times .04}{25} = 16$ watts which agrees with the value listed by the manufacturer.

This approximate formula is suitable for tubes having amplification constants of from 8 to about 25. "Zero bias" variable μ class B tubes or very high-μ tubes require more than twice cutoff bias so these results must be multiplied by 2 or 3 in most cases.

The above formula can be used for the 80- and 160-meter bands for c.w. (or phone if the tube μ isn't over 25). At higher frequencies additional circuit losses become of increasing importance. There are radiation losses from the grid tuning condenser, coil, and r.f. leads, circulating current losses in the coil, and dielectric losses in the grid lead into the tube. Degeneration from the plate circuit may also require an increase of 50% or so in grid driving power. From numerous transmitter experiments and designs certain approximations can be assumed with a reasonable degree of accuracy. For 40-meter band class C amplifiers a good approximation is

$$P_g = \frac{6E_bI_{go}}{\mu}$$

where P_g = watts grid driving power
E_b = d.c. plate supply
I_{go} = d.c. grid current
μ = μ of tube

For 20 meters use $P_g = \dfrac{7.5\ E_bI_{go}}{\mu}$.

For 10 meters use $P_g = \dfrac{10\ E_bI_{go}}{\mu}$.

For 5-meter amplifiers of good design a value of $P_g = \dfrac{15\ E_bI_{go}}{\mu}$ will give satisfactory results.

All amateurs are familiar with the experience of finding that an amplifier requires a great deal more r.f. driving power to obtain a certain value of grid current on 10 meters than the amplifier requires on 80 or 40 meters. A factor of 2 to 1 has been used in these formulas over this range of frequencies since the radiation, dielectric and heat losses are much greater at 10 than at 80 meters. In the case of some transmitting tubes not designed to work at high frequencies the losses are several times as high and the formulas cannot be used above 7 or 14 megacycles.

Some tube manufacturers list the recommended d.c. grid bias voltage and current. The product of these gives the bias supply loss and a simple way of figuring the total grid driving power is to multiply this value by 2½ at 80 meters and by 5 for 10-meter operation. It should be remembered that all these results list an average value of grid driving power for c.w. amplifiers with pretty close to minimum requirements for plate-modulated phone operation.

Another thing to remember is that a doubler or buffer on 10 meters will not deliver as much r.f. as on 80 meters with nearly all conventional tubes and circuit arrangements. The actual output available for use in driving the next grid circuit may be from 10% to 40% less than on the lower frequencies.

Paralleled and Push-Pull Tubes

The circuits shown in figures 4, 5 and 6 sometimes cause the amateur a little head-scratching to decide on grid driving require-

[Continued on Page 79]

Figure 1. This amplifier can be driven by most any 20-25 watt exciter and delivers 250 watts on phone or 350 watts on c.w. It uses push-pull 812's.

Applying the 811 *and* 812

RCA has brought out two new transmitting tubes in the low price range, the RCA-811 and the RCA-812. Both tubes have a 6.3 volt filament and are similar except for amplification factor, the 811 having a very high amplification factor for zero bias class-B audio applications and the 812 having a medium high amplification factor for optimum performance in r.f. applications. Both tubes may be used either for r.f. or for audio applications with very good efficiency, but the characteristics of the 811 make it more ideally suited for use as a class B modulator and the characteristics of the 812 make it a slightly better class C r.f. amplifier.

For this reason only the class B audio ratings are given here for the 811, and only the class C r.f. ratings for the 812 are listed. Dual ratings are given in conformance with the new RCA policy of rating certain transmitting tubes as explained elsewhere in this issue.

Putting Them to Work

A highly economical and efficient 250-watt phone transmitter can be realized by using a pair of 811's to modulate a pair of 812's. Such an amplifier and modulator are shown in the accompanying illustrations. Because the plate current to the modulators will vary only about 100 ma. maximum with voice modulation, it is possible to use a single 1250-volt power supply to feed both modulator and modulated amplifier.

The Class C Amplifier

The push-pull class C amplifier is strictly conventional. The rotor of the plate tank condenser is allowed to float in order to

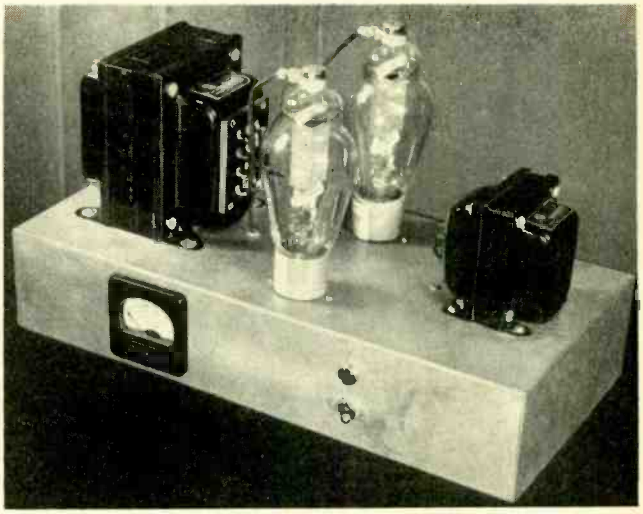

Figure 2.

Class B 811's are used in this modulator. At 1250 volts the output is more than sufficient to modulate the 812 amplifier of figure 1.

minimize flashover during keying or modulation and thus permit use of comparatively small plate spacing. This requires that the tank circuit be symmetrical mechanically in order to preserve circuit balance.

For phone work the amplifier is run at 1250 volts and 250 ma., the ICAS rating for the 812. The output will be close to 250 watts.

For c.w. work the plate input may be increased to 1500 volts (ICAS rating) at 300 ma. The output under these conditions will be approximately 350 watts.

Excitation for either service may be supplied by any exciter that delivers at least 20 watts output on all desired bands of operation. Even though the perveance of the tubes is quite high and the excitation requirements are moderate, it is desirable to have slightly greater excitation power if possible, and for this reason an exciter delivering about 25 watts is to be preferred.

Commercial plug in coils are used in both grid and plate circuits. The grid condenser will hit all bands except 160 meters. Rather than use a larger grid tuning condenser, two 50 $\mu\mu$fd. 1000 volt test mica condensers are connected in series across the 160-meter grid coil.

The plate tank condenser hits 10, 20, and 40 meters with the coils specified. If 80 and 160 meter operation is contemplated, a mounting base for a 50 $\mu\mu$fd. fixed air padding condenser of the plug-in type should be incorporated in the amplifier. With the extra 50 $\mu\mu$fd. connected from plate to plate, the plate tuning condenser will hit 80 meters with the plates pretty well out and the 160 meter coil will resonate with the plates nearly meshed.

As the particular amplifier illustrated in figure 1 was to be used only for 10 and 20 meter operation, no mounting base for a plug in auxiliary tank condenser was provided. If such a condenser is used, it should have an air gap of at least 0.144 in.

It will be noticed that 45 volts fixed C bias is specified. This safety bias protects the tubes in the event of excitation failure and at the same time permits keying of the oscillator or one of the buffer stages for c.w. work. This bias may come from a heavy duty B battery.

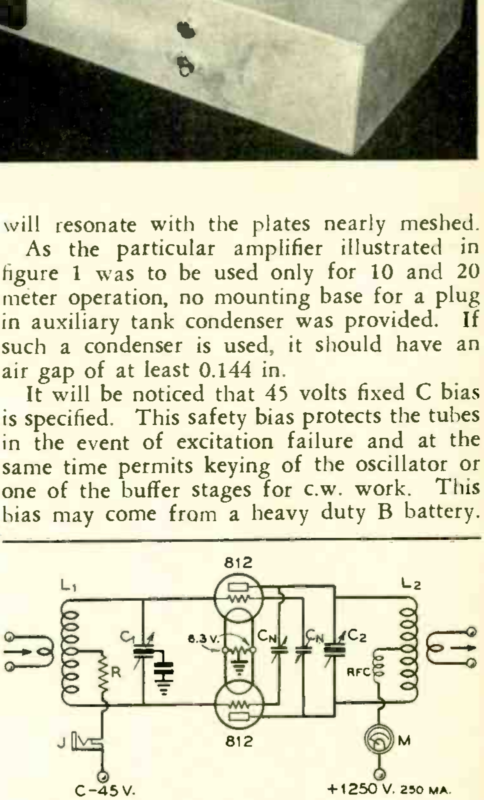

Figure 3.

Wiring diagram of the 812 push-pull amplifier. For c.w. work the plate voltage may be raised to 1500 volts.

C_1—140 μμfd. per section, 500 volt spacing
C_2—100 μμfd. per section, 3000 volt spacing
C_N—4-6 μμfd. adjustable, 6000 v. spacing
L_1—Commercial 5 0 watt coils, center link
L_2—Commercial 500 watt coils, center link
R—2000 ohms, 20 watts
M—0-350 ma. d.c.

811 TENTATIVE CHARACTERISTICS and RATINGS

Filament Voltage (A.C. or D.C.)	6.3	Volts
Filament Current	4	Amperes
Amplification Factor	160	
Direct Interelectrode Capacitances:		
Grid-Plate	5.5	μμfd.
Grid-Filament	5.5	μμfd.
Plate-Filament	0.6	μμfd.
Bulb	ST-19	
Cap	Medium Metal	
Base	Medium 4-Pin "Micanol," Bayonet	

MAXIMUM CCS and ICAS RATINGS with TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service
ICAS = Intermittent Commercial and Amateur Service

As A.F. Power Amplifier and Modulator—Class B

	(CCS)	(ICAS)	
D.C. Plate Voltage	1250 max.	1500 max.	Volts
Max.-Signal D.C. Plate Current	125 max.	125 max.	Milliamperes
Max.-Signal Plate Input	125 max.	150 max.	Watts
Plate Dissipation	40 max.	50 max.	Watts
Typical Operation:			
Unless otherwise specified, values are for 2 tubes			
D.C. Plate Voltage	1250	1500	Volts
D.C. Grid Voltage	0	—9	Volts
Peak A.F. Grid-to-Grid Voltage	140	160	Volts
Max.-Signal D.C. Grid Current	38	38	Milliamperes
Zero-Sig. D.C. Plate Current	48	20	Milliamperes
Max.-Sig. D.C. Plate Current	200	200	Milliamperes
Load Resistance (Per Tube)	3750	4500	Ohms
Effective Load Resistance (Plate-to-Plate)	15000	18000	Ohms
Max.-Sig. Driving Power (Approx.)	3.8	4.2	Watts
Max.-Sig. Power Output (Approx.)	175	225	Watts

812 TENTATIVE CHARACTERISTICS and RATINGS

Filament Voltage (A.C. or D.C.)	6.3	Volts
Filament Current	4	Amperes
Amplification Factor	29	
Direct Interelectrode Capacitances:		
Grid-Plate	5.3	μμfd.
Grid-Filament	5.3	μμfd.
Plate-Filament	0.8	μμfd.
Bulb	ST-19	
Cap	Medium Metal	
Base	Medium 4-Pin "Micanol," Bayonet	

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

As Plate-Modulated R.F. Power Amplifier—Class C Telephony
Carrier conditions per tube for use with a max. modulation factor of 1.0

	(CCS)	(ICAS)	
D.C. Plate Voltage	1000 max.	1250 max.	Volts
D.C. Grid Voltage	—200 max.	—200 max.	Volts
D.C. Plate Current	105 max.	125 max.	Milliamperes
D.C. Grid Current	25 max.	25 max.	Milliamperes
Plate Input	105 max.	155 max.	Watts
Plate Dissipation	27 max.	40 max.	Watts
Typical Operation:			
D.C. Plate Voltage	1000	1250	Volts
D.C. Grid Voltage:	—100	—125	Volts
From a grid resistor of	4000	5000	Ohms
Peak R.F. Grid Voltage	180	245	Volts
D.C. Plate Current	105	125	Milliamperes
D.C. Grid Current (Approx.)	25	25	Milliamperes
Driving Power (Approx.)	4.5	6	Watts
Power Output (Approx.)	82	120	Watts

As R.F. Power Amplifier and Oscillator—Class C Telegraphy
Key-down conditions per tube without modulation

	(CCS)	(ICAS)	
D.C. Plate Voltage	1250 max.	1500 max.	Volts
D.C. Grid Voltage	—200 max.	—200 max.	Volts
D.C. Plate Current	125 max.	150 max.	Milliamperes
D.C. Grid Current	35 max.	35 max.	Milliamperes
Plate Input	155 max.	225 max.	Watts
Plate Dissipation	40 max.	55 max.	Watts
Typical Operation:			
D.C. Plate Voltage	1250	1500	Volts
D.C. Grid Voltage:			
From a fixed supply of	—125	—175	Volts
From a grid resistor of	5000	7000	Ohms
From a cathode resistor of	835	1000	Ohms
Peak R.F. Grid Voltage	215	285	Volts
D.C. Plate Current	125	150	Milliamperes
D.C. Grid Current (Approx.)	25	25	Milliamperes
Driving Power (Approx.)	5	6.5	Watts
Power Output (Approx.)	116	170	Watts

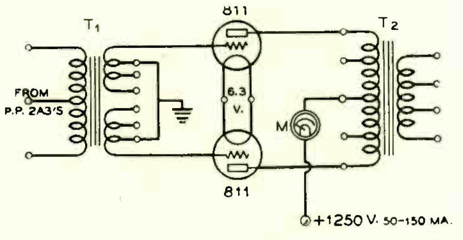

Figure 4.

Wiring diagram of 150 watt modulator for 812 class C amplifier.

T1—Variable ratio class B input transformer adjusted to 5-1 step down ratio (pri. to ½ sec.), 15 watts

T2—125-175 watt variable ratio class B modulation transformer

M—0-250 ma. d.c.

A light duty battery will not be satisfactory because of the magnitude of grid current forced through it in a reverse direction.

If a power pack is used for "fixed" protective bias, this bias will increase when excitation is applied to the stage, and the value of R should be reduced accordingly in order to maintain approximately the same amount of total bias voltage on the tubes when normal grid current is flowing. If R is eliminated and all bias is obtained from a bias pack, a 125 ma. r.f. choke of such an inductance that it will not resonate with the plate r.f. choke should be placed where the resistor R is shown in the diagram. Because the magnitude of r.f. voltage is very low, the resistor effectively serves as an r.f. choke and therefore no regular choke is required with the resistor in the circuit.

Grid current is measured by means of a 0-100 ma. meter plugged in at J, the meter also being used to measure exciter plate current. The grid current should run between 50 and 60 ma. for phone and between 60 and 70 ma. for c.w. if maximum rated plate input is to be applied to the amplifier.

The Modulator

More than sufficient audio power may be obtained from a pair of 811's in class B at their CCS rating of 1250 volts to voice modulate an input of 313 watts (maximum rated input to the modulated 812's). Running the modulators at this plate voltage permits use of a common power supply and allows zero bias operation.

As the modulator is conventional in every respect, the diagram and pictorial illustration should be self explanatory. While a pair of 45's will drive the 811's satisfactorily in this application, either four 45's (push pull parallel) or a pair of 2A3's would be preferable. A pair of 6V6's or 6L6's with a substantial amount of inverse feedback also make a suitable driver.

Best results with most multiple-ratio driver transformers will be obtained with the transformer connected for maximum step down. A ratio of approximately 2.1:1 step down (primary to one-half secondary) will be found satisfactory.

Power Supply

To minimize voltage drop with swinging modulator plate current, a single choke and condenser are used for the modulator. Because of the push pull connection of the modulator tubes, nearly all of the ripple cancels out in the modulation transformer, and this amount of filtering is sufficient.

The modulated amplifier, however, requires more filter, and therefore another section is added. This additional section also serves as a decoupling filter, preventing motorboating and excessive harmonic distortion.

The resting current on the modulators will be about 50 ma., and the current should never be allowed to kick up to more than 150 ma. on peaks or there will be bad overmodulation of the carrier. Because of the high potential power output of the class B 811's, it is very easy to overmodulate an input of 310 watts.

See Buyer's Guide, page 98, for parts list.

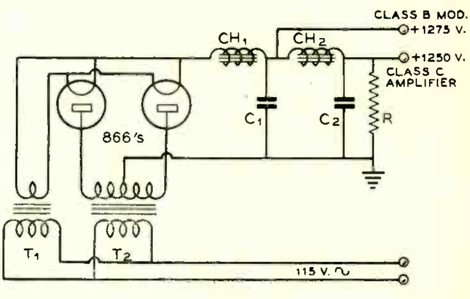

Figure 5.

Power supply to feed both 812 class C amplifier and 812 modulator. For c.w. work the second section of filter (CH2, C2) may be omitted.

T1—2.5 v. 10 amp., 10,000 v. insulation

T2—1450 v. each side c.t. at 400 ma.

CH1 — 5-20 hy. swinging choke, 400 ma.

CH2—15 hy. smoothing choke, 250 ma.

C1—4 μfd., 1500 v. working voltage

C2—2 μfd. 1500 v. working voltage

R—75,000 ohms, 200

R. F. STAGES *at Ultra-High Frequencies*

By E. H. CONKLIN,* W9BNX

First, let us give a word of warning to those of our readers who object to articles not describing a specific piece of apparatus. Rather, this discussion is concerned with the practical experiences of widely-separated experimenters. The title does not mention receiving or transmitting, the problems often being common.

Electron Transit Time

In treating vacuum-tube operation at ultra-high frequencies, one must mention electron transit time soonor or later, because it appears to be one of the most important factors reducing gain as the frequency increases. So let's consider it first.

Vacuum tubes have the unique property of amplifying small voltages at low frequencies without absorbing power from the input circuit. Electrons leaving the cathode pass the grid so soon after starting out that their time in making the passage is usually negligible in respect to the length of a cycle. When higher frequencies are considered, however, there comes a point where an electron, leaving the cathode when the grid is at one point in the cycle, arrives when the phase of the grid voltage has changed. This state of affairs is such that the grid acts as though there were a leak from it to the cathode, and power from the input circuit is necessary. Even when the grid is biased beyond the point where grid current flows, this conductance or input admittance appears and damps the input circuit as if a resistor had been placed across it. A type 57 or comparable standard tube, when hot, acts like 75,000 ohms across the input circuit at 15 Mc., 20,000 at 30 Mc., and 5000 at 60 Mc. The loading effect increases approximately with the square of the frequency. An RCA 954, using much closer spacing, has an input resistance of about 55,000 ohms at 60 Mc., and 15,000 at 112 Mc. Large triodes as used in transmitting may have an input resistance of only 3000 ohms at 15 Mc.[1]

Inasmuch as a tube cannot amplify at all when the internal input loss is equal to the power output, one cannot expect any gain from ordinary receiving tubes at frequencies around 100 megacycles since the grid input conductance is then equal to the transconductance. The higher transconductance of the 1852 type is obtained at the expense of a smaller increase in input admittance. The result is some gain even though the 13.5-$\mu\mu$fd. input capacity makes for an unsatisfactory *L/C* ratio in the input circuit and a substantial impedance generally cannot be built up. The small loading of the grid circuit with the RCA 954 acorn, due to the low input conductance and capacitance, is attractive for applications above 14 Mc. These tubes should come into more general use as there becomes a greater realization that they have about normal tube life.

Repeatedly we see comments to the effect that a 6K8 and 6J8G are superior to the RCA 954 as a mixer, and that the 1852 gives more gain as an r.f. amplifier. The same articles usually mention oscillation difficulties with the standard tubes, indicating that regeneration is present, thus explaining the reported results. One should not be led away from acorn tubes on this score. Also, some such comparisons may have been made without increasing the coil size in order to take advantage of the low input capacitance of the acorns.

The Cathode Circuit

Almost every circuit in use today involves returning the grid and plate r. f. circuits to the cathode or filament via a common lead which in many cases contains a bias resistor and by-pass condenser. This lead has reactance which is common to both grid and

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[1] W. R. Ferris, "Input Resistance of Vacuum Tubes as U.H.F. Amplifiers," *Proc. I.R.E.*, January 1936.

plate circuits. The by-pass condenser, particularly on the higher frequency bands, has not only capacity but inductive reactance as well, contributing to the common coupling. Very likely, a good deal of the trouble with 807 and 6L6 tubes in r.f. applications arises from this coupling which is sufficient in high-gain tubes to permit undesired oscillation.

Not only does the same thing happen in receivers, but here a new trouble has made itself evident—loss of stage gain. That is not to say that the same thing does not happen in transmitters. RCA engineers made measurements of the effect of electron transit time within tubes and found that the common cathode lead greatly increases the measured time. The 1852 should have electron transit time loading of 3 to 12 micromhos at 40 Mc. whereas the observed value is 230 micromhos. A test, in which a short wire 2 centimeters long was made part of the cathode lead common to grid and plate returns, showed that the input loading was increased to 330 micromhos. The common cathode lead within the tube is about this same length. In another test, a special 1853 was provided with two cathode leads, one for the grid circuit and one for plate and screen. This dropped the loading considerably.[2] The effect of a common cathode lead increases with the square of the frequency. Thus it is seen that at 30 Mc. and possibly at considerably lower frequencies, the cathode return connection should be made as close to the cathode pin as possible and, if a bias resistor is used at all, the inductive path through the by-pass condenser should be a small fraction of an inch. The common cathode lead (chassis usually) in transmitters may be a foot long!

Sometimes, regeneration obscures the effects of loss of gain, but in a receiver's first stage it is important to get the non-regenerative gain up in order to obtain a good signal-to-set-noise ratio. In the case of one r.f. amplifier using an 1852 tube, the grid and plate had to be tapped down on the 10- and 5-meter coils, and the screen voltage reduced below normal, to prevent oscillation. The cathode bias resistor was removed and the r.f. returns were brought right to the cathode socket terminal. A *C* battery was temporarily used for bias, by-passed in the usual way, pending the arrival of bias cells. It was immediately apparent that the screen voltage could be raised to normal without oscillation, boosting the stage gain materially without bringing up the set noise in the same ratio.

[2] A. P. Kauzmann, "New Television Amplifier Receiving Tubes," *R.C.A. Review*, January, 1939.

The tuning condenser in this preselector was insulated from the chassis in order to permit bringing grounds to a common point near the cathode terminal. In the event that the condenser is grounded, bias might be supplied through an insulated wire pulled through small copper tubing used as the coil material, keeping d.c. off the coil without the necessity for the chokes ordinarily used with parallel feed. It is illustrated in figure 1. This feed system, incidentally, can well be used on transmitter tanks to keep d.c. off and thus to reduce the possibility of electrocution. The system in practice is identical to that used with concentric lines as tuned circuits or interstage couplers.[3]

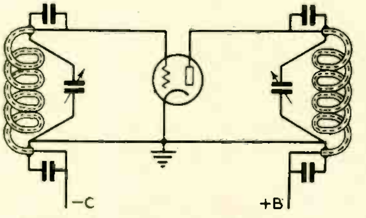

Figure 1. Bias and plate voltage leads can be insulated and pulled through hollow inductances to isolate d.c. from coils and condensers.

• • •

The effects of other leads than the common cathode return circuit have been shown to be important in the observed transit time effect,[4] indicating that gain at high frequencies will be improved by shortening leads between tube elements, via the tuning capacitors.

Increasing Transconductance

With tubes of the 1852 type, the transconductance can be increased 25 per cent (from 9000 to 11,250) by using the no. 3 grid as an accelerator instead of as a suppressor, as is done with the 802. It can be made 50 volts more positive than the normal value for the no. 2 (screen) grid. This causes negative screen current and increases the plate current from 10 ma.[2] to 12.5.

Converters

When the 1851 or 1852 is used as a mixer tube (which may require using an i.f. of

[3] Reber and Conklin, "Improving U.H.F. Receivers," RADIO, January, 1938 and 1939.

[4] M. J. O. Strutt and A. van der Ziel, "The Cause for the Increase of the Admittance of Modern High-Frequency Amplifier Tubes on Short Waves," *Proc. I.R.E.*, August, 1938.

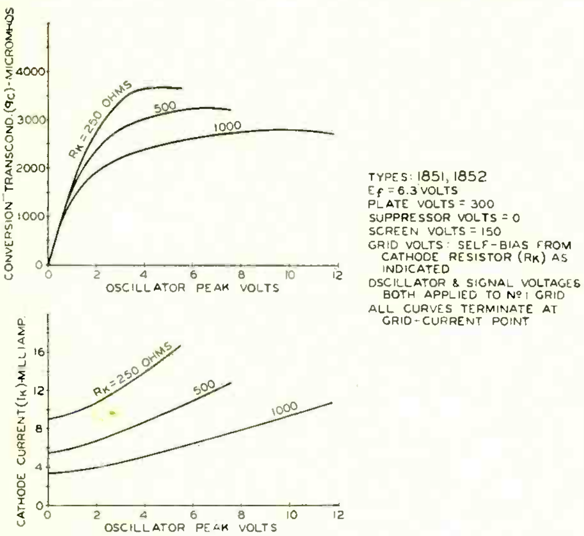

Figure 2. Conversion characteristics of 1851 or 1852 when operated with control-grid injection. (Courtesy RCA Review)

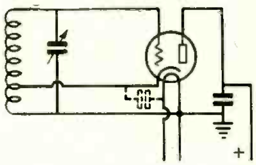

Figure 3. Dotted condenser indicating cathode-heater capacity which can cause 60-cycle modulation of an oscillator of this type.

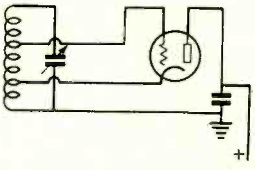

Figure 4. Tapping the tube elements across only a portion of the coil reduces to a great extent the disturbing effect of the tube upon the tuned circuit.

1600 kc. or higher), the oscillator is usually coupled to the control grid, although excellent results also are obtained with injection into the suppressor. Cathode coupling at high frequencies is not recommended because as discussed earlier, any increase in the cathode lead produces a serious increase in input loading. Figure 2 shows the converter characteristics for various values of cathode resistance, by-passed by a suitable condenser. Uniform conversion gain for various oscillator voltages can be obtained with a 1000-ohm cathode resistor but a higher gain is obtainable with 250 ohms, and 3½ volts from the oscillator. The approximate oscillator output can be determined by the cathode current which, in case of a low value of cathode resistor, can be too high.

Oscillators

Cathode-above-ground oscillators often have hum or frequency modulation on the output if the tube is working at a high frequency, such as in a u.h.f. superheterodyne, or if a high harmonic of a lower frequency oscillator is examined, such as an electron-coupled oscillator in a transmitter. Often this hum can be reduced by putting a resistance-capacity filter in the supply lead to the oscillator tube, but sometimes the modulation persists. This may be the result of the fact that the cathode-heater capacity is across part of the tank inductance, as shown in figure 3, which is modulated by the a.c. on the heater. The effect can be reduced by tapping the cathode down on the coil or hooking a small condenser from cathode to ground, but it is suggested that the heater be fed through small r.f. chokes or through unity coupling in the oscillator coil so that it may remain at the same r.f. potential as the cathode.

The effect of the tube upon the oscillator frequency, resulting from capacity or voltage changes, can be reduced substantially by tapping the tube across only a part—say a quarter—of the coil as shown in figure 4. This may increase the plate current of the tube, but such oscillators are generally capable of dissipating a little more heat. This idea may have application in oscillators for transmitter control, superheterodyne receivers and frequency meters. Additional steps to compensate for coil changes with temperature will bring about quite good stability. Other approaches to the problem involve bridge stabilization, addition of reactance, adjusting element voltages, and use of dynatron characteristics between the grids of standard pentode tubes.

G. E. engineers have developed a 100-kilowatt high frequency tube with a *replaceable filament*. Too bad they can't build 100 watters that way.

"IRON" ANTENNA WIRE

For Copper-Filled Pocketbooks

By W. W. SMITH,* W6BCX

Galvanized iron wire for antennas? Why iron wire is what they use for making rheostats! Think of the terrible loss!

Before attempting further to promote the use of galvanized wire for certain antenna applications, perhaps we had best point out that radio frequency currents, especially those of high frequency, travel on the outer portions of a conductor. Now galvanized iron wire has a nice heavy coating of zinc, and zinc is a pretty good conductor as conductors go, appreciably better than brass or nickel. Thus, so far as the r.f. is concerned, we might as well be using solid zinc wire, which may not be as efficient as copper but is still pretty good.

Galvanized iron wire has several advantages over copper wire. It is much cheaper, is considerably lighter, and is less inclined to stretch or break. It is possible to get extra-hard-drawn copper wire on special order which will withstand great tension without breaking or stretching, but this wire is so brittle that it cannot even be fastened to an insulator without breaking. Copper clad steel wire (or steel core copper wire) is not subject to stretching and will stand considerable strain, but it is comparatively expensive and has a tendency to act like a coiled spring when not kept under tension, thus making it difficult to work with.

Certainly nobody is going to complain about buying enough copper clad steel wire for a 40-meter flat top. But what about the yearly wire consumption of the antenna addict who is forever putting up and taking down various multi-element arrays and feed lines? It takes several dollars worth of steel core copper wire for a Kraus multi-wire 160-meter doublet.

Wire Loss

What determines the wire loss in an antenna system, anyway? It is not the wire resistance, but the *ratio of the wire resistance to the radiation resistance.* Thus, if it is all right to use a certain size copper wire for an antenna with comparatively low radiation resistance, it is possible to use wire having three times the resistance for an antenna having a radiation resistance three times as high, *without any more wire loss.*

The radiation resistance of antennas using a lot of wire is usually medium or high. This is fortunate, because it is with an antenna using lots of wire that a considerable saving can be effected by substituting galvanized iron wire for copper clad steel wire. Antennas having very low radiation resistance, low enough that it would be best to use copper wire, usually are small physically. In such an installation little saving would result from the substitution of galvanized wire.

There is another item that enters here: while the resistance of zinc is approximately three times that of copper, and the wire losses will be three times as great for a given radiation resistance, the wire loss is so low in most antennas that it still will be less than one per cent of the antenna power. What if the wire loss does go up three times, so long as it is a small fraction of one per cent in the first place?

Whether galvanized iron wire lasts as well as copper clad steel wire depends upon the climate and the nature and amount of foreign matter in the air. In most every case galvanized wire will last several years, which is considerably longer than the life of the average amateur antenna installation. Galvanized wire, being a ferrous wire, is not measured by the common B & S wire gauge used for identifying copper and other nonferrous wire. Thus, "number 12" galvanized wire is approximately the same size as "number 10" copper wire, and "number 14" galvanized wire is approximately the same size as "number 12" copper wire. Because galvanized wire is so much cheaper, and because it is lighter than solid copper wire, one can just as well use a larger diameter galvanized wire. Thus, if you are worried about the resistance of the galvanized wire in spite of everything we have said, then use number 12 galvanized (same size as number 10 copper) and the r.f. resistance will be approximately the same as for number 14 copper wire.

[*Continued on Page 81*]

* Editor, RADIO.

COMPACT COIL SWITCHING

for the Final Amplifier

By JOHN W. MORAN,* W8IOB

A description of an ingenious method for switching bands both on the grid and plate circuits of a medium-powered final amplifier.

After building a bandswitching exciter unit, the next logical step was to incorporate bandswitching into the final amplifier. The amplifier had to cover 80, 40, 20, and 10 meters, and it was decided that the coilswitching arrangement must have the following merits: 1, it must be rugged mechanically; 2, it must have simplicity of control; 3, it must be applicable to medium power. All of these features must be combined into a unit that would be less complicated to operate than a standard plug-in coil amplifier. The problem of coil switching was approached from a new angle, and this article describes the unique and wholly satisfactory system finally evolved.

The operation of this amplifier is simplicity itself, since all of the switching is done with the dial that tunes the plate condenser. Instead of using band switches with separate control knobs on the panel, the plate and grid condensers themselves are used as switches. As can be seen by referring to the illustrations, both condensers are set in cradles so that the frame, which carries the stator section, can rotate freely around the rotor shaft. The plate condenser must be provided with a stop so that the rotor section can only travel over 180 degrees. Then when the condenser is turned to either 100 or 0 on the dial, the rotor hits this stop, and a little more twist on the plate tuning dial will start to move the condenser frame itself. This stop had to be built into the condenser, as most transmitting condensers are not provided for only 180 degree rotation. It is simply a flat piece of brass drilled to fit over the rotor rod, and held in place by the rotor rod locking nut. The front condenser end plate was then drilled and tapped in such

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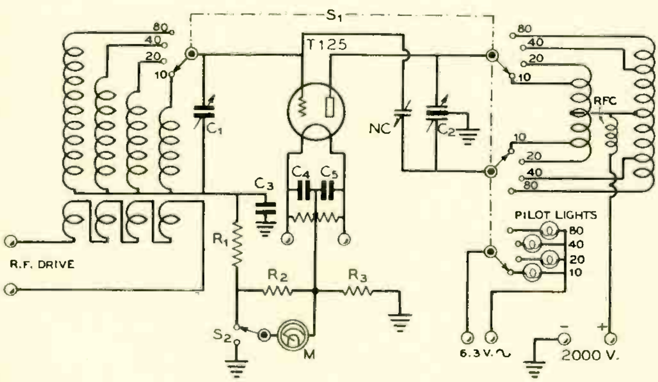


Wiring diagram of the bandswitching final amplifier.

C_1—80-µµfd. transmitting variable

C_2—100-µµfd. per section 4000-volt variable

C_3, C_4, C_5—.002-µfd. mica

NC—2-8 µµfd. neut. cond.

R_1—10,000 ohms, 10 watts

R_2, R_3—100 ohms, 2 watts

RFC—2.2-mh. 1.0-a. r.f. choke

S_1—Homemade bandswitch

S_2—S.p.d.t. meter switch

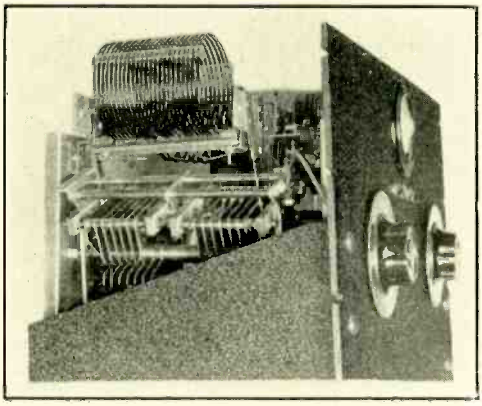


FIGURE 1.

a fashion that two 10-32 screws could be placed to act as pins for this arm to hit when either 0 or 100 was reached on the dial.

Contact arms were placed on the stator sections, so that when the frame of the condenser is turned, the stator is switched into a different coil position. The grid and plate condenser are switched simultaneously through the use of an insulated tie bar which connects both.

In order to indicate the band to which the amplifier is set, four indicating pilot lights were placed on the panel underneath the meter. These lights are controlled by an extra set of switch points, which can be seen on the front end of the plate condenser turret in figures 2 and 3. The contact points on these switches were made small enough so that the r.f. contacts on any band have to be in perfect mesh before the band indicator will light. These lights are the only indexing device used on the condenser since a mechanical indexing device would make the condenser too hard to switch.

In figures 2, 3, and 4, the construction of the condenser cradles is clearly shown. These cradles are built as independent units, and are mounted on the chassis after they have been completely assembled, and the coils mounted in place. The upright pieces that serve as end pieces for the turrets are made from formed aluminum channel which can be bought at most parts jobbers. Shaft extensions are put on the ends of each condenser and these extend through the panel bearings in the aluminum channels.

The mycalex strips which hold the switch contacts on the plate coil turret are fastened to the aluminum channels by means of brass strips. Two additional mycalex strips keep the contacts spaced the proper distance apart. One of these strips can be seen running through the 20-meter coil. In figure 1, the other strip can be seen underneath the 80-meter coil. Since the grid coils are switched only at the grid end, there is only one contact mounting strip on the grid coil turret. This is held in place by two ceramic insulators which fasten onto the back channel of the turret.

In figure 1, the front set of switch points on the plate coil turret is readily discernible. This set switches the plate lead. The manner in which the stator switch arm is built into the condenser can also be discerned from this illustration. This switch arm is an inverted T, which fastens onto the stator rods. The condenser end plates have to be removed to put this in place. One switch arm is put on each stator section. These arms are made of half-inch brass stock, 1/16 inch thick.

All r.f. contacts are made from spring brass, shaped much the same as a knife switch. This type of construction provides a self-wiping contact, and eliminates the possibilities of poor contact due to dirt or corrosion. The 10- and 80-meter contacts on the plate

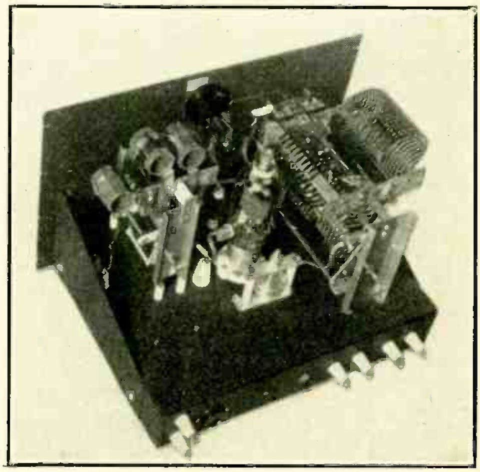
GRID COIL DATA

BAND	NO. TURNS	WINDING LENGTH	WIRE SIZE	DIAMETER
80	24	1⅛"	#20 PE	1½"
40	13	1¼"	#18 PE	1½"
20	6	1¼"	#16 PE	1½"
10	4½	1¼"	#12 PE	1"

All grid coils have three link turns.

Plate Coils described in text.

FIGURE 2.



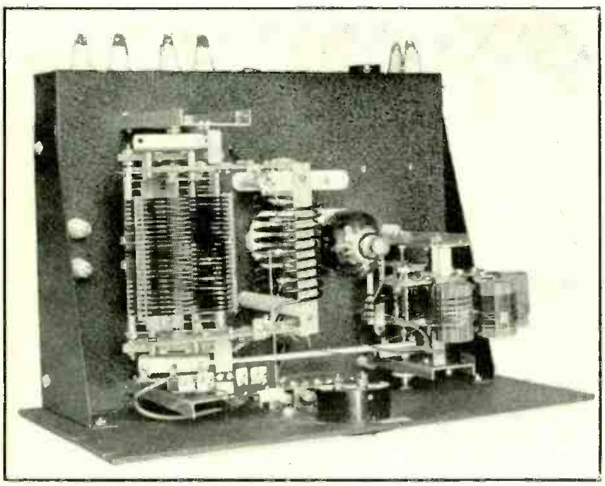


Figure 3.

Top view of the coil-switching final amplifier. Individual grid coils are used for each of the four bands. Two plate coils are used, each one being tapped for operation on adjacent bands; one operates on 80 and 40, the other on 20 and 10.

coil turret have stops to prevent the switch arms from traveling out of the path of the contacts.

Four separate grid coils are used, but due to space limitations, only two plate coils are used. The 20-meter plate coil consists of 10 turns of no. 8 wire, 2 inches in diameter, and spaced to occupy a length of 3¾ inches. This coil is self-supporting, and is tapped two turns from either end for the ten-meter position. The 80-meter coil consists of 22 turns of no. 12 wire, 3½ inches in diameter, and spaced to occupy a length of 3½ inches. This coil is supported by acetate locking strips, and is tapped six turns from each end for the 40-meter position.

The grid link coils, which are in series, can be seen in figures 2 and 3. Although not shown in any of the illustrations, the same sort of coupling is used on the plate coils. The plate links are run separately to two antenna matching units.

The grid coil switch arm is mounted on a piece of mycalex that is bolted across the top of the grid condenser. This arm is made from the same brass stock as the plate condenser switch arm, but is bent in the form of an L-shaped angle. Figure 4 illustrates the manner in which this is done. The 80-, 40-, and 20-meter grid coils are wound on 1½ inch bakelite coil forms that have had the pin base

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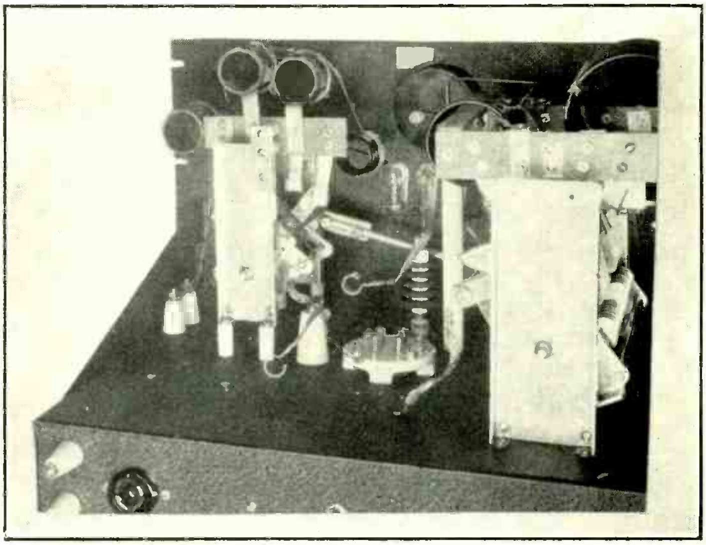
Figure 4.

Back view of the amplifier. This view shows the cradle arrangement for the tank condensers, the linkage between them, and the contact system for switching bands.



Meet Your DX IN PERSON

By JO and BILL CONKLIN*

One of the most interesting things about amateur radio is our ability to get a reasonably accurate insight into the life and thoughts of people far from our own home town. Sometimes a distant station is contacted without more than an exchange of signal reports or contest numbers, but at other times a close friendship springs up. It is even more interesting to call upon the distant amateur to see his home first-hand, to talk with him and his family. Few can get as much out of foreign travel as those of the "ham" fraternity. This year we took a spring cruise to Africa and Europe aboard the *Kungsholm*, SMJA, on just such a jaunt. If you did not get away from home, draw up your deck chair and come along with us in your imagination.

En Route to Africa

Our first introduction to the sometimes spotty nature of U. S. signals was while crossing a very calm Atlantic between New York and Madeira. We listened on an all-wave broadcast receiver provided for the passengers. It did not work as well as we had hoped, for someone had neatly covered the antenna lead-in insulators with a thick coat of white paint. Only a very few broadcast stations came through on the whole trip. At noon on Sunday, April 23, we heard no North American stations although G5TP and several others in England were calling India stations and working FN1C. That evening, the only signal was that of Bud Haskins, W4DRZ, working a new Moroccan station, CN8BD.

On the afternoon of April 25 we had better success, even getting c.w. on beat notes. The first we heard was F8VC whom we were to meet within a week; others were F8PA, F8DX, SP3HS, G3IQ, G8AN, G6ZI, PAφKB, PAOIDW, PAOMZ, G3YM, W1BHP, W8-QZM, W8QA, and W1BLO who had a good signal, sometimes being the only U. S. phone. There were a number of loud code signals at 14,400 kc. One station commented about the northern lights on the previous night, but said that the band was recovering. On the afternoon of the 26th we took time out from shipboard activities to hear G6WT (talking about a three-element beam described in RADIO), G5KA, JAW, G3QV, G3LN, G6BC and the *only* American, W8DST. All this was entirely different from conditions in Panama and other countries around the Caribbean where little could be heard except W QRM.

Jo Conklin, W9SLC, all set for an ocean trip.

* W9SLG and W9BNX (ex W9FM), Wheaton, Illinois.

Home of CT3AN, Funchal, Madeira. The door through the wall to the right opens upon the patio; the door farther down the street is the main entrance. A mast is barely visible just at the corner of the roof of the house to the right.

The Island of Madeira

At sunrise on our eighth day out, we could see the mountains of Madeira—believed by some to be part of the lost continent of Atlantis—towering out of the sea straight ahead. We felt like the Venetians who discovered the island group in Roman times, or the Portuguese who rediscovered it in 1418. We pulled into the bay to see Funchal, a city of picturesque whitewashed houses in gardens full of tropical plants, nestling against the lower slopes of the mountains which form a background some six thousand feet high.

Both CT3AB and CT3AN came aboard with the port authorities while we were being amused by boys diving for coins thrown from the ship. Together, we had an internationally flavored breakfast aboard the ship. 3AB had to work at his job with the province government from eleven until five, but 3AN had a day off from his school-teaching and could accompany us on a tour. Ashore we were met by the ever-present flower girls in red Hungarian-like costumes, carrying their baskets on their heads. There was available a goodly supply of bullock sledges called *carros* which glide over the carefully laid round stones in the narrow streets, with the driver sometimes applying a greased rag under the runners to make them slide easily on their way. However, autos were available for the trip over the mountain.

CT3AN pointed out that Madeira is a province of Portugal. Although it is 360 miles from Morocco, 240 from the Canary Islands, and is thus part of the African continent, it has an entirely "European" atmosphere. The main island is thirty-two by twelve miles, while Porto Santo, the only other inhabited one in the group, is flat and much smaller. A majority of the 180,000 people live near the capital city cultivating grapes in small plots, from which they can look down into the chimneys of their neighbors.

During the drive toward the cool and heavily wooded higher altitudes, children threw bunches of flowers in the cars saying "present" but hoping for a penny in return. With flowers so profuse, a few more did not matter. Part of the descent was made in one of the unique basket sleds which, guided by native runners, coast down along a narrow roadway three miles long.

CT3AB

At the home of CT3AB, who had finished his short working day, there was literally a small farm behind the high wall that was built along the sidewalk. Above the pigs and bananas was a beautiful tree with violet leaves called the *jacarandá*. Above all was a zepp antenna supported at about seventy feet with the help of a pipe mounted on the flat roof of the topmost room of the Spanish-style house. At the lower end of the feeder was a new RME receiver and a phone transmitter, operated directly from the 230 volt d.c. mains.

CT3AN shows us how to raise dx on low power.

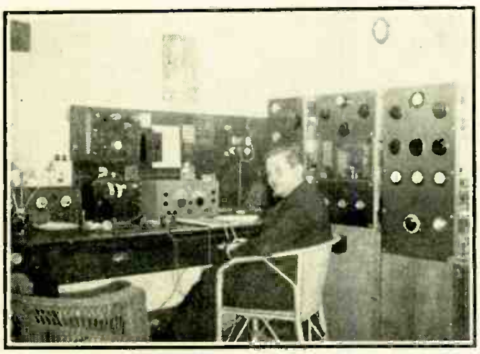
Both sides of the circuit were available in the house, making it possible to put about fifteen watts at 460 volts on grid modulated 809's operating on 7182 kc. and its multiples. Ferraz reads our magazines well enough to understand a considerable amount of our language, though he hesitates to speak it. If the W phones would urge him just a little . . .

Through auto ignition noise on 28 Mc. we heard VP1J, W3DUK and some other loud American signals, late in the season as it was. On 14,364 kc. we called CQ or QRZ on code a few times and worked F8UG, SP1HJ, PY2DN and W9MQQ—three continents in ten minutes—hearing G5TN, W1AVC, LA1H, ON4PW, G3OR, W1WC, G3YK, G4CY G2LT and G3RN. The band was loaded with loud English stations with a few W's.

CT3AN

After a dinner during which English was well mixed with words of three other languages, all went on to CT3AN. Again there was a nice high zepp antenna over the *patio,* though the need for a secluded receiving antenna or at least balanced feeders was made apparent by the ignition noise. There are only some two thousand cars on the island but the narrow streets bring them almost up to the "shack." Here we found another RME receiver. The pentodes in the transmitter were adjusted to draw thirty watts directly from the 460 volt line. Phone is used on 7 Mc. only, because Gomes, who speaks English fluently (thanks to talking movies), does not think he handles the language well enough to work W's!

At 9:30 p.m., an hour behind Greenwich time, we selected a 14,290 kc. frequency from among 14,114 and other crystals available and worked G3VK. The first signal heard was a good one from W8CRA; the loudest was FA3RY. Others were W3KPZ, W8RJL, G6VC, W8CEI, W1CH, VP2AC, ON4NO, W1RB, W3HTO, and W2KWZ. Conditions to the United States were relatively good but Europeans were louder.



CT3AB has an imposing layout—using no higher voltage than the d.c. mains which provide 460 volts.

A snakey bit of entertainment at Meknes, Morocco. Ah, if we had just noticed that veiled yl's eyes . . .

In the dark, before sailing, Gomes drove us all up on a hill from which we could see the white *Kungsholm* in the harbor, and the city which appeared to be a lighted starfish. It was a fitting close to our day in the great garden called Madeira, though it would have been perfect if, like Ferdinand, we had just sat and sniffed the flowers.

French Morocco

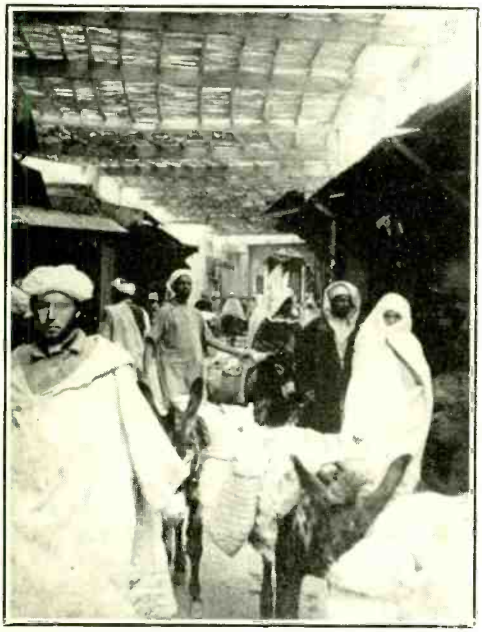
The first view of the lowlying African coast was at Casablanca which, like Fez and Marrakech, is a city of several hundred thousand people but differs in being nearly as much French as Oriental and in having been founded during this century rather than a thousand years ago. Many glaring white apartments built in the modern style could be seen along the skyline. After the train of old coaches—with no glass in the windows—pulled out for the 150 mile trip to Marrakech, the capital city of the south located at the base of the snow-capped Atlas mountains, our party climbed into the small French automobiles for the 180-mile trip inland to Fez. The fine French roads led straight back to the Arabian Nights, where all heads were covered with a turban or a fez, bodies with flowing white robes, and faces of the women with veils.

A most surprising thing is that Morocco is *not* a desert, being protected from the hot winds of the Sahara to the east and south by the tall mountain range. While there are a few rocky areas, there are some woods and many rolling fenceless fields of flowers, vegetables, grain or grapes. Roads are lined with trees. Nomad shepherds live in the open in odd tents or beehive-shaped thatched huts. The beast of burden is either the camel or the small shaggy burro. High points on the mud or stone village houses are usually capped with a stork's nest.

Our first meeting with Morocco amateurs, in Grand Hotel, Fez. At the left is Captain Bertrand, CN8AY. In the center is CN8MT, police commissioner of Fez; to the right is CN8MU of Meknes who claims to have the most modern CN8 rig.

Old Fez

The city of Fez is unique as being one of the few sacred places of Mohammedans open to Christian visitors. Second only to Mecca and Medina in the list of Mohammedan holy spots, for over a thousand years it was closed to the western world; only recently had a Christian been permitted to enter without special permission of the Sultan. Within its walls are many fine mosques and religious shrines, bazaars that have changed little since the days of the Good Caliph of Baghdad. Resonant voices calling the faithful to prayer now and then are heard from small, high windows. Along the pathways are hundreds of tiny shops, with even the small children helping with the weaving, or hammering designs on copper kettles that may have been discarded in Brooklyn some time ago. The narrow lanes are sometimes roofed over with trellises and matting to shield pedestrians from the sun. Natives with loaded dirty burros go along yelling *attention* with a provincial French accent to give you a chance to squeeze aside among the Moslems who may have an eye or leg missing, and face covered with sores. With man and beast occupying the same small space, the odor can stand on end! And just outside the walls are green trees and fertile fields reaching part way up the occasional mountains that form the lesser Atlas range in the valley of which many a compact white city can be seen.



A street or SOUK of markets and stores in Fez, Morocco. We'll have to move or those burros will be upon us!

Around sunset, crowds gather at an open space to be amused at an Oriental carnival by story-tellers, snake charmers and musicians. Through them walk water carriers each with his goatskin bag, brass cup and clanging bell; after seeing them, it is no wonder that we preferred to drink the *vin du pays* rather than to risk the hidden germs in the water.

The relative handful of Europeans live in a settlement apart from the old city. There, in Grand Hotel, we had a room with a white tiled bath—bath for hands, bath for bodies, and bath for feet—but, much to our surprise, not a bath in the "modern" sense. Upon our arrival at the hotel, Captain Bertrand, CN8AY, of the French Colonial army, along

Captain Bertrand, CN8AY ex FB8AA ex FB8IA ex F3EZ, pounds his round-knobbed key with elbow in air, European style.

with CN8MT who is commissioner of police of the native city and CN8MU who claimed to have in Meknes the most modern radio equipment in the country, called upon us. We turned down 8MU's invitation of a night drive to Meknes and back in favor of dinner and an evening with the families of the other two.

CN8AY

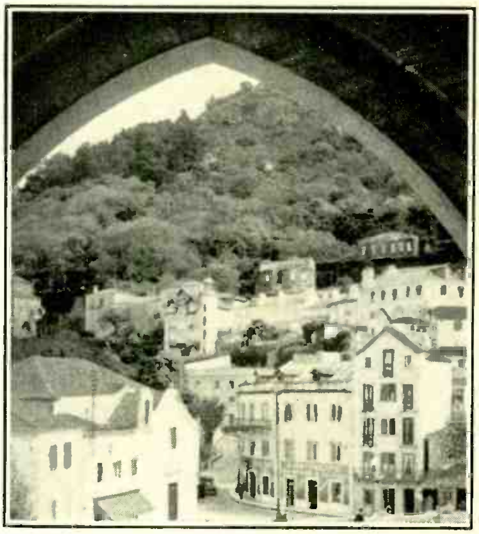
The Captain lives with his wife and children in a small home of Spanish style in the officers' reservation. He moves around quite a bit, hoping to return to France next time via the U. S. A. He has held the calls FB8AA, FB8IA and F3EZ. On Reunion Island, he became well acquainted with FR8VX who is the exiled Emperor of French Indo China, having in 1918 started a revolt against France which cost him his "liberty."

Madame Bertrand, who reminds one of Paris in the spring, served a dinner with a number of courses, including native strawberries in a wine juice. We overlooked all advice to avoid local uncooked fruit, trusting to the wine for sterilization. Even the children drink part wine in their water to avoid sickness. Most interesting was the omelet which the Captain had to make himself, assisted by all of the guests with remarks from us about Madame Poulard, the world renown omelet expert of Mont St. Michel in France. The black Senegalese servant had prepared a wood fire in the iron stove. The egg beating went on, with ceremony about salt and pepper. There was consternation at our mention of putting milk in it. The net result was an excellent dish.

Afterwards, our attention turned to the "rig" in the front room. The transmitter ended with an RK20 with fifteen watts input. The receiver was a regenerative three-tube job including a potentiometer made of a cardboard mailing tube and wooden blocks. The phone caps had been broken; in the absence of replacements, any old cap was made to "fit" with the help of a hammer to break out half of the circumference. But the net result was a lot of dx. We heard ON4WH, SP3AC, LU3EV, GM8CH, W2GTZ, SP1QC, SP2MA, PY1FM, HB9AJ, VO1B, LU9BV, G5PL, HB9X, G3AH, W8B?G, LU9AX, G2LT, SP1AO, K5AY, HA5T, W9CXL; and worked SP1MJ, VE1DB, W8MTY, and VP5PZ. The last of these, John Grinan, we had called many a time at home over a period of years—it took a CQ at CN8AY to raise him. What a chance to tell him about all of those fruitless calls!

CN8MQ, who has done good 56-Mc. dx work, had left Meknes for the interior and could not meet us. CN8AV, another five-meter enthusiast, heard an English phone a few days after we left, according to F8VC.

In Rabat, which is surrounded by great reddish-brown clay fortifications, there are Roman ruins and a very modern Sultan's palace of Moorish design. Many houses of Europeans in the city are surrounded with low walls and visible gardens filled with flowers. Back in Casablanca we received cards and a note from CN8BB and CN8MI who represented a delegation of the local club, A. A. E. M.; we were sorry to have missed them by having set out so early for Fez, but it was unavoidable.



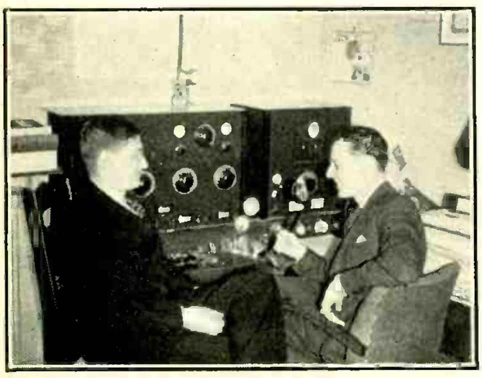
Cintra, Portugal, the "glorious Eden" of Byron.

So it was good-bye to Africa and off to Europe, after a visit that we'll never forget.

Portugal

The cruise took us north from the Moroccan coast, outside of Gibraltar, to Portugal. This country, larger in area than Maine, is known for Port wine, fishermen, a once great empire that included all of Brazil, and a language that is still widely spoken. It contains the nearest European capital city to the United States, Lisbon. This city is located nine miles up the river Tagus, is built on hills like Rome but looks more like Genoa; the older part is picturesque with narrow, steep, winding streets, the newer is of the monumental type. Some streets have steps—and in one place we found an out-door elevator doing a great business. Street cars have only four wheels but get you around for a fraction of an *escudo*. If you cannot speak Portuguese, you can always use Spanish on the conductor and hope he does not kick you off the car. Not far out of town is Pena palace, in the midst of a magnificent forest on top of a hill, or should we say a mountain. It is a remarkable combination of Moorish and Portuguese architecture, a perfect example of a medieval castle in the clouds. More widely known is Cintra, "The Glorious Eden" of Byron. An old castle there is surrounded by a strikingly pretty town of largely bright blue colored houses built on a wooded hillside.

CT1ZZ, who is one of the most active Portuguese amateurs in contests and on 28 Mc., lives in Porto, the wine center. He attended the Naval radio school, then operated at shore stations for five years becoming an amateur in 1932. His transmitter, starting with a bi-push, ends with an HF100. For code he uses 14,400; and for phone, 14,008 kc., and



W9BNX and F8LX are hot after W's. This time it's F8VC behind the shutter.

The boat train from Paris to Boulogne.

their harmonics. Modulator is class-B 46's. An 8JK antenna is used on 20 and 10 meters. The receiver is a copy of one in the RADIO Handbook, with an indoor antenna. On 56 Mc., he puts 25 watts on a 6L6 for code or phone, with a 6A6 modulator, but has never heard a signal.

La Belle France

After rounding Cape Finisterre in Spain and crossing the unusually smooth Bay of Biscay, the *Kungsholm* anchored at St. Nazaire. This port was very active in handling U. S. men and supplies in World War I. F8TD, whom we tried to raise with a CQ on a whistle, was on hand ashore at an early hour. A trainman objected to whistling in a railroad station. Although there were some cars on a nearby track, it looked to us more like a vacant lot by the water's edge.

Striking out on our own in a taxi, we passed unguarded harbor defense gun emplacements of which the French were more proud than secretive. Our destination was Brittany, an ancient duchy that consisted of the western peninsula of France, where many cling to old customs, old manners of living, and their own language. Many of the medieval towns, like Guerande, are surrounded by high walls, and are entered through a door above which hangs a spiked gate. But our real destination was the Chateau country in the pretty valley of the Loire. Nearly every hill is topped with an old or ancient castle, many with moats or other defense remnants of the period in which they were built. The fenceless countryside is farmed from villages in which all houses are made of stone, with either thatched or bluish slate roofs. The similarity of the buildings

[*Continued on Page 74*]

NEW RATING SYSTEM

for Transmitting Tubes

An entirely new system of ratings for air-cooled transmitting tubes has been announced by RCA. Instead of one set of maximum ratings for each tube type, *two* sets of maximum ratings are given. These ratings are designated "Continuous Commercial Service" (CCS) and "Intermittent Commercial & Amateur Service" (ICAS).

The CCS ratings are essentially the same as the former maximum ratings. The ICAS ratings, however, are considerably higher, permit the use of much greater power input, and provide a relatively large increase in useful power output. For example, the a.f. power output of two 809's in class B is 100 watts at the old maximum plate-voltage rating of 750 volts. At the new ICAS rating of 1000 volts, the power output is 145 watts—an increase of 45 per cent. In plate-modulated telephony service, the r.f. output of the 809 is 38 watts with the CCS ratings and 55 watts with the new ICAS ratings—also an increase of about 45 per cent. Complete operating data, including both CCS and ICAS ratings, have been prepared for RCA types 802, 804, 806, 807, 809, 810, and 814, as well as for the new 811, 812, and 828, and can be obtained on request from the RCA Manufacturing Co., Radiotron Division, Harrison, N. J.

The new system provides transmitting-tube ratings which recognize the diversified design requirements of modern transmitter applications. For example, there are numerous applications where the design factors of minimum size, light weight, low initial cost, and maximum power output are far more important than extremely long tube life. In such cases, the set designer may very properly decide that a small tube operated with ICAS ratings better meets his requirements than a larger tube operated with CCS ratings.

It is self-evident, of course, that the harder a tube is worked the shorter will be its useful life. Although no rule can be set up which will accurately predict the life performance of an individual tube under specified operating conditions, it is practical to make an estimate of tube life on the basis of average results from a large number of tubes. In average amateur service, a tube operated at the higher ratings can normally be expected to give about 50 per cent of the life obtainable with CCS ratings.

It has been estimated that an active amateur does not have his carrier on the air more than 300 hours per year. Therefore, a tube lasting 1000 to 1500 hours when used with CCS ratings would give him at least 3½ to 5 years of service. The amateur, because he is usually most interested in *low initial cost* and *maximum power output,* may consequently decide that the ICAS ratings are better suited for his purpose.

The engineer designing a broadcast transmitter has quite a different problem. A broadcast station may operate tubes on an average of 18 hours a day. Tube failures are expensive both in themselves and in advertising revenue lost because of interrupted programs. Consequently, since *reliability* is his main concern, he should operate tubes at the CCS ratings, or perhaps even lower. Only in this way can he obtain the long tube life required for continuous commercial services.

In airplane transmitters, tubes may be operated only a few minutes a day. In addition, mechanical failure of tubes may occur prematurely due to the severe vibration and shock to which they are frequently subjected. For these reasons, operation of tubes at ICAS ratings, especially where maximum power output for a minimum size and weight are essential, should be considered. On the other hand, there are installations where it is imperative that the tubes be ready for operation at all times, because failures at the wrong moment may mean damage to an expensive airplane or even loss of human life. The choice of tube operating conditions for any service must, therefore, be based on a careful consideration of all factors.

In view of the fact that the ICAS ratings are considerably higher than the former maximum ratings, an explanation of the basis on which these new ratings are established is desirable. The old method of rating transmitting tubes has been based on the assump-

[*Continued on Page 86*]

Carrier-Operated

REMOTE-CONTROL CIRCUITS

By L. C. WALLER,* W2BRO

Using the house wiring as a transmission line for relay operation.

Although the use of radio-frequency carriers on wire lines for remote control and for numerous other practical applications is quite old, there has been little said about such uses so far in amateur publications. A simple remote-control switching circuit which utilizes the house wiring system for a transmission line will be described. With two of these circuits an amateur can, for example, turn a transmitter off and on and key it from any room in his house, provided the operating position is close to an a.c. outlet.

The glow-discharge relay tube, type OA4-G, is designed particularly for remote-control relay service. Because the control circuits to be described are built around this tube, an understanding of its operation is essential. The OA4-G is a gas "triode" having a cold cathode (K), a starter anode (P_1), and an anode (P_2). Figure 1 shows the socket connection.

In normal operation, a very small amount of energy starts a glow-discharge between the cathode and the starter-anode of the OA4-G. This discharge, which is ionized argon gas, produces free electrons which assist in initiating the main discharge between cathode and anode. The rectified anode current, which has an average value of 15 to 25 milliamperes, will operate a suitable relay connected in series with the anode and the anode-voltage supply. In actual operation, the starter-anode is used to "trigger off" the main anode discharge. Because the starter-anode requires very little energy, it can be set in operation by an r.f. carrier voltage, as will be shown.

The circuit of a simple switching arrangement is given in figure 2. The starter-anode (P_1) is supplied with a 60-cycle voltage from a bleeder (R_1 and R_2) which is connected directly across the a.c. line. The voltage drop across R_2, shown as E_{R2} in figure 2, is adjusted to have a *peak* value of about 65 volts; this potential is almost, but not quite large enough to initiate a starter-anode discharge on the positive peaks of the a.c. line voltage. Potentiometer R_2 should be set so that the discharge actually occurs, and then "backed off" until the discharge just ceases. The voltage E_{R2} is *in phase* with the line voltage.

The a.c. line is made to carry a small r.f. voltage, which is supplied by a simple Hartley oscillator to be described a bit later. The frequency of this carrier voltage can be in the order of 50 to 400 kilocycles. Care should be taken that the carrier frequency chosen does not correspond to one of the intermediate frequencies commonly used in superheterodyne receivers, in order to avoid interference. In the example under discussion, we shall assume that the carrier has a frequency of 300 kc. Again referring to figure 2, we note that inductance L_1 and capacitance C_1 make up a simple series-tuned circuit shunted across the a.c. line. L_1 and C_1 have values such that they are series resonant with the 300-kc. oscillator frequency. At resonance, a comparatively large r.f. voltage (E_{L1}) is built up across L_1. This voltage, in series

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

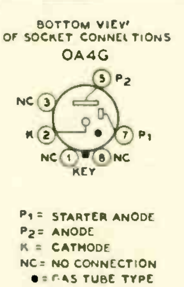


Figure 1.

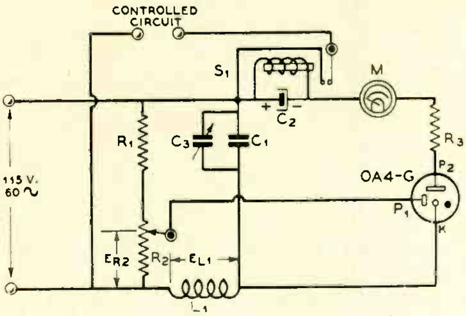


Figure 2. The OA4-G switching circuit.

C_1—.002-μfd. mica
C_2—8-μfd. electrolytic, 200 volt
C_3—100-μμfd. mica trimmer
R_1—15,000 ohms, ½ watt
R_2—15,000-ohm potentiometer
R_3—1000 ohms, 2 watts
M—0-25 d.c. milliammeter — employed merely for tuning
L_1—75 turns closewound no. 26 d.c.c. on 1.75" form
S_1—10 to 20 ma. relay (see text)

with the cathode and the starter-anode, adds to the 60-cycle voltage already applied to P_1 (see figure 3). In this manner, the starter-anode discharge is started; this discharge in turn starts the anode discharge and operates relay S_1.

The d.c. milliammeter shown in figure 2 is not required as a permanent part of the circuit, but is very useful while the apparatus is being adjusted for correct operation. The resistor R_3, in series with P_2 and the relay, is essential. It serves to limit the peak anode current of the OA4-G to a value less than the maximum rated value of 100 milliamperes. The average d.c. anode current should never exceed 25 milliamperes. The relay used can be of either the a.c. or the d.c. type; its resistance is not critical, values from 200 ohms to 2000 ohms having been employed with good results. If a d.c. relay is used, the large by-pass condenser (C_2) is essential to prevent chattering, caused by the pulsating nature of the d.c. anode current (the anode passes current only on the positive half cycles of the a.c. line voltage). The relay should be designed to operate on about 10 to 20 ma.

It is important that the series-resonant circuit of figure 2 be tuned exactly to the carrier frequency on the a.c. line. The simplest scheme is to use a .002-μfd. mica condenser for C_1, shunted by a 100-μμfd. trimmer of the mica compression type. A cathode-ray oscillograph is extremely useful for checking the amplitude of the r.f. voltage built up across L_1, and for tuning the series-resonant circuit to resonance. For satisfactory operation of the OA4-G, the r.f. voltage (E_{L1}) should have a peak amplitude of at least 55 volts. This value is easily obtained.

Control-Oscillator Considerations

The control oscillator can be quite simple, as shown in figure 4. A type 30 is connected as a Hartley oscillator and inductively coupled to the a.c. line through a low-impedance secondary winding (L_2). The impedance of the average house power line is quite low—probably in the neighborhood of 10 or 15 ohms at a frequency of 300 kc.

The tank inductance (L_3) consists of about 75 turns of no. 26 d.c.c. wire on a cardboard form 1.75 inches in outside diameter, tapped for the a.c. plate voltage lead 25 turns from the grid end. The low-impedance secondary or output coil consists of 3 turns wound around L_3 at the point where the large coil is tapped, i.e., at the point of zero r.f. potential. The blocking condenser (C_4) serves to prevent L_2 from shorting the a.c. power line and also to by-pass the tank circuit at the r.f. voltage node. In this circuit, the 30 tube draws an average d.c. plate current of about 6 to 7 ma. The oscillator can be keyed at a reasonably good speed in the grid-leak-return circuit, as indicated in figure 4.

Care should be taken not to make the grid condenser (C_7) too large, because it must have a high impedance at 60 cycles to prevent the grid from swinging positive in phase with the plate voltage. Such an occurrence will result promptly in a burned-out oscillator filament.

The type 30 oscillator, with reasonably close impedance matching to the house line, was found to deliver from 70 to 100 volts peak r.f. voltage across L_1 over all house wiring circuits on which tests were made. This voltage was measured with an oscillograph. The oscillograph pattern of the r.f. voltage developed across L_1 looks like that

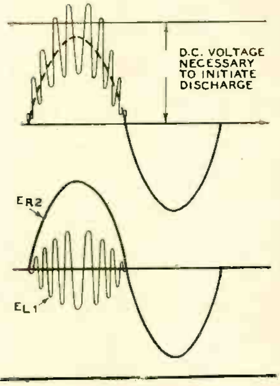


Figure 3. Showing how the r.f. control voltage is superimposed upon the a.c. line voltage to give a peak value sufficient to initiate the discharge of the gas tube.

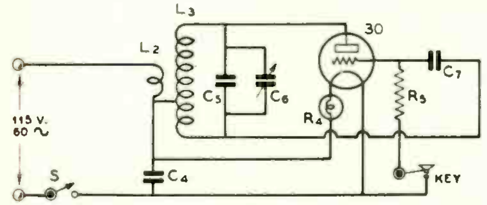


Figure 4. The 300-kilocycle control oscillator.

C_1—0.25-µfd. 400-volt tubular
C_5—.002-µfd. mica
C_6—100-µµfd. mica trimmer
C_7—.005-µfd. mica
R_4—7.5-watt 120-volt lamp
R_5—10,000 ohms (or larger), ½ watt
L_2—3 turns no. 26 d.c.c. (see text)
L_3—75 turns no. 26 d.c.c. closewound on 1.75" form, tapped 25 turns from grid end.

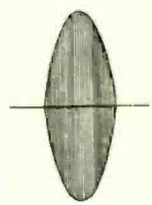
shown in figure 5, when the OA4-G is taken out of its socket. With the OA4-G functioning, the pattern of figure 5 becomes badly distorted, due to the intermittent load which the tube shunts across the line when the OA4-G is passing current.

It is important to note that the r.f. pulse delivered to the line occurs only on the *positive* half cycle of the line voltage, referred to the oscillator filament. The line plug at the OA4-G relay unit must be inserted so that P_1 and P_2 swing positive with respect to the OA4-G cathode on the *same* half cycle that the r.f. pulse is generated in the oscillator. The two ends of the control circuit must, in other words, be "in phase." If the polarity is connected wrong at first, reversing the line plug of either the oscillator or the relay unit will allow correct operation.

It is this phasing proposition which makes possible two switching circuits without undue complications. Thus, one relay can be used to turn off and on the high-voltage supplies of the transmitter and a second relay can be used for keying purposes. To accomplish this result it is only necessary to use two oscillators and two relay units like the ones just described. One pair of units can be operated on one half cycle of the line voltage and the other pair of units on the opposite half cycle. With correct "phasing," the keying oscillator will operate only the keying relay without interfering with the transmitter "off-on" relay. The two oscillators can be operated on the same frequency, or on a different frequency, as desired. If the two oscillators are found to operate on the same half cycle of line voltage when first connected, the a.c. line connections to one of them and to its corresponding relay unit should be reversed.

In some cases, where the apparatus to be controlled is located at an unusually great distance from the control point, it may be found that the type 30 oscillator will not put enough signal into the a.c. line to operate the OA4-G. The logical procedure in such a case is the use of a larger oscillator tube with more power input. The 56, 27, 6C5, 37, 6J5, and similar receiving tubes of the triode type all make suitable oscillators where more input is required. It is necessary with tubes of this type to use a filament transformer because a series resistor is not very practical. Another suitable, and possibly preferable oscillator arrangement is the use of two of the new 35L6-GT's as triodes, with the screen tied to the plate. The 35-volt heater of the 35L6-GT draws only 0.15 ampere; two tubes can be operated with their heaters in series with a filament-dropping resistor of only 300 ohms (10-watt size), directly across a 115-volt a.c. line. Since the two heaters require 70 volts, only 45 volts has to be accounted for by the series resistor.

Figure 5. The r.f. signal as it is applied to the line, modulated at 60 c.p.s.



The question of local interference on the station receiver, caused by harmonics of the control oscillator every 300 kilocycles "up the band," does not come up if one oscillator is used to control the transmitter plate supplies and the other to key the rig. Obviously, both oscillators are off when the station receiver is on. This arrangement requires, however, that the operator manually turn on all transmitter filament supplies before he goes to the "remote" operating position, and turn them off manually after he has finished operating. If a control oscillator were also used to turn on the transmitter filaments, it would be desirable to leave this oscillator running during all the time the station is "on the air," so as to avoid delay in coming back after a stand-by period. Harmonic interference will almost certainly be experienced with such a setup, due to the potent r.f. signal pumped into the primary of the receiver power transformer from the a.c. line.

[*Continued on Page* 79]

BROAD-BAND DOUBLET

By EUGENE BLACK, JR. * W2ESO

For 3.5-4.0 Mc. operation, the twisted-pair-fed doublet is just about the ideal transmitting antenna. It is easy to throw together, simple to erect and adjust, and at this low frequency line losses are negligible. For power outputs up to a few hundred watts, it is even practical to use the better grades of line made for receiving antennas. These run in the neighborhood of 120 ohms or so, rather than the accepted standard of "72 ohms." But, as has been discussed before[1], the radiation resistance is not constant with varying heights, and investigation will show that the mismatch is not as bad as it first appears. For heights between 0.2 and 0.5 wavelength, the radiation resistance will run over 73 ohms, up to the neighborhood of 100 ohms or so—and antenna height above a half-wave at this frequency is not likely!

The usual antenna of this type has one disadvantage, however: it will not load evenly over the entire range of from 3.5 Mc. through 4.0 Mc., since this would represent 4% frequency change if the flat top were cut to 3750 kc. (approximately 126' overall). Theoretically, the radiating efficiency and load presented should remain constant over a range of 2% plus and minus the resonant frequency of the antenna. Thus, a radiator approximately 65.4' long will resonate at 7.15 Mc., and function equally well over the entire band from 7.0 to 7.3 Mc., since this represents a change of just about 2%. Similarly, a 33' wire resonates at about 14,200 kc. and covers the entire 14 Mc. band, since the variation is only 1.4%.

The solution for the 3.5-4 Mc. band is simple, and is shown in figure 1.[2] Two radiating sections fed in parallel flatten out the response of the antenna, equalizing the loading with a fixed coupling coil, and improving the radiating efficiency at either end of the band.

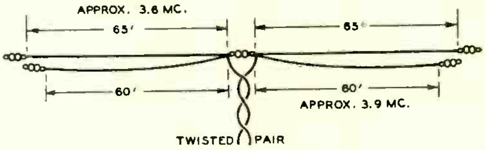


Figure 1.

Lengths of wires and method of connection for the broad-band doublet covering the range from 3500 to 4000 kc.

One flat top resonates in the phone band, while the other is cut for the low-frequency edge of the c.w. band. The net result is a bandpass effect. While each section must be carefully trimmed if absolutely constant loading is to be obtained with a fixed coupling coil, there is sufficient tolerance to guarantee that the loading will be fairly even with the figures given, while maximum efficiency is assured for the most used sections, at the opposite ends of the band.[3]

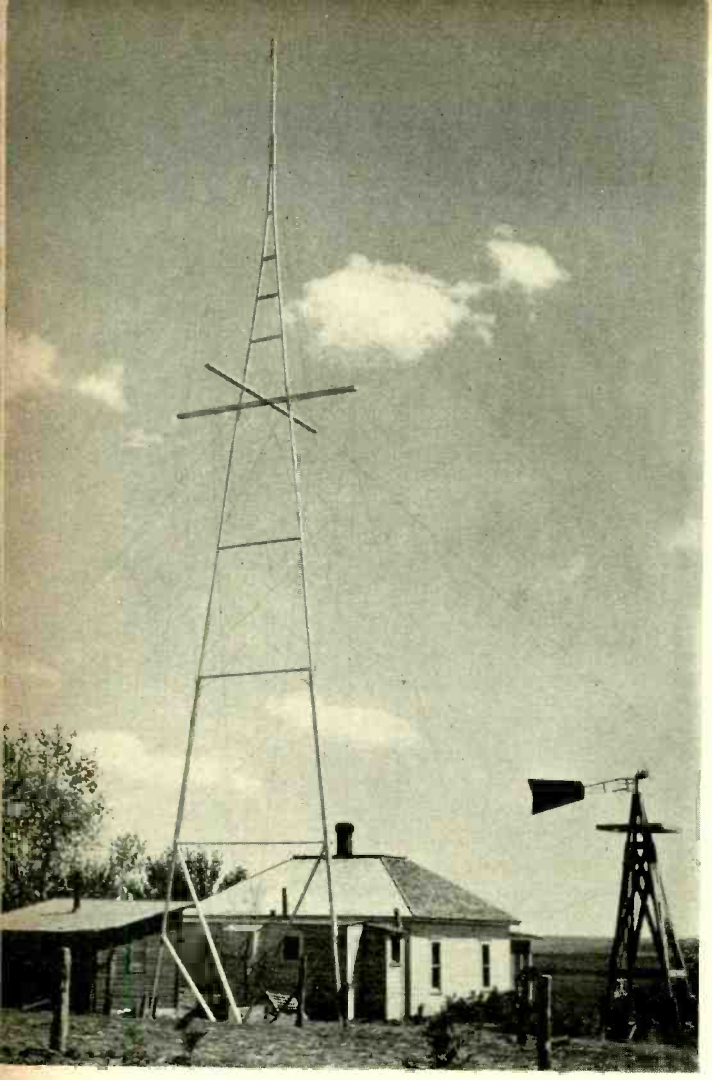
The spacing of the wires is not critical; it may be anything from 3 inches to 3 feet, and need not be constant.

* 170 West 73d Street, New York, N. Y.

[1] Kraus, "Multi-Wire Type Antennas," RADIO, June, 1939.

[2] This is the same basic idea as used in the first RCA "Double Doublet" for shortwave b.c. receivers some years ago.—EDITOR.

[3] A Kraus "Multi-Wire" doublet could be used with the same practical result; the radiation resistance would be so much higher that the antenna would tune much more broadly than a conventional single wire doublet, thus giving even loading over the band.—EDITOR.



ANTENNA MAST CONSTRUCTION

By FORREST H. HOPPE,* W9YUM

Desiring to build an antenna system for 160-meter phone that would be really efficient, the first consideration became that of a suitable mast to support the radiator as high as possible above the surrounding terrain. Considerable physical height is necessary on 160 to attain any material electrical height. Even if the antenna were 120 feet high its electrical height would be only in the vicinity of one quarter wavelength. About the greatest height that it is possible to build a mast without the application of advanced engineering principles is in the vicinity of 100 feet. Hence it was decided to make the mast just about this height; actually a height of 105 feet was decided upon.

Other considerations in the design of the mast are cost, the ability to withstand high winds, and ease of construction. As to cost, it will vary from about $35 to $40 depending upon the exact height, the availability of lumber, and upon the type of finish applied to the completed mast. The design of the mast is very strong and if it is braced in the manner shown in the drawings, wind alone, up to 60 m.p.h. will not bring it down. This assumes, of course, that satisfactory joints and connections have been made in the guys and that the anchors are firmly installed in the ground. As to construction, the entire mast may be constructed on the ground by a single person. Raising it, of course, is another proposition and will be covered in detail later.

Materials

The mast is constructed of 2" by 4" yellow pine lumber and smooth no. 9 galvanized iron wire. The lumber must be of the very best grade, *straight grained and knot free;* this is very important in a mast of this kind. The

* Gordon, Nebraska.

single stick at the top of the mast is of hickory for the extra strength that is needed at this point.

Constructing the Mast

And now for the method of construction. Decide first what height you want the mast by using either 24 foot, 28 foot or 32 foot pieces for the legs. If the mast is located in an area subject to high winds where it is liable to be covered with sleet, make it only 80 feet high, otherwise it may be made up to 105 feet. Then select a level plot of ground at least as wide and as long as the mast. If possible have the base of the mast on the spot where it is to be erected. However, this is not strictly necessary, as the mast may be "walked" into position after erection by advancing first one side and then the other 2 or 3 feet at a time, and by the proper manipulation of the front and back guy wires.

Start construction with the top (hickory) piece of 2 by 4 by laying it edgewise on the ground. The length of this piece for all heights should not be more than 16 feet. Then lay down two of the long pieces, one on each side of the hickory stock so there will be a lap of 3 feet at this joint (no. 3). This joint is made with one machine bolt and two eyebolts and bound at both ends with strap iron. The strap iron referred to is sheet iron cut to the correct length and 1½" wide. Lay down two more long pieces and bolt with two machine bolts at joint no. 2, with a lap of 2 feet. Lay down the last two long pieces, lap them 2 feet and bolt with one eyebolt and one machine bolt, and bind all joints at both ends with strap iron.

Both legs now lie side by side. See that they are even in length and then spread the ends 16 feet and fasten a 2" x 4" to them with spikes and strap iron, this being the base. That width base will do for any height mast. Put in the girders, working from base toward the center. The center girder or brace is made by placing one 16' x 2" x 4" under and another over the legs at the joint and with four bolts clamping them to the legs, also spiking them to keep the brace from slipping. A block the proper size is bolted at each end and two holes drilled in each block for the truss wires.

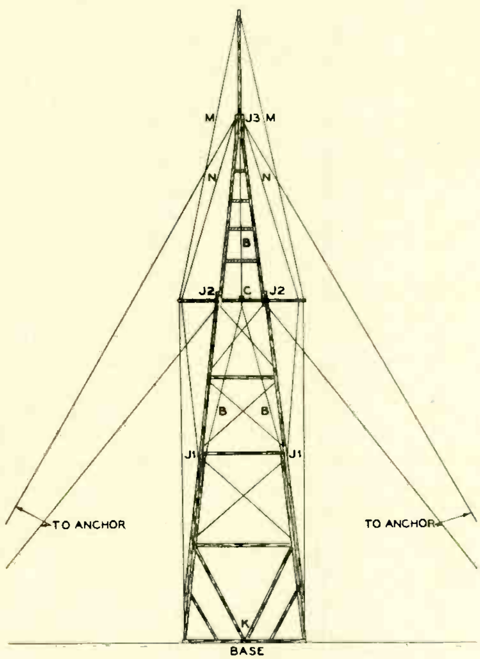
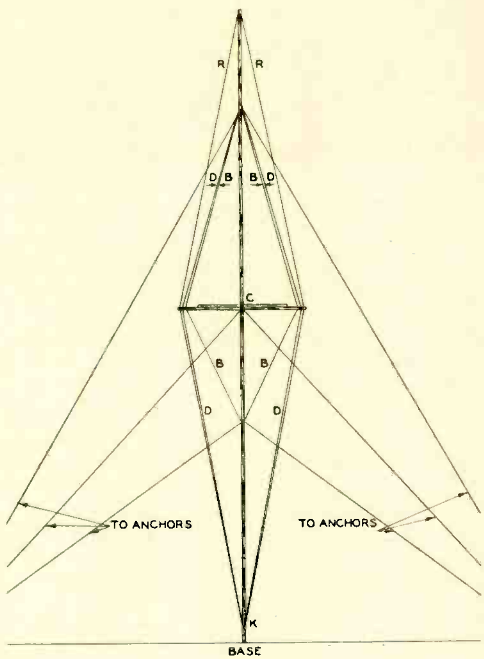


Diagram showing cross bracing, internal guying, and external guying in a front view of the mast.



Side view of the mast showing internal bracing, guying, and the 12-foot additional member that is placed upon the 16-foot crosspiece.

Sway Braces

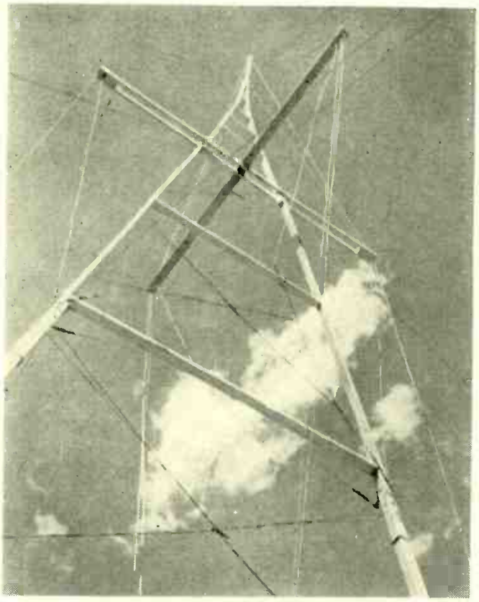
The sway braces are put in next. Two no. 9 wires are used for this purpose. Starting at joint no. 2 pass a single wire over the girder-brace and outside of leg across to the other leg, about a foot from the girder. Drill two holes the size of no. 9 wire. Run the wire down through one hole and back through the other one. Cut the wire to the proper length, tie the two ends together and twist the wires a little. Repeat the operation on opposite sides and the sway braces will form an X between girders. Now take the slack out of the braces by twisting each pair of wires. Use care here as the mast may be pulled badly out of shape. Fasten the wires in such a way that they cannot become untwisted. Drive a nail in the center of each girder and be sure that the nails in the girders line up properly. Put in all the wire sway braces until the bottom section is reached where two pair of wooden braces are bolted in and bound with strap iron. Be sure the mast will be plumb when standing up.

The girders between joints 2 and 3 are next. All girders are put in with two spikes at each end and a strip of strap iron. Put a band of strap iron at the mast top and another about one foot lower down. Drill two holes for eyebolts through this bottom band. An eyebolt is placed about one foot from the base on the outside of each leg.

Installing the Side Truss Wires

You are now ready for the side truss wires. Truss wires (M) run from the top eyebolt through a hole in the block of the center girder-brace to a turnbuckle which is hooked in one of the eyebolts at the base. Truss wire (N) runs from the eyebolt in joint 3 through the hole in the center girder-brace block to the turnbuckle which hooks in the eyebolt at joint 1. Tighten all turnbuckles and straighten the mast.

The mast must now be fixed so that the 2″ x 6″ x 16′ cross piece can be put on. It has been lying on the ground, and in order to raise it the truss wires must be put on the "top" side. Drill one hole in each 2″ x 4″ of the girder-brace at (C) for the 2″ x 6″ cross-piece. Make a temporary cross-piece 2″ x 6″ x 9′ by drilling three holes in one end for truss wires (R, D, and B) and drill holes at the other end for bolting it to the girder-brace. Place a large eyebolt between the bottom wooden sway braces and through the base at (K). Wrap truss wire (R) around the mast top just above the eyebolt, run through the hole in the temporary crosspiece and down to the turnbuckle which hooks in eyebolt (K).



Looking up from the base of the mast toward the top. The construction and relative positions of the girder-brace and the 16-foot cross brace can be seen.

Truss wire (B) runs from the eyebolt in joint 3 through the inside hole of the cross-piece where it is terminated with a loop. Fasten two wires to the loop, each one going through a turnbuckle to an eyebolt in each leg at joint 1. Bolt the temporary cross-piece in place so that it stands 8 feet straight up. Tighten the "top" truss wires with turnbuckles.

The Preliminary Raising

The mast is ready to be raised a few feet. It may be raised by setting a pole in the ground about 1 foot or so toward the base side at (C), attaching a small hoist to the top of the pole and to (C) of the mast. In raising even a few feet, watch joint 1 of each leg. There will be a tendency to bend toward the ground. The legs should be propped up while raising the mast. Raise (C) only about 3 feet and stop.

The reenforcement pieces should be put on the legs at this time. They are 2″ x 4″ pieces extending down from joint 1 on each leg at least two-thirds of the distance to the base. These pieces are laid against the legs and are bound to them in about four places with strap iron. Do not weaken the legs by bolting, as a bolt hole will weaken the mast considerably. These pieces are needed mainly when the mast is being erected.

Now is the time to paint the mast. Three quarts will cover it twice. Aluminum paint was used on the entire mast. Paint and allow to dry completely.

Make the permanent 2" x 6" x 16' crosspiece. The ends are banded with strap iron and a thin long bolt put through each end to keep it from splitting. Drill three holes, parallel to the length of the board, 3" apart near each end for the truss wires (R, D, B). A 2" x 4" x 12' is laid on top of the crosspiece, centered and temporarily bolted on with three bolts.

Installing the Guy Wires

You are now ready to put on the guy wires. There are four at the top, four at the middle and two at joint 1, on each leg. These use the same eyebolt as truss wires (B) and run directly to the "front" ground anchor, but hook on to the "back" anchor through turnbuckles. At the top, front and back guys have their own eyebolts and the side guys use the same eyebolts as the side truss wires (N). The guys running to the middle are made by twisting two no. 9 wires together. The front and back guys are run between the two 2" x 4" girder braces and looped around the 2" x 6", ends tied and the two wires twisted. The side guys are looped inside of leg and over the girder-brace, ends tied together and the wires twisted together. Make the guys somewhat longer than necessary. After twisting, cut the wires and insert insulators where wanted. The length of guys may be determined by measuring from base center out as far distant as the anchors are to be placed.

Attach the truss wires at the top and at joint 3 so that they can be reached from the ground when the mast is raised higher. The pulley may now be attached near the top. Tie a ¼" rope to a five-pound sash weight. Thread the opposite end of the rope through the pulley and down one leg to the base. Place screw eyes every three or four feet down to about joint 1 where the rope can be wrapped around the leg on down to the base. Turn the screw eyes at a small angle so the rope has no play in them.

We are now ready to raise the mast high enough to put in the regular 16' crosspiece. The center (C) must, naturally, be at least 8' high. In raising watch the legs at joint 1 so that they do not bend too much. When (C) center is high enough, prop joint 1 at each leg, use a 2" x 4" x 12' to prop joint 3 and a 2" x 4" x 14' to hold up the mast top. Now loosen the "top" truss wires and take off the temporary crosspiece, pull out the truss wires and rethread them through the permanent 2" x 6" x 16'. Place strain insulators at the desired spacing in the truss wires, be sure the twisted guy wires are in place and bolt the 2" x 6" crosspiece in place. Then lay the 2" x 4" x 12' over the 2" x 6" and bolt it in place. Put on the bottom truss wires in the same way as the "top". Leave truss wires (R), (top D), (bottom B) quite loose, but tighten truss wires (top B) and (bottom D) as they bear the brunt of the strain in the erection of the mast.

During erection there will be a tendency to sag at joint 1 and hump at joint 3. Truss wires (top B) and (bottom D) are designed to overcome the defect. In erecting, wires (R) should let the top drop 8" to 12", and the rest of the truss wires should not be "tight" as this will place extra strain on the mast.

Ground Anchors or "Deadmen"

This completes the construction of the mast. The ground anchors should not be buried, their position being 40 to 50 feet from (K). An anchor may be a steel plate 1 foot in diameter and ¼" to ½" thick. The anchors are sunk 4 feet in the ground. Fasten an iron rod of ¾" in diameter to the plate and make a loop in the other end for attaching guy wires. Four no. 9 wires may be twisted together to substitute for the rod but the wire will rust quickly.

Erecting the Mast

The mast is now ready to be erected. Set three short posts at the base of the mast so that the pull will be against these posts. After erection the mast may be tied to the posts to insure its staying in place. Fasten a long thick rope to (C) with a loop in it in such a way that it may be pulled down when mast is erect. Run the rope over a 20 foot or, better still, a 30 foot gin pole and down to the car or truck which will back up and raise the mast. It will take one man to operate the power, one to work at joints 1, and one to operate the back guy wires and to watch for snagged wires. The side guy wires may be fastened very loosely and will need no more attention. When everything is ready for the "pull" one man should place himself at the center of the girder between joints 1 and as the mast raises he should lift on the girder until it is out of reach. In the meantime, another man should have placed a 2" x 4" x 14' in the center of the girder in order to be able to continue the lifting (pushing); he should do this as long as he is able to reach the girder with his board. When he can no longer reach the girder it will not

[*Continued on Page* 77]

The Evolution of a VU HAM

By FRED J. TOWELL,* VU2AU/G4BL

An appreciation of the conditions and difficulties under which the other fellow works should lead to better mutual understanding and make for easy and less strained conversation. In addition it should bring home more clearly the advantages enjoyed by the W amateur as compared to the limited privileges of the foreign ham. Perhaps this bit from the Temples of Hindustan will be influential in persuading some of the dx men to drop the usual formula type of QSO and take advantage of the many opportunities for an interesting conversation.

My story begins in the early summer of 1926 when many of us Britons abroad had never heard or even seen anything connected with radio except perhaps for one of the huge crystal sets used aboard ships. About this time a friend, returning to India from a spot of leave in England, filled my ears with wonderful tales of entertainment obtained with the aid of a couple of tubes strung together by a few pieces of wire. Knowing nothing of the theory of radio wave propagation I ordered the necessary gear from Great Britain and after the usual couple of months' delay received a collection of parts, the functions of which I had only the vaguest idea.

The parts were duly strung together and, surrounded by dozens of helpers, I eventually managed to get the hookup working. The only signal available was the old marine spark from Vera Cruz, close to Bombay, but even that grinding signal was beautiful music to all of us hearing our first signal over the air.

I was in a British infantry regiment at the time, and found it impossible to get privacy for experiments, or to persuade the boys that radio gear was delicate stuff and would not respond to the usual treatment meted out by such toughs as they.

After about two weeks of proud possession the inevitable happened. One of the boys, whose aim was more accurate than would have been thought possible considering the amount of "hot water" he was carrying, managed to score a direct hit with a football boot, and I was minus one receiver.

He apologized most profusely after coming out of the hospital, but that wasn't much help as money was tight, and radio gear was worth its weight in gold!

In October '26 after some misguided boys had spent a fortune in teaching me to play cards, I again had enough cash to think of radio, and was fortunate in obtaining a 5-tube Pilot, one of the very few in India at that time. With this receiver I was successful in receiving my first introduction to a voice-modulated carrier!

This signal came from the amateur station at Colombo in Ceylon, and considering the distance (1000 miles), and power (100 watts), intelligible reception on 800 meters said something for both transmitter and receiver. Music from this one source, however, soon

Fred. Towell, VU2AU/G4BL

* The Arsenal, Quetta, Baluchistan.

began to pall, and as India had no broadcast stations, the receiver was scrapped, and the parts used to build a shortwave job.

Once again luck was with me, for the new receiver worked down to 15 meters and I was able to listen to various commercial stations (mostly in Java and Sumatra) experimenting with modulation on about 15 meters. I say the receiver worked, but its working would raise a laugh in a kindergarten these days, as the only way one could hold a station was to fix the body in the position it held at the moment of tuning in, and the frequency varied with each heart-beat! However, troubles of this and a similar nature were overcome, and as the majority of signals audible were in the ham hands, I naturally clung to those frequencies to the exclusion of all others, and was rewarded eventually by hearing Gerald Marcuse (G2NM) put over Big Ben from England!

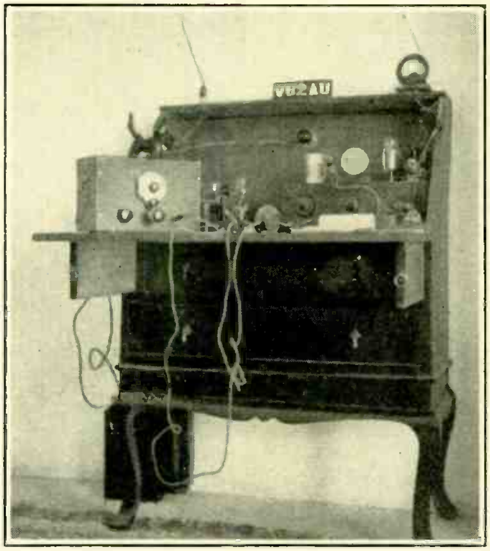
This event startled the authorities both in London and in India, and roused the British manufacturers to the possibility of a radio market being created in India, and it at last became possible to obtain components at a reasonable price from the ports.

With the advent of the old Chelmsford (G5SW) station, more and more people became interested; sales mounted, though slowly, until most Europeans and the majority of the better class Indians living in the larger towns possessed a radio of sorts.

Extension to outlying districts was held up, due to the limited range of the b.c. transmitters which were operating in the cities, and to the power problem—mains even to this day being confined to the towns and military stations.

Just prior to the establishment of Empire Broadcasting by the B. B. C., I became interested in the transmitting side of radio, but my duties prevented my operating a rig until late in 1934 when, at Kirkee, a small town about 100 miles east of Bombay, I started to study code, and was so enthusiastic that sleep was a secondary consideration for about a month, when, to my surprise, I found copying 12 w.p.m. was pie! After a few weeks of under cover activity, a license was issued for the call VU2AU.

There were about a dozen VU hams on the air at the time, and I spent a happy period making their acquaintance. A description of the rig used may be of interest—it consisted of a Hartley oscillator using a small pentode with plate and screen strapped, working into a half-wave antenna with a non-resonant feeder. The wire was 20 gauge enamelled and was erected in the most inconspicuous position possible—along the verandah beams, where it was invisible! This was considered sound policy (even if it didn't make for efficiency) as it was not possible to obtain permission for the erection of any power carrying antenna on the government building I was then occupying. The difficulties encountered in operating this rig may be more fully realized perhaps if I mention that the method of changing from send to receive involved the removal of that precious pentode from the transmitter and replacement in its proper home—the audio stage in the receiver.



The present rig at VU2AU—the 6L6G transmitter and the 6J7-6C5 receiver

This inelegant setup really went places so far as the Eastern hemisphere was concerned —Europe, Africa, or Australia providing contacts as required, and these kept me wakeful to the tune of 2500 odd QSO's. A freak contact (on forty) with XE1AY towards the summer of 1935 set up a longing for real dx, and as the rupees don't grown on trees, even in VU, I started out to try my luck with a couple of 89's—as tritet p.a. This job managed quite a deal of dx, and "W" on 14 Mc. provided good hunting! In a contact with W8CRA, Frank remarked that he had been receiving my sigs at good strength months prior to our QSO. That drew attention to the shortcomings of the receiver, as his was the first "W" signal ever heard here and the power ratio between our respective transmitters worked out at about 100/1, my portion being the 1!

[*Continued on Page 76*]

NEW FEEDER DEVELOPMENTS

By E. H. CONKLIN,* W9BNX

While it is well in an elementary study of antennas to dissociate feed systems such as Johnson *Q, J,* Collins and Delta-Matched, from the antenna proper, there are times when the feed system radiates. In the latter case there may be unpredicted results, especially at ultra-high frequencies. Lately, there have been some developments in feed systems that are of general interest.

Concentric Line Feed

When a concentric line is used directly to feed a doublet at its center, common practice is to hook a quarter-wave length wire to the inner conductor and the other quarter wavelength wire to the outer conductor, as illustrated in figure 1. In the case of a horizontal antenna, we can consider the left half of the doublet of figure 1 as being at ground potential, and *not* fed by the line. Essentially, the antenna consists of a grounded quarter wave that is directly fed, and another that receives its entire excitation from radiation. One engineer who has been making measurements at ultra-high frequencies states that the addition of the second quarter-wave wire sharpens the pattern moderately and produces a 2 db gain in the favored direction.

A recent development effectively ungrounds the "undriven" quarter-wave wire, resulting in balanced feed with the line effectively feeding both wires. It is pictured in figure 2. The only change is the placing of a quarter-wavelength tube around the concentric line, shorted to the line's outer conductor at the bottom, to permit the last quarter wavelength of the line to assume a potential other than that of the outer conductor.

This leads to another possibility, which is already in use at the Empire State building. Now that balanced lines can be fed directly with a concentric line, it is possible to operate four 220-ohm open wire lines, hooked to separate doublets, in parallel to match directly into a 55-ohm concentric line. This is illustrated in figure 3. Of course, it is still necessary to match each 220-ohm line to each doublet, but again this is done simply by building the doublets for the proper impedance.[1] The method used in the sound portion of the RCA television antenna is shown in figure 4.

Vertical Radiators

A problem with vertical antennas is to feed them from the bottom without upsetting the

* Associate Editor, RADIO.

[1] "Television Transmitting Antenna for Empire State Building," Nils E. Lindenblad, *RCA Review*, April, 1939. "Multi-Wire Doublet Antennas," John Kraus, RADIO, May and June, 1939.

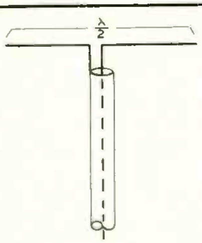


FIGURE 1

COMMON CONNECTION OF CONCENTRIC LINE TO HORIZONTAL DOUBLET

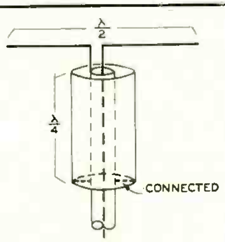


FIGURE 2

BALANCE CONVERTER TO FEED BALANCED SYSTEM WITH CONCENTRIC LINE

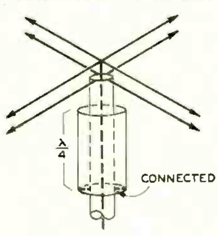


FIGURE 3

BALANCE CONVERTER TO FEED 4 SPACED LINES OF ABOUT 220 TO 320 OHMS

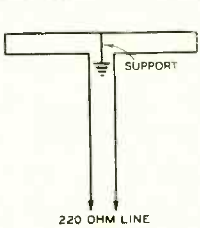


FIGURE 4

ONE TYPE OF FOLDED DOUBLET WHICH MATCHES AN OPEN WIRE LINE DIRECTLY balance of the feed line. Another is to prevent the line from reradiating power picked up from the excited antenna (which current is *in phase* in both wires of an open wire line). If a doublet is lifted above the earth, the radiation pattern in the vertical plane has a number of lobes of maximum radiation, separated by angles at which the radiation is zero. Much the same thing occurs with a high horizontal antenna, but in this case the nulls and maxima are reversed. For certain angles of radiation—and in the case of very high antennas, even some low angles—one polarization should give maximum signal and the other none. This may explain a few cases of failure of a good antenna to receive an ultra-high frequency signal of the "skip" type.

If there is radiation from the feed line caused by unbalance, reradiation of picked up power, or unwanted capacity coupling at the antenna, the over-all radiation pattern is further complicated. When this happens, it is of considerable help to use a complex beam because of the greater relative strength of the signal radiated from the antenna compared with that from the feed line.

The Western Electric type of concentric feed[2] was designed to keep radiated power off the feed line. As shown in figure 5, the lower half of the antenna is a quarter wavelength tube around the feed line, insulated from the concentric line at the bottom but not at the top. This forms a quarter-wave resonant section such as used in some ultra-high frequency receivers[3] as tuned circuits, and permits the bottom of the antenna to assume a high potential while the concentric transmission line inside it, which acts as the inner conductor of the "trap," can remain at ground potential.

[2] "Concentric Line Antenna," RADIO, November, 1937.
[3] "Ultra-sensitive U.H.F. Receiver," E. H. Conklin and Arthur Avery, RADIO, June, 1939.

The outer tube presents a mechanical problem of mounting at its top and insulating at its bottom. It can be considered as being made up of a number of parallel quarter wavelength wires, as illustrated in figure 6. This suggests something else.

A quarter wavelength wire, insulated at its far end, "looks like" a zero impedance at its near end. The same would be true of the center of a half wave wire, the center of which, then, can be used as a ground. It will have no pickup (if horizontal) and will not radiate. This type of ground has been recommended for use at high frequencies to terminate nonresonant antennas such as Beverage wires and tilted wires because of the difficulty of obtaining a constant resistance ground. It can also be used to terminate the outer conductor, which in the case of figure 6 would amount only to spreading the lower wires horizontally as shown in figure 7. This has been termed a "ground-plane quarter-wave vertical." Since the outer conductor of the line hooks at the center of two half-wave horizontal antennas, it is actually at a ground point and both the antenna and line are completely balanced. One of the outstanding advantages of the antenna is that the field below the ground plane drops off to an extremely low value. On receiving, this shielding effect should be very helpful in greatly reducing automobile noises from near the base of the tower supporting the radiating system, or if it is supported high enough above ground, from anywhere in the vicinity of the antenna.

This proposal has been made by G. H. Brown to whom we are indebted for the close-spaced idea incorporated in so many flat-top and reflector types of beams. The antenna of figure 7 has the disadvantage of having a radiator that is not directly grounded for lightning. That objection is met by the construction of figure 8.

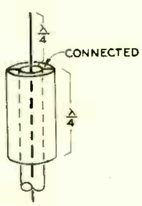


FIGURE 5

WESTERN ELECTRIC-TYPE CONCENTRIC-LINE-FED ANTENNA

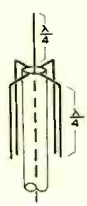


FIGURE 6

WIRES SUBSTITUTED FOR TUBING OF FIGURE 5

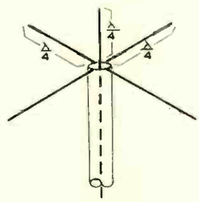


FIGURE 7

GROUND PLANE QUARTER-WAVE VERTICAL

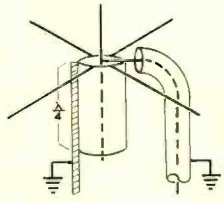


FIGURE 8

SAME AS FIGURE 7 BUT WITH RADIATOR AT GROUND POTENTIAL

SIX HUNDRED VOLTS

By JERRY CROWLEY,* W6HBT

The current safety campaign has done much to make the amateur conscious of the latent power of death in even the smallest of amateur transmitters.

Yet, a week ago I read in the Los Angeles *Examiner* of still another amateur found dead in his ham shack. The body was found by his wife; the hastily summoned doctor ascribed the death to electric shock. Just exactly what had happened it was impossible to discern, as has been true in almost every case of this nature.

There is a constant trend toward the incorporation of safety devices in the modern transmitters being built today, but all the safety devices in the world will not protect the *careless* amateur. I've heard it said, "There's no danger here; I only have six hundred volts on the buffer stage; the final is what I have to be careful of." Those fellows are the ones that should make sure their insurance policy is paid up to date.

Until last fall I felt much the same way about it. I held the average amateur's contempt for anything less than a thousand volts, and on several occasions had tangled with voltages up to fifteen hundred with no serious results. It is hard to believe that six hundred volts of direct current brought me closer to death than I ever expect to be again. Had I been alone at the time, I would be pushing up daisies now, instead of pushing these typewriter keys in the hope that some of you will take to heart the lesson I learned through *carelessness.*

I could be brief and say that I got tied up with six hundred volts and couldn't get away until a friend finally pulled out the a.c. plug, that I dropped to the floor, out cold, and that they worked over me for a while, and I came out of it all right. But what I want to bring out is just what happened, and why: those very things we try to guess when some unfortunate amateur is found on the floor of his ham shack, beyond all power of resuscitation.

The transmitter was to be a small one, ending up in a pair of TZ40 tubes. It was nearly finished, with just a little more work left on the buffer stage, a TZ20 with six hundred volts on the plate. My immediate problem was to adjust the links on the buffer plate coils to give me the same grid current to the final on all bands, from ten to one hundred and sixty. In the exciter stages of the rig I was using small air-wound plug-in coils.

I had the exciter chassis and the six hundred volt power supply chassis out of the rack and up on a long workbench. I was working at one end of the bench that morning, and possibly ten feet to my left Ron Eunson, W6ABK, was investigating the innards of an automobile radio. "Dow," W6LR, was in and out of the shop, and some other ham whose call I've forgotten was also there.

The chassis I was working on had its power supply connections brought out to the back in a Jones plug. Not having made up the connecting cables as yet, I was using several long rubber-covered test leads for connection to the power supply. The chassis rested on its side so the power supply connections could be clipped into the bottom of it, and in order to pull out the buffer plate coil to alter the turns of the link it was necessary to grasp the chassis in my left hand, and tilt it up enough to enable me to reach the coil with my right.

Each time I made a change in the link, and noted the new reading in grid current, I would dutifully turn off the plate switch before pulling the plate coil again. There were several toggle switches on the power supply chassis, and finally *carelessness* guided my hand to the exciter filament instead of the plate switch! I tilted the chassis with my left hand as usual, and grasped the coil firmly with my right.

Shades of Lot's wife! I stood there petrified; the muscles of my arms gradually contracting to pick the chassis up off the bench. Hot waves chased themselves through my chest, to be replaced by a feeling as though an iron band were being tightened around it! I tried to call out, but the words died in my constricted throat. I could see clearly: Ron was still working at the auto set, entirely unaware of the near-tragedy being enacted at his side.

[*Continued on Page* 87]

*1647 Golden Gate Ave., Los Angeles, Calif.

A Unique System:

"TOUCH TO TRANSMIT"

By J. E. WILLIAMS,* W2BFD

An inexpensively constructed overload protection system and a push-button control arrangement which does everything but put out the cat are highlights in this construction article by Mr. Williams.

The accompanying diagram shows the electrical "works" of a control system now in use at W2BFD which allows the operator to turn on the transmitter filaments, throw the carrier on and off and/or reset any circuit breaker which may have been thrown out by a temporary overload. This is accomplished with but one toggle switch and one "momentary" type push button in a control box at the operating table. A set of small colored bulls-eye lights is also incorporated to indicate what operations have taken place.

A green light shows that the filament toggle switch has been closed. After about a minute, the glow of a yellow light informs the operator that the rectifiers are warmed up and it is safe to apply plate potential. A touch of the push button throws on the high voltage and illuminates the red lamp. Pushing the button again removes it. Should a momentary overload occur, the breaker relay will kick out, and the red light will be extinguished. To reset the breaker, it is merely necessary to touch the same button. A second touch will put the carrier back on the air.

The three a.c. relays and the thermal time delay switch, together with a small step-down transformer to operate the filament relay, were procured ready-mounted on a small panel from a local oil-burner repair shop. This assembly, which was made by the Minneapolis-Honeywell Co., is now considered obsolete by oil-burner men, and should be obtainable for about $5.00. The thermostat was made to "break circuit" upon heating, and so will have to be altered to "make circuit." This is accomplished by reversing the

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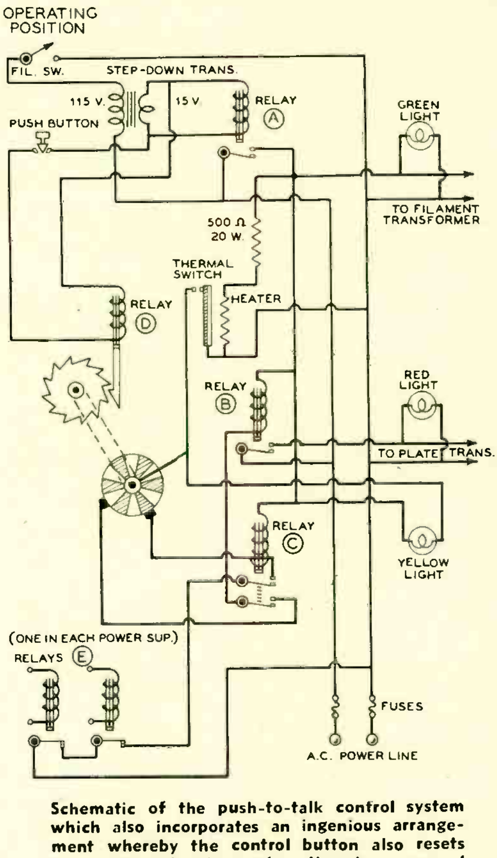
*38-06 Sixty-first St., Woodside, N. Y.



Schematic of the push-to-talk control system which also incorporates an ingenious arrangement whereby the control button also resets the overload breakers when they have opened due to a sudden surge. Relay (A) is a 110-volt a.c. operated unit for filament control; (B) is of the same type but controls the plate power; (C) is a 110-volt a.c. operated interlock relay; (D) and (E) are special types and are treated in the text.

Stabilizing the Power Type E. C. O.

By CLIFFORD E. BERRY,* W9TIJ

The current trend toward self-controlled and readily adjustable oscillators for amateur use, together with recent FCC rulings, makes it increasingly important that those oscillators be of the utmost stability. The purpose of this article is to describe a method of improving the stability of the ordinary electron-coupled oscillator.

The Conventional Circuit

Consider figure 1, which is a diagram of the conventional e.c.o. It will be observed that the control grid, screen grid, and cathode of the tube are connected in a Hartley circuit, with the screen as the anode but at ground potential for r.f. in order to obtain screening action. The electron stream to the plate is controlled by the oscillating portions of the tube in such a way that power at either the fundamental frequency or one of its harmonics may be obtained from the plate circuit.

There are two reasons why this circuit is inherently more stable than the simple Hartley. First, changes of screen and plate voltages in the same direction and of the same percentage tend to cause opposite changes in frequency. Second, because of the screening action within the tube, there is presumably no coupling back from the plate circuit, or output circuit, to the grid-cathode-screen circuit, which determines the frequency; thus, changes in plate loading or tuning cannot affect the frequency.

The second point contains the joker, however, because in all but a few tubes, and particularly in those capable of delivering a reasonable amount of power, the grid-plate screening is not adequate at the higher frequencies. The result is severe interaction between plate loading or tuning and the grid circuit. This may, and often does, result in chirps or frequency modulation if the following stage is keyed or modulated, or it the following stage is improperly neutralized and drives a keyed or modulated stage.

Neutralizing the Oscillator

A method of obviating, or at least minimizing, the effect of insufficient screening is to neutralize the grid-plate capacity of the tube, exactly as in an r.f. amplifier. This may sound paradoxical, since neutralizing is commonly thought of as preventing oscillation, but remember that the plate in an e.c.o. is not a part of the oscillating circuit. Figure 2 shows such a neutralized oscillator; the neutralizing scheme is conventional in every respect. Since operation over a wide range of frequencies and several bands may be required, the use of a split-stator tank condenser is advised. With this, the neutralizing adjustment need be made only once. One

[*Continued on Page 86*]

* 611 Burnett Ave., Ames, Iowa.

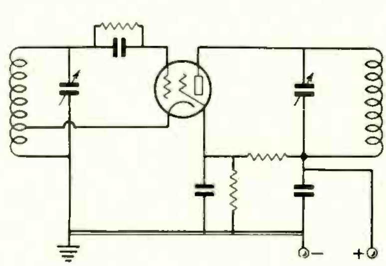


Figure 1. Conventional electron-coupled oscillator circuit.

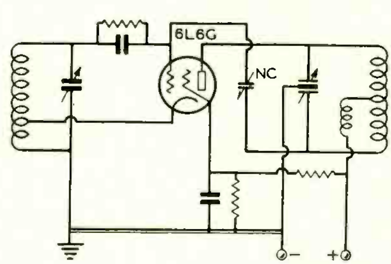
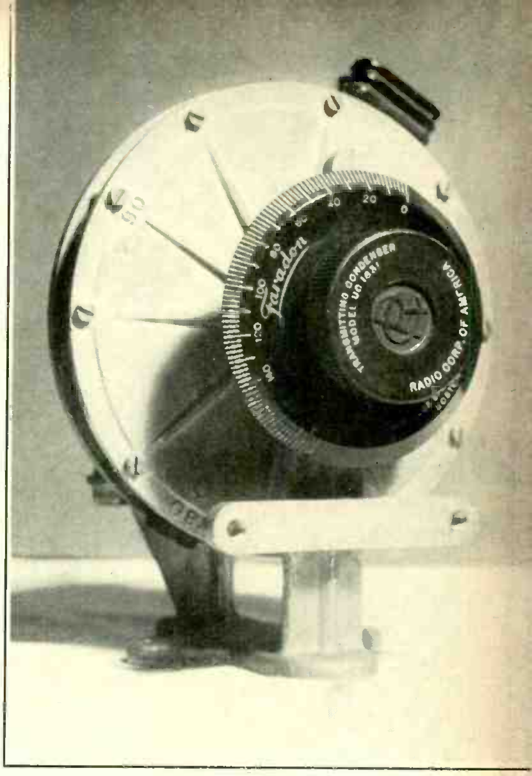


Figure 2. Electron-coupled oscillator using a 6L6G with the neutralizing circuit added.



"Dusting off the old ones," a mercury variable condenser of the early 1920's.

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W8BTI	39	147
W6CUH	39	143
W6KIP	39	143
W8OSL	39	143
W6ADP	39	140
W6BAX	39	140
W4CBY	39	138
W6DOB	39	138
VK2EO	39	133
W3EVT	39	131
G5BD	39	131
W6QD	39	130
W2GWE	39	129
W6KRI	39	129
VE4RO	39	126
W4CYU	39	126
W7BB	39	123
W6HX	39	123
G5BJ	39	120
W2IYO	39	119
W2CYS	39	117
G2LB	39	115
W4IO	39	115
W7DL	39	115
W6FZL	39	112
ON4FE	39	110
W6FZY	39	109
W6SN	39	95
W6GPB	39	94
XE1BT	39	90
K6AKP	39	67
W1CH	38	150
W2BHW	38	149
W1BUX	38	145
W2GT	38	143
W5VV	38	143
W2GTZ	38	141
W2GW	38	140
W3EMM	38	139
W8BKP	38	138
W3HZH	38	137
W5BB	38	134
W9GDH	38	134
W3HXP	38	133
W8LEC	38	131
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W2GVZ	38	131
W9FS	38	130
W9TB	38	130
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W3DDM	38	116
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W8EUY	38	112
W2BXA	38	111
W6GRX	38	111
W3FQP	38	111
LY1J	38	110
W6HZT	38	110
W1AQT	38	109
W8KWI	38	108
ON4HS	38	108
W8JIN	38	107
W8BOX	38	106
W9ADN	38	106
W9KG	38	106
W9CWW	38	106
W8OE	38	106
ON4UU	38	104
W9PK	38	104
G2IO	38	103
J2KG	38	95
G6XL	38	95
ON4FQ	38	92
W8GBF	38	87
W9VDQ	38	79
SU1WM	37	138
W6GAL	37	131
W8KKG	37	127
W7AMX	37	125
J2JJ	37	123
W2IOP	37	122
W1RY	37	117
W3GHD	37	116
G6NF	37	115
W8ZY	37	114
W9RCQ	37	114
ON4FT	37	112
W9RBI	37	112
W6LYM	37	111
W3TR	37	111
G6CL	37	110
VE2EE	37	108
W9ELX	37	106
W1AB	37	105
W4MR	37	104
W9PTC	37	103
W6ITH	37	103
W3FJU	37	103
W9GBJ	37	103
G6GH	37	102
W3AYS	37	102
VK2DA	37	101
W6FKZ	37	101
W6JBO	37	101
W3KT	37	101
W8KPB	37	100
W4DMB	37	100
W9AJA	37	99
W4EQK	37	99
ON4VU	37	99
W3EXB	37	98
ZL2CI	37	97
W6MHH	37	95
G2UX	37	91
W2BSR	37	90
W9NRB	37	86
W6MCG	37	84
W9UBB	37	77
W2GRG	36	123
W8AQT	36	120
W6MVK	36	117
W2BJ	36	116
W6MEK	36	112
W8ISU	36	109
W6BAM	36	106
W8DOD	36	106
W9AFN	36	105
W8QDU	36	105
SP1AR	36	103
W5ASG	36	104
W5PJ	36	103
W8PQQ	36	103
W6NNR	36	100
W6KWA	36	99
W8LZK	36	99
G6BJ	36	99
VE1DR	36	98
W8AAT	36	96
W6DLY	36	96
W3BEN	36	96
ZL1HY	36	95
G6YR	36	94
W7AYO	36	94
VE5AAD	36	92
W9KA	36	92
W2IZO	36	92
W5ENE	36	91
W4ADA	36	90
W9LBB	36	90
W8JAH	36	89
W1APU	36	89
W9GKS	36	88
OK2HX	36	86
VK2NS	36	84
W6TI	36	80
W9GNU	36	80
W6GCX	36	76
W7DSZ	36	73
W2GXH	36	71
W8OXO	35	113
W8LFE	35	108
W6GHU	35	103
W4QN	35	103
W8OUK	35	99
W8CJJ	35	98
W6HJT	35	98
W2WC	35	98
OK1AW	35	96
W8AAJ	35	96
W3RT	35	95
W9EF	35	94
G6QX	35	94
W6AQJ	35	92
VE5ZM	35	92
W8LDR	35	91
LU3DH	35	89
K6NYD	35	86
W6KQK	35	85
W9ERU	35	83
W6ONQ	35	83
ON4NC	35	82
GI6TK	35	80
W4ELQ	35	80
W6HEW	34	103
W9PGS	34	103
K7FST	34	102
W6NLZ	34	101
W8BSF	34	100
W2BZB	34	99
W1APA	34	96
VK2AS	34	94
W8HGA	34	93
W8OUK	34	91
W8NV	34	91
W2FLG	34	89
G6WB	34	88
W6CVW	34	88
VK2OQ	34	87
G5VU	34	85
W9BCV	34	83
ZS1CN	34	82
VK2TF	34	81
W6MJR	34	81
W6PNO	34	81
ON4SS	34	80
W6HIP	34	76
VK2TI	34	75
W7AVL	34	75
W8JK	34	75
ZL2VM	34	72
W6LHN	34	71
VK2AGJ	34	70
VK2EG	34	70
VE5MZ	34	69
W8QIZ	34	68
VK2VN	34	63
W9QOE	34	56
F8XT	33	112
W8ACY	33	106
W6GK	33	101
W6KEV	33	96
K4FCV	33	96
W8BWC	33	93
W8CED	33	94
W6MEK	33	91
W9VKF	33	91
W6KUT	33	90
W8LFE	33	89
W6CEM	33	88
W9TJI	33	88
W3DRD	33	87
W6ANN	33	86
W8BWC	33	85
W8MFB	33	85
W6POZ	33	84
W6TE	33	84

PHONE

	Z	C
W3LE	38	121
F8UE	38	103
W6OCH	36	105
W6ITH	36	97
W3FJU	36	87
VE1CR	36	81
W9NLP	35	95
W9TIZ	35	93
KA1ME	35	79
F8VC	35	78
W4CYU	34	93
W6EJC	34	84
W7BVO	34	80
W4DAA	34	71
W1ADM	33	88
W6NNR	33	88
F8XT	33	70
W3FAM	33	68
W6MLG	32	92
W2IKV	32	90
ON4HS	32	89
W9QI	32	86
W8QXT	32	85
G5BY	32	85
W9BEU	32	85
W4DSY	32	84
VK4JP	32	84
W6IKQ	32	72
W6OI	32	68
VE1DR	32	59
W3EMM	31	88
W1AKY	31	87
W8LFE	31	85
G6BW	31	83
G3DO	31	78
W6FTU	31	77
G8MX	31	73
W2GW	31	68
W6AM	31	67
W8RL	31	67
W9UYB	31	66
F8KI	31	58
W9ZTO	31	53
W1JCX	30	81
W2AOG	30	77
W9BCV	30	68
W6MZD	30	52
W2IXY	29	93
W8LAC	29	81
W4BMR	29	80
W1HKK	29	77
W6NRW	29	60
KA1CS	29	59
CO2WM	28	73
W9RBI	28	70
W8AAJ	28	66
K6NYD	28	66
W6PDB	28	65
W7EKA	28	63
VE2EE	28	62
W4DRZ	28	62
W1BLO	28	62
W6NLS	28	61
VK2AGU	28	61
W6GCT	28	56
W2HCE	27	76
W2GRG	27	73
W2IUV	27	68
G6DT	27	59
W5CXH	27	52
G5ZJ	26	77
W5ASG	26	62
W8NV	26	62
W4EQK	26	61
W8QDU	26	61
W5DNV	26	60
W5VV	26	59
VK2OQ	26	56
W4TS	26	54
W6MPS	26	51
VE4SS	26	50
W6FKK	26	47
K6LKN	26	46
G6CL	26	46
W3FQP	25	65
W8NYD	25	60
VK2TR	25	56
W8JK	25	47
W7AMQ	25	40

DX AND OVERSEAS NEWS

by Herb. Becker, W6QD

Send all contributions to Radio, attention DX Editor, 1300 Kenwood Road, Santa Barbara, Calif.

When the war first broke out it seemed we might just as well call off the contest, because we figured that a large percentage of the dx would not be on the air, and because it appeared as though it would not be a good time to encourage intense operating activity, even if for only two week-ends.

However, after talking with several dx men after the conflict had been in progress a while, we discovered that the consensus seems to be that while it won't be so much fun to go "dx hunting" with quite a bit of dx off the air, a dx contest would be as much fun as ever, because the reduced amount of "available dx" would work an equal hardship on everyone. Actually it might be more fun, because there would be less QRM with which to contend.

It also appears that while a large number of countries are not on the air, the curtailment of dx has not been as widespread as was first anticipated. Many of the countries which we suspected would shut down their amateurs evidently have not done so, because at the time of this writing they are still heard on the air.

As for the increased foreign operating activity, it would seem that W amateurs are less likely to get themselves in trouble exchanging serial numbers with foreign stations than in discussing the war with other amateurs in the U. S. A. Judging from past A.R.R.L. contests there is small likelihood of amateurs taking time to do any more than exchange numbers; no amateur can afford to take much time to converse with dx stations if he is intent upon running up a high score.

So, after considering all the aspects, it was decided that there was no good reason for not holding the contest, and that there was no reason the contest wouldn't be just as much fun even if dx is a little more scarce.

Observe Neutrality

No doubt you have read the proclamation of American neutrality. Naturally this is of particular significance to us because of our international contacts. We all want to protect our own ham radio. It is felt with reasonable assurance that no government restrictions will be put on us *PROVIDING* we actually keep neutral. It depends on us, as far as the amateur bands are concerned; therefore we recommend, first, that all international contacts be along technical or experimental lines, and second, that no news or happenings that may have military significance be discussed even in this country. Remember that our signals may be received by belligerents.

Let's keep the hams on the air in the United States. Be neutral. The safest thing of course is to avoid any conversation whatsoever about the war. There is plenty to talk about besides that. The government will be giving closer scrutiny to all amateur bands; so let's be on our best behavior.

1939 DX MARATHON

C. W. and PHONE

Call	Z	C	Call	Z	C	Call	Z	C	Call	Z	C
VE4RO	38	112	W4FVR	34	81	W2GVZ	31	69	W8LFE	30	78
W9TB	38	109	G2FT	34	76	W9ERU	31	68	W6NNR	29	73
W9TJ	38	104	W9NRB	34	68	VK2EO	31	67	W1JCX	29	72
W4TO	38	99	W5ASG	33	85	W6TE	31	64	W1AKY	29	71
W8BTI	37	112	W6NLZ	33	82	G3AH	31	63	W1ADM	29	64
G5BD	36	110	W2IZO	33	80	W8AU	30	61	ON4HS	28	72
SU1WM	36	102	W4QN	33	79	W6OLU	31	58	W2IKV	28	68
W3EPV	36	100	W9GKS	33	75	G2QT	30	46	W1HKK	28	66
W9GDH	36	100	W9CWW	33	70	W1IED	30	43	W3FJU	28	60
W3HXP	36	86	ON4HS	32	91	W5EDX	30	42	W7BVO	28	57
W9ELX	36	86	W9VKF	32	86	K4FCV	29	84	K6NYD	27	63
W6MEK	35	103	W3HZH	32	81	D4QET	29	72	W6EJC	27	59
W9RBI	35	101	W3FJU	32	81	**PHONE**			W6PDB	27	59
W2AIW	35	93	W4FIJ	32	80	W9BEU	32	83	G3DO	26	57
W6SN	35	63	VE5ZM	31	87	W8QXT	31	78	CO2WM	26	55
W8LFE	34	101	W8CED	31	80	W6ITH	31	71	W4DRZ	25	62
G2ZQ	34	94	W8BWC	31	78	F8UE	31	71	W8BTI	25	59
W5PJ	34	88	W1RY	31	76	F8VC	31	55	W2AOG	25	55
K6NYD	34	83	W1BGC	31	75	W6OCH	30	80	W9RBI	25	54

Phone and CW Chatter

W8LFE wields a wicked mike when operating on phone but he's a sort of versatile guy and never let it be said that he doesn't know the code. At quite regular intervals Bob forsakes phone for a little of the "dah-dit" type of dx. New ones for him on c.w. are LY1AH 14,385 kc.; ES5C 14,355; and the new countries on phone are YR5VV 14,400; and CP1BA 14,055. His zones are at a standstill, which leaves him with 35 and 108 total. On phone only Bob rates 31 and 85. Here's a little phone dx that Bob sends in along with frequencies: YN1IP 14,010; TI4JG 14,060; CE3CG 14,020; CE1AM 14,010; CE1BC 14,040; OQ5AE 14,400; OQ5AA 14,070; LU2DG 14,130; SM7NU 14,050; SM6WE 14,260.

G6NF reports that he is up to 37 and 115. G3DO on phone adds a few zones and countries, XE2FC, XZ2BH, KA1CS, PY2BH, FN1C and LU2FI. I would say that Doug made quite a haul and his efforts total to 31 zones and 78 countries. G3DO's Marathon showing is up also and now registers 26 and 57. Apparently the chief reason for this sudden burst from G3DO is due to a new rotary beam erected in July.

G6QX gives again—this time with a flock of nice ones—VQ2GW, VQ3HJP, VQ8AF, CR4HT, CR4MM, CR6AI, CR7AF, CR7BN, VP4TO, VP7NT, ST6KR, and W6QQL in Nevada. Bob relates how he worked LZ1HL, supposedly in Bulgaria, but his card came back "inconnu." There is apparently only one good LZ according to Bob and that is LZ1ID. G6QX lost his 46-foot poles and for an antenna he has been using a 66-foot end fed, 9 feet above ground. F8VC made the most of his time and has worked VE5AHU and CR4MM for new zones which brings Gene's total to 35 and 78 on phone. His Marathon figures show at 31 and 55.

ON4HS says that he has not as yet received word from AC4YN in order to determine whether or not he worked the real AC4YN. We hope that he did work him, but apparently he is a little doubtful about it. ON4HS reports the 20-meter band as "generally rotten." There are others who will say the same no doubt. Simmons has boosted his total zones to 36 and countries to 108, while on phone he has 32 and 89. ON4HS is also active in the Marathon and has 32 and 91—and again on two-way phone he has 28 and 72. He reports that W7DX usually comes through a full hour before his own signal is heard by 7DX. He wonders why that should be. Just an off-hand guess would be that 7DX is using probably 8 or 10 times the power input, and then

RADIO's WORLDWIDE DX CONTEST RULES

1. Contest Period: 0200 G.m.t. November 25 to 0200 November 27 and 0200 December 2 to 0200 December 4.
2. Contacts: Contacts between amateur stations on different continents shall count 3 points; contacts between amateur stations on the same continent but not in the same country shall count 1 point. Contacts between stations in the same country for the purpose of obtaining multipliers shall be permitted but no points will be allowed for these contacts.
3. Multipliers: Two types of multipliers will be used; (1) a multiplier of 1 for each zone contacted, (2) a multiplier of 1 for each country worked on each band.
4. Bands: The contest activity will be confined to the 7. 14 and 28-Mc. amateur bands.
5. Divisions: The competition will be divided into *two* divisions, c.w. and phone. Each of these two divisions will be divided into *two* sections, the one-operator and the more-than-one-operator section. Thus there will be: (1) one-operator c. w. section and (2) more-than-one-operator c. w. section; (3) one-operator phone section and (4) more-than-one-operator phone section. Stations in each section will compete for awards only with others in the same section.

   C. w. stations must work c. w. stations and phone stations must work phone stations only. However, stations in the one-operator section and stations in the more-than-one-operator section of both the c. w. and phone divisions may contact each other. Stations may enter in more than one section but separate logs must be submitted for each section.
6. Equipment: Competitors may use the maximum transmitter power permitted under the terms of their licenses. Competitors in divisions (1) and (3) may not use more than one transmitter. Competitors in divisions (2) and (4) may use any number of transmitters. Any number of receivers may be used in any of the four divisions.
7. Serial Numbers: C. w. stations will exchange serial numbers consisting of six numerals, the first three being the RST report and the last three being the contact number (001, 002, 003, etc.). Phone stations will exchange numbers consisting of five numerals, the "T" report being omitted.
8. Scoring: The total contest score will be the sum of all contact points multiplied by both the zone and country multipliers.
9. Awards: Winners in each division in each Call area in the United States and in each licensing district in Canada, Australia, and New Zealand and the winner in each division in each other country will be given certificates in recognition of their accomplishment.
10. Eligibility: The contest will be open to all amateurs except employees of RADIO, Ltd.
11. Disqualification: Falsification of logs in any manner will be cause for disqualification. The decision of the judges will be final in all cases.

SAMPLE LOG RADIO WORLDWIDE DX CONTEST
W1XYZ—One Operator C. W. Division

Date	Time	Station	Country	Zone		Country Multiplier for each band			Serial No.		Points
				No.	Total	7	14	28	Sent	Rcvd.	
Nov. 24	11:00 p.m.	PK1MF	Java	32	1		1		589001	589009	3
"	11:20	OZ4H	Denmark	14	2		2		589002	579042	3
"	11:25	LA2X	Norway	14	2		3		579003	569006	3
"	11:45	ON4AU	Belg.	14	2	1			579004	579010	3
"	11:50	W9TJ	U. S. A.	4	3	2			599005	599081	0
Nov. 25	12:05 a.m.	W7AMX	U. S. A.	3	4	2			599006	599014	0
"	12:30	KB6ILT	Guam	27	5	3			589007	589021	1
"	1:10	KA1HR	P. I.	27	5	4			569008	569038	3
"	7:00	ZE1JR	S. Rhod.	38	6			1	569009	569011	3
"	7:45	ON4AU	Belg.	14	6			2	579010	569008	3
"	7:50	SU1WM	Egypt	34	7			3	589011	579031	3
"	8:15	XE1A	Mexico	6	8			4	589012	589070	1

Total—26

Country multiplier 4 + 3 + 4 = 11
Zone multiplier 8
Contact points 26
Total score 26 × 8 × 11 = 2288

too, the antenna setup may be ideal on 7DX's end of it. Another very consistent station in the eyes of ON4HS is W7BVO. ON4HS is using a TZ40 at present with about 60 watts input.

VE4RO sends in what probably will be his last report for some time. Of first importance is George jumping into the lead in the 1939 Marathon with 38 zones and 112 countries. George also has upped his Honor Roll totals to 39 and 126. A few of the new ones are VP8AA, OQ5AE, VU7BR, VQ3HJP, HB1CE, YN9G, UX1CN, J9DA, KB4FCS, VK4KT, MX5B. VE4RO has a few more in the bag but is not quite sure how good they are, but is hoping they turn out as OK.

To the Gang Overseas

It may be some time before many of you fellows will again turn in a report on your dx. We hope that it will not be too distant and in the meantime, this department wants those overseas to know that it will be especially glad to hear from all of you from time to time. Even though your amateur operating has been suspended, it will be interesting to hear from you, giving us a little information about yourselves. I know the rest of the gang will appreciate a bit of news now and then. Remember, this is your column and I feel that we have quite a close fraternity of regular readers of "DX" and it might be the only way in which you can keep tab of one another.

Well, here we have W9VDX with his latest—YR5CF 14,365; KB4FCS 14,400; and KA7EC 14,360. This gives Charlie 33 and 79. W5PJ is still pounding brass and his catches are KH6KKR 14,350; I7AA 14,400; HB1CE and ST6KR. Ken now has 36 and 103 while in the Marathon it looks like 34 and 88. W6QL kicks through with an item of interest to those who are trying to work a y.l. on every continent. This one is ZS1DB and she operates c.w. W7FTM writes that KF6QMQ on Canton Island is on nearly every p.m. on 7104 or 7252 kc. He is an op with PAA. Here's another W9—and it's W9WCE. He has a few new ones, some of which are J6DU, I1MZ, KB4FCS, U9AW, HA2N, ES5C, LY1AH, GW3QN . . . and now Johnny has 26 and 53 in the Marathon, and 29 and 70 in the Honor Roll. Oh, 'twill never do . . . another nine pops up—W9GKS with 36 and 88 while the Marathon score is 33 and 75. His new ones are PK1TM and UK6AA.

W8OUK is smiling again after landing a new zone and a few new countries. VS6BE was his no. 35 and the others were YN9G, HB1CE, KB4FCS and VP6MY, giving Red 99 countries. W6NLZ had a close one when he worked XU4TT and then found out that he was 50 miles from Zone 23. W2BMX is up to 118 countries with CR4MM, KB6ILT, VK9XX, HB1CE and VU7BR helping out. Prose claims his "pal" W8AU is getting lazy. All he has to do is to whistle "Yankee Doodle" twice daily into the mike for a modulation test. You see, W8AU is the chief technician at the Utica P. D.

Speaking of phone, there is W9UYB who has not been letting things happen without his knowing about it. At present Frank has worked 31 zones and 66 countries on two-way phone. W9BEU takes the phone lead in the Marathon with 32 zones and 83 countries. W8QXT is right behind him 31 and 78. That represents a lot of good dx work for 1939. W9BEU has just a couple more countries in his Honor Roll list—32 and 85. Elmer's newest are SV1KE, VQ8JM, CP1BA.

W6TE is up to 33 and 84 and a few that helped are KB4FCS, CP4ANE, and OQ5AE. W6TE has 31 and 64 in the Marathon. All of this on c.w. for 6TE. K6PSB has a new 3-element rotary up and has been knocking off

Frank Swan, KA1CS, and his pet rooster work a little dx. The rooster sometimes takes part in QSO's, and when he does the rig really modulates.

a few recently—ES5C, LA1RA, GM8MQ, XZ2TM, VS6AG, and VS6AF. These were on c.w. I presume. A line from Johnny Hunter, G2ZQ, tells us that he is up to 148 countries—and you know that Johnny is one of two who have worked all zones. His Marathon is at 34 and 94.

W8BTI has 37 zones and 112 countries in the Marathon—and, oh yes, Carl is on phone too, with 25 zones and 59 countries. W1AKY has been doing some good phone dx with the results showing in his 30 and 86, and the Marathon stands at 29 and 71. His latest was VU2FA who was located about 100 miles from Tibet. Ed gives a few phone frequencies—ES4G 14,080; J5CW 14,060; CX2BK 14,116; OQ5RT 14,040; HA8Q 14,045; LA8J 14,120; OQ5AA 14,045; I1TKM 14,020; SM6VX 14,095; OZ7HL 14,125. He then lists his pal W1JCX "just outside the band." Guess he must mean because he has just recently married. Or I dunno maybe it's something else.

W4TO is sailing along in the Marathon very well and has 38 zones and 99 countries to show for it. W9PK is figuring upon spending a busy winter sending out QSL cards. Jack says that he owes plenty and everyone who has one coming will get it. Jack, also, has snagged a few new ones: J8CA 14,385; J2KN 14,400; VS1AR 14,400; ES5C, PK1TM and VP4TR. This activity brings Jack's total to 38 and 104—and I get a kick out of the remark 9PK makes about his power. Says he runs from 140 to 800 watts input—depending upon the blink of the lights. The nines seem to have the floor, as here is W9GDH with a swell Marathon total of 36 and 100. Johnny has increased his Honor Roll standing to 38 and 134, and those whom he owes a vote of thanks to are TG9BA, VQ8AT, G8MF, HB1CE, VU7FY, HS1BJ.

W6PNO, who lives in a little town near here called Tujunga, seems to have a pretty good dx location. Roy has 29 zones and 60 countries in the Marathon and 34 and 81 for the Honor Roll. His latest new ones are LY1J, VO1B, HB9AW, VK9VG, GI5QX. Received a letter from some guy in Detroit saying that he has 37 zones and 107 countries now—but the sad part of it is he didn't sign his name, call or address. I might hold this for a guessing contest, which after all might be a lot of fun. Anyway he gives the QTH of MX3A as: H. Matsui, via MX3H Qsl Bureau, P.O. Box 30, Shinkyo, Manchukuo. W8QIZ worked EI6G, CR4MM and CR7AK, which gives him 34 and 69. W6BIL has 25 zones and 43 countries in the Marathon. He is radio tech with the P.D. at Porterville, California.

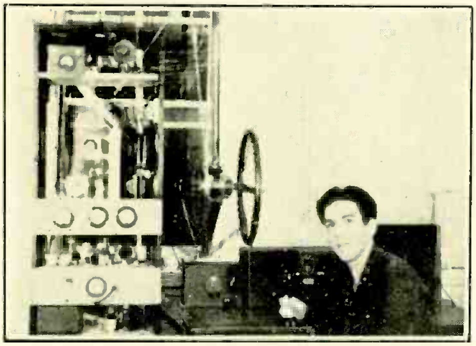
W4FVR, and in case you have forgotten he is ex-W2AAL, has not been idle at his new location at Charlotte. Al has accumulated 34 zones and 81 countries in the Marathon while his Honor

Roll totals show up at 38 and 129. New ones for Al are VU7BR, CR4MM and PK6XX. W4FVR reports the new QTH of KA1HR as follows: Major Simpson, Fort McKinley, Rizal, P. I. W8BWC is up to 33 and 93 now with 31 and 78 in the Marathon. W8JSU got a good one the other day in LX1RB, who is supposed to be the only LX on c.w. His frequency is between 14,368 and 14,375 kc. Charlie is now holding up 36 zones and 109 countries.

W5VV, who still manages to hold up a couple of rackets—one of 'em being tennis and the other ham radio—insists he doesn't know which is the lesser of the two evils. Wilmer has hooked a few new ones on c.w. lately, bringing those figures up to 38 and 143. The latest are: FT4AG 14,400; VS1AP 14,380; CR4MM 14,400; KB4FCS 14,390; and HB1CE. W5VV meekly admits adding a few to his phone score, which now looks like 25 zones and 59 countries. W6SN enters the Marathon list with 35 and 63. Bill also has added a couple to his Honor Roll score resulting in 39 and 95—the new ones being HB1CE and U2NE.

W1GDY is still at 'em and by working VU7BR he has 38 and 118. Herb has 105 cards out of the 118 worked. His newest are VU7BR, CR4MM, ZP2AB, HB1CE, and KB4FCS. W2LMN has just completed his first year as a ham. During the year he has had 1626 QSO's, 1186 of which were W and VE stations, 187 with G's, and the remainder with other dx stations. Ed has worked 28 zones and 65 countries, and probably the most important part is that he hasn't ever used more than 50 watts. It's an 807. W8OSL seems quite happy about several things, and mostly because he hooked KH6KKR, HB1CE and VS1AP and then last but not least VQ5WES 14,045. These give Jule 39 and 143. The QTH of VQ5WES is supposed to be Box 81, Kampola, Uganda. Jule also adds that W8CRA is rebuilding, and that it was a funny thing that W8JMP christened an XEC the same day his x.y.l. presented him with a Jr. op. Well, congratulations to JMP.

After many months W2IOP tells us that he is still active. We are very glad to hear that



A familiar call from New Orleans is W5CXH. The steering wheel aims a three element rotary at dx and way points.

Larry hasn't fallen by the wayside. W2IOP has a y.l. by the name of Priscilla—and from what we can gather she just loves ham radio. She sends all of Larry's QSL cards for him and they never fail to bring replies—sometimes as many as three cards in return—one for her, one for Larry and another for good luck. W2IOP says she is R99 plus—and my guess is that when they start talking about R99 y.l.'s we are just about seeing the end of a good dx man. Larry has 37 zones and 122 countries, is running 500 watts into a pair of 100TH's and the receiver is an NC-101X. I don't get it but he closes his letter with "Women and QSLs, they are both Provoking."

W9RBI apparently has had those phones clamped to his ears lately because his Marathon total is up to 35 and 101, and 25 and 54 on phone. In the Honor Roll, Ross has 37 and 122 total, and for phone only it is 28 and 70. Ross' latest c.w. includes J8CA 14,392; XU8CM 14,350-380; J2KN 14,400; LY1KK 14,360; HB1CE; YR5EF 14,350; PZ1AB 14,396; CR4MM 14,400; YU7BJ 14,395. Newest on phone are ES5D 14,050; VK9VG 14,115; and J5CW 14,077.

W9QI catches two new zones and 5 new countries. Larry now has 32 and 86 on phone, and the ones that helped are LY1J, J5CW, XU7HV, VQ8JM. W6PDB finds time to get on the air when he isn't catching up on other things and to show for his time Ken has 28 zones and 65 countries. In the Marathon he has 27 and 59. W4BMR recently hooked VQ8JM, which gives Dave 29 and 80—and then, too, he has a new 3 element rotary 75 feet in the air.

W6OCH must have been yelling pretty loud because he surely has boosted his totals. Larry must have had his window wide open so they could all hear him, because with 36 zones and 105 countries, someone has to make some noise. W6OCH says his new ones include VK4HN, VP2LC, EK1AF, CT2BP, ZB2B, FN1C and VR4RT. His Marathon is also plenty good with 30 zones and 80 countries—all on two-way phone, of course.

G8MX did himself proud when he worked K6NYD on 14 MC. phone. He has been after a K6 for over a year and the time he hooked him was 0645 G.m.t. Now his Honor Roll score looks better with 31 zones and 73 countries on phone. It has been a long time since we have heard from W9BCV but he has added a couple of zones making a total of 30 and 68 on phone. W9BCV uses a homemade 3 element rotary and runs 500 watts into a single 250TH.

G5VU brings his listing up to 34 and 85, with the new one being CR4HT. 5VU has been trying to get a card out of K7UA but with no success. He needs Zone No. 1. Here's an interesting little item submitted by W5ESB—"*W5GZK*, Harral Allen of Ada, Oklahoma, and *W5GKZ*, Paul Wolfe, of Ft. Smith, Arkansas, made contact on 10 meters during the afternoon of August 28, 1939. This QSO completed the working of all states by both hams. After the 10 meter band folded up they adjourned to 160 meters where

[*Continued on Page 90*]

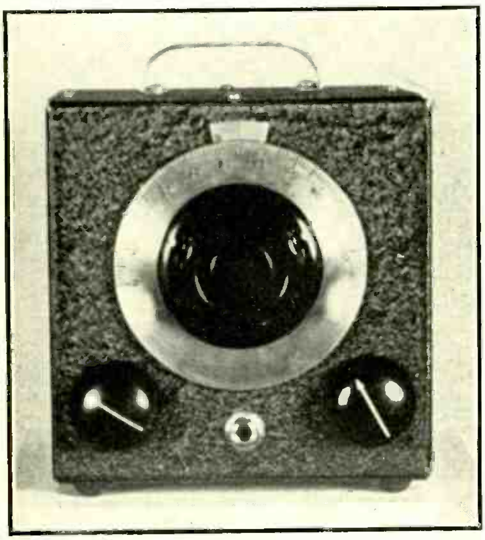
C. W. MONITOR-FREQUENCY METER

By L. V. BRODERSON,* W6CLV

Although this inexpensive freqmeter-monitor is being shown in the Newcomer Department, it would make a very worthwhile addition to the station equipment of many advanced c.w. operators who are without such an instrument.

It is lamentable but nevertheless true that many amateur c.w. operators have no means of monitoring transmissions or checking their transmitter frequency other than by employing their station receiver for this purpose. In many cases it is neither convenient nor practical to do this. It is hoped that the instrument to be described will correct this situation. Although of simple design and easy construction, it will enable the amateur operator to comply with FCC regulations regarding frequency measurement.

* 515 Salinas Nat'l Bank Bldg., Salinas, Calif.



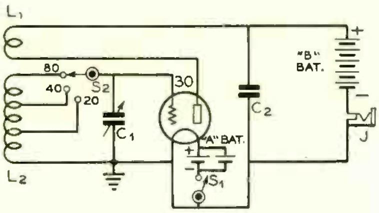
Front view of the compact bandswitching monitor showing the engraved metal dial with the vernier above it which assists in accurately calibrating the unit.

Heretofore, the trend in the construction of a monitor-frequency meter has been either to use separate plug-in coils for each amateur band, or a single coil operated fundamentally at the lowest desired frequency and on its harmonics at the higher frequencies, or a variation of these two methods. The former is usually frowned upon inasmuch as the coils are being constantly mislaid and repeated handling introduces errors in calibration. The harmonic operated instrument invariably emits a strong signal on its fundamental, the intensity of which decreases as the higher frequencies are approached.

The monitor-frequency meter to be described features but one coil for fundamental operation on the three most popular amateur bands, 3.5 Mc., 7 Mc., and 14 Mc. The generated signal is of equal intensity on all frequencies. Properly constructed, it is capable of being accurately calibrated. Employed as a monitor, it is an indispensable adjunct in detecting those undesirable characteristics of a keyed transmitter.

The Circuit

The circuit itself is extremely elementary. All parts not absolutely essential for efficient performance have been omitted. A grid coil tapped for fundamental operation, and a single plate winding for all frequencies simplifies construction. Filament current to the type 30 tube is supplied by connecting two 1.5-volt flashlight cells in parallel. Although rated at



Wiring diagram of the bandswitching monitor.

C_1—15-μμfd. midget variable	S_2—Rotary Selector switch
C_2—.002-μfd. mica	J—Closed-circuit jack
L_1, L_2—See coil diagram	A batt.—2 flashlight cells in par.
S_1—Rotary filament switch	B batt. — 22.5-volt midget

2.0 volts, .06 amps., this tube oscillates very satisfactorily at 1.5 volts. However, a 1.4-volt 1G4G may be substituted for the 30 tube. A midget B battery of 22.5 volts completes the power requirements. With normal operation these batteries will function well over a year before replacement is necessary.

Construction

Of prime importance to the builder is the fact that, with the exception of a good vernier dial, no special or expensive parts need be purchased. It is quite likely the majority of parts will be found already at hand. A vernier dial capable of reading one part in a thousand (one tenth of a dial division) is to be recommended if accurate readings are to be taken.

All equipment is enclosed in a black crackle-finish metal cabinet only six inches square. Top and bottom plates are removable. The three-inch chromium-plated handle mounted on the top lid may be obtained from any hardware store. On the front panel is centered the four-inch vernier dial for the 15-μμfd. grid tuning condenser. The lower panel space from left to right holds the on-off rotary filament switch, a single closed circuit headphone jack and the rotary band-selector switch. In addition to presenting a symmetrical appearance, the placement of these parts insures extremely short and rigid leads. It will be noted that all front panel parts, with the exception of the rotary selector switch, are at ground potential. To those averse to drilling metal, it may be an incentive to state that there are only ten small holes to be drilled in the steel cabinet.

Four rubber feet cemented to the bottom plate complete the outside appearance.

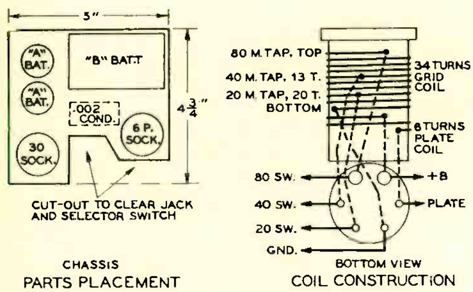
The chassis, cut from "prest-wood", measures 5 x 4¾ inches and is ⅛ inch thick. It is built to a height of approximately ¾ inch by washers and bushings and held in position by three brass bolts extending through the bottom plate. Cut-outs are made in order to provide clearance space for the selector switch and jack.

Most wiring is of no. 14 enameled and the greater portion is concealed beneath the chassis. Heavy "pushback" hookup wire is used for connections to front panel parts. It is advisable to wire the entire chassis assembly and all parts controlled from the front panel before installing them in the cabinet. The panel parts may be guided into place when assembling. While it is possible to allow leads of sufficient length for connection to their terminating points after assembly, it is a rather slow and awkward procedure. Complete wiring before assembly makes for an efficient and neat appearing unit.

The parts placement diagram clearly shows the position for each component mounted on the chassis, as well as the necessary cut-outs. The .0002-μfd. fixed condenser is the only part mounted beneath the chassis and is located between and to the rear of the sockets. These positions should be duplicated as closely as possible. Short leads are desirable, especially those from the rotary selector switch.

Both filament and plate batteries are fastened securely to the chassis by friction tape, and cushioned at each end. A U-shaped strap cut from sheet brass may be substituted if desired. Either method will prevent their being moved when handling the instrument.

Top view looking down into the box to show the placement of the components of the monitor and the location of the batteries.



Left, drawing showing placement of components on the chassis. Right, diagram showing winding and connecting of the oscillator coil.

Too much stress cannot be laid upon the importance of mounting all parts solidly and to make all wiring as direct and rigid as possible. Faulty connections and swinging leads can easily nullify all attempts at accuracy in calibration.

Coil Data

Both grid and plate windings are wound with no. 26 plain enameled wire on a 1¼ inch diameter 6-prong plug-in coil form. The plate winding consists of six turns, closewound, and occupies the lower portion of the form. The grid winding is wound above the plate winding with no space between coils. This grid winding consists of thirty-four turns, also closewound, and tapped at the sixth (14 Mc.) and thirteenth (7 Mc.) turns. The full winding of thirty-four turns is cut in for 3.5-Mc. operation. Both coils must be wound in the same direction or oscillation will not occur. It will facilitate matters if an experimental coil is wound first. In all probability a little pruning will be necessary to enable the bands to be spread over the greater portion of the grid condenser dial. This may entail the adding or subtracting of a turn, or spacing the last few grid coil turns at the top of the form. With the coil completed, one will have a fair idea where taps are located and the winding space necessary. With this knowledge a permanent form may be drilled to take the various leads, and a neat, well-finished coil will result.

Care must be taken that all leads are terminated at their respective prongs; likewise, those leads from coil socket to selector switch must be made properly. Should the builder desire, a 1¼ inch diameter form may be substituted, a single end bracket sufficing to hold it permanently in place. The various leads may then be connected directly to their terminating points at the selector switch.

Operating Data

When used as a monitor, the headphones are plugged into the jack and the transmitter signal tuned in. The signal picked up in the monitor is very similar to that being received at a distance, and objectionable chirps and key-clicks may be detected and corrected.

Employed as a frequency meter, the instrument must first be calibrated. The headphones may be removed as the closed circuit jack automatically completes the circuit.

Calibrating

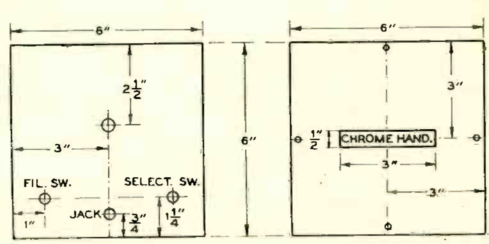
This subject has been adequately covered in numerous amateur radio publications and current handbooks, and need not be elaborated upon here. Briefly, the procedure followed is to tune a receiver to zero beat with a signal, the frequency of which is known to be accurate and in the amateur band to be calibrated. The monitor-frequency meter is then tuned to zero beat in the receiver with the signal being received, and a notation made of the frequency and corresponding vernier dial setting. Other stations whose frequencies are known may be checked in like manner. When sufficient readings have been taken to cover the bands, a calibration curve may be drawn.

If one is fortunate in having access to an instrument already accurately calibrated for the amateur bands, the monitor-frequency meter may be calibrated by employing this instrument as a transmitter, tuning its signal to zero beat on a receiver and then beating the monitor-frequency meter against the receiver.

Stability

It is interesting to note that the monitor-frequency meter described has been periodically checked and at no time has it shown any deviation from its original calibration.

See Buyer's Guide, page 98, for parts list.



Layout diagrams showing drilling dimensions for the monitor cabinet.

What's New . . . .

IN RADIO

HETEROFIL UNIT

An interesting item of the new line offered by the James Millen Mfg. Co., Inc., Malden, Mass., is a wired and tested "Heterofil" unit. This device, the Woodward adaptation of the Wien bridge, is connected directly in the audio output of any receiver to provide a very high degree of rejection (virtual elimination) of any single audio frequency. Thus for phone work an objectionable heterodyne from an interfering signal may be eliminated, and for c.w. work an interfering signal may be effectively tuned out by adjustment of the Heterofil tuning knob.

The Millen Heterofil requires no auxiliary accessories such as tubes or batteries, and can easily be attached externally to any existing receiver or incorporated as an integral part of a receiver being built. It represents a simple and inexpensive means of providing QRM reduction in any type receiver.

IMPROVED VELOCITY MICROPHONE

Universal Microphone Co., Inglewood, Cal., announces a new 4 magnet velocity microphone, type M4, that was formerly catalogued as "RH." The new model reflects scientific advancement in ribbon-velocity microphone construction and is said to be a general all-purpose instrument for p.a., amateur and semi-professional uses. It is equipped with adjustable cradle and thumb nuts for tilting and locking the instrument in any desired position. It includes a removable bayonet-locking plug and 25 feet of low capacity rubber covered cable.

The frequency range for the "M4" series is from 40 to 10,000 CPS and the output level —64 db. It comes in the following standard output impedances: direct to grid (high impedance); 500 ohms; 200 and also 33 ohms to match inputs, mixers or other low impedance lines where dynamic microphones have been used.

1.7 to 60 MC. TRANSMITTER

The latest addition to the Hallicrafters line of amateur and commercial transmitters is the Model HT-6 phone and telegraph transmitter which provides 25 watts output and operates at any desired frequencies, amateur or commercial, within the range of 1.7 to 60 megacycles.

The HT-6 has provision for instantaneous switch selection of any three desired bands or frequencies. Each of the three distinct channels is set up by means of appropriate plug-in units and all circuits except the final tank pretuned to the desired operating frequencies. Thereafter to shift from one band to another requires only a flip of the selector switch and retuning of the final tank by means of the single tuning control on the front panel. Operation is normally from the 115-volt a.c. line but with provision for connecting external generator or vibrator supply units for operation from battery or other d.c. sources. A special model is available for 220-volt, 50-60 cycle lines.

The HT-6, including modulator and power supplies, is completely self-contained in a table mounting steel cabinet only 20 inches long, 15 inches deep and 9 inches high. It utilizes eight tubes with an 807 or RK39 in the power-amplifier stage. Front panel controls include a dual-range meter with 4-position switch, c.w.-phone switch, 3-position band selector switch, tank tuning knob, master off-on switch, modulator off-on switch, and stand-by switch with provision for simultaneous control of antenna relay and receiver stand-by circuit.

NEW TURNER CRYSTAL MIKE

A new crystal microphone, with tilting head adjustable over full 90 degrees range for semi- and non-directional pickup, has just been out on the market by The Turner Co. of Cedar Rapids, Iowa. The new microphone is satin chrome plated all over, in streamline modernistic design. This

[*Continued on Page 90*]

U. H. F. . . .

By E. H. CONKLIN, W9BNX*

28 MC.

Nelly Corry, G2YL, reports on summer 28-Mc. conditions as observed on her side of the world. 2AZX in England logged W's on June 6, 9 and 22. G5BM heard W1WL on July 13, with no other North American reports that month. In July, 1938, W's from six districts were logged. English activity on "ten" suffered due to a spasm of five-meter dx with much shifting to the higher frequency band. VU2AN had shifted to "five" but with no results. African stations were reported in England spasmodically. South America came through on several days, but no Australians had been heard for five months.

August conditions to the U. S. were somewhat better, particularly the 20th when the 1st and 6th districts were worked. SU1MW worked W's on the 15th. Africans came through on at least twelve days, usually due to SU1MW working Europeans, and occasionally ZS1X was heard. Other Africans were OQ5AB, ZE1JR and VQ2WP. South Americans came through the same number of days, LU1EP working G5BM for 2½ hours on the 10th. As expected, ZL's came through in the U. S. during the month.

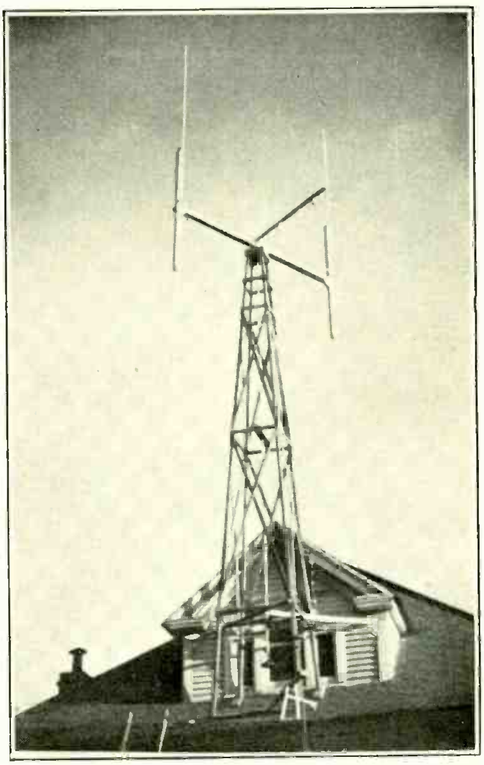
56 MC.

First off, our congratulations go to Vince Dawson, W9ZJB, who, with the help of W7GBI, has completed at least one contact with each district in the U. S. Vince found ten meters open to W2-W3 at six p.m. August 17, swinging around to the south and west by midnight. During a contact with W7GBI early on the 18th, it was decided to change to five meters which had not been open. GBI came back on "ten" with a R3-4 report, shifted to "five" too where he lasted only a minute or so. A later check indicated that the wind had blown his antenna around, accounting for the loss of the signal.

W9ZJB in Kansas City uses a vertical H array rotating on a twenty-foot tower on his roof. He uses a Skyrider 5-10 for receiving, though he has also ordered an RME. W7GBI is on 56,708 and 57,264 using three 6L6's, a 35T, and a 250TH final running 500 watts input on phone. Most of his summer work with W6 and W7 from his Montana location was on six- or four-element Sterba (barrage) beams. A three-element closely spaced job 38 feet high, fed with a 500-ohm line, has replaced them and brought the first signals from the east. There was one W9 on 58.8 Mc. August 8 (when W9VHG heard a W9 near Wichita at noon on 56 Mc. and W6's on 28 Mc. in the evening), then the contact with W9ZJB. The receiver is unusual—an RME DM36 works into 1852 r.f. stages rather than directly into the SX16 used as an i.f. channel.

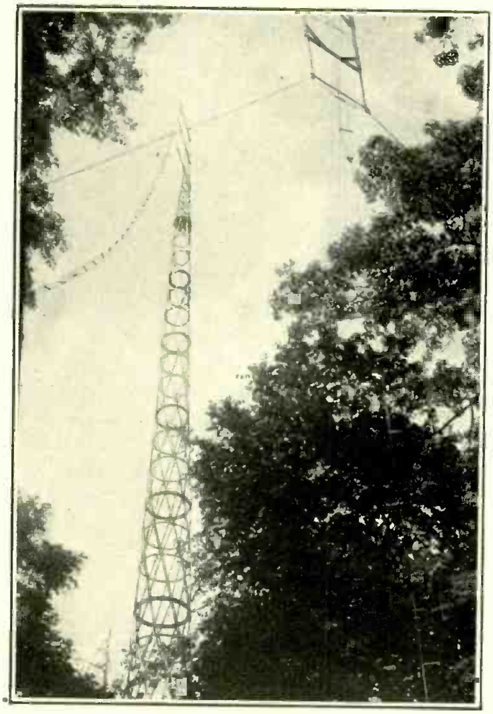
Additional Open Days

Last month we reviewed the summer dx, but now can add a few days on which the band was open, subject to any error that may be present in isolated reports. W6LDP in San Francisco reports that W6AHH heard



W8ZJB's H array with which he worked all districts on five meters.

* Ex-W9FM, Associate Editor of RADIO, Wheaton, Illinois.



This lightweight tower holds the top of W8QDU's colinear array 94 feet in the air. The antenna in the upper right is the vertical 8JK.

W8QA and W8VO using i.c.w. on May 11. On a questionable day, July 8, W9ZJB heard a harmonic of W4CRF in Mobile, Alabama, during good ten-meter conditions to W4. At 12:27 a.m. Eastern daylight time on July 25, W3BYF reports working W9ARN, the only signal heard if he means July 26 (just after midnight), it agrees with strong Sporadic-E layer reflections at Washington at 11 p.m. and midnight standard time July 25, for which no other dx has been reported. W9IZQ reported W4AUU, W4FBH and W5EHM on July 26 but the report of FBH indicates that this must have been on the big day, July 27. However, W1DEI says that the band was open six hours, though he omits details. On August 2 from 10:20 p.m. Eastern time, W9VHG heard W1HM, HQP, KLJ, W2CUZ, W3FBH, BYF, FQS, and worked W1LLL, KLC, KLJ, with bad fade. At 7:27 p.m. on the 6th, W4FBH raised W1BJE DEI HM KLC W2ADW and heard W1CLH W2GPO LAL. The reports of W7GBI and W9VHG for August 8 and the work of W9ZJB and W7GBI on the 18th have been mentioned above. W1DEI says that the DX was coming in for two hours on the 8th but he gives no calls. According to W9VHG, W9GGH worked W8CIR on August 22. August 31 was a good day for those left on the band; after 7:43 p.m. Eastern time, W9VHG heard W1JQA W2JCR KWE, and W1JQA lists W8LMP NZ CVQ EID(?) W9CBJ GHW MYV ZHB SMM SQE QCY LVK IZQ III(?). W2KWE was overheard to say that W4FBH was heard in the east on August 30.

W1DEI says that the band has also been reported open on April 21, 24, 27; May 7, 22, 25; June 21(?); July 10, 20(?); he says that most of this was pre-skip dx, however. He mentions August activity of the skip type on August 1, 2, 4, 6, 8, 12, 14(?), 22, 28, 29, 30, 31. He has been studying skip dx from the "curve fitting" viewpoint using old

56 Mc. DX HONOR ROLL

Call	D	S	Call	D	S
W9ZJB	9	18	W9AHZ	6	
W3BZJ	8		W9ARN	6	10
W3RL	8	24	W9NY	6	13
W5AJG	8*				
W8CIR	8*		W1JMT	5	9
W8JLQ	8		W1JRY	5	
W8VO	8		W1LFI	5	
W9ZHB	7		W2GHV	5	8
			V3GLV	5	
W1EYM	8		W3HJT	5	
W2AMJ	7	22	W6DNS	5	
W2JCY	7		W6KTJ	5	
W3AIR	7	9	W8EGQ	5	10
W3BYF	7		W8PK	5	
W3EZM	7	24	W8RVT	5	7
W3HJO	7		W9UOG	5	8
W4EDD	7				
W5CSU	7		VE3ADO	4*	
W5EHM	7		W1JNX	4	
W8CVQ	7		W3FPL	4	8
W8QDU	7		W6IOJ	4*	
W9CLH	7		W8AGU	4	
W9SQE	7		W8NOB	4	
W9USI	7	16	W8NOR	4	7
W9VHG	7*		W8NYD	4*	
W9WAL	7		W9QCY	4	7
W9ZUL	7	11			
			W1JFF	3	
W1DEI	6	17	W1KHL	3	
W2LAH	6		W6AVR	3	4
W2MO	6	20	W6OIN	3	3
W4DRZ	6*		W7GBI	3	4
W6QLZ	6		W8OEP	3	
W8OJF	6		W8OKC	3	

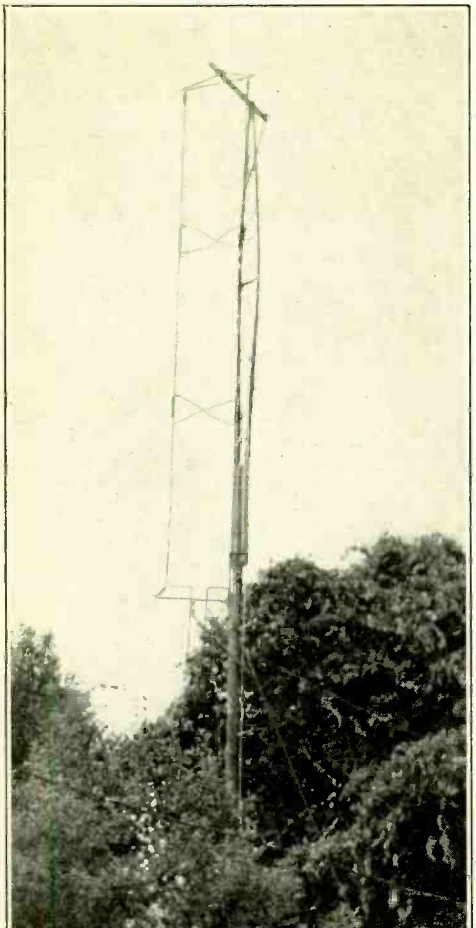
* plus Canada. (reported in 1939)

Note: D—Districts; S—States

Pre-Skip DX

reports as a basis for prediction. His charts are mailed a month in advance to stations interested. Sometimes his predictions have been accurate or within a day of the best dx, but it is too early to say if his method is going to be the solution to the problem of predicting 56-Mc. dx in advance. We have leaned toward a somewhat different approach—if it is assumed as proved that dx out to 1250 miles and multiples is the result of Sporadic-E layer reflections, then it is possible to work with the hourly Sporadic-E records of the National Bureau of Standards, without relying upon reports from amateurs. His comments on five-meter dx are as follows:

> The general conditions of the five-meter band for skip type DX during the past summer period seem to have been definitely worse than the corresponding period of the last two years. First, the ionization periods have been less. The actual number of days reported open this year are only about 85% of the number reported last year (But above 1937—Ed.) Secondly, the peak ionization has been noticeably less, as manifested by the average distance between reporting and reported stations. This year the majority of reports dealt with a longer zone of 850 to 1250 miles. Thirdly, the openings seem to have become more stable and definite with respect to mutual relations.
>
> The general outlook for the fall and winter conditions as based on this summer's reports would seem to indicate the average number of openings as is usual for this period. Expected openings may not be complete; that is, signals may be mushy or fluttering, yet some should be complete and last a reasonable length of time. Times at which I expect skip dx of the E-layer type for the coming months follow:
>
> *September.* Just after the middle of the month there should be a definite opening, probably not of extreme distance.
>
> *October.* Open about the 15th with skip probably longer than in mid-September.
>
> *November.* Second week-end may provide an opening but not necessarily a definite one unless for a short time. About a week later, another with fluttery signals likely, adequate for c.w. or i.c.w. contacts.
>
> *December.* Queer conditions for the last half of the month, with a short opening on the third week-end and around Christmas. More than one scattered opening expected.
>
> *January.* The band should be very good on the 4th for 850-1250 miles.



Vertical 8JK used at VE3ADO, Toronto.

Recent Reports of DX

Since the closing date for the October issue, we have received quite a few more reports on 56-Mc. dx. We had to shut off early for the last issue in order to have time to arrange and write up all of the material (this *is* just a hobby, you know). From now on we are interested mainly in reports on days for which little or no dx was reported in RADIO for October.

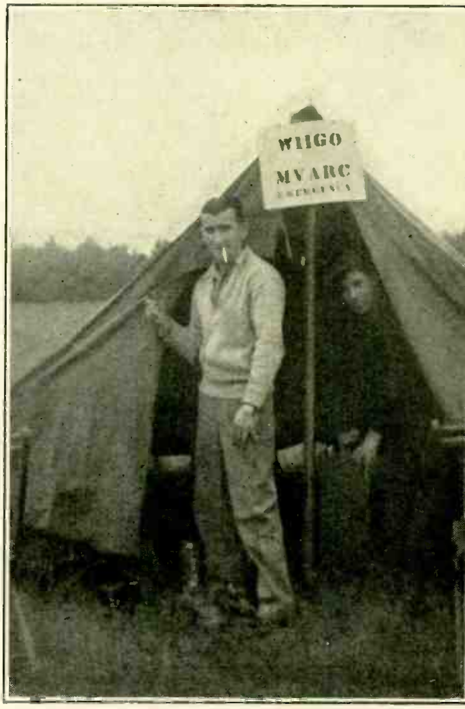
W1JQA on July 31 contacted W9FVI UXR RBK AHZ PQH VHG GGH. On the same day W2AMJ hooked W2KLZ (bending?) W8CVQ LZN W9USI AHZ CBJ and heard W4AUU W8NZ W9SQE VXR. W3BYF was on six hours during the July 27 heat, connecting with W4DRZ W5AJG W8QQS W9SQE ZHB VHG MIW UOV AHZ ZJB GHW and logging W4AUU EDD W8NZ W9GGH; W4FLH was in for a few minutes at 8:29 p.m. on the 28th; contacts were made with W9CJB ZHB USI ARN while W9PQH WDU were heard on the 31st.

W4FBH brings us up to date from May 26 when at 6:05 p.m. he worked very short skip to W4DRZ EDD; June 12 brought QSO's with W1BJE COO HXP JQL LLL ISI IVC W2KLZ W3AIR BZJ DOD W8AGU EID LKD NOR NYD OKC PK in addition to which he heard W1ANA BOA DEI JNC KLJ KTV SI ZE W2ADW DB GPO ISY KLZ MO W3DYE HOH KLV W8EID; on July 6 W5AFX was contacted and W9ZJB was received; the 9th brought QSO's with W2FGB W4DRZ EDD FLH W9ZHB while W8JHW and VE3ADO were logged. FBH was in on the 27th DX, working W2JCY MO W3GNA W8LZN W9ARN BJV DQH (PQH?) GGH LVK MQM QCY SQE UOV USI VHG ZHB ZJB and hearing W1KLJ W3FBH W9AZE and VE3ADO again. The last day he reports is August 6 when W1BJE DEI HM KLC W2ADW were contacted and W1CLH W2GPO LAL logged.

W5AJG worked W9WDA at 10:27 a.m. Central time August 6 while ten was wide open.

In San Franisco, W6LDP received an undated July report for 9:48 p.m. Eastern time from W8JLQ near Toledo; our guess is that it was July 27. LDP says that AHH and DEK are the only others on five meters in S.F. and why don't we urge more W6's to get in on the summer DX? (Heh, Heh, W7's particularly in the eastern end of the district, too!) From North Hollywood, W6IOJ says that he was reported on July 27 by W8QF in Saginaw and W8TCX in Greenville, Michigan, about 9:30 p.m. Eastern time. W6QLZ says that he has had reports for the 27th from lots of W1-W2 and a few W4, but only one out of four will QSL, with Illinois and Texas at the bottom of the list!

In Detroit, W8SS was rebuilding on the 27th but he heard some of the dx including a W6 on 58.82 Mc. calling CQ at 8:10 p.m. Eastern time. SS is another who has visited W4EDD in Coral Gables, Florida—Robbie should be a "one man Chamber of Commerce" such as W4DRZ in Fort Lauderdale is reputed to be! W8QDU was in on some skip dx but only incidental to his pre-skip work. On some days for which we have few reports, his log is of particular interest. W2KLZ heard him on May 21 during a pre-skip contact with W8CIR, the only dx reported to us for that day, and again June 13 which was a relatively poor skip DX day. He heard W4EDD on May 27 and July 9, W1CLH on July 31.



W1IGO (left) and W1LEA (inside tent) simulate an emergency with their portable equipment.

W9ZJB adds these reports: worked W6-QLZ June 14; raised W8PKJ CDM on the 17th; contacted W9WDA and logged W8-LNW on the 18th; hooked W3EIS RL on the 25th. In July on the 6th he and W9AHZ could not raise W5AFX W6KTJ QLZ OVK although 6QLZ stopped for a schedule and listened. During this time, W5AFX in Oklahoma City worked five stations in California. The 12th brought W2AMJ for twenty minues, then W6QLZ was worked; on the 13th he (W9ZJB) worked W8CIR and heard W1KLJ shortly after which the band reopened west for W6QLZ KTJ. The 27th brought contacts with all districts except W2-W7-W9 though some of these were calling him! In Milwaukee, W9IZQ got in on four good days in June and July.

VE3ADO supplied most of the Canadian contacts on July 27, it appears, including W4AUU EDD DRZ W5AJG FYF W9GHW ZHB AHZ, and hearing W6KTJ.

Aurora-type DX

Occasionally a magnetic storm creates a churning of the ionosphere that may modulate five-meter signals and permit contacts not normal for pre-skip nor for real skip. One night in August—W3BYF says that it was the 11th but W3RL says the 12th——this sort of thing happened again. W3BYF worked W8CIR and W1KTF, hearing W1HPD(?) W2JCY HEJ HWX CUZ W3RL during a visible display of "northern lights" just before midnight. The beam seemed to indicate that signals came off the northern horizon!

W3RL writes thus: "I noticed the largest and most impressive display of the Aurora that I have seen since the summer of 1928, eleven years ago. A solid band of silvery light, centering about twenty degrees above the horizon, extended at least forty degrees east of north. Long wavering streamers rose to the zenith, their tips a rosy red. The earth was illuminated to a point where it was possible to read small print.

"After I had watched this marvelous sight for a while I began to wonder what effect it might be having on radio transmission, so I went into my shack and turned on the set. The broadcast band seemed to be going on about as usual, the 160- through 20-meter bands were dead, but on ten meters I heard W9FFB in St. Louis working W3HOH near Philadelphia. I could hear both sides of the contact with a bad audio flutter on the carrier that made copying difficult; these were the only ones heard on the band so I switched to "five" and called CQ. A station came back to me but the flutter and fade were so severe that I was unable to get his call and I did not hear him again. Down the band I heard W8CIR in Aliquippa, Penna., working W3-BYF whom I could not hear. When they were through I called W8CIR and raised him at six minutes past midnight, signals R8 to R9 at both ends with the same bad flutter noticed on ten meters. We tried both voice and i.c.w. but one was as hard to copy as the other. No other signals were heard.

"I am wondering just what part the Aurora played in the contact. We are well beyond ground wave range, with the whole of the Allegheny and Blue Ridge mountains between us. We contacted once before, this summer, on a night following a very hot day and an evening of thunderstorms over the area which cooled the atmosphere near the ground thus creating a decided temperature inversion. At that time there was no flutter or mush to the signal, only the slow fade that is usual when lower atmosphere bending takes place. I do not believe that a signal whose path is in the troposphere or even the stratosphere is affected by variation of the ionosphere, and if a temperature inversion was responsible for the contact of August 12, there should not have been any flutter. We are much too close for reflection from a very dense E-layer to have been a factor, the distance being much less than I have ever noted even for 28 Mc."

Honor Roll

This month the 56 Mc. DX Honor Roll is little changed from the last issue. We expect that publication of the October issue will start correspondence to us giving additional calls and corrections to the list.

Last month we withheld reports of 50-300 mile "pre-skip" dx because of the volume of the more seasonal Sporadic-E layer type of dx reports on hand. We had hoped to give you these "short haul" reports by dates, but a study of the data shows very little change in conditions—the best stations keep right on doing good work day after day with very few blanks. There was a time when most of the five-meter work out to 200 miles or more was confined to the northeastern states, but judging from reports this summer, the center of activity has moved to western New York, western Pennsylvania, Ohio and Michigan. Anyone can get on the air with a few watts and a mediocre receiver on a good summer day and work a thousand miles; generally only those willing to attack the problem carefully and thoroughly can turn out consistent results beyond 200 miles. Most of the best stations at such a distance have given particular care to the antenna and transmission line, and to the receiver. Yet few of them have made the "final plunge" to using both acorn tubes and concentric-line circuits in order to take even greater advantage of the resulting improved signal-to-noise ratio and weak signal sensitivity.

Using a twelve-element vertical beam, W1DEI worked W2AMJ and W2MO several times in August. W1JFF heard W1COO in New Hampshire on May 26. W2AMJ often works W3BYF in Allentown, Penna., mentioning particularly May 8 when contacts were also made with W1IZY JNX in Mass., W1HDQ on Mount Wilberham, and W3GQS. The "Aurora fade" then came on and W8SLU on c.w., in Michigan, came through. Incidentally, a lot of the contacts mentioned in these columns are on c.w., particularly pre-skip dx, though we do not usually mention it. AMJ worked or heard W2KLZ FBA W8EID JHW up around Albany on May 24, June 4, 7, 12, 14, 16, 18, 28 and July 31; this is not considered "usual" because of intervening mountains. W3BYF heard W1HDQ W2JCY ISY CUZ KLV W3AIR W8SLU RV CVQ on May 8; the beam was ineffective on the W8's but was sharp on the definitely "pre-

[*Continued on Page 93*]

NEW BOOKS

and trade literature

THE RADIO HANDBOOK, Sixth (1940) Edition, by the Editors of RADIO. Published by Radio, Ltd., 1300 Kenwood Road, Santa Barbara, California. Over 500 pages, 6¾ by 9½ inches, profusely illustrated. Price, $1.50 in continental U.S.A., $1.65 elsewhere, postpaid.

The new sixth edition of THE RADIO HANDBOOK bears similarity to previous editions only in name and in the wide scope of material that is covered. The 1940 edition of THE RADIO HANDBOOK is not just the previous edition brought up to date; it is an enlarged and almost completely re-written reference manual on theory, construction, and operation of high-frequency and ultra-high-frequency radio equipment. Each chapter has been entirely re-outlined, new equipment shown, and most of the text re-written. Two new chapters have been added, *Introduction to Amateur Radio*, and *Transmitter Construction*. The chapter order has been changed to give a more satisfactory progression from fundamental theory through the more advanced material. Certain chapter divisions made in previous editions have been combined when it was felt that the subjects covered were closely enough allied to warrant inclusion into one chapter.

Radio amateurs, servicemen, engineers, and experimenters will find a wealth of valuable material, both new and fundamental, covered in the book. The chapters on construction are alone well worth the price of the book to the radio amateur; the apparatus described employs the very latest in improvement, new ideas, and new components. Almost all the constructional material appears for the first time in this edition. The new equipment shown has been tested and proven under actual operating conditions as would be found in the average amateur station.

The theoretical treatment of transmitter and receiver theory, modulation, and antenna systems has been enlarged and made more comprehensive. The more useful formulas have been supplemented in a great many cases by charts and tables which reduce calculations to a minimum or eliminate them entirely.

While the book contains data of value and interest to the advanced amateur and engineer, the novice studying for his amateur license will find the book of great assistance in obtaining his "ticket." The chapters start right at the beginning with a discussion of fundamental electricity and advance through the more advanced stages of radio theory. Ample material is given to enable the beginner to obtain any of the amateur licenses.

The chapter headings themselves give a good indication of the subject material that is treated. They are, in order: Introduction to Amateur Radio; Introductory Electricity and Fundamental Radio Theory; Vacuum Tube Theory; Radio Receiver Theory; Receiver Tube Characteristics; Radio Receiver Construction; Transmitter Theory; Radiotelephony Theory; Transmitting Tubes, Transmitter Design; Exciters and Low-Powered Transmitters; Medium and High-Powered Amplifiers; Speech and Modulation Equipment; Power Supplies; Transmitter Construction; U.H.F. and Mobile Communication; Antennas; Test and Measurement Equipment; Workshop Practice; Radio Therapy; Radio Mathematics and Calculations; Radio Laws and Regulations; Appendix.

As an added convenience the page size of the sixth edition of THE RADIO HANDBOOK has been enlarged to that of RADIO. This allows the HANDBOOK to be included in the same binder as is used for copies of RADIO.

1940 Mallory Encyclopedia

The third edition of the Mallory-Yaxley Radio Service Encyclopedia is now available. While this book is of most interest to servicemen, it also contains much valuable general information that will be of vital interest to radio amateurs, engineers, and experimenters. Those who possess earlier editions are sure to want the 1940 encyclopedia. To those not familiar with this useful book, we strongly recommend it as a most handy and helpful publication to have in one's library. A new feature of the 1940 edition is optional monthly supplementary service, available to owners of the encyclopedia for a small charge.

The 1940 general Mallory-Yaxley catalog has been released and includes comprehensive data on every Mallory radio item manufactured. It is available on request.

Aerovox 1939-40 Catalog

A new 1939-40 catalog has just been issued by the Aerovox Corporation of New Bedford, Mass., and is available for the asking either from local jobbers or the company direct. This 28-page book contains a complete choice of condensers of all types, as well as essential resistors and test instruments. Many new items are introduced for the first time, including the L-C Checker and the motor-starting capacitor selector and emergency unit kit. There are complete specifications including dimensions and detailed sketches. The various condenser types are classified and indexed, so that the user will have no trouble locating just the right condenser in every instance.

[*Continued on Page 92*]

YARN of the MONTH

THE DEATH OF A WIDOW

At first, I will admit, it did seem to me a bit strange that my husband could just sort of misplace himself. But if you really understand the bitter meaning of the word addict, you will see that it was bound to happen.

To scotch the malicious rumors so prevalent later, I wish to state here that I did not swear. It is not true that, when I regained consciousness, my first remarks were profane. They were merely forceful. And if there is one of my sex who would condemn my language, let her put herself in my shoes.

My husband was a confirmed addict long before I met him and, although I was aware of his insidious habits, little did I know to what they would lead. During the months of our whirlwind courtship he so thoroughly overwhelmed me with attentions and with vows of his undying devotion that my fears were allayed. Little did I know how bitterly I was later to regret that I had not reformed him before giving him my heart and hand. How was I to foresee that I was destined to become a widow almost immediately the honeymoon was over?

Now there are many classifications of pseudo-widows. There are golf widows, candid camera widows, fishing widows AND radio widows. Although all of these may be roughly grouped together as women berefit of men, I can now recall stating contentedly, soon after the last grain of rice had fallen from my chic traveling suit, that my husband's radio hobby would keep him at home!

Aside from a few slight differences of opinion as to the desirability of real estate, it was relatively easy for us to find just the right cottage for our little love nest. Foolishly, as I now realize, I, the happy bride, visualized a cozy cottage surrounded by shade trees, roses 'round the door and nearby neighbors for bridge on long winter evenings. How was I to know that we must live high on a bare hill in an isolated region so that he could erect that antenna; that the winter nights were to be not only long but frightfully lonely.

That was only the auspicious beginning. I was to learn later that since boyhood my dear spouse had been spending all his waking hours —and they were considerably more than the mere daylight ones—experimenting with all sorts of wires, condensers and coils with which to send out and bring in those tantalizing short waves.

Not in defense of myself, but to keep the record strictly truthful, I am compelled to say that I am a very adaptable and amiable person, and a more considerate wife would be difficult to find. Modesty forbids me to go further into my good qualities. Suffice it to say that I did my best for John. As a serious-minded golden blonde, rather on the attractive side, I not only felt it my duty, but actually tried—and in no small degree succeeded—to keep the house neat, myself dainty and sweet and the table attractive with really good food usually so conducive to the well-being of males. What a disillusionment was in store for me!

It is true that for the first few weeks he did kiss me goodby as he sprinted for the 7:15; that he did sit at the dinner table with me; that he even gave up operating the radio after eleven at night.

I have never at any time denied these now remote facts, regardless of what unfeeling remarks have been repeatedly made at numerous ham conventions purporting that certain wives are very jealous of the time their husbands spend on the air.

I was not jealous. To the contrary I was inordinately proud of my brilliant husband. In all the letters I wrote to the girls back home I was able quite truthfully to include words to the effect that I had plenty of time to sit quietly and keep up with my correspondence, as my dear John was in the shack communicating with some far-away country.

Many are the facetious statements that have been made about "when the honeymoon is over." But there was definitely nothing face-

By IONE ADEN HILL

EXPERIENCE GAINED IN PRODUCING 20,000 *Taylor Tubes*

T-40's and TZ-40's

NOW MAKES POSSIBLE

Increased Ratings

Over 20,000 of these Wonder Tubes have been made and sold in 20 months. Continued research and experiment have proved that in INTERMITTENT AMATEUR SERVICE our original Operating Ratings were extremely conservative. The new ratings shown below are still conservative and allow you true long life performance. The regular operating ratings remain the same for continuous commercial service, the new ratings for Intermittant Amateur Service.

T-40 . . . . TZ-40

Commercial	*Class C Telegraph*	*Amateur*
1250 V.	Plate Volts	1500 V.
125 M.A.	Plate Current	150 M.A.
31 M.A.	Grid Current	38 M.A.
	Class C Telephone	
1000 V.	Plate Volts	1250 V.
115 M.A.	Plate Current	125 M.A.
40 M.A.	Grid Current	40 M.A.

Conservative Ratings

The performance in actual service of the Wonder Tubes T-40 and TZ-40 over the past 20 months prove that Taylor's ratings are conservative. The *husky Carbon Anode* is rated at only 40 watts, yet it actually takes 70 watts plate dissipation to cause the anode to show color. That means your T-40 or TZ-40 can stand serious overloads without damage—a real safety factor. The *complete Molybdenum Grid* designed for heavy duty service withstands abnormal abuses. *Taylor Tube filaments* are designed as to diameter and length so that they provide the necessary surface area needed to furnish emission in amounts well beyond the requirements of maximum peak plate current with good emission efficiency in terms of filament power at safe temperature for long life.

When Taylor Tubes brought out the Wonder Tubes—T-40 and TZ-40 — comparative types sold at $10.00. Amateurs the world over quickly recognized the outstanding value of the T-40 and TZ-40 and rapidly they have become the most popular of all Amateur Transmitting Tubes. Naturally the tremendous success of these Wonder Tubes has attracted competition—and we expect more. We ask you to remember that the experience gained in producing this large number of tubes is your best assurance of Better Performance and Top Value. *Insist on Taylor's T-40's and TZ-40's*—conservatively rated like all Taylor Tubes—and *proved through use.*

$3.50

ACTUAL SIZE

RECOMMENDED BY LEADING PARTS DISTRIBUTORS

"More Watts Per Dollar"

TAYLOR TUBES, INC., 2341 WABANSIA AVE., CHICAGO, ILLINOIS tious about the way my honeymoon bliss changed to ashes and wormwood.

In a surprisingly short time the goodby kisses ceased. John just simply could not leave that radio until the last possible minute to catch the train for town. His morning procedure was invariable. At the first tinkle of the alarm clock he sprang from bed, rushed to his sanctorum—his beloved shack—turned on the switch and, as he shaved, carried on what he referred to as a short conversation with some other zealot. Since the shack adjoined the bath, it was comparatively easy for him to perform the cleansing rites with a minimum of time lost from transmissions.

The fact that he had chosen that particular room for his operations was not what caused my mental state, later classified by a very frowzy female who had led me to believe she was my friend, as slightly deranged. I deny that giving up my adorable orchid and silver guest room which I had, with so much good taste and hard work, made into a dream of a nook, caused me even a twinge of regret compared with the suffering I experienced later. To see it changed into a sort of conglomerate storage room filled from floor to ceiling with all sorts of indescribable electrical contrivances, the dainty wall paper completely obscured by the radio cards fastened with pins, was faintly disconcerting.

But the explosive words that followed my every effort to be helpful and clean the place while John was away seemed to me a bit unjust. Certainly I did not deliberately throw away all the diagrams he had been drawing, nor did I intentionally burn all the foreign reports he had received. Gradually, it became clear to me that my efforts in that direction were neither appreciated nor desired.

I repeat, it was not the little things like John's taking over the large cedar-lined closet for his power supply and moving the best blankets and my fur coat to the attic that was reached only by way of a ladder through a dark hole, that disturbed me most. I am not one of those neurotic women and, in spite of all that was said when the affair became known, I did not actively resent John's sleeping on the shack couch so that he could be on the scene when the foreign stations were coming through, nor his having his meals served there. In fact, the maid we had engaged for the house work and cooking so that all my time would be free to answer the cards he received and acknowledge his contacts, really gave me an opportunity to store up quite a bit of information that came in handy later.

In all fairness to my husband, I must say that he was most considerate. Every morning before I arose he placed his log book on the hall table where I could find it at the first possible moment. Then, seated at my desk, I put in the quiet days writing the necessary notations, addressing the cards to his ham friends and putting them out for the postman. Returning from the office at five, John was thoughtful too. He went directly to the back entrance, lest he disturb any rare tea guest. Once inside the shack he was in a world of his own and several thousand other such busy men who indulge in what is sometimes erroneously referred to as a hobby.

All psychologists aver that a hobby is what every person needs. I am not a psychologist, my college courses having been largely composed of subjects dealing with the finer arts, but I am sure that these eminent men could not be far wrong after delving for years on the subject. I said as much to the psychoanalyst it later became necessary to call in, and I had only one really pertinent question on my mind to ask him. To be quite frank, he wrote in his case history that I asked it repeatedly to the exclusion of all other conversation. It was, "When does a hobby cease to be a hobby and to become an obsession?"

Of course John had impressed upon me, very tactfully, I will admit, that any interruption whatsoever was very derogatory to the reception of sound waves. Consequently, I never went into the shack. I had trained our jewel, Louisa, to give a gentle tap on the door to announce her entrance with meals. If he did not answer she just took the food away, for he was frequently too intensely occupied to pause, but waited until there came a lull in operations to raid the ice-box. Aside from those brief digressions, he proceeded quite unannoyed.

I was not wallowing in self-pity as some calloused persons might contend. I had at last become not only reconciled, but entirely adjusted, to being a radio widow. Our household ran smoothly. Louisa attended to all the domestic duties, I to my secretarial ones and John, I am sure, must have been completely happy with his transmitter and receiver. I say I am sure because never once did he for a moment abandon his private abode to criticize a single thing, taking only time enough each week to compute his expenditures on his hobby and to leave a check for exactly one-third that amount, for household expenses, in his log book for me.

As I have said at the beginning of this narrative, I did not know that I was marrying an addict. And I have also truthfully said that I, for myself, had become reconciled to that fact. But I am a very vulnerable person, and there is something about afflicted humanity that brings out all the nobler qualities in me. For that reason, I did all that I could to make life at home pleasant for John.

Many is the time that I have flung recriminations upon my head for just this kindly attitude. Because, say what you will, it is a wife's duty to take care of her husband and, although I had been lulled into a state of self-satisfaction by the smooth tempo of our home, I should have been better prepared for the blow that fell.

I was sitting at my desk filling out the last card for the day when the doorbell rang. Since Louisa was in the attic busy with the moth spray, I opened the door to be confronted by a messenger boy with a telegram. As it was growing late, my mistake in reading the address was entirely excusable in the dusk.

Thinking, quite logically, that the wire was for John, concerning one of his frequent rush orders for radio parts, I took it to his room. I tapped very gently on the door and, upon receiving no answer, started to tiptoe quietly inside. The room was empty. Or rather it was empty of human presence. It was not empty of anything else. But I found a tiny space through which to squeeze, and laid the envelope on the desk.

I know that I should have walked out immediately, but something held me there in the dimness. Some premonition crept over me. It had something to do with the clock. I stared at it. Yes, definitely, it was the clock. The hands pointed to six, and then I knew with all certainty that some dire calamity had befallen John. Never before in all the time we had been married had he been absent from that room after five-thirty in the afternoon. With my own eyes, as I looked out the window, I had seen him go there day after day.

I struggled with my fears and assured myself that there was nothing wrong; he had only been detained at the office. However, it was that vague sense of uneasiness which I could not shake off that led my feet an hour later to the shack again. I placed my ear to the keyhole, hoping to hear some reassuring sound, but not a murmur issued forth. Then my common sense triumphed over uncertainty. I thought, "Surely I should open that telegram and, should it require answering, do it now so that John will lose no time from the air in waiting for equipment."

With that in mind, I picked up the envelope and stepped into the lighted bathroom. As I tore open the flap I was nonplussed to discover the message addressed not to my husband, but to me.

Louisa found me there when she came to call me to dinner. It is not true that the lick on my head as I fell against the bathtub, caused a brain injury. It was the shock of my own horrible callousness to John's welfare, when I grasped the import of those words glaring at me.

To verify my statements, I have on the desk before me that telegram, now yellow and dim with age. It was sent from Chicago and it reads, "Five wonderful days of radio convention. Return tomorrow. Anxious to get on air again. John."

Louisa's horror at my words, when I opened my eyes, was responsible for her calling the psycho-analyst who had treated her brother for D. T.'s. That she later repeated my remarks to her voluble friends, made it necessary for me to deny, as I have already, that they were profane, but were merely forceful.

I will say that in praise of the doctor that he was thorough. After many hours of analysing my mental reactions to hobbies he obtained a general idea of the situation. He told me that I had become so accustomed to never being with my husband that the shock of his having been gone for seven days without my missing him, had brought out all kinds of things from my sub-conscious mind. My deep sense of duty recoiled from the thought that, as our life was arranged, some fatal accident might have befallen John and I would never have discovered it until the weekly checks ceased. That same sub-conscious was responsible for my having repeated a whole week's data on the daily cards without ever noticing the dates in the log. I was in such an advanced stage of apathy that the routine details just didn't penetrate my brain.

The next day John, naturally, knew nothing of what had occurred as he went, directly he returned, to the shack to try out some ideas he had acquired at the convention. He was, therefore, startled and not a little outraged, when his door burst open and the doctor entered. To be quite just, I must admit he was contrite when he learned the true state of affairs.

The two men had a long private talk, from which the doctor emerged looking a trifle shaken. I learned from Louisa, who was not above a little discreet eavesdropping, that the physician had seemed to be attempting to draw John out on some sort of hobby fixation. Regardless of his success with my husband, he made a new woman out of me.

He prescribed a drastic change in our lives and I must relate that my dear John most considerately and enthusiastically endorsed the idea. That is why now the guest room is back in its rightful role, the cedar closet restored to its legitimate purpose and John no longer shuts himself in alone.

We are happy and serene again since we have all the apparatus in our large master bedroom where we operate it together.

It is true that the psycho-analyst was somewhat reluctant to dismiss my case. I was somewhat disturbed by the subsequent visits he so frequently made, and I secretly feared for my sanity as I groped for the purpose of his continued observation. My mental state vastly improved when I realized that his covert glances were directed, not at me, but at our transmitter! He still calls at every opportunity and will soon be on the air himself.

E. Shroudsburg, Pu.

Radio Magazeen, Sainted Barbers, Calif.

Dear Gentlemen and Ed:

What you think, hon. ed? Scratchi are solve the QRM problem. Will becoming grate humane benefactor and stuffs. In fack, are thinking that would not being bad idear at all to build collosus statyoo of Scratchi so all can come from far and wide to see the fameous fellow what are grate emancepator and liberator of ham bands in year 1939 A.D.

The idear are all very simple hon ed. when you are get the idear. The system are work out by Scratchi other nite when are lye awake after eating late repast at Tomaine Takamoto's Tea Tavern. All one have to do is to analyzing why QRM are come about and if not how so? Hear are how QRM get started. It are very simple when you are get idear that QRM are nothing but a lot of interference going somewheres to bother somebodies. Hear are what getting the QRM going:

One fellow are not get the other fellow solid because of nother station are make interfere. So he say to please send or speak each word twice account of QRM. It then make twice as much QRM on band. This extra QRM bother other amateurs and they are findings of necessity to making QSZ to get through. This are now make total QRM on entire band twice as bad, and are now so bad that to getting solid copy must of necessity sending each word three times. Station now take three times as long to finish QSO, and cause three times as much QRM.

This go on with all station in band till QRM on hole band are three times as bad. You can see, hon. ed., that after this go on for a while are sound like the 20 meter phoney band on Sundays afternoon, which are mean that ultimate in QRM are achieve at last. Under these condition the fun are not come from how many other fellow can work, but object are instead to see who can keeping the most others fellow from working anybodies. Are not liking this new aspeck of the game at first, but I are understand that after few Sundays it are become as much fun as former system of working many stations as possible, which are seem to become frown down upon as old fashions.

However, down deep in heart every troo amateur are know that old fashion way of try to actually work other fellow are best and are provide most enjoyments and satisfackshon.

Now under Scratchi system, no-one would be allow to repeat anything. This would reduce QRM to point where QSZ would seldoms be necessary, and everybodies would be much betters off. Besides, are much more interesting this way, and fellow must always be on his toe in order not to miss anythings, because he are only get one chance at everything.

So you see hon. ed., the Scratchi System of Controlled QRM Reduction not only reduce QRM, but also are provide more interesting sport and besides are making operator more profishent and selfs-relient.

Respectively yours,
HASHAFISTI SCRATCHI.

Meet Your DX in Person

[*Continued from Page 34*]

was particularly striking in the turreted town of Chinon, site of the ruined castle in which Joan of Arc met Charles VII, and where Henry II of England met his death.

The First Zepp

A few miles out of Tours, a zepp antenna was seen but the desire to stop and inquire was resisted. A slow and late dinner in town discouraged late calls upon local hams. During the next day, which included stops at Chartres and Versailles on the way to Paris, we were impressed by the planning of everything—even the trees in woods had been planted in rows. Apparently every tree, even those always lining roads, is considered as a crop to be harvested at the best time, or to be clipped for firewood or charcoal. The roofs changed to red tile as we entered Paris among an increasing number of tandem bicycles, airdromes, and Chireix-Mesney beam antennas.

Springtime in Paris means Horse Chestnut trees in bloom, and not many tourists. In fact, with no street cars or elevated trains, and with few buses, the city did not look active. Most people use the Metro (subway) of which there are fifteen lines, charging but little and by the distance but covering the ten-mile city rather well, if one doesn't mind changing to a train on a different level now and then, navigating underground blindly from a map. Most of the newer city—from about Napoleon—is in the central west area and can be covered by walking or by inexpensive taxi. It is this newness that permits having many wide boulevards from the Place de la Concorde to the Bois de Boulogne. Buildings usually are five stories high topped with a sharply slanting roof in front, then a flat roof; in some areas, business firms may occupy the first several floors, and families may live in the rest, their financial means not at all evident from the outside. As in other cities like Berlin and Amsterdam, the buildings have a central court.

A Ham Dinner

F8VC and F8KI, with their wives, had a dinner for us at the Cafe dé la Paix. All could speak English though the conversation often lapsed into French. It was a most enjoyable meal, lasting until perhaps eleven o'clock when we all went to F8LX. After stumbling around in the dark corridors looking for the bell and the push-button elevator, we found his apartment. F8LX is a newsreel cameraman, his "luckiest" shot being the famous one of the assassination of the King of Jugoslavia and the French Foreign Minister at Marseilles. He has a two-element beam, controlled with ropes from the bathroom window. At 11:30 p.m. the U. S. stations were going out on 14 Mc. but we heard W1JEA, W2HHF, W2LUB, W9TJI, CE2AG, VP5PZ, W4FIJ and worked W2JT, W1ENU. W2JT was using 900 watts and a new three-element beam for his first dx contact since tuning it that day. There were lots of signals, more like what we had expected of the band but there were few heterodynes in the phone band. Because of the law, French stations make short contacts, with little more than a signal report although they can listen and acknowledge reception. We took the mike for a few minutes, following which F8LX added a little propaganda about coming to France on a visit, perhaps to "smooth over" any official irritation caused by our use of the mike.

F8KI said that the strongest U. S. signal comes from W1JFG, with good volume from W4EDD, W4DRD, W2JKQ, W4DSY, W1BLO, W2IKV, W8DST, W9NNO, W3FII, W4DLH, W4EEV, W4DRZ, W1BIC and W2ISY. Good ten meter phones are W1KTF, W4EDQ, W2JCY and W8EBS.

F8VC

Jean Ramond, F8VC, has a nice high location overlooking Paris from the east. He uses a home-made superhet and a 59-2A5-RK20 transmitter for 160 to 20 meters. He also has an acorn superhet and a transmitter using 6L6's for crystal and doubler stages ending in a T20 for 20 to 5 meters. The equipment is built up in approved rack-and-panel style. With only 45 watts input, Jean has worked 33 zones and 76 countries on phone within two years. He has heard English five-meter stations.

Meals in France differed from those elsewhere. Breakfast of coffee and French rolls can be made to satisfy by consuming a lot with the help of honey and jam. It is no wonder that coffee is served with half of it warm milk, helping to dilute the bitter taste. A light wine is always served instead of water; the government is probably afraid to improve the water for fear of ruining the wine industry. Our meal at Samur included snails and shrimps with the legs left on. Sandwiches, a standby elsewhere, were impossible without bread and were found only at the Café de la Paix where the bread was as thin as chipped beef. The point is, when in France, eat as the French do!

Our four days in France ended with a boat-train trip to Boulogne, a port on the English channel directly north of Paris. There the *Kungsholm* was waiting to take us to the Netherlands in a short over-night run.

(To be continued in an early issue).

Evolution of a VU Ham

[*Continued from Page 45*]

In an endeavor to improve matters, I scrapped the four-tube job and built a receiver using a 6J7 as electron-coupled detector, with a 6C5 audio, and (don't smile fellows) this hung the world on my sky-hook! Must seem ridiculous in your ether congested area, but with local QRM non-existent, my problem was solved, and my log began to look like a dx-er's dream! It even placed me in the first twenty in both senior and junior BERU contests, and this using an input of only 6½ watts to the transmitter.

The ten-meter band opened up for dx during October '35, and I tried my luck down there, but no sigs were audible at my location until February 1936, and then a QSO with OK opened my ears to the possibilities for doing original stuff in this (to me) new field. With more consistent listening, QSO's with Europe, Africa, Australia, and Asia were quickly accomplished, until there came the great day when I heard W9KFA calling me on October 4th, 1936! He put over both phone and c.w. to (correct me if I'm wrong) effect the first 28-Mc. contact between the American Continent and VU! This was followed by contacts with W9-SPB, JFB, DWU, MIN, GHY, and W3AIR, 4AUU and 8BTI, all on the same day, so KFA may count himself lucky to be No. 1.

Signals were getting across so well that a certain W8 called me a few days after, and accused me of being a funny guy operating in his (the W8's) native city! He gave me a mouthful that almost knocked me off the operating stool. Anyway, the "coals of fire" idea welled up within me and I sent him a card, and I think the shock must have been too much for him, as he hasn't apologized to date.

In November of the same year, VE2KA kindly answered my frantic calls, and as a result, I acquired the first WBE (Ten) award in VU.

The 89's began to get sick about this time, and the final was replaced by a 6L6G, which improved things all round in spite of the low voltage (200) used. Phone contacts with Europe became a regular occurrence when using a 2-watt battery affair as a modulator!

1937 saw me located in Quetta (Baluchistan) but the old body wasn't standing up to the climate too well, and several turns in hospitals on account of fever kept me off the air for long periods, until in June 1938 I was shipped home for a long rest.

Fit and well now, however, I shall be back in Quetta about mid-July, and will be on the air on 14 and 28 Mc. with more power in the antenna provided funds will take it. All VU's would be very happy to QSO if you fellows will turn your beams on Asia between 1200 and 1400—and 0100 to 0230 hours G.m.t. these being the only times contact is possible due to QRM-skip, and our daily work.

So long pals, and perhaps, in the not too distant future we'll QSO and be able to discuss operating conditions applying in the many widely separated districts of this land of temples, smells, and what-have-you!

Antenna Mast Construction

[*Continued from Page 43*]

need extra support as the greatest strain on the mast comes at the start of raising.

After the mast is half way up all that needs to be done is to watch for snagged wires. When it is almost erect, stop the power and straighten the mast by hand, being careful to keep it under control with the front and back guy wires. And now if everything went well it is up, but shaped a little like the letter S. To straighten, attach and tighten the guy wires from joints 1 to their ground anchors. Fasten the rest of the guy wires temporarily to their anchors. Tightening or loosening of the wires will straighten the mast. It may be necessary to climb to joints 1 on each leg to take the slack out of truss wires (B). If not, no climbing of the mast is ever necessary.

WAR WARNING

In announcing the suspension of one amateur's operator license for *communicating with an unlicensed station* and the suspension of another's operator license for permitting his station to be operated by an unlicensed operator, the F.C.C. made the following comment:

". . . the international situation makes it doubly necessary that the amateurs of this country observe closely the rules and regulations laid down for them."

The Commission warned that further unauthorized activities by amateur stations during the period of the European war *may tend to bring about curtailment of the short wave operations of amateurs generally.* The Commission urged the 60,000 amateurs, who as a body have frequently performed outstanding public service, to take all appropriate steps to protect their own standing and their privileges.

In this connection the editors of this magazine wish to go further and not only recommend that amateurs make a special effort to "keep their *own* noses clean" while the war is in progress, but that they be on the alert for any "funny business" going on in the amateur bands, and promptly report any suspicious or strange goings-on to the Radio Inspector.

In the past some amateurs have felt that they would not be "good sports" if they reported every infraction of the rules and regulations that came to their attention, and some have neglected to turn in known offenders even though their failure to do so made them an accessory after the fact, and liable to fine and punishment. It should be pointed out that if you know of such an incidence *or even have reason for being suspicious about anything,* that under the present conditions the best thing you can do for your fellow amateurs is to report it *immediately* to the nearest Radio Inspector's Office.

Class C Grid Excitation

[*Continued from Page 17*]

ments. The actual grid driving power in figure 4 for paralleled tubes is twice that for one tube and is the same for parallel or push-pull class C amplifier stages. The d.c. grid meter should read the same for figures 4 and 5 and the d.c. grid bias should be the same. The d.c. bias voltage will be the same as for one tube but the d.c. current will be twice as great. The r.f. voltage across the push-pull grid LC circuit will be higher than that of figure 4 for parallel tubes since it is split between the two tubes. The parallel impedance of the tuned circuit in figure 5 is proportionately higher, however, so no more power from the link is required than in the case of figure 4.

Grid Neutralized Amplifier

The same reasoning holds true for figure 6. The grid drive is the same, though in some cases a better impedance match is obtained because the grid circuit of the tube is across only a portion of the total tuned LC circuit. In this event, the impedance match is better, there is less loss, and the grid circuit is apparently easier to drive.

Carrier-Operated Remote-Control Circuit

[*Continued from Page 38*]

A suitable r.f. filter in the a.c. line leads to the receiver will help to avoid trouble of this kind. However, harmonics 300 kc. apart will cause little interference in any event. The use of a control oscillator operating at 400 kc. might be more desirable, from this standpoint, in order to "jump" the 14-Mc. band. As a matter of fact, the 35th and 36th harmonics of 400 kc. fall exactly at 14,000 kc. and 14,400 kc. Needless to say, these points could not be used for "edge-of-band" markers, only as a very rough approximation.

In a subsequent article, another type of carrier-operated remote-control circuit will be described. The circuit, while not quite as simple as the one just described, is capable of operating three relays independently, with only one oscillator and without the use of the "phasing" principle. With it, means are available for turning on the transmitter filament and plate supplies separately, as well as for operating an independent keying circuit.

The Open Forum

McKee, Kentucky.

Sirs:

By way of passing along a tip to any of the gang that operate portable or portable-mobile: be sure to take along not only your license and log, but also a copy of the F.C.C. Rules and Regulations. It may save a lot of trouble. This is particularly true if you operate portable in the backwoods.

After operating portable with a gas-engine-generator here for some six weeks we received a visit from the local so-called "Law"—in other words, a hill-billy sheriff. In fact, he broke in without a warrant and without knocking! And he was all ready to take us to jail because our license read "Columbus, Ohio" for the station location. It was just by luck that we happened to have a copy of the handbook with the F.C.C. Rules and Regs in it, and we managed to convince him we were operating under sec. 152.05. He didn't understand it, of course—in fact we had to read it to him—but he decided maybe we were too hot to handle.

So, a warning to the portable gang: take a copy of the Rules & Regs with you as well as your license.

R. B. Jeffrey, W8GDC.

P. O. Box 815
Jerusalem
Palestine

Sirs:

I was certainly surprised to see in the July issue of RADIO on page No. 46 a Hanging Rotating Beam Antenna described by W6MUF, and I shall be very pleased if your attention will be kindly drawn to the following. 4 years ago, when I have just met with Short-Wave Radio Reception, and did never see any Radio magazine, and didn't know about any Radio Club or Society in the world, I have erected the real Original Hanging Antenna, without any knowledge of Radio at all (!) and this particular antenna gave me excellent results and I was using it for over 2 years until I met with Ham Radio and Experimenting generally.

I do consider myself, therefore, to be the originator of the Hanging Antenna, although mine isn't rotating, I've simply erected 4 antennas, each for each direction and it surely works vy vy fb.

I shall be very pleased if these few lines will see "light" in your next issue of RADIO.

REUBEN SOKOLOVSKY

"Iron" Antenna Wire

[*Continued from Page 25*]

The use of galvanized wire need not be confined to the radiating portion of the antenna. The current is a 600-ohm untuned line, if the standing wave ratio is less than two to one, is sufficiently low that galvanized wire can be used with negligible loss. A 600-ohm line consisting of number 14 galvanized (equivalent to no. 12 copper) spaced 6 inches with low loss spreaders will show a loss of less than 1 db for 500 feet at 30 Mc. if no standing waves are present. Such a line will not tend to tangle when being installed as will steel core wire, and in long spans will not stretch as will open-wire lines of solid copper.

Undoubtedly it will be hard for some amateurs to get used to the idea of using "iron wire," the same as it is hard for many people to accept the propriety of pie as a breakfast food. If you feel that you must use copper in order to have "confidence" in your antenna, perhaps you had better stick to copper. But if you put up a lot of antennas, especially long wire or multi-element affairs, it will pay you to reason a little with yourself and convince yourself that even though iron wire makes a good rheostat, it also makes good antenna wire when given a good coating of zinc.

One amateur we know who contemplated replacing his tinned copper antenna wire because "the tin had all worn off and the copper was beginning to corrode" accused us of heresy when galvanized iron wire was suggested after an unsuccessful attempt to convince him that the corrosion did no harm so long as there was good copper underneath. Incidentally, tin has twice the resistance of zinc.

Twin-Three Flat-Top Antenna

[*Continued from Page 14*]

"wet" conditions was extremely small. Even if considerable variation were observed, there would be *no* appreciable decrease in radiated signal or change in performance in the case of this antenna, as long as the transmitter is retuned so that the antenna input is constant. This results from the fact that all elements of this antenna are *driven* and the current magnitude and phase relations between the elements are maintained even though the frequency is varied over wide limits.

However, this statement does not apply to a beam antenna system using *parasitic* elements. For example, the signal strength in a given direction from an antenna with a driven element and a parasitically excited closely-

small stub, and very low standing wave ratios have been obtained on the transmission line using this arrangement.

spaced director and reflector may change to a

Compact Coil Switching

[*Continued from Page 28*]

sawed off. The 10-meter grid coil is air wound.

Heavy flat braid is used for all flexible leads in the r.f. circuits. From figures 2 and 4, it can be seen that the plate and grid leads to the tube are anchored to insulators so that the entire length of the leads does not shift during switching. This precaution saves the tube caps from any strain that might occur with shifting leads.

In figure 4, the tube and neutralizing condenser have been removed in order to show more clearly the connecting rod between the grid and plate condenser. Since the frames of both condensers are at a different potential, the connecting rod is insulated with a piece of mycalex at the grid condenser end. The entire grid condenser and coil assembly is mounted on four ceramic insulating pillars.

The plate condenser is a 100 $\mu\mu$fd. per section split-stator type. The particular condenser used has an exceedingly large capacity ratio (7 to 1), which lends it very readily to use in a band switching arrangement of this sort.

After the amplifier was built and put into use, the efficiency was found to be exceedingly high, in fact just about as good as the previous amplifier that used plug-in coils. The same input power (350 watts) was used in both cases. Two precautions should be observed in building this amplifier. The first is to have all contacts in the switches silver plated. The second is to file flat surfaces on all condenser and panel bearing rods where dial or coupling set-screws are to fasten, since the plate tuning dial has quite a strain placed on it during band switching, and it might slip if the shafts are not filed flat.

No exact dimensions for any of the special parts are given, since slight modifications of this design might have to be made to fit individual requirements. However, the accompanying illustrations should give enough information on this score. The actual contact areas of the switch blades should be about ⅜ inch square. This amount of contact surface is capable of handling inputs far in excess of the actual input that the tube will safely stand.

The only change made since the photos were taken is the meter switching indicated in the wiring diagram. This switch was placed under the meter and between the dials on the front panel.

See Buyer's Guide, page 98, for parts list.

Touch to Transmit

[*Continued from Page 49*]

stationary contact. Also the contact arm should be bent so that it will close in about 60 seconds.

The only alteration necessary on each of the transmitter power supplies is the insertion of a small d.c. relay (E in the diagram) in the negative lead. In our case, these were made from 15c trickle-charger B eliminator control relays. Though these are generally of the s.p.d.t. type, only the armature contact and the back-stop contact are needed. At normal load, the armature should lie firmly against its back contact, but any increase in current (say 5 or 10 per cent) should result in contact being broken and the consequent release of the interlocking relay (C) and the plate power relay (B).

The main purpose of the interlocking relay is to prevent plate power coming back on again as soon as the d.c. relays drop back. It requires two pushes of the control button to restore the carrier after the overload breaker has operated, the first to reset the breaker (C), and the second to close the plate supply relay (B).

The relay (D) is the secret of the single-button operation of the entire rig. It is a rebuilt solenoid type remote control reversing switch from a Lionel toy electric locomotive, and contains a miniature commutator rotated by a ratchet. Each push of the button turns the commutator one segment. Before alteration the brushes were arranged so as to require two pushes of the button to rotate the commutator from one contact to another. This must be revamped so that the commutator acts as a continuous s.p.d.t. switch which closes alternately the circuits to the interlocking and plate power relays.

For high power stages, the (E) relays will operate correctly with the original windings, but for low power supplies, the winding must be removed and the space wound full of about no. 28 wire. If it is impossible to mount one of these relays in an accessible spot so that the spring tension can be adjusted to the desired overload point, the relay can be mounted in an out-of-the-way spot and adjusted by means of a 15-ohm rheostat shunted across the winding.

About the only difficulty experienced in getting the apparatus to work properly was the chattering of the thermostat contacts when the a.c. relays snapped closed. The thermal switch was originally mounted on the small panel with the relays and the trouble persisted until it was removed to a place where vibration could not reach it.

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Lenses and prisms for use with ultra-violet and infra-red light are now being made from single large crystals of rock salt, potassium bromide, lithium fluoride and other salts. Crystals made by a new process have been "grown" to weights as much as 25 pounds and sizes of 8 inches in diameter and 10 inches long. Lenses of this type are used because ordinary optical glass is almost opaque to ultra-violet light.—Ohmite News.

Stabilizing Power Type E.C.O.

[*Continued from Page 50*]

thing—with this system of neutralizing the center tap of the coil should never be by-passed to ground, but should be fed through an r.f. choke.

In tests using this circuit with a 6L6G, the reaction on the fundamental frequency was so great without neutralization that at certain settings of the plate condenser oscillation was stopped altogether. With the oscillator neutralized, however, the stability compared very favorably with that of a 24A which was doubling; the output, of course, was very much greater with the 6L6G.

The need for good shielding, solid mechanical construction, and well-regulated power source is, of course, as great for this circuit as for any oscillator; time spent on these matters will be well repaid.

New Rating System

[*Continued from Page 35*]

tion that tubes would always be used under the most severe operating conditions possible for each class of service. Although it was recognized that this method was not representative of actual operating conditions, it did provide a very large factor of safety. In recent years, rapid progress in tube design, tube manufacturer, transmitter design, and operating technique has made it practical to refine the method of rating transmitting tubes so that it more closely represents actual operating requirements.

For example, in class C telegraph service, the old ratings were set up on the basis of continuous, key-down operation. In practice, however, all class C stages which are keyed are not under load when the key is up, as it is during spacing intervals. The average load on the tube is, of course, much less than it is under steady, key-down conditions.

In class C plate-modulated telephony service, the old ratings were based on steady, 100 per cent, sine-wave modulation. Under this condition, the total plate input (d.c. and a.c.) is 1.5 times the unmodulated d-c plate input. In practice, a broadcast transmitter (for example) modulates its carrier on the average only 25 to 30 per cent. Under these conditions, the average plate power input is only 5 per cent higher than the unmodulated d.c. plate input.

Similarly, the old class B a.f. amplifier ratings were based on steady, full-signal operating conditions with a sine-wave signal. Actually, the average signal is much smaller than the maximum value and the average d.c. plate current and power input varies continuously between no-signal and full-signal values. In addition, it is well known that speech signals place a much lighter load on the class B amplifier than signals having sinusoidal waveform.

In class B r.f. amplifier service, the old ratings were based on *carrier* conditions where the carrier output represents $\frac{1}{3}$ of the d.c. plate input and the other $\frac{2}{3}$'s is dissipated by the plate. At 100 per cent modulation however, the efficiency of the amplifier increases to approximately 50 per cent, so that the plate dissipation is reduced about 25 per cent. However, because the average decrease in plate dissipation is rather small, the ICAS ratings for this class of service have to be more conservative than for the other services.

It is apparent from the foregoing considerations that increased transmitting-tube ratings are practical for many applications. The new ICAS ratings, together with the CCS ratings, make it possible for the radio amateur and the radio engineer to choose the operating conditions best suited for the job at hand.

Six Hundred Volts

[*Continued from Page 48*]

I was slowly forced backward a few steps, and hoped that the connecting wires would be pulled off and break the connection. I tried to help that movement, but my legs were not my own. My nervous system was completely paralyzed by that *contemptible six hundred volts* flowing through my chest. My shoulders were soon against the back wall, and the wires still held. My God! Could no one see what was happening to me? Everything now was a swirling red fog, but in the center of the fog I could still see Ron, and now he was looking straight at me, a funny expression on his face. His lips were moving too, but I could hear nothing, nothing but a frying noise that I knew was my own flesh!

He started slowly down the bench, pulling out all the a.c. plugs as he came to them. It seemed to take hours before he reached the plug that would release me from the suffocating horror of that ever constricting band around my chest. I saw him reach the plug, saw him take the cord in his fingers, and watched his arm slowly pull it from the socket. A crash came dimly to my ears as the chassis hit the concrete floor; then the red fog became black, and swirled over me completely!

It must have made a pretty picture. I had folded up into the large wooden box used for defective and defunct parts. There was a transformer that couldn't stand up under a hundred ma. drain, a filter condenser that went "west" at a thousand volts, and on top of them a *careless* ham who had thrown the wrong switch and almost went "west" at six hundred.

Far away voices buzzing around me intruded into my peaceful oblivion. I opened my eyes a little, and there was Dow's usually jovial face. It was drawn now, and there was a scared look in his eyes. He was trying to straighten out my clenched fingers; I couldn't open them either.

"I'm all right now," I mumbled. I said it several times to make sure they heard me. I couldn't be sure I was really there in the room with them. There was no pain, no feeling of any kind. I just sat there on the chair dumbly, someone behind me holding me by my shoulders, and someone else trying to push a lighted cigarette into my mouth.

It was the middle of the afternoon, and I was home in bed with the x.y.l. anxiously hovering over me before I began to feel the burns on my hands, and the bruised shin where the chassis had struck me when it fell. That was when the chills and fever started, too. The heavy blankets I was wrapped in couldn't keep me from shaking until my teeth rattled.

The next day I felt normal, except that I could hardly move my arms. It was a week before I could lift a cup of coffee with only one hand. Measly little six hundred volts, indeed! A steam roller couldn't have done a much better job of flattening me out.

The burns have healed now, and the arms are all right again, but believe me, every time I stick my hands into a transmitter I make certain the *right* switch is turned off. I try also to follow the advice of W6AM. Don says something like this: "When you stick your hand in where there could be voltage, even though you "know" there isn't, go in with the back of your hand first, with the other hand in your pocket. If you get bit then, your hand will naturally pull away from it."

Sound advice, Don, and I'll add my little bit. Remember the number of people that are killed every year by *unloaded* guns; then be mighty careful of that *dead* power supply, and live to a ripe old age. If there "might" be voltage, it is safer not to stick your hand in at all.

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ROTOLINK FEED FOR TWO ELEMENT ARRAY

Several inquiries have been received regarding the use of Rotolink feed (Oct. issue) with a two-element array. The only change that need be made for a two-element close-spaced array is the substitution of a single length of 28-ohm cable for the two twisted ones between the driven element and the coupling link. This will give an accurate match if the director is adjusted for maximum discrimination instead of for maximum gain, the director length being slightly shorter than the length which gives greatest forward gain.

What's New

[*Continued from Page 61*]

inexpensive microphone allows the cable set to be removed and changed without opening the mike. It has a range of 30-7000 cycles, high level (—52 db) and is fully shielded and protected.

828 TRANSMITTING BEAM POWER AMPLIFIER

RCA-828 is a new multi-electrode transmitting tube with a maximum plate dissipation rating of 80 watts (ICAS) for class AB_1 and class C telegraph services. The 828 contains a suppressor and has beam power features. The tube is designed particularly for use as a class AB_1 modulator and audio-frequency power amplifier; it is also well-suited for use in radio-frequency applications as an r-f power amplifier, frequency multiplier, oscillator, and grid- or plate-modulated amplifier. *Two 828's in class AB_1 service (CSS ratings) are capable of delivering 300 watts of audio power with only 1% distortion!*

Because of its high power sensitivity, RCA-828 can be operated in r.f. services to give full power output with very little driving power and, consequently, with a minimum number of driver stages. Neutralization is unnecessary in adequately shielded circuits. The 828 is ideal for use in transmitters where quick band change without neutralizing adjustments is required. The tube may be operated at maximum ratings at frequencies as high as 30 Mc and at reduced ratings up to 75 Mc. RCA-828 is equipped with the new "MICANOL" base which has excellent insulating qualities at high radio frequencies together with low moisture-absorption characteristics. The plate connection of the tube is brought out through a separate seal at the top of the bulb to provide high insulation.

DX

[*Continued from Page 57*]

they continued the QSO for another hour and a quarter."

W1RY has a few new ones, XU8MI, KA1HR, VS7RA, LX1RB, VQ2GW, VU7BR, PK4KO and VU2EU. These bring his score to 37 and 117. W2IZO has been operating up at Sandy Point, Maine, and he says that is a swell location. With 36 and 92 for his totals he has added CE4AD, U9AW, UK6WA, XU8MI, J2KN and KA1FG. W2LOY says that a signal turned up signing TA1AB on 14,382 kc. and claimed to be working under cover but didn't say where. Sounded as though it were coming from K4 or HH section. Well, anyway he's trying.

W1AKY says that OQ5RT is on 14,035; CX2BK 14,116; I1MZ 14,084; ES4G 14,080. I1TKM told Ed that he would QSL through W2LYP.

In a letter from VU2AN he mentions about having 220 v.d.c. mains. They are 220 when there is no load on. The rig Tom is using is a 6L6 oscillator, 6L6 doubler and pair of them in the final. He has been working G stations on 3.5 Mc. Antennas are his chief problem, and get changed around regularly. His present QTH at Fort Sandeman, Baluchistan is very compact, and although there is as much open space in Baluchistan as there is anywhere, he has to crowd his antennas into a very small space. Even then they are surrounded by power lines and iron-roofed bungalows. There isn't enough wood in Baluchistan to make one decent 30-foot mast. Tom uses two 30-foot iron telegraph poles. He wishes he could put a consistent signal over here but guesses he will have to wait until he returns to G. Tom is in the Signal Corps and his eight years will be up in February, 1940—so he'll probably be there until then. The frequencies he uses on 14 Mc. are 14,080, 14,350 and 14,390 kc. Yes, thanks, I received my card from him.

"Siam" Re-named "Thailand"

In a letter just received from our dx friend HS1BJ, he informs us that on June 24 they celebrated Thai National Day, and the government officially changed the name of the country from Siam to Thailand. The natives of the country call themselves "Thai" while the foreigners are "Siamese". The meaning of "Thai" in native language is free, independent. The race is a big branch of the Mongolian, and the ancestors of Thai people were in China. The government have changed their postage stamps accordingly, although for foreign use they continue to use "Siam" as well as "Thai" until such time as the new name is generally known.

HS1BJ, Sangiem Powtongsook, is Chief of the Staff at the Overseas Broadcasting station which operates as HS6PJ on 19.02 Mc. and HS8PJ on 9510 kc. Then there are HSP and HSE2, commercial phone transmitters in the same building. Sangiem has been very busy installing new equipment in various parts of Thailand, which accounts for his not being very active during the past few months. However, he will soon be on again.

PJ5EE just arrived for a brief visit in Los Angeles, and while here gave a few interesting points during an evening. W6JBO, W6FZY and W6-OAQ dropped in so we had quite a fine confab. PJ5EE says there are five active stations in the Netherlands West Indies, PJ1BV, PJ3CO, and himself are three of them. He has never heard of YV2CU being there, although says he might be, as all of them are undercover anyway. PJ5EE says it looks pretty good toward getting licenses, though, sometime after the first of the year. He uses 6 watts into a 6L6G. He says NEVER send cards direct to them as trouble may arise from it. It would be best to handle all of them through A.R.R.L. He is all hopped up over RADIO's 1939 World-Wide DX Contest and plans to be on as much as possible. His usual time on the air under normal conditions is around 0600 to 0700 g.m.t. and the frequency very close to the high frequency edge of the 14 mc. band.

Now that so much of the dx is off the air I would certainly appreciate anything in the way of news regarding our friends overseas. Any bit of news as to what they are going and how they are would be welcome news to all of us.

Much to my surprise the other night, while working W9EQG, I was informed that W6CXW was there in Chicago. I can't figure out what Henry was doing there, unless he was taking me literally on a remark I had made to him, which went something to the effect that I wished someone would go back in the ninth district and line up all those W9's for me. Well, anyway, Henry was visiting W9LW, W9EQG, W9CVN, W9AIO, W9NLP and a few others.

Remember, gang, keep firing that news in to me, and by the way if you work Zone 23, let me know about that too, will you?

New Books

[*Continued from Page 67*]

Automatic Tube Tester

Serviceman-amateurs will be interested in knowing that Dayco Radio Corp., 915 Valley Street, Dayton, Ohio, has accomplished the development and is now manufacturing an "Automatic Robot Tube Tester." The theme of the operation of the ingenious tester is the insertion of a keyed card, punched for whatever tube is being tested, into a slot in the instrument. From then on the testing of the tube for shorts, emission, etc., is a simple matter of pulling a handle and watching the indicating meter and a set of colored lights. Complete information may be obtained by writing to the manufacturer.

New Stancor Hamanual

Stancor's new Hamanual will be released to the trade October 1. As usual, it is printed in two colors, and has contained in it many unusual features of special interest to the amateur and P.A. man. There are seven excellent transmitters ranging from 10 to 100 watts, and four amplifiers from 14 to 60 watts, all of which are completely described with diagrams, complete parts list, bottom, top, and front view and complete descriptive matter on each. All transmitters were "air-tested" on each band, and the amplifiers were laboratory checked for frequency response and overall performance. They are all available in kit form, using standardized punched chassis developed by Stancor.

Other features of the Hamanual are: Complete catalog section, formulas for the amateur, power supply circuit, and many charts. A free copy of the Hamanual may be secured from any Stancor jobber; none will be mailed directly from the factory.

Ward Leonard announces that its new, revised Circular No. 507 is now ready for distribution to the radio trade. Copies of this circular will be sent free to anyone interested in radio resistors, rheostats, line-voltage reducers and other items of the Ward Leonard line.

Amphenol Blue Book Catalog 57-J

American Phenolic's new catalog for 1940 has just been released. The book comprises 32 pages of amply illustrated description of the well rounded line of sockets, hardware, plugs and jacks, concentric cables, and insulating materials which Amphenol manufactures. The catalog should be of wide interest since Amphenol most likely manufactures the most complete line of such small components available in the industry. Of especial interest is the listing of a new series of sheets, rods, tubes, insulators, and sockets made of the new ultra-low-loss polystyrene insulating material Amphenol "912." A number of different types of co-axial cable insulated with "912" are also listed.

U. H. F.

[*Continued from Page 66*]

skip" signals. W3RL on June 9 worked W8CIR on "low atmosphere bending." That winds up Eastern reports—perhaps only because we are not receiving as many letters from the east as formerly, though W2AMJ claims that the band even in the New York area is not very active.

Albert W. Friend, before he left West Virginia University for research work at Harvard, wrote that he had worked W8CIR and W8CLS, hearing W8NYD, on May 25. A quarter-wave vertical mounted on a truck and a 1-10 receiver were sufficient to do this at an 1800-foot altitude. W8RFP and W2CTT plan to carry on u.h.f. work this autumn at the university.

W8CVQ in Kalamazoo says that May 23 was a freak. Detroit and Chicago stations disappeared leaving only W8VO fading badly and W8CIR near Pittsburgh. May activity at distances out to 300 miles reached a new high. July 31 brought in eastern districts on skip but with mushy signals and no definite carriers, stations at 200 miles were of unusual strength, W8QDU coming through like a local. W8NZ who is twenty miles from CVQ could be found twenty places on the superhet within a megacycle of his crystal frequency. Walter says that the mushy effect may be a multiple Doppler's Effect—probably not a bad explanation considering the churning of the ionosphere that goes on during a magnetic storm. He wants 56-Mc. calls heard—send them in and we'll publish them, but this department has not had time to tabulate reports in that form. W8JLQ in Holland, near Toledo, Ohio, between May 25 and June 2 heard W8CIR CJM MDA OXS VO JAH SLU NZ QDU GU LZN LJP CVQ IUD NYD. There is quite a group of 56-Mc. stations in and around Grand Rapids, including W8GRP RXE OTG LNW TCX TBN NOH LMP. They do considerable work with W8CVQ and W8NZ. NOH has been heard by W8VO in Akron, and reports these between May 25 and June 5: W8CVQ NZ RV VO ODU SLU IUD W9CLH. W8NOR near Buffalo between May 27 and June 8 worked VE3ADO opened for unstabilized oscillators? Don't write us, write to the League!

W9ZJB feels that his vertical H array is far superior to W9AHZ's vertical dipole for pre-skip, but inferior for skip dx. We cannot agree that the H is so sharp that it is good only at extremely low angles—more likely it is located at a height that produces a null at some useful angle—say 7 degrees above the horizontal. He noticed on June 11 that W9BRN in Butler, Missouri, 85 miles away, came in when the beam was 90 degrees off, the signal going out when the beam was pointed head on; this condition on ten meters, mentioned several months ago, has been continuing.

W1HXE in Methuen, Mass., writes us about field day activity on June 17, when a local bovine family took such a liking to the tent and equipment that the Merrimack Valley Club delegation had to vacate. The officers have made their annual change except that HXE again remains as treasurer. Look out, Paul, that the auditors don't get after you!

In Milwaukee, W9ANA helped W9IZQ put up a co-axial antenna system, which did not work as well as expected. It was found that the copper tubing line, when removed for house painting, contained a glassful of water.

Several antenna tests were made by W3BYF. All dx on July 27 came in best on a haywire horizontal doublet except W9AHZ and W9ZJB in Kansas City who came in best on a vertical W8JK. W9GHW near St. Louis was louder on the doublet while the Kansas City stations were coming in best on the W8JK. Dx is sometimes heard on the horizontal when inaudible on the vertical. W3GCN put up a doublet that can be changed from vertical to horizontal with a rope. On July 31 he spent an hour calling without results until he pulled the antenna horizontal; then he immediately worked W9CBJ and W9ZHB (both in Illinois). We believe that this is not likely to be the result solely of the polarization of the incoming wave. Kansas City is of such a distance from Allentown, Penna., as to require less than a three degree angle above the horizontal for single hops (common on five meters). This would give the vertical W8JK an advantage for such low angle signals. More important than this, however, is the recurrent null angles resulting from the height of an antenna above ground. The nulls and maxima for a given antenna height are reversed by changing the polarization. If an antenna is ineffective for signals arriving at a certain angle, changing the polarization may produce a maximum signal due to the altered directional pattern in the vertical plane.

Above 112 Mc.

In Milwaukee, W9ZGD is still working on both 1¼ and 2½ meters, but with improved equipment. He is ready to try schedules with Chicago. His dx on 112 Mc. has expanded to 23 miles, but local activity is nil. He has done very little on 224 but has a loud signal several miles away; he finds that indoor antennas are not very good down there because of absorption.

W2JND in Syossett, New York, says that he is a relative newcomer on 2½ but finds it "swell." He is using a transmission-line-controlled transmitter. His antenna is a three-element beam. Best dx so far is W1CPL at Devon, Conn., having been reported often in Bridgeport. A local group expects to be active this autumn.

• • •

A new remote reading antenna ammeter has just been announced by a Chicago manufacturer. Designed primarily for broadcast station use, it features extreme reliability and accuracy, a linear scale, readings which do not vary with modulation, and its accuracy is not affected by as much as 50 ohms of resistance in the lines leading to the remote scale.

The Marketplace

Classified Advertising

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

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

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

(d) No display permitted except capitals.

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

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

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

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

TRANSMITTING TUBES REPAIRED Tantalum & Carbon Plates $4.00 up. KNORR LABORATORIES, 5344 Mission St., San Francisco, California.

PRACTICAL Radio and Communication Engineering Course for Home Study offered by Smith Practical Radio Institute, Department R119, 1311 Terminal Tower, Cleveland, Ohio. Information Booklet Free.

QSL's—Samples, Brownie, W3CJI, 523 North Tenth Street, Allentown, Pennsylvania.

AC Generators and plants. Have some good buys in used machines. Ideal for emergency. Katolight, Mankato, Minnesota.

FOR SALE—K. W. 10, 20, 160 meter phone transmitter built by Frank C. Jones. 813 buffer, pair T200's final, 354C's Class B. Separate power supplies Class B and Class C. Price complete $450.00. W6OI. 1250 Parkinson Ave., Palo Alto, Calif.

WANT 600 meter receiver six or two volt. Jim Caldwell, Box 482, Willcox, Arizona.

QSL's—Quality Workmanship, Neatest designs! Fritz-455 Mason-Joliet, Illinois.

SELL new RCA 852's $10 each. Thordarson 10v. filament, 1250v. 280ma. transformers $12. Triplett 0-15 ACv; 0-15 AC amps; 0-500 DC ma. $2.50 each. 50mmfd. Cardwell transmitting $2.50. Francis Orcutt, W8GWT, Penn Yan, New York.

CRYSTALS in plug-in heat dissipating holders. Guaranteed good oscillators. 160-80 $1.25: (No Y cuts) 40X $1.65: 80M Vari-frequency, complete $2.95. State frequency desired. C.O.D.'s accepted. Pacific Crystals, 1042 South Hicks, Los Angeles.

QSL's?? SWL's?? Printed to your specifications!! Samples free. W8DED, Holland, Michigan.

FOR better cabinets, racks, panels, chassis, special work, and personal service. Write R. H. Lynch, 970 Camulos, Los Angeles, California.

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200 WATT four stage cw rig and RME69 $150.00. W5FRO. SELL—6F6—865 C. W. Transmitter complete $15.00. Write W3GVA.

HAMMARLUND Super-Pro, world's finest receiver, xtal model, like new, cost me 261 bucks, best offer cash or terms takes it, correspondence answered. W6CD, Box 111, Albany, Calif.

CRYSTALS Commercial-Amateur. Literature upon request. Angelus 7310. C-W Manufacturing Co., 1170 Esperanza, Los Angeles.

RECONDITIONED guaranteed receivers and transmitters. Practically all models cheap. All shipped on ten day trial. Terms. List free. W9ARA, Butler, Missouri.

QSL's—By W8NOS—"The QSL Craftsman"—13 Swan St., Buffalo, N. Y.

PRECISION filament transformers postpaid. 7½ volt @ 6½ amps, 2½ volts @ 10 amps—$2.10 each. Write for list of filament, plate, class B transformers and chokes. PRECISION TRANSFORMER COMPANY, Muskegon, Michigan. Formerly Michigan Electrical Laboratory.

SOUTHERN California Hams: I am selling out because of health 600 Watt fone or C. W. rack & panel xmitter, plug in coils for 20-40 & 75 meters. P.P. final, Class B modulators exceptionally good parts used thru out. $225.00 takes it. Also other parts including S.S. Superhet receiver with crystal & noise silencer etc. priced for quick sale. W. R. Kenyon, 1923 Main St., Santa Monica, California.

BARGAIN—My modern 50W, 160N. fone xmitter, complete $50. Write Ed. Gaddis, Chambersburg, Illinois.

SELL QST 1923-1935 inclusive $7.50. Few 1922 issues. W6IH.

ANYONE who knows the present address of Robert W. Bennett formerly in the radio industry in St. Louis and Dayton will confer a favor on his brother by sending it to Ell C. Bennett, 1836 Euclid Ave., Cleveland, Ohio.

CATHODE MODULATION—plans for building xmtrs around the type of tubes you now use. Complete instructions. Save dollars, and dollars, and dollars, and dollars. Send $1.00 to—Frank C. Jones, 577 Monadnock Building, San Francisco, U.S.A.

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814 EXCITER or transmitter, figures 22-25 chapter 11 1940 RADIO Handbook. $35 less tubes. $50 with tubes. F.o.b. Radio Ltd., 1300 Kenwood Rd., Santa Barbara, Calif.

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421 EXCITER or transmitter described in chapter 11 of 1940 RADIO Handbook, $29.50 including 10, 20, 40, 80, and 160 meter coils, less tubes, crystal, and power supply. Price f.o.b. Radio Ltd., 1300 Kenwood Rd., Santa Barbara, Calif.

THREE TUBE SUPERHET figure 6 chapter 6 RADIO Handbook (1940 edition) with dynamic speaker. Less tubes and power supply. $15 f.o.b. Radio Ltd., 1300 Kenwood Rd., Santa Barbara, Calif.

EQUIPMENT originally constructed for the next edition of the Radiotelephony Handbook is offered for sale as follows: P.p. T-40's, cathode modulated, 90 watt carrier, coils for 20 and 80 meters. Small grey cabinet. Price $125. P.p. TZ-40's, plate modulated, 150 watt carrier. Coils for 10 to 160 meters. 4 ft. grey relay rack. Price $190. E.c.o. unit in cabinet. 15 watts output 10 to 160 meters. Built in regulator, no power supply. Excellent stability. Price $30. All prices are f.o.b. Berkeley. Frank C. Jones, 2037 Durant Ave., Berkeley, Calif.

EGYPTIAN LOVE PERFUME. Exotic—Breath-taking—Enchanting. Just one tiny drop is enough. Full size bottle $1.00. Large, generous size $2.50. One bottle FREE if TWO are ordered. Schuyler Sales, Box 126-R, Schuylerville, New York.

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.

811-812 TRANSMITTER

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R.F. AMPLIFIER

C_1—Cardwell EU-140-AD
C_2—Cardwell MT-100-GD
C_N—Hammarlund N-10
RFC—Hammarlund CH-500
L_1—Bud type OCL
L_2—Bud type VCL and AM-1356 base
Tubes—RCA
Knobs—Crowe
R—Ohmite "Brown Devil"

MODULATOR

T_1—Stancor A-4762
T_2—Stancor A-3894
Tubes—RCA
M—Triplett 227-A

POWER SUPPLY

T_1—Kenyon T-360
T_2—Kenyon T-666
CH_1—Kenyon T-516
CH_2—Kenyon T-168
C_1—Cornell Dubilier TJU-15040
C_2—Cornell Dubilier TJU-15020
R—Ohmite 200 W.

Moran Bandswitching Amplifier

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C_1—Bud no. 1533
C_2—Bud no. 1627
C_3, C_4, C_5—Cornell-Dubilier type 4, 1000 volt
NC—Bud NC 1000
R_1—Ohmite Brown Devil
R_2, R_3—Centralab 516
RFC—Bud no. 568
M—Triplett 321
50-Watt Socket—Bud 226

BRODERSON BANDSWITCHING MONITOR

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C_1—Bud 328 variable
C_2—Aerovox 1467 mica
Coil form—Bud 596
Sockets—Bud wafer
Box—Bud 1098 shield can
Dial—Bud 165 with 725 vernier
S_1—Bud 499 rotary switch
S_2—Mallory-Yaxley 3215-J
Tube—RCA 30 or 1G4G
Additional components:
Chrome-plated handle, rubber feet, 2 1¼" bakelite knobs, bolts, washers, lugs, ¼-lb. spool no. 26 enam., spaghetti, 3 ft. no. 14 enam., flashlight cells, B battery.

Advertising Index

HUGHES PRINTING CO.
EAST STROUDSBURG, PA.


The GREATEST LOW-COST TUBES in RADIO HISTORY!
812
811
RCA Radiotron
RCA Radiot
RCA-811 and RCA-812
(High-mu type)
(Low-mu type)
225 Watts Input.
6.5 to 8 Watts Driving Power.
ICAS Class "C" Telegraphy Ratings.
"Big league" tube performance at only
$3.50 each
(Amateur Net)
Think of it! 225 watts power input to a $3.50 tube! Or, with a pair of the new RCA-811's or RCA-812's, you can use an input of 450 watts. That's real power *plus* real economy in any language.
This outstanding performance results largely from RCA's development of the Zirconium-coated anode, an exclusive RCA feature. These anodes mark an important forward step in the production of high-perveance, high-power tubes at hitherto unheard of low costs. They run cooler. They do a better job of absorbing gases, even under high overloads. Other exclusive features of these tubes include the new low-loss RCA Micanol base, now available for the first time. Summed up, they answer the need for high power output with low driving power and moderate plate voltages — at a tube cost within the reach of all!
Bulletin free upon request
Class "C" Telegraphy Maximum Ratings
*ICAS *CCS
1,500 . . . D. C. Plate Voltage . . . 1,250
150 . . . D. C. Plate Current 125
225 . . . Plate Input 155
55 . . . Plate Dissipation 40
Featuring the New RCA ZIRCONIUM-COATED ANODE
An outstanding RCA development.
Runs cooler at full ratings.
Gives instantaneous protection against gassing on overloads.
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Radio Tubes
RCA MANUFACTURING CO., INC., CAMDEN, N. J.
A Service of The Radio Corporation of America
FIRST IN METAL — FOREMOST IN GLASS — FINEST IN PERFORMANC
* NEW RCA DUAL RATING SYSTEM ANNOUNCED
Write for bulletin describing the new RCA Dual Rating System for air-cooled tran mitting tubes. New ratings, called Intermittent Commercial and Amateur Service (ICA are given for many popular amateur types. As illustrated above, the new ICAS ratings are much higher than the former ratings (now identified as Continuous Commerci Service—CCS). The new increased ratings are of particular interest to all radio amateur