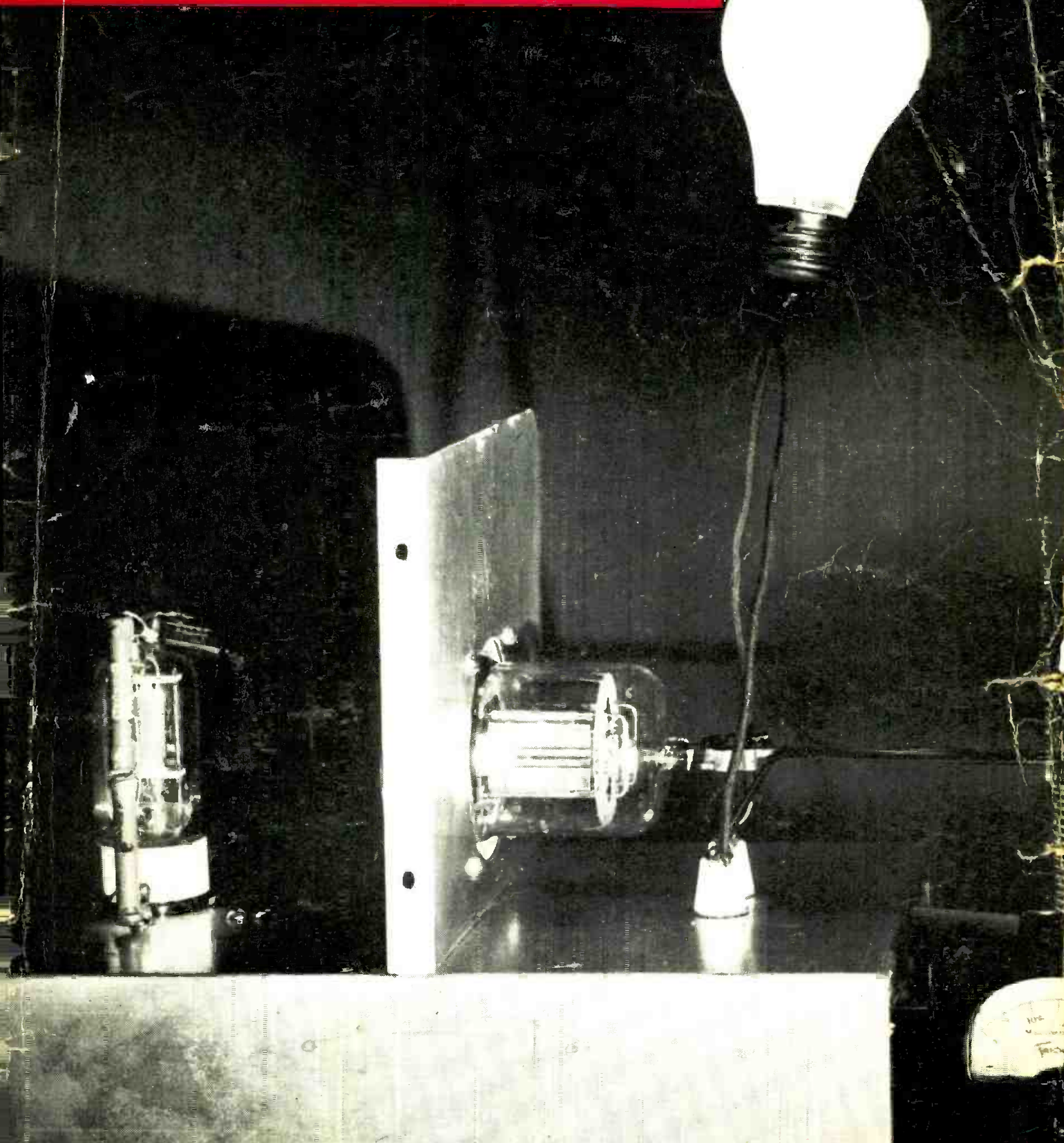
# RADIO

ESTABLISHED 1917



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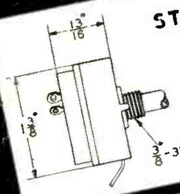


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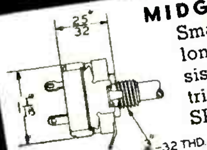


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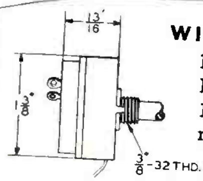


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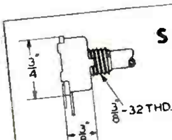


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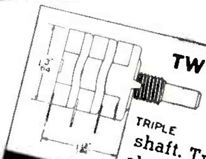


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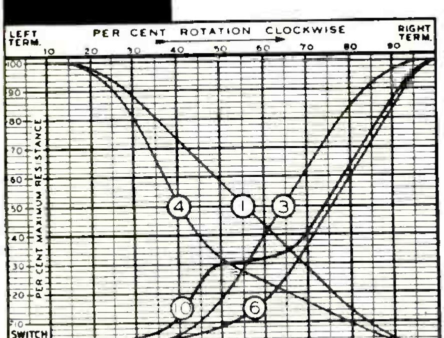


The resistor curve of a volume control is more important than its overall resistance . . . that is why all Centralab controls are furnished with the variety of curves shown here. Curve six is most widely used for high resistance radio grid and diode controls. Curve 1, or 4, are best for C bias, and Curve 3 for antenna C bias. Curve 10 is used on tapped controls.

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# *Past • Present and • Prophetic*

### Squisher

For the simple and effective gadgets, we heartily recommend Smith's splatter squisher, shown on page 16. Work on the 1941 HANDBOOK came to a standstill for several days while the staff stood around in the lab and gaped at the 'scope and listened to "before and after" tests with a 300 to 400 per cent modulated signal. That a skeptical gang like RADIO's staff was convinced that Smith "really had something there" should be ample proof that the squisher does a real job of holding a phone signal down to a reasonable slice of ether. But, in case you're unconvinced, build one and donate it to that local who splatters so much—of course we know that *your* signal doesn't splatter, but the other fellow may not read RADIO.

### Armstrong Tells All

One of the high points of the joint Pacific-Southwestern Division Convention was a talk by Major Armstrong on his latest discovery, noise reduction by means of frequency modulation. Once again we had it impressed on us that the difficult problems are more often than not bested by the simplest means of attack. In spite of the fact that Major Armstrong had undoubtedly prepared his material for a group of amateurs, there was no implication of "talking down" to his audience in the simple, clear description of what makes FM tick.

Time and again as the Major told of his early experiments with FM the thought flashed through our mind that here was the ham method—try a little of this or that, if it works better try some more of the same; if it doesn't work as well try something else—the simple approach to the difficult problem. As Major Armstrong told his audience that mathematics could always prove what had already been demonstrated experimentally, and that by making the wrong assumptions you could prove a fallacy, our thoughts traveled back to his announcement of the noise reducing capabilities of FM in the May, 1936, issue of the *Proceedings*—an article unusual for that journal because of its almost complete lack of mathematics. The one equation he gave, if it could be called that, involved nothing more than an understanding of grammar-school arithmetic. And as we compared that simple, confident article with the page after page of mathematics which in preceding years had proved that FM was of absolutely no value and with the similar page after page which has since proved that the Major was right, we once again were impressed with the value of the amateur way of doing things—the "tinkerer's" approach. Yes, it sort of made us think—this down-to-earth talk from the man who had figured out the complicated phase-modulation method of obtaining crystal-controlled frequency modulation—there will always be a place for those willing to try something new or different and who can apply a little common sense in analyzing the results they achieve.

### Conversationalists

Speaking of places, we wonder what place there is in the present scheme of things, what with the present emphasis on national defense for those conversationalists who operate completely "boughten" stations? Surely these men (and women) contribute but little to the public interest, convenience, etc. To our way of thinking it is to their own and amateur radio's interest that they get a practical understanding of what makes the wheels go around inside that shiny transmitter and receiver. To these, though few, we say: Get out the soldering iron. Build an emergency "blooper." Change the doubler stage in that chromium-plated transmitter. You'll get a kick out of working someone with a piece of equipment that is at least partly your own brain child and that represents some of your handiwork, haywire or otherwise, and you'll help justify the amateur cause at Washington.

### And Still They Come

As this is being written, work on the 1941 RADIO HANDBOOK is coming to a close. As usual, our "vacation" chore has turned out to be quite a job and, we think, a worth-while one. One of the biggest problems this year has been the compiling of the data for the receiving tube characteristic tables. Some idea of the magnitude of the job may be gained from the fact that the basic-type characteristics (exclusive of alternative basing and envelope types) runs to somewhat over twenty HANDBOOK pages. And the fact that the tube data was held to the last, just in case some manufacturer should get the idea that a 228X17-GT was needed to protect the industry from stagnation, didn't make things any

[*Continued on Page* 77]

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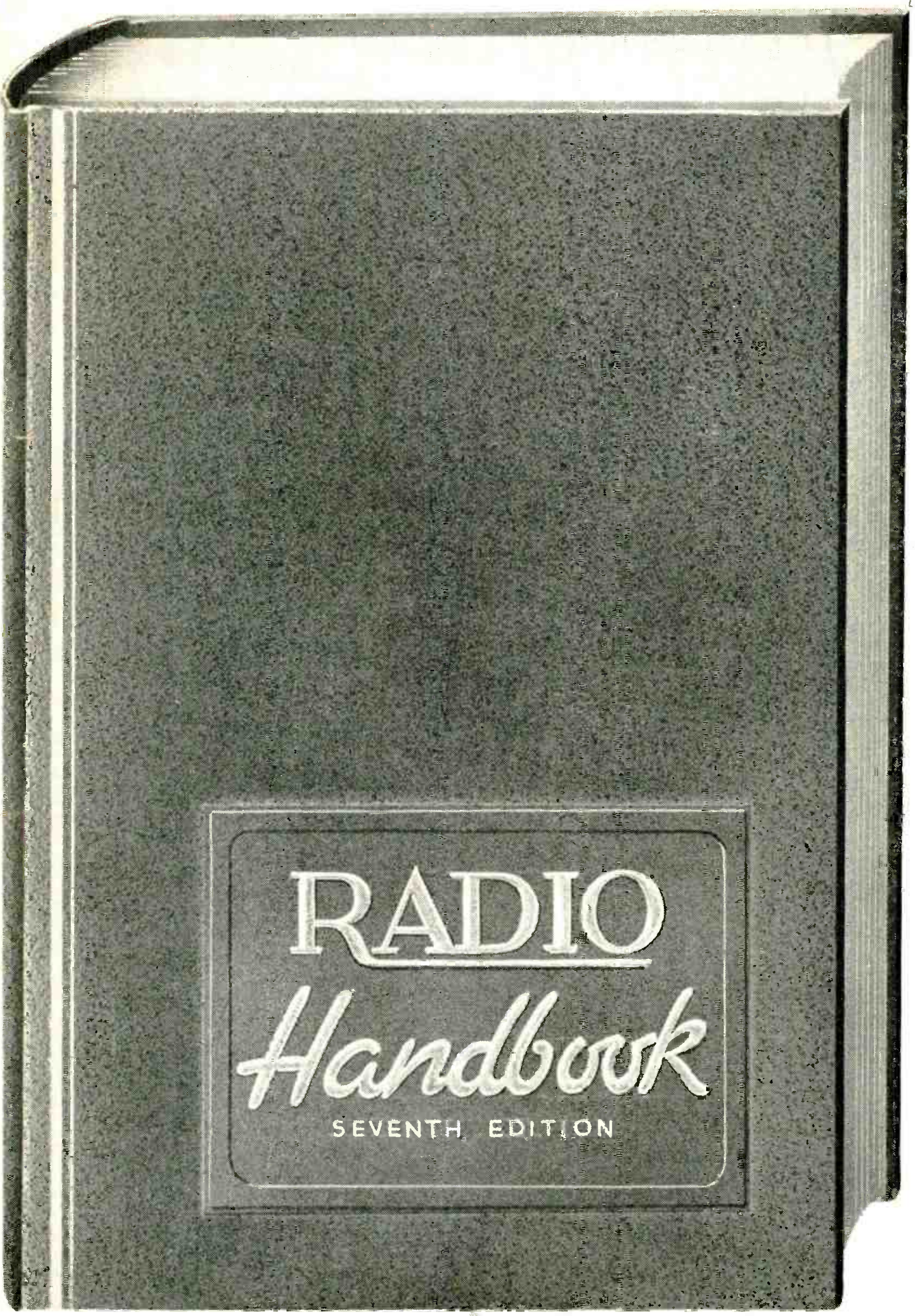


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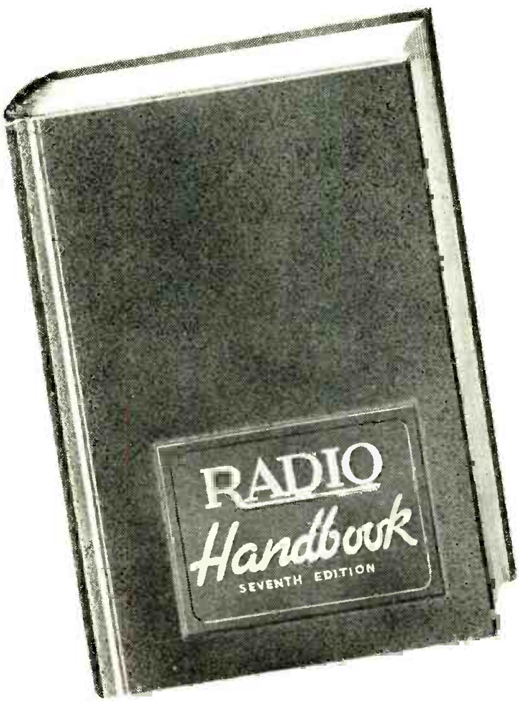


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Published by
RADIO, Limited

Home offices: 1300 Kenwood Road, Santa Barbara, California

Telephone: Santa Barbara 4242
Bell System teletype: S BAR 7390
Cables: RADIOLTD SANTABARBARACALIF

**October • 1940**

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**No. 252**


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## MISCELLANEOUS FEATURES



## DEPARTMENTS




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**PUBLISHED** monthly except August and September by Radio, Ltd., 1300 Kenwood Road, Santa Barbara, Calif. **ENTERED** as second-class matter Sept. 26, 1939, at Santa Barbara, Calif., under the Act of March 3, 1879. Additional entry at Mt. Morris, Ill.



**PRINTED** in U.S.A. by the Kable Brothers Company, Mt. Morris, Ill.

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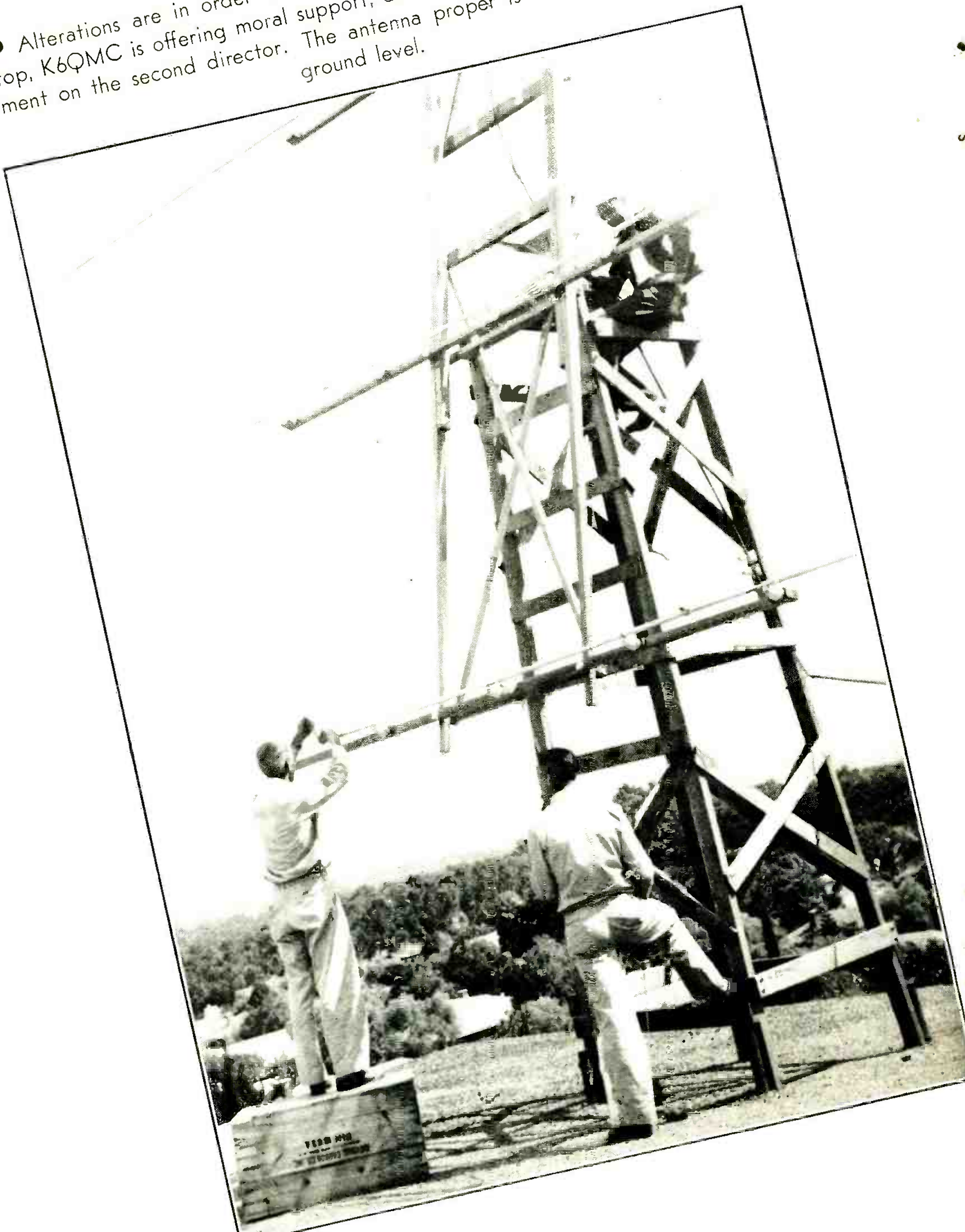


# *The Design of Single-Ended*

# U.H.F. AMPLIFIERS

INCLUDING A 112-MC. FM TRANSMITTER USING THE AMPLIFIER CIRCUIT

By NORMAN J. FOOT,* W9GQP

Various circuits for obtaining sizable amounts of r.f. at the ultra-high frequencies looked good on paper but just wouldn't work out in practice because of certain details that became rather important items on 2½ meters. Tank circuits took on the aspect of connecting bus-bar for low-frequency gear, and tube and distributed capacities appeared overwhelmingly large. Getting the f.m. signal to hit 2½ meters was not difficult when such low-power tubes as the 6J7, HY-615, 6C5, 6F6, and 6J7 were used, but when more r.f. was desired, the larger tubes presented new difficulties.

When the 807 was used as an amplifier on 114 Mc., the tank inductance became a short piece of copper tubing reaching from plate cap to the by-pass condenser which connects to the cathode, and in as short a line as was mechanically possible. With this circuit it is possible to reach 120 Mc. This indicated that tube capacities are important considerations when selecting a tube for the u.h.f. range, but probably more important is the internal tube inductance between the physical plate and its plate-cap, and, most important, the amount of internal inductance between the cathode and its pin at the base.

A certain conventional high frequency tube was tried, but didn't work out at all at this frequency in the single-ended circuit because the necessary minimum inductance was too large by a small amount to reach even 112 Mc. However, when a parallel tuned circuit was coupled closely to this plate tank, a plate-current dip was noticed as the coupled circuit was swung through resonance (see figure 1).

Power may, then, be drawn from such a circuit even though it in itself is not resonant but the efficinecy is low and adjustments are critical. It is a well known fact that, when two circuits are coupled together, an impedance called the coupled impedance is transferred from one to the other. It is this coupled impedance which explains the plate-current dip of figure 1, and with which we are concerned here.

*Assistant Engineer, KWNO.

## Complete Circuit Calculations

The equivalent circuit of a coupled system is illustrated by figure 2. Here, the reflected reactance appears as a capacity in series with the inductance in the primary. The value of this coupled reactance may be written as follows:

$$Z_c = \frac{(2\pi f\, M)^2}{Z_s}$$

where $Z_c$ = coupled impedance
$Z_s$ = secondary impedance
M = coefficient of coupling
f = frequency in cycles

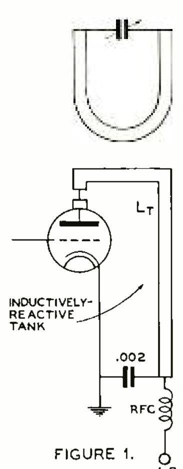



FIGURE 1.

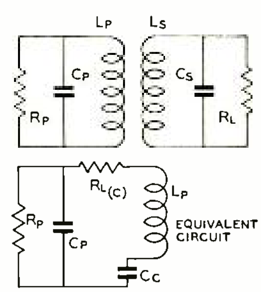
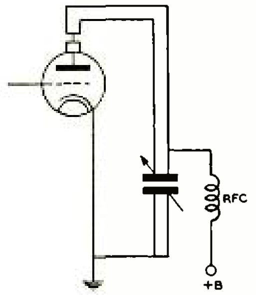



FIGURE 2.

**Figure 1 shows how the inductively reactive external circuit is coupled to the inductively reactive tank circuit in the plate of the amplifier tube. Figure 2 shows the diagrammatic equivalent of the arrangement where the coupled-in load resistance and the equivalent coupled-in capacity is shown.**

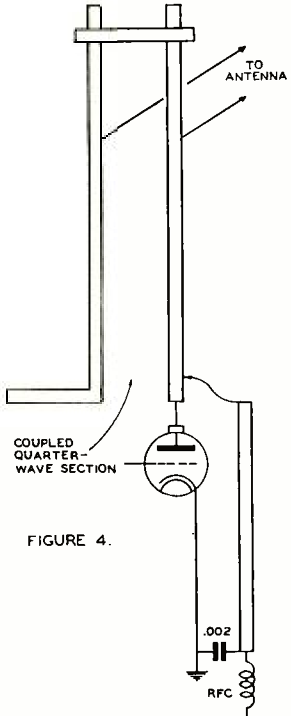



SERIES PLATE TUNING
FIGURE 3

The resultant primary impedance then becomes:

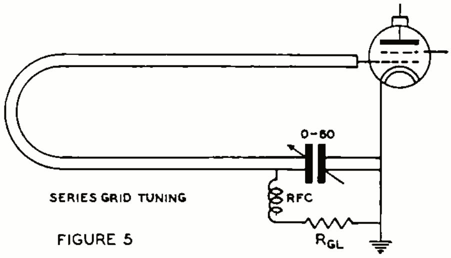
$$Z = Z_p - j\,(2\pi f\,M)^2/Z_s$$

From the above we see that the resultant primary impedance is a function of the original primary impedance, the coefficient of coupling, and the secondary impedance; and we also see that when the secondary is reactive, a reactance of the opposite sign is coupled into the primary circuit.




COUPLED QUARTER-WAVE SECTION

FIGURE 4.




SERIES GRID TUNING

FIGURE 5

Most amateurs are familiar with the effect produced when a loading circuit is coupled to the final tank circuit. If the coupled circuit is not resonant, or if the coupling is too close, the tank circuit will have to be retuned to effect resonance again.

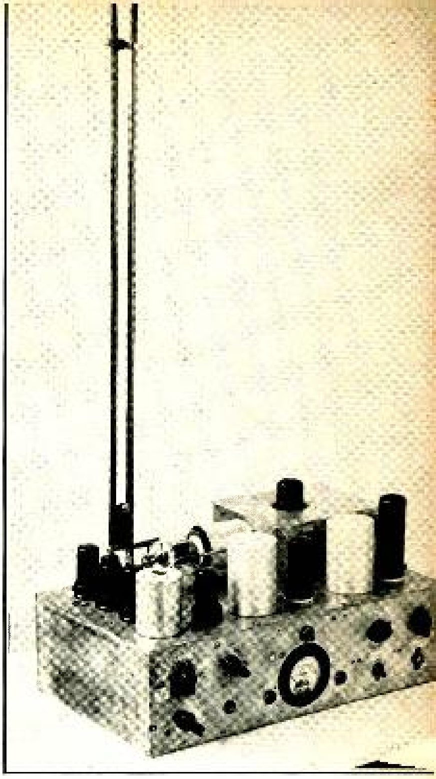
Figure 3 shows a simplified method of obtaining resonance when the tank inductance has an inductive reactance. Here a series condenser is actually placed in series with the tank inductance. In figure 1 the series condenser is theoretically placed there electrically, but in both cases the result is the same.

## The Circuit

In obtaining a simplified system, one that was not critical to adjust, and one that "stayed put" once it was tuned up, the final circuit of figure 4 was selected. A quarter-wave section of copper tubing of 5/16-inch diameter is mechanically coupled to the plate circuit by virtue of the common impedance of the plate and quarter-wave section at the plate, including that portion inside the envelope. A blocking condenser is placed in series with the quarter-wave section and the plate return tank to the cathode in order to remove the danger of high-voltage on the copper rods. The quarter-wave section is tuned by means of the slider at its top end, and the coupling between the two circuits may be varied by adjusting the tap between the plate-end of the quarter section and the plate-cathode return inductance, as indicated in figure 4.

When the slider is adjusted, a sharp dip will be noticed at resonance; however, it will be noticed that the resulting quarter-wave section will be slightly longer than an electrical quarter-wave, provided the coupling is not too great at the plate. Maximum power may be obtained when the section is slightly greater than an electrical quarter-wave. This indicates that this quarter-wave section presents an inductive reactance to the plate, which in turn is inductively-reactive. The result is a reflected capaci-

Front view showing the entire 112-Mc. FM transmitter using the high-efficiency output circuit for the 807 final stage. Reading from rear left is the 6SJ7 audio amplifier, the 6C5 audio, 6SJ7 reactance tube, the oscillator coil, 6SJ7 oscillator, 6SJ7 doubler coil, 6V6 doubler, 6V6 output coil, 6L6 quadrupler, and in the metal can is the 1614 (or 6L6) doubler which drives the 807 final amplifier. Also at the rear can be seen the quarter-wave line, and a portion of the output circuit of the 807. Included among the tuning and meter switching controls on the front panel is the trimmer condenser on the oscillator which is calibrated directly in megacycles at the output frequency in the 2½ meter band.



tive reactance back to the plate circuit and consequent resonance of this circuit. The length of the quarter-wave section for 113 Mc. is exactly 26 inches including the portion inside the envelope consisting of the plate, for maximum power output, and will vary between 30 inches and 20 inches for varying amounts of coupling at the plate as adjusted by means of the clip (see figure 4).

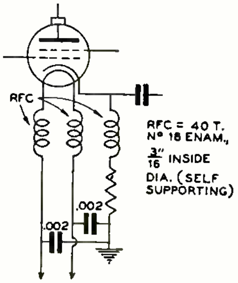
This tank circuit was applied both to single-ended doubler and straight amplifier circuits, using tubes that otherwise were mechanically too large to resonate in the conventional manner at 112 Mc. Notice that the free-end of the quarter-wave section is at opposite r.f. potential from the plate, and if this end is brought back through the chassis at a point near the grid, a triode may be neutralized by connecting a neutralizing condenser between these two points. This will, of course, reduce the length of the quarter-wave section because of the capacity of the neutralizing condenser. But since a single-ended circuit is difficult to neutralize even at the lower frequencies, this arrangement is not highly recommended.

## The 807 Grid Circuit

The 807 was selected for the amplifier circuit because it can be operated straight through without the need of being neutralized. Provided, of course, precautions are taken to shield the input and output circuits, and to otherwise isolate the input and output r.f. voltages. Here again trouble was encountered in resonating the grid of the 807 to 114 Mc. and still having enough grid coil left to couple to the preceding driver stage. Figure 5 shows an unconventional circuit for resonating the grid circuit to 2½ meters, one that is not critical and is easy to adjust. The grid coil consists of a piece of copper bus-bar of ⅛-inch diameter about 7 inches long, bent to follow the contours of the driver output tank which will be described. The series tuning condenser should be about 100 $\mu\mu$fds., but it should be tuned to not less than 30 $\mu\mu$fds, so that the reduction in drive due to the voltage developed across the series condenser will be small.

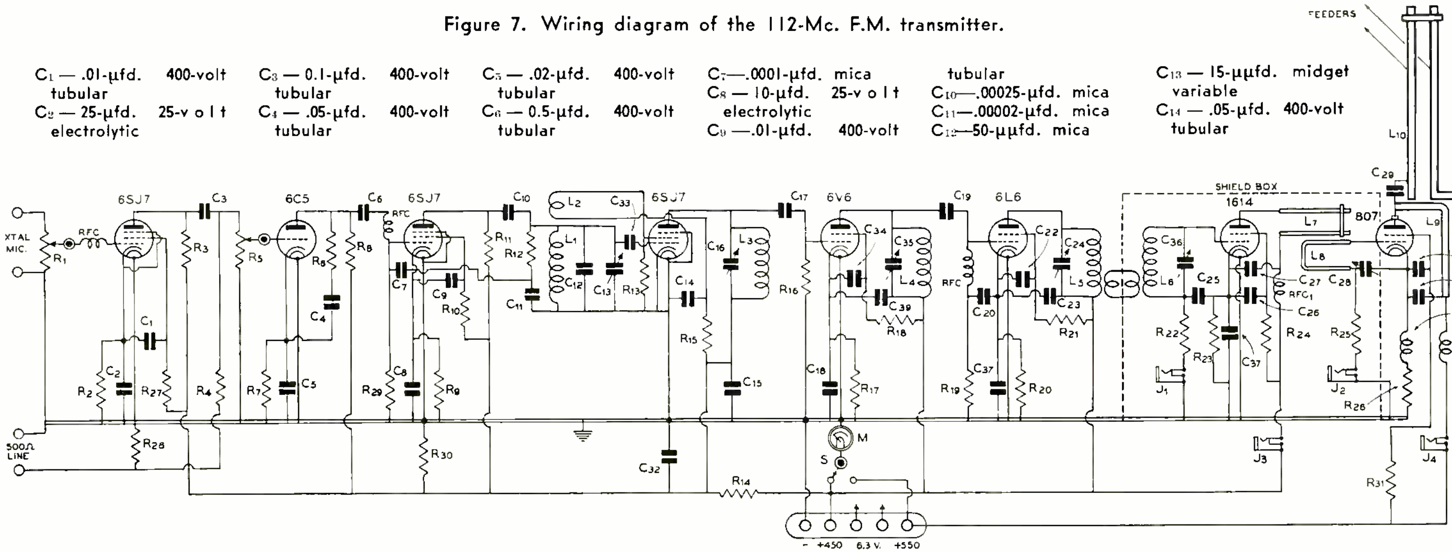
The ease in adjustment of this grid tuning system more than compensates for the small loss of driving power.

The 6L6 2½-meter doubler-driver stage has more than enough power output to make up the power loss in the 807 grid tuning system. Its power output is approximately 2 watts. Coupling to the 2½-meter doubler may be quite loose, the spacing being about an inch between adjacent coils. The 6L6 doubler is of conventional design, but care should be taken to return all r.f. by-pass conductors directly to the cathode, and the cathode should be grounded to the chassis at a point immediately beside the cathode socket pin. The doubler tank consists of a pair of bus rods, each 4 inches long, running up through the chassis in feed-through insulators, and tuned by means of a slider at the upper end. The grid of the 6L6 doubler is

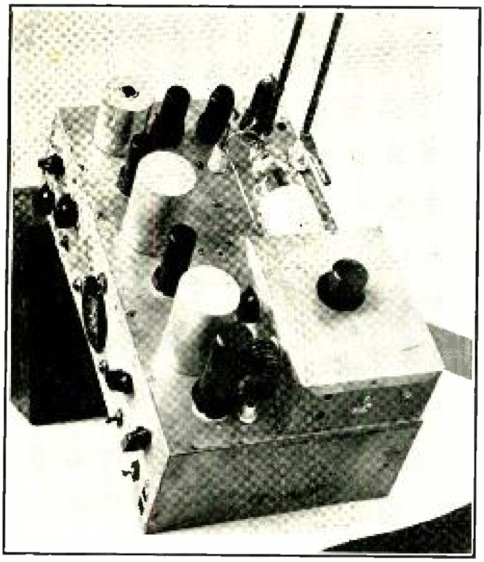



FILAMENT CHOKING
FIGURE 6

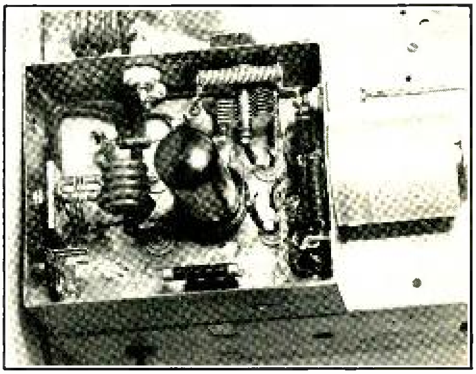
Figure 7. Wiring diagram of the 112-Mc. F.M. transmitter.




$C_1$ — .01-µfd. 400-volt tubular
$C_2$ — 25-µfd. 25-volt electrolytic
$C_3$ — 0.1-µfd. 400-volt tubular
$C_4$ — .05-µfd. 400-volt tubular
$C_5$ — .02-µfd. 400-volt tubular
$C_6$ — 0.5-µfd. 400-volt tubular
$C_7$—.0001-µfd. mica
$C_8$ — 10-µfd. 25-volt electrolytic
$C_9$ —.01-µfd. 400-volt tubular
$C_{10}$—.00025-µfd. mica
$C_{11}$—.00002-µfd. mica
$C_{12}$—50-µµfd. mica
$C_{13}$ — 15-µµfd. midget variable
$C_{14}$ — .05-µfd. 400-volt tubular
$C_{15}$ — .01-µfd. 600-volt tubular
$C_{16}$—25-µµfd. variable
$C_{17}$—.0001-µfd. mica
$C_{18}$—.01-µfd. mica
$C_{19}$—.0001-µfd. mica
$C_{20}$, $C_{21}$—.002-µfd. mica
$C_{22}$, $C_{23}$—.001-µfd. mica
$C_{24}$—25-µµfd. variable
$C_{25}$—.001-µfd. mica
$C_{26}$, $C_{27}$—.002-µfd. mica
$C_{28}$—100-µµfd. variable
$C_{29}$—.01-µfd. mica
$C_{30}$, $C_{31}$—.002-µfd. mica
$C_{32}$ — 1-µfd. 600-volt tubular
$C_{33}$—.00005-µfd. mica
$C_{34}$—.002-µfd. mica
$C_{35}$—30-µµfd. variable
$C_{36}$—15-µµfd. variable
$C_{37}$—.001-µfd. mica
$C_{38}$ — 1-µfd. 600-volt tubular
$C_{39}$—.002-µfd. mica
$R_1$ — 1-megohm potentiometer
$R_2$—1500 ohms, ½ watt
$R_3$, $R_4$—250,000 ohms, ½ watt
$R_5$—250,000-ohm potentiometer
$R_6$—50,000 ohms, ½ watt
$R_7$—2500 ohms, 1 watt
$R_8$—100,000 ohms, 1 watt
$R_9$—300 ohms, ½ watt
$R_{10}$—1 megohm, ½ watt
$R_{11}$ — 150,000 ohms, 1 watt
$R_{12}$ — 100,000 ohms, ½ watt
$R_{13}$ — 40,000 ohms, ½ watt
$R_{14}$ — 10,000 ohms, 10 watt
$R_{15}$ — 10,000 ohms, ½ watt
$R_{16}$—500,000 ohms, ½ watt
$R_{17}$ — 150,000 ohms, ½ watt
$R_{18}$ — 50,000 ohms, 1 watt
$R_{19}$ — 75,000 ohms, 1 watt
$R_{20}$ — 150,000 ohms, 1 watt
$R_{21}$ — 40,000 ohms, 1 watt
$R_{22}$—125,000 ohms, ½ watt
$R_{23}$—150 ohms, 1 watt
$R_{24}$—35,000 ohms, 1 watt
$R_{25}$ — 25,000 ohms, ½ watt
$R_{26}$—500 ohms, 5 watts
$R_{27}$—2 megohms, ½ watt
$R_{28}$ — 15,000 ohms, ½ watt
$R_{29}$—200,000 ohms, ½ watt
$R_{30}$ — 25,000 ohms, 2 watts
$R_{31}$ — 20,000 ohms, 5 watts
$J_1$, $J_2$, $J_3$, $J_4$—Closed-circuit jack
RFC—2½ mhy., 125 ma.
$RFC_1$—U. h. f. choke
$L_1$—20 t. no. 30 enam. closewound, 1¼" dia.
$L_2$—30 t. no. 30 enam. closewound, spaced 3/16" from $L_1$
$L_3$—17 t. no. 24 enam., 1¼" dia.
$L_4$—10 t. no. 22 d. c. c. 1½" dia.
$L_5$, $L_6$—5 t. no. 8 copper, ½" dia.
$L_7$, $L_8$, $L_9$—See text



Closeup view of the transmitter showing the output circuit of the 807 and the plate circuit of the 6L6 quadrupler to 56 Mc.



Looking inside the 112-Mc, doubler shield can (with the cover removed). At the left is the grid circuit on 56 mc. which is link coupled to the plate tank of the 6L6 quadrupler just outside the can. Immediately below the plate r.f.c. for the 807 stage is the series condenser for resonating its grid circuit. The 807 filament chokes are self-supporting at the right end of the shield can above the 807 socket. The 1614 plate circuit consists of the two copper rods with slider nearest the tube, and the grid circuit of the 807 is the rectangular shaped loop to the right of the 1614 plate circuit.

tuned to 5 meters in the usual manner and link-coupled to the preceding 5-meter multiplier-stage tank. It is well to mention that the 6L6 2½-meter doubler tank rods project above panel 2 inches, the remaining 2 inches consisting of the under-chassis portion including the by-pass condenser to cathode. Slight variations in mechanical design which are unavoidable may slightly reduce or increase the length of these rods by a portion of an inch. Do *not* use a glass 6L6 for the 2½ meter doubler since its internal inductance is too large, and the resulting external inductance becomes a pair of rods about 2 inches long. This is too small to couple effectively to the final stage. Incidentally, recent experimentation has shown that somewhat improved output from the 112-Mc. doubler stage may be obtained through the use of a 1614 instead of the 6L6. These two tubes are essentially the same, the only difference being that the 6L6 is designed for audio use and the 1614 for r.f. However, the increase in cost of the 1614 over the 6L6 may not justify the output increase obtained.

## Operating Efficiency

The efficiency of the 807 as a doubler using the described "reflected-component" tank system is approximately 38 per cent, while the same tank system applied to a straight single-ended amplifier is in the order of 50 to 60 per cent, within the rated plate voltage and current and drive. 550 volts are supplied to the plate, but 50 volts appears as cathode bias.

## Tuning the 112-Mc. Stages

Tuning the driver and final stages may be simplified if the following procedure is followed:

First, line up the multiplier stages ahead of the 2½-meter doubler. Then, with both plate and screen voltages removed from the driver and final stages, bring the 2½-meter doubler grid coil into resonance so that it draws power from the preceding stage via the link.

Second, connect the plate and screen voltage to the 2½-meter 6L6 doubler and adjust the slider for minimum plate current, or maximum glow on a pick-up bulb or neon lamp.

Third, with a milliammeter connected in the final grid circuit, tune the series-grid condenser for maximum grid current. At this point it would be well to adjust further the 6L6 doubler (to be sure no changes have occurred due to final coupling) for further maximum final grid current.

Fourth, connect plate voltage and screen voltage to the final, using a value in the order of 300 volts, and adjust the quarter-wave section slider for minimum plate current. A pick-up lamp will glow brightly when coupled near the slider. Next, apply the final high voltage and clip on the feeders at a point where the position of the slider is not affected, or where

[*Continued on Page 72*]

# An Effective
# SPLATTER SUPPRESSOR

By W. W. SMITH,* W6BCX

A simple device which may be added to any plate modulated phone transmitter to permit heavy modulation of the carrier without splatter.

A student of human nature once cynically remarked that a gadget to suppress phone "splatter" would never enjoy widespread use unless it were designed to go on the *receiver.* Unfortunately, there not only is no device in existence which will do the trick when attached to a receiver, but it looks as though the prospect of such a gimmick's being discovered is pretty slim. So perhaps it might be in order to point out why the gadget to be described, which goes on the transmitter instead of the receiver, is a desirable adjunct to a phone rig *from a purely selfish standpoint.*

Let's take a conventional plate modulated transmitter and crank up the gain until we are chewing the carrier about as hard as we dare without risking a ticket from an F.C.C. monitoring station. Not out of consideration for the other fellow but in fear of our own skins we dare not pour on any more decibels.

Now suppose just for the sake of illustration that the entire F.C.C. field staff is off fishing, and we can increase the gain without danger of getting in hot water with anyone other than a few dozen amateurs and b.c.l.'s. What happens? We find that if we keep increasing the gain until we are using the maximum that can be used without seriously affecting the intelligibility, the signal (voice) strength has gone up from one to two "R" points. This means that simply by ignoring the question of how much ruckus we are creating on adjacent channels, we can realize an equivalent power gain of from 4 to 8 times. It is easy to see why overmodulation has been such a problem on the amateur phone bands.

Several suggestions have been proposed recently for permitting heavy modulation without adjacent channel splatter. However, all of these possess certain limitations, and none has shown promise of being the final answer to the problem. The device to be described attacks the problem from a slightly different angle, and appears to be the best approach so far.

Before we proceed further, the assumption must be made that the class C amplifier is abundantly supplied with excitation and bias, and that it is perfectly neutralized and is working into a purely resistive load. When this assumption is made, it is only necessary to limit the pass band at the output of the modulator in order to confine the modulated signal to a narrow channel, *if* the output of the modulator does not swing the instantaneous plate voltage on the class C stage below zero or above the upward limit of linearity. The upward limit of linearity easily can be made three times the normal d.c. plate voltage, simply by running a goodly amount of excitation and bias; but something must be done about the plate voltage going below zero. The answer is a rectifier placed between the output of the modulator and the modulated stage. A low-pass filter placed *after* the rectifier then has a chance to go to work, because negative peak clipping will be confined to the rectifier instead of being inflicted on the modulated stage.

### The Splatter Suppressor Circuit

The circuit is shown in figure 1. The additional parts required consist of the rectifier, $V_1$; a filament transformer for it, $T_1$; a small choke, CH; and two mica bypass condensers, $C_1$ and $C_2$. In most cases $C_2$ can be the plate bypass condenser, and for this reason only one extra condenser ordinarily will be required.

### Suitable Rectifiers

The rectifier $V_1$ may be a 5Z3 (with plates in parallel) for d.c. plate voltages up to 2000 and d.c. plate currents up to 500 ma. The drop

*Editorial Director, RADIO.

through the tube at 500 ma. will be about 60 volts. If the d.c. plate current is greater than 500 ma., or if it is desired to reduce the drop through the rectifier, two 5Z3's may be connected in parallel. Tests have shown that a 5Z3 will safely withstand an inverse peak voltage of approximately 2000 volts, and as the inverse peak voltage across $V_1$ is unlikely to exceed the d.c. plate voltage with a modulator of orthodox size, a 5Z3 (or two in parallel) will stand up at this plate voltage unless the modulator is oversize or the modulator tubes have an unusually high plate resistance. It will be readily apparent from the diagram that the inverse voltage across the rectifier is represented only by the amount the modulating voltage swings below zero.

For d.c. plate voltages above 2000 and below 3500, an RK-22 may be used (plates connected in parallel) for any plate current up to 400 ma. The drop through the rectifier at 400 ma. will be approximately 24 volts, and correspondingly less at lower plate current.

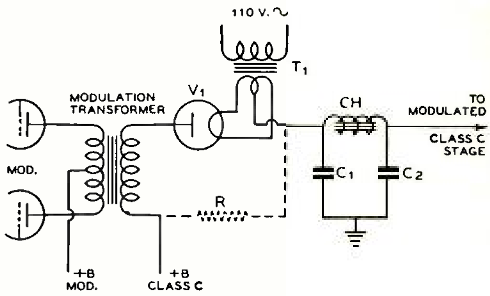



Figure 1

SPLATTER SUPPRESSOR

Specifications for the various components are given in the text. It is important that the output from $V_1$ be taken from the center tap of $T_1$, and not from one leg as is common power supply practice. Resistor R is shown simply for discussion; it is not used. For a 500-watt transmitter all components should not cost over $7.50.

## Filament Transformer Considerations

The filament transformer, $T_1$, must be insulated to withstand the d.c. plate voltage plus the peak modulating voltage, and preferably should have low capacity between the filament winding and the primary or core. Most transformers designed with high voltage insulation of the secondary will have sufficiently low capacity because of the thickness of the insulation between windings. To be on the safe side, the transformer should be insulated for three or preferably four times the d.c. plate voltage on the modulated amplifier. An "866" transformer of the open shell type, with 7500 or 10,000 volt insulation, may be obtained for about $1.25 in several makes. Such a transformer is suitable "as is" for supplying an RK-22.

For one or two 5Z3's, the same transformer can be made to serve by removing the secondary turns (an easy job on this type transformer) and replacing the secondary with just twice the number of turns of the next smaller size wire. Unfortunately there are no inexpensive 5 volt transformers insulated to withstand more than 2500 volts, and the only way to avoid spending considerable money is to rebuild an 866 transformer.

## The Filter Components

The condenser $C_1$ should have a voltage rating similar to that of a plate bypass condenser, or a test voltage of about four times the d.c. plate voltage. The same applies to $C_2$, which may be the plate blocking condenser if it is made of the correct capacity for the filter.

The choke CH should have good Q, low distributed capacity and capacity to core, high voltage insulation, and should be of "non-chatter" construction. For a given power the choke may be of small physical size, because its inductance need be only a henry or so, depending upon the impedance offered by the modulated stage. Unfortunately no suitable chokes are manufactured as a standard item, but it is hoped that some manufacturer soon will see fit to add such chokes to his line. In case some manufacturer considers such an addition, we might add that the same applies to an inexpensive 5 volt, 3 or 6 amp. filament transformer with 10,000 volt insulation.

A choke suitable for any power up to 1 kw. can be made by removing the winding from a 15 or 20 hy., 125 or 150 ma. smoothing type choke and replacing it with the requisite number of turns of No. 24 s.c.c. enamelled wire. Good insulation should be placed between layers, and the core should have sufficient air gap that the inductance of the choke will not be lowered appreciably at full load. To keep the choke from "talking" it may be necessary to immerse it in heavy oil, wax, or tar. Before starting the winding, place a couple of layers of empire cloth over the core.

## Gilding the Lily

In spite of the fact that the device as shown in the diagram made an amazing reduction in "splatter" when heavy modulation was employed, it was decided that possibly the already satisfactory results could be improved upon.

While the output of the rectifier $V_1$ never

| Class C Ohms | CH in Hy. | $C_1$ $C_2$ in $\mu$fd. |
|---|---|---|
| 2500 | 0.25 | .02 |
| 3500 | 0.35 | .015 |
| 5000 | 0.5 | .01 |
| 7000 | 0.7 | .007 |
| 10,000 | 1.0 | .005 |
| 14,000 | 1.4 | .003 |

If $C_2$ is not used as plate blocking condenser, capacity of plate blocking condenser should be subtracted from above values when determining correct value for $C_2$.

falls below zero, the voltage at the output of the filter will swing slightly below zero at frequencies approaching the cut-off frequency of the filter as a result of "carry over" effects (inertia of the filter). To prevent this, and keep the plate voltage on the class C stage from falling even slightly below zero at any time, a delay bias was provided by the addition of resistor R (shown dotted in the diagram). The value of R was adjusted until, using a sine tone, the output of the rectifier never went below 10 per cent of the d.c. plate voltage even with heavy overmodulation. In this way, the output of the filter was positive with respect to ground at all times. Oddly, the improvement was imperceptible on a voice test, and because the resistor wasted roughly 10 per cent of the modulator output, it was removed.

Next, an M derived filter was substituted for the constant K section in the hope that the sharper cut-off and better matching to the class C load would improve the splatter suppression. No improvement was noted.

Next, an additional section of filter was added. The improvement was subliminal. Consequently the original single section filter, without delay bias resistor, was decided upon as being the most practical solution.

## Low-Pass Filter Constants

For voice work a good compromise between intelligibility and channel width is a 3000-cycle cut-off. The intelligibility is virtually as good as with unlimited high frequency transmission; but if the cut-off frequency is made much lower than 3000 cycles the articulation begins to suffer.

Assuming 3000-cycle cut-off, the filter constants will depend entirely upon the load impedance presented by the modulated class C stage (plate voltage divided by plate current). The filter constants are not especially critical, and the following table may be used. This table takes into consideration the distributed capacity in the choke, the capacity of the rectifier filament transformer to ground, and a small amount of capacity due to the tank tuning condenser. For this reason the values will be found a little shy of those that will be obtained by the use of formulas.

## Transmitter Considerations

When using the "splatter suppressor," the modulator should not be too large, not only for reasons of economy, but because the available a.f. peak output may be sufficient to blow something. The plate-to-plate load on the modulators should be high enough that there is no danger of exceeding the upward modulation capability of the class C modulated amplifier. There is no danger of this unless the modulator is large compared to the modulated stage, in which case the modulator tubes should be run at about twice the plate-to-plate load recommended by the manufacturer for maximum output.

When the splatter suppressor is in use, the voice modulation may be poled so that the extended peaks are either upward or downward; little difference will be noticed in either intelligibility or splatter. However, if the modulated stage is essentially linear out to about 3 times the d.c. plate voltage, it usually will be advisable to pole the extended peaks upward. Most any well designed class C stage running at the grid current and bias recommended for plate modulation will be found linear out to three times the normal d.c. plate voltage. This will take care of a 200% positive peak.

When the modulation frequency approaches the cut-off frequency of the low-pass filter, an interesting thing happens. No matter how badly distorted the waveform out of the modulator may be, the output of the low-pass filter will be a pure sine wave. The reason for this is obvious; all harmonics fall above the cut-off frequency of the filter, and therefore are removed by the filter. Another interesting thing to note in this connection is that all components lying above 3000 cycles not only are removed, but show up as *d.c. input*, causing an increase in the carrier level. This "controlled carrier" effect is not enough to produce an annoying variation in the observed signal strength, but is sufficient to minimize negative peak clipping in the class C stage as a result of "hangover" effects in the filter. No doubt it is for this reason that the delay biasing arrangement discussed earlier in the article was found to be unnecessary after actual voice tests.

Frequencies above 3000 cycles impressed

[*Continued on Page 72*]

# A SIMPLE THERMAL DELAY

## *for Mercury Vapor Tubes*

By J. EVANS WILLIAMS,* W2BFD

The popularity of mercury vapor rectifiers in amateur power supplies is undeniable, yet there is one drawback in their use which, while not of major importance, is nevertheless annoying. I refer, of course, to the necessity of a preliminary warmup for these tubes without which very short rectifier life may be expected.

Despite the existence of many highly effective time delay relays on the market a checkup would soon prove that Mr. Average Amateur relies on nothing more complicated than separate switches in filament and plate supplies and his own patience to preserve his 866's for posterity (and future QSO's).

It is no problem to find a reason for this apparently negligent situation. Better use can generally be found for the several dollars needed for a delay relay, and various substitutes described from time to time seem to revolve around a vacuum tube whose grid condenser is charged or discharged slowly through a high resistance. Such systems require a filament and plate supply and end up with a relay anyway.

There is available a simple delay system costing not more than ten or fifteen cents and a trip to the corner hardware shop or the nearest "five and dime" emporium.

For transmitters of not over 200 watts plate requirement a standard electric bulb flasher with the changing of but one wire will give a satisfactory delay device controllable from about 15 seconds to around 2 or 3 minutes. Very long delays may be obtained by cascading two or more flashers.

Higher powers bring no greater difficulty than drilling a small hole in the end of the bimetallic strip to take contacts of adequate current carrying capacity.

A 110-volt bulb may be used as the series resistance for the heater although the writer prefers to use a 1000 to 3000 ohm wire wound resistance.

Proper timing is had by bending over the stationary contact to the minimum non-arching distance and adjusting the resistance until the circuit closes in the correct interval.

Many other uses will be discovered for these flashers. For example, by reversing the contacts so that the circuit is opened instead of closed upon heating, the altered flasher button can be used as a thermal overload circuit-breaker.

Merely insert the heater (minus the series resistor) in series with one leg of the plate transformer and shunt it with a resistance whose value is determined by the plate current. Use the contacts to control the main plate supply relay which may be provided with an interlock to prevent reapplication of plate voltage.

This arrangement as a circuit breaker fills a special need of the c.w. man who runs his final amplifier greatly in excess of normal ratings, relying on his keying (or rather the spacing

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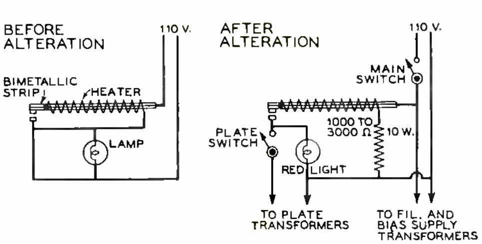
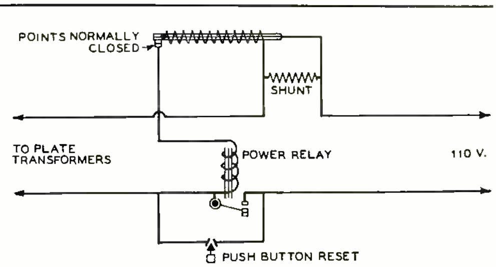
*38-06 61st St., Woodside, New York




The original circuit of the lamp flasher unit and the alterations necessary to adapt it to become a thermal delay transmitter control.




An alternative circuit for use of a flasher unit as a thermal overload control in the primary of the plate transformer to the power stage.

# *The Double*

# TWIN-3 BEAM ANTENNA

By HAROLD E. TAYLOR,* W8RNC, and
JOHN D. KRAUS,** W8JK

The twin-3 is a very effective bi-directional beam antenna.[1] Basically, it is a single-section flat-top beam antenna, consisting of two half-wave elements, spaced one-fifth wavelength and fed 180-degrees out-of-phase. Each element of the twin-3, instead of being a single conductor, is actually constructed of three parallel, very closely spaced wires, forming a 3-wire dipole or doublet.[2] With the three-wire dipoles the feed point resistance is much higher than with a single conductor dipole. As a result of this higher resistance, a very simple and efficient feed system using 600-ohm line throughout is possible. A twin-3 beam is shown in figure 1 with dimensions for the 28 to 30 megacycle band.

This antenna radiates a bi-directional pattern with a maximum in the plane of the elements and in both directions at right angles to them. For more detailed information on the twin-3 reference should be made to the article in RADIO[1] for November, 1939.

By combining two twin-3 antennas into a single structure, a system of even higher gain is obtained. Such an arrangement is shown in figure 2 and is referred to as a "double Twin-3." Dimensions are given for the 28 to 30 megacycle band. The entire system, like a single twin-3, requires no adjustments in the antenna and can be cut in advance according to the dimensions given.

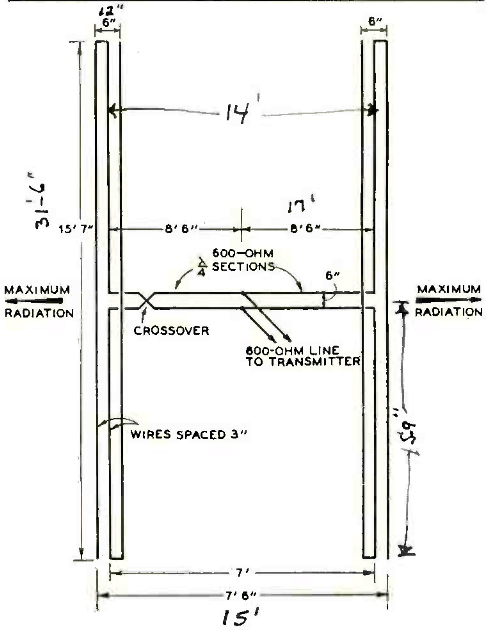



Figure 1. Single twin-3 in plan view with dimensions for 28 to 30 Mc. band.

## Construction

The double twin-3 consists of two identical twin-3's, each constructed as shown in figure 1, and stacked one above the other and fed in-phase. The vertical spacing used is about 0.45 wavelength. The two quarter-wave sections feeding the upper twin-3 hang in a "V" as is customary. The two quarter-wave sections feeding the lower twin-3, however, are raised upward into an inverted "V," and all four quarter-wave sections are connected together at the center point of the entire antenna system as shown in figure 2. The four quarter-wave sections are made of 600-ohm line, that is, of number 12 wire, spaced 6 inches, and are 8 feet 6 inches long. The transmission line from the transmitter to the junction of the quarter-wave sections can be of any impedance value from 400 to 600 ohms. A 600-ohm line gives a very satisfactory match but a somewhat lower im-

*Route 2, Box 2539, Detroit, Michigan
**Arlington Blvd., Ann Arbor, Michigan
[1]"Twin-Three Flat-Top Beam Antenna," J. D. Kraus, RADIO No. 243, Nov., 1939, p. 11.
[2]"Multi-Wire Type Antennas," J. D. Kraus, RADIO No. 240, June 1939, p. 21; and
"Multi-Wire Dipole Antennas," J. D. Kraus, *"Electronics,"* vol. 13, No. 1, Jan. 1940, p. 26.

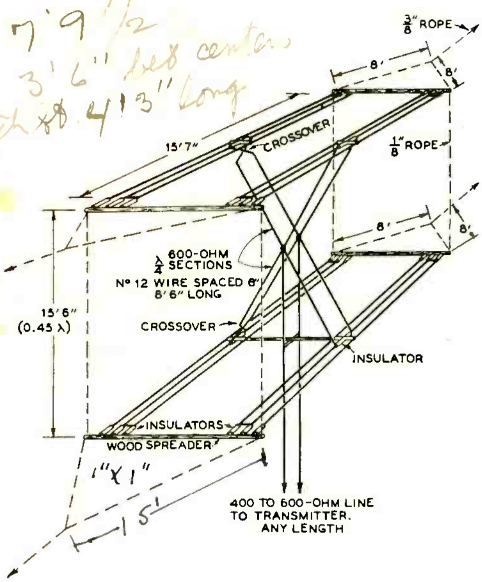



Figure 2. Double twin-3 in perspective view with dimensions for 28 to 30 Mc. band. This antenna consists of two stacked single twin-3 antennas, each identical to the one shown in figure 1. For dimensions not shown in this view, refer to figure 1.

pedance line may be slightly better in this respect.

The general construction of the double twin-3 is indicated in figure 2. It should be pointed out that one of the quarter-wave sections feeding each twin-3 has a cross-over or transposition, and, as shown in figure 2, these cross-overs are both on the same side of the antenna. These cross-overs can be made with a transposition insulator. A 2-inch type transposition insulator will be satisfactory. The fact that the line changes spacing for such a short length is of little consequence. It is desirable, however, that the transpositions be made close to the point where the quarter-wave sections connect to the center of the 3-wire dipoles, this being a low-voltage point.

Small receiving insulators are satisfactory for the insulators at each end of the 3-wire dipoles. Bamboo or wooden spreaders about 8 feet long are used at both ends of each twin-3. An additional 8-foot spreader should be used at the center of the lower twin-3 to aid in supporting the weight of the transmission line to the transmitter and holding the elements apart. The 7-foot spacing between the 3-wire dipoles is not critical. A few feeder spreaders made of paraffined wooden dowel rod are used on the quarter-wave sections, although, to simplify the drawing, these are not indicated in figure 2.

The middle of the center wire of each 3-wire dipole is opened where the quarter-wave section connects by means of a 5-inch insulator or two shorter insulators in series. A spreader approximately 6 inches long at right angles to the wires is also attached at the center of each 3-wire dipole to keep the three wires properly spaced. Number 12 wire is used throughout.

## Dimensions

The dimensions given in figures 1 and 2 are suitable for operation throughout the 28 to 30 megacycle band. This band seems to be a logical one for the application of the double twin-3 by amateurs. The dimensions given are actually optimum for a frequency of 28.6 megacycles, but will provide an excellent match over most of the band except possibly between 29.5 and 30.0 megacycles where the match, although satisfactory, is not quite as good. If optimum operation at the 30-megacycle end of the band is desired, the length of each 3-wire dipole can be shortened from 15 feet 7 inches to 15 feet 2 inches. This moves the optimum frequency to about 29.5 megacycles. All of the other dimensions of the antenna remain unchanged.

If difficulty is experienced in loading the transmitter, improvement can be obtained by lengthening or shortening the main transmission line not more than 8 feet.

A single twin-3 can be built for 28 megacycle operation according to the dimensions of figure 1. A 600-ohm line connects from the junction of the two quarter-wave sections to the transmitter. One of these twin-3 antennas has been in operation on 28 megacycles at W8RNC for about a year with excellent results. Good contacts with the Hawaiian Islands and Philippine Islands were obtained using only 40 watts input to the final amplifier.

A double twin-3 could be constructed for operation in the 14 megacycle band but it would be a huge affair and it is questionable whether the improvement over a single twin-3 on this band would be worth the effort.

For the 56 to 60 megacycle band, the dimensions given in figures 1 and 2 are halved. That is, the spacing between the center wires of the 3-wire dipoles is made 3 feet 6 inches. The 3-wire dipoles are made 7 feet 9.5 inches long with 1.5 inches spacing between the wires of each dipole. The quarter-wave sections are constructed 4 feet 3 inches long but the spacing remains 6 inches, if number 12 wire is used.

## Construction Template

To facilitate the construction of the 3-wire dipoles, a template such as shown in figure 3 is

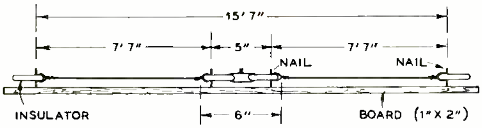



Figure 3. Construction template with dimensions for wires of 3-wire dipoles for 28 to 30 Mc. twin-3's.

recommended. Its use insures accurate and uniform lengths of all wires in the dipoles. Four nails, A, B, C, and D, are driven in a board as shown. The spacings between the nails are correct for 28-Mc. twin-3's. The sketch shows four insulators as required in the middle wire of each 3-wire dipole. The spacing between insulators C and D is approximately correct for the attachment of the quarter-wave sections. For the outer wires of each 3-wire dipole, insulators are placed only at A and B and the wire stretched directly between them.

## Horizontal Pattern

The gain of a double twin-3 over a single twin-3 is largely the result of increased vertical directivity. The horizontal directivity may be considered to be the same as for a single twin-3. The computed horizontal pattern for the twin-3 antennas is shown in figure 4. It is apparent that the pattern is very broad. This means that both the single and double twin-3 antennas are useful for contacts over a wide horizontal angle. By switching to a second twin-3 antenna system oriented at right angles to the first, or by rotating a single antenna, complete coverage can be obtained.

## Height Above Ground

The height of an antenna above the ground has an important bearing on its effectiveness. Due to the reflection of part of the radiation from the ground, the radiation at any given vertical angle changes over wide limits as a function of antenna height.

It is of interest to compare three types of horizontally polarized antenna systems in connections with antenna height. These are a *single half-wave, two stacked half-waves* (in-phase), and a *double twin-3*. These antennas are shown in figure 5. All have horizontal elements. The relative phase of the elements in the stacked array and the double twin-3 is shown by the plus and minus signs. The height, H, is taken to be the height to the top elements of the arrays, or to the single half-wave. With a given set of antenna towers of height, H, the maximum height obtainable for all of the antennas is the same. Thus, putting

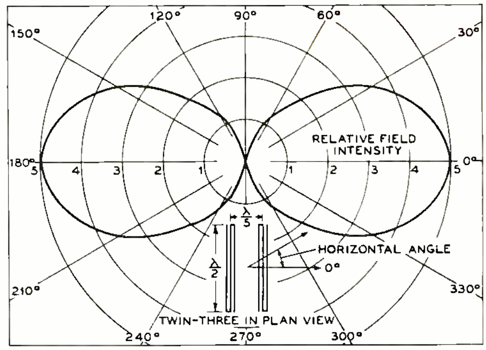



Figure 4. Horizontal radiation pattern for a single or double twin-3.

H equal to the height to the top element affords a very practical kind of comparison.

Figures 6 and 7 show the computed gains at vertical angles of 10 and 20 degrees for the three types of antennas for heights up to 1.5 wavelength. The heights are given both in wavelengths, and also in feet for a frequency of 28.6 megacycles. The ordinate gives the power gain of the antenna over a single half-wave in free space with the same power input. The gain for the free-space half-wave is, thus, equal to unity. The curves are computed on the basis of perfectly conducting ground and zero losses. Over actual ground, the gain curves will differ from those shown. However, the gain of any one of the three types of antennas under consideration relative to one of the others will be nearly the same, for both the computed case shown by the curves and over actual ground, provided all are compared over the same type of ground. Thus, the curves are very useful in comparing these three types of antennas.

It is apparent that the double twin-3 shows an improvement at all heights considered for both 10 and 20 degrees. For 28 megacycle communication, the optimum vertical angle probably varies between 10 and 20 degrees. Thus, for best performance under all conditions, a height of about one wavelength (35 to 40 feet) seems sufficient for the double twin-3, and the same for the stacked half-waves.

The proper height is also important for a single twin-3. A suitable height for this antenna on 28 Mc. is probably not over 35 feet. The same height (in feet) will also be quite suitable for a 14-megacycle single twin-3, except where very long distance communication is desired. In this case, the height should, of course, be increased.

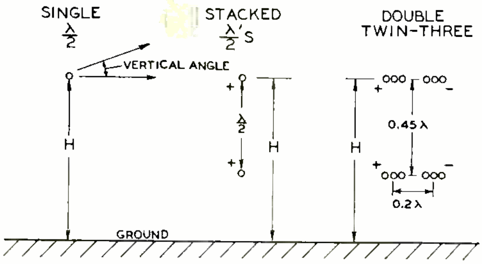
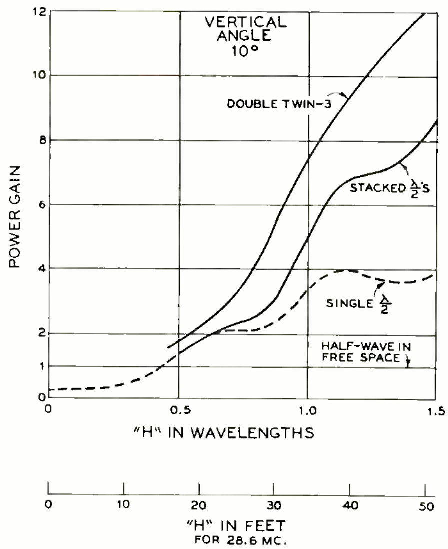



Figure 5. End view of three antenna systems at the same height, H, above ground.

Figure 6. Power gain at a vertical angle of 10 degrees for a single half-wave, two stacked half-waves, and a double twin-3 for various heights, H, above ground. The height, H, is given both in wavelengths and in feet for a frequency of 28.6 Mc. The gain is referred to a free-space half-wave with the same power input.




The height referred to above is the effective height and is not necessarily the same as the height above the actual ground. The "effective" ground may be slightly below the actual surface. Furthermore, the point at which the ground reflection occurs may be at some distance from the antenna. Accordingly, in any given installation the actual height and the effective height may differ somewhat. For this reason, it is helpful if some adjustment in the height of an antenna can be made to determine experimentally the optimum value

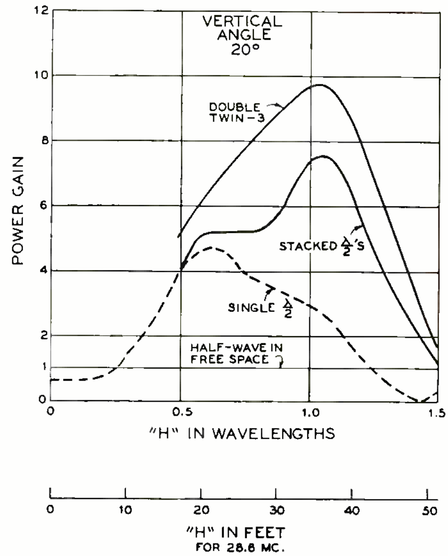



Figure 7. Same as figure 6 but for a vertical angle of 20 degrees.

under operating conditions.

The curves of figures 6 and 7 were computed from formulas involving both the self and mutual resistances of the elements and their "images." The formula for the double twin-3 is quite lengthy and about 70 separate mathematical operations are necessary to compute the gain for one point on the curve in the case of this antenna.

## Results

A double twin-3 has been used on the 28 megacycle band at W8RNC for some time with excellent results. Signal strength reports have been most flattering. The standing wave ratio as measured on the 600-ohm line to the transmitter is uniformly low over a wide portion of the 28 to 30 megacycle band, permitting operation with peak efficiency over most of the band. During wet weather no noticeable changes in performance are observed. Although the antenna is a fairly complex structure to build, it appears to have been worth the effort involved.

• • •

### *Just Like "10"*

According to theories advanced under the mathematical laws of probability and averages, an "uneducated" monkey banging away at a telegraph key for a sufficiently long time would finally, though unknowingly, send a perfect three-and-three CQ and sign *your* call.

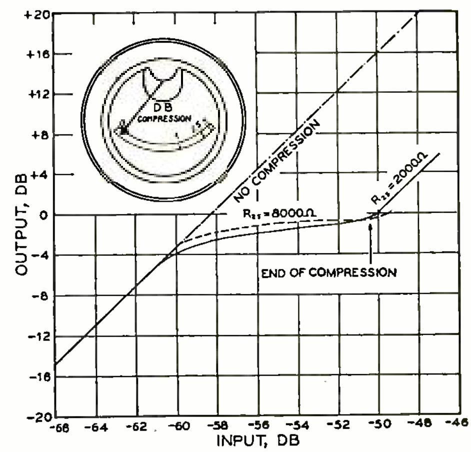
# *A Volume Limiting*
# FEEDBACK AMPLIFIER

By LEONARD L. NALLEY,* W6CLL, KVOA

The advantages of a limiting amplifier for use with a program circuit are more or less self evident: elimination of overloads for noticeable periods and increased program levels. There are considerable discussion and varied opinions on the character of desirable limiting action, speed of operation and release, circuits, distortion, etc. The ideal volume limiting amplifier should fill the following general requirements:

1. No increase of distortion with compression.
2. No noises, clicks, or flutter of volume level.
3. No over control of limiting action.
4. No matched or special tubes required.
5. Adequate compression range.
6. Have a meter showing amount of compression.
7. Have separate control of operation and release time.

Have a reasonably fast operation time.



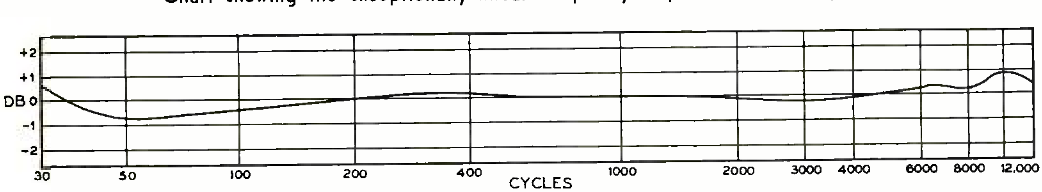

Input-output relation of the amplifier both with and without compression, and with varying values of resistance at $R_{25}$.

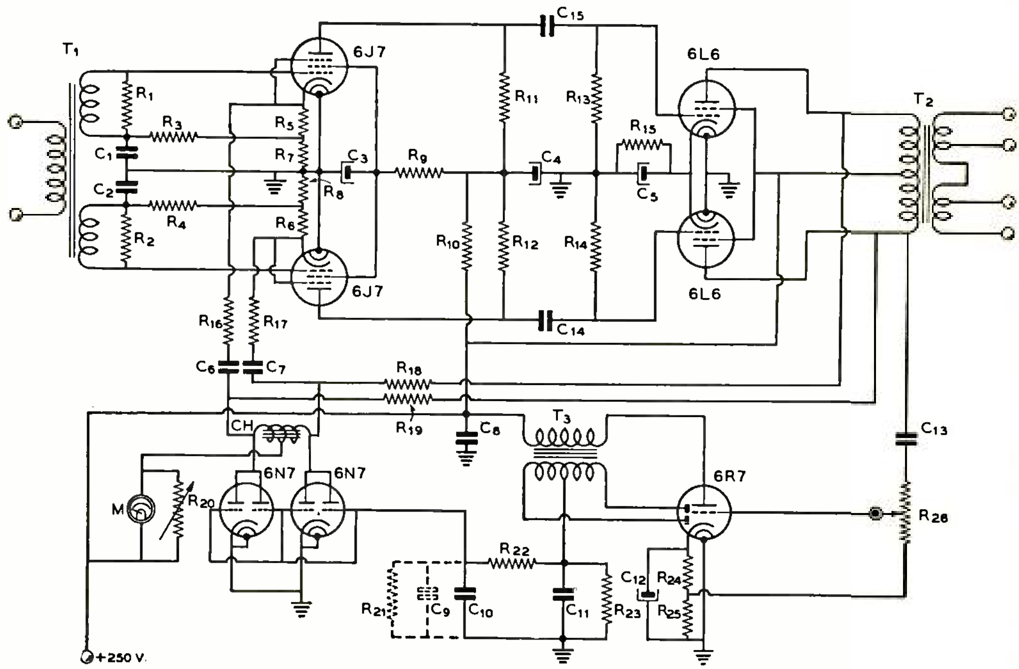
Any increase of distortion in a broadcast circuit is most undesirable even if the average level, the level of the faint sounds, can be notably increased. Systems that achieve compression by altering the gain of a triode or pentode amplifier stage by means of bias control usually have considerable distortion due to the nonlinear tube characteristics over the required compression range. If the bias is set so as to give the smallest amount of distortion without compression, as soon as compression becomes appreciable the distortion increases very rapidly. If distortion with compression is to be minimized, the bias must be decreased so that the distortion without compression is high. Both bias settings have disadvantages.

Electronic attentuators connected between two amplifiers work well but are from necessity rather inefficient as they must have a large insertion loss if they are to have low distortion and good impedance characteristics. Loss can be obtained by increasing or decreasing the proper impedance arm of the attentuator, or by phase control of a divided signal so as to add or subtract on subsequent mixing.

*1607 N. 10th Ave., Tucson, Arizona

Chart showing the exceptionally linear frequency response of the amplifier.






Schematic of the Volume Limiting Feedback Amplifier

$C_1$, $C_2$ — 0.1-µfd. 400-volt tubular
$C_3$, $C_4$—8-µfd. 450-volt elect.
$C_5$ — 25-µfd. 25-volt electrolytic
$C_6$, $C_7$—0.25-µfd. 400-volt tubular
$C_8$ — 1.0-µfd. 400-volt paper
$C_9$—.004-µfd. mica (optional)
$C_{10}$ — 0.1-µfd. 400-volt tubular
$C_{11}$—.002-µfd. mica
$C_{12}$ — 25-µfd. 25-volt electrolytic
$C_{13}$ — 0.1-µfd. 400-volt tubular
$C_{14}$, $C_{15}$—0.1-µfd. 400-volt tubular
$R_1$, $R_2$—100,000 ohms, ½ watt
$R_3$, $R_4$—150,000 ohms, ½ watt
$R_5$, $R_6$ — 800 ohms, ½ watt
$R_7$, $R_8$—40,000 ohms, ½ watt
$R_9$ — 250,000 ohms, ½ watt
$R_{10}$ — 25,000 ohms, ½ watt
$R_{11}$, $R_{12}$ — 150,000 ohms, ½ watt
$R_{13}$, $R_{14}$—1.0 megohm, ½ watt
$R_{15}$—150 ohms, 10 watts
$R_{16}$, $R_{17}$—50,000 ohms, ½ watt
$R_{18}$, $R_{19}$—100,000 ohms, ½ watt
$R_{20}$—10-ohm rheostat
$R_{21}$ — Optional 5-megohms
$R_{22}$ — 500,000 ohms, ½ watt
$R_{23}$—5 megohms, ½ watt
$R_{24}$—1000 ohms, ½ watt
$R_{25}$—2000 to 10,000 ohms
$R_{26}$—100,000-ohm potentiometer
$T_1$—Push-pull input or line to push-pull grids, two-winding secondary.
$T_2$—Push-pull plates to line, high level
$T_3$ — Push-pull input transformer
CH—Center tapped audio choke
M—0-25 d. c. milliammeter

## Degenerative Limiting

As these systems of volume limiting are not in every way ideal, a different way using a variable inverse or negative feedback voltage to limit the level of program was investigated and the following amplifier designed and built.

The first stage is a pair of push pull 6J7 tubes, pentode connected, and resistance capacity coupled to the second stage of push pull 6L6 or 6V6 tubes. There is an inverse feedback loop from the plates of the 6L6 tubes back to the cathodes of the input 6J7 stage. This feed back is by means of an "H" type network, the shunt leg being the a.c. plate resistance of the two bias controlled 6N7 tubes. They operate normally without bias.

A 6R7 is used as auxiliary amplifier and control voltage rectifier. When the output level rises high enough to overcome the bias on the diode plates of the 6R7 tube, the tube conducts and builds up a negative bias on the grids of the 6N7 tubes thus increasing their effective a.c. plate impedance. As the loss through the H network is determined by the value of shunt impedance and this is in turn controlled by the amount of excess program level, a very positive and accurate limiting action is obtained.

## Minimum Degeneration

When the 6N7 tubes are receiving no bias from the 6R7 control tube they form a shunt

[*Continued on Page 72*]

# *A Compact*

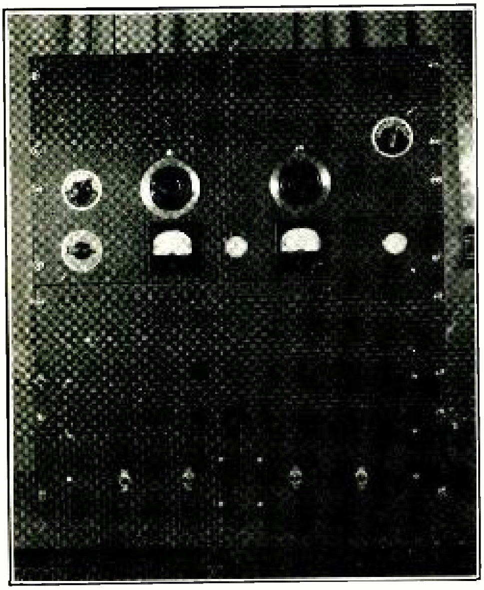
# 150 WATT C. W. TRANSMITTER

By A. L. HAMMERSCHMIDT*, W8EGZ

Since the author's radio shack is located in one corner of the living room of a small apartment, it was necessary, to remain in the good graces of the xyl, to have the radio equipment not only present a pleasing appearance, but to be as compact as possible. Keeping these requirements in mind, the following specifications were set up for the design of the transmitter to be described.

1. Power input of 150 watts;
2. Operation in 20-, 40- and 80-meter bands;
3. Minimum of tuning controls and coils to simplify band changing without the complications of band-switching;
4. Break-in operation if desired;
5. Final stage to have sufficient bias and excitation for plate modulation (to be installed at a later date);
6. Complete transmitter to be compact and present a pleasing appearance.

*2690 Neil Ave., Columbus, Ohio.



The complete 150-watt c.w. transmitter including power supplies.

### Design Considerations—The Final

Although the maximum rated power input to two 809 tubes in push-pull is 200 watts for amateur c.w. service, it was decided to operate the tubes at 150 watts input (the ICAS rating for these tubes for phone operation), so that no change need be made in the r.f. section for either phone or c.w. operation.

### The 807 Buffer

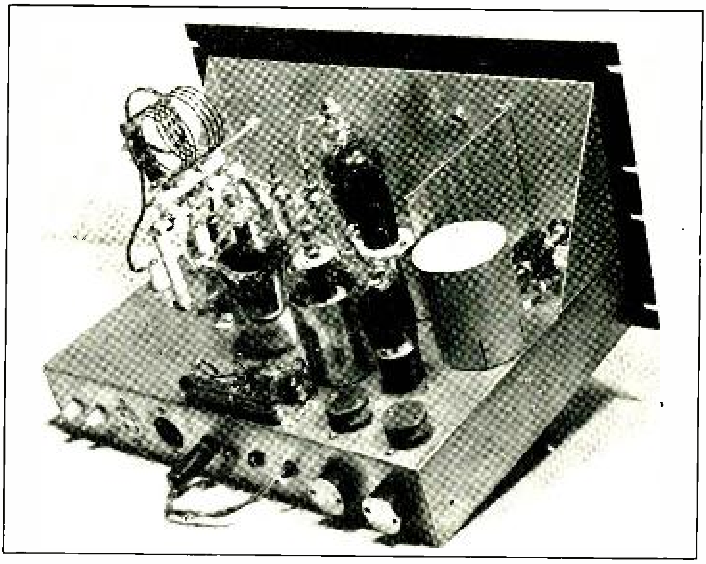
An 807 tube was chosen as the driver for the final amplifier since this type of tube requires a small amount of excitation, no neutralization is required, and the output on the second harmonic can be made nearly as much as on the fundamental. Inductive coupling is used between the driver and final stages, the grid winding being tuned by the stray circuit capacities. This type of coupling can be made very efficient. It has the advantage of reducing the number of tuning controls and coils, thus simplifying band changing.

### The Crystal Oscillator

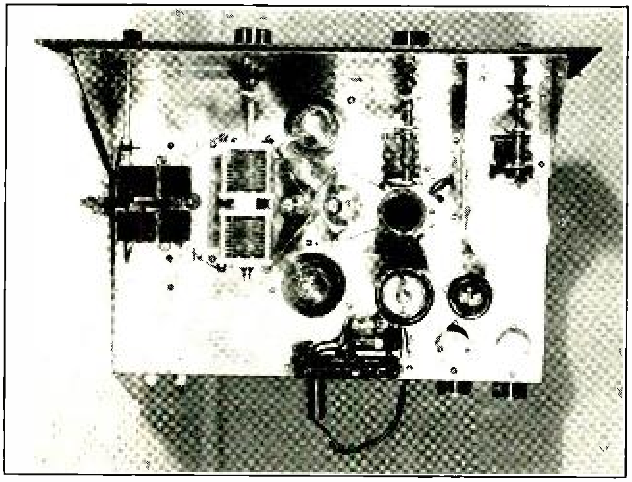
After trying various types of tubes in the crystal oscillator stage, including a 6V6G, 6L6G, and 6J5G, it was found that, in this particular case, a 6F6G connected as a pentode gave the cleanest keying for break-in operation. A two-section, four-position switch is employed to select either 40- or 80-meter crystals, and to short out a portion of the oscillator plate coil. Should it be desired to use all 40- or all 80-meter crystals, a coil of proper size, with the tap connection left vacant, is used. A tank circuit may also be plugged in one of the crystal sockets to receive the output of a variable frequency oscillator, if desired. When changing frequency to any one of the three bands of operation, it is only necessary to plug in two coils, namely, the driver stage coil, and the final amplifier plate coil.

### Construction Details

The various photographs show clearly the placement of the component parts of the transmitter. The transmitter is constructed on a 12x17x3-inch cadmium-plated steel chassis, and the front panel is a standard 10½-inch panel. All of the tank condensers are mounted on



Three-quarter rear view of the r.f. section showing the 20-meter coils in place.

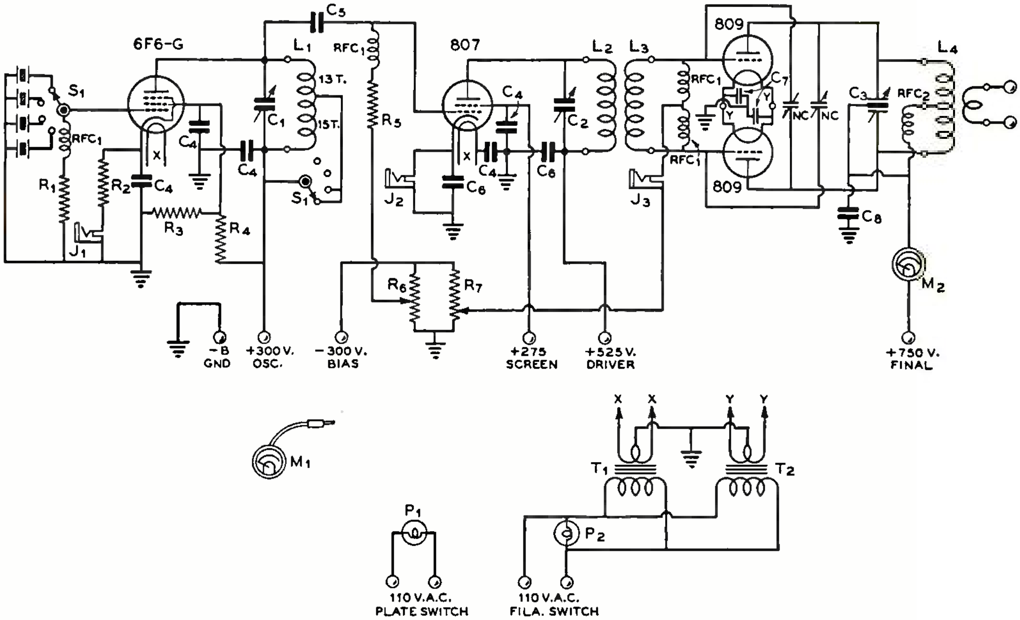


Top view of the r.f. section showing the 80-meter coils, and showing the general layout of the complete deck.

feed-through insulators, to permit series feed to be used in the plate tank circuits. An aluminum baffle shield was placed between the oscillator condenser and driver stage condenser to limit any interaction. Jacks are provided to measure the oscillator cathode current, the 807 cathode current, and the final stage grid current. The oscillator cathode jack may also be used for keying when break-in operation is desired. If break-in operation is not necessary, the 807 stage cathode jack may be used for keying.

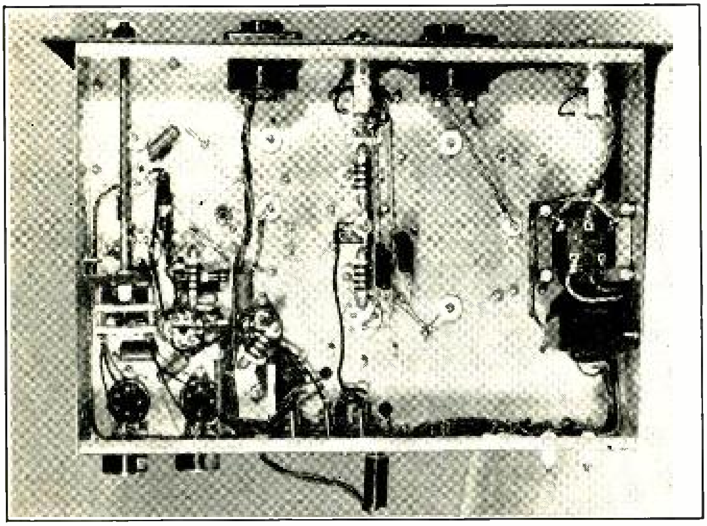
Four five-prong sockets are used for crystal holders, two of them being mounted on the back edge of the chassis, and the other two being mounted on top of the chassis. The two gang selector switch is located under the oscillator tube socket. All wiring of the first two stages, except the plate circuit of the 807 stage, is done underneath the chassis. The wiring for the plate circuit of the 807 tube is above the chassis, providing good isolation from the grid circuit.

The 200-$\mu\mu$fd. condenser in the plate circuit of the 807 stage may seem large, but its purpose is two-fold: First, it allows a fairly high Q to be used in the lower frequency coils, so that minimum plate current and maximum grid




Wiring diagram of the r.f. section of the 150-watt transmitter.

$C_1$ — 100-μμfd. midget variable
$C_2$ — 200-μμfd. midget variable
$C_3$—100-μμfd. per section, 2000-volt insulation
$C_4$ — 0.01-μfd. 600-volt tubular
$C_5$—.00005-μfd. midget mica
$C_6$, $C_7$ — 0.002-μfd. mica
$C_8$—0.002-μfd. 5000-volt mica
NC — 12-μμfd.-max. neut. condenser
$R_1$—15,000 ohms, 1 watt
$R_2$—250 ohms, 1 watt
$R_3$ — 15,000 ohms, 10 watts
$R_4$ — 10,000 ohms, 10 watts
$R_5$—40,000 ohms, 1 watt
$R_6$ — 15,000 ohms, 25 watts, slider type
$R_7$—5000 ohms, 50 watt, slider type
$S_1$—2-section, 4-position tap switch
$J_1$, $J_2$, $J_3$—Closed circuit jacks
$RFC_1$—2.5-mh. r.f. choke
$RFC_2$—1.0-mh. r.f. choke
$T_1$—6.3-volt 3-amp. fil. trans.
$T_2$—6.3-volt 6-amp. fil. trans.
$P_1$, $P_2$ — 110-volt pilot lamps
$M_1$—0-100 d.c. milliammeter
$M_2$—0-400 d.c. milliammeter
Coils—See Buyer's Guide



Underchassis view of the r.f. deck of the transmitter.

current correspond; Secondly, it permits using an ordinary 1½-inch diameter plug-in coil form for the 80-meter band, which would have been impossible were the condenser much smaller, due to the large number of turns required.

All of the r.f. wiring of the final stage is symmetrical and is above the chassis, with the exception of the two chokes used to shunt-feed the grid circuit. Shunt-feed in the final grid circuit was used in preference to center tapping the final grid coil to simplify adjustment of this coil for maximum excitation, and seems to have no particular disadvantages. Two of the new polystyrene condensers are used for neutralizing the 809 push-pull stage. The fixed condenser $C_8$ was not installed at the time the photographs were taken, the rotor of the condenser being directly grounded. It need be used only for phone operation. All circuit grounds were made by the shortest direct connection to the chassis. The low-voltage power connections are made to tube sockets mounted on the rear edge of the chassis. Feed-through insulators are used for the two high-voltage connections.

### Power Supplies

Three power supplies are incorporated in the transmitter, and are mounted on a chassis and front panel similar to the one used for the r.f. unit. One unit supplies power to the oscillator and driver stages, and delivers 525 volts at 200 ma. A 20,000-ohm bleeder resistance on this supply is tapped at 275 volts to supply the screen voltage for the 807 stage. A series dropping resistor of 10,000 ohms supplies the oscillator voltage, and with the voltage divider incorporated in the oscillator stage, forms a second bleeder. The final amplifier power supply unit delivers 750 volts at 250 ma. An ordinary receiver transformer, with a rating of 300 volts at 120 ma., is used for the bias supply. The two tapped bias bleeder resistors are a part of the r.f. unit. All power supplies have choke-input filters, and all but the bias supply are of the two-section type.

### Tuning Considerations

The operation of all stages is quite conventional, and hence there is no need for a lengthy discussion of this subject.

Before applying plate voltage to any of the tubes, the taps on the two bias resistors should be adjusted. The 15,000 ohm resistor $R_6$ should be tapped to supply 90 volts of bias to the 807 tube. Resistor $R_7$ should be set so that there is 1500 ohms resistance between the grids of the final amplifier and ground. Plate and screen voltages may then be applied to the oscillator and driver stages. The oscillator is tuned in the usual manner.

**COIL TABLE**

**Oscillator Coil**

$L_1$—28 turns No. 22 enamel wire loosely close wound and tapped at 15th turn from ground end of coil. 1½ inches diameter.

**Driver Coils**

| Band | $L_2$ | $L_3$ |
|---|---|---|
| 80 | 17 turns No. 22 enamel wire, close wound. | 60 turns No. 28 enamel wire, close wound. |
| 40 | 13 turns No. 20 enamel wire, spaced to occupy ¾". | 28 turns No. 24 enamel wire, close wound. |
| 20 | 11 turns No. 18 enamel wire, spaced to occupy ¾". | 15 turns No. 22 enamel wire, close wound. |

Grid coil $L_3$ is spaced ¼" from ground end of plate coil $L_2$. 40 and 80 meter coils wound on 1½" forms. 20 meter coil wound on 1¼" form.

Care should be exercised in tuning the driver plate tank, since it is possible to obtain fundamental, second, and third harmonic output from some of the coils, due to the large plate condenser employed. However, this should be of little concern, since only the proper setting of the plate tank condenser will yield maximum grid current to the final amplifier, because of the self-resonant grid coil.

Neutralization of the push-pull amplifier should be done in the usual manner. It is suggested that the amplifier first be neutralized for 40-meter operation. The amplifier will then remain neutralized for both 20 and 80 meter operation. If the plate and screen voltages of the 807 tube and the grid bias voltage of the 809 tubes are as specified, maximum grid current to the final amplifier, with no plate voltage applied, will be in the vicinity of 75 ma. It may be necessary to deviate slightly from the specifications given for the final amplifier grid coil to obtain maximum grid current. However, once this coil has been properly adjusted, no further attention to this detail is required. When the coils are properly adjusted, there will be no appreciable difference in grid current in going from one end to the other end of any band of operation.

Plate voltage may now be applied to the final amplifier, and the unloaded minimum plate current should be 20 ma. or less. The final amplifier may be loaded to a full 200 ma. of plate current, and under load the final grid current will drop to about 60 ma.

Typical meter readings for the various stages of the transmitter are as follows:

[*Continued on Page 78*]

# A 112 Mc. CONVERTER *and*

By M. P. REHM,* W2HNY

The superregenerator has been the generally accepted receiver for the ultra high frequency amateur bands. It was used on 28 and 56 Mc. before the necessity of stabilized signals made the superheterodyne feasible. It is still considered best on 112 Mc. and higher frequencies for the reception of modulated oscillators such as are still in frequent use. However, with the advent of frequency modulated e.c. oscillators and crystal-controlled signals on 112, the need for a better receiver became imminent.

We have a Hallicrafter Five-Ten, an ultra high frequency receiver tuning from 25 to 66 Mc., which has a wide band intermediate frequency position, originally designed to receive 56-Mc. modulated oscillators. To give some idea of its bandwidth, it will receive the f.m. broadcast stations with fair fidelity by tuning the receiver to one side of the signal peak. This receiver, tuned to 25 Mc., makes an excellent i.f. into which the 112-Mc. converter will operate (see figure 1). This unit, to be described, started out to be just the converter, but a regenerative r.f. stage was added after the converter was working. In order to make the unit more flexible we used band switching in the r.f. to cover 14, 28, 56, and 112 Mc. In spite of the slightly longer leads necessary for coil switching and for the change-over switch, the unit has been found very efficient. Different circuits were tried in each part and the ones in use were chosen on the basis of apparent merit.

*969 Roanoke Ave., Riverhead, N.Y.

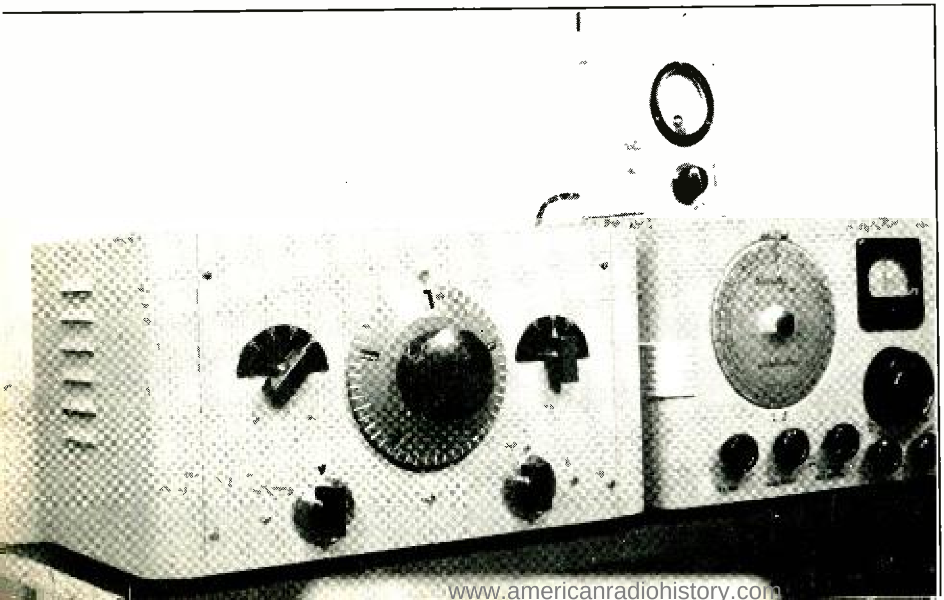
The 955 acorn tubes, used in the converter, were deemed necessary as they are without a peer for ultra-high-frequency work. Also, the use of triodes was found advisable because multi-element tubes have been found to be noisier at these frequencies.

## The Circuit Lineup

Reading from left to right in figure 2 are the regenerative r.f. stage, the PW dial mechanism and the 112 Mc. oscillator and detector. The r.f. tube is a 954 pentode acorn. The grid coils cover the following ranges: 12 to 16 Mc., 25 to 36 Mc., 41 to 62 Mc., and 78 to 122 Mc. The r.f. circuit is patterned after the one by Browning[1] and the coils, besides covering the four amateur bands, include the television, FM, and u.h.f. broadcast bands.

[1]Browning, "Regeneration in the Preselector," *QST,* Jan., 1940.

Figure 1. The combined 112-Mc. converter and 14-, 28-, 56-, and 112-Mc. preselector shown alongside the Hallicrafters 5-10 receiver with which it is used.



# 14 Mc. *to* 112 Mc. PRESELECTOR

The bandswitch on the left is a five-position, four-pole, two-gang isolantite. Each of the four positions marked 14, 28, 56, and 112 selects one of the coils listed above, and the fifth position puts the antenna directly through to the output of the unit. The regeneration is controlled by the 50,000-ohm potentiometer at the lower right which varies the screen voltage. The left hand dial controls the r.f. trimmer condenser. The output switch on the right is a three-position, three-pole, single-gang isolantite. No. 1 position, marked "RF", puts the r.f. into operation feeding into the receiver; position no. 2, marked "112", connects the output of the converter to the receiver, the r.f. to the converter input and turns on the converter plate supply; no. 3, marked "OFF", connects the antenna directly to the receiver and turns off the converter. The r.f. stage is made inoperative by cutting the potentiometer to minimum.

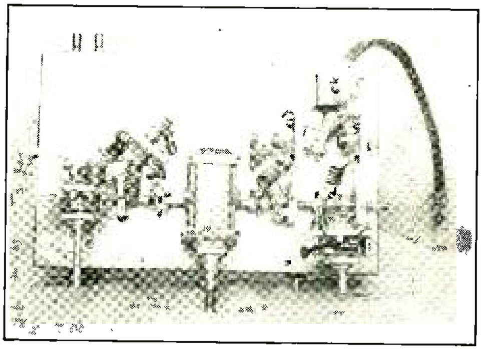


Figure 2. Top view of the r.f. section showing the inverted worm-drive dial in the center, the preselector r.f. stage to the left of the dial, and the 112-Mc. converter to the right of the dial.

### The 112-Mc. Converter Section

The 112-Mc. converter consists of a pair of 955 acorn tubes as oscillator and detector. The oscillator circuit is the grounded cathode type recommended for use with 955's and tunes from 87 to 91 Mc. to cover the 112 to 116 Mc. band. This makes a difference frequency of 25 Mc. which is fed through the detector to the Five-Ten. The band covers about twenty-five degrees on the dial but this is ample with the smooth working PW mechanism. Since we wanted the r.f. stage to cover a large frequency range, the converter condensers had to be of the same size to track properly.

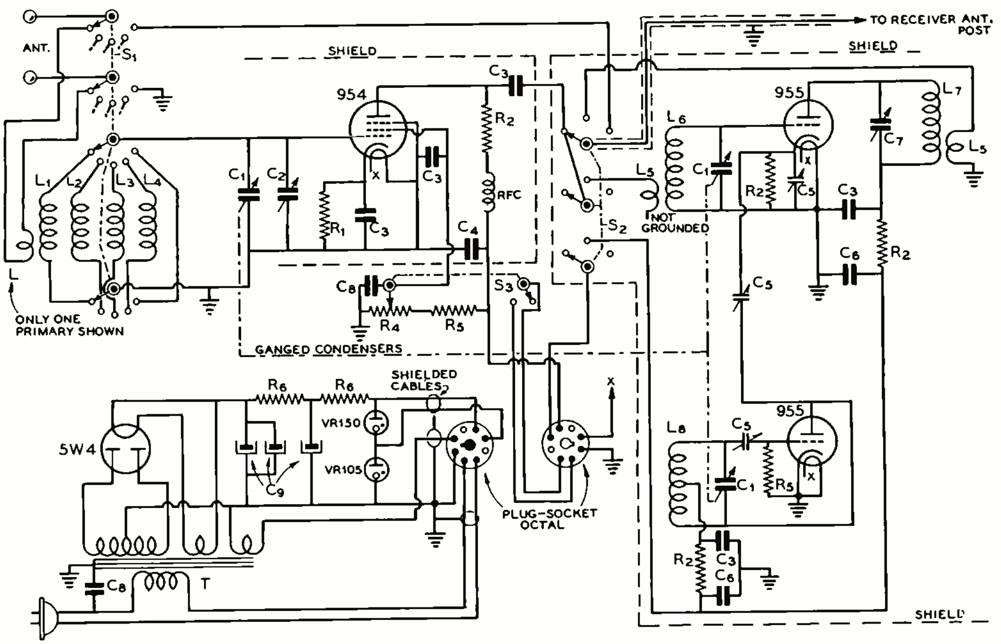
### Power Supply

The power supply consists of a small b.c. set transformer with appropriate windings. The resistance-capacity filter is ample since the power consumption is quite low. The two voltage regulator tubes were found necessary to stabilize the voltage for the oscillator. Also, the r.f. stage can be run just below the oscillation point without danger of its spilling over due to a line voltage surge. The two 1000-ohm resistors draw a twenty milliampere load through the regulator tubes. The r.f. draws 2 to 3 ma. and the detector and oscillator draw about 6 ma. The plug-in power connection is used for ease in dismantling the unit and also with a view to battery operation for field day and other portable work.

### Mechanical Construction

The cabinet is 8 by 14 by 8 inches with an 8 by 12 panel, grey ripple finish. The chassis is 7 by 11 by 2 inches and all parts are fastened to it. The panel holes are made large enough to clear the five controls and the panel is fastened to the front edge of the chassis by three nickel screws. The 1/16-inch bakelite engraved switch markers are "Duco-cemented" to the panel. The small dial markers are nickel screws filed to an arrow point at one end of the slot.

The PW dial mechanism is mounted upside down by cutting a rectangular hole in the chassis and using the "top" cover and four screws to hold it in place. This was done to match it to the condenser shafts which were ¾ inches above the chassis. Also it raises the dial above the center of the panel. To make the dial read properly the eccentric bushing on the mechanism is rotated 180 degrees by loosening the four screws holding it. The other




Wiring diagram of the combined preselector-112-Mc. converter.

$C_1$ — 25-μμfd. midget variable
$C_2$—2-12-μμfd. padders
$C_3$ — .0001-μfd. midget mica
$C_4$ — .0005-μfd. midget mica
$C_5$—3-30 μμfd. midget trimmer
$C_6$—.001-μfd. mica
$C_7$—25-μμfd. trimmer
$C_8$ — 0.1-μfd. 400-volt tubular
$C_9$ — Triple 8-μfd. 450-volt elect.
$R_1$—2000 ohms, ½ watt
$R_2$ — 10,000 ohms, ½ watt
$R_3$ — 50,000 ohms, ½ watt
$R_4$ — 50,000-ohm potentiometer
$R_5$ — 20,000 ohms, ½ watt
$R_6$—1000 ohms, 2 watts
RFC—See text
T—700 v. c.f., 50 ma.; 5 v. 2 a.; 6.3 v. 1 a.
$S_1$ — 3-pole 5-position preselector band change
$S_2$ — 3-pole 3-position function selector switch
Coils—See coil table

directions that come with the dial should be followed closely.

The three tuning condensers are fastened by their attached brackets to the chassis. The r.f. condenser is coupled with a flexible isolantite insulated coupling, but with the added drag of two condensers on the converter side the only couplings that had no play were the small bakelite ones we used. This is important for good tracking when tuning up the receiver.

The switches are mounted on brackets made of ⅛ by 1 inch aluminum. They are 2½ inches above the chassis and very solid. The isolantite acorn sockets, which are mounted on edge to make the leads short, are fastened down by small heavy brass brackets.

The two gangs on the r.f. coil switch are reversed so as to bring the common lead close to the grid contact and condenser. The top contacts on each gang are used for the coils and the lower ones for the antenna coil connections. The coils are soldered directly to their respective contacts and are self supporting, except for the 14-Mc. coil which is wound on a ¾-inch diameter polystyrene form. The antenna coupling for the latter is three turns and for the others one turn of the same diameter as the coil. They are all no. 20 d.c.c. with the leads twisted together lightly and soldered to the lower contacts. The antenna leads go down through the chassis through rubber grommets to the polystyrene-mounted terminals in the rear. The common ground for suppressor grid filament, by-pass condensers, and tuning condenser is located directly below the control grid lead. After trying separate cathode taps on each coil we found that a common tap ¾ of an inch up the coil ground lead from the chassis was very satisfactory for all coils. With this arrangement the screen voltage can be run up almost to maximum (100 volts) before oscillation takes place, thus insuring full gain from the r.f. stage.

Just behind the 954 is a small stand-off insulator with a ½-inch diameter body, around which is wound 30 turns of no. 30 enamel

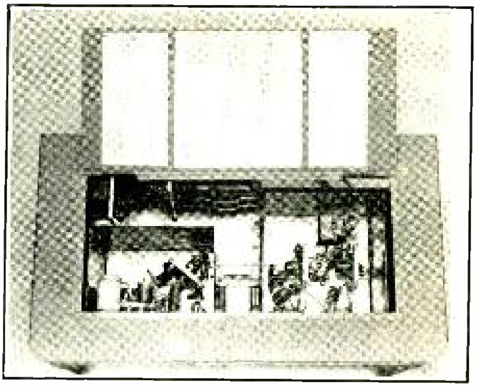


Figure 3. Looking down into the cabinet which houses the complete unit, including the power supply which is at the rear. The shields have been removed from the pre-selector and converter sections for the photograph.

wire as a plate choke. One screw holding the stand-off is insulated through the chassis and serves as the plate voltage lead. The plate resistor, coupling condenser, and plate clip lead are soldered to the top of the stand-off. The unshielded wire goes from the coupling condenser, through small holes in the copper shields, to the change-over switch. The small r.f. trimmer fastens through the chassis and couples to the small dial by a flexible shaft.

On the converter side, the oscillator, coil and condenser are just to the right of the PW dial. One plate that had been removed from the detector condenser was added to the oscillator condenser for good tracking. The 112 Mc. detector is at the right end of the chassis with the tuning condenser shaft out ¼ inch beyond the edge so that it can be reached for alignment. Directly behind the detector tube is the i.f. coil and condenser which tunes to 25 Mc. The condenser is mounted on a U-shaped copper bracket and a ½-inch polystyrene coil form is fastened to the condenser. The coupling coil lead runs to the change over switch. The shielded lead for the receiver goes from the switch down through, and out the back of, the chassis. It is made of an 18-inch piece of ⅜-inch copper braid with no. 18 wire through it supported on spacers cut from a polystyrene rod and drilled. At the end is a piece of polystyrene with banana plugs which go into the receiver. Jacks, also mounted on polystyrene, have been put on the rear of the receiver to replace the bakelite antenna terminal strip. Since one side of each input coil is already tied together this connection is grounded and the high side goes to the center wire of the concentric line. This arrangement seems to give a good match and the antenna may at any time be plugged directly to the receiver.

The top view of figure 3 shows the two shield cans (less covers), and also the power supply, in place. The r.f. shield is 4½ inches by 5 inches high and is a piece of 14 gauge copper 18½ inches by 5½ inches bent into a square with a ½-inch flange overlap for soldering and a ½-inch flange bent outward around the bottom. The oscillator-detector shield is 4½ inches wide by 6½ inches deep by 4 inches high, the piece of copper being 22½ inches by 4½ inches. They are fastened to the chassis by several self-tapping screws. A notch is cut in the side of each shield to slip over the condenser shafts. One-half inch holes

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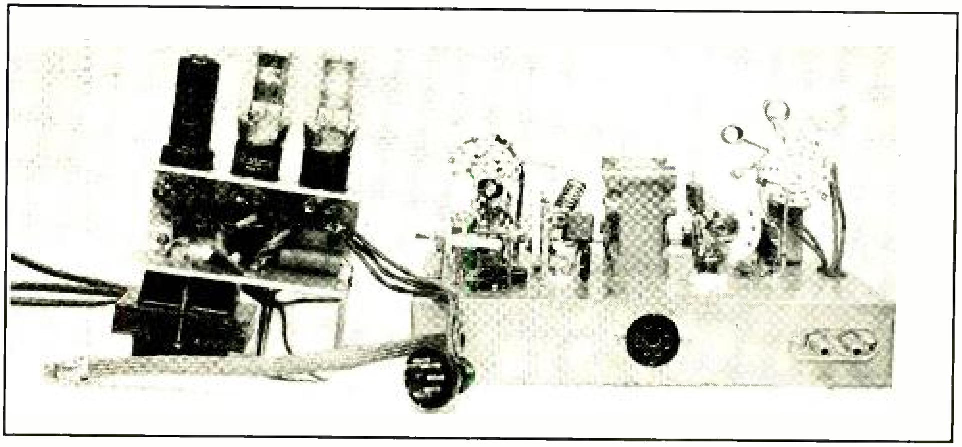
Figure 4. The power supply with its U-shaped chassis is on the left; on the right is the r.f. section as seen from the rear.



# *Simplified*

# DIRECTION FINDING

By W. W. SMITH, W6BCX

A loop which will provide accurate bearings may be constructed easily and cheaply. Elaborate shielding or balancing of the loop is not necessary, and greater pickup is obtained than with a shielded loop of comparable dimensions.

Many amateurs are of the opinion that there is something mysterious and occult about the use of a loop antenna for direction finding. Some say it must be shielded. Some say it needn't be. Some say you must use a balancing condenser; others get good results without one. Some advocate its use in conjunction with a Ouija board, while others prefer a crystal ball.

The root of the confusion is lack of understanding of the fundamental principles upon which the loop functions as a directional antenna. When these principles are understood, it is easy to see why a loop may or *may not* be exactly broadside to the direction of the received signal when rotated for minimum pick up.

A radiation field contains a magnetic component; hence it is readily apparent that a coil of wire placed in the proper inductive relation to the magnetic component will serve as an antenna. The efficacy of such a coil or "loop" as a pickup antenna is low as compared to a regular receiving antenna, but because of its compactness and directional characteristics the loop often is used as a portable antenna or as a direction indicator.

The loop may be in the form of a circle, square, or rectangle whose length and width are not too widely different. It may be wound in the form of a solenoid or in the form of a "pancake" helix. For true loop operation, however, the circumference of the loop should not be more than a small fraction of a wavelength.

The loop may be either resonant or nonresonant, though there will be considerable increase in signal pickup when the loop is resonant to the frequency of the signal being received. Also, the directional pattern is different for the two types, except when both are perfectly balanced to ground and there is no stray pickup. If there is stray pickup or the loop is not perfectly balanced, an asymmetrical pattern results *except when the loop is tuned to exact resonance*. With a resonant loop, the only effect of circuit unbalance to ground is to result in the absence of complete nulls; instead there will be found *minima* as the loop is rotated, the minima being 180 degrees apart the same as the nulls in a perfectly balanced system.

The result of circuit unbalance to ground or of stray pickup in the input coupling circuit permits the whole loop to work against ground as a Marconi antenna. The current thus induced combines with the true loop current. If the loop is resonant, the two currents are 90 degrees out of phase and the radiation patterns tend to be additive (numerically) in all directions. Thus, while the resulting pattern is still symmetrical, there no longer will be complete nulls. If the loop is not resonant, the phasing of the two currents is such as to add in certain directions and cancel completely in others, resulting in an asymmetrical pattern.

Figure 1 shows the patterns obtained under these various conditions. Pattern A is obtained when there is no Marconi effect (also variously known as "antenna effect" or "vertical effect") with either a resonant or nonresonant loop.

With a nonresonant loop, a moderate amount of Marconi effect will produce the pattern shown at B. If the amount of Marconi effect is increased, a point finally will be reached where the small lobe completely disappears, leaving only one null. This pattern is shown at C.

A moderate amount of Marconi effect produces the pattern shown at D when the loop is

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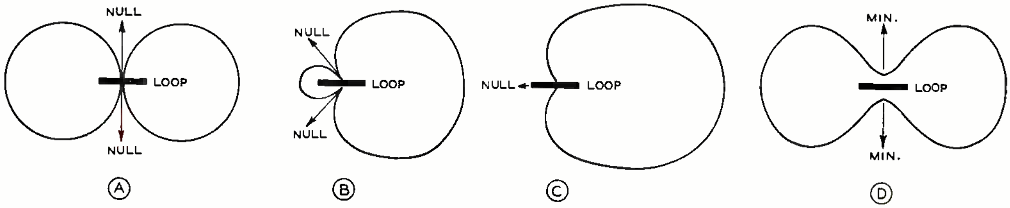


Figure 1
Typical Loop Antenna Patterns

A: Loop antenna, either resonant or nonresonant, perfectly balanced to ground (no antenna effect).

B: Nonresonant loop antenna, moderate antenna effect.

C: Nonresonant loop antenna, critical amount of antenna effect. Minor lobe completely disappears, leaving only one null.

D. Resonant loop antenna, moderate antenna effect. Nulls are changed to minima, but remain separated exactly 180 degrees.

resonant. When the loop is tuned just slightly off exact resonance, a pattern intermediate between B and D is obtained.

For some applications the entire loop is enclosed in a static shield. For aircraft work this shield greatly reduces "rain static." It also virtually eliminates Marconi effect, which is important in the special circuits used in aircraft direction indicators. These instruments give a continuous indication and have "sense"; that is, they do not have 180 degrees ambiguity. However, these instruments are rather complicated, and their theory and operation therefore will not be covered here.

For simple direction finding work, in which two or more bearings are taken and the station is located by observing the point of intersection on a map, an *unshielded resonant loop will be found satisfactory*. The only requirement is that the Marconi effect be not too great; otherwise the minima will not be sharply enough defined for accurate bearings.

While the pattern symmetry of a resonant loop is not disturbed by Marconi effect in the loop or loop coupling line to the receiver, the symmetry of the pattern *will* be affected if there is appreciable *inductive* pick up by the signal frequency tuned circuits in the receiver. Most communications receivers are either well enough shielded or else have their coils oriented so that this pick up is minute. However, even if the pick up by the first tuned circuit in the receiver should be appreciable, it is still possible to obtain accurate readings simply by adjusting the tuning of the loop until the minima are exactly 180 degrees apart. If the minima are 180 degrees apart the resulting bearing must be accurate even with a receiver having poor shielding.

Loops can be used to take accurate bearings only when the ground wave strongly predominates. When there is appreciable sky wave signal in addition to the ground wave signal, the loop will give inccurate bearings as a result of downcoming horizontally polarized waves exciting the horizontal portion of the loop when it is adjusted for a null. This is commonly called "night effect" because for certain frequencies it is serious only at night.

While loop antennas can be used for high frequency reception, they are useless as *accurate* direction finders when the signal arrives largely or entirely by sky wave propagation, because sky wave signals do not always follow an exact great circle path.

## Loop Construction

In figure 2 is shown a simple loop and method of connection to the receiver for use on the 160-meter amateur band or the broadcast band. On these frequencies bearings accurate to less than two degrees can be taken if there is no "night effect," which means 100-200 miles during the day and 50-75 miles at night. The

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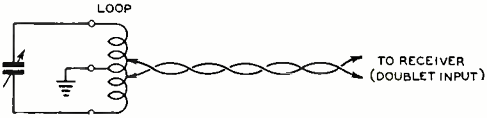


Figure 2
Simple but Accurate Direction Finder
If the loop is always tuned to resonance, it is not necessary to provide shielding or balancing adjustments in order to obtain accurate readings. For dimensions and data, refer to text.

# A Fixed Frequency Receiver

By G. F. MOYNAHAN, JR.,* W6AXT

Since many readers of this magazine are employed in police or government service, point-to-point work, and other branches of commercial communication wherein fixed operating frequencies are employed, it was felt that this practical article on the construction of a crystal-controlled fixed-frequency receiver would be of interest to them. This is not a new design, but rather a thoroughly proven one in which all the normal operating difficulties have been ironed out by several years of operation of a large number of these units.

The fixed frequency receiver shown in the accompanying photographs and diagrams was developed as a result of the need for a high-stability receiver employing noise suppression and capable of operating unattended over a long period of time.

The characteristics of various combinations of circuits as well as mechanical arrangement and placement of parts were given consideration before the actual construction of the receiver. After due study we decided to mount the receiver on a standard 19"x8¾" panel using a horizontal chassis, and arrived at a tube line up consisting of a 6K7 radio frequency stage, followed by a 6L7 mixer, working into a 6K7 intermediate stage. The i.f. stage is coupled to a 6H6 diode detector, which is also used to furnish a.v.c. to the 6L7 mixer and 6K7 r.f. stage.

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### The Q.A.V.C. Circuit

An auxiliary tube is used to furnish q.a.v.c. action, quieting the receiver when no carrier is being received. This tube, a 6F5, receives plate current through a 1-megohm resistor as shown in the diagram. The voltage drop across this resistor is applied to the grid of the first audio frequency stage, another 6F5, biasing it past cut-off. The control grid of the first 6F5 is at the same d.c. potential with respect to ground as the plate of the detector diode section of the 6H6 except for the small drop in the 25,000-ohm filter resistor.

The rectified portion of the carrier appears as a potential drop across the 250,000-ohm resistor as shown in the accompanying diagram,

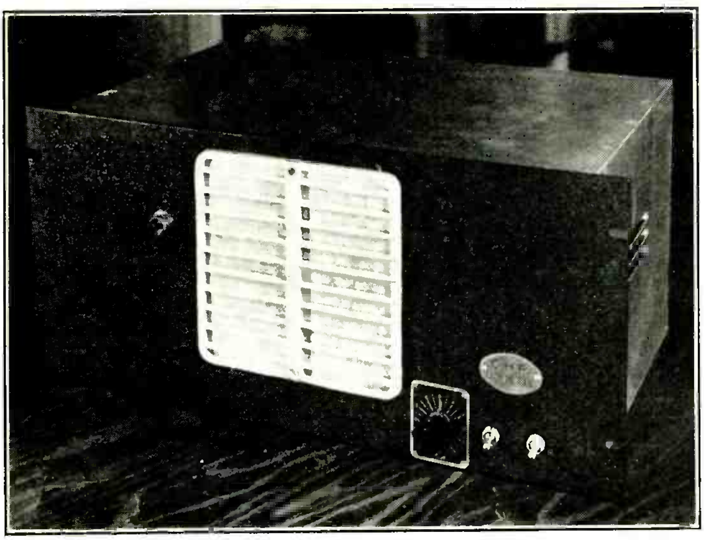


Figure 1. Front view of the fixed-frequency receiver shown for relay-rack mounting as they are used by the California Highway Patrol. Note that there are only three controls on the front panel: the on-off switch, the q.a.v.c. on-off switch, and the volume control.

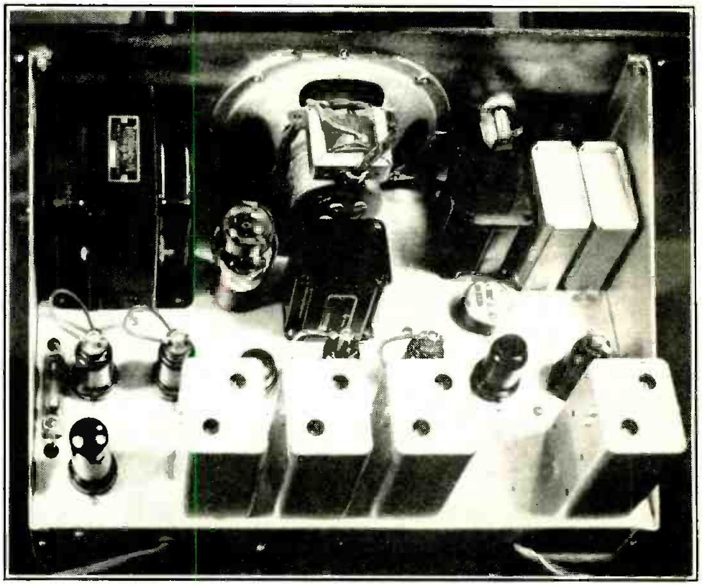
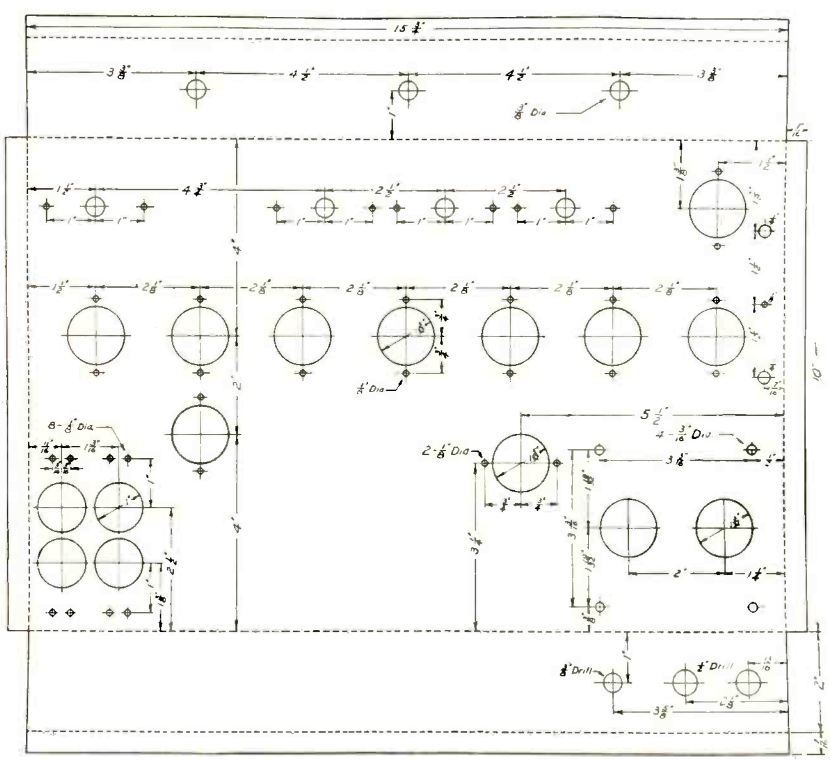
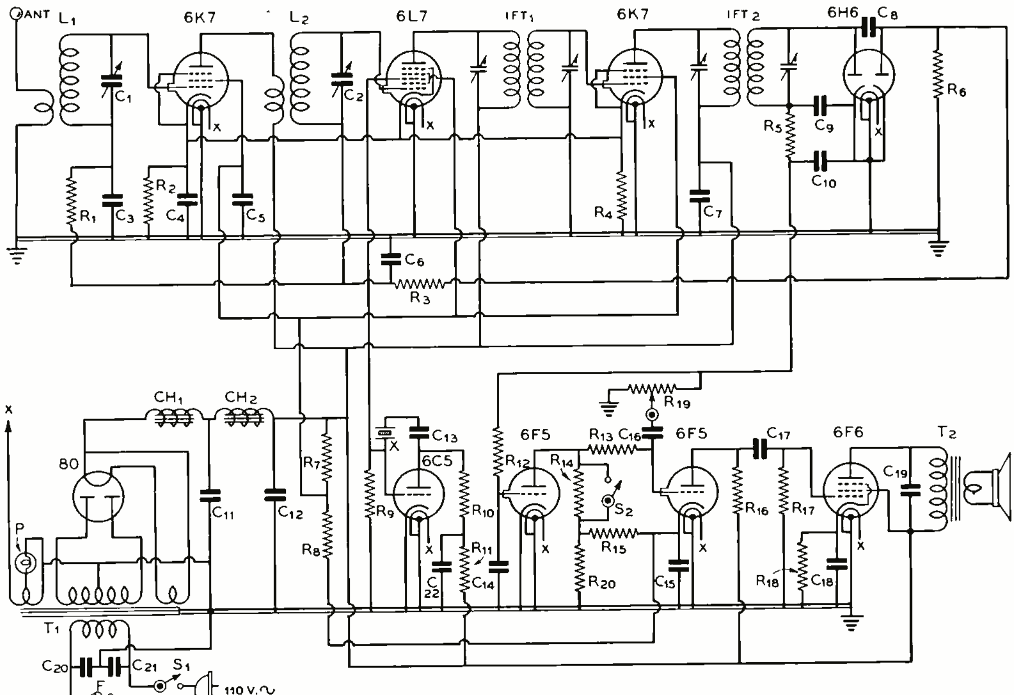


Figure 2. Top view of the chassis. Note the two oil-filled filter condensers on the right front of the chassis, and the row of "exciter"-type shield cans which house the two i.f. transformers and the r.f. and detector coils.

COMPLETE CHASSIS LAYOUT OF THE RECEIVER.






WIRING DIAGRAM OF THE FIXED-FREQUENCY RECEIVER.

$C_1$, $C_2$ — 50-μμfd. air trimmers
$C_3$ — 0.01-μfd. 600-volt tubular
$C_4$, $C_5$—0.5-μfd. metal cased
$C_6$ — 0.01-μfd. 600-volt tubular
$C_7$ — 0.5-μfd. metal cased
$C_8$—.00005-μfd. mica
$C_9$, $C_{10}$—.0002-μfd. mica
$C_{11}$, $C_{12}$ — 4-μfd. 600-volt oil filled
$C_{13}$, $C_{14}$—0.01-μfd. 600-volt tubular
$C_{15}$ — 0.5-μfd. metal cased
$C_{16}$, $C_{17}$—0.01-μfd. 600-volt tubular
$C_{18}$ — 0.5-μfd. metal cased
$C_{19}$, $C_{20}$, $C_{21}$, $C_{22}$—0.01-μfd. 600-volt
$R_1$ — 70,000 ohms, ½ watt
$R_2$—700 ohms, ½ watt
$R_3$—1.0 megohm, ½ watt
$R_4$—700 ohms, ½ watt
$R_5$ — 25,000 ohms, ½ watt
$R_6$—500,000 ohms, ½ watt
$R_7$ — 30,000 ohms, 10 watts
$R_8$ — 20,000 ohms, 10 watts
$R_9$, $R_{10}$—50,000 ohms, ½ watt
$R_{11}$—10,000 ohms, ½ watt
$R_{12}$, $R_{13}$, $R_{14}$ — 1.0 megohm, ½ watt
$R_{15}$—700 ohms, ½ watt
$R_{16}$—500,000 ohms, ½ watt
$R_{17}$—250,000 ohms, ½ watt
$R_{18}$—700 ohms, 10 watts
$R_{19}$—250,000-ohm potentiometer
$R_{20}$ — 10,000 ohms, 10 watts
$L_1$, $L_2$—Fixed-tune tanks for operating frequency
$IFT_1$, $IFT_2$—465-kc. i.f. transformers
$T_1$—700 v.c.t., 145 ma.; 5 v. 3 a.; 6.3 v. 4.5 a.
$T_2$ — Output trans. on speaker
$CH_1$, $CH_2$ — 20-hy. 50-ma. chokes
P—6.3 volt pilot lamp
$S_1$—S.p.s.t. on-off switch
$S_2$—Q.a.v.c. on-off switch
X—Low-drift crystal

and this drop is applied to the grid of the first 6F5. The incoming signal thus biases the grid of the first 6F5 to a point where no plate current flows, and consequently there is no drop across the 1-megohm resistor which furnishes bias to the second 6F5. This restores the latter tube to the normal operating point when a carrier is received.

The output of the second 6F5 is fed to the control grid of the 6F6, which tube is fed either to a line or a voice coil, depending on the particular application of the receiver.

In the original models of the receiver, a 6C5 employing a conventional tuned plate circuit was used as local oscillator. However, it was found desirable from the standpoint of simplicity and dependability to replace this with a 6C5 Pierce oscillator, operating with a crystal cut to incoming frequency plus or minus the intermediate frequency.

The power supply of the receiver is a heavy duty choke input affair and employs two 4-μfd. oil-filled 600-volt condensers.

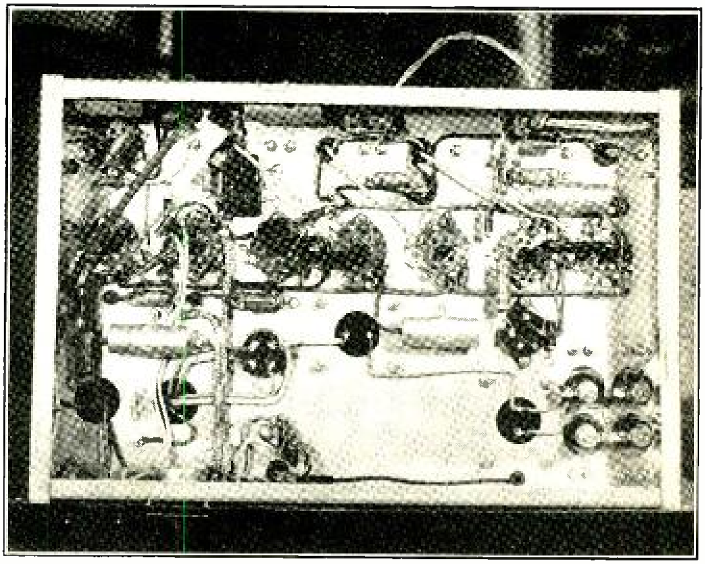


Figure 3. Bottom view of the chassis. Metal-cased "automobile-type "condensers are used throughout for by-passing purposes.

## The Tuned Circuits

All tuned circuits in the receiver employ small air condensers instead of conventional mica compression type. In the receivers which we built, special "exciter tanks" with 50$\mu\mu$fd. condensers instead of the customary 25$\mu\mu$fd. are used, with both sections of the condensers in parallel. Air tuned 450 kc. to 550 kc. i.f. transformers to match are used in the intermediate stage.

The antenna coil is designed for a low-impedance line since it is frequently a considerable distance from antenna to receiver. The coupling coil between the 6K7 and 6L7 is wound with the primary coil self resonant at the lowest frequency on which the receiver is designed to operate. With the coils which we have used, the receiver operates satisfactorily over a frequency range of 1550 kc. to 2650 kc.

There are several small points of interest in the circuit. The two 700-ohm cathode resistors in parallel in the i.f. and r.f. stages are not in error, but were merely used to reduce the number of values of resistors used as these same values are used elsewhere in the circuit. The ½-$\mu$fd. condensers in all cases are standard automobile ignition condensers. In over 70 pieces of equipment we have had only one condenser failure during a period of three years.

We experienced constant trouble with pilot lights burning out until we found that they were satisfactory working at half voltage. Consequently we now use them on one half of the filament secondary.

These receivers have been in operation for a period of three years, many of them for 24 hours a day, and have given very little trouble other than an occasional tube replacement. At one station a bank of eight of them is being operated unattended at a point ten miles away from the control operator. They have proven highly dependable. They provide sufficient sensitivity and selectivity for ordinary communications work and have excellent signal to noise ratio in comparison with standard receivers.

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## *Radiodditiez*

Several successful early radio experiments were based upon a theory that the upper atmosphere conducts ordinary direct currents.

Human nerve impulses, believed by countless laymen to be as fast traveling as electricity, in reality move only about 1/2,400,000 as fast.

The total radio spectrum already assigned in the United States is nearly a half-million kilocycles wide.

The operation of every home or office electrical appliance depends upon the property of resistance or inductance, or both.

# *Your*
# COMMERCIAL LICENSE

By JOSEPH DOCKENDORF,* W6SGZ

The tendency of the National Emergency toward conscription, increased transportation and communication facilities has made many more commercial jobs. Amateurs who have considered radio as only a hobby are being "drafted" into radio as a trade. For the first time civil service commissions are considering amateurs for positions, provided in many instances that they obtain a commercial license.

On July 1, 1939, a new type of examination went into effect for commercial licenses. An outline of the scope of the examination is given in a "Study Guide" containing approximately 1,200 sample questions. The "Study Guide" is obtainable from the Superintendent of Documents, Washington, D. C., for 15c, stamps not being accepted.

### Restricted Radiotelephone License

The "Guide" is divided into six parts called elements. Element 1 consists of the general laws governing all radio services. The applicant for a license of any kind must pass this element. Ten questions are asked and the applicant writes an answer in his own words—this being known as an "essay" type test. After passing element 1 you are qualified for a Restricted Radiotelephone Operator's license. Such a license is of use only to those who use radio as incidental to their regular duties. This means police, firemen, air pilots, small boat owners, and others who use low-powered radiotelephone equipment for small range contact work.

### Other Classes

Anyone desiring a telegraph third class license must take, in addition to element 1, elements 2 and 5. A telegraph second class license requires elements 1, 2, 5, and 6. A radio telephone second class license requires, in addition to element 1, elements 2 and 3. A radiotelephone first class license requires elements 1, 2, 3, and 4. Thus, element 2 is the basis for all these licenses and, therefore, contains the basic theory of radio and electrical fundamentals.

Elements 2 to 6 contain 50 questions, each with a value of two per cent. The majority of the questions are multiple choice although five or ten problems, and five or more diagrams are required on certain elements. Element 3 is fundamental radiotelephony that would be applicable to emergency stations, aviation services, police radio, etc. Element 4 is based on broadcast station work. Element 5 is radio telegraph and serves certain emergency classifications, point-to-point, etc. Element 6 is advanced radiotelegraph and goes into auto alarms and direction finders.

### Telegraph First

No mention has been made regarding the first class telegraph license because this license is issued to applicants who have served one year on a ship under the American flag, who are 21 years of age, and who can pass a 25 word per minute plain language and 20 words per minute code groups test, in addition to passing elements 1, 2, 5 and 6. Note that the requirement specifies a vessel under the U. S. flag. Many U. S. ships to avoid labor disputes, or because of the Neutrality Acts, embargoes, and other events have registered under foreign flags, such as the Panamanian, Belgian, etc. Although much, and in many cases, all of the crew are U. S. citizens, time aboard these ships is of no value toward obtaining a first class license.

### Multiple Choice Questions

The multiple choice questions as used by the F. C. C. are similar to those used the past few years by psychologists, civil service commissions, and other testing groups. It has been found that a more accurate rating of an applicant is obtained by the multiple-choice

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test than by the essay-type test. In addition, the test indirectly serves as an intelligence test because the questions require study and analysis. For example a student with a high I. Q. who answers questions rapidly might find that he failed the examination because he overlooked a simple word, or a comma placement. I have known radio men with over 20 years experience who could describe radio action yet who failed the test because of a lack of deep analysis. One student told me a dictionary would have been of more use than a radio text.

Let's take an example. In schools students are given the equation $R = \frac{k\ l}{d^2}$ meaning that the resistance of a wire is directly proportional to the material of which made, and its length; and, inversely proportional to the cross sectional area. Such a question might be worded by the F. C. C. as follows:

Which one of the following does not affect the resistance of a wire:

(1). length
(2). area
(3). contour
(4). material of which made
(5). diameter

The correct answer is of course no. 3, and the applicant puts the number 3 in the margin. In school the student learned the things which *did* affect the resistance of a wire but obviously no instructor could teach him what did not affect its resistance—so that in place of the word "contour" an almost unlimited number of qualities or items could be used. This requires a knowledge of what is pertinent to the problem and what is irrelevant.

In some of the problems, answers are given and the applicant must pick out the correct answer if given, or the answer nearest to the correct answer. I would suggest that all work be carried out to hundredths, that is, two decimal places. A slide rule can be used but I personally am against its use for two reasons; first, so many users have insufficient practice with a rule and, second, if your rule gives a wrong answer then you lose two points, and those two points could be the difference between success and failure. However a slide rule is good to check work.

The diagrams are simple ones, the majority being one-tube circuits. Each diagram counts for two per cent. I understand that the diagrams are checked for fundamental accuracy: i. e., where a diagram calls for a means of coupling two tetrodes, the F. C. C. is interested in seeing if you know what a tetrode is. Some diagrams call for indicating correct polarities. It is a good idea to indicate polarities whether called for or not. Some diagrams require you to connect various sections together to achieve a given result. You might be given a transformer, tube, condenser, choke, ground, and bleeder, and be asked to connect them up as a half-wave rectifier with the choke at ground potential. Or, a diagram could be given with no errors and you would be asked to correct same. Obviously no correction could be made.

Some of the diagrams that might be requested since they cover fundamentals are: series-fed Hartley, Armstrong, crystal oscillators using triode, tetrode, pentode, non-regenerative type oscillators, direct coupled amplifiers, multivibrator, arc, methods of coupling, grid and plate modulation systems, bridge rectifiers, and various methods of keying a transmitter.

Although the present examination has resulted in a high percentage of failures—some districts report that only 6% to 10% pass—by using the ideas herein student-friends have achieved over a 95% average. Should you apply for a telegraph second class license and fail element 6 you would be given a telegraph third class license. The Inspectors will issue the license covered by whatever elements are successfully passed. Because it is basic to both telegraph and telephone licenses, the element 2 has the greatest number of failures. In the telegraph class, element 5 is the most difficult and in the telephone class element 3 gives the most trouble. Many reasons exist for this.

The failure of so many applicants on element 2 shows a lack of fundamentals for this element goes thoroughly into inductance, capacitance, meters, Ohm's Law, and simple vacuum-tube theory. These subjects can not be covered in one lecture period, nor by any one book on the market today. Merely memorizing Ohm's Law is not sufficient—it must be so thoroughly made a part of one's mental state that it becomes a tool to achieve an end, not as an end in itself. And I assure you the F. C. C. can set even the best operator back on his heels with an occasional problem.

In the study of inductance and capacitance I suggest that college texts on radio and electricity be used rather than the "practical" or trade texts—writers on these topics for the trade level too frequently "sugar-coat" theory and omit or necessarily slant the theory so that erroneous ideas result.

Element 3 has been difficult mainly because of the laws. Rules, regulations and laws governing services other than Broadcast stations have not been available from the Superintendent of Documents until very recently and the F. C. C. has many questions on these classifications. Any good phone amateur should pass the phone theory covered in element 3 without much trouble. It is also suggested that a good review of grid modulation be taken before tackling any of the phone tests.

Element 4 concerns itself mainly with equipment used by the average broadcast operator. For the beginner I would suggest a trip to the nearest broadcasting station, and questions of the technician about apparatus used. Those who think element 4 is engineering definitely show they do not know what constitutes engineering because the F. C. C. does not expect an engineering knowledge of pads, sideband analysis, acoustical analysis, nor radiation field theory; however, fundamental questions on field strength, decibels, and antennas are to be found in element 4 but no difficulty should be had if a good text on the college level has been used. Just before taking the test for any of the phone licenses a review of decibels and logarithms will be helpful.

Element 5 emphasizes practical operation of general equipment such as crystals, tube constants, non-regenerative oscillators, detectors, significance of meter readings in various portions of a circuit, and finally d.c. and a.c. problems, and laws.

Element 6 concerns itself mainly with direction finders, auto alarms, and procedures in an actual communication setup. Some of the auto alarm and d. f. questions are not only downright tricky but an occasional one turns out to be untrue.

The a.c. problems on elements 5 and 6 are mainly of the simple series circuits. Some parallel circuit calculations are given in element 4.

The laws on element 5 and 6 are available in the Cairo and the Madrid Conventions, and the Ship Safety Acts. Obviously, since ships sail the seven seas a knowledge of International radio treaties is of more consequence than are the national laws. On the other hand, the telephone elements, 3 and 4, are more concerned with national laws and F. C. C. Rules and Regulations. The Cairo Convention costs 45c, the Madrid Convention costs 20c and both are available from the Superintendent of Documents, Washington, D. C.

I have found that if a student has the problems licked and has studied the laws and treaties, he has a flying start toward passing the examination because on elements 5 and 6 these two topics are worth 20% to 40%. The problems and Laws give the same edge when taking elements 3 and 4.

You perhaps wonder how you can learn auto alarms and direction finders when these are found in few schools. The answer is that no school is any better than its instructors and if these men have had no marine experience since 1935 you would do well to look elsewhere for your training. Radio advances so rapidly that only through actual experience can a teacher keep up. The teacher makes or breaks a school, for a good teacher can put over the facts of equipment operation even though none is on hand. Few persons can study alone and pass these tests—I have met one, and only one, who did. A residence school is the best answer and by putting in 6 hours per day with a real teacher, you should complete the requirements for a license in 4 months to 9 months. But when you get that license remember that you are an apprentice and are qualified to begin learning.

Some texts that an average student should have are listed here. Ghirardi's "Radio Physics Course" gives a plain clear-cut picture of simple theory and radio parts. Few errors exist. Glasgow's "Radio Engineering" or Terman's "Radio Engineering" give the necessary information on inductance, resonance, and coupling. Both books will be found valuable year after year as your knowledge increases. Nilson & Hornung's "Practical Radio Communication" is a good all-around text but has been cut down so much and so badly checked that many small errors exist. Sterling's "Radio Manual" is especially good for the practicing operator and covers auto alarms, laws, modulation, and amplifiers very well. It would be the ideal book if a few more chapters were added to cover d.c., a.c., and fundamental theory. Nilson & Hornung cover batteries, motors, generators, and a.c. sufficiently well to equip anyone to pass that portion of the examination.

Some one might wonder how the present examination compares with the type in use prior to July 1939. On the old tests any good parrot could pass. Several books were on the market with actual questions and answers, and several days of memory work were enough to pass. Available are answers to the questions in the Study Guide but simply knowing these answers is not much help if the knowledge and reasoning power isn't there.

The tests would be improved by several things. From a technical standpoint, the first class license should be issued only to those who can copy on a typewriter. Questions on meteorology, teletype, and simple facsimile should be added to both telephone and telegraph licenses. A first aid section should also be required for telegraph licensees because other licensed officers aboard ship are required

[*Continued on Page 78*]

A somewhat novel installation for a rotary array (also rather a novel array) seen at the Joint Southwestern - Pacific Division Convention in Long Beach over the Labor Day Weekend.

# DEPARTMENTS

- **X-DX**
- **With the Experimenter**
- **U. H. F.**
- **The Amateur Newcomer**
- **Postscripts and Announcements**
- **Yarn of the Month**
- **What's New in Radio**
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# "WAZ" HONOR ROLL

## CW AND PHONE

| | Z | C |
|---|---|---|
| ON4AU | 40 | 158 |
| G2ZQ | 40 | 147 |
| J5CC | 40 | 130 |
| W8CRA | 39 | 156 |
| W2BHW | 39 | 156 |
| W8BTI | 39 | 154 |
| W1BUX | 39 | 153 |
| W2GTZ | 39 | 153 |
| W2HHF | 39 | 152 |
| G6WY | 39 | 151 |
| W6GRL | 39 | 151 |
| W6CXW | 39 | 150 |
| W2GT | 39 | 150 |
| W9TJ | 39 | 149 |
| W4CBY | 39 | 145 |
| W6CUH | 39 | 143 |
| W6KIP | 39 | 143 |
| W8OSL | 39 | 143 |
| W9KG | 39 | 141 |
| W6ADP | 39 | 140 |
| W6BAX | 39 | 140 |
| W8OQF | 39 | 139 |
| W8LEC | 39 | 136 |
| W6QD | 39 | 135 |
| W9TB | 39 | 134 |
| W2ZA | 39 | 134 |
| VK2EO | 39 | 133 |
| G5BD | 39 | 133 |
| W2GVZ | 39 | 132 |
| W4CYU | 39 | 132 |
| W3EVT | 39 | 131 |
| W5KC | 39 | 130 |
| W2GWE | 39 | 129 |
| W6KRI | 39 | 129 |
| W1ADM | 39 | 128 |
| VE4RO | 39 | 126 |
| W6VB | 39 | 125 |
| W7BB | 39 | 123 |
| W6HX | 39 | 123 |
| G5BJ | 39 | 120 |
| W8JSU | 39 | 120 |
| W2IYO | 39 | 119 |
| W2CYS | 39 | 117 |
| G2LB | 39 | 115 |
| W4IO | 39 | 115 |
| W7DL | 39 | 115 |
| W3BEN | 39 | 115 |
| W2GNQ | 39 | 113 |
| W6FZL | 39 | 112 |
| ON4HS | 39 | 111 |
| ON4FE | 39 | 110 |
| W1AQT | 39 | 110 |
| W6FZY | 39 | 109 |
| W6SN | 39 | 99 |
| W9NRB | 39 | 98 |
| W6GPB | 39 | 94 |
| XE1BT | 39 | 90 |
| K6AKP | 39 | 78 |
| W1CH | 38 | 150 |
| W2GW | 38 | 143 |
| W5VV | 38 | 144 |
| W3HZH | 38 | 139 |
| W3EMM | 38 | 139 |
| W5BB | 38 | 138 |
| W8BKP | 38 | 138 |
| ZL1HY | 38 | 138 |
| W3EPV | 38 | 136 |
| W9GDH | 38 | 134 |
| W3HXP | 38 | 133 |
| W4FVR | 38 | 130 |
| W9FS | 38 | 130 |
| W3EAV | 38 | 130 |
| W8JMP | 38 | 127 |
| W2GRG | 38 | 127 |
| ON4EY | 38 | 126 |
| W8ZY | 38 | 125 |
| W3GAU | 38 | 125 |
| W3EVW | 38 | 124 |
| W3GHD | 38 | 121 |
| W8AU | 38 | 120 |
| W8LYQ | 38 | 120 |
| W8DFH | 38 | 119 |
| W9PST | 38 | 119 |
| W8QXT | 38 | 119 |
| W8JIN | 38 | 119 |
| W3FQP | 38 | 119 |
| W8DWV | 38 | 118 |
| W1GDY | 38 | 118 |
| W2BMX | 38 | 118 |
| W1BGC | 38 | 117 |
| W6AM | 38 | 117 |
| LU7AZ | 38 | 116 |
| W3DDM | 38 | 116 |
| W9UQT | 38 | 116 |
| W8MTY | 38 | 114 |
| W9KA | 38 | 114 |
| W9ELX | 38 | 114 |
| W8LFE | 38 | 113 |
| G6CL | 38 | 112 |
| W8HWE | 38 | 112 |
| G2QT | 38 | 112 |
| W8EUY | 38 | 112 |
| W9CWW | 38 | 112 |
| W2BXA | 38 | 111 |
| W6GRX | 38 | 111 |
| LY1J | 38 | 110 |
| W1AB | 38 | 110 |
| W6HZT | 38 | 110 |
| W4MR | 38 | 108 |
| W8KWI | 38 | 108 |
| W8BOX | 38 | 106 |
| W9ADN | 38 | 106 |
| W8OE | 38 | 106 |
| W6NLZ | 38 | 106 |
| W9PK | 38 | 105 |
| W8GBF | 38 | 105 |
| ON4UU | 38 | 104 |
| G2IO | 38 | 103 |
| W8BWB | 38 | 98 |
| J2KG | 38 | 95 |
| G6XL | 38 | 95 |
| ON4FQ | 38 | 92 |
| W9VDQ | 38 | 79 |
| SU1WM | 37 | 138 |
| W2BJ | 37 | 134 |
| W6GAL | 37 | 131 |
| W8KKG | 37 | 127 |
| W7AMX | 37 | 125 |
| J2JJ | 37 | 123 |
| W1BXC | 37 | 123 |
| W2IOP | 37 | 122 |
| W1RY | 37 | 120 |
| W6MVK | 37 | 118 |
| G6NF | 37 | 115 |
| W8PQQ | 37 | 115 |
| W9RCQ | 37 | 114 |
| W3TR | 37 | 113 |
| ON4FT | 37 | 112 |
| W9RBI | 37 | 112 |
| W6MEK | 37 | 112 |
| W6ADT | 37 | 111 |
| W1IED | 37 | 111 |
| G2MI | 37 | 110 |
| W7AYO | 37 | 110 |
| W8DOD | 37 | 110 |
| VE2EE | 37 | 108 |
| W4DMB | 37 | 108 |
| W5ENE | 37 | 107 |
| W6ITH | 37 | 105 |
| W3KT | 37 | 104 |
| W9PTC | 37 | 103 |
| W3FJU | 37 | 103 |
| W9GBJ | 37 | 103 |
| G6GH | 37 | 102 |
| W3AYS | 37 | 102 |
| VK2DA | 37 | 101 |
| W6FKZ | 37 | 101 |
| W6JBO | 37 | 101 |
| W8KPB | 37 | 100 |
| W4DMB | 37 | 100 |
| W9AJA | 37 | 99 |
| W4EQK | 37 | 99 |
| ON4VU | 37 | 99 |
| W3RT | 37 | 99 |
| W3EXB | 37 | 98 |
| ZL2CI | 37 | 97 |
| W6DLY | 37 | 97 |
| W6MHH | 37 | 95 |
| W6MCG | 37 | 92 |
| G2UX | 37 | 91 |
| W2BSR | 37 | 90 |
| W6MUS | 37 | 87 |
| W9UBB | 37 | 77 |
| W8AQT | 36 | 120 |
| K4FCV | 36 | 109 |
| W8AAJ | 36 | 107 |
| W3GGE | 36 | 106 |
| W6BAM | 36 | 106 |
| W9AFN | 36 | 105 |
| W5PJ | 36 | 105 |
| W8QDU | 36 | 105 |
| W5ASG | 36 | 104 |
| SP1AR | 36 | 103 |
| W8LDR | 36 | 101 |
| W6NNR | 36 | 100 |
| W6KWA | 36 | 99 |
| W8LZK | 36 | 99 |
| G6BJ | 36 | 99 |
| VE1DR | 36 | 98 |
| W9VES | 36 | 98 |
| W8AAT | 36 | 96 |
| W9GKS | 36 | 95 |
| G6YR | 36 | 94 |
| W2IZO | 36 | 94 |
| VE5AAD | 36 | 92 |
| W4ADA | 36 | 90 |
| W1APU | 36 | 91 |
| W9LBB | 36 | 90 |
| W8JAH | 36 | 89 |
| OK2HX | 36 | 86 |
| VK2NS | 36 | 84 |
| W6TI | 36 | 80 |
| W7DSZ | 36 | 73 |
| W2GXH | 36 | 71 |
| W1WV | 35 | 119 |
| W8OXO | 35 | 113 |
| W6GHU | 35 | 103 |
| W4QN | 35 | 103 |
| W9PGS | 35 | 103 |
| W6HJT | 35 | 103 |
| K6NYD | 35 | 100 |
| W8CLM | 35 | 99 |
| W8OUK | 35 | 99 |
| W8CJJ | 35 | 98 |
| W2WC | 35 | 98 |
| OK1AW | 35 | 96 |
| W9EF | 35 | 94 |
| G6QX | 35 | 94 |
| W8NV | 35 | 94 |
| W3DRD | 35 | 93 |
| W6AQJ | 35 | 92 |
| VE5ZM | 35 | 92 |
| LU3DH | 35 | 89 |
| W9GNU | 35 | 88 |
| W9ERU | 35 | 88 |
| K6CGK | 35 | 88 |
| W9VDX | 35 | 86 |
| W6KQK | 35 | 85 |
| W6ONQ | 35 | 83 |
| ON4NC | 35 | 82 |
| GI6TK | 35 | 80 |
| W4ELQ | 35 | 80 |
| W8QIZ | 35 | 78 |
| W6GK | 34 | 105 |
| W6HEW | 34 | 103 |
| K7FST | 34 | 102 |
| W8CED | 34 | 102 |
| W8BSF | 34 | 100 |
| W1APA | 34 | 98 |
| W2BZB | 34 | 99 |
| W9VKF | 34 | 96 |
| VK2AS | 34 | 94 |
| W8HGA | 34 | 93 |
| W3EYY | 34 | 91 |
| W9MQQ | 34 | 89 |
| W2FLG | 34 | 89 |
| W6TE | 34 | 88 |
| G6WB | 34 | 88 |
| W6CVW | 34 | 88 |
| VK2OQ | 34 | 87 |
| G5VU | 34 | 85 |
| W9BCV | 34 | 83 |
| ZS1CN | 34 | 82 |
| W6PNO | 34 | 82 |
| VK2TF | 34 | 81 |
| W6MJR | 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 |
| VK2VN | 34 | 63 |
| W9QOE | 34 | 56 |
| F8XT | 33 | 112 |
| W8ACY | 33 | 106 |
| W3DAJ | 33 | 97 |
| W6KEV | 33 | 96 |
| W8BWC | 33 | 93 |
| W6KUT | 33 | 90 |
| W6CEM | 33 | 88 |

## PHONE

| | Z | C |
|---|---|---|
| W3LE | 38 | 128 |
| F8UE | 38 | 103 |
| W6OCH | 36 | 107 |
| W6ITH | 36 | 101 |
| W3FJU | 36 | 87 |
| VE1CR | 36 | 81 |
| W1ADM | 35 | 101 |
| W9NLP | 35 | 95 |
| W9TIZ | 35 | 93 |
| KA1ME | 35 | 79 |
| F8VC | 35 | 78 |
| W4CYU | 34 | 100 |
| ON4HS | 34 | 92 |
| W9ELX | 34 | 90 |
| W6EJC | 34 | 84 |
| W7BVO | 34 | 80 |
| W4DAA | 34 | 71 |
| W2IXY | 33 | 105 |
| W6NNR | 33 | 92 |
| GM2UU | 33 | 84 |
| F8XT | 33 | 70 |
| W3FAM | 33 | 68 |
| W6MLG | 32 | 97 |
| W8LFE | 32 | 91 |
| W2IKV | 32 | 90 |
| W4DRZ | 32 | 89 |
| W9BEU | 32 | 88 |
| W9QI | 32 | 86 |
| W1HKK | 32 | 85 |
| W8QXT | 32 | 85 |
| G5BY | 32 | 85 |
| VK4JP | 32 | 85 |
| W4DSY | 32 | 84 |
| W6OI | 32 | 83 |
| W9TB | 32 | 82 |
| W6IKQ | 32 | 80 |
| VE1DR | 32 | 59 |
| W1AKY | 31 | 93 |
| W3EMM | 31 | 88 |
| W8LAC | 31 | 85 |
| G6BW | 31 | 83 |
| G3DO | 31 | 78 |
| W1KJJ | 31 | 78 |
| W6FTU | 31 | 77 |
| G8MX | 31 | 73 |
| W8RL | 31 | 71 |
| W9UYB | 31 | 71 |
| W6AM | 31 | 67 |
| F8KI | 31 | 58 |
| W9ZTO | 31 | 53 |
| W4EEE | 30 | 86 |
| W2GW | 30 | 86 |
| W1JCX | 30 | 83 |
| W8AAJ | 30 | 82 |
| W2IUV | 30 | 79 |
| W2AOG | 30 | 77 |
| W9BCV | 30 | 68 |
| W6MZD | 30 | 52 |
| G6DT | 29 | 83 |
| W4BMR | 29 | 80 |
| K6NYD | 29 | 78 |
| CO2WM | 29 | 78 |
| W9RBI | 29 | 71 |
| W6NLS | 29 | 64 |
| W6GCT | 29 | 62 |
| W6NRW | 29 | 60 |
| W2GRG | 28 | 74 |
| W6PDB | 28 | 65 |
| W8NV | 28 | 65 |
| W7EKA | 28 | 63 |
| VE2EE | 28 | 62 |
| W4DRZ | 28 | 62 |
| W1BLO | 28 | 62 |
| VK2AGU | 28 | 61 |
| W6MPS | 28 | 60 |
| W3EWN | 27 | 93 |
| W2DYR | 27 | 77 |
| W2HCE | 27 | 76 |
| W5CXH | 27 | 52 |
| G5ZJ | 26 | 77 |
| W5ASG | 26 | 62 |
| W5VV | 26 | 61 |
| W4EQK | 26 | 61 |
| W8QDU | 26 | 61 |
| W9NMH | 26 | 61 |
| W5DNV | 26 | 60 |
| VK2OQ | 26 | 56 |
| W4TS | 26 | 54 |
| VE4SS | 26 | 50 |
| W6FKK | 26 | 47 |
| W7AMQ | 26 | 47 |
| K6LKN | 26 | 46 |
| G6CL | 26 | 46 |

# X-DX AND OVERSEAS NEWS

**By Herb Becker, W6QD**

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

Hello gang! A lot of water has passed under the bridge since our last session, hasn't it? So much so in fact that almost everything was washed along with it. The FCC rulings which occurred early in June just about caught us with our antennas down . . . with all the details for RADIO'S DX Contest showing up in the July issue. Luckily we heard about the dx lid being clamped down in time to put the ol' cancellation notice in the same issue. It now looks like the FCC has everything well in hand and the consensus seems to be that no further curtailment will be necessary, with the international situation as it is. We should be very thankful that we can still use all of our bands . . . and take advantage of it by using them more . . . let's get acquainted with the boys around USA once again. I am no different than most of the other dx men . . . I didn't like dx being taken away . . . but I'm not going to give up brass-pounding because of it. Boy, this is probably just what the doctor ordered . . . look what a sweet time I'm going to have with all those W9's, and even now my log looks like the 9th call area section of the Call Book. This guy Goodman, W1JPE, cracked about running a list of 9's for QD to work . . . and I'm just frothing at the mouth waiting for it. Right now let's forget this for a while and get along with something which should prove more interesting to you x-dxers.

### WAAP

#### Worked All American Possessions

During the past couple of months several of the boys in this neck of the woods were hashing over an idea whereby they could do something to fill in to a certain extent, in the absence of real dx. The discussion finally fell upon a plan of working all of our possessions, which would include the Pacific Islands as well as Alaska, Canal Zone, Virgin Islands, Puerto Rico, Little America, and the Philippines. About this time we heard from Tom Caswell, W5BB, who came up with the finishing touches. Tom suggested the name, WAAP, (Worked All American Possessions), as well as other details. After a certain amount of collaboration we came up with the fact that confirmations will be required. A total of 15 will be necessary, and a certificate will be awarded to all those who can submit the confirmations.

Following are the prefixes involved: K4, KB4, KC4, K5, K6, KB6, KC6, KD6, KE6, KF6, KG6, KH6, K7, KA and W.

Following is a list of those from which confirmations will be required:

| | |
|---|---|
| K4 | Puerto Rico |
| KB4 | Virgin Islands |
| KC4 | Little America |
| K5 | Canal Zone |
| K6 | Hawaiian Islands |
| KB6 | Guam |
| KC6 | Wake |
| KD6 | Midway |
| KE6 | Johnston |
| KF6 | Baker Island, Howland Island and Amer. Phoenix Islands |
| KG6 | Jarvis and Palmyra |
| KH6 | American Samoa |
| K7 | Alaska |
| KA | Philippines |
| W | United States |

A few simple rules should be remembered for WAAP.

1. 15 confirmations must be submitted which will entitle the operator to a WAAP certificate. A list will be published in RADIO showing the order in which they have been awarded.

2. Either 'phone or c.w. may be used, or both.

3. Confirmations may consist of QSL cards, letters, or lists sent in by the station to RADIO. Other forms of confirmation will be acted upon by the committee.

4. All confirmations should be sent via registered mail direct to The Editors of RADIO, 1300 Kenwood Rd., Santa Barbara, California." A self-addressed envelope should be included with sufficient postage to cover the return of your confirmations.

#### Overseas Mail

The mail has thinned out from the boys overseas but every now and then we receive something from one or two of them. At this moment I have a letter from Johnny Shirley, ZL2JQ. Most of us will remember him, as he spent considerable time roaming around USA. Johnny is still in New Zealand, and every now and then he expects to shove off for other places, and just as often they change their mind at the last minute, keeping him home. He at present is Orderly Sergeant, but this being a temporary job, rumor has it that he is in line for a commission. His duties have been training rookies in the fundamentals and details of radio communication. Johnny also remarked that their big home of 15 rooms is quite vacant now with only his father, mother and kid brother . . . his sister recently has gone away nursing. They are arranging to care for some of the British kiddies who are on their way to ZL from G. ZL2JQ asks to be remembered to the whole gang, and adds that every once in a while he goes into a little day dreaming on what were probably the two best years of his life . . . when he was in USA and at sea doing his brasspounding. We'll hear from him again.

Here's a portion of a letter from ON4HS, Harold Simmons, who is now in England:

"I feel I must drop you a line so that you can tell the boys over there that ON4HS is now back in England after a hectic journey down from Brussels to Lille on May 13th, and from Lille to Le Havre on May 19, and back to G. B. on May 20. Tho' the Heinkels were over us really all the way from Brussels to the Belgian border, we got through safely and the old car (a good old Oldsmobile) suffered little damage. We were sorry to have to discard it at Lille, but we had to obey orders, so we are now "carless and homeless." Re my future . . . well, I don't know just what I am going to do now. It looks as though I must get into uniform again although I swore (as many others did too) way back in 1918 that I should keep out of the next war. (Note: About two years ago this column carried a brief resume of Harold's past during the last war. He was an ambulance driver, having had many hair-raising experiences on the battlefields of France and Belgium. It is ironical that after writing to us about his experiences, then, he closed his letter with . . . "and may God forbid that we ever have another one.") We'll be hearing more from Harold from time to time.

### In the Pacific . . .

If W6KMS/KC6 is still on at Wake, he would like all of his QSL cards sent to the W6-QSL manager, who happens to be Horace Greer, W6TI. KMS is supposed to be on the air at the present time, and incidentally his name is Paul Harper. KC6OKS was on 20 phone there for a while as W6ITH worked him . . . frequency 14162 kc. W2DMJ says he will forward QSL cards to I1JKV. Anybody ever work him? As is always the case there is never anybody who is the first to work anybody else. A few months ago I mentioned that W6FHQ was the first to work KC4USA on phone. Now, along comes Bud Walton, W6AED, who says that's a lot of hooey because he worked KC4USA on March 4th at 9:00 p.m., P.s.t. and was told he was the first W6 contacted. Fire away boys, but remember leave me out of this "middle" spot . . . don't shoot 'till you see the whites of their eyes and all that sort of thing. Next month, we may have a few more "firsts" to add to the list.

It should be of interest to you that RADIO has a list of the stations worked by KG6MV on Palmyra Island. Warner Hobdy has included all QSO's between May 10, 1940 and July 5th, both c.w. and phone. Yes, Palmyra counts as the same "country" as Jarvis Island.

Of course, we can't recognize any new countries worked after June 5, 1940, which was the date the FCC issued No. 72, banning foreign contacts. Madge Williams, W6KPS of Martinez, which by the way is in California, says that W7HTY began a 10-meter QSO one evening and talked into the next day . . . in fact it was 'till 4:06 a.m. At this time he had to give up and hit the hay, but the band was still open. I guess KPS's xyl was glad of that. (By the way, is that what they call "short skip"?)

K4KD calls our attention to the fact that the only legal K4 stations with two-letter calls are K4BU, K4KD, K4RJ and K4UG. He says there are stations in places other than K4 using two-letter K4 calls but they must be classified as illegal. Once again we set in type the fact that you can QSL to KF6SJJ on Howland Island via W1KFV . . . Robert W. Lieson, 17 Litchfield St., Springfield, Mass. I notice a splash in *Life* magazine on the activities of the Tri-County Radio Association, during the June field day. Nice going. W9GKS finally succumbed to phone after 19 years of code work. Rig consists of 100TH's modulated with TZ-40's.

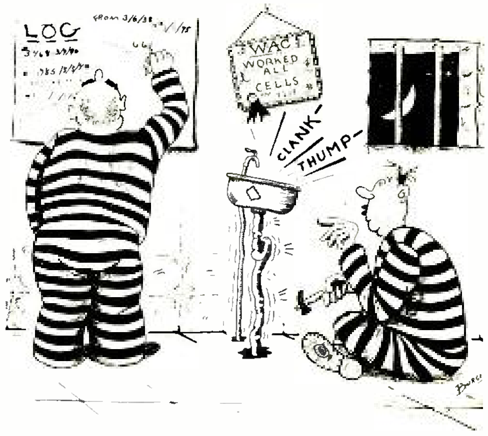
### X-DX

From this point on this department will have less and less dx news to report. I don't feel that we should necessarily cut down on the space or discontinue it entirely. I believe there is enough news floating around the country to give the whole bunch of us good reading material. If you fellows feel that we should continue running the column, and incorporate items that would not necessarily be dx, such as club activities, individual achievements that are unusual, more photos etc., drop us a line. Give an idea what you would like to see and I'll do my dangdest to write it up every month. Of course, we must not forget the forgotten dx man, we must keep an eye on him so that the whole mob will not lose contact with each other. In order to keep tab on the x-dx men, shoot in any news that you may learn about them. If it's of interest to the gang we'll run it . . . but right here would be a good time to say that I'll not take the responsibility of its being correct. If a report comes in that W3XXX saw an x-dx man, W2ZZZ, fall over a brass rail and get his foot jammed in a cuspitoon (wouldn't that be awful), then the man sending it to us would be sticking his neck out when published. It wouldn't be expected that a man would report much about himself, in the nature of the above episode, but we would like to hear from all of them. Maybe some of them have taken up knitting sox for their offspring, such as Lucas, for example. Maybe they are experimenting with FM, UHF and what not. That's what we want to know. The way things are shaping up, many of the boys are fooling around on 5, 2½, and 1¼ meters.

Not just to fill up space, but to give you an idea how a trip to the annual Radio Parts National Trade Show in Chicago, affected, or reacted to, an average ham (anyway, a ham) the following account is written. Then topping it off with a trip to the Milwaukee ham brawl was almost the blow that killed. This screwy narrative may bring back past experiences of yours, too. So, here we dive into it and I hope you have the courage to wade through it. When it gets too bad . . . mix an Alka Seltzer.

### Vox Popoff

There just "ain't no justice" for the poor working man. Here is a letter from W7DVY which tears this department up one side and down the other. So much so in fact, that I feel an answer is necessary. The general gist of its contents have to do with not enough publicity and credit being given to the W7's. I should like to run the whole letter, and no doubt if we did, it would appease his desire for W7 credit . . . but due to the length I shall have to give only a running sketch. W7DVY claims that if RADIO would devote more space to the doings of the W7's, and give them more credit, the feeling of being left out in the cold would leave, and consequently we would see more activity in the 7th district. Now then, I believe that most everyone knows that in order to give credit for any kind of achievement, it is almost impossible to do so unless there is evidence. By evidence I mean to have it at hand. I, personally, cannot remember a time that I haven't given full credit to any of the dx achievements of any W7. Upon checking back issues we find where the column has recognized the adverse conditions under which most W7's work—in other words not the best of dx conditions. In all dx contests in the past, both ours and A.R.R.L.'s, we have noted that the W7 scores were low, but at the same time realized that they have to work harder to get what they do. I am sure W7DVY isn't speaking for all W7's because there have been a number from that neck of the woods who have contributed very regularly to the department, such as W7AMX, W7DL, W7AYO, W7BVO, W7ETK, W7DSZ, W7AVL, W7EKA, W7VY, etc. It is pretty tough to run anything unless we first have something to use for material. There are two methods to get it. One, to be sent in by the operator or a friend of his. Two, to go out and get it myself. Obviously the latter is out of the question, but then again, I guess I could send Operative No. 1492 around on another scouting trip. When the whole thing is summed up, it means that we will be tickled pink to receive more and more contributions from the W7's. We are glad to devote some space, and I'm sure that most of the gang around the country would like to know what the 7's are doing. I hope that this paragraph has served to clear up a few things, and if leads to more W7 activity . . . and news from them, we'll all be happy.



"Boy, what a night for DX!—there's 7388 in cell 210."

### A Trip to the Land of W9's

Early in June it was hurriedly decided that I was to make a trip to Chicago. What! Actually going into the land of 9's—gosh, I thought, can I take it. Well, anyway I hopped into Bill Eitel's car and found that I almost landed on his xyl's lap. This was overlooked, however, before we arrived at our destination, but now, I must tell you of a few of our experiences.

The first night we stopped at one of these "air-conditioned" auto-courts, or Motels, in Phoenix. I'm telling you this air-conditioning is really something. Why, when we first opened the door of our cottage and switched on the air-conditioning . . . whooof, it almost blew us out the front door. And whatta a roar . . . would we have to put up with this? It was a cool day for Phoenix I guess, because they said it was only about 104 or so. We were dripping perspiration by the bucket full, but this was put to a stop by this young blizzard going on in the cottage. We had one puzzle to solve that night. How were we going to sleep with all that racket going on from this machine made blizzard? If we turned it off we would probably be too hot to sleep. So there we were, right in the middle not knowing which would be the worst. Bill's wife hit on the final solution. She said that we could go to bed and sleep all right with the air-conditioning going full blast, because she knew the roar couldn't be worse than our snoring.

The next morning at the crack of dawn we headed out over the famous Arizona desert. I must say that from here on through New Mexico and into Texas we saw plenty of good ol' "rhombic" land . . . but no rhombics.

While ripping along the highway in the Indian country of New Mexico, we notice a great many of the Indians lying around the landscape snoozing in the sunshine. I poked Bill in the ribs and told him they reminded me of Bill Rudolph, W6OEG, during a DX contest. Bill said I was just jealous. Although I'm not employed by either the Arizona or New Mexico Chambers of Commerce I must say that in spite of the scorching effects of the sun, the desert country is mighty pretty and picturesque. During the day we made knots, thanks to the overdrive in Bill's car.

Arriving in El Paso so early, we decided to breeze along for a couple of more hours until we hit a wide spot in the road. Well, the next bulge in the road we came to was a place named Van Horn, Texas. There were two Motels, one on each edge of the town, and at a rough guess I'd say they were about 300 yards apart. We grabbed the farthest one so we would have a 300 yard start in the morning. The three of us enjoyed a fine feed that night and looked forward to a swell sleep, as these cabins had what was called air-conditioning. It wasn't a cyclonic effect as in Phoenix but more of a gentle breeze. The night was hot and for a while we wished the "breeze" would turn into a cyclone.

We had not long to wait for after a few hours, along about 1 a.m., we all awoke in what sounded like one of the Hollywood Movie-made storms. We were undecided as to whether it was a dust storm or a rain storm, so in order to settle the uncertainty, I poked my hand outside the door. Upon looking at said mitt, we found that it was a combination, as I had a handful of mud. All of us looked as though we had on mud masks, the dust being so thick inside the cabin. By placing wet cloths over our faces we were able to breathe, thereby getting a bit more sleep. Again at dawn we were on our way.

After a couple of hours of driving we had a pretty good appetite cooked up so stopped at a coffee shop in another small Texas town. We walked into this place just in time to see the chef arguing some petty point with one of the waitresses. Now, here was a picture for you, the chef leaning in the doorway between the kitchen and lunchroom tossing it back to this cute little southern y.l. It was entertaining all right, but we were hungry, and they seemed intent upon settling their feud, if that is what is was. We finally broke it up by dropping a few pieces of "silverware" on the floor. At this point, too, we discovered we should have arrived a half hour earlier because this same cute waitress seemed to think it necessary to tell us all of the preliminary details of the argument. It was nice enough listening to her, with the Texas drawl and all that . . . but we were starved . . . and apparently getting no place. Well, we actually did have breakfast . . . and it was a pip, too. Upon leaving she said, "Yo' all come back sometime."

Next stop was Fort Worth and then Dallas, both of which were mighty pretty cities. We tossed our luggage into a Motel in Dallas for the night and later met W5PJ and W5VU and their wives. W5PJ and xyl steered us around Dallas a bit and we had quite a nice time. 5PJ's xyl was telling us about some sort of little bugs, like fleas, or chiggers, or something that infest the lawns in Dallas. She explained if you were to walk across the grass you would probably be scratching for quite a time afterward. Bill's wife was all for trying it out, but actually the xyl of W5PJ gave such a graphic description of what it was like, that we all spent the next few hours scratching for all we were worth. Some fun. Speaking of W5PJ I might bring up that we saw his station, and best of all the QSL cards showing the results. Due to lack of space for a ham shack 5PJ had little room available for the rig, consequently it was built small and compact. Oh yes, the QSL's he had handy were from 36 or 37 different zones. And I might add that some W6's would give plenty to get a few of them.

At W5VU's that night we saw a very beautiful ham shack . . . in fact some folks not understanding the meaning of "shack" would consider it an insult to call this one a shack. Anyway W5VU has a kw. job which looks very commercial in appearance. Having just moved into this new home he hadn't quite finished every little point of installation. And of all things before the evening was over we thought it would be good to hook up with some guy in L. A. We hooked all right and then on about the third or fourth word something went blooey. 5VU's temporary twisted feedline shorted and we were off the air. Thus ended our QSO and shortly after we adjourned for the evening. This definitely proves my contention that when you have an out-of-town visitor . . . "it always happens."

Bill was a great one for getting us up early, so it wasn't unusual for him to haul us out the next a.m. at about 5. His wife didn't want to go as she was fascinated with that southern hospitality as well as the southern drawl. That ol' hospitality cannot be excelled. Just one last tip . . . don't pull any fast ones on 5PJ . . . he is only about 6 feet 5 inches in height.

To get on with our journey . . . we rolled through Oklahoma, stopping long enough to get a bite of lunch and listen to this new little waitress. Bill Eitel offered to take her along just to talk to his xyl, but after we came out of a huddle we thought better of it. You see, if my xyl heard of it she would not have thought it was Bill's idea. It really was though . . . honest.

That night we stopped at a place in Kansas—Fort something or other, I guess it was Fort Scott. Here, there wasn't much of any excitement, except we noticed the abundance of ice-cream parlors and the absence of the dimly-lighted places which made the brass rails famous for hanging either your heels or chin. Can you imagine it, we were in the territory of the 9's and yet we hadn't found one, but we won't forget that it was here that we first read about the now famous FCC rule No. 73, no more DX. And to think we had just put the July issue to bed with all the rules of our WW DX Contest. A telegram killed the whole thing, but not without a struggle, as the printer had things nicely under way, when we had to chisel a hole in the form somewhere for the cancellation notice. I was told that the words emitting from him at that time were about T2.

We were off in a cloud of rain the next a.m. for Kansas City. Arriving there we headed for an air-conditioned hotel this time, as it was plenty hot. This was real air-conditioning . . . in fact it was so cold we had to wrap up until we found a regulating switch behind the door. It was so cold in there that when we walked outside, the heat smacked us so hard we thought we were being singed. After coaxing and pleading for a while with the telephone operators we finally succeeded in running down W9GDH and W9ARL. In the evening it was decided that we should go out to W9GDH's new spot . . . just out of town. At this point Bill's wife made a great sacrifice, as most wives do. She decided not to go hamming, but instead she would go to the hotel to absorb some of the air-conditioning. W9GDH has a nice dx location and it's just too bad he can't put it to good use. We had a bull session in his shack and during this time we managed to squeeze in a couple of contacts with W6's. Can you imagine that, all the way to California . . . and here we were actually at a W9's working 6's. I'm telling you this "wireless" stuff is gonna to amount to something one of these days.

Next day we headed for Cedar Rapids, Iowa, winding up there in the afternoon. We visited Collins Radio Company seeing everything from a 25-watt rig to a 5-kw. water-cooled job, in the various stages of construction. It would take too long for me to tell you of the precision fund there . . . so you just take my word for it and let it go at that.

The next morning provided an incident that looks humorous now, but it didn't then. We found a little spot nearby to have breakfast. The place had just opened up and we had an idea that the "ham and" would be tops. Well, in the first place the cook who we'll call "Ma" couldn't find enough eggs to go 'round so she went out in back to see if "Pa's" hen had kicked through with a couple more. At the same time "Pa" hiked down the road a bit and came back with a couple slices of ham. Things looked quite promising for a while then. However, this thought changed rapidly because she couldn't find the coffee pot. By this time you can well realize we were just on the verge of starvation. Bill spotted the coffee pot hiding behind a couple packages of "krispies" or something, so once again we were on our way toward breakfast. "Ma" found that she had the "drip" grind of coffee instead of the "perk" grind, but we told her to throw it in anyway. It poured out like coffee but tasted several degrees stronger. While all this was going on we located the cup and saucers, and all incidental "tools" just in case "Ma's" memory failed her at the vital moment. This was actually the only case of where we worked for a meal and then had to pay for it, too. It did occur to us after driving a few miles that we failed to do the dishes, but we agreed too, that our consciences wouldn't bother us.

We really made time from here on in to Chicago. Just before arriving at the Stevens it appeared that we were in the wrong lane of traffic, and this called for a near battle with a taxi driver. He nearly fell out of his cab yelling at us. At first we thought it was some sort of a hog calling contest, but finally discovered he was shouting at us rather than someone six blocks away. Bill's wife prevented me from putting in all the adjectives that I would have liked, but he certainly was anyway. During the eight day stay in Chicago I met many W9's . . . about 50 I guess. It being impossible to recall all of them I shall dig up a few that I saw most often: there were W9NLP, W9AIO, W9TB, W9TIZ, W9VDQ, W9KA, W5BEN/9, and W9TJ.

Went out to W9NLP's station and just as we were getting cranked up on the air . . . it happened . . . a bias transformer went up in smoke. The whole shack was filled with smoke in one minute but Rollie asked us not to get excited because he had gas masks handy. He took quite a beating from those present.

One evening Rollie took a couple of us to dinner at a place he called "Ulcer Gulch." Fortunately he knew the waitress, and we all walked out under our own power. While in Chicago I learned that they allowed one hour longer parking at night in the city parks due to daylight saving time being in effect. I didn't learn from experience . . . W9AIO gave me the lowdown. He didn't say how he found out. W9TB, Wally Schroeder and his friend "Ben" who is W5BEN, breezed into the hotel and we had quite a session. Later Wally said we could take a ride out and see his old location, and take a look at WBBM. It so happened that they were showing us around the WBBM transmitter first, and I said, "Wally, now that we have seen W9TB let's go see WBBM". He said that this was really WBBM, and he wouldn't believe it that lots of W6 stations were as large as that. Some fun, and no fooling.

Wally has a swell new home . . . of course it is a good radio location too. His backyard is of grass and blends right into the country club's golf course. We suggested that we have the 18th hole, or whichever it is, moved over about 50 feet into his yard and on weekends he could serve drinks to the golfers as they passed by. He said he might as well for all the DX that's on the air. Ben has a very nice y.l. and from the balmy look that he had across the eyes, I fear . . . or I think, wedding bells are not so far away. During the weekend of June 15, I was invited to go to the Wisconsin Convention in Milwaukee with W9NLP and his wife. Oh yes, W9AIO was going along and he said I could be his wife. I said I'd just go. We shared the same room together, in Milwaukee, but with twin beds. During the night 9AIO awoke, although in a stupor, he mumbled, "What time is it, dear?" Did you get that . . . DEAR! With teeth gritting I managed to squeeze out with, "It isn't time, and go to sleep . . . darling!" It was a pretty nice convention. At the banquet a gag prize was given to W9ULV. It seems that he was married that afternoon and he and his bride spent the weekend at the convention. The gang probably saw to it that they stayed up all night.

W9RBI had just finished telling me he couldn't see running any more power than 175 or 200 watts . . . when his number was called. His prize was a 250TH. Nuf said! W9NLP won two handbooks, one on FM and the other on Cathode Modulation, so he's all set. While in Milwaukee we met W9DIR, W9VDY, W9VD and a whole flock of others.

Returning to Chicago from this convention I'll swear W9NLP made a bet with someone that he could get back in an hour flat. This distance is about 80 miles I guess. We just closed our eyes and tried to appear nonchalant otherwise. Once in a while I think Rollie closed his eyes too. Other things we'll remember Milwaukee for are: the stuff that made it famous, the debate between W9AIO and the xyl of W9NLP on the correct pronunciation of the Hotel Schroeder. She said it should be like "Schroeder" and 9AIO said "Schroder". They finally ended up by referring just to the "Hotel". Then there was the Whistle-tootin' cop on the corner, just below our window. I'll bet you that guy blew his whistle every 7 seconds without missing a toot. And I'll bet you that every 7 seconds we picked up another pitcher of water and let him have it.

I was invited to stay at W9NLP's the night

[*Continued on Page 81*]

# *With the Experimenter*

## MORE ON FEEDING THE 3- AND 4-ELEMENT ROTARY

By D. F. Stone,* W6KTJ

Having been interested in the building and operation of rotary beam antennas for the past three years, and noticing Thompson's article on EO-1 "Q" bars in the May issue of RADIO. it was thought that a similar arrangement, used very successfully by the author about a year ago, might be of general interest.

For several years the matter of properly feeding rotary beams of the 2-, 3-, and 4-element types had been of some concern as the 180 or 360 degree rotation requirement necessitated some sort of flexible connection between the antenna and the feed line. The advantages in favor of the open-wire line, especially at the ultra-high frequencies, were evident after experimentation with both open-wire and rubber insulated lines of various kinds. However, the rubber dielectric lines such as EO-1 cable or flexible concentric cable provided the necessary flexibility, and the losses at 14 Mc., which for many years has been the author's favorite band, were not too great. Various types of commutators, slip-rings, and the like, designed to provide flexible rotation permitting connection to a rigid type of line, were tried but in one way or another all were found wanting.

Having about 100 feet or more of EO-1 cable in the junk box, considerable experimentation was conducted with the delta match.

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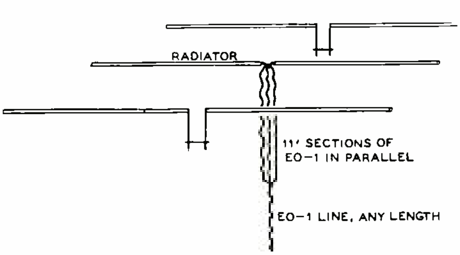



Figure 1. The flexible feed system for the three-element rotary.

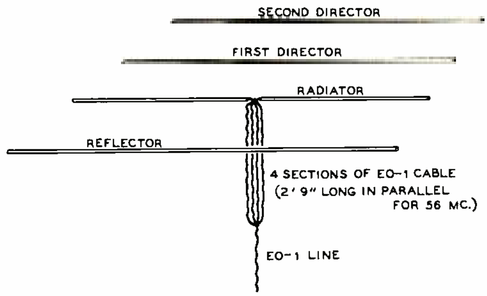



Figure 2. The feed system for the four-element rotary.

On 10 meters the arrangement was fairly successful but the coefficient of coupling on 14 Mc. was so low that results were quite unsatisfactory. It was thus, in a somewhat troubled state of mind, that a pencil was sharpened and the old reliable slip stick unpacked and many sheets of scratch paper were subsequently covered in the effort to work out a more suitable type of coupling, especially for the latter band. A new three-element beam had just been erected and it was imperative that an efficient type of feed be provided. After considerable thought and much "slip-sticking" a low impedance Q bar was worked out, using three eleven-foot sections of EO-1 cable connected in parallel. This would provide a surge impedance of 24 ohms which is

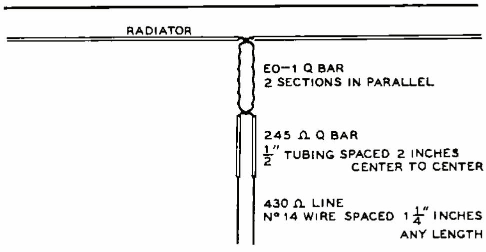



Figure 3. Alternative feed system for coupling a long open-wire line to the center of a three-element rotary.

the exact geometric mean between 72 and 8 ohms.

The line was built and connected up as shown in figure 1, and, after a preliminary adjustment of the beam, the line was found to load up satisfactorily and gave no evidence of the existence of standing waves.

A similar arrangement was then tried out on an experimental five-meter, 4-element beam. Calculation prescribed that a Q bar consisting of four parallel sections of EO-1 cable should provide quite a satisfactory match between a 72-ohm line and the 4- or 5-ohm center impedance of the radiator. Such a beam was made up in the author's back yard and raised 8 feet above the ground. The measured front-to-back ratio was found to be from 30 to 32 db. Again standing waves on the 72-ohm line were negligible.

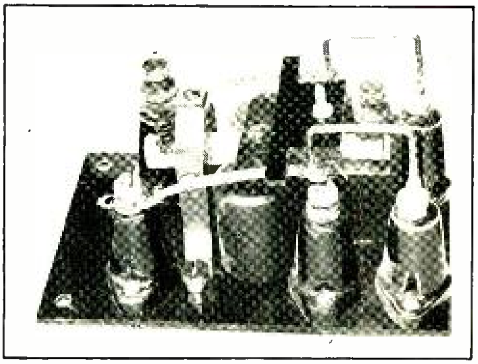
In the latter case it was found that for use with long feed lines a system of 2 Q bars was somewhat more efficient since an open wire line could be used for the greater part of the distance. Figure 3 shows the details of this arrangement for matching the center of the radiator to a 430-ohm line, which the author greatly prefers to the usual 600-ohm line at the ultra-high frequencies.

## AN ANTENNA RELAY FROM A TELEGRAPH SOUNDER

By George E. Sanders,* VE3QC

Many ideas have appeared in past issues of various amateur magazines for the construction of a good antenna switchover relay. The largest percentage of these ideas have been quite good, but when one has only the kitchen table as a workbench, and a minimum number of tools with which to work, most of the designs are out of the question. However, the building of the relay shown entails very little mechanical work or skill, and the number of tools required is an absolute minimum.

Our old friend the telegraph sounder was used as the mechanical basis of the relay, eliminating at once about seventy-five per cent of the work of constructing the relay. The remainder of the materials needed are very simple to obtain. For the base a piece of bakelite approximately 5½ by 3½ inches was used; as the insulating qualities do not enter into the picture there is no reason why a piece of masonite or similar material could not be used. Sheet brass was used for the arms but bronze weather stripping has been used when brass was not readily obtainable. The contacts are made of coin silver and a dime's worth will do if it is cut carefully; be sure to use a foreign coin so as not to violate the law. A piece of bakelite was used on the original model for the bar that pulls down the arms. But now that polystyrene can be obtained easily it could be used for greater efficiency as the full r.f. voltage of the antenna is across this piece. The material holding the upper contacts is no. 10 copper wire but sheet copper or brass or any good conducting material could be used. The only other parts are the six stand-off insulators, which are 1⅞ inches overall.



The completed telegraph-sounder antenna changeover relay.

By studying the picture, the placement of the parts and general layout of the relay can be seen. The mounting of the relay on the bakelite can be done by using the original base of the relay for a drilling template. The screw holding the cross bar is mounted in the threaded hole that held the adjusting screw for the sounder bar. This screw is held in place with a lock nut. Two more nuts on the same screw hold the cross bar, thus allowing the bar to be adjusted up and down. The only part of the construction that is the least difficult is the adjusting of the contacts. The contacts are first soldered in their proper places (one on each side of the two arms, two on the center pair of stand-off insulators, and two on the bars made to hold the upper contacts). The contacts are now filed to remove any solder and to get a smooth flat face for contact.

The contacts are adjusted in the following manner. The tips of the arms are bent so that when the relay is in the down position the contacts are parallel and together with a medium amount of pressure. This pressure can be tested and equalized by inserting a piece of paper between them and seeing how firmly it is held—there should of course be equal pressure on each side of the relay. The upper

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set is now adjusted in the same manner except that the brackets holding the upper contacts are bent instead of the arms. These are about all the construction pointers but to make a permanent and trouble-free job lockwashers should be used under all nuts.

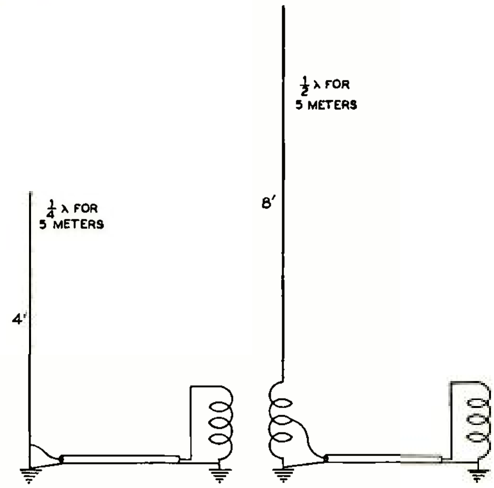
For a source of current, the relay was operated in series with the negative return of the exciter, which consisted of a 6L6 crystal oscillator and an 807 buffer, drawing a total of about 125 milliamperes. As an alternative the coils could be rewound with more turns of a smaller size of wire, so that the relay will operate with less current. Then it would be possible to operate it in series with the bleeder of a low-voltage power supply.

The relay also has another use, that of silencing the receiver during transmissions. As all parts of the relay are insulated on the bakelite base it is a simple matter to make another set of contacts on the parts of the sounder itself. By glueing a piece of celluloid or other insulating material to the place where the sounder bar hits, so that the bar makes contact only in the receiving position, this set of contracts can be used to break the center tap of the power transformer of the receiver. As the current broken was only 60 milliamperes no special contacts were used at this point. Using the antenna relay to silence the receiver permits the station to be controlled by the switch that turns on the plate supply for the transmitter without any additional equipment.

## SHUNT FED MOBILE ANTENNAS

By Eric W. Cruser,* W2DYR

My first shunt fed antenna was tried after I had had some difficulty with my first mobile antenna, which was a bumper-rod on the back bumper. This was fed in the conventional concentric manner using crystal mike cable and it apparently worked quite well on transmitting. I later installed a relay operating from the transmitter plate voltage to throw the antenna over to the receiver. This worked well while the car was stationary, but when in motion so much static was generated in the antenna circuit that it was impossible to receive. It was while attempting to eliminate this that shunt feed was first tried. It was found to be the solution as far as static was concerned, and I have since found it superior in other respects. Perhaps the improvement was the result of a better impedance match, as there is undoubtedly some mismatch between a crystal mike cable and the bottom of a quarter-wave antenna.




Showing how an extensible bumper-rod antenna may be shunt fed with a concentric line, either as a half-wave or a full-wave antenna on the 56-Mc. band.

The antenna proper is an adjustable bumper-rod of the usual type which has an extended length of eight feet. This can be used as either a quarter or half wave antenna on five meters. The feeder is crystal-mike cable which is very reasonable in price compared to the 34-ohm concentric line which is necessary to match correctly the bottom of a quarter-wave antenna. Crystal mike cable has a higher impedance, but it can be well matched by shunt feeding the antenna. For quarter-wave operation the bottom of the antenna is grounded to the car frame and the concentric cable is grounded at both ends. At the antenna end a copper clip is fastened to the center conductor. This clip is moved about on the antenna until the best transfer of power is accomplished. A field strength meter will be advantageous in making this adjustment, although it will not be found too critical.

Superior results may be obtained on five meters if the antenna is run out to its full length making it one half wave long. In this instance it will be necessary to insert a quarter wave loading coil (6 turns of heavy wire 2″ in diameter) between the bottom end of the antenna and the car frame. The center conductor is now connected somewhere about the center portion of the loading coil. Here again,

[*Continued on Page 88*]

*Church St., Lakehurst, N. J.

# U. H. F. . . .

By E. H. CONKLIN,* W9BNX

Another summer—and a very satisfactory one for ultra-high frequency work—is drawing to a close. It is a summer in which more W7 contacts have allowed quite a few fellows to work all districts on five meters. W9ZJB made the grade last year and did it twice again, while W5AJG, W9AHZ, W9USI and W9USH also have made the top honor this year for five meter work. At last report, W5AJG had contacted 34 states, only two short of having worked *three-quarters* of all 48 states! And not long ago comment was made on the number of stations that had hooked *half* of them.

The band was more crowded in 1938, perhaps, with much unstabilized equipment, and a great many contacts were reported then when the band was open nearly every day. With better transmitters, receivers and antennas now, though, very good work is being done which obscures any tendency for conditions to become poorer. The gang is recovering from the shock of having to stabilize their transmitters, and the passing of dx on other bands has brought thrill-seekers to the ultra-highs. Reports—and photographs—received by this column are fewer than in 1938 due, no doubt, to the fact that no thousand or so letters were sent out to active 56 Mc. stations, and to the helpful competition from W1HDQ on whose shoulders fell the full task of reporting during RADIO'S summer vacation.

### Carnival—July 23

No small number of stations report July 23 to be the big day of the year. It was not the first double-hop skip, because W6QLZ had already made eastern contacts, but it provided most of the east-west fun, the loudest signals beyond 1200 miles or so, and the most W7 contacts for "W.A.D. on five."

Leroy May, W5AJG, found the band open in Dallas once around 11 a.m. and again from 5 p.m. until he signed off more than five hours later. Although he raised forty stations, he passed up dozens calling him while he looked for a W7. At least 75 could have been worked, as W5ML ALK DXB EEK may have done, judging by the number calling them. The band was packed and jammed with signals, sometimes with QRM although the crystal filter usually fixed that up in short order. All were very loud except W7FDJ whom Leroy worked for his 9th district and 34th state—all on 30 watts or so. Ten meters was very hot with normal summer short skip at the time.

May heard W1HDQ KLJ LLL very strong, not bothering to log other stations heard. Those contacted were W7FDJ, W8PWU BJG RUE ARF RKE MDA RV QQS SDD RWF KQC QDU UKC AGU PKQ AZZ DAL, W9HAQ CLH AMH BDL VJD WWH SQE VAV CJS ZJB ZHL BJV USH ZHB YKX ZUL GGH VHG DQU PQH QCY, W3BKB.

In addition to the W7's, no small part of the day's thrills were provided by Clyde Criswell, W6QLZ, of Phoenix. He worked W1HDQ DEI W2GHV W3HDJ BZJ HWN W5AFX W8CIR KQC QA QDU RKE W9VHG EET WAL HAQ CLH DQH PQH ZQC BJV USH ZHB ZJB NFM NKW and heard W1??J W2MO AMJ TP W3HJQ W4AUU EQM EDD W5AJG BYV DXB W8PIL RV BJG W9VWU AZE AQQ. All districts except W7 were logged and sevens were known to be coming through in Texas, South Dakota, and points east. Clyde does not think that twenty meters in a dx contest was ever any worse than five was from 5 to 9 p.m., his time.

He was working on a concentric line receiver, checking the band every few minutes. At four o'clock, 43 megacycles commercials from the east came in R9, so he shifted to five and put out some cq's. The first signal was W9BJV in South Dakota at 4:20 while the first double-hop was W8CIR at 5:10, followed by W2GHV, W1DEI and W1HDQ. The loudest signal on the band that night was W2TP, an old timer on the ultra-highs who, according to Clyde, ran around 48 to 72 db on the receiver meter for three hours. TP covered up plenty of dx, along with some others at the bottom of the band. There was a solid squeal from 56.0 to 56.5 megacycles for over an hour. No signals were heard above W9WAL and W9VHG, around 57.6. Several W4's came through but none was contacted for the missing district. W1HDQ was heard on i.c.w. until 7:15, W8CIR to 8:15, while the last one-hop stations to go out were W5AFX and W9EET at 10:30.

No stations were lost through fading. A different type of fade with a "rain barrel" echo was noted on W1DEI W2GHV MO W3HJQ and W8RV in Buffalo, who may have been on the edge of a skip zone or affected by peculiar ionosphere conditions.

Doc. Krysinski, W9SQE, advised by telephone that the band had been wide open, with W6QLZ coming in with less fade than the W5's who were trying for W1 and W2 contacts. W9CLH also called QLZ.

It must be that W6QLZ was putting in a very good signal, judging by the number that heard him among all the other districts that were coming through. W9WWH in Racine, Wisconsin, heard him along with W4EDD AUU BBR FBH W5EHM ML ALK W8KWI W9ZJB, while working W4ELZ EQM W5AJG DXB EEL. W9ZUL missed the fun by having to work that night, but says that others in the Chicago suburban area heard QLZ and another W6 (KTJ?) in Phoenix. A W7 in Oregon (FDJ?) was also reported, a rare signal in these parts.

W9ZJB heard a local, W9DWS, mentioning

*Associate Editor, RADIO.

that someone was trying to hear his harmonic on five, and found him working W7ACD in Shelley, Idaho. When W7ACD listened on five, ZJB gave him a call. ACD came back first to ZJK then ZJP and finally to ZJB! After that, the signal built up to R6 on c.w. and phone. Vince said he had a Turkish bath free of charge on that one, and almost lost his girl who had been expecting him. Just after the W7ACD contact, Vince hooked W7GBI on ten and shifted to five, giving him an R8 report on his c.w. Then GBI contacted W9AHZ who needed a W7 to get to the top of the honor roll.

### Here and There

Mel Wilson, W1DEI, must have about eight districts by now what with his summer activity and contacts with W6QLZ and W5AJG. His last letter was just before the big opening on July 23, and was devoted to the theory of skip dx rather than to personal news.

From Methuen, Mass., W1HXE sends the local news. The officers of the Merrimac Valley Club are now W1IGO LEA JJE; Muller is still treasurer. W1LGG of Lawrence has been getting in on summer five-meter dx. W1LSN says that the active New Hampshire stations include W1IUI JK HRP JNC COO KXK JOG LSN. W1MDN has been building up equipment, too. W1EKT has been doing some logging of dx and locals.

Your conductor spent a few weeks in Washington on duty in the Navy department, getting fingers into power from one end of the spectrum to the other. The old standby, W3DBC, has been off five meters since May. Good intentions of seeing W3RL were frustrated due to lack of transportation. Dick Peck worked W6QLZ for his eighth district and needs only W7. He has 29 states. The rig is much the same as before except for adding a two-stage acorn preselector made from a National 1-10. He and W3GIO in Baltimore complain about inactivity caused by so many going to ten meters on the theory that the local range is about as good, and the band opens more often. It lacks some of the thrill and fascination of five, though.

During band openings in Atlanta, W4FBH still looks for W9BNX ex W9FM, he says; he will have to go beyond 200 Mc. for that these days or BNX will have to rebuild.

### From the Fifth District

Every day or two a report comes in from W5AJG who seems to be on for most openings. Not only that, but on May 31 he heard W5VV in Austin, 180 miles south, his first non-skip dx. The prospects for a Texas net are improving, in spite of the large distances to cover. June 4 was a fair opening with six districts outside of W5 worked—all but W4 and W7. June 13 was not so bad with 38 contacts—all but W1 which was heard, and the two west coast districts. On July 1 after working W6QLZ, Leroy listened to a local QSO between W6OVK and W6SLO. The next day was unusual in that the beam had to be pointed right on the nose. Except for the big day, July 23, W1's were few and usually weak,

## 56 Mc. DX HONOR ROLL

| Call | D | S | Call | D | S |
|---|---|---|---|---|---|
| W9ZJB | 9 | 27 | W1LLL | 6 | 18 |
| W9USI | 9 | 23 | W2KLZ | 6 | |
| W9USH | 9 | 18 | W2LAH | 6 | |
| W9AHZ | 9 | 16 | W5VV | 6 | 18 |
| W5AJG | 9 | 34 | W8LKD | 6 | 11 |
| W1DEI | 8 | 20 | W8NKJ | 6 | 16 |
| W1EYM | 8 | 20 | W8OJF | 6 | |
| W1HDQ | 8 | 23 | W9NY | 6 | 13 |
| W2GHV | 8 | 24 | W1HXE | 5 | 18 |
| W3AIR | 8 | 24 | W1JMT | 5 | 9 |
| W3BZJ | 8 | 27 | W1JNX | 5 | 12 |
| W3RL | 8 | 29 | W1JRY | 5 | |
| W6QLZ | 8 | 20 | W1LFI | 5 | |
| W8CIR | 8 | 32 | W2LAL | 5 | 11 |
| W8JLQ | 8 | | W3EIS | 5 | 11 |
| W8QDU | 8 | 25 | W3GLV | 5 | |
| W8QQS | 8 | 17 | W3HJT | 5 | |
| W8VO | 8 | | W4EQM | 5 | 8 |
| W9ARN | 8 | 17 | W6DNS | 5 | |
| W9CBJ | 8 | | W6KTJ | 5 | |
| W9CLH | 8 | | W6OVK | 5 | 10 |
| W9EET | 8 | 15 | W8EGQ | 5 | 10 |
| W9VHG | 8 | | W8NOR | 5 | 16 |
| W9ZHB | 8 | 29 | W8OPO | 5 | 8 |
| W2AMJ | 7 | 22 | W8RVT | 5 | 7 |
| W2JCY | 7 | | W8TGJ | 5 | 9 |
| W2MO | 7 | 25 | W9UOG | 5 | 8 |
| W3BYF | 7 | 22 | W9WWH | 5 | |
| W3EZM | 7 | 24 | VE3ADO | 4 | |
| W3HJO | 7 | | W1LKM | 4 | 6 |
| W4DRZ | 7 | 22 | W3FPL | 4 | 8 |
| W4EDD | 7 | | W4FKN | 4 | 7 |
| W4FBH | 7 | 17 | W6IOJ | 4 | 4 |
| W4FLH | 7 | 18 | W7GBI | 4 | 6 |
| W5CSU | 7 | | W8AGU | 4 | 8 |
| W5EHM | 7 | | W8NOB | 4 | |
| W8CVQ | 7 | | W8NYD | 4 | |
| W8PK | 7 | 9 | W8OKC | 4 | 10 |
| W8RUE | 7 | 17 | W8TIU | 4 | 8 |
| W9BJV | 7 | 12 | W1KHL | 3 | |
| W9GGH | 7 | | W6AVR | 3 | 4 |
| W9IZQ | 7 | 14 | W6OIN | 3 | 3 |
| W9SQE | 7 | 22 | W6OVK | 3 | 4 |
| W9WAL | 7 | | W6PGO | 3 | 6 |
| W9YKX | 7 | 12 | W6SLO | 3 | 3 |
| W9ZUL | 7 | 18 | W7FDJ | 3 | 3 |
| W1CLH | 6 | 13 | W8OEP | 3 | 6 |
| W1JFF | 6 | 11 | W9WYX | 3 | 3 |
| W1JJR | 6 | 17 | | | |

Note: D—Districts; S—States.

while California sixes never came through although W6QLZ did. On one day, W8TCX using low power on 59.3 megacycles lasted longer than lower frequency stations, a tendency noticed before. AJG has tried the high end but finds it difficult to raise as many stations. On the big day, W6QLZ could not hear anyone above 57.6 or so, due either to conditions or to inactivity on the high end of the band. Leroy reports that the most consistent stations in each district are W1HDQ W2AMJ W3RL W4AUU W6QLZ W7FDJ W8RKE W9VHG.

In Hugo, Oklahoma, W5TW doubts the value of the suggestion, "just double in your final from ten to five." More bugs showed up in one day than he had encountered in 25 years in ham radio. Well, Ed, those are just the bugs you should have removed when you were on ten. Anyhow, you ought to expect more than when you were using "spark" transmitters!

Wilmer Allison, W5VV, has been giving Austin, Texas, plenty of publicity. His log shows an average of 7¼ hours per day on five meters from April 15 up to the time in July when he went off to the tennis wars. He was worried because of receiving good reports on days he thought were dead, and has experimented with his antennas and receiving equipment. A rotary lazy-H proved to be 15 to 20 db better on both receiving and transmitting compared with anything else, after the feeder was properly matched. He knows that it does not have that much gain but the results are there. He even thought of building a converter with concentric lines, but when W5BB got married he borrowed the 101X to use behind the DM36 and found that it would bring in stations that he could not raise, while with the HRO it was the other way around.

Allison has made schedules with W5AJG, 180 miles north, and has a promise of activity from W5DSL, 60 miles east toward Houston. He gave W5GGS a tube and parts for a doubler, so that means another station toward Houston—he hopes. So the Texas net progresses! Wilmer heard W5EHM in Dallas once during the summer; W5AQN in San Antonio, 80 miles south, reported him one day too.

June 16 was the longest that the band was open at VV—13 hours straight. June 30 brought in W9ZHB louder than any signal on any band. On July 2, Wilmer heard W6RPR in Oakland call W6QLZ, one of the few California signals to get out of the west coast districts.

### Farther West

W6QG proves that there are some stations on the air—mostly at the high end of the band—in the Los Angeles area by mentioning W6LFN CLH PTJ GAT QG IMJ RTZ QKB. July 17 was a good day to work W7's; FLQ HEA FDJ were contacted and DYD was heard. During this time the sevens each raised from one to four Arizona stations including W6OVK QLZ and probably KTJ. W6LFN, who hooked W7FLQ HEA observed that his single half-wave antenna brought signals in best when tilted back 30 degrees from the vertical. What did that do, change the matching? QG was reported by W7DYD on May 26, June 27 and 30, July 5 and 17.

The most reliable sixth district station this summer, W6QLZ, always sends nice complete reports. On ten days in May that were open, W5VV was generally the station heard. Skip in June was erratic but more contacts resulted than in June, 1939. On the 27th, W3RL was raised with no other signals audible at the time, though W8QQS and W9VWU were hooked later and W9USH, a W2 on c.w., and some W8's were soon heard. One of the latter was PKJ or NKJ, Clyde thinks. On June 26 and 27, the band was open to 70 Mc. for 36 hours but few amateurs were heard. Double hop appeared on four days; some two-hop signals were W3RL W4EQK CSU EDD W8QQS NKJ (or PKJ) W9VHG HAQ ZHB AQQ and possibly other W9's.

July was not outstanding for the number of stations worked—except for the 23rd—but Clyde believes that the band opened early mornings instead of evenings. Of course, a study of sporadic-E observations indicates that it is only slightly more probable late mornings and early evenings—but can happen even at 3 or 4 a.m. almost as often. Clyde heard 45 megacycle commercials on 14 mornings before 9 a.m. without any five or ten meter amateur signals. On the big day, W8CIR was one R better on his vertical than on his Yagi; W9ZHB swung his three-element beam around to W4EDD and went from R9 out of the picture. Just

## 2½ METER HONOR ROLL

### ELEVATED LOCATIONS

| Stations | Miles |
|---|---|
| W6QZA-OIN | 215 |
| W6BCX-OIN | 201 |
| W9WYX-VTK | 160 |
| W6IOJ-OIN | 120 |
| W1HDQ-W2JND | 105 |
| W6BCX-IOJ | 100 |
| W1HDQ-W2IQF | 100 |
| W1HDQ-W2GPO | 100 |
| W6NCP-OIN | 98 |
| W6IOJ-OIN | 80 |
| W6CPY-IOJ | 80 |

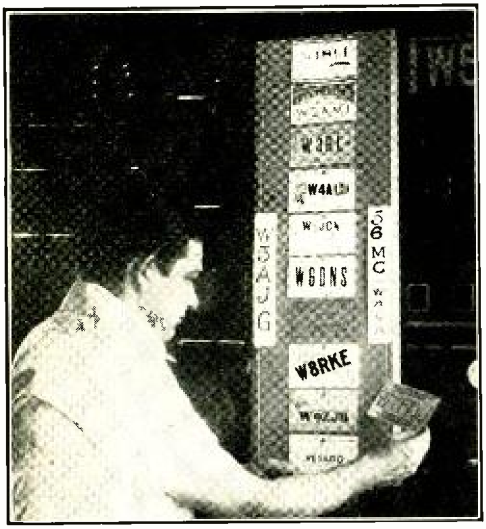
### HOME LOCATIONS

| Stations | Miles |
|---|---|
| W1HBD-W1XW (1935) | 90 |
| W1SS-BBM | 74 |
| W8CVQ-W8? | 48 |
| W1LEA-BHL | 45 |
| W2MLO-HNY | 40 |
| W3CGU-W2HGU | 40 |

## 1¼ METER HONOR ROLL

### ELEVATED LOCATION

| Station | Miles |
|---|---|
| W6IOJ-LFN | 135 |




W5AJG filling in the "reserved for W7" position with his card from W7FDJ to make him WACA (Worked All Call Areas) on 56 Mc.

to show that California is active, on the 28th Clyde hooked W6CME DOU and heard W6AHH IOJ. He also raised W5FSC in Huntsville, Texas, 80 miles north of Houston, who ought to be a help in the Texas net.

At Bothell, twenty miles north of Seattle, W7DYD wonders why more W7's don't report their activity. In western Washington, Herb says that W7EUI has 90 watts and an X-H antenna, W7AXH uses 400 watts but must rely on a superregen receiver, while W7CEC has 300 watts and a three element beam. Herb has 100 watts on an 812 feeding an X-H array. The latter is best for local signals but a ten meter lazy-H is better on dx. A new W8JK had not been tested when he last wrote in.

From Great Falls, Montana, W7GBI worked mostly W5-6-9, using 500 watts on 57,264. He feels that more use of c.w. would mean more W7 contacts, because he hears lots of weak but unidentified signals.

### The Midwest

In Detroit, W8QDU NKJ have been holding forth, NKJ getting six states in June. Both seem to have reached out to the W6's too. W8OKC in Pennsylvania added new states to his score nearly every time the band opened for him. His location appears to rule out contacts with some of the eastern districts.

In Des Moines, W9CXL is now active with 150 watts on a 35TG, and an acorn receiver with 28 inch coaxial circuits.

W9IZQ in Milwaukee heard FN1 calling FN2 just short of 56 megacycles when W5EEX was coming through on the morning of June 9. He wonders what that could have been. On the first of June George heard W4FBH so loud he pinned the meter; no contact resulted, however, because the latter was telling W4MV about some girl who was testing but never gave her call. George thinks FBH rates the same criticism for not checking the band for other calls when he might suspect some dx. Could it be that FBH thought the girl to be a local and she wasn't?

After putting up an eastbound H array, W9IZQ started to pull in more eastern stations. On July 15 he repeatedly tried to raise W6QLZ—on a day when Clyde did not report hearing anything—and wonders if Clyde wants Wisconsin as much as George wants a W6. George has really done some good ground wave work into Illinois and Wisconsin this summer, working W9DRN CLH VHG YLV MXK.

Several active stations in Salina, Kansas, have been reported since Vince Dawson, W9ZJB, went to the Wichita convention to throw things around, or was it to stir things up? One of them is W9PKD. Joe Addison decided to listen on five one day in June after some ten meter contacts and found what he thought was a swell bunch of ten meter second harmonics—but they started to call "cq five meters." That brought on a well known stomach feeling, what with no five meter rig on the air at PKD. Joe wants to close the gap to Kansas City and Wichita so that a relay might get into Oklahoma and west, but both look rather blank along western Kansas and eastern Colorado.

W9SQE has landlord and antenna trouble. It's just one trouble. With an antenna in his window ten feet off the ground, though, his ground wave is good to W9ZUL UDO and he works dx.

W9USI writes on Fort Snelling, Minnesota, stationery reporting that he has moved and is off the air except for a little antenna outside of his window. He and W9USH have worked W7GBI ACD W6QLZ. Both have all districts now.

In Racine, W9WWH is helping to represent Wisconsin with a cathode-modulated T21 taking 40 watts input. He is using a W.E. coaxial while fighting the landlord about setting up a new three element job. Not only has he raised five districts and heard eight, but he is also working W9GGH VHG ZUL CLH IZQ MXK CXV DRN UDO on ground wave and hearing W8RKE CVQ in Michigan and W9HAQ in Iowa.

In Denver, W9WYX says that local five meter contacts were fun when the bootleggers were active on five, but now he has to spend a nickel to talk to anyone. He mentions his "harmonics" aged 12, 10 and 8, who are learning a little code. That's a new name for the kiddies or junior ops; on that basis, a harmonic analyzer at W9BNX-SLG suggests that a bit of third may be showing up soon.

In Woodbine, Iowa, W9YKX has 150 watts and a resonant line receiver. He heard W6OVK on his first try at the band on June 4, and worked one of the Phoenix stations on July 16. Without an antenna he hears W9FZN ten miles away who has 30 watts on a 6L6. During one opening, Bill worked W9CHI at Grand Junction, Iowa, 100 miles away.

Activity in Terre Haute, Indiana, is picking up. W9ZHL says that they all use three element beams. He has 330 watts, ANH has 75, W9BDL in Marshall, Illinois, uses 180, W9AQQ in Indianapolis puts 225 into his final. They hold a 100 percent schedule nightly, Indianapolis being 80 miles from Terre Haute.

Vince Dawson, W9ZJB, complains that ten meters can be hot to Illinois and into Pennsylvania while five can be dead. That is not hard to understand—it takes skip as short as 310 miles or so for double the frequency to become possible at about 1200 miles, assuming reflection at the same point in the layer or a continuous layer. But the sporadic-E layer is usually spotty, and may not be placed so that the shorter and longer distances mentioned can both come through at one receiving point. Generally, five and ten meter signals will come from the same area, and only ten will get through unless the patch of ionization is strong enough to reflect five meter waves too.

Several times in May, Vince heard commercial harmonics for hours, usually in the mornings, without any five meter activity. Early on June 1, ten was open for weak W4's but the five meter harmonics of W5FKG and W4FRF were R9; after that, ten opened wide but no five meter signals came through. June 13 was one of those good days when everyone heard was worked and, with only about twenty stations on the air, there was time to raise them a second time.

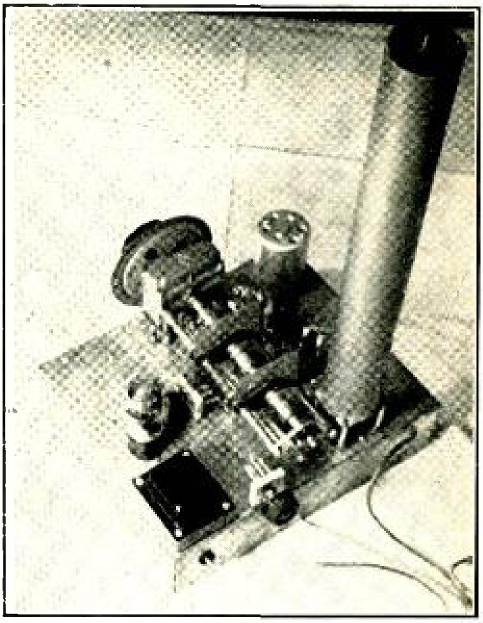
W9ZUL in Morton Grove, Illinois, started the season with a horizontal two half waves in phase. After getting a little dx, he replaced it with a vertical three element job. His first cq brought an answer from W8CVQ across the lake, and he began to work W9GGH UDO like locals. Then in June he raised W8RKE in Grand Rapids, finding that he can push through daily with R1 to R5 reports. W8RSW in the same town was also heard. This gang is mostly or entirely vertically polarized, so ZUL is all for doing the same, forgetting W9ZHB and his horizontal gang downstate.

### Honor Roll

Each month the Honor Roll grows. The summer has brought many new contacts which will probably require more than a few changes. Send your reports direct to this department, addressing your card or letter to E. H. Conklin, W9BNX, 512 No. Main Street, Wheaton, Illinois. Give total districts and states worked to date on five meters, and details and distances worked on 2½ and 1¼.

### Question and Answer Department?

Your columnist does not feel that he knows the correct answers to all the u.h.f. problems, but enjoys spouting a few words here and there on such subjects, often later to receive a deluge of letters from the gang who think differently. But that is fine, isn't it? We all learn by exchanging ideas, and this column is open for both sides of controversial questions.

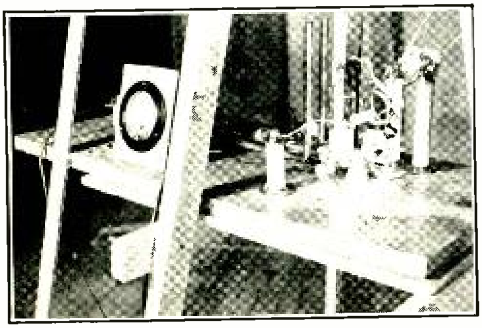


W9YKX's receiver which uses a 954 r.f. concentric-line tuned, followed by a 6K8 coil tuned—the latter to be replaced by a coaxial line soon.

Harley L. Christ, W9ALU, writes from Metamora, Illinois, with some questions and suggestions. One idea is to build an r.f. stage and detector (superhet or superregen), coupling the plate of the r.f. tube to the detector line with a hairpin loop. Should concentric lines be used on low frequencies, that would have its points because the plate circuit impedance would be below the following grid impedance. But at five meters these two values are about the same order for many tubes, calling for a plate connection close to where the grid hooks on to the line.

Harley also wonders about using shield cans for the outer conductors of lines, with a standard tube for the oscillator. The tube would be about long enough to hook its grid at the open end of the line and its cathode down near the shorted end but high enough to make the stage oscillate on the cathode-above-ground principle for superregeneration. That idea is all right, so far as it goes, but unless a very hot r.f. stage comes first, it would be so much better to use an acorn tube, HY615 or the like, because ordinary tubes have practically no gain on frequencies on which superregen receivers are now used.

He raises a question about the condenser size needed to tune different sized shield cans (with an inner conductor) to 2½ or 5 meters. It all depends on the size of the inner conductor, the length of leads to the tube and tuning condenser, and the inductance and capacity (to ground) of the tube's grid. The thing to do is to use the smallest diameter inner conductor that will reach



The HK-24 "rotatable" 227-Mc. transmitter at W1AIY, Walcott, Conn.

the 2½ meter band with the condenser almost out. For details, see the charts and instructions in RADIO for February, 1940—or the 1941 RADIO HANDBOOK in the newly written, expanded u.h.f. chapters. Loading such a line to five meters would require a very large condenser and something would be sacrificed—though the band could be reached that way. It would be better to go up to about a 9 to 11 inch line and get better results on both bands. The outer pipe is easily made from sheet copper wrapped around a rolling pin and soldered.

Another thing that he brings up is the possibility of using a coaxial-line-tuned oscillator on five meters, with tone modulation. A rig of this kind for 2½ was described by Ray Dawley in the June issue, and could be used on five meters by increasing the pipe length. The trouble is that the line would have to be a good one, or a buffer used, in order to prevent some degree of frequency modulation which is not permitted below 60 megacycles. It is assumed that the "frequency modulation" permitted by the F.C.C. on five meters refers to pure FM with no AM.

Another question concerning two-wire lines tuned with a condenser as the shortening bar. In this case, the line approaches a quarter wave in length, which is shortened because of the capacity and inductance of the tube at the unshorted end. The amount of shortening is increased if the line is more widely spaced or made of smaller diameter wires or rods. When the variable condenser replaces the shorting bar, it does *not* load (shorten) the line as it does when a condenser is placed across the open end, nor is it as likely to ruin the *Q* if it is other than an excellent u.h.f. condenser. Rather, it appears to act as a variable inductance shorting bar, and its capacity is not as important as the physical length through the frame. This was confirmed by W. W. Smith in his transceiver described in RADIO for March, 1940, when he tried to move the band on the tuning condenser by putting a fixed capacity across it. The result was that the fixed capacity had less inductance and became the shorting bar, while the variable no longer affected the frequency. So, at the shorting bar, just about any variable should do the trick but the length of the two-wire line will have to be adjusted carefully to hit the band with the tube and wire-spacing used.

The use of a two-wire line instead of a coaxial for the tank circuit of a superregen oscillator (detector) has its points. From casual listening, W6BCX wonders if the *Q* of this tank does much good. It may sharpen the receiver up a bit, but as long as the circuit superregenerates, the signal output seems to be about the same. Perhaps so, but if it sharpens the signal, there is more *Q*. and probably more stage gain; the a.v.c. action may work to produce the same signal output, but better stage gain would appear to mean a better signal-to-hiss ratio and a noticeable improvement on weak signals.

The use of a concentric line in the grid, making the tube oscillate with a small cathode coil or by tapping the cathode down on the line, makes possible close adjustment of antenna coupling and the strength of oscillation. Other ways of controlling the oscillation include the use of a tuned cathode circuit or a plate line t.p.t.g.). The usual superregen detector with a tapped coil or two wire line is difficult to adjust. Another arrangement with a short, condenser-loaded two wire line is to tap the detector's grid and cathode on one side of the line only, sliding the cathode tap up and down to find the best point. This is somewhat unbalanced, but appears to work well with acorn tubes on a shortened line.

Bill Copeland, W9YKX, has done some work with coaxial-line-tuned converters. He started in with a line-tuned 1851 r.f. stage and coil-tuned 6K8 mixer. The pipe is 16 inches long, two inches in diameter. The inner conductor is 3/16-inch. Using the charts in RADIO for last February, he figures that the line tunes with only seven micro-microfarads less than the calculated amount, which can be due to stray capacity but is more likely to be caused by the length of leads from the pipe to the tube and condensers, and by the inductance in the tube and the condenser frame and plates. The line was installed after the coil-tuned circuit was found to be too unstable. The tuning was no longer critical when the coil was replaced. On a local test signal, the line made an improvement of three R's.

Upon replacing the 1851 and 6K8 with a coaxial-tuned 954 mixer, results were disappointing. Signals dropped off but the selectivity was improved. No measure of signal-to-noise ratio is available. There may be some difficulty with the injection, but it is comparing one stage with the two used previously. The question is, should he use the acorn and one of the other tubes? Because the r.f. stage is most important in determining signal-to-set-noise ratio, the suggestion is made that he use the 954 as a coaxial-tuned r.f. stage, followed by the 6K8. There is some doubt as to the relative merits of the 6K8 and the 1851 as a mixer at 56 megacycles, but because the gain of the r.f. stage depends considerably on the impedance of its plate circuit, the higher input resistance of the 6K8 may result in better r.f. gain and over-all results.

Mel Wilson, W1DEI, raises some questions about five meter work a little beyond 1200 miles. If a signal starts off at sea level at an angle three degrees above the horizontal, and is reflected from a layer 110 km. high, it will be received at a distance of 1105 miles and come in at the same three degree vertical angle. A layer height of 120 km. will increase the distance to 1165 miles. The reason for assuming some angle above the horizon in making this calculation is that the radiated power drops off sharply at angles much nearer the horizontal. This is partly the result of absorption when waves graze the earth but largely is due to cancellation of the direct waves by those that are reflected by the ground. The use of a lower limiting angle may explain somewhat longer one-hop dx. Should the same signal be bent slightly in the lower atmosphere, it will come in at a slightly higher angle, and will drop down at a shorter distance. However, if there is some bending, it may be possible to consider what would happen to signals that would take off at the "impossible" horizontal angle were there no bending. A greater distance would be covered if one assumes absolutely horizontal radiation and reception. But a somewhat more distant station may radiate a signal at an angle a little above the horizontal, and the atmospheric bending may turn it until it is a mile or so above, but parallel with, the ground. From this point, then, horizontal radiation may not be so impossible so the absolute maximum one-hop distance becomes plausible. There were many days of loud one-hop signals out to 1200 miles or so this summer, on which weaker signals somewhat beyond 1200 miles were also heard. Half-way signals at 700 miles were generally absent, suggesting that distances approaching 1400 miles did not involve two hops. Three hops, of course, might have taken place but this would require a larger sporadic-E layer, or three small patches properly located and spaced, which should be less probable than two hops except on days when ionization is heavy and general, bringing in stations at various distances and from a large area. Unless there are three separate patches, therefore, three hops and two hops between stations separated by less than about 2500 miles might occur simultaneously (a situation permitting violent fading), and stations at the half-way point would come through. If a signal comes in via two hops, it seems almost axiomatic that a station at the half-way point along the great circle path, will also be heard because the two-hop signal must be reflected from the earth's surface at about that point.

### Last Minute Letters

This portion of the column is devoted to correspondence received subsequent to the compilation of the major part of the summer reports. To let you in on a secret, the deadline has passed but the Editors have been working on a complete rewrite of the 1941 RADIO HANDBOOK and may let this slip into the October issue of RADIO.

W2LAL in West Englewood, N. J., confines his activity to 57,553 kc., using 6L6's with 65 watts input, a 5-10 Skyrider, and an extended double zepp 25 feet high. He says that skip dx was not as good as in 1939 but extended ground wave work was better, the number of stations within 50 miles showing an increase.

W6IOJ's ground-plane vertical antenna mounted on the side of his car. The oscillator-detector portion of his transceiver is mounted in the black box at the base of the antenna. The audio amplifier and modulator are inside the car.

In Atlanta, W4FKN has an X-H antenna for 2½ and 5, a Utah transmitter driving an HK24 final, and a Superskyrider. He has raised W1KLG, LLL, W4MV, FBH, ELZ, BBR, W8OKJ, W9BJV, GHW, ARN, YKX, DQH.

The last reported opening at W5AJG is August 13 when Leroy was at home for luncheon. He hooked W9ZHB, KZP, NFM before going back to work.

Although he works every day, W6OVK has had time to put 200 watts into his cathode-modulated 812's now and then. His receiver has 6K7GT r.f., 6K8GTX in the converter ahead of an NC44 operating on 3.5 megacycles. The antenna is a half-wave vertical with a matched delta connection. W6OMH at Campwood, Arizona, reports OVK 200 miles northwest R3 to R7 quite regularly. On July 23, W1DEI came in for half an hour on c.w. and had the most consistent signal, but a storm ran OVK off the air. He feels that he did well to raise 5 districts and 10 states, but plans a beam for next year. He found out in July that small antennas when *properly* matched to the receiver, were much better than long wires.

W6OMH has moved to Tempe, Arizona, 75 miles from Tucson. He hopes to be transmitting soon. W6GBN at Estrella Hill works Phoenix, 45 miles away, with 35 watts on a 6L6 final, and a superregen receiver. He is still using a 135-foot wire pointed at Phoenix and has not been heard at Tucson. Tucson stations include W6SLO, OJK, OVK, SNU, SNT, OWX, PGO, SGG, MWJ. Also, W6QAV will be on soon. OJK and OWX have worked two districts.

W7FGQ in Spokane has yet to hear a five meter signal. Another local was said to have worked a W6; he tried a month to hear something, tore down a hunk of wire that he had used as an antenna and replaced it with two half waves in phase. He pulled in signals on the first night

[*Continued on Page 83*]

A Combined

# AUDIO SOURCE and MONITOR

By WILLIAM D. HAYES,* W6MNU

When testing an audio amplifier or modulator there arises the question of what to use for a low-level audio source. Of course the standard procedure is to use a wide-range audio oscillator in conjunction with an output meter, but this method has several drawbacks. In the first place, many of us don't possess a suitable audio oscillator, and in the second place, if it is merely desired to know whether a given amplifier sounds good, bad, or worse, measuring and analyzing the frequency response characteristic is an unnecessarily long and complicated operation. Furthermore, an amplifier that is flat from 30 to 10,000 cycles may actually sound worse than one that cuts off at 4000 cycles because of the presence of high order harmonics in the range above 4000 cycles.

Another possibility is to use a microphone, but this necessitates two operators, one to talk and one to listen. It also requires that the loudspeaker, if one is used, be isolated acoustically from the microphone, which is impossible in many cases. Some amateurs in testing with a microphone use the scientific approach; this consists of wiring up the amplifier, connecting it to a defenseless carrier, and pushing the whole mess out onto the antenna to fend for itself. Then an "accurate" check is obtained from some brother amateur who says that the quality is "intelligible" when he means that—well, you know what he means. He says that there is "some hum," when actually the ripple is modulating 50% or more. In this way another horrible signal makes its debut, and the misguided soul behind the mike never does realize just how bad he sounds. Even his best friends won't tell him. Obviously what he needs is a monitor that's not afraid of hurting his feelings.

One popular solution to the problem of what to use for a low level audio source is

*429 Perkins Street, Oakland, California

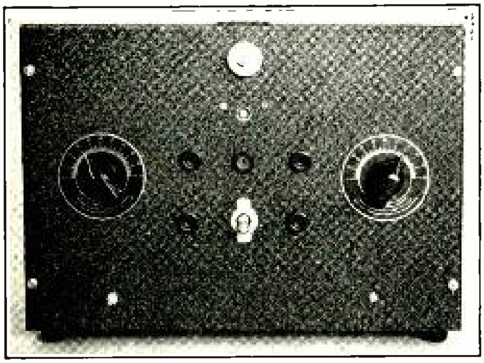


Figure 1. Front view showing the five output terminals. Left hand dial is the tuning condenser, right hand dial the regeneration control.

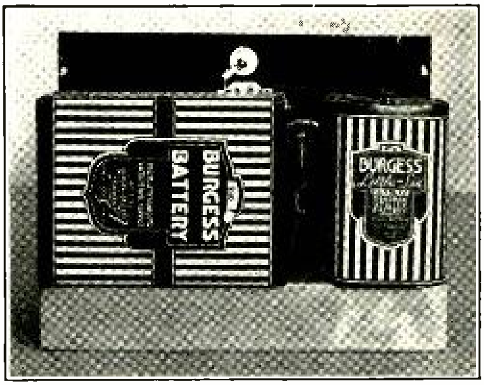
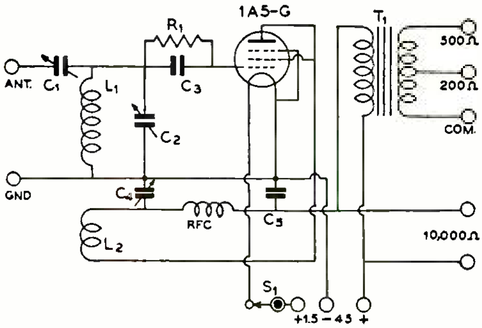



Figure 2. Rear view with the cabinet removed showing placement of the batteries.




Wiring diagram of the monitor-audio source.

$C_1$—10-70 μμfd. mica trimmer
$C_2$—140-μμfd. midget variable
$C_3$—.0001-μfd. mica
$C_4$—140-μμfd. midget variable
$C_5$—.0002-μfd. mica
$R_1$—1.0 megohm, ½ watt
$L_1$, $L_2$—Manufactured plug-in coil
RFC—2½-mh. r. f. choke
$S_1$—S. p. s. t. toggle switch
$T_1$—10,000 ohms to 200 or 500 ohms

the phonograph pickup. However, a good pickup and turntable require quite an investment, and if low quality ones are used, it is sometimes hard to decide whether the pickup or the amplifier is to blame for the disappointing sounds that come out of the speaker. Also record scratch is apt to develop if the same record is played many times, and one essential qualification of a testing source is that it be free from noise of any kind.

An obvious solution, but one that is frequently overlooked, is to utilize the transmissions from local broadcast stations. However, the receiver used must be free of hum and tube noise, and should be capable of matching the input impedance of the amplifier to be tested. The unit here described fulfills these requirements.

## The Circuit

A glance at the circuit shows it to be that good old reliable, the regenerative detector. A 1A5G is triode connected (screen tied to plate) and provides real battery economy. Batteries were decided upon because they eliminate the hum problem, and also permit the unit to be used as a completely shielded monitor. Two 140 μμfd. midget condensers are used for tuning and regeneration control, and since the receiver was designed for the reception of broadcast signals or checking the "home" station, no provision was made for bandspread. If for any reason bandspread is desired, it would be a simple matter to incorporate a bandspread condenser and a small vernier dial. Standard two-winding plug-in coils are employed, and can be purchased from a number of manufacturers very reasonably.

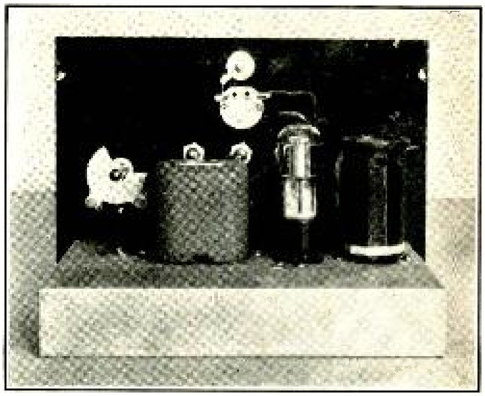


Figure 3. Removing the batteries shows the transformer, coil, tube, and condensers.

Three output impedances are provided: 200 ohms, 500 ohms, and 10,000 ohms (approximately). Connections are made to pin-tip jacks on the panel, the top three being "common," 200, and 500 ohms respectively, and the bottom pair being 10,000 ohms. By connecting the primary of an ordinary three-to-one audio transformer across the 10,000-ohm terminals, the secondary can be fed directly into the grid of the first tube in the amplifier under test. As shown in the wiring diagram, the primary of $T_1$ is left in the circuit at all times. This can be done because, with the secondary open, the primary presents a very high impedance and does not by-pass any appreciable portion of the signal when paralleled with a 10,000-ohm load.

The battery complement is entirely self-contained and consists simply of a 1½-volt "A" battery and a portable size 45-volt "B" battery. A s.p.s.t. toggle switch in the filament circuit cuts both batteries simultaneously.

## Construction

The unit is housed in a black crackle-finished metal cabinet, 10 inches long by 7 inches high by 6 inches deep, with hinged lid and removable front panel. The chassis itself is 9x5½x1½ inches, and there is plenty of space for everything. In fact anyone especially interested in compactness could easily reduce the size of the unit considerably. The placement of the batteries and other parts is shown in the photographs. At the top center of the front panel is the small feed-through insulator for the antenna, and about an inch below it is mounted the antenna trimmer condenser which can be adjusted from the front of the panel with a small screwdriver.

[*Continued on Page 80*]

# POSTSCRIPTS... *and Announcements*

## Order No. 73-A, Affecting Amateurs, Clarified

There has been unnecessary confusion in some minds regarding Federal Communications Commission Order No. 73 as amended by Order No. 73-A, restricting the use of portable and portable-mobile radio equipment by amateurs.

Order No. 73-A does not in any sense rescind the original order No. 73, but merely makes it possible for amateurs to continue the development and testing of equipment designed and built for the sole purpose of emergency use. This relaxation of Order 73 does not, and was not intended to, authorize the use of emergency equipment for routine amateur communications. It was made in the realization that effective emergency communication can only be based on prior experience, including personnel and equipment, all thoroughly coordinated into a communication network. Any extension of Order 73-A to cover the use of regular portable or portable-mobile equipment under the guise of "testing for emergency purposes" is an unwarranted and unauthorized stretching of the letter of the order.

The Commission's press release of June 11, authorizing the moving of amateur stations from one fixed location to another, is not intended to permit short-period operation from a location other than that noted in the station license. It is difficult to draw an absolute dividing line between what is considered a "summer residence" and what is not, but week-ends or short vacation periods do not constitute "summer residence." On the other hand, a move to a summer cottage for a four-month period could be considered a "summer residence."

The announcement of June 11 was a convenience to permit amateurs to continue operation even though they might move from one fixed location to another in routine civil life. It was not contemplated as a means whereby amateurs could operate their stations from week-end vacation locations, or similar situations definitely restricted under Order No. 73.

## Convention and Hamfest at Boston

The 7th Annual Boston Hamfest and Massachusetts State Convention, combined, will be held at the Hotel Bradford, Boston, Mass., on Saturday, October 5, under the auspices of the Eastern Massachusetts and South Shore Radio Clubs.

A fine array of speakers, lots of prizes, contests, meetings and a real turkey supper make up the program. Among the demonstrations will be featured the latest in television and frequency modulation. It's worth making the trip just to see the exhibits.

The registration fee is $1.00. Banquet and registration is $2.50.

For tickets and information write, W1JOX, Robert Williams, 105 Harvard Street, Newtonville, Mass.

## Simplified Filter Design

In the article by John P. Tynes, "Simplified Filter Design," as it appeared in the May, 1940, issue of RADIO, there was an error made in the two small diagrams which were shown at the top of the chart, figure 2, on page 18. As shown in these two small charts, the value of the outside inductance or capacitance in a high-pass filter should be one-half the calculated value. This is in error. The outside values of inductance and capacitance should be *twice* the calculated values. Thus the two terminal inductances in the first diagram should be $2L_0$ instead of $L_0/2$, and the values of the terminal condensers in the right-hand diagram should be $2C_0$ instead of $C_0/2$.

## 112-Mc. Propagation

Amateurs participating in 112-Mc. mobile activities have noticed some interesting effects regarding propagation of these waves. In hidden transmitter hunts, it appears that one is likely to get a deceptive bearing unless it is taken from an elevated position, well in the clear. Undoubtedly this is due to reflections, which result in an error of as much as a full 180 degrees in the vicinity of steel buildings or other large objects considerably higher than the automobile.

Another interesting observation that has been reported by several readers is that the peak of

[*Continued on Page 74*]

## NEW 224-MEGACYCLE RECORD

On August 18, 1940, W6IOJ/6 in the Hollywood Hills and W6LFN/6 at Mt. Soledad, San Diego, made a 1¼ meter contact with five to ten watt transceivers, getting R9 signals at *112* miles.

Later on the same day, W6IOJ moved to a point above Chatsworth, California, and W6LFN moved to Point Loma, *135* miles away, to stretch the distance for a new record.

# YARN *of the* MONTH

## GOOD OLD JOE

Not so very long ago Joe was a regular guy. He was R9 plus. One of the kind of hams you could meet on the street and say hello to, and he'd come right back at you, friendly like, with a "how ya doing", and mean it. That was before he built that little fifty watter for Hank, the new ham in town. Joe sure does build good rigs and Hank couldn't build one to save his life. Hank was all set to buy a commercial job when Joe, being his usual friendly and helping self, suggested that Hank get the necessary gear together and Joe would build it for him. Hank was tickled pink.

Well, Joe built it for Hank. He put an 807 in the final, plate and screen modulated. She perked FB on all bands, 160 to ten, phone or c.w. Hank put the peewee on ten-meter phone, the band being open some, and kept it there.

At his own shack Joe had a pair of husky bottles in the final and socked about 500 watts to them. On ten he used a three element, and put out a walloping signal. He allowed Hank should have a three element too, and he did the friendly thing by helping Hank slap up a beam. The dope in the HANDBOOK being a little over Hank's head, Joe tuned up the beam for him. There are lots of guys in this ham game like Joe and there are still a few on the air like Hank, radio-crazy and good fellows, but unable to drain a grid-leak drip pan for themselves.

The first good day on ten phone Joe called up Hank over the land line and told him to point the beam toward the south. The South Americans were coming through. PY's and LU's and one or two CE's. Joe called an LU and the Argentine obliged by coming back to him. Joe told him on the next go-around to look for Hank, which the LU said he'd be glad to do. They sure are pleasant fellows in South America, and maybe that's what started to make a grouch out of Joe.

The LU found Hank all right.

They made it a three-way for a little while and soon Joe asked the LU about the comparative sig strength. The LU being a right guy came back and said that Hank was just about as loud as Joe, maybe half an R weaker.

Next time we ran across Joe we asked him how he was coming along.

"Not so hot," says Joe, kind of gloomy like, "I'm off the air for a week or two. Doing a little rebuilding. Got a pair of cyclonatrons for the final. Hope to shove 700 watts to them. Boy, am I going to have a wallop!"

Well, we didn't think so very much about that. But about a week later we happened to be listening in to Joe and he was calling the same LU as before.

Sure Joe hooked him; didn't he have 700 watts?

"What's the dope?" Joe asks the LU. "Can you give me an accurate and critical report on the sigs today. Just rebuilt this pile of junk here."

Well, the LU gives him an R7, plus. Conditions were none too good, explained Arturo.

So Joe goes to the phone and calls up Hank.

"How'd you like to make it a three-way with Arturo, in Argentina?", asks Joe. "You remember, the same LU we hooked up with a week or so back."

"Sure thing," answers Hank.

Well Joe calls Arturo and tells him to stand by for Hank. Which the LU does. They sure are accommodating fellows in South America. And, Arturo gives Hank an R7, with a swell sig, nice modulation and such.

It wasn't but about five minutes when Joe guessed he'd better do a little more work on the rig and so he was going to QRT and SK. 73 and be seeing you again.

We next saw Joe at the local radio parts house. Ham radio is funny stuff, but sometimes hams are even funnier. Joe was looking at high power transformers. Allowed he was going to step his rig up to a kilowatt.

"Been needing a bit more power," says Joe. "Got a new final. I can sock it a little more

[*Continued on Page* 74]

By DICK GROVES, W5EKV

# "NICHEVO" (WHO CARES)


THAT'S how Rruditchka Rubinski feels about it. A change in his power supply put nearly 2200 volts on his 2000-volt G-E Pyranol capacitors, but it doesn't phase Rruditchka. He knows Pyranol capacitors can take it—that *they can be operated continuously at 10% above rated voltage* with complete safety. Pyranol makes them extra compact, too, and they are available in either round or rectangular shapes for both upright and inverted mounting.


**GL-872 ........ $9**
Plate Current
1.25 amp
Max. Peak Inverse
Volts 7500

**GL-872-A ........ $11**
Plate Current
1.25 amp
Max. Peak Inverse
Volts 10,000

SPEAKING of power-supply changes, should you be changing yours? If you have a high-power rig, you may be loading your rectifier tubes pretty heavily. If so, you can get greater dependability and longer tube life by changing to GL-872's or GL-872-A's. Commercial operators in all parts of the country have made that change, and they're money ahead for it. That's reason enough, we believe, for you to consider doing the same.

The G-E distributor near you handles our complete line of transmitting tubes and Pyranol capacitors. He has full information, plus bulletins GEA-3315A (G-E Transmitting Tubes) and GEA-2021B (G-E Pyranol Capacitors). If you don't know where he's located, use the convenient coupon.

*General Electric Co. Sec. R-161-4*
*Schenectady, N. Y.*
*Please send names of near-by G-E dealers, and also*
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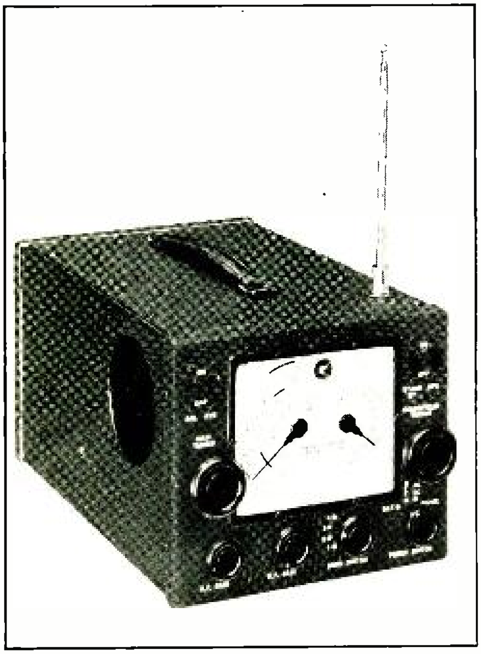
**GENERAL ELECTRIC**

161-4

# *What's New . . . .*

# IN RADIO

### 3-IN-1 PORTABLE COMMUNICATIONS RECEIVER



Something distinctly new in receiver equipment is the Hallicrafters Model S-29 "Sky Traveler" which combines the universal convenience features of the modern 3-in-1 portable with those of a really good communications receiver. It therefore constitutes an ideal unit for use in ham, commercial or all-wave broadcast services—at sea, ashore or in the air.

The "Sky Traveler" is housed in a crackle-finished aluminum case with carrying handle, 7 inches high, 8½ inches wide and 13¼ inches deep. The weight with self-contained batteries is 18 pounds. Operation is from any 110-volt a.c. or d.c. line or from the batteries. Battery life is prolonged by a built-in charging circuit with the result that one set of batteries provides approximately 100 hours service.

Nine tubes provide one r.f. and two i.f. stages, mixer, detector and a.v.c., two audio stages, beat oscillator, automatic noise limiter, and line rectifier. The tuning range is continuous from 542 kc. to 30.5 megacycles in four steps and electrical band-spreading is provided for all parts of this range. Sensitivity averages better than 2 microvolts in all ranges.

The complete adaptability of this receiver for all types of service is indicated by the number of controls, the inclusion of both built-in speaker and headphone jack, a collapsible rod antenna socket mounted on the case plus external antenna connections for both doublet and "L" antennas. Controls include separate main and band-spread knobs and dials, r.f. gain, a.f. gain, band switch, power switch, a.v.c. off-on switch, b.f.o. off-on switch, noise limiter off-on switch, and send-receive switch.

### HERMETICALLY SEALED CRYSTAL UNITS

General Electric has announced two new hermetically sealed crystal units for radio service, Types G18 and G19. Protection of the crystal and electrodes from atmospheric effects such as moisture and dust is provided by the hermetic sealing, which is accomplished when the crystal unit is encased in a weld-sealed shell and then successively evacuated and filled with dry air or gas. The operating range of the new units is −40 C to + 60 C− and in some cases greater.

The G18 and G19 units have a metal tube type shell. An adjustable air gap is used in the G18, permitting extremely accurate frequency

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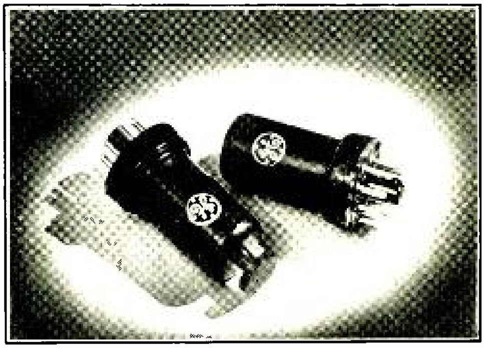

# The Open Forum

Rockland, Mass.

Sirs:

Herewith is a list of recent additions to the membership of the Old Man Radio Club (OMRC). I hope that you will see fit to publish this in the October issue of RADIO.

W1HUV — July 2 — 1883
W1ZE — June 29 — 1890
W2IB — Oct. 22 — 1873
W2MIE — July 22 — 1888
W3HXB — Oct. 28 — 1878
W5IZW — June 29 — 1889
W6SQC — Apr. 16 — 1888
W6RBJ — Jan. 1 — 1890
W6ON — Mar. 28 — 1879
W6SNE — Jan. 24 — 1882
W6FOD — Sept. 11 — 1888
W6DLA — Nov. 7 — 1874
W6QJJ — Mar. 17 — 1889
W7GUX — Feb. 5 — 1879
W8SBV — Dec. 22 — 1889
W8GET — Nov. 22 — 1883
W8CD — Apr. 26 — 1890
W8PJB — June 19 — 1878
W9VJH — Jan. 28 — 1889
W9BJA — Dec. 16 — 1866
W9KXJ — July 17 — 1886
W9ZAK — Apr. 21 — 1876
W9YS — July 21 — 1880
W9HKI — July 11 — 1886
PY5AG — June 17 — 1876

CHARLES F. LOUD, W1JIS

●

Wheaton, Illinois

Sirs:

Due to the increased use of concentric transmission lines you may find the following calculations of interest. Often a wire may be used for the center conductor of the line.

In most wire tables the wire diameter varies logarithmically with wire gauge number, hence we may write

$$D_1 = \frac{K}{k^N}$$

where $D_1$ is wire diameter and N is gauge number. K and k are constants. Picking any two gauge numbers and their respective diameters from a wire table gives two simultaneous equations from which we may solve for K and k. When this is done using diameters in inches and the B & S wire table these constants become

$$K = .3252 \text{ and } \log_{10}K = 9.5122\text{–}10 = -0.4878$$
$$k = 1.123 \text{ and } \log_{10}k = 0.0504$$

Now the characteristic impedance of a concentric line is

$$Z_o = 138 \log_{10} \frac{D_2}{D_1} \text{ ohms.}$$

Inserting the value for $D_1$ given in first equation and the above derived constants gives

$$Z_o = 138 (\log_{10} D_2 + 0.0504\ N + 0.4878) \text{ ohms}$$

where $D_2$ is inside diameter of outer conductor in inches since we used inches in the calculation of K and k. It is interesting to note that the characteristic impedance increases about 7 ohms per wire size (B&S) irrespective of the diameter of the outer conductor.

If $Z_o$ is known and it is desired to find the wire size for the inner conductor we have:

$$N = 0.144\ Z_o - 9.67 - 19.86_{10}\ D_2$$

The above calculations can be carried out using practically any wire table and any system of measure to give new constants K and k for that wire table and system of measure.

GROTE REBER, W9GFZ.

●

Los Angeles, Calif.

Sirs:

Lives there a ham
With ears so dead
That never to himself has said,
"Why don't they do something with the low end of 20?"

It's odd, so very odd, that all that territory goes for naught except for occasional stray phones. The present phone band is even as the River Styx: all confusion and turmoil on one side, all peace and serenity on the other. That ain't cricket. It all ought to be messed up.

Why not reallocate the 14-14.4 Mc. band similarly to the 3.5-4.0 Mc. band with the phones on one side instead of in the middle? Here is the idea that has been disturbing me for some time. I feel qualified to speak my piece, being interested in most all phases of amateur activity. Why not split up the 20-meter band fifty-fifty? Half to phone, half to c.w. As the present phone band runs to 14,250, a new allocation from 14,000 to 14,200 kc. would widen the active portion of the c.w. band by 50 kc. Sure, there may be international squawks, but methinks action along these lines would be entirely in accord with present agreements. The

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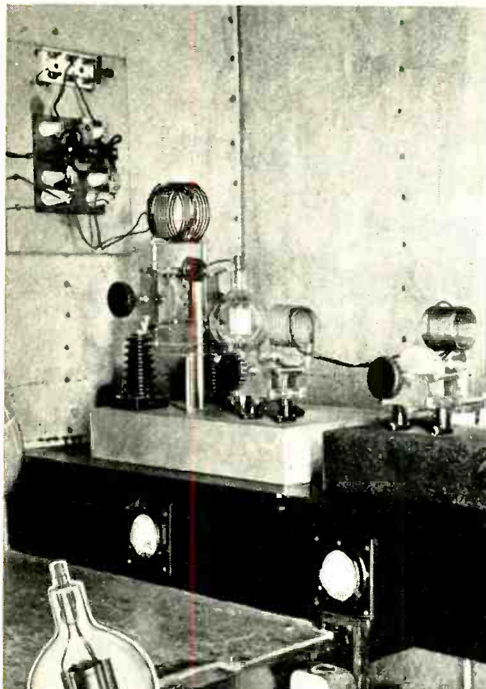
*Another of the world's leading amateurs who uses Eimac Tubes.*



# One of the First Members of the DX Century Club

# FRANK LUCAS W8CRA

**says: "I find Eimac Tubes superior to any I have ever used. They certainly can take a lot of punishment"**

*Frank is smiling over the good luck he is having with Eimac Tubes*

Eimac 250T as used by W8CRA

One of the five amateurs who first won Century Club membership in December, 1937, Frank's score of 112 countries ranked him number one at that time. Since then he has been consistently out in front and as the record stands today he is in second place following another Eimac user, W6GRL. The outstanding success of Station W8CRA has been achieved and maintained through Frank's careful study and application of good equipment. Frank Lucas knows that the outstanding performance capabilities of Eimac tubes have been responsible for many a record-breaking performance. That's why Station W8CRA, like most of the other leading amateur stations of the world, is equipped with Eimac tubes.

Here's something for you to remember whether you are interested in DX or simply "Chewing the Rag": What Eimac tubes have done for others they can do for you. See your nearest Eimac dealer or write direct for information.

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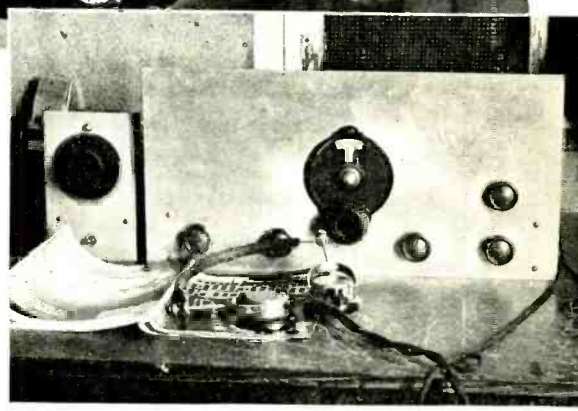
Eitel-McCullough, Inc., San Bruno, California



*Upper photo shows general view of the transmitter. Above is a close-up of Frank's receiver*

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# NEW BOOKS

## *and trade literature*

AMATEUR RADIO—A Beginner's Guide, by J. Douglas Fortune. Published by Thordarson Electric Mfg. Co., 500 West Huron Street, Chicago, Illinois. 155 pages, 6 by 9 inches, price of cloth-bound edition, $0.75 in U.S.A.

This is a book expressly written for the beginner in amateur radio who has not had previous radio or electrical experience. It takes the reader step-by-step from an Introduction to Amateur Radio, through Learning the Code, the construction of his own receiver, the building of several transmitters, and of a modulator for the largest transmitter. Many of the components which are used in constructing the smaller units are also included in the larger transmitter, thus effecting quite an economy for the constructor.

The fundamental theory is directly tied in with the practical applications so that the reader is unburdened with strictly technical facts. In addition, a Reference Chapter is included which gives more detailed information than is included in the regular text.

Copies of the book may be obtained from radio parts distributors, or by writing to the factory direct at the address given above.

THE AMATEUR RADIO HANDBOOK (Second Edition), edited by John Clarricoats. Published by the Incorporated Radio Society of Great Britain, 53 Victoria Street, London, S.W.1, England. 328 pages, 6½ by 9½ inches, price of paper-bound edition, 5/– ($1.00 will cover at present exchange) postage prepaid. The temporary office of the Radio Society of Great Britain is 16 Ashridge Gardens, London N13, England.

This is a well written and informative book covering essentially the same type of material as the American radio handbooks, but it is written, quite naturally, from the British point of view. Much of the theoretical material would be of considerable value and interest to the American amateur, and in addition, a considerable amount of the constructional material shows American components or British ones which are very much similar. There are very useful chapters on the Elimination of Transmitter Interference, Aerials, and Dummy Antennas. In addition there are chapters on The Calculation of Great Circle Distances, and on Television Technique which are not found in the American publications. A comprehensive chapter on Data and Formulae, including a number of ABACS, round out the work.

### New Ward-Leonard Catalog

Ward Leonard Electric Company, Mount Vernon, New York, has announced a new revised circular no. 507 which describes their complete line of radio resistors, rheostats, parasitic suppressors, and other components of interest to the radio amateur and engineer. The catalog is free and is obtainable by writing to the Ward Leonard Electric Company at the above address.

RCA HAM GUIDE. Published by Commercial Engineering Section, RCA Manufacturing Co., Inc., Harrison, N.J. 8½ by 11 inches, 48 pages, profusely illustrated. Price $0.15 in U.S.A.

The RCA Ham Guide, as its name implies, is intended primarily for the use of radio amateurs. In its pages are given authoritative technical data on RCA's popular transmitting tubes, carefully proved circuits for utilizing them to best advantage, and helpful information on the design and operation of amateur transmitters. Detailed descriptions with illustrations for constructing two complete amateur transmitters are shown on pages 29-47.

The constructional articles were written after the RCA engineer-amateurs had built the actual transmitters themselves. One is a complete 5-band cathode-modulated phone/c.w. unit operating from 10 to 160 meters. Power input is 200 watts on phone and 450 watts on c.w. The other is a plate-modulated outfit with 310 watts input on phone and 450 watts on c.w. It also operates on 10 to 160 meters. Each piece of equipment is described, and the name of the manufacturer of each component is given.

The book may be obtained from RCA Transmitting Tube Distributors, or by sending 15 cents to the Commercial Engineering Section, RCA Manufacturing Company, Harrison, N. J.

### Short-wave Station Guide

A new 16-page short-wave station guide which lists several hundred stations throughout the world, together with their frequencies and call letters, has been prepared by the broadcasting division of the General Electric Company.

The book is being offered gratis to listeners of the company's international stations and many thousands of requests have been received from Latin and South America.

The guide also includes operating schedules of stations and a world-wide time map comparing times of the world with Eastern Standard Time. It is printed in English, Spanish and French.

### Stancor's New Pack Catalog

Pack catalog no. 109-C is now offered by the Standard Transformer Corporation, Chicago, in addition to their Service Guide, Hamanual and Complete Catalog.

[*Continued on Page 96*]

# When Specifications Read "Thordarson Power transformer, or equal," You are Demanding the Best!

A transformer "equal" to a Thordarson means one made under the highest quality standards by an organization with forty-five years of precision engineering and production back of it.

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CHICAGO, U. S. A.

The Design of Single-Ended U.H.F. Amplifiers

[*Continued from Page 15*]

there is an impedance match. A non-resonant line is suggested, although a tuned line may be used; however, the subject of antennas is outside this article.

It is suggested that filament leads be choked as illustrated since the filament is not at ground potential due to filament-cathode capacities. Since it is difficult to duplicate mechanical design, I also suggest that when cutting the 807 grid coil, a temporary piece of copper wire be inserted and clipped until the series condenser is about ¾ths of the way "in," and then replaced by a permanent grid coil.

#### 112-Mc. F.M. TRANSMITTER USING THE OUTPUT CIRCUIT

Figure 7 shows the circuit diagram of a complete 35-watt f.m. transmitter for operation on the 112-Mc. amateur band using the high-efficiency plate circuit described in the preceding paragraphs. Aside from the high-frequency plate circuits for the 1614 (or 6L6) doubler to 2½ and the 807 final stage, both of which have been described in ample detail, the balance of the circuit of the transmitter is more or less conventional. Hence, it will be covered but lightly.

### The Speech Circuit

The audio circuit of the f.m. transmitter consists of a 6SJ7 high-gain amplifier, operating from a crystal microphone into a 6C5 speech stage which acts more or less as an audio buffer amplifier. This 6C5 buffer amplifier feeds the grid of the 6SJ7 reactance-tube modulator, which uses the conventional circuit for such a stage. The condenser component of the grid phasing network is not necessary since the reactance tube grid-to-cathode capacity is adequate. However, better all around stability was obtained through the use of this condenser, so it was left in the circuit.

### The Oscillator

The oscillator shown in figure 7 is somewhat unconventional but was chosen for several reasons, the main one of which is that the cathode of the tube is at ground potential. Therefore the plate and screen currents are not common to the grid circuit, as is the case in certain other arrangements. This oscillator has been found to provide an inherent frequency stability of 20 kilocycles in the 112-Mc. band. The normal frequency swing of this oscillator under modulation is 150 kc. Naturally, this value of swing can be decreased simply by reducing the gain of the audio system should it be desired to use this transmitter in conjunction with receivers designed for smaller deviations.

An Effective Splatter Suppressor

[*Continued from Page 18*]

upon $C_1$ are of three kinds: (1) actual components in the voice, passed by the modulator, (2) harmonics generated by the modulator, or modulator distortion, (3) harmonics produced as a result of rectification by $V_1$ when the peak voltage out of the modulator exceeds the d.c. plate voltage. All three are smoothed into d.c. input by the low pass filter. Thus, if someone accuses you of having "upward carrier shift", there is no need for alarm. Your signal undoubtedly is taking up a narrower slice of the band than his, even though you may be modulating heavily. Carrier shift is a result, not a cause, of distortion; and other things besides distortion will produce carrier shift.

The "splatter squasher" does not preclude the use of a.m.c. or peak compression; these may be hooked up the same as for a conventional transmitter whose modulated amplifier is unprotected against the ravages of an angry class B modulator. The advantages of a.m.c. or peak compression will be retained. A.m.c. voltage should be taken ahead of $V_1$, not after the filter.

A Volume Limiting Feedback Amplifier

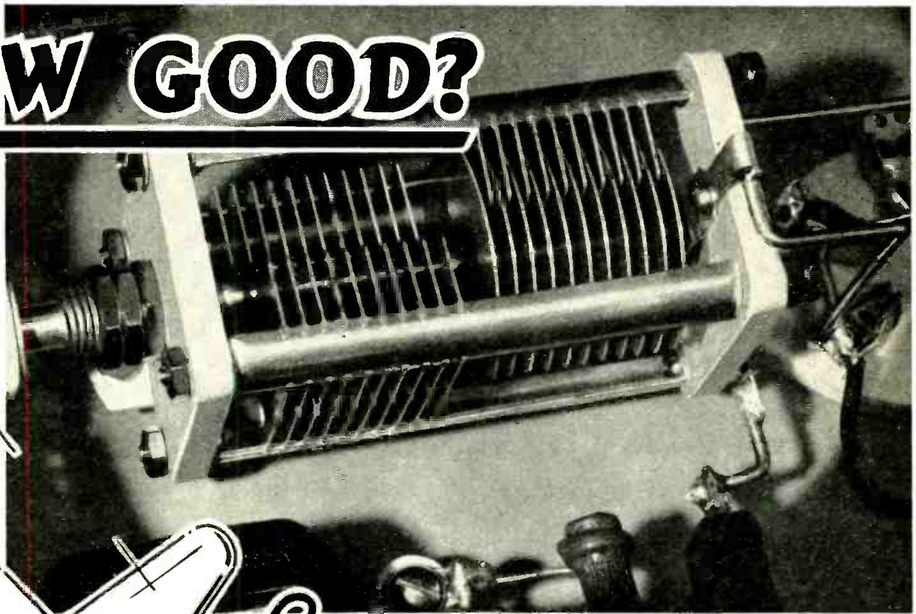
[*Continued from Page 25*]

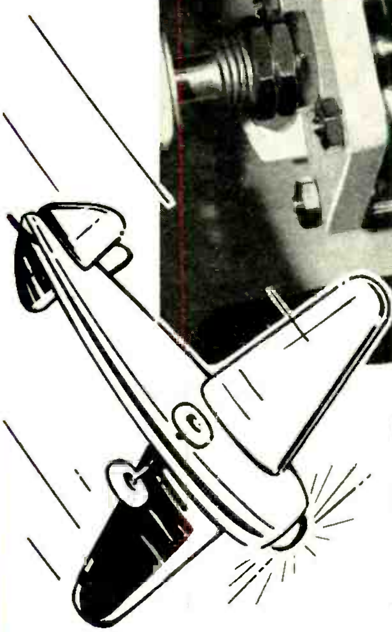
of rather low impedance and allow a minimum feedback of from 10 to 15 db. As the a.v.c. control bias voltage increases the a.c. plate resistance of the 6N7 tubes increases too and permits an increase of feedback which in this manner reduces the over all gain of the amplifier and so keeps the output nearly constant.

Since the diode plates of the 6R7 are biased by the 6R7 cathode resistors they do not begin to conduct until the peak of the signal exceeds this value. By making the triode grid return to a point above ground, proper bias for the triode is obtained but a higher bias is applied to the diode section. This rectified delayed automatic volume control voltage is resistance capacity filtered so as to have desirable characteristics. Values are not critical; they should be adjusted if necessary so as to eliminate clicks and surges. Operation time is fast enough so that there are no noticeable overloads of appreciable length. Release time is slow enough so that low frequencies are not distorted and tremolo effects lost. Release time can be increased with but a slight over shoot of the limiting action.

Due to the large amount of overall feedback, distortion both with and without compression is very low. This amplifier has been checked

# HOW GOOD?





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### TYPE H SINGLE SECTION

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|---|---|---|---|---|
| 25H15* | 24 | 4 | .030" | $2.00 |
| 35H15* | 35 | 5 | .030" | 2.05 |
| 50H15* | 52 | 6 | .030" | 2.15 |
| 70H15* | 71 | 7 | .030" | 2.25 |
| 100H15* | 101 | 8 | .030" | 2.35 |
| 150H15 | 150 | 9 | .030" | 3.15 |
| 250H15 | 250 | 11 | .030" | 3.60 |
| 25H30 | 26 | 8 | .080" | 2.60 |
| 35H30 | 35 | 9 | .080" | 2.70 |
| 50H30 | 50 | 10 | .080" | 3.00 |
| 70H30 | 70 | 12 | .080" | 3.40 |

### TYPE H DUAL SECTION

| Cat. No. | Capacity** Max. | Capacity** Min. | Spacing (Inches) | List Price |
|---|---|---|---|---|
| 35HD15 | 35 | 5 | .030" | $4.20 |
| 50HD15 | 52 | 6 | .030" | 4.40 |
| 70HD15 | 71 | 7 | .030" | 4.60 |
| 100HD15 | 101 | 8 | .030" | 4.90 |
| 35HD30 | 35 | 9 | .080" | 4.80 |
| 50HD30 | 70 | 12 | .080" | 5.25 |

*Single End Plate

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"MANUFACTURERS OF RADIO TRANSMITTING EQUIPMENT" with as high as two watts output and fifteen db of compression without being able to tell by listening on a high quality speaker if the input or output of the amplifier had been bridged.

Frequency response does not change with compression unless equalization is required, and then not materially. High or low frequency compensation or both can be obtained easily by altering the feedback network. To increase the highs connect a small capacity from one cathode of the 6J7's to the other. Lower frequencies can be increased by making the d.c. blocking condensers smaller.

A 0-25 d.c. milliammeter should be connected in the B plus lead of the 6N7 tubes so as to read compression. As these tubes take about 20 ma. each the meter should have a suitable adjustable shunt. If the meter is mounted upside down the indicator will swing to the right—a more normal movement. A scale calibrated in db of compression can be cemented over the old dial to assist in monitoring. See sample calibration.

The amplifier should be perfectly stable with both of the 6N7 tubes out of their sockets. If trouble is experienced with amplifier oscillation, loading of the input transformer secondary with lower resistance, grounding the center tap (line side) of the input or output transformer, or increasing the resistors of the series legs of the H network should stabilize the amplifier. Also of importance is the balance of the audio choke. The center tap must be at the electrical center and both halves must be of equal capacity to ground. Any good broadcast type of choke will be suitable, but it should be of balanced construction with four leads from the coil brought out. Those made for receivers will probably give trouble. Resistors could be matched with an ohmmeter.

The point at which limiting starts can be set to any required level by adjusting the 6R7 grid volume control. Flatness of compression can be controlled somewhat by the value of the 6R7 cathode resistor ($R_{16}$), but compression should not be too flat if naturalness of program material is to be retained.

This volume limiting amplifier gives a definite increase in program levels and gives increased volume in the listener's home receiver, where it counts the most.

### Amateur Applications

Although the amplifier as described is primarily for commercial use, such as broadcasting or police work, the system is also quite suitable for use in amateur speech amplifiers either for use as a peak limiting or volume compressing arrangement or for use as an a.m.c. amplifier. With the amplifier operated just as it is shown it makes an excellent peak compressing or volume limiting amplifier, provided the proper amount of gain is used between it and the modulator stage, and provided the 6R7 grid volume control is set at the proper value. If the amplifier is to be used with a.m.c., a conventional a.m.c. peak rectifier may be fed into the control grids of the 6N7 feedback control tubes.

### Yarn of the Month

[*Continued from Page 64*]

so thought I'd make the plunge and do it now."

That plunge cost Joe about fifty bucks.

So Joe was off the air for a little while. All this time Hank was getting out vy FB. Working the guys on the east coast when the one's, two's and three's were coming through and then swapping over the country to the W6 gang with an occasional K6 as well. He even worked an XU on ten fone.

In about three weeks Joe had rebuilt his "pile of junk" again.

Sure, the DX was coming through once more. And from South America, too. The omnipresent Arturo was on hand with his "yamando say coo." Joe calls him.

Art comes right back to Joe, and says he sure did have a swell sig today, better than ever before, and what had he done to the rig and where had he been so long? Joe told him he had rebuilt the power supply and now was running 999 watts to the pair of cyclonatrons, a little more soup and how's about another critical report.

Sometimes it is a wonder the good natured hams in South America answer us W's at all. But Arturo says sure, Joe, and tells him he's R8 to R9 with R9 plus on peaks.

Joe says to QRX, Arturo, and he goes to the phone and calls Hank. It must have been a good day on ten.

Arturo gives Hank an R8 to R9 with R9 plus on peaks.

Since that time, Joe has been even more grouchy. He even threatens to give up ham radio and sell his rig. To whom? Why to Hank.

### Postscripts and Announcements

[*Continued from Page 62*]

a hill is not always best for dx work. Oftentimes reception and transmission is improved substantially by locating down the hill a short distance towards the other station. Also, signals often can be improved slightly by moving the car forward or back as little as two feet.

## A 112 Mc. Converter

[*Continued from Page 33*]

in place. The r.f. shield is $4\frac{1}{2}$ inches by 5 inches high and is a piece of 14 gauge copper $18\frac{1}{2}$ inches by $5\frac{1}{2}$ inches bent into a square with a $\frac{1}{2}$-inch flange overlap for soldering and a $\frac{1}{2}$-inch flange bent outward around the bottom. The oscillator-detector shield is $4\frac{1}{2}$ inches wide by $6\frac{1}{2}$ inches deep by 4 inches high, the piece of copper being $22\frac{1}{2}$ inches by $4\frac{1}{2}$ inches. They are fastened to the chassis by several self-tapping screws. A notch is cut in the side of each shield to slip over the condenser shafts. One-half inch holes are drilled in the front to accept the switch shafts and each shield will slip on and off easily at any time. The covers are made to fit snugly by bending down a $\frac{1}{4}$-inch lip on all sides.

Figure 4 shows the power supply and a rear view of the completed chassis. The small power supply chassis is a 5 inch by 7 inch by $\frac{1}{8}$ inch piece of aluminum bent U shape. The side holding the tubes is 2 inches, the back is 2 inches and the transformer side is 3 inches. The triple 8 $\mu$fd. condenser is also mounted on this latter side. The output leads to the plug are in shielded pairs to keep the a.c. hum at a minimum. The supply is bolted to the inside back of the cabinet.

### Tuning Up and Alignment

From previous work on the ultra high frequencies, very little trouble was experienced in finding L/C combinations for 112 Mc. Preferably, the oscillator should be lined up first and a couple of milliammeters will help considerably. A 0-10 ma. in the oscillator plate lead and a 0-1 ma. in the detector plate lead. The oscillator should read about six ma. when the circuit is oscillating and the frequency can readily be checked with any standard communication receiver by beating it against some harmonic of the receiver oscillator, keeping in mind the harmonic used, the intermediate frequency, and the receiver-oscillator signal-frequency relation (osc. high or low side of signal frequency). Small adjustment of the converter oscillator frequency can be made by changing the grid condenser, which is normally set at about 20 $\mu\mu$fd.

With a knob fastened to the detector condenser shaft for tuning, the detector coil should be adjusted until the condenser rotor position is the same as the oscillator condenser. As previously mentioned, one condenser plate has been removed, giving good tracking over a wide frequency range. The detector plate meter should lead about 0.4 ma. (oscillator off) and with the proper adjustment of the coupling condenser (set close to minimum capacity) the meter reads 0.6 ma. (oscillator on). The cathode bypass is also the trimmer type and is set for 20 $\mu\mu$fd. for 112 Mc. operation. The i.f. transformer should be peaked when the converter is coupled to the receiver at 25 Mc. Of course this converter can be used into any receiver or i.f. unit having a wide band pass and will be good as the front end of a FM receiver.

The r.f. tuning condenser also has one plate removed. A temporary tuning shaft is extended from the condenser out through a hole in the shield. The trimmer condenser is set at center scale and the 112-Mc. coil is adjusted until the main condenser setting is the same as the other two. Now, final adjustment of the detector and r.f. tuning should be made by coupling to a signal generator harmonic or other signal source at 114 Mc. It is best to set the regeneration control for one optimum point to cover the entire band as a change in screen voltage will affect the r.f. tuning slightly. However, the trimmer will take care of this or any changes in antenna loading.

When the band switch is in the no. 5 position, to put the antenna directly through to the receiver, the two coil-switch contacts are bridged to keep the grid circuit closed. The antenna coupling coils should be adjusted with the r.f. regenerating and an appropriate antenna attached. Then they are fastened in place with coil cement. The lower frequency grid coils can be changed for any desired frequency range. More band spread is attained by reducing the total condenser capacity.

This unit has been in operation for several months and the results have been very gratifying. On 112 Mc. it has been tested against an acorn superregenerative receiver. Signals that are readable QSA5R5 on the converter are just breaking through the superregen hiss and not readable. Our location is only forty feet above sea level and with two half-wave vertical dipoles on a 50-foot pole we hear stations in a one-hundred mile radius consistently. Our twenty-watt transmitter will not touch a good many of the stations heard now and we figure that 200 or 300 watts would be required to match the new receiver. The r.f. stage, tested thoroughly on 14, 28, and 56 Mc., will raise a signal several R points on the meter. Actual readings show that a weak signal can be raised six R's with the noise coming up only four R's.

Simplified Direction Finding

[*Continued from Page 35*]

loop also can be used to provide fair pickup (satisfactory on all except very weak signals) up to about 20 Mc. for determining the *approximate* direction of distant stations or the exact direction of local stations.

For frequencies below 2,000 kc. the loop may be from 1 to 2 feet square, the larger size providing somewhat greater pickup. For frequencies between 2,000 and 10,000 kc. it may be about 1 ft. square, and above 10,000 kc. about 8 or 10 inches square.

The loop is wound with "bell wire" on a wood frame in the form of a "square solenoid" with an exact even number of turns so that the center tap will come at the bottom of the loop. The tuning condenser C may be an ordinary 350-$\mu\mu$fd. broadcast type, fitted with an insulated shaft extension to minimize body capacity.

A twisted pair line is used to couple the loop to the receiver, which should have balanced (doublet) input; that is, neither side of the antenna coupling coil should be grounded in the receiver. The twisted line is tapped symmetrically either side of the grounded center tap on the loop, the feed line taps being adjusted together a turn at a time for maximum signal strength.

To take a bearing, simply tune the loop to resonance as indicated by the signal strength meter on the receiver, the loop direction being adjusted roughly for maximum pickup of the signal. Then check to see if the two minima that are observed as the loop is rotated are exactly 180 degrees apart. If not, the tuning of C should be altered slightly as necessary to cause the two minima or nulls to fall exactly 180 degrees apart. When this is done, either null may be taken as a bearing.

Surrounding metal objects have a tendency to distort the directional pattern of the loop; likewise large metal objects tend to deflect or reradiate the received signal, resulting in deceptive bearings. To be accurate, loop bearings should be taken with the loop as much in the clear as possible.

### Sense Determination

After an accurate bearing is taken with the loop just described, the 180 degree ambiguity can be eliminated as follows:

Tune in a station whose direction is known, and adjust the loop tuning condenser C so that it is considerably on the low capacity side of resonance as indicated by reduced signal pickup. The pattern then will be similar to B of figure 1. If the tuning condenser always is tuned to the same side of resonance and sufficiently off resonance, the small lobe (which is sharper than the large one) will always occur in the direction of the same vertical leg of the loop, which should be given an identifying mark.

Thus, to determine sense, simply detune the condenser C to the low capacity side of resonance and observe the relative positions of the large and small lobes.

---

### P. P. & P.

[*Continued from Page 4*]

easier. Take a look at those tube tables. We will wager that there are several dozen types which you, like ourselves, have never heard of before. Henceforth we will be willing and energetic workers in any campaign to reduce the number of receiving type tubes! Oh yes—there are 168 different basing arrangements being used at the present time. They run from 4AA to 8Z.

### Your Commercial License

[*Continued from Page 42*]

to pass such a test. If the F. C. C. did not care to give questions on these topics, it could permit the Field offices to give voluntary tests and make a notation under the "Special Endorsements" portion of the license.

The questions should be changed every few months, without public notice, so that unethical students and schools could not assemble a set of actual questions and answers. I have found that if a school, such as a civil service coaching school, will mimeograph questions and answers and drill students on these that a surprising number of students make excellent scores. The applicant should be required to take all elements without time delays. At the present time the test must be completed within a calendar month, thus permitting a student to "stall," on elements 1, and 2, and perhaps 29 days later return for the other two elements. This results in a stack of papers on the Inspector's desk, lowers his efficiency, and permits the applicant to "bone-up" on the remaining elements. It is always a wonder to me how the F. C. C. men manage to remain calm and unruffled.

Finally, being both facetious and serious, it would be a good idea to furnish free drinking water to applicants so that during a test they would not have to leave the examining room. Schools that give a lifetime guarantee to answer a student's questions on radio, do not mean for that guarantee to cover questions asked by a student who, after excusing himself from the examining room, (sometimes referred to as "sweat room") heads for the water fountain, and just incidentally deposits a nickel in a pay phone and amazes his school instructor by asking the answer to question number 408 on element 3. After all a nickel an answer is too cheap.

There are legitimate ways in which a good instructor can help a student pass these tests—and any instructor who knows his subject, has experience in the field, and takes the test can see many angles to pick up two per cent here and two per cent there. So it all comes back again to the student and his instructor.

Finally, no mention has been made of latitude, longitude, G.M.T., or frequencies to use for communication between two points. Any good amateur can handle this phase of the test and its scope is shown in the Guide.



### A Compact 150 Watt C.W. Transmitter

[*Continued from page 29*]

| | |
|---|---|
| Oscillator cathode current | 20 ma. |
| Driver grid current | 2 ma. |
| Driver cathode current | 85 ma. |
| Final amplifier grid current | 55 to 65 ma. |
| Final amplifier plate current | 200 ma. |

No trouble with parasitic oscillations was experienced in either the 807 stage or the push-pull final amplifier.

For my purposes, the transmitter has proven very satisfactory, and it is a pleasure to be able to change bands in less than one minute without the usual complications of band switching. It might also be mentioned that the transmitter is still located in the living room, with no serious complaints from the xyl. See Buyer's Guide, page 97, for parts list.

### The Open Forum

[*Continued from Page 68*]

majority of active phone stations are using e.c.o. anyhow so there should be no difficulties encountered as far as equipment expenditures are concerned. After all, we might as well make full use of what we possess, 'cuz we can't take it with us. How's about it?

Bill Breuer, W6TE

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**THE EDITORS OF RADIO** *technical publishers* **1300 Kenwood Road, Santa Barbara** CALIFORNIA

## A Combined Audio Source and Monitor

[*Continued from Page 61*]

### Operation

When using the unit as a source of audio for testing purposes, the best procedure is to tune in the loudest signal on the broadcast band and then reduce the antenna coupling or the length of the antenna (a few feet of antenna will be sufficient) until the desired output level is attained. The output is readily adjustable by judicious use of the regeneration control and the antenna trimmer.

When using the unit as a monitor for checking the complete transmitter in operation, it is only necessary to disconnect the antenna, and plug in a coil for the band being used. Any hum or other fault with the signal is very apparent, and can be corrected without having to ask another station for a report.

If every station using phone would do these two simple things, (1) check the modulator before ever connecting it to the r.f., and (2) check the complete transmitter with a monitor before calling CQ, the phone bands would sound much better than they do at present.

Incidentally, when using the unit as a monitor, believe what it tells you. If you hear a hum, for instance, *don't* say to yourself, "Well, maybe it's not getting out," and then go ahead and blast out a raucous CQ. If you have reason to believe that the hum is being picked up from a local source other than from the carrier, move the monitor thirty or forty feet away and try again. If the hum is still present, don't connect the antenna to the transmitter until it is cleared up. The most asinine practice on the phone bands today is this business of asking another station for hum or quality reports. If you hear no hum in the monitor, you're safe in assuming that your signal is clean; and if you *do* hear hum in the monitor, the transmitter shouldn't be on the air in the first place. Likewise, the monitor will give a more accurate idea of the quality than a dozen reports from other stations.

By using the unit described in this article in conjunction with some form of dummy antenna, your debut on the air may be delayed for a while, but when you do finally connect the antenna, you won't have to ask for a report on anything but signal strength—and even signal strength reports don't mean much under the present system.



## A Simple Thermal Delay for Mercury Vapor Tubes

[*Continued from Page 19*]

between his characters) to save his tubes from destruction. The ordinary circuit-breaker is useless for this purpose whereas the thermal arrangement can be adjusted so that average keying will not operate it, but continuous long dashes will. It may be necessary to remove part of the heater winding to minimize voltage drop to the plate transformer. In the case of the high power transmitter heavier resistance wire may be needed on the heater.

The writer has had several of these revamped flasher buttons in operation for the past several years without a single contact failure. Certainly the cubic inch of space they occupy can cause no objection to their use!

## X-DX

[Continued from Page 49]

after returning from Milwaukee. Whatta night! By that I mean, if you ever have a chance to stay at Rollie's over night, and he puts you in the guest room . . . you're really taking a chance. When a fella walks into this room he sees about a dozen sets of stuffed heads and horns all around the wall—gee, there were moose, deer, antelope and even an elk horned in. The floor was covered with wild cat skins, as well as many others that might be described as tigers, lions, etc., if I hadn't known better. The amount of sleep you get during the night depends largely upon your condition when you enter this room.

The next day W9TB took me out to his new spot. Wally's xyl had a very nice dinner for us, although Wally and I managed to delay it for about an hour while he showed me his new shack. This, of course, made a big hit with his wife . . . in fact just the same kind of a hit that it usually does with my xyl. It was a pretty warm day and evening and the natives around town confessed that it was just beginning to get hot. That night I was to leave on the U.P. for Los Angeles, so Wally put me on the train. This statement possibly will create the wrong impression, so I'll say that Wally took me to the train and I got on by myself. Here again I ran into another type of air conditioning. I could see it was going to be rather comfortable, although I discovered later that at times it was so cold that it reminded of the icy blasts you get when you open the door of your ice box. I soon discovered that I had a very choice lower berth, and no one had been assigned to the upper. I cooked up a special deal with the conductor whereby he wouldn't put anyone in that upper. This resulted in two things. First, it assured me of not having my face stepped on by the guy climbing into the upper. Second, it assured me of at least enough space in which to sit up in bed thus enabling me to dress without going through "straight-jacket" contortions. As soon as the train got rolling I made my way up a few cars to the Lounge Car. I did pretty well only falling into three laps on my way. The Lounge Car is one of those cars where everyone tries to find room to relax, and the first night no one knows anyone else but at the end of their journey they are old time friends and almost shed tears when they leave. The Lounge Car is a car where everybody grabs a nice comfy arm chair and a magazine. They sit there apparently reading but actually they are peeping over the top of the magazine giving everybody else in the car the once over. All this time the one BC set in the car is blazing away with a program that no one wants to hear but everyone is afraid to change. The last day of the trip this timidness disappears and everybody takes a crack at changing the program.

The first morning I discovered that my car had about 14 young kids in it. They all had their toys up and down the aisle. The kid having a toy train of cars provided the foundation of the day's highlight. A nice looking blonde (I would say *beautiful*, if I was sure my wife wouldn't read this) started down our car. She stepped smack on one of the toy flat cars, taking one of the most picturesque spills I have seen outside of the Ice Follies. Her feet went up, and she went down, lighting between Section 8 and Section 9, wherever that is. To say the least she was in a state of confusion for a moment. She took the spill and the kid did the bawling. Unfortunately I didn't have my camera handy, otherwise we would have had a good shot for the Departments page . . . I think.

The rest of the trip to Los Angeles was practically uneventful except we stopped at Grand Island long enough for me to see if their station was actually papered with green and pink slips. There is no truth to the rumor, it is not. At Cheyenne we had about 15 minutes. I grabbed a telephone in the station and phoned W7GGG. Before I finished my argument with the telephone operator there was Doc standing in front of me. He lives about two miles from the station and how in the world he got there in a minute and a half, I'll never know. We stopped at Salt Lake City long enough to gallop around town for a while, and appreciate the air conditioning when we got on the train again. That night we stopped in Las Vegas, but not long enough to get into any trouble. The next morning we pulled into Los Angeles and as usual . . . the weather was just perfect.

I can't understand how this is going to get by in the DX column, but if it does we'll all know that taking a trip into the land of 9's is no cinch . . . that is, if you take them the way I do. It was so tough that I think I'll do it again next year.

### The Long Beach Convention

The ham convention at Long Beach is over and it brought out quite a flock of old timers. Among them were W6WB, W6SZ, W6BIP, W6AK, W6FW, W6EA, W6EB, etc. It was good to see Bud Bane, W6WB, again because during the past few years he hasn't been doing much in the way of hamming. The night before the thing started at Long Beach a few of the gang gathered at QD's jernt. We had W5KD from Oklahoma City, W5BDB Mims of Texarkana, W1DMV now at W6YX Stanford U., W6HJT, W6UF and the xyl's of course. The Convention proved that ham activity is on the up again as the attendance was about 650.

The highlight was Major Armstrong's talk on FM . . . He gave a two-hour talk that kept the gang stuck to their seats. The Major not only knows his stuff but certainly gained a high spot in the eyes of the hams present. Mims gave some dope on beams and all about squirting signals.

The X-DX Roundup was poorly attended. It was held at 8 a.m. on a Sunday and there were about 20 who braved the weather at that time of *night*. I still think they stayed up all night in order to get there.

### Fellers on Forty

I notice quite a number of the gang are using the ol' 40-meter band again. W2BMX, W8EUY, W8AU, W9FS, W7WY, W7VY, and a flock of others are getting a big kick out of renewing acquaintances. Why not get your heap harnessed up and get on 40 for a change? There is a swell club in the Bay area consisting of fellows from the Telephone company, BC stations, and radio industries. In fact, there are some of the hams from Fire departments, Police departments, etc., and anyway they have their own net on 80 and 160 and are planning on giving 40 quite a play in the near future.

It looks to me at the present time that we are more sure of staying on the air than at any time during the past six months. It's only my opinion, but I can't see how we are going to have any further restrictions put on us, especially after going to all the work and expense of getting our birth certificates, photos and fingerprints. I believe that most of the jitters have left now, as many more of the fellows are rebuilding their rigs, putting up beams and in general getting over their fright. It is too bad that we couldn't go through with our DX contest but of course, it was not to our liking either that we had to cancel it. If you have any good ideas on a contest, write us your suggestions and maybe something will spring out of it.

I would appreciate your cooperation in sending in photos, and information about the gang around the country. It is still your column. 73-CUL.

## U. H. F.

[*Continued from Page 59*]

thereafter. FGQ is planning on 300 watts or so on 35T's for next season.

In Pennsylvania, W8OKC finally had conditions break rather well for him on July 23 when the band was open 3½ hours. For a while he also heard W8FDA at Pottsville, 30 miles over the hills. Last opening reported is August 15.

W8PIK in So. Williamsport, Pa., now puts 200 watts into an 8JK two section beam. He mentions calls heard but none worked. On July 23 he heard W9ZJB in Kansas City working W6QLZ which illustrates how the double hop was working. ZJB is above a straight line on a map but about on the great circle path. The distance from QLZ to ZJB is about 1050 miles, and to Williamsport is 934 more. It is another 310 miles to Boston, but two hops of 1050 miles would be within 200 miles of Boston, and slightly longer hops would make it easily. W8PIK also heard St. Louis stations which suggests that three hops between Phoenix and Boston might also have occurred, but two and three hop signals simultaneously would have resulted in severe fading of W1DEI's signals in Arizona—which was not the case.

From Saginaw, Michigan, W8QQS reports having worked seventeen states in all districts but W7 this year. W8RUE in Pittsburgh is on 56,712 and 57,224 with a T21 doubler final, 28 watts input. He still needs W6 and W7. The last skywave dx was W5EHM on August 13 and W5AFX EHM on the 16th.

### Horizontal Antennas Again

Rain, static and no fishing led "Lightning," W9EET, to report on the Ozark net which originally included W9GHW, NYV, OWD, WAL, NKW, EET. W9VAV and JIJ are new or prospective members. The candidates are required to be able to hold communication consistently with all existing members; EET being the remotest station, gets the final say, making him a plutocrat, autocrat, democrat or such. Good ground wave contacts from 180 to 248 miles were with W9BDL, ZHL, ARN, RGH, DQH, WIV, DQU, NFM, ZHB. The last was worked 4½ hours on July 18 at 248 miles, and W9NFM at Solon, Iowa, was brought in for a three-state contact, all at long distances. All this work has been done on various types of long wire or multiple element beam antennas, but all were *horizontally* polarized.

W9EET says that he is a newcomer (but he is a *doer*), having been browbeaten, cajoled, bribed and threatened into it by W9GHW-NYV. In his first season, though, he has worked fifteen states in eight districts, working eight districts in two hours and hearing W7GBI momentarily for the ninth on July 23. His rig starts with a 6L6 xtal, 809-HK54 doublers and 200 watts on a 100TH final. Receiver is an Ultraskyrider with 1851 r.f. Mostly, a four element horizontal rotary is used, with a two wire folded doublet as the antenna as in May RADIO but fed with a two-inch open wire line and concentric slip rings. The feeder is tapped directly on the parallel rod tank circuit for proper load. Antenna tests with

W9GHW at 40 miles show vertical-to-vertical satisfactory but not as consistent or satisfactory as the horizontal beams. Good feeder match to the receiver is a necessity.

### Verticals Forever!

Fred Bornman, W8QDU, reports continued improvement in Detroit activity but many are hampered by poor locations. Fred says, "I have had a lot of fun this year on 5 and 2½. My six months of continuous activity has definitely proved that the ultra-high frequencies can keep one going, and I heartily recommend to anyone who has a fairly noise-free location at a good elevation to get up there and try it. When you consider the number of hill-top stations wasting their time on 40 and 80 meters—boy, they don't know what they're missing.

Fred is still putting 500 to 600 watts on 254's and has a DM36 ahead of an HQ120. The antenna is a coaxial vertical with horizontal fins a few inches below it. His location is too close for east coast contacts except for rare cases of very short skip or aurora conditions. However, he has continued his excellent groundwave work. He missed a 300-mile contact with W9CLH, who was unable to use c.w. He works W8RKE in Grand Rapids, W8CVQ in Kalamazoo, W8VO, NYD in Ohio and W8GU in Erie, Penna. Newer stations are QUO, ARF Toledo, LPQ, FXM Saginaw, QQP Fremont (Ohio), TCX Greenville (Mich.), NBV Erie, OPO Kent (Ohio), PZM Parma, PWM Pt. Clinton (Ohio). During a drive to visit W8CIR, VO, NYD, W8QDU's mobile job did well. From Bald Mountain, a hill in Michigan, he worked W8CIR and W8GU, 220 and 180 miles away, with R4 signals.

Fred is becoming less interested in horizontal antennas, feeling that the vertical is much superior (and more convenient for mobile). He says that it is not how much goes into the final, but how much is radiated at low angles by the antenna and where the antenna is—otherwise how could he get solid contacts at 220 miles from his car with 20 watts input, when Detroit stations have difficulty duplicating the contacts with 200 watts?

In Milwaukee, W9IZQ reports working W4EQM on August 13 and W9ZUL on ground wave on the 6th.

W9YKX put his 954 in a coaxial-line-tuned r.f. stage followed by a coil-tuned 6K8 mixer. This now drives the R-meter off scale and is as stable as a b.c. set. The line tunes very sharply and the noise ratio is considerably improved over anything else tried. He is putting a line in the mixer, intending to reach ten meters by changing the oscillator coil and turning in the condensers. Bill says that everyone wants to know "what he burns" in the receiver. Incidentally, he found out what was wrong with the injection in the 954 when used as a mixer, which improved it over the condition mentioned above, in his earlier report.

Vince Dawson brings his reports up to date, saying that while lots of boys have been getting longer hops, he has made shorter ones around 400-600 miles, with W1's rare except HDQ, DEI.

Mostly, the skip that way is to W2TP, AMJ, W3BZJ, BYF. W4's roar in on ten but there are too few of them on five when the band is open. On July 23, the band opened at 5:30 p.m. Central time and was still going at midnight, by which time Vince had worked all districts but W4-7, including W6QLZ, OVK, KTJ, PGO. On August 13, W8CIR came in 10 db better on his Yagi than on the vertical doublet.

W8TIU in Saginaw has worked eight states in five districts. W1JJU in Hartford has contacted 108 different stations on five meters, including six districts and seventeen states. He has heard W6QLZ, W5AJG, EHM, VV, but has had no luck in contacting them.

W1DJ sends in a card with drawings of equipment used since 1901. Now, he is all on five meters with ten watts mobile, working five states in two districts this year. W1AIY is on 58,480 with 25 watts for local contacts.

In Dumont, N. J., W2GHV puts out a good signal using a 6L6 40-meter regenerative crystal oscillator with output on five, driving a 6L6, 807's and W.E. 304B's, the last running at 400 watts. The antenna is an extended doublet. The receiver uses 1231 r.f. and 6K8G mixer. GHV's contact with W6QLZ was the first W2-W6 QSO.

### Article Contest

It is interesting to receive and to discuss problems with those interested in the ultra-highs. Publication of these ideas brings out more thought on the problems encountered, and wider knowledge of the solutions proposed. Letters from the gang are encouraged. Possibly the management of this magazine can be induced to provide a monthly prize for the best short article on some u.h.f. problem submitted and published in this column. Would you support such a proposal?

### ABOVE 112 MEGACYCLES

According to W1HDQ, new records have been made on the "modulated oscillator bands." Let's get the reports in and revise the Honor Roll accordingly.

The M.V A.R.C. sheet provides some 2½ meter news from the first district. W1JDF of Methuen, Mass., has been reported on 2½ in Rhode Island, Connecticut, and Maine. W1LEA has pushed signals over to W1GRZ at Fitchburg, Mass., a hard hop even for five meters. W1IZE is using 807's on 2½, and someone thinks it funny because he gets out—how come? W1JDF is having a hard time forgetting "cq 160" when down on 2½.

W7FGQ of Spokane wonders why the diameter was omitted from the Falor 2½ meter transmitter described in the June issue. The answer is that the coaxial line can be as large in diameter as possible. And the cathode tap should *not* short against the outer conductor. FGQ wants to encourage activity on 2½ in his territory.

From Cleveland, W8IPU writes that he is against push-push doubling for 1¼ meters, but prefers push-pull tripling with a little regeneration. His proposal is to couple 75 megacycle drive into the grids through a parallel-rod line or coil and condenser resonant circuit; then to use a reactive circuit consisting of parallel rods in the filaments to provide controllable regeneration at the output frequency. The plates tune to 225 Mc. with the usual rods. It all sounds fine, for those who like nice stable 1¼ meter signals.

In Des Moines, W9CXL has tried out some of the coaxial superregen receivers with promising results. One uses a small choke in the otherwise grounded cathode lead to make the detector oscillate without need for a cathode tap on the line. It is hard to make tests, with the three other stations having left the band. However, he notices that the coaxial line superregen brings in carriers stronger than on his superhet, tuning is sharper, and carrier hum is noticeable. Or perhaps the receiver hum modulates the carrier! Ed is getting comparable results with the HY615 and acorns at 112 megacycles.

W9SQE heard that a Chicago 2½ meter station was heard in Milwaukee, but neither details nor confirmation has been provided as yet.

W9YKR in Ste. Genevieve, Missouri, is trying to interest local club members in 2½ meter activity. St. Louis stations should take a hand, producing another dx contact.

#### Latest Above 112-Mc. Reports

Late reports above 112 Mc. include word that W4FKN is on 2½ in Atlanta, Georgia. W7FGQ still plans to put Spokane, Washington, on the band. W8RUE in Pittsburgh has worked 40 miles to Uniontown, Penna. Ken Falor in Bay City, Michigan, urges the use of push-pull superregen detectors with parallel quench injection, in order to improve fidelity and reduce background noise (rush). W8QDU has installed a TR112 in his car and finds that contacts from favorable locations are good up to 20 miles, although there are fewer stations than on five. At his home location, he has 54's doubling to 2½. He has FM with 50 kc. deviation but says that there is much to be desired from it when using a commercial receiver built for 200 kc. deviation.

The best news of all comes from Allen Wippert, W6LFN, reporting 1¼ meter contacts with W6IOJ at distances of 135 and 112 miles along the southern California coast. Transceivers were used with five to ten watts input.

W8IPU is on 225.6 Mc. but seems to need 110 watts input to get 5 out, not counting the soup in doublers and driver. An increase in output results from using filament lines, but he does not get the output that W9BNX does from an oscillator alone. W8LXQ tells him, "That ain't nothin'—wait till you try to build a good receiver." The 132 Mc. mobile transmitter at WGAR has been cleaned up but receiver troubles came up too, partly the result of running the r.f. stage on the a.v.c. voltage which dropped the gain and ruined the signal-to-set-noise ratio. A 956 mixer converter turned out to have 15 db less gain than an r.f. and mixer combination which also used acorn tubes. The hiss and gain problems were solved by using an acorn preselector in front of the mixer. R-meters were calibrated by running the mobile unit out to where the meter was R9 with 150 watts in the transmitter. The input was then reduced to 37 watts and the new R-meter position was marked R8. Then with 150 watts again the mobile unit went on until the receiver meter was at

[*Continued on Page 91*]



## What's New in Radio

[*Continued from Page 66*]

adjustment during manufacture. The frequency range is 540 to 2000 kc. In the G19 the crystal is clamped, and the frequency range is 1800 to 8000 kc. A small metal knob, welded to the top of the G19, facilitates the removal of the holder from the socket.

Insulation within the G18 and G19 units is provided by glazed low-loss ceramic material. Both units fit standard octal sockets.

X-ray orientation, employed in the manufacture of these crystals at the General Electric crystal laboratory in Schenectady, makes it possible to produce crystals whose frequency remains constant to less than 0.0001 per cent per degree Centigrade temperature change.

### NEW UNIVERSAL MICROPHONE

Universal Microphone Co., Inglewood, Cal., this month started to distribute its new line of handi-mikes for portable field use, especially for small transmitters, sound trucks, call systems, sports events and other points where clear reproduction unit and close talking is required.

It is made in polished chrome finish with snap switch and balanced grip. The overall length is eight inches, a packed weight of slightly more than a pound, and the assembly includes six feet of flexible cord.

### CRYSTAL UNIT FOR AMATEUR FREQUENCY STANDARDS

A new 1000-kc. crystal unit, Type G18A, for use in amateur frequency standards has been announced by General Electric. It has a temperature range of +10 degrees to +45 degrees centigrade and a temperature coefficient over that range of .0001 per cent per degree C.

Employing the same hermetically sealed, metal-tube type construction as that which houses G-E crystal units for broadcast stations, the unit is immune to atmospheric effects such as dust, dirt, fumes, and moisture.

When used in recommended circuits, the G18A can be installed as shipped from the factory and adjusted to zero beat against standard transmissions such as those from WWV, standards station at Washington, by means of a small capacitor shunted across the crystal.

### WAVE METER

A new wave meter primarily intended for identifying the various amateur bands has been recently introduced by Bud Radio, Inc., of Cleveland, Ohio. This wave meter is particularly intended for adjusting the various stages of a transmitter to the desired wavelength. It consists of an accurately calibrated coil and condenser combination together with a suitable pilot bulb for resonance indication, and band switching is employed enabling the unit to cover all amateur bands from 10 to 160 meters. Calibration is indicated on an attractive etched nameplate, and the case of the unit is finished in attractive grey crackle. More complete information is available by writing the manufacturer.

### COMPACT NEUTRALIZING CONDENSERS

The increased tendency in the design of r.f. amplifiers towards compactness and the elimination of large and bulky parts has created a need for transmitting components of small size. In keeping with this trend and in order to fill the need for neutralizing condensers of small physical size, Bud Radio Inc., of Cleveland, Ohio, has introduced a new line of Compact Neutralizing Condensers.

Three types are made in this new series. All are tubular in design and have a single hole for mounting. The capacity is adjusted by means of a small screw driver and may be locked at any desired setting.

No. NC-1928, using ceramic insulation, has a capacity range of .25 μμfd. to 4 μμfd. and is designed for use in stages operating with 1000 volts or less. It is particularly useful for neutralizing the various popular beam power tubes. No. NC-1929, using Lucite insulation, has a capacity range of .25 μμfd. to 4.75 μμfd. and is designed for use in stages operating at 2000 volts or less. No. NC-1930, using Lucite insulation, has a capacity range of 1 μμfd. to 9.5 μμfd. and is designed for use in stages operating at 3000 volts or less.

Further information on these items may be had by writing direct to Bud Radio Inc., Cleveland, Ohio.

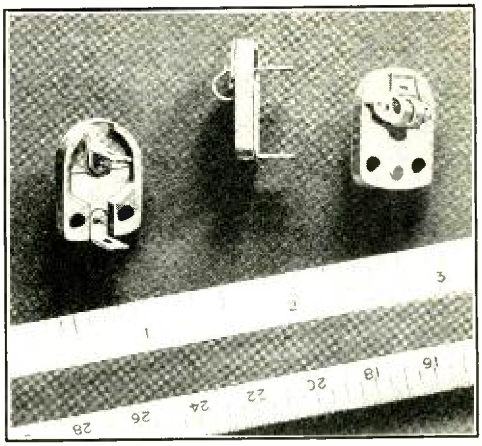
### STORAGE BATTERY FOR FLASHLIGHTS

A rechargeable flashlight battery similar in principle to the well-known automobile storage battery is announced by the Ideal Commutator Dresser Company, 4027 Park Avenue, Sycamore, Illinois.

An ingeniously arranged chamber and vent plus semi-fixation of the electrolyte makes it spill proof. The plates are over ¼″ thick and connected to terminals by reinforced electrodes so that the battery is rugged to withstand rough handling. The case is of transparent Lucite. All batteries are "use conditioned" at the factory. A small charger consisting of transformer and rectifier plates makes it easy to keep the battery always fully charged.

### CERAMIC TRIMMER CAPACITOR

Fixed plate bonded to the ceramic base, eliminating the usual variable air film. Variable plate rotates on a ground ceramic surface. Equally stable at all capacity adjustments. Provides negative temperature compensation



New Trimmer Condensers

of .0006 μμfd. μμfd./°C. Power factor less than 0.1%. Capacity change with humidity or temperature cycling less than 0.5%. Available capacity ranges 2 μμfd. to 6 μμfd., 3 μμfd. to 12 μμfd., 7 μμfd. to 30 μμfd., 60 μμfd. to 75 μμfd. Manufactured by Centralab, Milwaukee, Wis.

With the Experimenter

[*Continued from Page 52*]

the field strength meter will be helpful.

To facilitate antenna changes in my own installation I am using copper clips on the outside end of the feeder (both inner and outer conductors), on a short flexible lead from the bottom of the antenna, and on both ends of the loading coil.

## QRO WITH A BUG AND PRIMARY KEYING

By Dean C. Swan, Jr.,* W1BXC

The advantages of primary keying are well known to the amateur and its disadvantages are gradually being overcome by its enthusiastic users. One disadvantage of this system which has always proven to be a great annoyance to those who use a bug is the tendency of the contacts to stick together or "freeze." This tendency is evident even when relatively moderate power inputs are keyed, such as one or two hundred watts, and it is most unpleasant to be forced to stop in the middle of a word and pry apart a pair of "frozen" contacts.

Keying relays have been used by some amateurs to overcome this difficulty. The measure of success to be obtained by the use of a relay

*22 Marshall Street, Medford, Mass.

is largely governed by the amount of power to be keyed and the capabilities of the particular relay employed. Ingenious, home-made affairs and even some of the commercially-built relays which have been used for this purpose in the past have not been entirely adequate, although commercially-built relays of recent years give an improved performance. With heavy power inputs relays are difficult to adjust, may not stay in adjustment, may chatter, "freeze," or "act up" in other ways. They are likely to be rather noisy unless a modern "quieted" type is employed. They require some sort of power (other than that being keyed) by which to operate.

Fortunately there *is* another way to cope with this problem. Most of the trouble experienced when a bug is used for primary keying arises from welding together of the dot contacts. This condition may be partly alleviated by the use of extra large contacts, by the use of an extra large amount of spacing between the dot contacts, and by increasing the tension of the dot lever spring (as distinguished from the dot contact spring) on those bugs where such a spring adjustment is provided. These adjustments are not sufficient, however, in themselves, unless the current being keyed is quite low, to prevent sticking.

Such sticking *can* be entirely eliminated by providing your bug with a new dot contact spring, the object being, of course, to provide a much stronger spring—one strong enough to break the circuit before the contacts can weld together because of the heavy current.

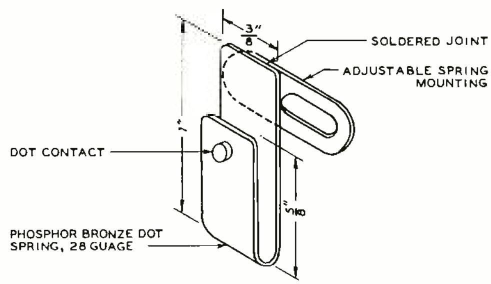
The amount of spring tension required will vary somewhat with the amount of power being keyed and the design of the plate transformer, but the spring illustrated, made from 28 gauge phosphor bronze, is guaranteed to cure even the most subborn cases of sticking of dot contacts. If such a strong spring is not required, due to lower current being used, the design may be modified.

The writer's bug is a Vibroplex, model 6. The steel dot contact spring which was supplied with the bug was removed from its small, slotted mounting by the use of pliers—one pair in each hand. If this causes you to shudder, and you think you might like to preserve the steel spring, you can construct your new spring so that it will fit directly over the threaded, screw mounting which projects from the dot lever. You can also slot the spring for the sake of adjustment.

The constructor of one of these springs should be warned, at this point, against attempting to solder the dot contact to the spring. The chances are, if he does so, that the contact will fall off after a relatively short period of use, since there is not sufficient metal to conduct away fast enough the heat generated at the contacts by the high current. The best method, perhaps, is to bore a hole in the spring and use the type of contact which may be riveted to the spring before it is bent into its "U" shape. The other three contacts on the bug may be replaced, when this becomes necessary, with home-made coin silver contacts which may be soldered to their mountings, as the heat conductivity at these points is good.

If sufficient spacing and spring tension is used at the dash contacts of the bug, no trouble will be encountered because of sticking at the dash contacts.

Those who do not wish to be bothered with the construction of a dot contact spring may obtain one almost "tailor-made" for the purpose (with a nice tungsten contact all in place) from their local automobile parts store. Ask for the coil points of the vibrator assembly supplied for Ford spark coils. The writer recently obtained a supply of these assemblies (marked for Model "T" Ford cars), at five cents per assembly, at a local auto store. Thus two good tungsten (much better for our purpose than silver) contacts were obtained, in addition to the spring, for only five cents. The brass spring furnished is the one to be used. Simply remove this from the piece of metal on which it is mounted, by punching out the rivets, slot the end opposite to the end on which the contact is mounted (to provide for adjustment of the position of the contact in relation to the fixed contact on the bug with which it is to work), bend into the proper shape, and it is ready for use. It may be necessary to use washers between the spring and the lever of the bug to provide additional adjustment.




Line drawing of the improved dot lever spring which allows primary keying of high power inputs without sticking.

The other spring furnished with the assembly could also probably be used, together with its contact, if the steel were properly treated before bending so that it could be bent into the desired shape. Without treatment it will break before the desired shape is achieved. However, if you break this spring, the contact may still be used, as a replacement, on a spring one has constructed or purchased, by cutting out a small piece, approximately 3/8" by 1/2", of the steel spring around the mounted contact. This small piece of steel, with the contact mounted on it, if fastened by a reasonably good soldering job, will not come off, because of the added heat conductivity afforded.

The writer also purchased (at seven cents per pair) a pair of over-size tungsten contacts, intended for an automobile distributor, one of which contacts was mounted on a short screw. This type of mounted contact may be used as a replacement for the whole screw and contact assembly provided with most bugs for the stationary dot and dash contacts of the bug.

With such good tungsten contacts available, at such reasonable cost, the bug user need no longer be concerned with the old bugaboo about the high current of primary keying chewing up the contacts. The writer, for example, found that a pair of ordinary 1/8" silver contacts lasted approximately two years. Tungsten will last much longer than silver.

As to results: the writer regularly uses his bug to key inputs varying from 500 to 1200 watts (note for R.I.: the last two stages are primary keyed simultaneously) and he cannot remember the last time the dot contacts stuck—it was so long ago. This method has been in use for approximately two years without experiencing difficulties of any kind with it. Other amateurs who have tried it have had the same gratifying results. The reader may dispel any apprehension he may have as to any adverse action such a spring might have on the performance of the bug. It may be thought that, theoretically at least, the action of the bug would be more stiff. In actual practice this has not been found to be so and the sending of good code is limited by the operator's ability only. If the action *is* more stiff, it will not be enough so that it may be detected by an expert operator on the "receiving end," and the sending operator will not notice any difference in manipulating his bug.

## U. H. F.

[*Continued from Page 86*]

the new R8 point, etc. The R-meters are driven by a d.c. amplifier with the grid tied to the a.v.c. bus.

### W6IOJ and W6LFN Work 130 Miles

W6IOJ and W6LFN, both with 224-Mc. transceivers in their cars, and W6MYJ and W6QG, respectively in North Hollywood and Santa Ana, have been testing for several months with the idea of determining the greatest practical distance for reliable communication on 1¼. W6MYJ uses a 316-A, W6QG uses a pair of 35T's, and W6IOJ and W6LFN use the transceivers previously mentioned, with HY-615's. Both IOJ and LFN have worked QG in Santa Ana from the Hollywood Hills, a distance of about 35 miles, but the signals do not compare with the type signals obtained from two elevated mobile stations over the same distance. On August 18 a test was made from the Hollywood Hills to Mt. Soledad, San Diego, a distance of about 100 miles, and the signals were as good as the previous 35-mile elevated tests—W6IOJ and W6LFN participated. This contact was then lengthened by W6LFN moving south, and W6IOJ moved to the Ventura-Los Angeles County line at Santa Susana Pass making the distance about 130 miles. Signal strengths were somewhat poorer probably due to the poorer locations of both mobile stations.

### Last Minute Record

At the very last moment we received the following wire from W1AJJ:

W1AJJ ATOP MOUNT WASHINGTON TRANSMITTING ON 233 MEGACYCLES TALKED WITH W1COO EXETER WHO WAS ON FIVE METERS. BELIEVE THIS IS A NEW RECORD FOR A PORTABLE ONE AND ONE QUARTER TRANSMITTER. DISTANCE IS 90 ODD MILES SAME AS RECORD WITH FIXED TRANSMITTERS RECENTLY ESTABLISHED BY W1COO. TRANSMITTER USED HY75 OSCILLATOR WITH 20 WATTS INPUT MODULATED BY HY31Z REGARDS. VIN ULRICH AND ARTHUR CANN

While this is not strictly a new record since the 130-mile W6IOJ-W6LFN mobile contact was made almost a month previously (assuming that the W1COO-W1AJJ contact was made on the date of filing of the wire, September 8), it does constitute a new record for a contact between a fixed and a mobile station on 1¼ meters. (We assume that the 233 Mc. as shown in the wire was an error and the station was actually in the band.) It is a shame that the contact could not have been two-way, but a later air-mail letter tells that W1COO's 1¼-meter transmitter was temporarily indisposed, hence the return path for the contact was made on 56 Mc. The letter also says that the W1AJJ rig was vibrapack powered from the automobile storage battery.

### Plane Meet

About a dozen Chicago hams including six mobile units assisted in a model plane meet. W9PNV's rig was a 100 watt mobile 2½ meter job. He was reported as far away as Whiting, Indiana. George has been heard in Evanston but questions his receiver sensitivity because he is heard places that he cannot hear. The Chicago Suburban Radio Association is running a 2½ meter contest from August 16 to September 27. During the first few days, participants included W9AVE in Berwyn, PNV Riverside, NIL, LME in Forest Park, VCU Chicago, SIO in Oak Park, HVO Cicero. W9LLM in Downers Grove was reported to have worked Chicago. W9MNW has about the best receiver, using a debased 6J5, a coil of ten turns of wire on a ⅜ inch diameter, and dielectric tuning. Apparently, he has two fixed parallel metal plates that bring the receiver close to the edge of the 2½ meter band; when he slides a piece of glass between them, he gets 60 degree bandspread in covering the band. The low minimum capacity of this arrangement seems to account for so much inductance. Now if someone will sell him a foot or so of copper pipe and an acorn or HY615 tube, he won't need another thing but a good r.f. stage. Heh, heh! After that, about all we can spring on him is W9GFZ's arithmetic which proves that the signal-to-hiss ratio is reduced by regeneration, super or otherwise. GFZ is a strong advocate of one (or more) r.f. stages followed by a non-regenerative detector or mixer, for best signal-to-set-noise ratio.

W9PNV says that dairies and creamery supply houses have a lot of copper pipe available at scrap prices. It may be tinned, but that can be rubbed off.

W1JJR in Hartford has had four contacts on 2½, and three on 1¼ meters including one at 16 miles with W1KLJ in Bristol. In Waterbury, Conn., W1AIY has one transmitter on 224 Mc. for relaying signals from weather instruments and another rig on 227 megacycles for contacts. His 15 watts on an HK24 have been reported at 53 miles. This transmitter is mounted on the supports of a Yagi beam antenna that is rotated on casters in the attic.

In Chicago, W9YDV who is chairman of the Chicago Area Radio Council, is getting on 2½ with a pair of 76's as described in RADIO a while back.

W3EIS is in Alexandria, Virginia, near Washington. He has 50 watts xtal on 112 megacycles, working a dozen or so stations. W3RL reported him from 22 miles away but best contact is Takoma Park, Maryland, 13½ miles. He reports considerable activity in Baltimore but no contacts yet. Also, Don has 36 watts on a 316-A on 224 megacycles. He was heard at Takoma Park and worked W3FQB, 8½ miles, for his best dx. Mobile equipment is expected to expand these ranges.

More reports of developments on these more-ultra-high frequencies, and some pictures of equipment would come in handy. Now is the time for all hands to blast away and get the whole dx gang down on these bands where they can still get the thrill of accomplishment.



### Calls Heard

The gang has requested a list of calls heard and worked, so that everyone can get an idea of what others are doing. This year, the smaller number of reports permits it, whereas in 1938 there was just room to list the calls of the numerous reporting stations on each date that the band opened! Still, openings have been reported on about 70 days out of 100. W1DEI reports openings on May 16, June 10, 11 and 21 without details, though none of these dates were otherwise reported open to this column. Some reports for July 23 are given above and will not be repeated in this list:

### April—May

*April 30—W4FBH:* W4EDD FLH. *W9WWH:* W4EDD.

*May 1*—exclusive of reports in the July issue: *W4FBH:* W1DEI EKT EYM GJZ HXP INJ IUI JLK JNC JQA LKJ LKM LLL LPF LSN W2COT GHV KLZ W3AIR CRT GYG IBQ W5VV W8FYC OLX. *W5VV:* W4QN FLH FBH EDD. *W6QLZ:* W5VV. *W8NKJ:* W4EDD DRZ FLH. *W9WWH:* W1BRB W4EDD DRZ.

*May 2—W4FBH:* W8RFW RKE TCX W9AZE DTP DWU GGH HAQ IZQ USI VHG. *W5VV:* W9CBJ ZHB RGH WIV. *W6QLZ:* W5VV. *W9WWH:* W1DJ LLL W2KLO MO BZB W3BZJ RL W4AUU FTM FBH W5AJG. *W9ZUL:* W1LLL W2GHV FHJ W4AUU MV W5AJG EHM.

*May 3—W6QLZ:* W5VV.

*May 4—W4FBH:* W1CLH DEI HDQ MDN W8FYC OKC PKJ. *W6QLZ:* W5VV.

*May 5—W6QLZ:* W5VV. *W9ZUL:* W1IZY.

*May 6—W4FBH:* W1DEI. *W6QLZ:* W5VV.

*May 11—W5VV:* W9QNG CLH WAL. *W9ZUL:* W5VV.

*May 12—W5VV:* W9GHW. *W6QLZ:* W5VV. *W9VWU:* W6QLZ.

*May 17—W4FBH:* W8PKJ CIR AFO (Harmonic working W4FGR). *W9WWH:* W4AUU.

*May 18—W4FBH:* W5AJG on c.w. *W5VV:* W6OVK W9ARN. *W6QLZ:* W5VV. *W6OVK:* W5VV EEX. *W7EUI:* W6QG JTZ. *W7GBI:* weak signals.

*May 19—W6QLZ:* W6EOV also mobiles near Sacramento. *W9WWH:* W1CLH LLL W4FLH.

*May 21—W4FBH:* W1HDQ W2TP W3DOV W9GHW SQE VWU. *W5VV:* received a heard card. *W9SQE:* W4EDD. *W9WWH:* W4AUU.

*May 26—W7DYD:* W6QG. *W7EUI:* W6QG.

*May 27—W5AJG:* W6QLZ W8RUE CIR FXM QDU. *W6QLZ:* W5AJG EHM AFX W9ZJB ZHB. *W9ZJB:* W6QLZ.

*May 29*—W5VV received a heard card. *W7GBI:* W6QG. *W9ZJB:* W3BYF W8NED NOR OLX.

*May 30—W5AJG:* W8UOS RKE QQS. *W5VV* received a heard card.

*May 31—W9ZJB:* W9RBK. *W9RBK:* W9ZJB.

### June

*June 1—W5VV:* W8CIR W9ZHB WIV SQE. *W9IZQ:* W4FBH AUU MV EQM. *W9SQE:* W5AJG VV. *W9WWH:* W4AUU EQM. *W9ZJB:* W4FRF (harmonic) W5FKG (harmonics).

*June 2—W5VV:* no signals in 12 hours.

*W6QLZ:* W5AFX EHZ W9VAV ZD WHG (VHG?) YKX. *W7GBI:* W5AFX.

*June 3—W5VV:* W4EQK W9GHW NKW. *W6QLZ:* W4EQK W5DXB VV W9VWU.

*June 4—W2LAL:* W4AUU FRF W5AJG W9ZJB. *W9YKX:* W3RL W4AUU FBH FKN MV W6OVK W9AQQ RBK. *W6OVK:* W5BHO EEX AJG W7FDJ. *W5AJG:* (12:45 a.m.) W8QQS TIU. In late morning, W3RL W8NOR QA TIU W9DWU GHG. Night, W1AVV W2AMJ CVF TP HWX CUZ HEJ W3HOH DI AIR GQS W6QLZ OVK W8CIR NYD NOJ NBV FHA VO BJG RV NKJ KQC PKJ JLQ NOR RUE CMS W9AQQ. *W5VV:* W8QQS KQC JLQ NKJ LZN NZ RFW VO W9UJE QCY. *W6QLZ:* W5AJG EEX W6GBN W7FDJ W9VWU. *W8OKC:* W9ZJB. *W9PKD:* W8LZM QA VO KQC CIR NYD RKE W9AB QCY ARN ZHT (ZHB?). *W9ZUL:* W5BHO EEX BCX W9CLN. *W9ZJB:* W2GHV TP HEJ AMJ W3HDC BKB RL W4EQM AUU W6QLZ W8FHA OUJ GU JLQ CIR RKE QFX VO QA DAL W9QCY AQQ.

*June 6—W6QLZ:* W9ZJB. *W9ZJB:* W6QLZ.

*June 8—W5AJG:* W4FLH W6QLZ W8QQS QDU W9AZE. *W6OVK:* W9ZJB. *W6QLZ:* W4CSU W5AJG W9ZJB. *W9ZJB:* W1KTF W2TP AMJ HEJ HWX HGU CUZ W3HKM HDJ CUD HOH DI W8RUE. *W2AMJ:* W4FLH.

*June 9—W5VV:* W5EHM W4AUU W9WAL EET ZHB GHW AHZ ZJB. *W9IZQ:* W4FLH W5EEX "FN1." *W9ZJB:* W4FLH EDD W5EEX VV. *W5EEX:* W9CLH.

*June 12—W9YKX:* W3BZ RL W4EDD W8KWI QKI NKJ OLX QDU QQS W9CHI. *W6QLZ:* W9ZJB WAL GHW NKW. *W8NKJ:* W1LSN. *W9ZJB:* W5IHT W6QLZ.

*June 13—W2LAL:* W4EDD FLH. *W5AJG:* W1DEI W2AMJ TP W3RL BYF BKB W4FLH W8NKJ FXM TIU RUE BJG QFX QGZ PWM UBA QDU CVQ QQS CIR SLU NOR MST AOC JLQ TT OTV QA PZM REU UOS TWL W9YLV ARN CBJ IVQ HAQ ZHB CLH GGH CEZ. *W5VV:* W4EDD FLH W8NKJ QA PZM RKE RFW W9BDL LF ZHB CEZ GGH. *W6QLZ:* W8CIR. *W8NKJ:* W4FLH GRN W5AJG VV EHM W9VWU ZJB CLN YKX QPK CHI. *W8OKC:* W9USH ZJB. *W9IZQ:* W5AJG EHM. *W9PKD:* W3RL W8NKJ BJG CVQ W9ZJB. *W9WWH:* W4FDN W5EHM AJG VV. *W9ZJB:* W1GJZ DEI W2AMJ W3IDS FDN BYF BKB W5EIN W8OLX GIR TIU BJG QGZ NKZ CVQ UOS QQS RUE NED CIR/8 MST RH W9ZQS.

*June 16—W9YKX:* W5VV. *W3RL:* W4EQM W5EEX BHO VV EHM AJG. *W5AJG:* W2MO W3DI GIO BKB BZJ HKM W8NKJ NYD TT ANN RV CLS EOU QDU SAH QA PIL NED RUE W9AQQ RBK. *W5VV:* W8SLU QDU QQS NKJ JLQ W9IZQ ZHB ZUL MXK YKX



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DWU. *W6QLZ:* W9VWU AHZ FKU HAQ ZHB. *W8NKJ:* W5EHM AJG VV DXB EEX. *W9IZQ:* W5VV. *W9WWH:* W4EQM W5AJG. *W9ZUL:* W4FRF AUU EQM W5DXB VV FNQ.

*June 17—W5VV:* W9ZHB. *W6QLZ:* W9VWU QPK.

*June 18—W5AJG:* W1AVV W2AMJ TP HGU W3BKB RL FJ W8RUE MST. *W9ZJB:* W3BZJ W8NOJ GU.

*June 19—W5AJG:* W3RL HOH BJZ W8QQS W9ZHB ZQC USH. *W5VV:* W9BDL KZL. *W8OKC:* W9IZQ. *W9IZQ:* W1LLL HDQ JNX GJV W2AMJ W3AIR HOH W5EHM. *W9WWH:* W1KLJ JDV DEI COO DJE JLK W2TP AMJ W5EHM.

*June 20—W2LAL:* W4FBH. *W5AJG:* W3RL W4ELZ W8PIL MST RUE CLS W9CEZ. *W5VV:* W1DEI KTF W2GHV W8CIR RUE PIL QA. *W2GHV:* W5VV. *W3RL:* W5VV. *W8NKJ:* W4FLH. W5VY. *W9ZHB:* W4ELZ FLH AUU BBR.

*June 23—W6QLZ:* W9ZQC USH. *W7GBI:* W9AHZ ZJB. *W9USH:* W7ACD GBI. *W9ZJB:* W7ACD GBI.

*June 24—W9ZUL:* W3HKM. *W9ZJB:* W1JJR KLJ W2AMJ AYC working shorter skip.

*June 25—W9ZJB:* W3HWN HOH W8CLS.

*June 26—W5AJG:* W8MHM W9BKV ZQC USH. *W6QLZ:* W5IHT W9GHW WAL NYV TOQ USH.

*June 27—W2LAL:* W9AHZ ZJB GHW AQQ WWH OFL ZUL USH VJD. *W9ZUL:* W1DEI FKN SE LKM JQL LSN HM BHJ LTF HRP CK LPF BSU SI W2KLZ MO. *W5AJG:* W1KLJ HDQ KTF W2TP MO W3RL HDC HPD HOH W8PIL W9ZQC USH. *W5VV:* W8VO W9USH ZQC. *W7DYD:* W6QG. *W6QLZ:* W2? W3RL W8QQS PKJ? W9USH. *W8NKJ:* W1DEI W4EDD FLH W5EHM W9ZQC. *W8OKC:* W9HDQ ZHB OFL MQM VAV ZJB AZE. *W9IZQ:* W1KTF KPN KLJ BGE HDF JJR HDQ CCZ LLL W2AMJ GHV. *W9PKD:* W8QQS W9QCY LMX. *W9WWH:* W1BJE LKM SE CCZ HXP JJR FJN HM LTF BSU JNC LLL W2LAL KLZ. *W9ZJB:* W1LLL JJR KJC BKO KTF HDQ W2BYM MEU CVF LAL MO W8OKC FXM SLU RV.

*June 30—W5VV:* W9ZHB (loudest signal on any band). *W7DYD:* W6QG.

July

*July 1—W5AJG:* W6QLZ OVK SLO. *W6QLZ:* W5AJG.

*July 2—W2LAL:* W4AUU EQM W5DXB. *W5AJG:* W2GHV W8RFW QDU RKE JLQ FQV QUO ARF NYD QQS W9MQM ZHB ZUL QCY UIA DQU. *W6RPR:* W6QLZ. *W5VV:* W4FBH W6QLZ RPR W8CLS RKE JLQ QDU DAL W9ZHB UNS ZHL. *W6QLZ:* W5VV W6RPR W9ZJB. *W6OVK:* W5VV EEX W6RPR. *W8OKC:* W4FBH BBR? W5DXB. *W9WWH:* W5VV EHM FFP. *W9ZJB:* W3HDC W5EEX VV.

*July 3—W5AJG:* W8THZ EUH (harmonic) W9RBK. *W5VV:* W8DAL. *W6OVK:* W5EEX.

*July 4—W5AJG:* W4AUU.

*July 5—W5AJG:* W6QLZ W8NSS JLQ QDU W9AQQ RBK. *W7DYD:* W6QG. *W6QLZ:* W5AJG ALK W9TOQ NFM HAQ. *W9WWH:* W5EEX.

*July 6—W5AJG:* W2AMJ GHV W3HKM CUD GNA W8OMY KWL OLY/pm QFX TWL QXS NOJ RV CMS KQC. *W6QLZ:* W5ALH (ALK?) EHM.

*July 10—W6QLZ:* W9EET ZJB TOQ. *W6OVK:* W9TOQ ZJB. *W9ZJB:* W6OVK SLO.

*July 11—W5AJG:* W4EQM AUU W8LNW QA QUO FHA CVQ RKE QDU THZ W9HAQ NFM BJV ARN CJS MXK ZUL GHW LDK/p WWH VHG. *W9IZQ:* W5KLJ EHM AJG. *W9WWH:* W5AJG ALK EHM. *W9ZJB:* W5EEX.

*July 15—W9IZQ:* W3BZ W5AJG EHM EEL

EEX W6QLZ (this may be July 16). *W9ZUL:* W1JJR SI LSN.

*July 16—W5AJG:* W1HDQ AVV W2CUZ GHV BYM AMJ W3FQS HJQ BZ W8CIR NOR RUE FDA HKG QFX MYZ UJG. *W6QLZ:* W9YKX ZJB. *W9PKD:* W4EQM. *W6OVK:* W7HEA FDJ. *W9ZJB:* W4AUU W6QLZ.

*July 17—W5AJG:* W8CIR VO W9CLH HAQ. *W6QG:* W7FLQ HEA FDJ DYD (each W7 worked W6OVK QLZ etc. in Arizona). *W6LFN:* W7FLQ HEA. *W6QLZ:* W7HEA FDJ DYD FLQ. *W9ZJB:* W4AUU.

*July 18—W5AJG:* W9VHG. *W6QLZ:* W9ZJB ZHB EET NKW. *W6OVK:* W9ZJB. *W9ZJB:* W6QLZ PGO.

*July 20—W5AJG:* W8FDA TIL.

*July 22—W9USH:* W6QLZ (this appears to be July 23).

*July 23*—See text above for reports of *W5AJG W6QLZ W9SQE. W9WH ZUL. W2LAL:* W9CLH ZJB YKX ZHL Z5B WAL EET. *W6OVK:* W1DEI W5EHM W8OLX CIR W9EET ZJB. *W8OKC:* W5EHM W9ZHB HAQ ZHB YKX NFN WAL NKW ARN UWV (VWU?) DQH KCX. *W8PIK:* W9YKX VAV WAL ZJB NKW EET. *W9WAL:* W1LLL JJR. *W9EET:* W1DEI W2MO HEJ W3BYF AIR W4EDD W5BYV W6QLZ OVK KTJ PGO W7GBI W8NOR CIR W9WAL. *W9ZJB:* W1DEI KHL HDQ JIS W2BW W3BMT HWM BKB EEN HDC W5EHM BYV DXB ALK AJG W6QLZ OVK PGO W8OKC PIL FDA SDD RFW KWI UKC QDU BJG OMY W9GGH.

*July 24—W9WWH:* W1IHA JJR DEI SI W4GJO/1. *W8OKC:* W9TOQ ZJB. *W9ZJB:* W1KTF HDQ W2TP CGO W3HDJ.

*July 25—W5AJG:* W8CIR. *W9ZJB:* W3DBC.

*July 27—W5AJG:* W1HDQ W3CYW DBC W8RKE QUO AZZ LW NED TCX/8 TIL W9CLH VHG LMX MQM. *W8PIK:* W9ZJB TOQ. *W9ZJB:* W4AUU EQM W8QUO QQP MKG ARF LW QGU QA NYD W9LMX. *W9IZQ:* W4ELZ.

*July 28—W6QLZ:* W6CME DOU AHH IOJ. *W6OVK:* W6AHH DOU.

*July 30—W6QLZ:* W5AJG W9BJV ZQC. *W5AJG:* W1HDQ BJE W6QLZ W8CIR OKC RKE LPQ. *W8OKC:* W9VAV ZUI. NFN MQM EET GHW ZHB GMB? NYV CLH BJV AHZ.

*July 31—W5AJG:* W8CIR. *W6QLZ:* W5FSC EHM.

### August

*August 1—W6OVK:* W5EHM.

*August 4—W9ZJB* from midnight August 3: W1KLG W3BYF BZJ GNA W8SAH W9AHZ.

*August 8—W6OVK:* W5AJG EHM.

*August 12—W6OVK:* W7FDJ.

*August 13—W5AJG:* W9ZHB KZP NFM. *W8RUE:* W5EHM. *W9IZQ:* W4EQM. *W9ZJB:* W3GSX W8CIR PIL.

*August 16—W8RUE:* W5AFX EHM.

*August 18—W2LAL:* W9VAV NFM GHW BDL.

### New Books

[*Continued from Page 70*]

This valuable book contains information on many stock packs manufactured by Stancor. A wide assortment of filtered and non filtered packs are shown together with technical data and operating graphs on each.

In this catalog will be found packs for use in portable battery radios, to convert them for use on 115 volt a.c. 115 volt d.c. and 6 volt d.c. There are model railway packs, units designed to operate pin games, packs for auto radio demonstration work, time clock, etc. Other packs to be used in electro-plating, to operate telephones, for the operation of solenoids, etc. In fact, many uses will be suggested by the wealth of information contained in the book itself. Never before has there been as much interest in this type merchandise. New developments in the Radio Industry make them highly desirable for many applications, new processes and applications in the industrial field have created a demand for packs such as never before.

The catalogs are free of charge and may be obtained by writing to the Standard Transformer Corp., 1500 N. Halsted St., Chicago.

### Allied Releases New Greatly Enlarged Catalog

Allied Radio Corporation, Chicago, has just released a new 212-page radio catalog for 1941. Planned to include everything in radio, the new Allied Catalog is the largest and most complete in the history of the company. Direct color photography is used with striking effect. Eighty pages of rotogravure embody the latest techniques in photography and layout. Carefully arranged, this new 212-page catalog features each radio field in individual, clearly defined sections. Each section and each piece of radio equipment is precisely indexed for speedy reference.

A wide selection of amateur equipment is featured in the big 26-page amateur section, a catalog within a catalog. All of the latest and newest communication receivers are completely described, together with a large presentation of transmitter kits ranging in power from 10 watts to 100 watts. Complete listings of nationally known equipment lines with many new Amateur parts and hard-to-get items make this section a real equipment directory for all Amateurs.

The big special 40-page radio section introduces 83 new radios featuring new style plastic and wood table models, luxurious consoles, "Camera" and 3-way portables, newest 1941 low-cost phono-radios and phono-radio-recorder combinations, auto sets, record players and recording accessories.

In the big 35-page Public Address Section are featured 24 complete new Sound Systems of the latest 1941 design. There are systems ranging from 7 to 75 watts and incorporating many new features such as new illuminated panels and the exclusive "Safused" speaker development. Also listed in this section is a complete line of the latest P.A. accessories.

Of special interest to the Serviceman is the big 128-page section devoted to all the new test equipment and more than 15,000 quality Radio parts. There are sections devoted to photo-cell equipment, to bargains in brand new merchandise, and to the latest books, manuals, and literature.

A copy of this new 212-page Radio Catalog may be obtained free of charge from Allied Radio Corp., 833 W. Jackson Boulevard, Chicago, Illinois.

### Radio Builder's Handbook

A thoroughly revised edition of the Allied Radio Builder's Handbook has been released by the Allied Radio Corporation, Chicago, Illinois. This edition has been enlarged to include new diagrams and kits with complete data, plans, and parts lists for the construction of a wide variety of receivers, transmitters, amplifiers, and photo-cell equipment. The basic theory is clearly and simply presented and each section is fully illustrated with tables, charts, diagrams, and pictures. The book includes valuable information on amateur radio and serves as an excellent introduction to amateur receiving and transmitting. Copies may be secured by sending 10c to cover mailing and handling to Allied Radio Corporation, 833 W. Jackson Boulevard, Chicago.

●

A recent Associated Press item was headed by the code characters copied from a door in the girl's dormitory at New Jersey College which read, "Hello Toots."



## Changes of Address

**To become effective with The Next Issue must be RECEIVED at SANTA BARBARA by the 5th of this month**

●

Address labels are shipped to our mailers on that date. Remember: under U. S. postal laws, magazines sent to an old address are junked unless forwarding postage has been left in advance with the postmaster; unlike letters and cards, magazines are not forwarded either free or collect (except to addresses in the same city).

*Circulation Department*

# 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.

### HAMMERSCHMIDT 150-WATT C. W. TRANSMITTER

Page 26

$C_1$—Bud MC-905
$C_2$—Bud MC-908
$C_3$—Johnson 100FD20
$C_4$—Mallory TP410
$C_5$—Aerovox 1468
$C_6$, $C_7$—Aerovox 1450
$C_8$—Aerovox 1652
NC—Millen 15002
$R_1$, $R_2$, $R_5$—Aerovox 1094
$R_3$, $R_4$—Ohmite Brown Devil
$R_6$, $R_7$—Ohmite Dividohm
$S_1$—Centralab 2543
$J_1$, $J_2$, $J_3$—Yaxley 702
$RFC_1$—National R-100
$RFC_2$—National R-200
$T_1$—Stancor P-5014
$T_2$—Stancor P-3064
$M_1$, $M_2$—Triplett model 227-A
$P_1$, $P_2$—Drake 110-volt lights
Oscillator coil forms—Bud CF-126
Buffer coil forms—Bud CF-125 and Bud CF-594
Amplifier coils and base assembly—Barker and Williamson BVL

●

### MOYNAHAN FIXED-FREQUENCY RECEIVER

Page 36

Mica condensers—Aerovox 1467
Tubular condensers—Aerovox 684
Metal-cased condensers—Ampco
$C_{11}$, $C_{12}$—G.E. Pyranol
Half-watt resistors—IRC BT-½
$R_7$, $R_8$—Ohmite Brown Devil
$IFT_{1,2}$—National IFC
$L_1$, $L_2$—National FXT
X—Bliley LD-2
$T_1$—Thordarson T-70R62
Speaker—Wright-Decoster Nokoil

●

### NEWCOMER DEPT. MONITOR-AUDIO SOURCE

Page 60

$C_1$—Hammarlund IBT-70
$C_2$—Hammarlund SM-140
$C_3$—Solar MW-1216
$C_4$—Hammarlund SM-140
$C_5$—Solar MW-1218
$L_1$, $L_2$—Hammarlund SWK
RFC—Miller 2.5 Mh.
$T_1$—UTC S-11
"B" Battery—Burgess B-30
"A" Battery—Burgess 4-FH
Cabinet—Bud 993
Chassis—Bud 996

## Advertising Index

# 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.

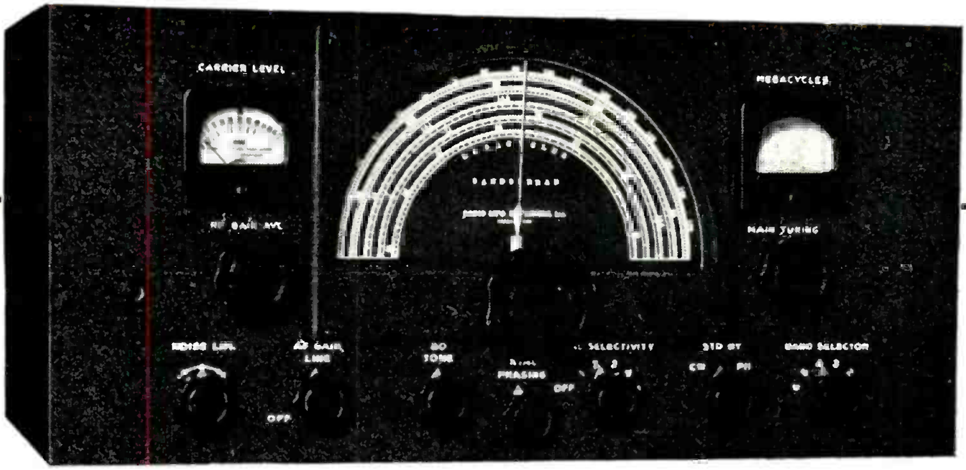
(d) No display permitted except capitals.

(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.




## NOW YOU SEE IT . . . . . . . . NOW YOU DON'T!

No, we're not playing the old shell game so popular when our fathers were boys . . . we're referring to the new RME-99 communications receiver as pictured above.

It's a great communications receiver with all the features so desired by the amateur operator. In fact, you may bet a thousand-to-one that the ham who owns one of these receivers has, without a doubt, the last word in high-quality performance.

But!—just as in the old shell game, things are not always what they seem. In the case of the new "99", for example, its extreme versatility in design makes it much more than a mere "one service" receiver. One moment you see a top notch amateur band model . . . the next moment, "faster than the eye can follow" it does duty as a dependable commercial unit of outstanding characteristics.

Not only that . . . this same chassis, with a few minor changes, is being ordered by high-frequency commercials . . . forest stations, foreign governments, aircraft interests, and the like . . . to be used in radio communication services where absolute reliability and accuracy MUST BE ADHERED TO, DAY IN AND DAY OUT, WITHOUT FAIL!

Why do you suppose these services choose RME? Why do you suppose "when all the chips are down" RME equipment is chosen?

The secret of this almost universal choice, by professionals, as well as amateurs, lies to a great extent in the high-geared make-up of the RME organization . . . an organization of:

- SOUND ENGINEERING PLUS WIDE EXPERIENCE IN THE DESIGN OF PRECISION RADIO APPARATUS
- CAREFUL CONSTRUCTION BY SEASONED EMPLOYEES
- RELIABILITY GAINED BY ALWAYS INCORPORATING PARTS OF HIGHEST QUALITY
- ADEQUATE FACILITIES FOR COMPLETE LABORATORY ANALYSIS
- AND A REPUTATION FOR FAIR DEALINGS COVERING YEARS OF ACTIVITY

For nearly a decade, amateur and professional operators have turned to RME for the fulfillment of their communication reception needs. Perhaps your own problems can be solved quickly and accurately, at a great savings, by our engineering laboratory. Why not make it a habit of consulting us first? Eliminate needless, blind searching for that next receiver for that special service!

Our literature describing a multitude of special equipment is available for the asking.

RME — TIME WILL TELL

*Fine Communications Equipment*

**RADIO MFG. ENGINEERS, Inc.**

**111 HARRISON ST. PEORIA, ILLINOIS**

# 5KW *Air-cooled!*


Hundreds of giant 891-R's and 892-R's in daily service in leading broadcast stations testify to the sound economy resulting from RCA's development of these popular Air-Cooled Transmitting Triodes. First costs are lower. Installation has been greatly simplified. Gone are all water-cooling problems. High output and long life make these tubes favorites for broadcast service.

All of which is interesting, but what, specifically, does it all mean to you as an amateur?

The answer is that it would be impossible to give you the amazing performance values inherent in the smaller RCA amateur tube types were it not for lessons learned in developing tubes of larger size or higher power for the world's most exacting commercial applications.

From anode to filament, from tube envelope evacuation to the avoidance of gas, the development of amateur tube types goes hand in hand with RCA commercial tube engineering. In every component part; in every phase of engineering and design; in every characteristic, your RCA Amateur Tube is a direct reflection of RCA's far-reaching participation in the most important commercial broadcast developments.

## Typical RCA Values

In no amateur tubes is RCA supremacy better illustrated than in the RCA-811 and 812—introduced only a few months ago, but already breaking all sales records. Thanks to the exclusive anode coating and other RCA features, these tubes set a new record for high-perveance, high-power tubes at unheard of low cost. 225 watts* input, only 6.5 to 8 watts driving power at $3.50 amateur net! Write for bulletin.

**ICAS (Intermittent Commercial and Amateur Service) class "C" telegraphy ratings.*

*Invest in Experience not Experiments... Buy RCA!*


RCA *Radio Tubes*

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