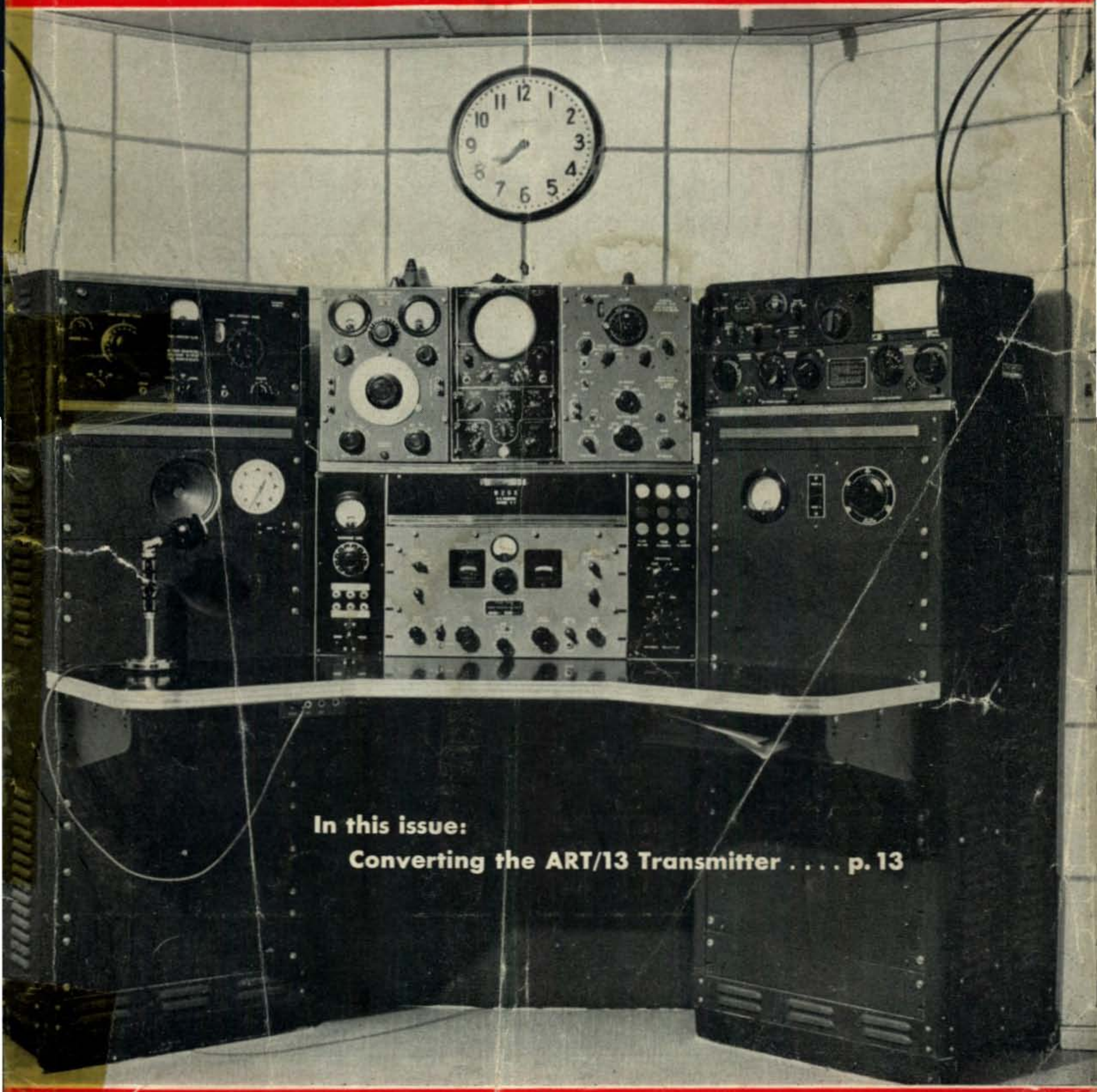
CQ

NOVEMBER, 1946

The Radio Amateurs' Journal

25¢



In this issue:

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Precision

the New RME 84

High In Quality - Low In Cost!

You'll find that the new RME 84 is a precision instrument — built to RME's rigid specifications of quality components and quality workmanship.

No low priced, "average" components are used anywhere in this instrument. The vernier bandspread scale, for instance, is operated integrally with the main scale indicator through a planetary drive mechanism, spring loaded to eliminate all backlash. This feature means accuracy and ease of tuning. What's more, you'll be delighted with the calibration — held to an accuracy of one-tenth of one per cent in the final test procedure.

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For portable operation, the RME 84 is a natural for those many field days to come.

Provision is made for connection to either a B battery and an A battery supply or a vibrapack. Drain on the B battery is only 22 mils at 135 volts, on the A but 1.2 amps.

To mention but a few of the other features there's a new series noise limiter that really works on cw as well as fone, sensitivity of two microvolts over the entire range, provision for doublet or single wire antenna, provision for an S meter, and a host of others.

You'll find that the RME 84 is full of pleasant surprises, the receiver in the lower priced field which will give you the most for your money.

Specification Sheet on Request

TIME WILL TELL

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FINE COMMUNICATIONS EQUIPMENT

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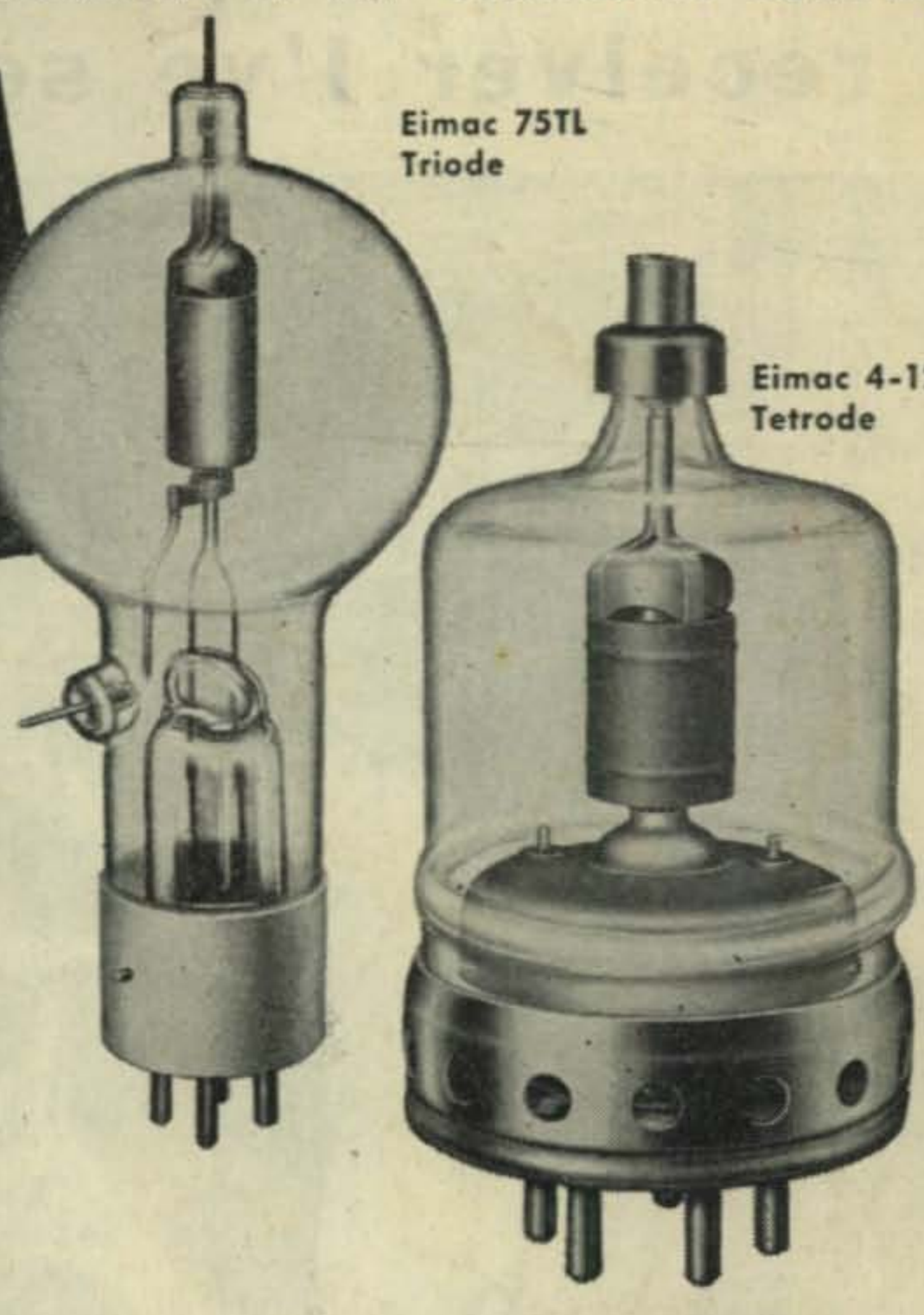
Eimac TUBES

THE COUNTERSIGN OF DEPENDABILITY IN ANY ELECTRONIC EQUIPMENT

½ Kilowatt on CW with the Collins 30K Transmitter

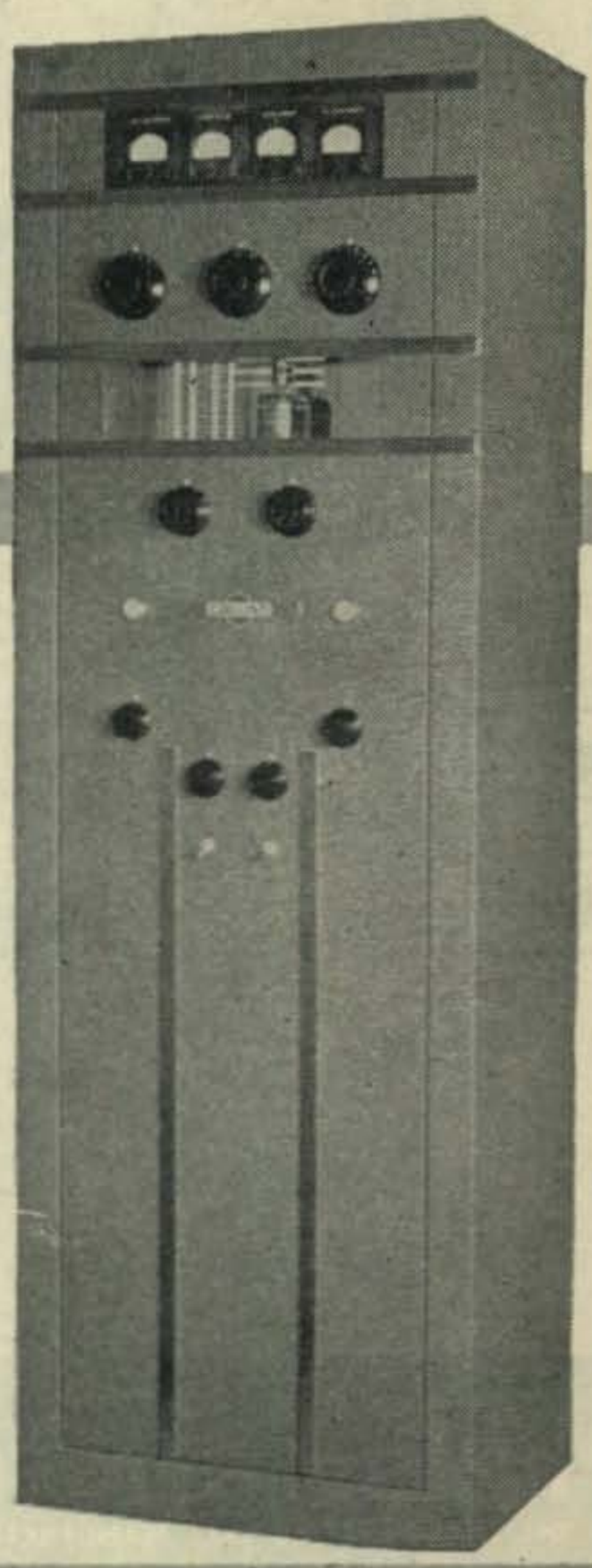


Eimac 75TL Triode

Eimac 4-125A Tetrode

ing a single Eimac 4-125A tetrode in the wer amplifier and a pair of Eimac 75TL's the modulator, this transmitter is designed r ½ Kw input on CW, 375 watts input on one. Vfo-controlled, it features 6-band eration, push-to-talk and band-switching, eak-in operation, speech-clipper, clean sharp ying, and is fully metered.

Be sure to investigate the Collins 30K transmitter; d remember—Eimac is first choice of leading elec- onics engineers throughout the world.



Follow the Leaders to Eimac TUBES

NATURALLY COLLINS CHOOSES EIMAC TUBES

Eimac's long-lasting 4-125A tetrode brings you maximum performance in *any* rig, with a minimum of worry about such bugaboos as neutralization, shielding, or driving power. For example, at 70 Mc, the 4-125A develops 375 watts with a driving power of less than 3 watts.

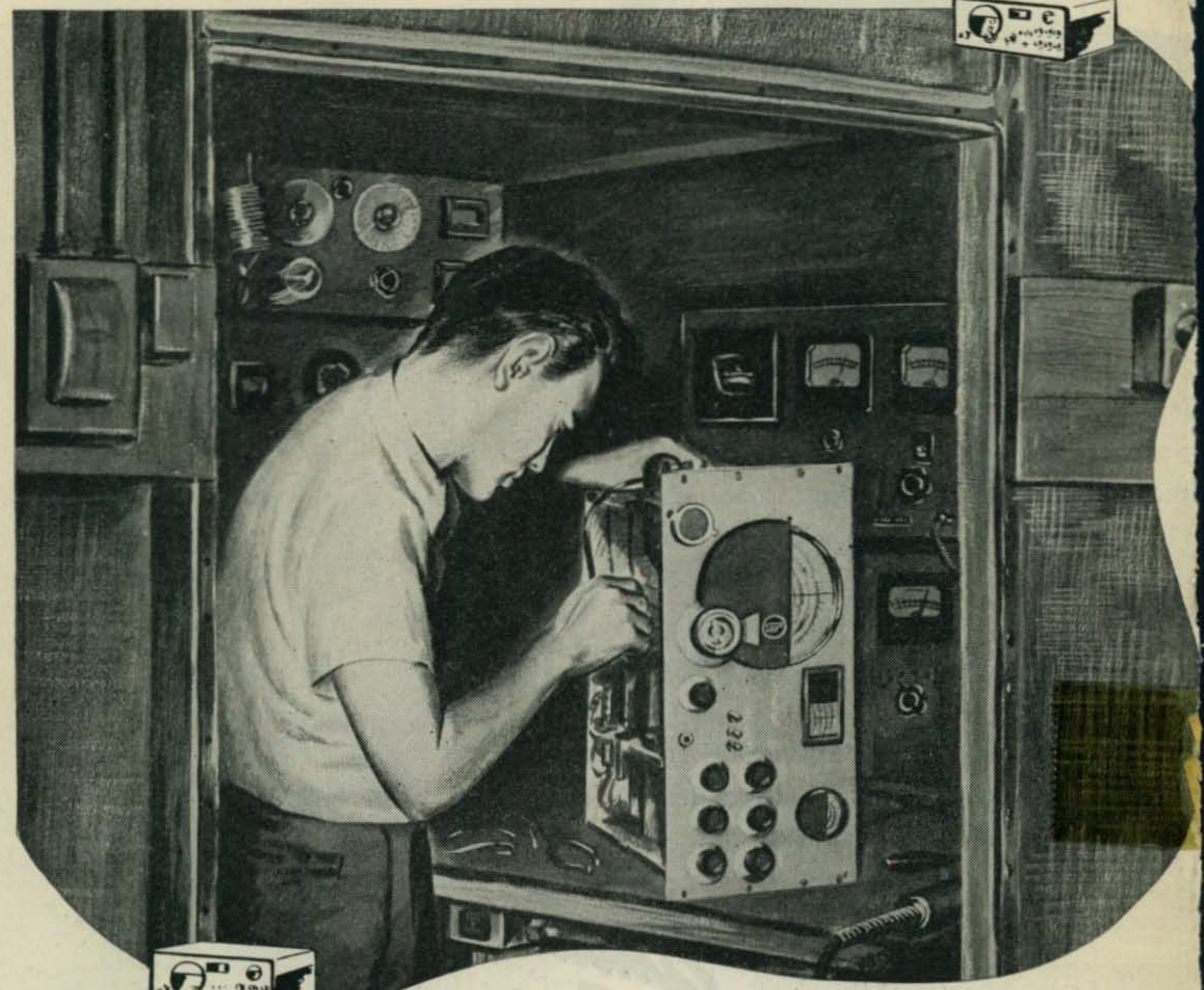
The pair of Eimac 75TL's used in the modulator provide high audio output at low plate voltage, and require a minimum of audio driving power.

Get specifications on these tubes direct from Eimac!

EITEL-McCULLOUGH, INC., 1291N San Mateo Avenue
San Bruno, California

Export Agents: Frazar and Hansen
301 Clay Street, San Francisco 11, California, U.S.A.

"The first real postwar receiver I've seen...."



Here come advance reports on Hallicrafters SX-42 *"The Model SX-42 is the first real postwar receiver I've seen."* That's a convincing piece of testimony. Out of the hundreds of postwar promises about new and better receivers, the Model SX-42 meets all demands for a new and improved kind of radio. Although no models are yet available for public distribution advance models of the SX-42 are under-going intense testing right now. All who have handled this remarkable piece of equipment have been impelled to remark on one or more of its features. The "42-file" at Hallicrafters is fast growing with testimonials and here are a few extracts of particular interest to hams:

"Signal to noise ratio unbelievable . . . ", ". . . its frequency coverage from 540 kc to 110 mc is amazing . . . " , ". . . its beautiful appearance is revolutionary in ham radio, I like its functional and practical design . . .", ". . . . on all bands I've heard stations I never heard before . . .", "I found the crystal action superb for cutting through QRM . . .", ". . . the calibrated 6 meter band opens up new DX possibilities with coming sun spot activities . . .", "I like the features of both AM and FM on 10 meters . . .", "Your new easy-on-the-eye green dial color is certainly appreciated after several hours on the air . . .".

That's just a hint of what's to come. Watch for the SX-42, wait for the SX-42 . . . . the radio man's radio . . . the radio that's remembered by the veteran . . . perferred by the amateur . . .

BUILDERS OF *Skyfone* AVIATION RADIOTELEPHONE

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CQ The Radio Amateurs' Journal

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Vol. 2, No. 11 NOVEMBER, 1946

COVER

Borrowing a leaf from commercial practices, W2GX is an outstanding example of good design and compact layout. So much of this station is of unusual interest that future articles will deal with many of the major components. Hams may recognize the BC-211 frequency meter converted into a primary standard, or the single dial transmitter using the frequency meter dial. W2GX's method of converting his ART/13 will be the basis for the second article on adapting this versatile aircraft transmitter to amateur radio.

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. . . Zero Bias . . .

Amateur Radio

Every dyed-in-the-wool amateur in the pursuit of his hobby has occasionally been faced with the problem of whether to work on the rig or spend some time with his family. Our own conscience is none too comfortable in recalling the few times the family won out. We don't propose to write a lengthy sermon on the subject—nor do we think the average ham would read it. But moderation in anything is desirable. Amateur radio is no exception. It is a wonderful hobby—we think the best in the world—but it shouldn't become a fetish to the extent of ignoring family, business, and non-radio friends. Just remember that amateur radio is a hobby.

Operating Techniques

With all the talk about poor operating habits, much of it justified, it is worth editorial comment to report some of the better things being said about the gang. Time after time we have heard amateurs tell a particularly rare piece of DX that they know many more stations are awaiting a contact, and then cut their own QSO short. Such thoughtfulness has given a DX contact to many a ham who would almost surely not have gotten it otherwise.

A letter from EL4A telling about the wonderful thing amateur radio has been to Americans stationed in Liberia also comments on the courtesy of the Americans, particularly the phone stations. EL4A has been keeping traffic schedules all over the country with great regularity because of this cooperation. One outstanding schedule has been with a chap in Michigan who is giving nightly reports to an expectant father whose offspring is due any day.

When we are critical of certain operating practices on the ham bands we are speaking about the conduct of a small minority group among licensed hams. The average amateur is, and will remain, a gentleman.

Chain System DX

Talking about operating practices brings to mind a number of letters commenting on the August discussion of DX techniques. We were griping about a good portion of the band opening up to call a DX station that has been asked to listen for some specific station. This group of letter writers contend that "chain system" DX isn't fair to the average operator. If a good catch is snagged by one of a group of DX'ers working together, it pretty well washes him up for most everyone else. The contention of the gang of DX men writing is simply this—so long as a DX station is in QSO, lay off! But when he signs SK, he is fair game for all. Otherwise if you don't get a DX station on his initial CQ, you don't get him at all. It makes good sense and we are inclined to agree with their logic, contrary to our August views. Of course, if there is a special reason for turning a DX station over, such as traffic, etc., the same rules of conduct should bind the DX hunters that would if the DX station were in QSO.

Editorial Errors

No publication can achieve perfection no matter how much care is exerted when it comes to type-set errors. That is especially true when working to meet a deadline. For some months now the editorial staff of CQ has been attempting to move the publication date forward so readers may have their copies around the first of the month. Now we are on a slightly better schedule and we have set up very careful steps to check and double check copy for technical accuracy as well as grammatical correctness. Every writer has his own style and we do not want to edit this to the point of creating one set pattern for our articles. We do promise our readers that no effort will be spared to keep errors of any sort to an absolute minimum.

Safety First

This month's editorial seems to be jumping from one topic to another so we might touch on another subject of concern to all amateurs. Safety is a habit with the careful amateur, but like most habits it has to be developed. New hams should start off on the right foot and spare no effort to make their stations foolproof. Interlocks should be used on cabinets and doors, high voltage should be carefully shielded, fuses and overload relays should be incorporated freely, and the proper respect for voltage, high or low, should be shown at all times. Another point, frequently overlooked, is a good ground of all gear. More than one tragic accident can be traced to this careless oversight on the part of an experienced amateur. In building new gear or cleaning up pre-war equipment the primary consideration should be to make the equipment as safe as possible.

SILVER

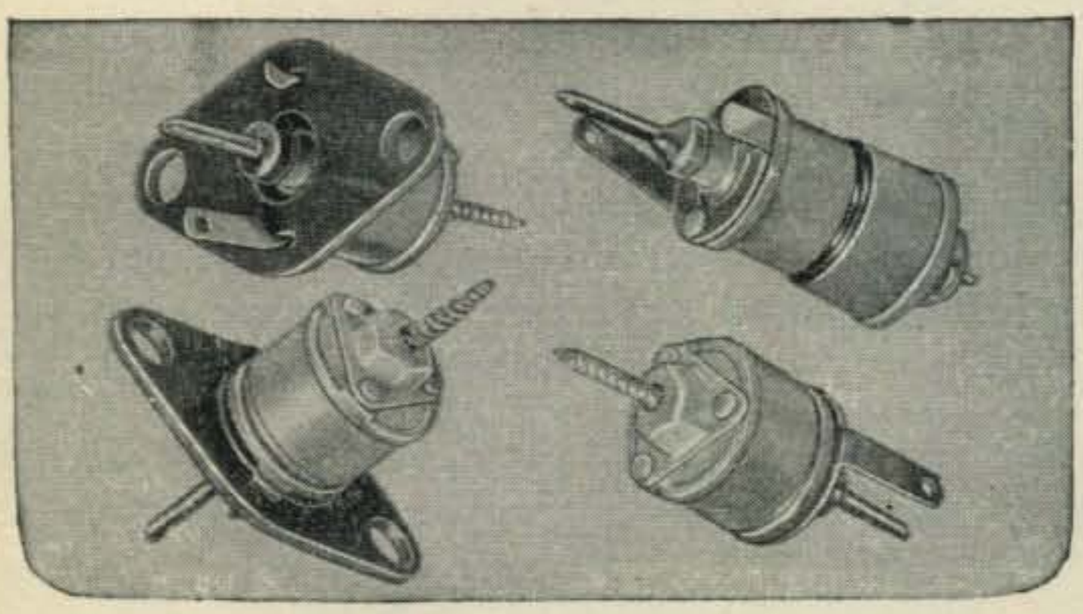
Announces-

"MODEL 800" RECEIVER

MODEL 800 • 144-148 and 235-240 mcs. U.H.F. receiver. E. P. Tilton's Feb. 1946 QST design modified to Byron Goodman's inductive r.f. tuning, built-in PM speaker, 88" band-spread, all in new "ATOM-X" construction. Factory built or kit for easy home construction, compact.

"MODEL 700" TRANSMITTER

MODEL 700 xtal controlled transmitter. 144-148 and 235-240 mcs. 6AQ5 Tritet drives 6C4 doubler, 6C4 doubler/tripler, 832 longline push-pull final. Built-in 14 watt 6AQ5 push-pull voice modulator. New "ATOM-X" construction, size only 5" x 10" x 5¼". Matches MODEL 800. Makes serious home-station or mobile rig. Factory built or kit.



HI-Q AIR CAPACITORS

Of unusually high-Q, extraordinary mechanical and electrical stability, easy of adjustment, small in size and useful to beyond 500 megacycles for trimming or tuning, a new air-dielectric capacitor is now available.

Less than one-half inch in diameter, less than 1-7/16" in length, SILVER Model 619 capacitor provides 3 to 30 mmfd. with air and high quality ceramic insulation. Rotor and stator are one piece, low inductance, multiple aluminum cups. Rotor meshing with stator gives a linear capacitance range of 27 mmfd. over three full rotations.

Produced at the famous Philips works in Holland, it is brought to American amateurs and experimenters. Price 30c each, net, at your favorite jobber.

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The Collins 32V-1 Ham-band Transmitter

You CAN take it with you!

The Collins 32V is the last word in compact, efficient, and versatile transmitters for amateur radio. It is small enough to set right on your operating desk. It is light enough to take anywhere—all you need to put it on the air are a 115 volt a-c power source, key or microphone, and an antenna. The 32V has more desirable features per cubic inch than any previous equipment.

For instance, compare these features with your desires: 150 watts input on CW, 120 watts on phone, v.f.o. control, band-switching, direct frequency reading dial, push to talk, clean keying, 6 bands. A pi network is included for output coupling—and it's easy to use. One control tunes the final and another control loads it into the antenna.

The v.f.o. is so accurate you'll be using it to calibrate your receiver. It's permeability tuned, and can be set to within 500 cycles on the 80 meter band. The overall accuracy and stability are within one dial division.

Be one of the first to own this brand new job. You'll be proud of its excellent performance and attractive appearance. Let us send you an illustrated bulletin with complete details.

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COLLINS

COLLINS RADIO COMPANY, CEDAR RAPIDS, IOWA

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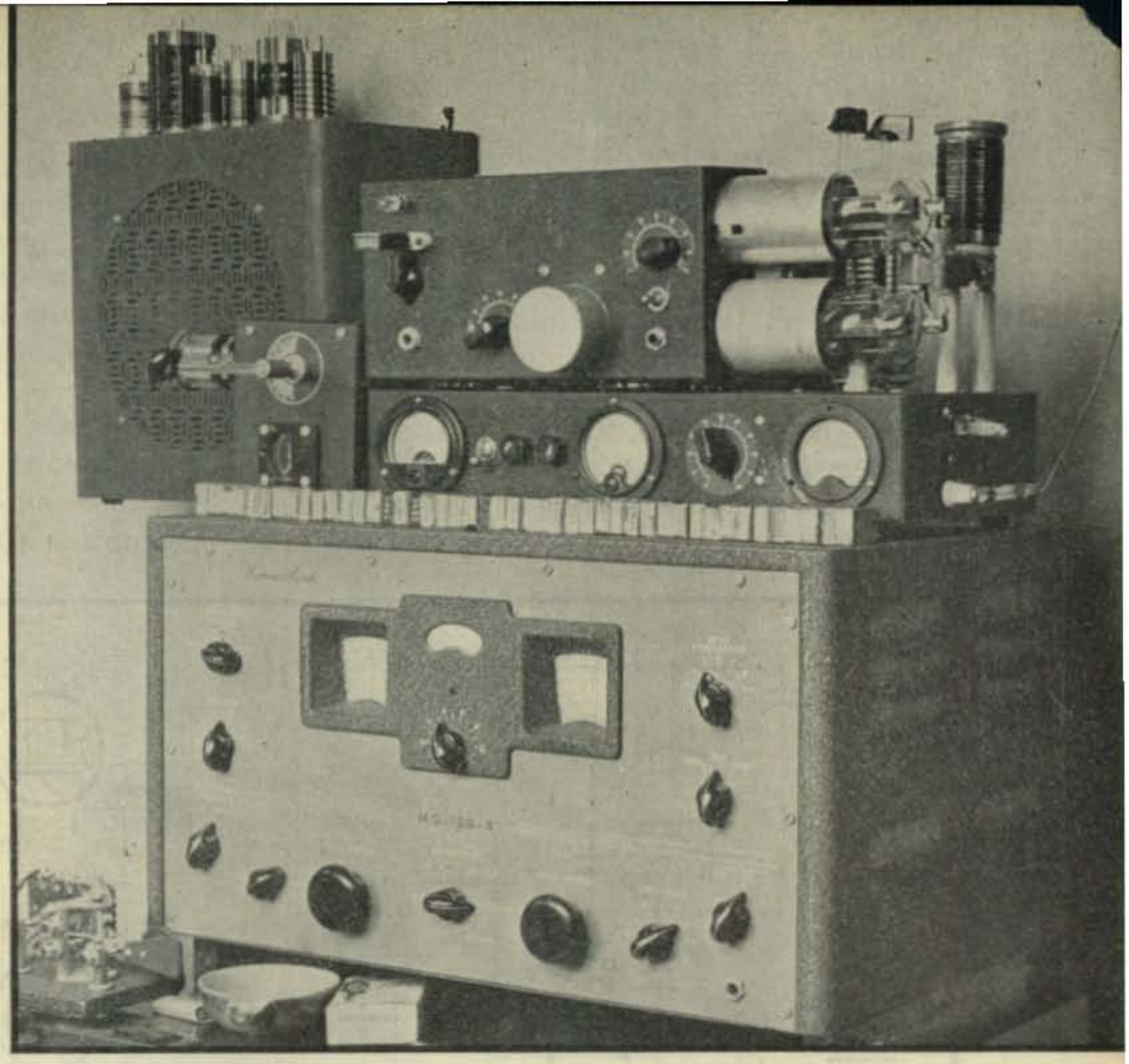


The complete home station for the displaced bachelor. With an 802 oscillator and a pair of 807s in parallel as a PA, the transmitter does not occupy the total space on top a communications receiver.

The Displaced Bachelor's Special

A three-band 125 watt c-w transmitter incorporating a novel turret type, plug-in mounting of two chassis.

PAT MILLER, W2AIS*

BEING A DISPLACED bachelor is no fun these days. Apartments for one are as welcome at realty offices as tables for one are in our overcrowded restaurants. However, this particular bachelor was lucky, for he found a twelve-by-fifteen footer on the top floor of a walkup in the Manhattan lower fifties. All went as well as could be expected in my bandbox until the 80-meter band opened up. Then, alas, the ole ham bug bit. I simply had to get on the air and work somebody. A study of the available space in my apartment brought to light only one spot—the top of the receiver. After a mental tussle of no small dimensions the transmitter described below was designed and now effectively pumps a little over 100 watts into the distant reaches of the globe.

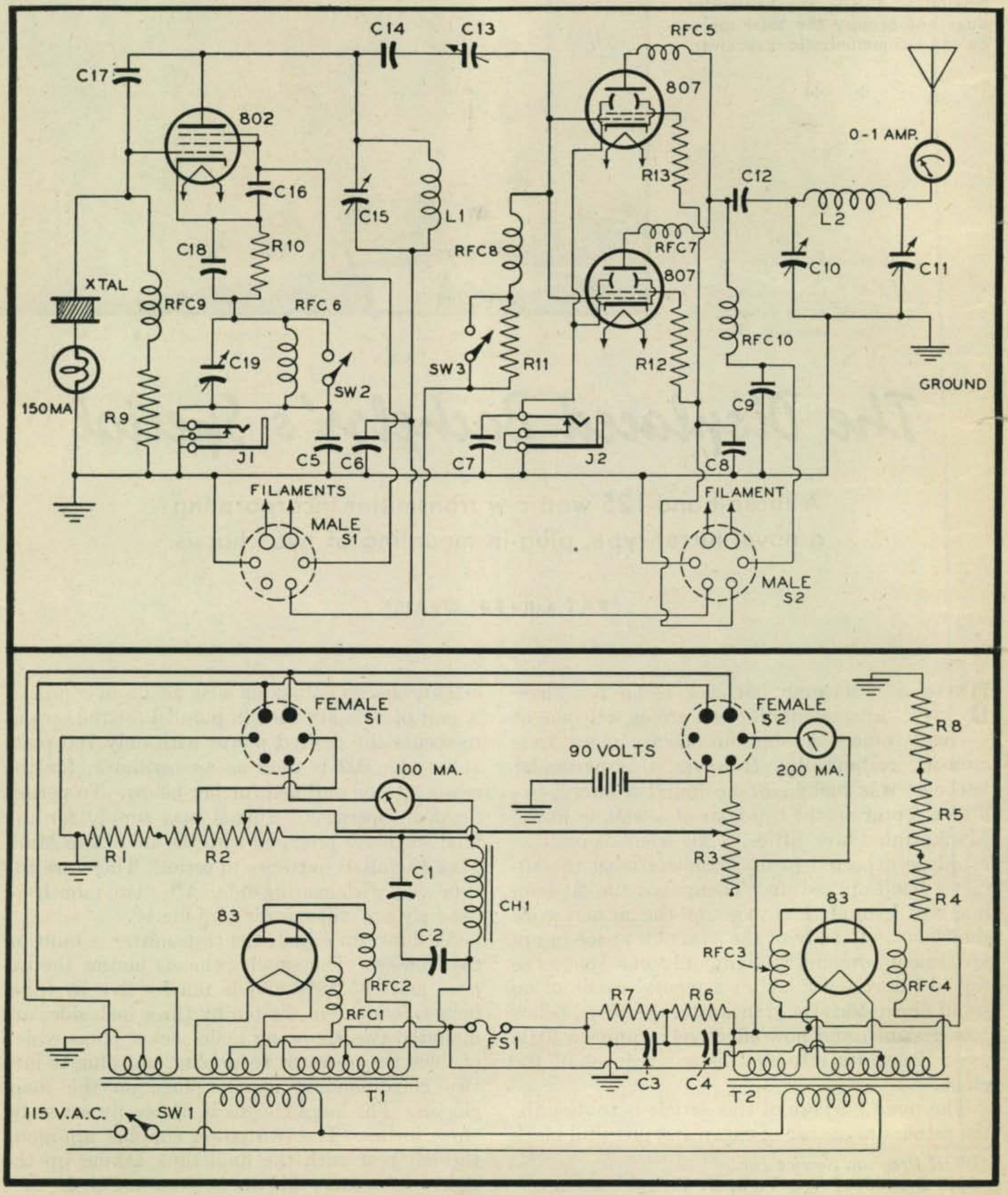
The main purpose of this article is to describe the rather unique use of cheap and plentiful black crackle chassis in making a rig neat and compact. A pair of 807s are used in parallel for the output to secure the desired power with only 700 plate volts. An 802 is used as an oscillator, for the reasons to be outlined further below. To permit break-in operation, a fixed bias supply for the final stage was prepared with the aid of two Mini-Max 45-volt B batteries in series. These are the type used with hearing aids. After two months of use they are still standing up nicely.

As shown in *Fig. 1*, the transmitter is built on two chassis. The smaller chassis houses the exciter and the 807s and is ten by five by three inches. On one of the ten by three inch sides are mounted two six-prong male socket plugs which enables the operator to unplug and plug it into two corresponding female plugs on the main chassis. The large chassis is fifteen by seven by three inches. The two power supplies are along the left rear with the final tank taking up the right rear corner; this can be seen in *Fig. 2*.

*WOR Program Service Inc.,
1440 Broadway, New York, N. Y.

Power Supply

The low voltage power supply is orthodox in every sense. It delivers 375 volts under full load conditions, and handles the filaments of all the tubes except the final 83 plate supply rectifier. Voltages for the 802 oscillator plate and screen, as well as the screens of the 807s, come from this supply. A 10,000-ohm, 100-watt resistor with sliding taps acts as a voltage divider. This resistor is in series with a 25,000-ohm, 25-watt fixed resistor, and acts as a bleeder. The screens of the 807s obtain their voltage from one of the taps on the 10,000-ohm resistor. The 5000-ohm variable resistor on the front panel is in series with this tap and acts as a variable source. This feature is very handy as it enables the operator to vary the screen voltage to the optimum point of efficiency. With the full 5000 ohms the plate current of the 807s at resonance is kept reasonably low. The suppressor and the screen grid of the 802 are tied together and obtain their voltage from the other tap on the 10,000-ohm resistor. The voltage to



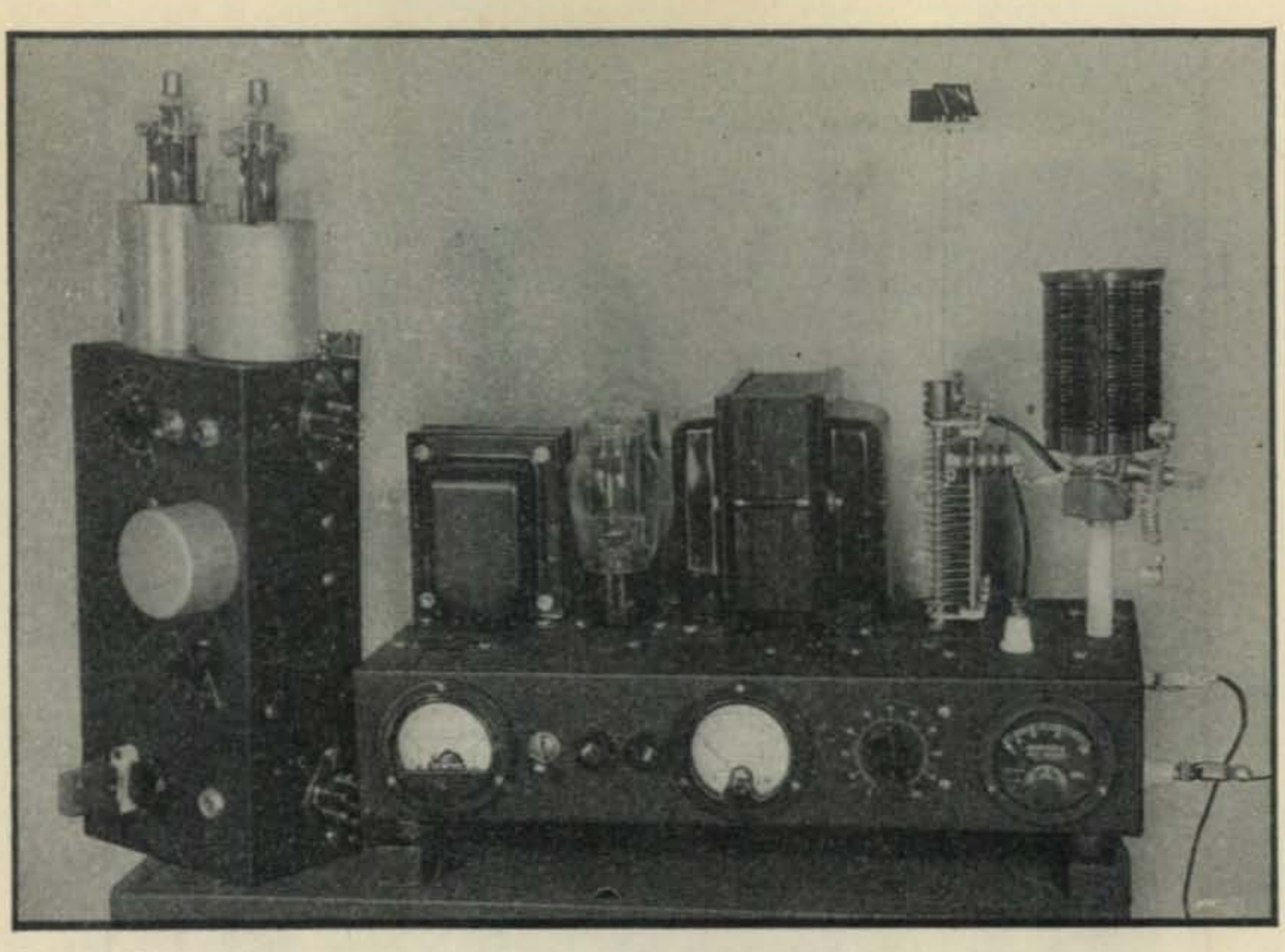


Fig. 1. The r-f stages unplugged from the power supply chassis showing the two six-prong sockets used for voltage connections. The left hand meter reads the oscillator plate current. The middle meter reads the plate current of the 807s and right hand meter reads antenna r-f current.

the screens of the 807s varies between 225 and 300 volts. The 802 screen has 250 volts impressed. The plate of the 802 has 375 volts. The filter choke is a small, 18-henry variety and the filter condensers are standard tubular electrolytics.

The voltage supply uses a Thordarson transformer giving 700 volts with a 200-ma load. Although the 83 type rectifier is not designed for this rating, no trouble has been experienced as yet. The only unorthodox departure is the failure to use a filter choke in this supply. The entire filter consists of a two 16-μf electrolytics in series, each shunted by a 500,000-ohm resistor to compensate for variations in condenser leakage thus assuring that the voltage is equally divided across each condenser. Three 10-watt, 25,000-ohm resistors in series act as a light duty bleeder. Because the 807 screen voltage is well filtered, it was found unnecessary to add the extra high voltage filter choke. This also saved approximately 40 volts for the final plates. The output of the high voltage supply varies from 850 volts with the bleeder load alone to 700 volts when 200 ma are drawn.

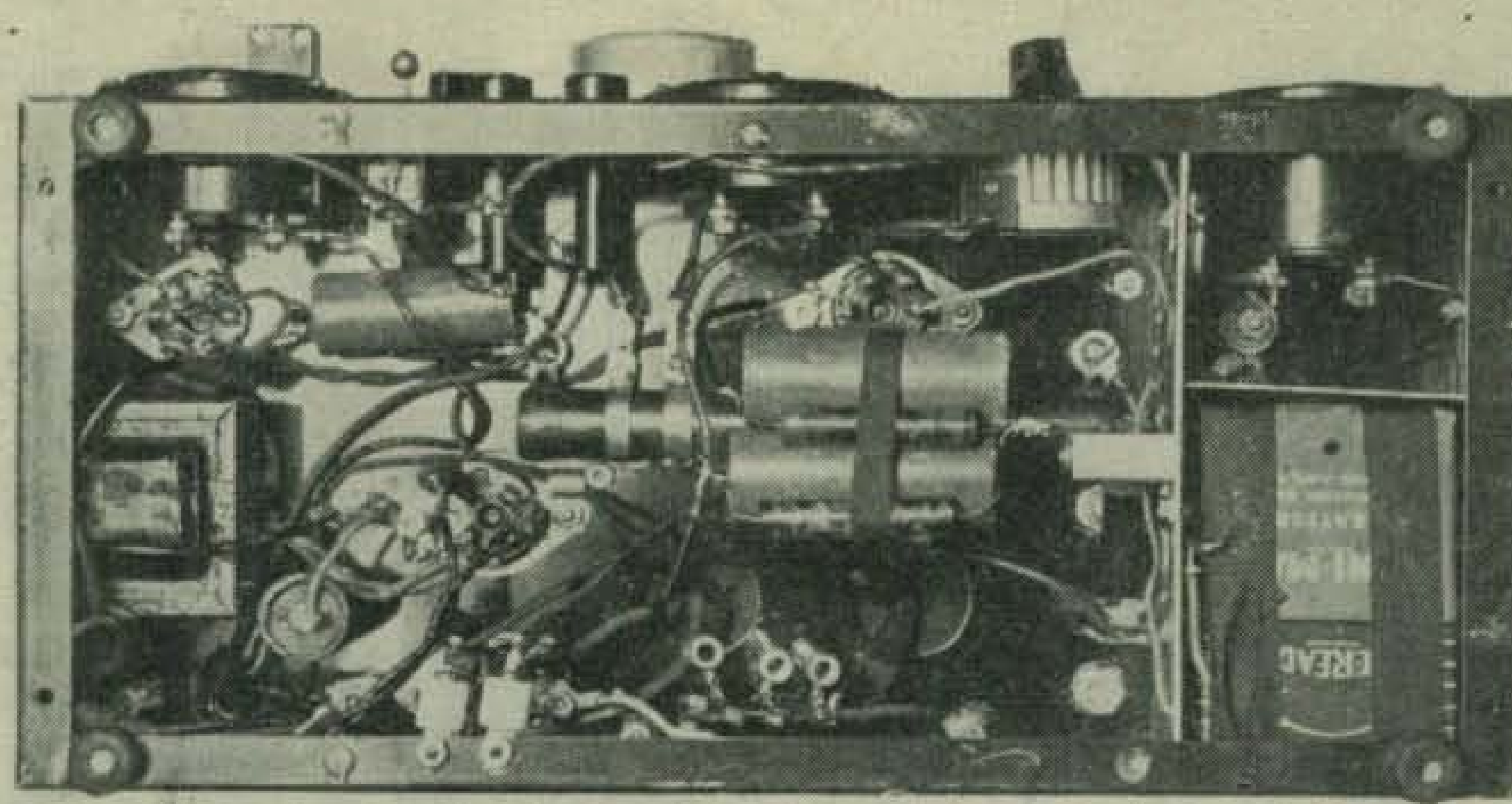
The Transmitter

The oscillator is a grid-plate feedback harmonic oscillator. Though an 802 is used, an 807 can be substituted. This type of oscillator has many advantages and one disadvantage. The pronounced disadvantage is the possibility of cracking your crystals. This would happen, however, only with inexperienced operators. For instance,

---

Parts List

C-1, C-2—8.0 μf, 450 v.
C-3, C-4—16.0 μf, 500 v.
C-5, C-6, C-7, C-8, C-14, C-16, C-18—.01 μf, 600 v. mica
C-9—.01 μf, 1250 v. mica
C-10, C-11—100 $\mu\mu$f, variable.
C-12—.01 μf, 2500 v. mica.
C-13—100 $\mu\mu$f, variable, Hammarlund APC midget.
C-15—50 $\mu\mu$f, variable, Hammarlund APC midget.
C-17—2 to 5 $\mu\mu$f, approx. 2 turns of hook-up wire twisted on end of feed-through insulator.
C-19—140 $\mu\mu$f, variable, Hammarlund APC midget.
CH-1—18 h., 125 ma
FS-1—0.25 amp. fuse.
J-1, J-2—closed circuit jacks.
R-1—25,000 ohms, 25 watts.
R-2—10,000 ohms, 100 watts.
R-3—5000 ohms, 25 watts, variable.
R-4, R-5, R-8—2,500 ohms, 10 watts.
R-6, R-7—250,000 ohms, 3 watts.
R-9—25,000 ohms, 3 watts.
R-10—500 ohms, 10 watts.
R-11—5000 ohms, 3 watts.
R-12, R-13—50 ohms, 1 watt.
RFC-1, RFC-2, RFC-3, RFC-4, RFC-6, RFC-8, RFC-9—2.5 mh r-f choke.
RFC-5, RFC-7—u-h-f parasitic choke. 8 turns No. 14 tinned, $\frac{3}{8}$" dia.
RFC-10—r-f choke, 250 ma rating.
S-1, S-2, S-3—SPST toggle switches.
T-1—power transformer, 800 v. c.t. at 100 ma, 5 v. at 3 amp., 6.3 v. at 5 amp.
T-2—power transformer, 1200 v. c.t. at 200 ma, 5 v. at 3 amp.



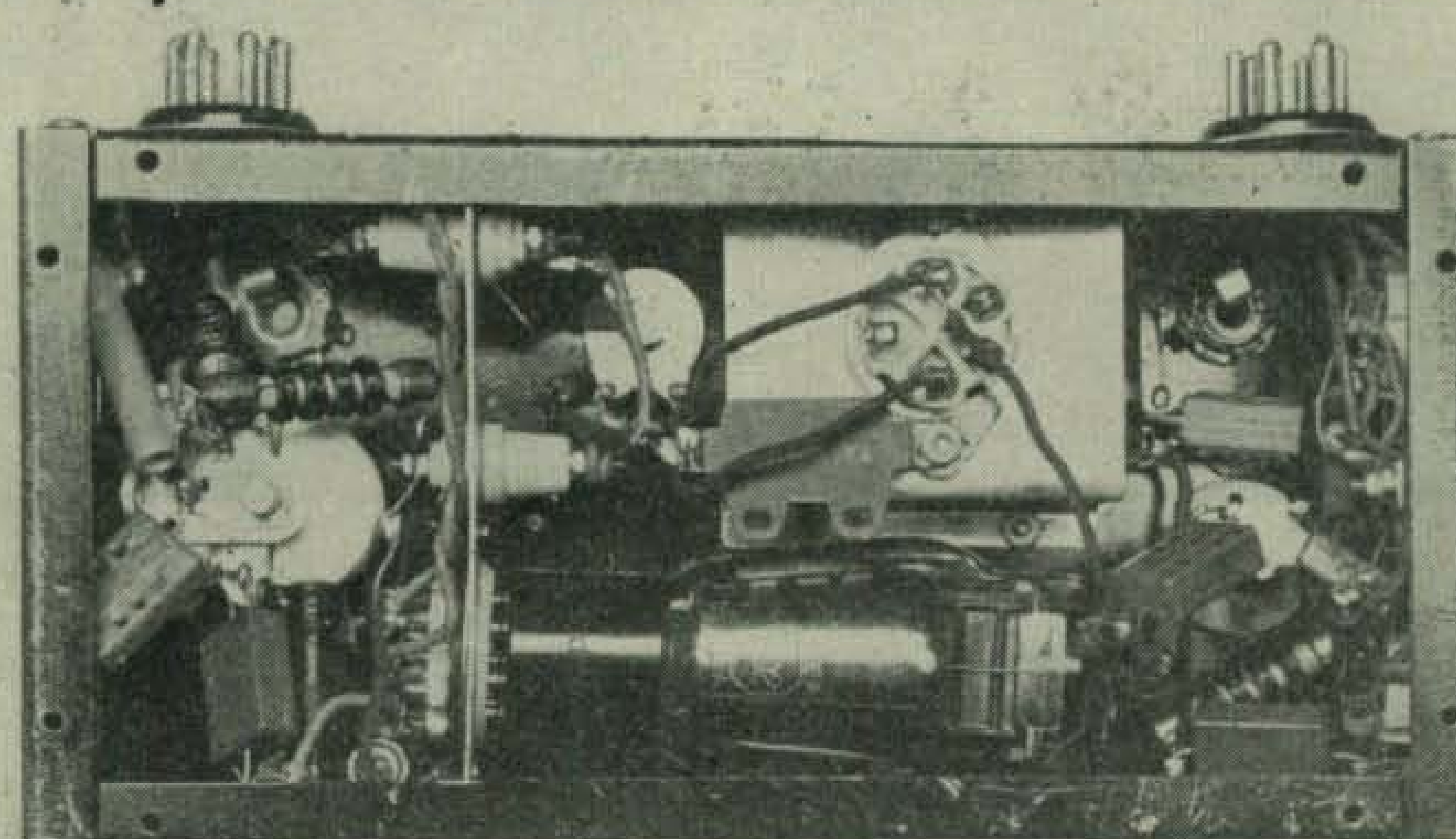


Fig. 2. (top). Under chassis view of power supply chassis. In the lower right hand corner are the two 45 volt batteries used for the fixed bias supply. The heavy duty rheostat in the upper center controls the 807 screen voltage.

Fig. 3. (bottom). Under chassis view of the oscillator section. The aluminum plate running from top to bottom on the left hand section mounts the socket of the 802. The center feedthrough insulator contributes a very small amount of extra grid-plate capacity for feedback.

if a choice for 40-meter operation were possible with either an 80-meter or 40-meter crystal, being in a hurry to change frequency on 40 meters, the operator unplugs the 80 meter crystal which has the cathode feedback condenser set fully unmeshed with a whopping load of feedback tearing through the circuit. If you plug in the 40-meter crystal and forget to mesh the condenser, pong goes the crystal. After conquering this bad habit, it will be found that this oscillator has advantages over the popular but hard-on-crystals tri-tet circuit. One advantage is that there is no coil problem in the cathode circuit. The overall crystal current is lower for given output. It will also key various crystals well on their harmonics, something which isn't always true of the tri-tet. Last but not least the amount of feedback can be smoothly controlled by the feedback variable condenser in the cathode lead. The writer has been very successful with even the most cranky crystals in this circuit. If the harmonic output method in the oscillator is not needed, but a small degree of feedback is desired to maintain the crystal activity at very high keying speeds, the screen by-pass condenser may be removed from the hot side of the cathode of the 802 and run directly to ground.

As shown in *Fig. 3*, a three-inch piece of aluminum is run from the top to bottom of the chassis and is spaced three inches from the left end of the chassis. The socket of the 802 is mounted on this strip along with two feed-through insulators, one carrying the plate voltage and the other running from the grid control to a small coupling condenser, *C17*. This coupling is used to create feedback when an 802 is used as an oscillator. The capacity of *C17* is from 2 to 5 $\mu\mu$f. The cathode feedback condenser has a bent plate to short it (or *SW2* may be substituted) and the r-f choke, when operating the 802 as a straight tetrode oscillator. The amount of feedback increases as the capacity across the r-f choke is decreased.

The sockets of the 807s are mounted on the right end of the chassis. Parallel operation was chosen because the space limitations necessitated

[*Continued on page 60*]

Converting the ART/13 Transmitter

PAUL L. RAFFORD, Jr., W2GQM*

For multi-frequency all-band operation the auto-tune ART/13 is an easily converted war surplus model.

THE ART/13 TRANSMITTER offers a refreshing variant from the present general run of war surplus equipment. Essentially, the ART/13 is a Collins product using the auto-tune selector. This allows any one of eleven preselected frequencies to be automatically chosen, tuned and operated from a remote position. As if this one feature were not sufficient to warrant further consideration, a *frequency meter type* v.f.o. allows the transmitter to be manually operated on any frequency between 2000 and 18,100 kc with a calibrated accuracy on the order of 1 kc. A Collins pi-network enables practically any type of antenna, excepting two wire balanced lines, to be matched to the final output.

Technical Description

The tube lineup consists of an 837 electron-coupled oscillator operating in the range from 1000 to 1500 kc. This oscillator has excellent frequency stabilization and is sufficiently shielded to rule out any possible broadcast-band interference. The oscillator tuning is broken into two ranges, the first range tuning from 1000 to 1200 kc and the second from 1200 to 1500 kc. Together these two ranges are spread over almost the entire 4000 possible dial divisions, thus a very high order of dial divisions per kc is obtained even on the 10-meter band. Setting up a frequency is much the same procedure as followed in using a frequency meter with calibrating charts and the results are of about the equivalent accuracy.

The 837 low frequency oscillator drives a 1625 (12 volt filament 807) operating as a doubler, tripler or quadrupler depending upon the output frequency. The second frequency multiplier is also a 1625 and is always operated as a tripler. The final amplifier is an 813 which is modulated by a pair of 811s. We have stepped the high voltages up to 1500 volts and a plate input, fully modulated, of about 225 to 250 watts may be reached without exceeding the commercial ratings of the tubes. The lower voltages have also been stepped up to about 450 volts, resulting in somewhat more excitation to the final amplifier in the 10 meter band.

The speech amplifier consists of a 12SJ7 followed by a 6V6G which drives the 811s. Also incorporated in the speech end of the ART/13 is another 6V6G which acts as a sidetone amplifier. The output of this amplifier is delivered to a phone jack labeled "Sidetone No. 1" on the front

*519 Chestnut St., Roselle Park, N. J.

The ART/13 with a-c power supply. Equal in size to the average communications receiver, this aircraft transmitter is rated at 200 watts output on phone and c.w. with automatic selection of 11 frequencies on any band from 80 to 10 meters after conversion.

panel. The speech may be monitored by the side-tone amplifier or the keying may be monitored through a built-in audio oscillator when the emission switch is in the c-w position.

A carbon mike may be plugged directly into the mike jack with the modification shown in *Fig. 1*. Quality reports even with a carbon mike have been excellent and the designers claim that the frequency response of the transmitter is about plus or minus 2 db from 300 to 4000 cycles. C-W operation with a high speed key is not advisable, although ordinary hand key operation is satisfactory. The present keying relay appears too sluggish for rapid keying. If necessary, the relay may be removed and the 813 biased to cutoff of about 40 to 50 volts. No bias is necessary with the 1625s. The keying relay, however, permits the same antenna to be used on both the transmitter and receiver. A binding post marked "receive" is located near the antenna post and the receiver lead may be connected to it. The relay also grounds the receiver antenna input while transmitting.

Because of the compact size of the ART/13 after a period of continuous filament operation the transmitter becomes very hot. In fact, the pitch in the modulation transformer may become so warm that it will soften sufficiently to permit the unit to "talk" so loudly that acoustic feedback to the mike may occur. This difficulty was solved by obtaining a small automobile fan which works smoothly from a spare 5-volt filament winding. This forced air draft cools the entire transmitter down to a safe operating point and is practically a necessity. If brush noise results in the receiver from this fan, it may be circumvented by using shielded crystal mike cable and 0.1 μf by-pass condensers.

Generally the ART/13 is sold with a 30 wire cable and/or a power supply plug type U-7/U. The remote control head may also be for sale at the same time and this is especially valuable if remote operation from the living quarters of the house to the transmitter in the attic or cellar is desired. There are a few different models of the ART/13, but the following pointers may be applied to all.

Power Supply

Because the ART/13 is an aircraft transmitter, the question of a power supply is extremely important. There are several models that might be adopted for converting the unit to a.c., but we decided that the best procedure would be to separate the 24-28 volt filament circuits from the relay coil circuits and the auto-tune motor channeling-operate the filaments of the tubes from a 26 volt a-c supply and the d-c circuits from a 26-volt source. This reduces rewiring to a bare

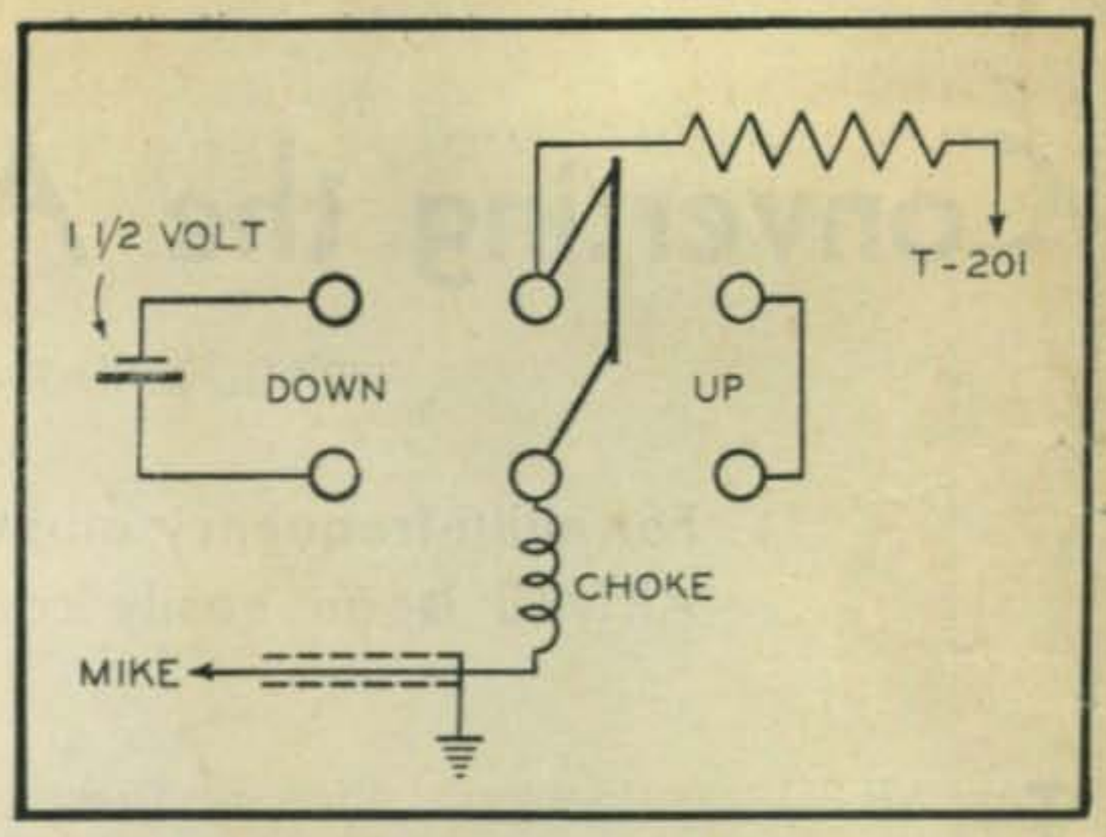


Fig. 1. First modification of the ART/13 is changing the microphone supply to a high level carbon mike by adding a pen-lite battery on the down terminals of the mike switch.

minimum and requires only a low amperage d-c source. The separation is the only obvious solution since it does not appear practical to build a d-c supply capable of delivering 10 amps when the tubes may be operated on a.c. The a-c requirement is 8 amps. Direct current is provided by a 30-volt, 2 amp. transformer, and rectified by two 1-amp. selenium rectifiers operated in parallel. The voltage is filtered by two 100 μf 25 w.v. condensers. Other arrangements, equally as good, could be employed, especially certain types of variable voltage battery chargers.

The general power supply in use at W2GQM is shown in *Fig. 2*. The only unconventional arrangement in the power supply is the resistor in series with the center-tap lead of the 1550-volt transformer. It will be noted that the side of the resistor away from the center tap is grounded. The plate current meter is placed across this resistor and actually measures the entire current being drawn from the power supply. This is not usually considered a very desirable feature as the grid currents and screen and modulator currents are also being measured at the same time. This system was employed by the original designers and it was decided to retain it rather than place the meter elsewhere. If the transmitter is tuned in the c-w position, fairly accurate readings may be taken. The exact position of the sliding contact on this resistor must be obtained by experiment and it is suggested that a 25-ohm unit first be tried. The milliammeter is calibrated from 0 to 200 ma, but with the increased plate current from the higher voltages it is necessary to adjust the resistor until the full scale meter reading is actually 400 ma.

Transmitter Conversion to A-C Filaments

The rewiring of the ART/13 to incorporate a-c filament voltages is fairly simple. The first step

is to remove the bottom and lower front panels, exposing the autotune mechanisms and the bottom of the transmitter. Remove the screws from the jack mounting strip which is fastened to the lower part of the autotune units *C*, *D*, and *E*. This will allow removal of autotune unit *C*. Unscrew the autotune locking bar on unit *C* and remove it so that the knob and disc may be removed. Unscrewing the locking bar may have to be done with pliers. Remove the knob by unscrewing with one of the special wrenches that are mounted inside the chassis. This knob will not slip off easily and some force must be used. Observe the reading indicated by the knob before removal. If it is not replaced exactly the same way, it will be necessary to experiment after the transmitter is placed in operation, to show what the proper reading of the knob for a given switch setting should be.

Remove the disc behind the knob so that the three screws holding the autotune are accessible. Take out these screws and remove the autotune unit from the chassis. The autotune unit will come loose if pulled forward with a medium amount of pressure. Notice that the coupling between the autotune unit and the switch is composed of a short shaft with a keyed cog on each end. These cogs fit snugly into both the autotune units and switches. When the autotunes are replaced these keyed cogs will automatically align the autotune with the switch. Removal of the autotune *C* allows access to the 1-ohm resistor *R-116* which is shown in *Fig. 3* and is located above and to one side of the motor relay. Remove autotune unit *A* in the same manner. This exposes the speech amplifier power plug which is also shown in the bottom view photo.

Observe that there are three leads connected

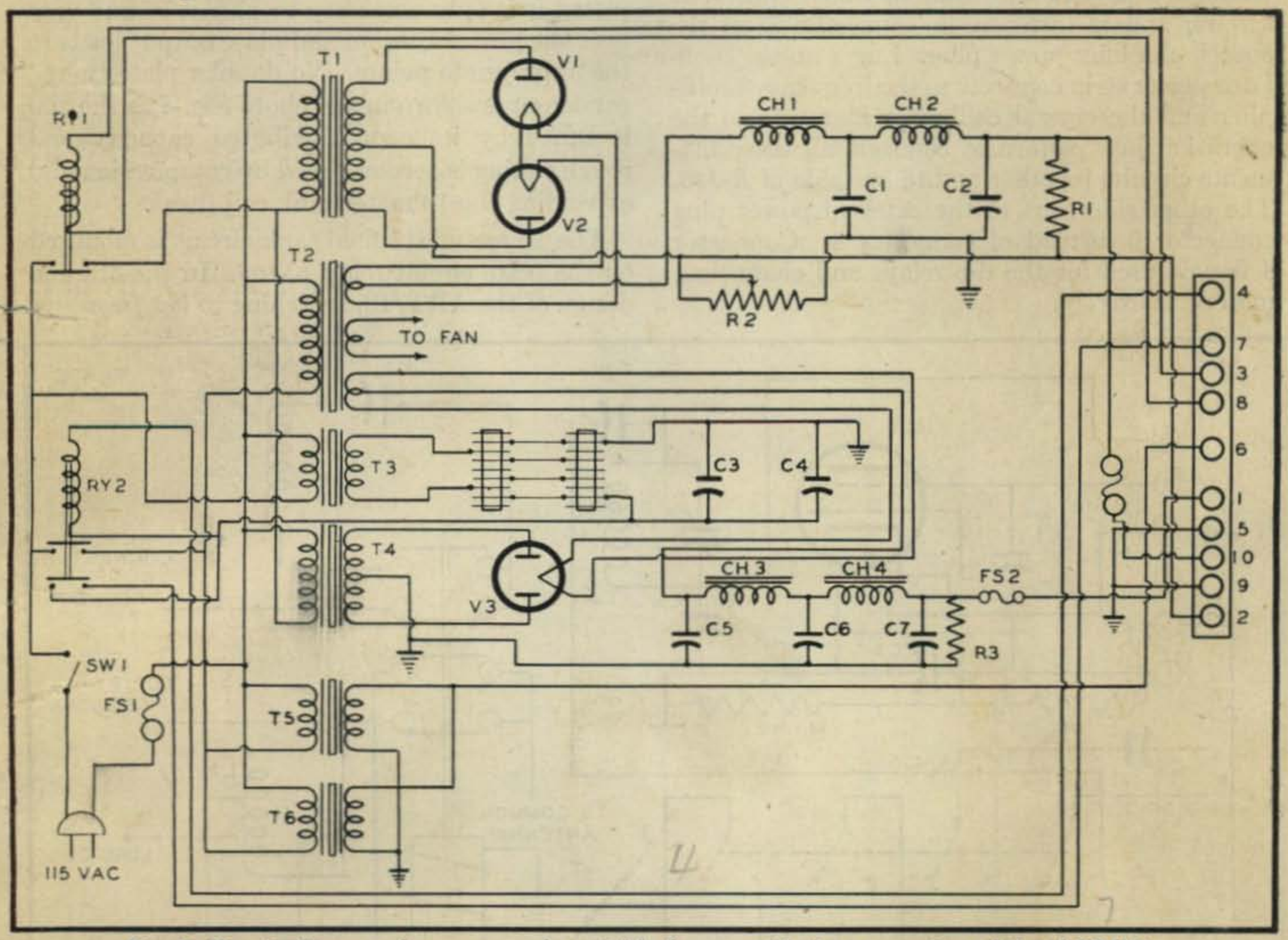


Fig. 2. Circuit diagram of power supply suitable for use with the a-c version of the ART/13.

C1, C2—2 μf, 2000 volt working
C3, C4—100 μf, 25 volt working
C5, C6, C7—8.0 μf at 600 volts working
CH1—300 ma swinging choke
CH2—15 h 300 ma choke
CH3, CH4—15 h 200 ma choke
R1—150,000 ohms, 25 watts
R2—see text
R3—50,000 ohms, 10 watts
FS1—10 amp. fuse
FS2, FS3—500 ma fuse
T1—plate transformer, 3500 volts, c.t.
T2—filament transformer, three 5.0 volt windings at 4.0 amps.
T3—step-down transformer, 30 volt secondary
T4—plate transformer, 600 volts, c.t.
T5, T6—filament transformer, 25 volts at 4.0 amps. each
RY1—relay, plate circuit
RY2—relay, four pole single throw, 26 volt coil
V1, V2—866 rectifiers
V3—5Z3 rectifier
SW1—heavy duty line swing or circuit breaker
Selenium rectifiers, 1 amp. rating each, in parallel

to one side of *R-116* and two leads to the other side. Remove all of them and solder the three leads together and insulate. These leads are on the power side of *R-116*. The other two leads are on the filament side of this resistor and one connects to contact 7 on the speech amplifier power socket while the other runs around through the transmitter and fastens to lug 2 on the oscillator power supply terminal strip.

In our modification, the two leads are fastened one to each side of *R-116*. The lead going to the oscillator is cut where it leaves the bakelite tube mounted at the rear of the transmitter. This wire is then pulled back through the tube and is fastened to the power side of the 0.8 ohm resistor *R-121* which is the filament dropping resistor for these tubes. The other half of the wire is pulled out of the cabling from the oscillator end, run through a hole in the wall, to which control *A* screws, and is fastened to connector 7 on the speech amplifier power plug. Lug 2 on the oscillator power strip connects to the frequency multiplier and the crystal calibrator filaments so the operation just performed connects all these filaments circuits together and to one side of *R-116*. The other side runs to the external power plug connector 6 instead of connector 4. Connector 4 is now used for the d-c relays and channeling motor exclusively.

Conversion to 10 Meters

It is not possible to reach the 10 meter band, using the frequency multipliers in the ART/13. Provision has been made in the transmitter for the addition of a low frequency oscillator if so desired. This arrangement makes it convenient to add a frequency multiplier using another 1625. A chassis may be built around *panel MX-128* to fit very nicely into the space allotted. Without the l-f oscillator the 28-ohm resistor *R-402* is connected across the power input plug and is used to take the place of the 1625 filament drain. This may be removed and the new 1625 doubler filaments connected across the plug. This plug also provides plate and screen voltages, thus greatly simplifying the problem of wiring up the doubler stage for 10 meters. The schematic of the new doubler appears in *Fig. 4*. When completed it is only necessary to plug it in and connect the grid excitation and plate output leads to the appropriate points. No doubler plate tuning condenser is shown in the photo *Fig. 5* as the coil is tuned by its own distributed capacity and rough tuning is accomplished by compressing and expanding the 10 meter tank coil turns.

The 10 meter 813 final tank circuit is mounted on the plate circuit relay *K-105*. In the original design of the ART/13, switching to *low frequency*

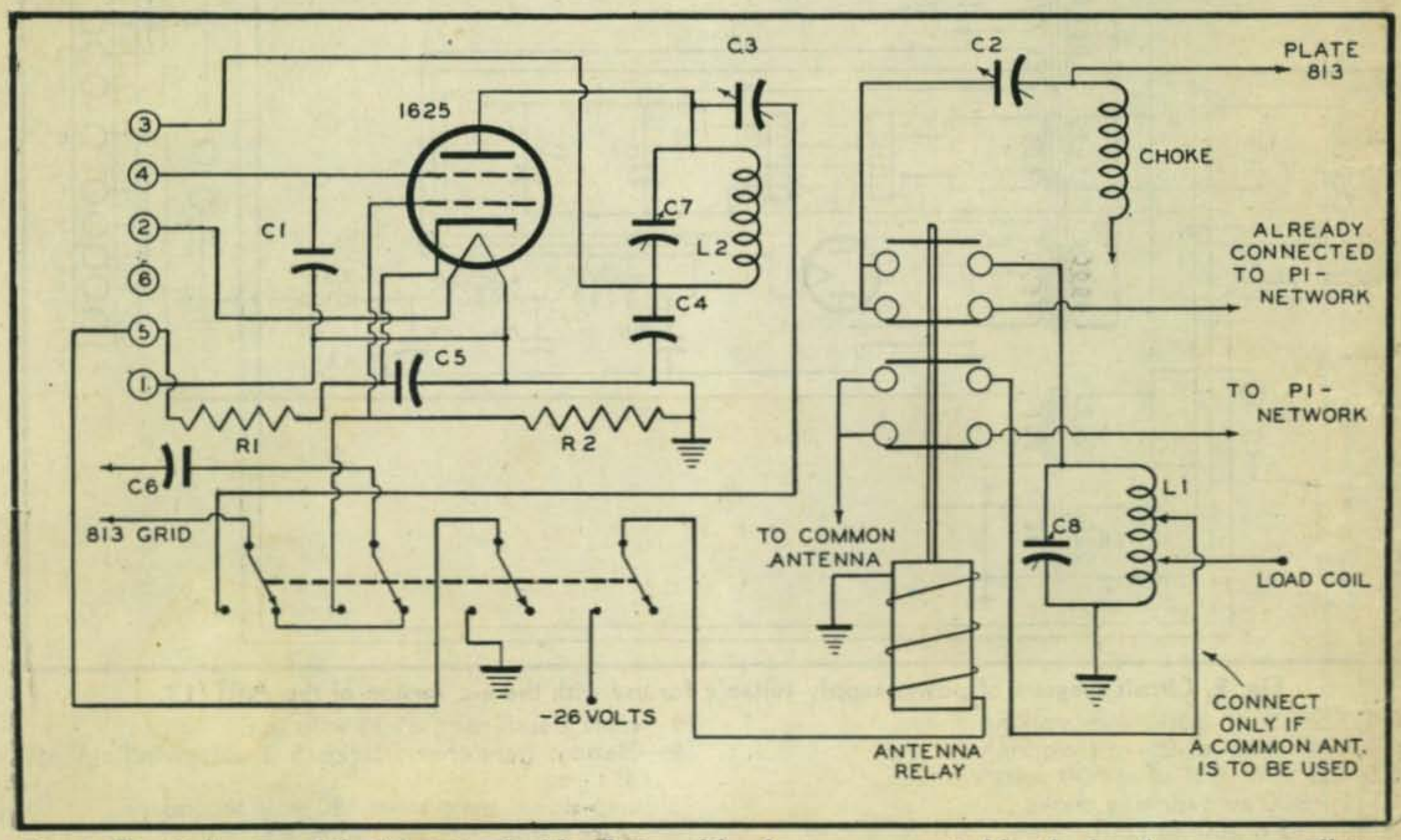


Fig. 4. Circuit diagram of the 10 meter doubler designed for the space occupied by the low frequency oscillator MX-128 before conversion.

C1, C4, C5—.001 μf mica
C2, C6—.002 μf mica
C3—4-40 μμf trimmer
C7—10 or 15 μμf variable
C8—35 μμf variable
R1—1000 ohms 2 watts
R2—100,000 ohms, 1 watt
L1—4 t. No. 10 enamel, 1½" I.D.
L2—4 t. No. 14 enamel, 1½" I.D.

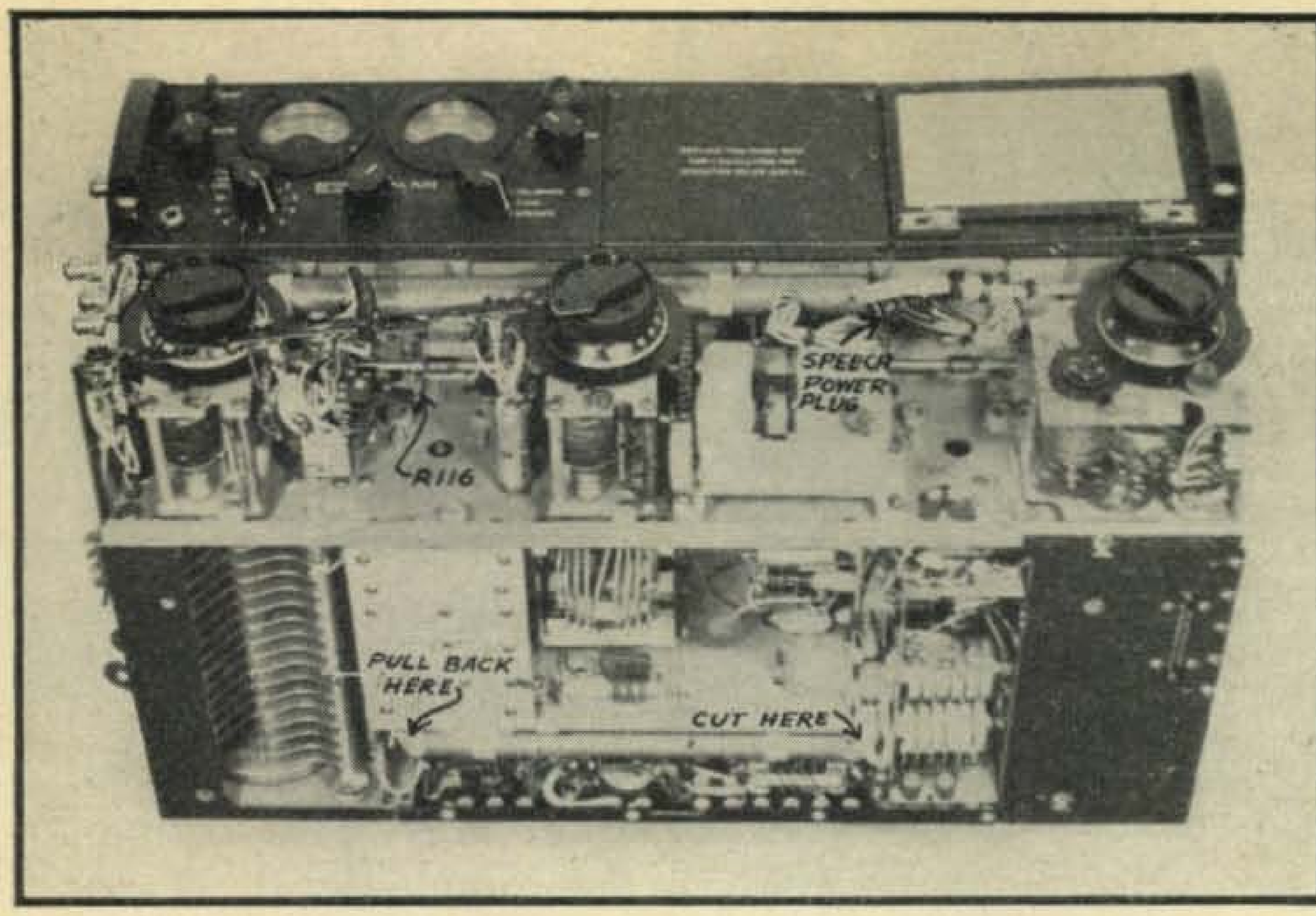


Fig. 3. Bottom view showing location of the low voltage resistor R-116.

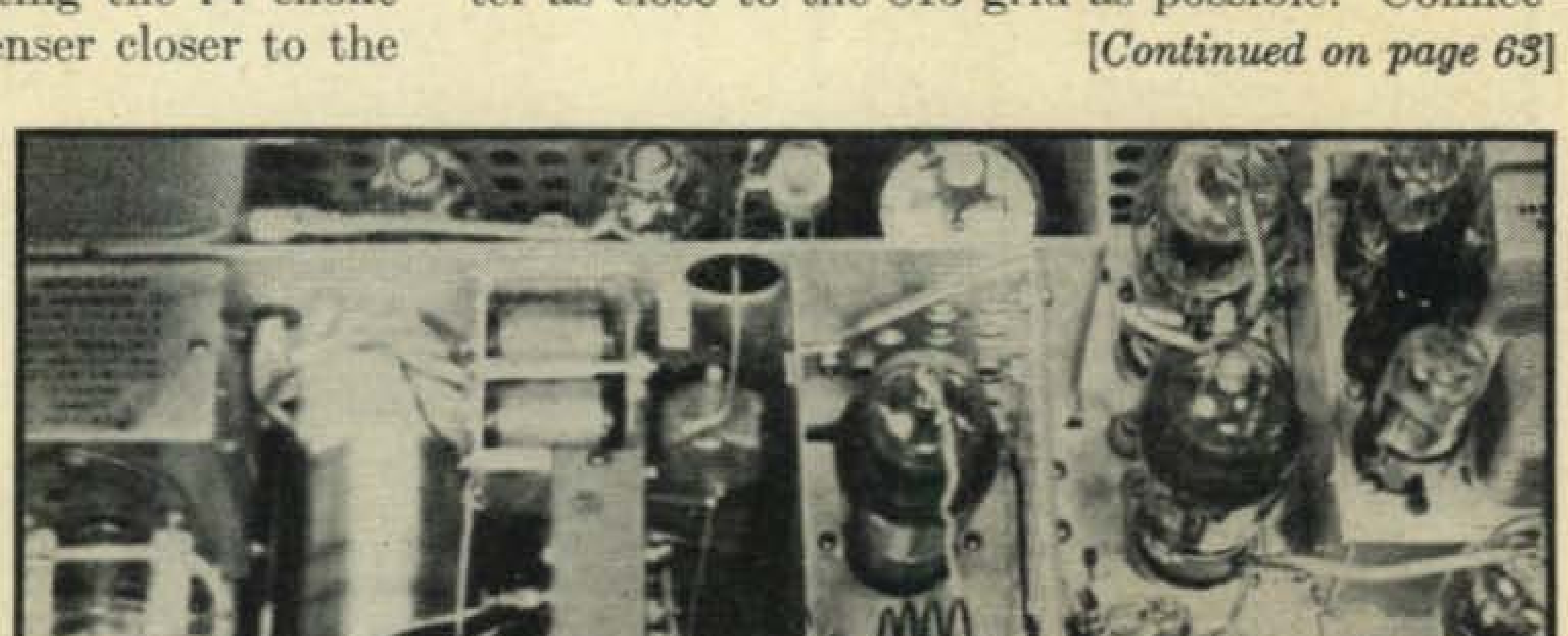
causes this relay to close, which disconnects the antenna coupling system from the 813 plate and transfers it directly to the *load coil* post on the side of the transmitter. External antenna loading is normally used on the low frequencies. Here again, the original low frequency design lends itself readily to 10-meter conversion. The relay contact that provided output for the low frequencies is connected to the *hot* side of the 10 meter tank circuit and the other side is grounded with as short a lead as possible.

The 10 meter tank circuit is composed of a $35\,\mu\mu$f double-spaced condenser and a coil made of No. 10 solid copper wire. It is recommended that the low frequency r-f choke, *L-109*, be removed from the circuit. The .002 μf by-pass condenser *C-128* is then mounted in the same spot, the bottom end of the high frequency r-f choke and the B+ lead connected to one side of it, and the other side grounded. Eliminating the l-f choke and moving the by-pass condenser closer to the high frequency r-f choke shortens the circuit leads and reduces unwanted plate circuit capacities and circulating currents. It also allows the relay contacts, formerly used to short the large choke, to be used for switching the main antenna over to 10 meters. The external load coil is now available for use as a connection for the 10-meter antenna. Simply run a lead from it to the experimentally selected tap on the 10 meter tank coil. This tap is the spot on the coil selected as the one giving the proper loading of the final for the antenna in use.

Although the frequency multiplier unit may be converted to fully automatic 10 meter operation, a much simpler method is shown in *Fig. 4*. This conversion consists of breaking the lead between the 813 grid and its coupling condenser. A four-pole double-throw switch, insulated for r.f., is mounted on the lower rear panel of the transmitter as close to the 813 grid as possible. Connec-

[*Continued on page 63*]

Fig. 5. Top view showing installation of 10 meter doubler and 813 10-meter tank circuit. No tuning condenser is used in the plate circuit of the doubler; the stage is tuned with its own distributed capacity.



Double-Current Keying System for Radio & Carrier Current Transmission

JOHN EVANS WILLIAMS, W2BFD*

Designed for the advanced amateur, this double-current keying system offers possibilites that may have been overlooked in the haste to get back on the air and try war-born improvements in the communications art

IT IS A MATTER of history that wire telegraphy, around the close of the last century, ran into difficulties similar to those encountered by present-day radio services in adapting its equipment to automatic methods of transmission and recording.

It may surprise many radio men unfamiliar with long line practice to learn that fading and noise, ever the bane of the radio traffic man's existence, are not unknown to the wire communications field. Fading is a widespread occurrence.

For many years the only method of transmitting messages telegraphically over wire lines was by the process of supplying direct current to the line to operate the distant receiving relay and interrupting this current in the form of morse characters by means of a telegraph key. This is similar to the method of radio telegraphy we are acquainted with and known to us as c.w.

Inspection of *Fig. 1* discloses that this elementary form of signaling circuit had all of the receiving, sending and power supply equipment

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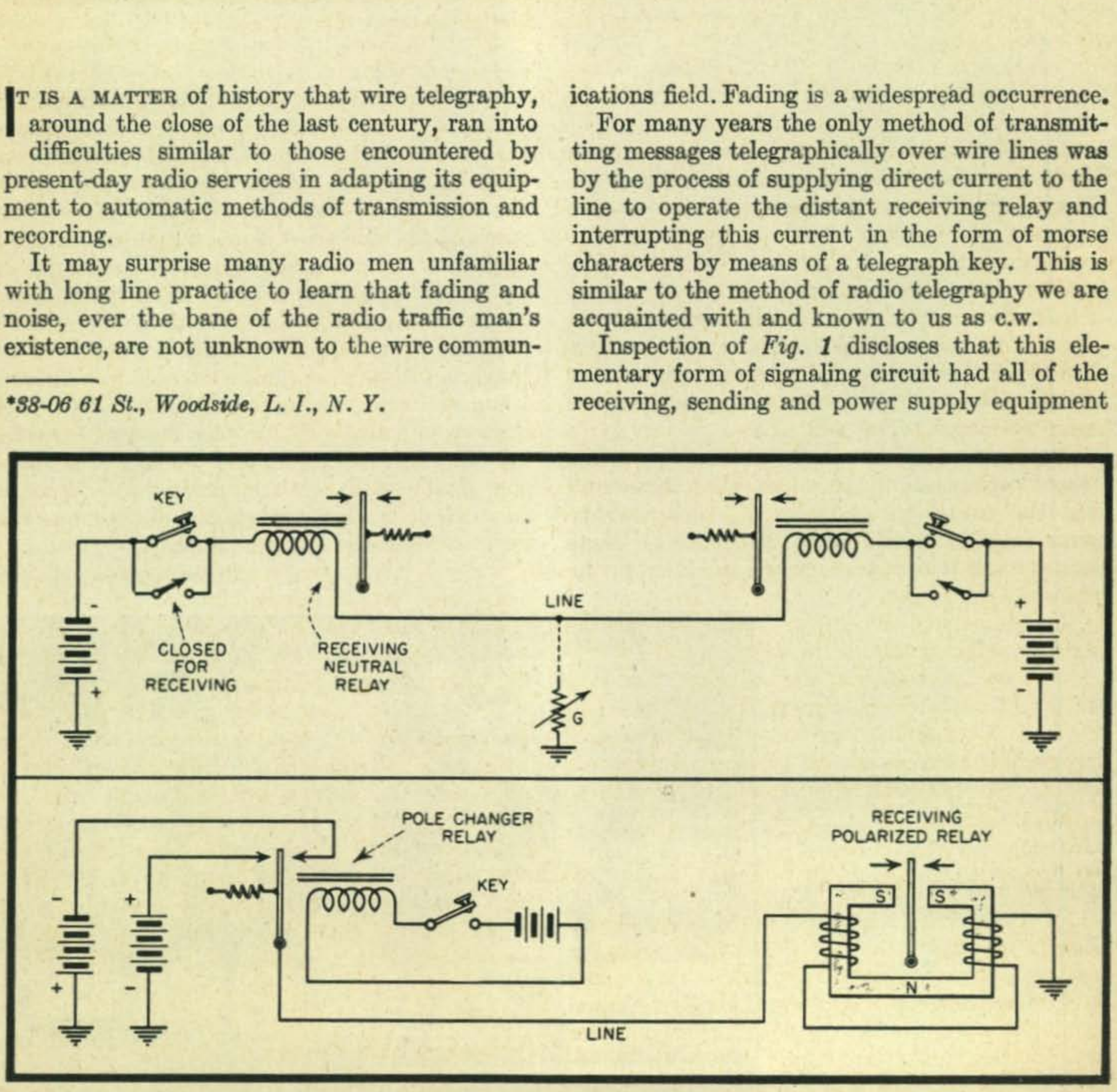


Fig. 1 (top). Elementary form of signaling circuit with equipment in series. Fig. 2 (bottom). Elementary form of double-current telegraph circuit.

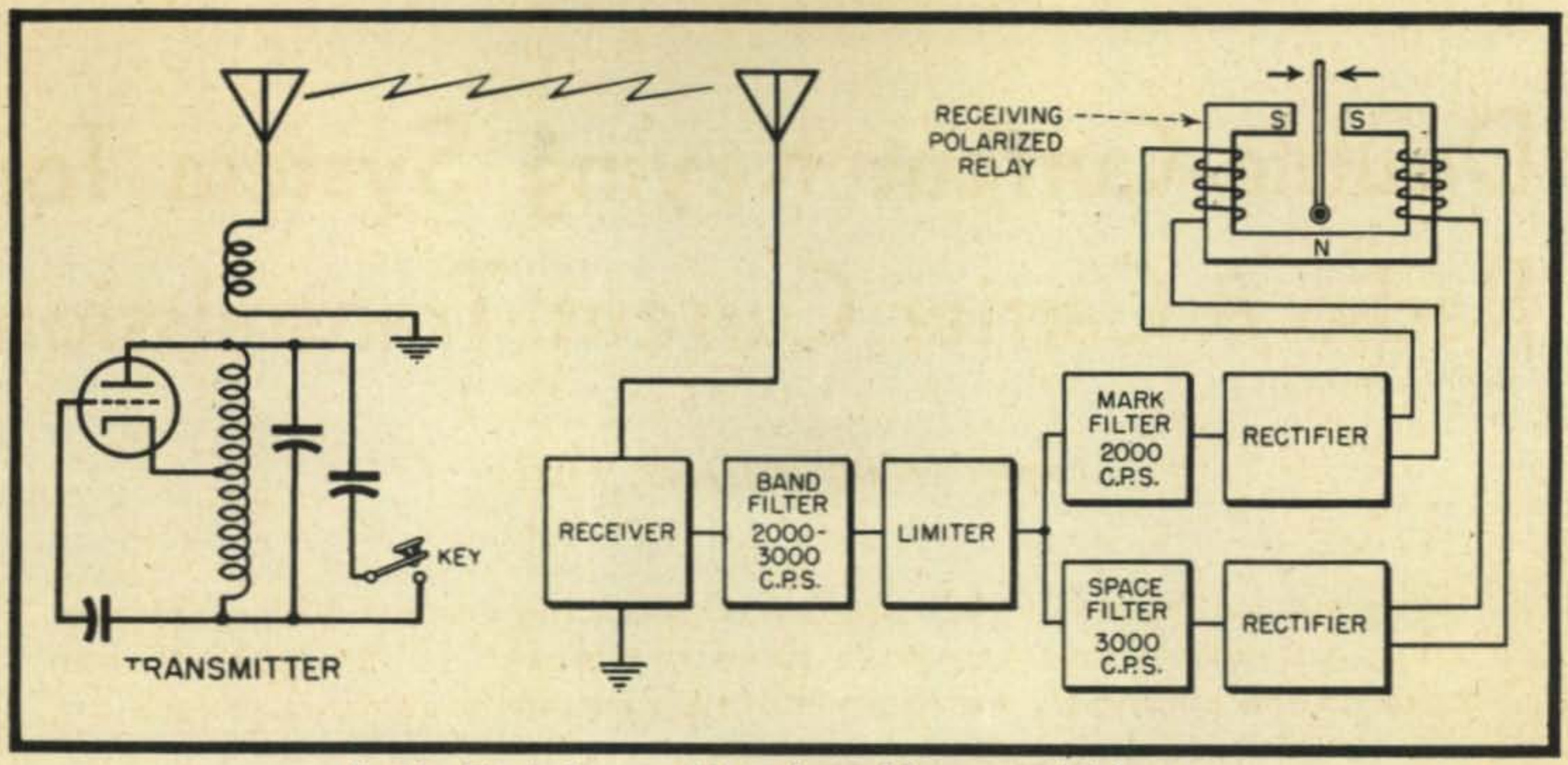


Fig. 3. Block diagram of basic form of frequency shift keying.

in series with the line and utilized a ground return in place of a second copper conductor.

In the absence of strong induction currents from adjacent power wires paralleling the telegraph right-of-way and in reasonably dry weather the receiving relays could be adjusted for satisfactory signaling at high speeds. But the flow of current from line to ground (represented by *G*, *Fig. 1*) known as leakance would often render the apparatus inoperative. Opening the local key would not reduce the current in the distant relay to zero and so the relay tongue would remain attracted to its pole pieces.

Increasing tension on the retracting springs would permit resumption of signaling for a while but the erratic variations of the leakance currents on circuits of 100 to 1000 miles in length would make it impossible to use the circuit commercially for traffic.

The advent of the duplex, multiplex and the various printing telegraphs which increased efficiency by augmenting the message handling ability of the wire was responsible for the introduction of the double-current or polar system of telegraphy because of its freedom from these effects and relegated the single-current line to local circuits only.

Double-Current Telegraph

An elementary double-current telegraph is shown in *Fig. 2*. The polechanger supplies battery of one polarity to the line when the key is open and battery of opposite polarity but equal potential when the key is closed. The receiver is a polarized relay responding only to the direction of current flow and insensible (within the limits of its sensitivity) to its magnitude.

A telegraphic polar relay differs from the more common biased types in that no retracting springs are used, and in the absence of signals will hold its armature against one of its contacts or the other. Intermediate position shown for clarity. It will provide marking and spacing signals of nearly ideal form even though its actuating current varies over an amplitude range of more than 100 to 1, whereas a single-current relay is adversely affected by a change of as little as 20 per cent. Moreover, induction currents and noise can approach within a few per cent of the signaling currents without causing false operation of the receiving instrument, while the single-current neutral relay will produce false marking signals when the disturbance has only half the value of the signal.

Despite this improvement in telegraphy which, mind you, *was in commercial use before the inception of radio telegraphy* no serious attempt was made to secure the benefits of double-current signaling for radio telegraphy until quite lately.

Automatic printing telegraphs require a strict maintenance of the mark-space ratio and the introduction of a few false dots will cause the mechanism to print meaningless copy. For this reason printers have been restricted to longwave and a few very stable high power shortwave channels. Recently, the adoption of frequency shift keying has brought the advantages of double-current signaling to the limelight in its connection with the military use of the radio teletype.

Frequency Shift Keying

The basic form of this system of keying is outlined in *Fig. 3*. Rather than interrupt the

radiation of the transmitter in accordance with the operation of the key, the output of the transmitter is kept constant and closing the key merely shifts the frequency of the output by a few hundred cycles. Reception of frequency shift keying can be accomplished by means of an ordinary communications receiver. The beat oscillator is adjusted to produce two different audio tones in the output, one corresponding to the marking signal and the other to the spacing signal. The audio output of the receiver is passed through a filter to eliminate all frequencies except the two tones and those frequencies between them. Variations in amplitude are wiped out by a limiter stage and then the composite signal is fed to two very sharply discriminating filters, one passing only the marking tone and the other only the spacing tone. After separately amplifying and rectifying these signals they are applied *in opposition* to the two windings of a polar relay. Operation of this relay actuates the receiving equipment.

One probable reason for the remarkable performance of this method of signaling is that noises of the type that produce the most disturbing effects on c-w telegraphy have their energy components more or less equally distributed throughout the audio spectrum and tend to balance out in the opposed coils of the relay. Another point is that automatic gain control can be used to full advantage during fading because the transmitter carrier amplitude is constant during keying.

Receiving Frequency Shift Keying

It occurred to the writer that a simplified receiving apparatus for frequency shift keying could be constructed in a small unit securing its signal by plugging into the "phone" jack of a communications receiver. Before the equipment was completed it was realized that it would not be necessary to wait for the war to end in order to test the apparatus with radio signals of this type. Since his original article on wired wireless in 1940* a two-channel carrier current hookup working on four frequencies between 165 and 185 kc has been maintained almost daily between the writer's home and his place of business about a half mile away.

Although signals are generally reliable there are times when remote control of a relay is made uncertain by the terrific noise level. Here, on carrier current, where the noise conditions are generally worse than radio, no false signals whatsoever have been received with this new method in the six months that the test has progressed.

*"Wired Wireless" for Remote Control. *QST*, Feb., 1940.

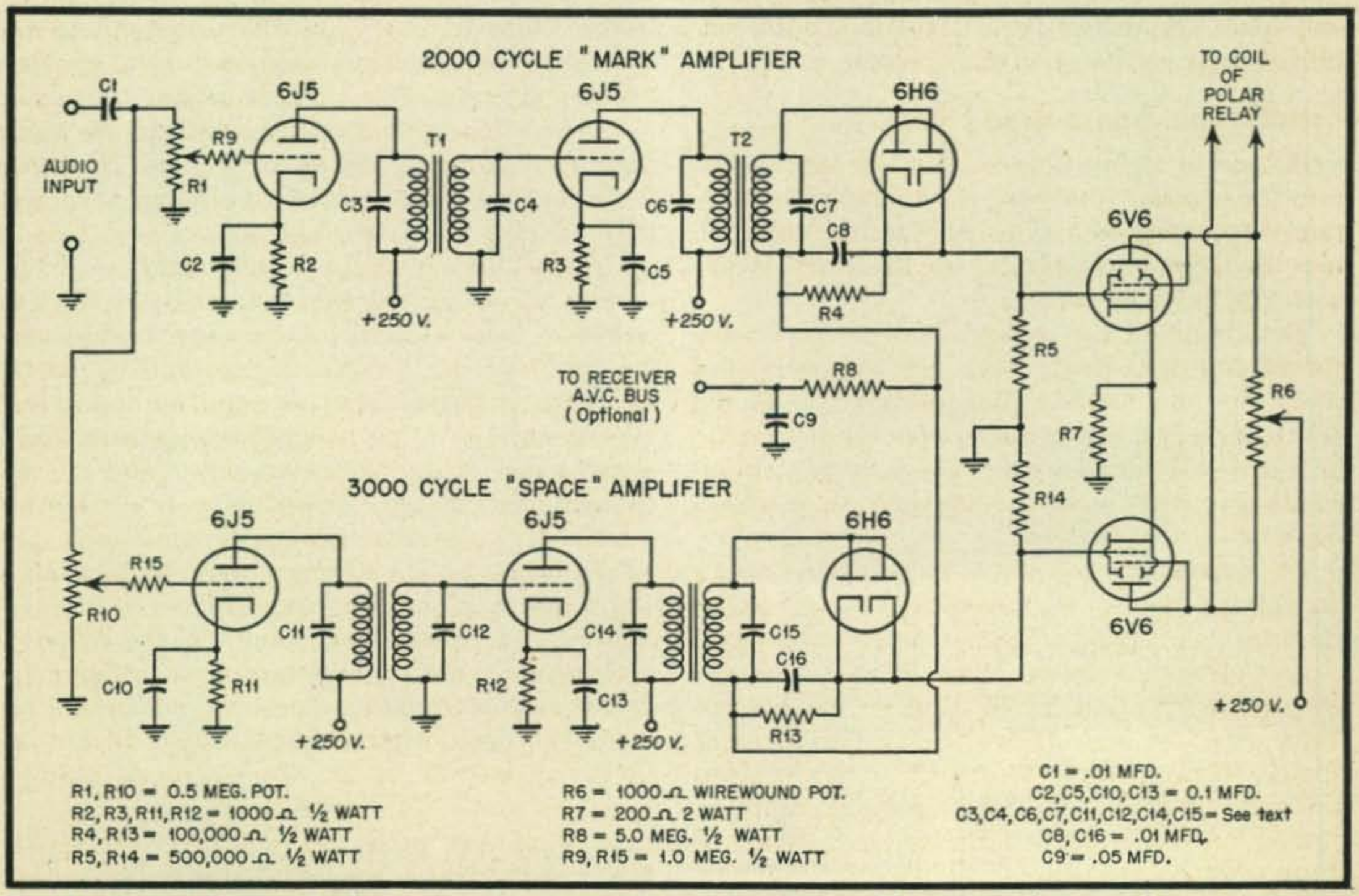


Fig. 4. Circuit diagram of selective amplifiers. Simple tuned audio amplifiers, the only unusual construction are the selective transformers T1 and T2, fully explained in the text. Note corrected value R6 is 3000Ω

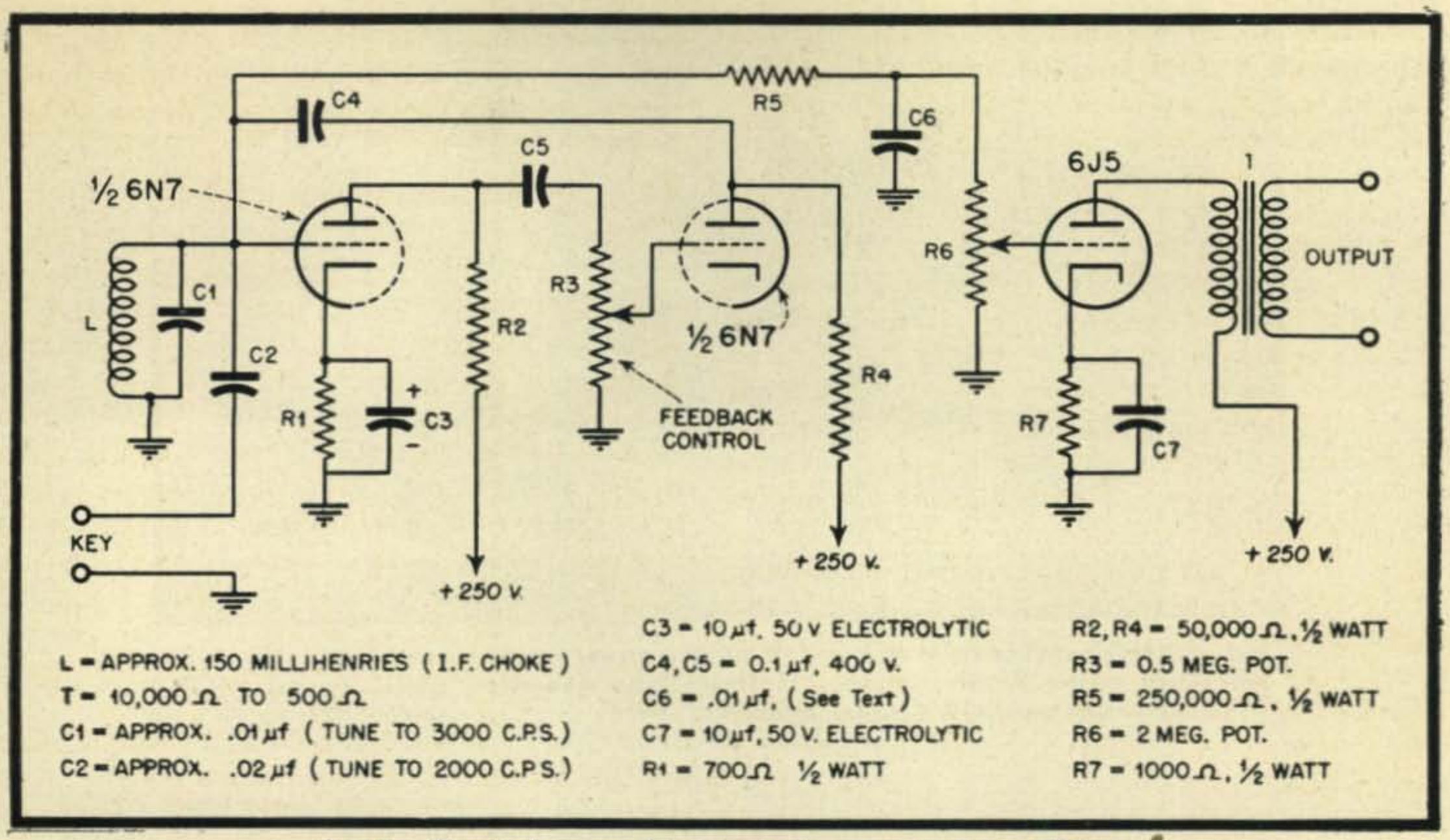


Fig. 5. Circuit diagram of two-tone sine-wave audio oscillator.

In order to avoid the necessity for crystal control of the carrier current rig a departure was made from the arrangement as used for the radio teletype. Amplitude modulation of the wired wireless outfit (which is equipped for phone work) by the two audio tones representing mark and space also did away with the need for a stabilized beat oscillator in the receiver.

Constructing Audio Band Filters

Instead of highly complex band filters to separate the signals, very good results have been obtained from simple tuned audio amplifiers which may be aligned as easily as an i-f amplifier and with the same procedure.

The circuit of the selective amplifiers is very simple and perhaps the only explanation needed would be about the tuning elements. As the photograph will show, these were made to plug in, but this is only for convenience where experimentation with various frequencies is contemplated.

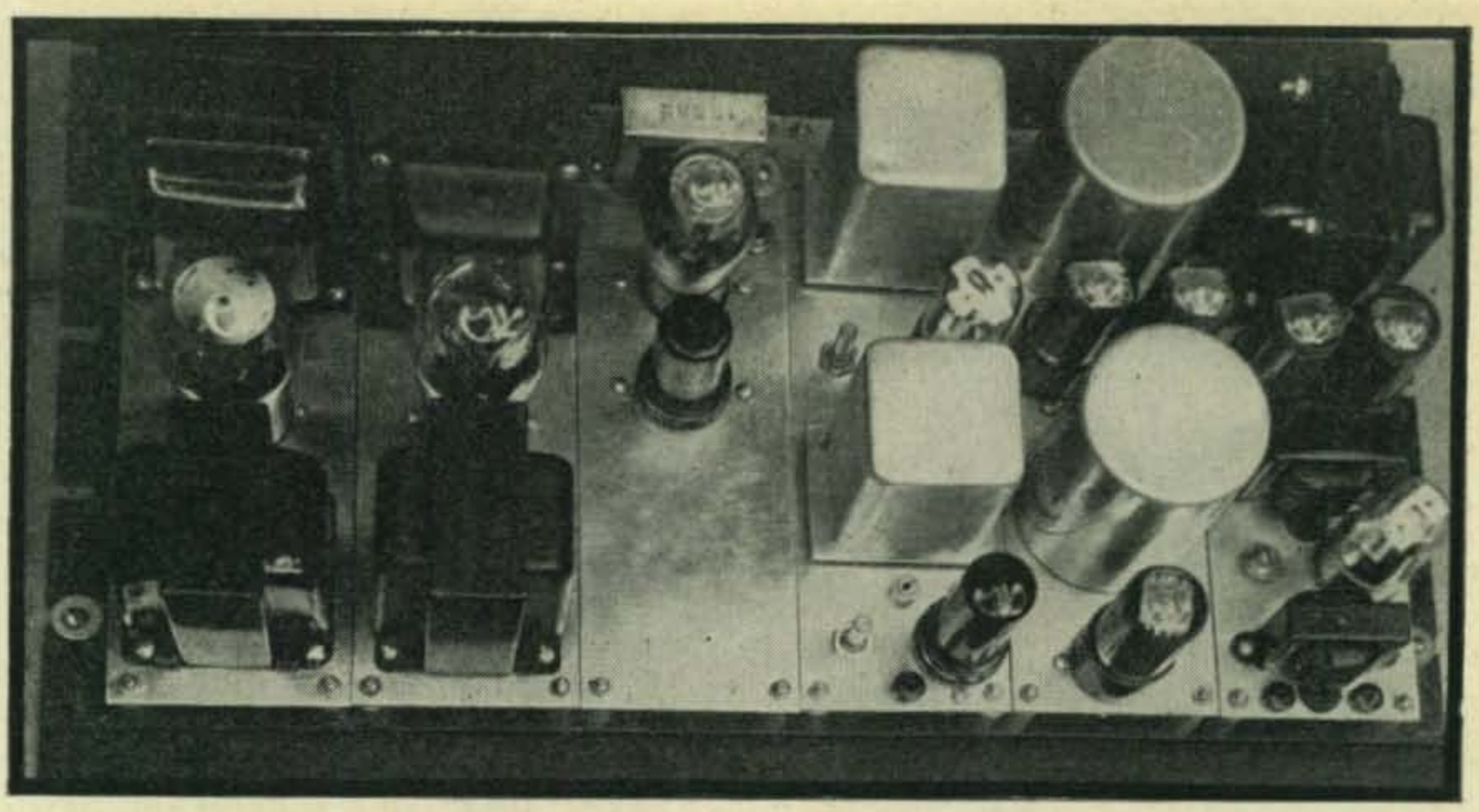
The selective transformers (which provide a 12 db voltage gain at resonance) were constructed from an assortment of midget filter chokes and output transformers of the a. c. - d. c. variety. An ohmmeter check of 30 of these inexpensive units disclosed that 12 had a d-c resistance of about 150 ohms while the remainder ran between 450 and 500 ohms. Working on the assumption (which proved correct) that the inductance of those coils having similar resistances would be approximately equal, the 150-ohm units were used for the 3000-cycle spacing signal amplifier and the higher resistance coils were used to tune the 2000-cycle marking signal amplifier.

Each tuned element is made of the windings and E-shaped laminations of two of the chokes or output transformers. Leave out the *I* laminations and bolt two strap mountings together base to base with the open end of the *E*s facing one another, separated by a quarter-inch thick piece of wood or bakelite.

Greater discrimination may be had by using large chokes having higher "Q" values. However, both amplifiers as constructed showed a voltage drop of over 46 db one-half octave each side of resonance, which should be sufficient.

The values of the paper condensers used to resonate these coils are determined quite easily by feeding the two-tone transmitting audio oscillator into the selective amplifier input and trying various values while observing a milliammeter temporarily inserted in series with the relay winding. About 150 volts or more will appear across the diode load resistance before the amplifier begins to overload, but the oscillator feed should be kept just high enough to give a satisfactory indication of resonance. As the 150-ohm coils turned out to have about .28 henry and the 450-ohm coils .63 henry (after alteration and reassembly) both amplifiers peaked with condensers in the vicinity of .01 μf. The extremes reached were .0075 and .012 microfarad.

Most random noise will produce equal output from the two tone amplifiers and as the amplifiers have their rectified outputs connected in opposition, no voltage will appear across the relay



Standard rack panel containing, from left to right, power supply for carrier current MOPA, modulator power supply, monitor, 2 tone audio generator, carrier current MOPA (6V6GT driving parallel 6V6GTs), modulator speech amplifier unit (6J5 driving PP Class A 6V6GTs).

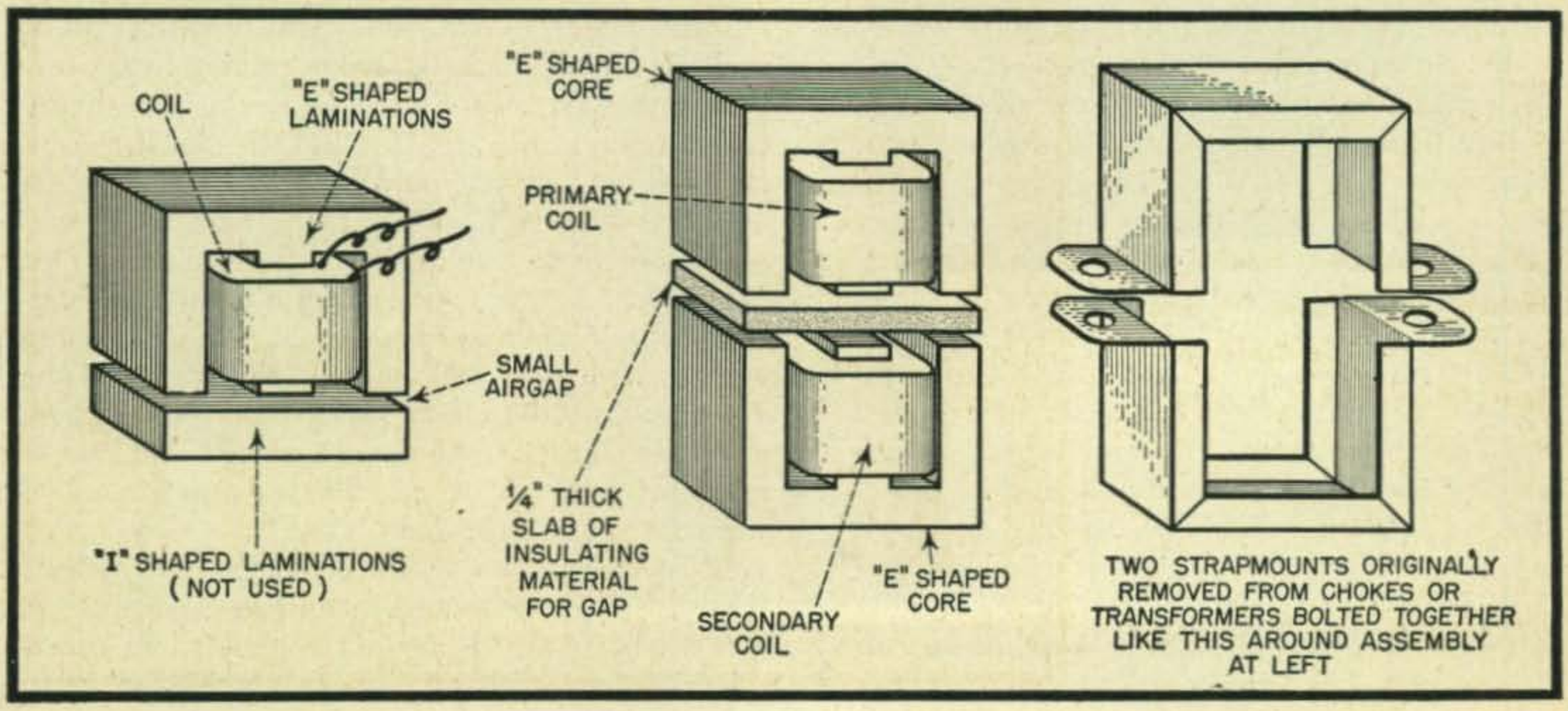
control tube grids. Mark and space signals will cause the plate current of one of the 6V6GTs to increase and the other to decrease, thus causing the polarized relay to click to the corresponding contact.

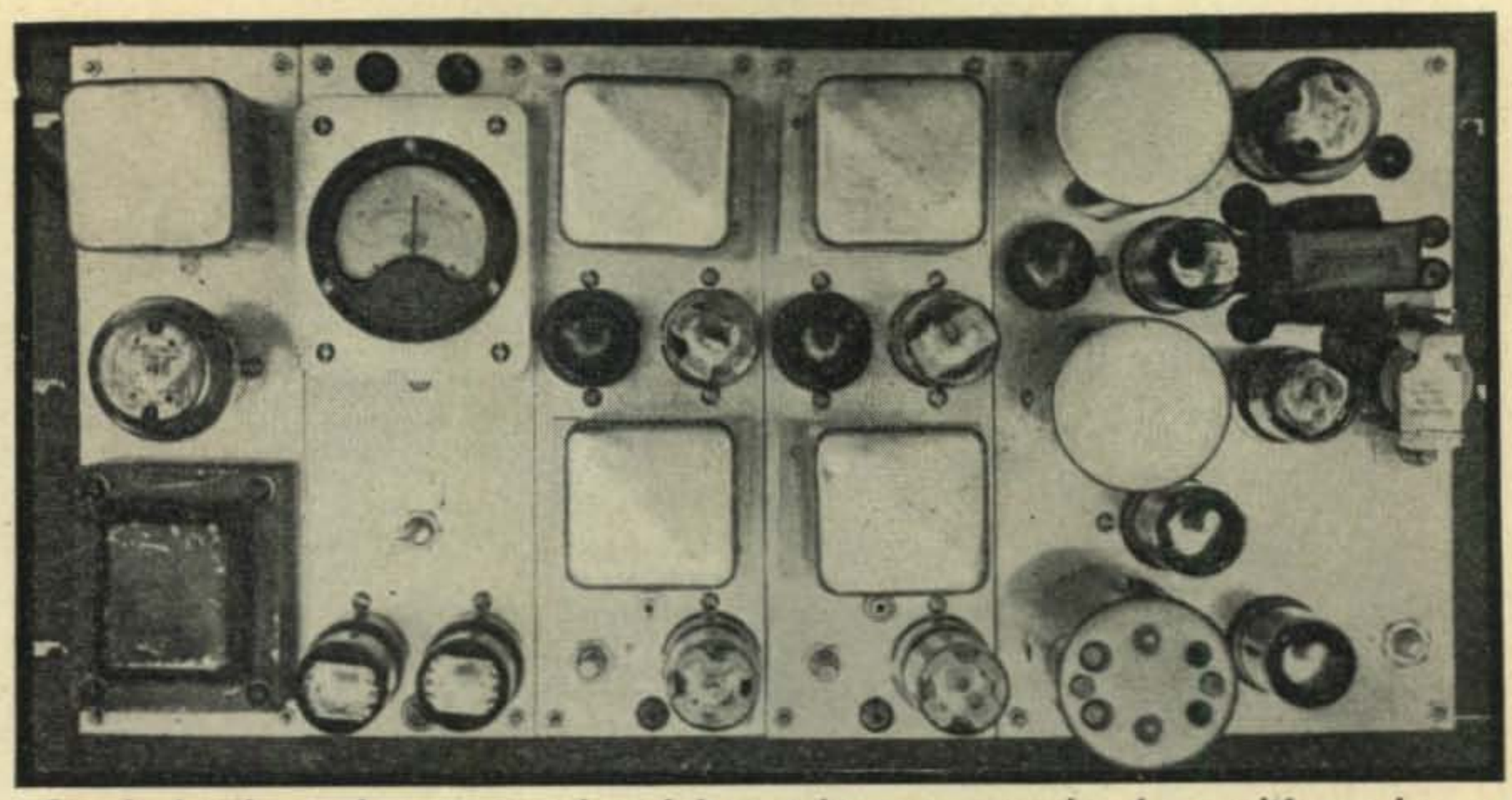
Using A.V.C.

In the apparatus illustrated the limiter circuit was dispensed with for the sake of simplicity but in the presence of fading signals it would be a definite asset. A form of a.v.c. can be used (optional) in which a gain controlling voltage proportional to relay current is fed back to the receiver a-v-c bus, resulting in a smaller relay current variation. If this a.v.c. system is used and reception of frequency-shift radio signals is attempted, trouble will be avoided if it is understood that the plate voltage of the receiver's high frequency and beat oscillators will have to be stabilized. The variation of the receiver's plate supply under a-v-c conditions will make the beat note vary too much. It should be remembered that a variation of only 1 kilocycle in the pitch of the heterodyned signal will cause a mark to become a space and vice versa. Stabilization of the receiver oscillator plate supply can be achieved with one or two VR-150s.

For use on v.h.f. the writer believes that the audio sub-carrier method would be simpler than the carrier frequency shift system, as it eliminates the need for frequency stabilization.

On a recent test of this FM telegraph system on 144 megacycles, a super-regenerative receiver was fed into the mark and space amplifiers and a modulated oscillator transmitter several miles away was modulated with the frequency shift keyed audio oscillator output. Although the input to the modulated oscillator was reduced to





Standard rack panel containing, from left to right, power supply, d-c amplifier and zero center meter for balancing polar relay, space channel filter, etc., mark channel filter, amplifier, and rectifier, carrier current receiver.

the point where absolutely no reduction of receiver hiss occurred and the modulation could be heard only with difficulty the polarized relay continued to turn out perfect reproduction of the transmitted message.

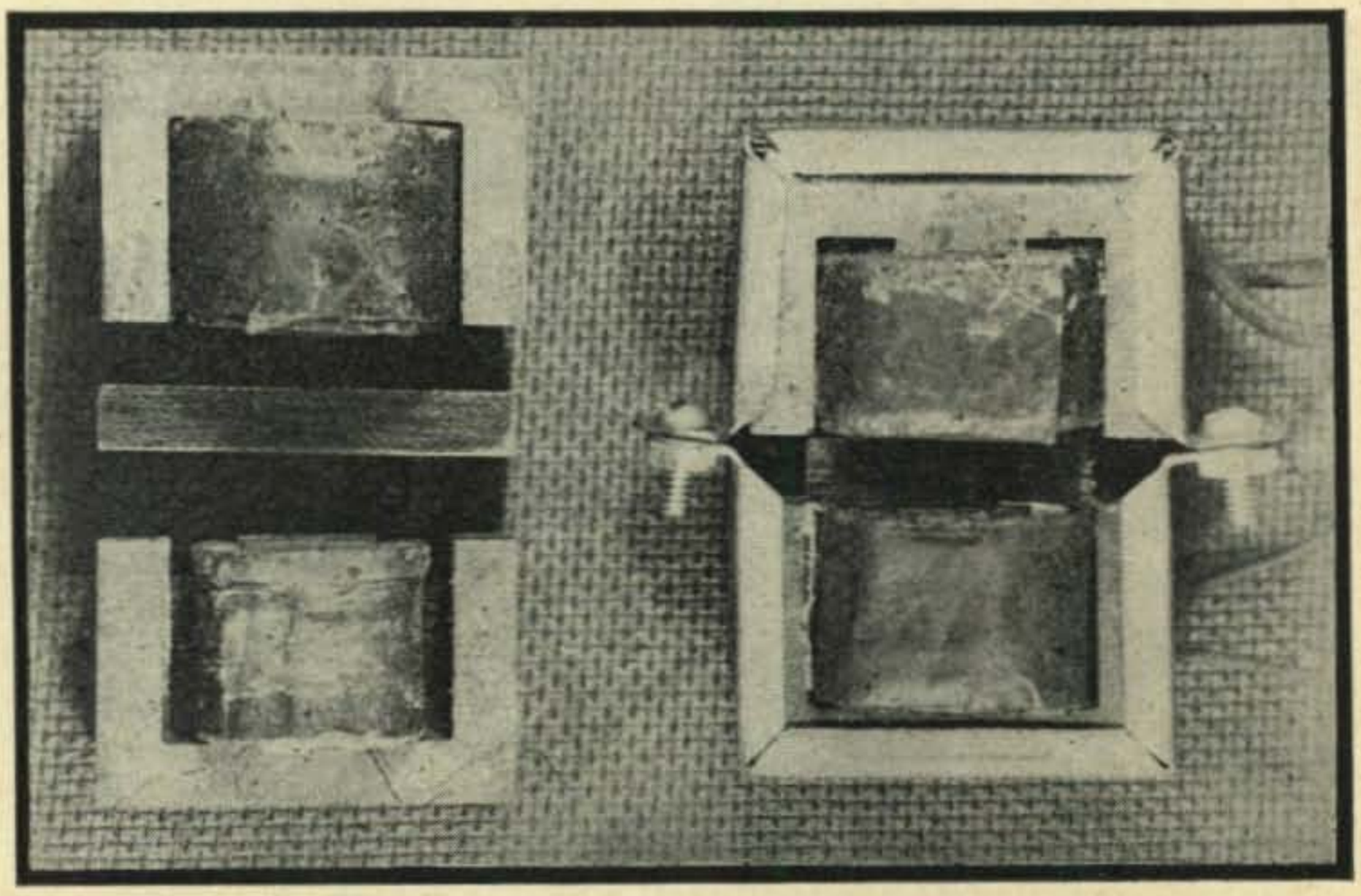
Sine-Wave Audio Oscillator

The two-tone sine-wave audio oscillator in *Fig. 5* is a circuit familiar to most of us. To it has been added a buffer stage and an equalizer (*R5*, *C6*) between oscillator and buffer to adjust for equal modulation at the two frequencies.

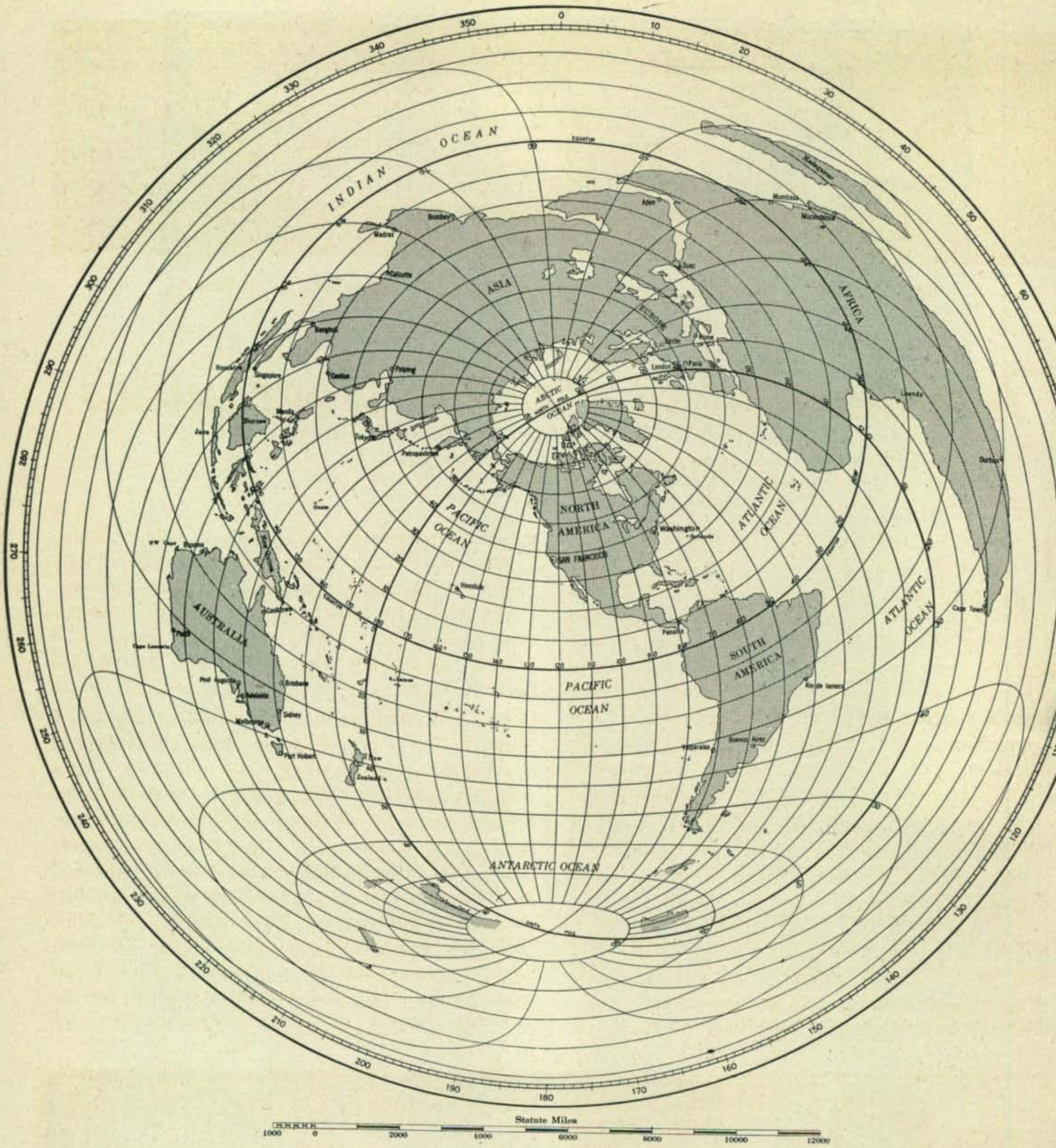
The key merely connects an additional condenser (*C2*) across the tuned circuit, lowering the pitch from 3000 to 2000 cps. An oscilloscope is helpful in getting the oscillator going on the right note. The feedback control (*R3*) is advanced very slightly beyond the point where oscillations begin with the key depressed (2000 cps). The value of the equalizer condenser should be selected so as to modulate the transmitter to the same degree at both frequencies and will be in the neighborhood of .01 μf.

Polar Relays

As serviceable polarized relays can be obtained second-hand at a very nominal sum it is hardly worth the effort to build one. However, the writer constructed two relays that gave satisfactory response up to a keying speed of 20 wpm. One was constructed from an obsolete 20-cycle telephone ringer and the other from a balanced armature magnetic speaker with a contact fastened to the armature arranged to travel about .004-inch between mark and space contacts. These contacts should be adjusted so that equal currents are required to click the armature from mark to space.



(Left) Construction details of selective transformers *T1* and *T2* used in the selective amplifiers. Photograph at right.



GREAT CIRCLE MAP OF THE WORLD

Centered on San Francisco

The great circle distance from San Francisco to any other point on the surface of the globe may be scaled off directly on this map using a straight-edge and the scale of miles shown directly below the map. For example, Melbourne scales roughly 7800 miles from San Francisco. Distances of points from other cities in the western United States can also be scaled off directly with sufficient accuracy for most purposes. To determine distance in kilometers multiply miles by 1.6.

The great circle direction of any point from San Francisco may be determined by laying a straight-edge from San Francisco to the point whose direction it is desired to determine. The point at which the straight-edge crosses the numbered circle will give the direction. Thus, Durban, South Africa, lies about 13½ degrees north of east from San Francisco (76½ degrees on the numbered circle). This is the first in a series of great circle maps of the world to be presented. (*Reproduced by permission of the Navy Department, Hydrographic Office*).

Fig. 1. Enlarged cross-section of silver-laminated-bronze interlock type of construction.

Introduction to Flexible Waveguides

ALFRED M. WINCHELL, W1AIY*

IT HAS BEEN approximately 50 years since the first paper relating to the operating principles of waveguides was published but it has been only for the past five or six years that their use and application have been standardized to any degree. The rapid development of radar and other microwave services during the past war provided great strides in the development and application of waveguides, and now that the demand for such devices has been greatly reduced for military purposes, the uses for waveguides and their associated equipment is being taken up by commercial enterprises as well as by serious minded amateurs, experimenters and student groups.

It is commonly known that waveguides can be hollow tubes of various shapes or cross-sections through which electromagnetic waves are propagated. Guides have been made of copper, brass, bronze, aluminum, fine silver, etc. with round, square, rectangular and elliptical cross-sections. Early work was done with waveguides of various cross-sections but present-day applications call almost exclusively for rectangular guides and fittings.

At some frequencies there may be a choice of either hollow waveguides or coaxial cable, but as the frequency and power is increased beyond a certain point, it becomes imperative in many cases that waveguides be used, dependent of course on the application. At frequencies, say higher than 3000 mc, waveguides are usually employed as transmission lines as they provide less attenuation and greater power handling capacity than other types of lines. Due to the fact that the wave travels inside of the guide it is in effect a shielded transmission line and usually there is no appreciable loss due to radiation from the line itself

*The American Metal Hose Branch
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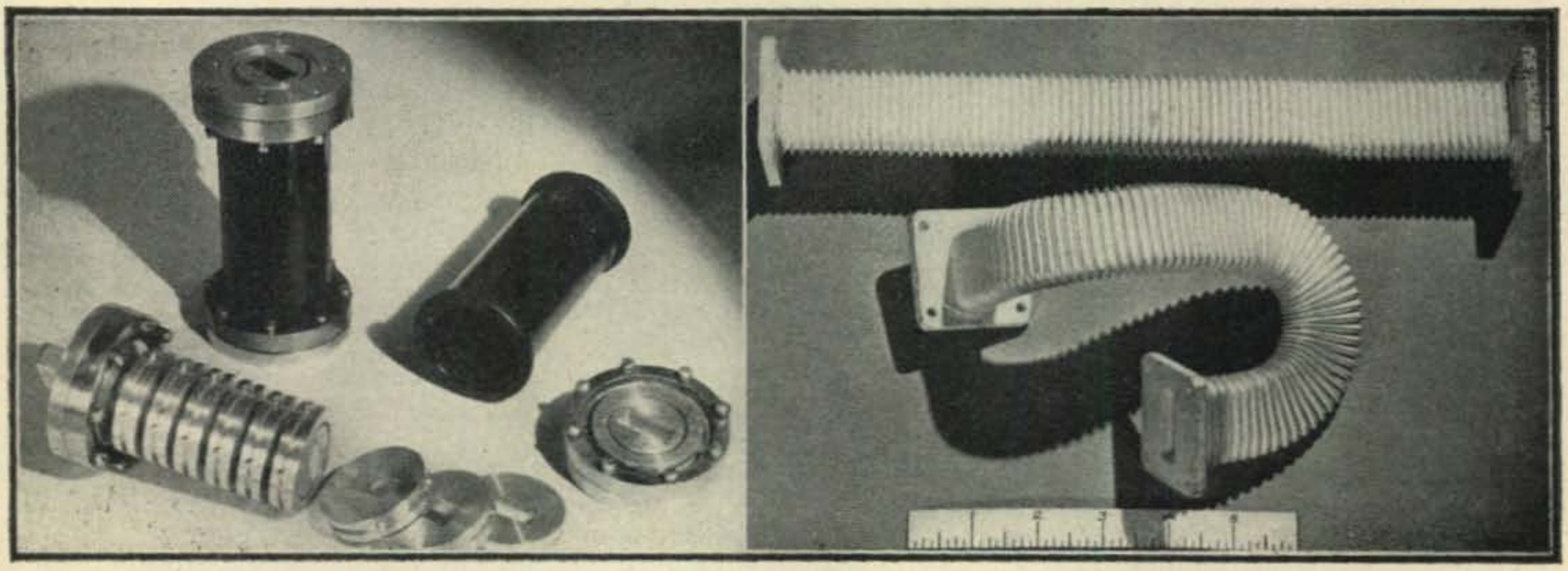

Fig. 3. (left) End fittings, choke-plate disks and synthetic rubber jacket used in Vertebra waveguide assembly, together with a completed assembly. Fig. 6. (right) Two silver plated seamless copper waveguides with an I.D. of .5 x 1.125, before and after being bent in both planes. With two plate flanges such assemblies have a nominal V.S.W.R. of 1.08.

TABLE 1

Approx. W/L Range in Cm	Rigid Waveguide O.D. Inches	Flexible Waveguide I.D. Inches
15—25	3.0 x 6.0	3.250 x 6.500
7.6—11.8	1.5 x 3.0	1.338 x 2.838
5.0— 7.6	1.0 x 2.0	.875 x 1.875
3.7— 5.7	0.75 x 1.5	.625 x 1.375
3.0— 4.7	.625 x 1.125	.500 x 1.125
2.4— 3.7	.50 x 1.0	.400 x .925

as is the case with some other types of lines, for example, Zepp feeders.

Waveguides are seldom used for frequencies lower than 1500 mc (20 cm) as beyond this point the guide becomes quite bulky.

With the increasing use of rigid waveguides it became evident that there were problems with this rigid "plumbing," as it is referred to, in aligning components mechanically with other transmitter, receiver or test equipment components unless precise machine design prevailed. Also there were problems of vibration and shock mounting. With the thought of reducing or eliminating such problems as these, flexible waveguides were developed.

Flexible Waveguide Types and Applications

Flexible waveguides of rectangular cross-section are at present manufactured in three chief types, namely, those made from metal strip wound into an interlocked tube, a cross-section of which is shown in *Fig. 1;* the seamless copper type made from thin wall tubing which is convoluted as shown in *Fig. 2;* and the vertebra or choke type which has a definite number of choke-plate disks cascaded in a synthetic rubber jacket as shown in *Fig. 3.*

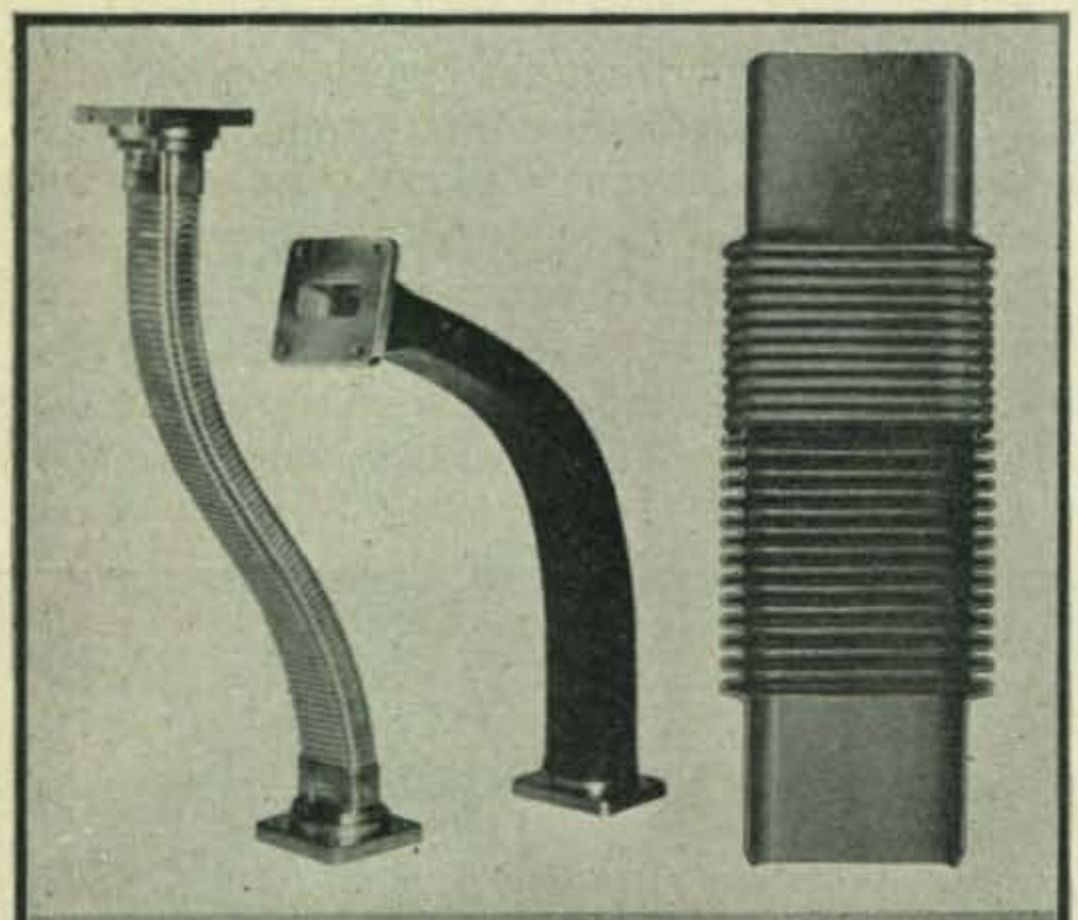

Fig. 4. (top, left) Two interlock type assemblies 12" long with I.D. of .5" x 1.125" before and after having synthetic rubber jacket molded on. Assemblies such as these have a nominal V.S.W.R. of 1.10. Fig. 2. (top, right) Convoluted rectangular copper guide. Fig. 5. (below) Ease of changing plane of polarity of electromagnetic horns is clearly illustrated.

Some one of these three types will satisfy most requirements for bending, twisting, extension, compression and shear. *Fig. 4* shows the interlock type of flexible guide material before and after having a synthetic rubber jacket molded on it. The enlarged cross-section of this type of guide shown in *Fig. 1* was made of laminated silver-bronze which provides silver to silver contacts throughout its length. This type of flexible guide is also made of other materials such as tinned stainless steel which, being considerably less expensive, will appeal to amateurs and others, especially for experimental, test and demonstration work. It can be made in quite long lengths and the amateur could cut off portions of a coil of waveguide as needed, as an electrician does with BX cable. Appropriate flanges including the choke, plate or contact types could then be attached with soft solder.

The interlocked waveguide can be made into elbows and will bend in both H and E planes. It can be used as a tilt joint in feeding an antenna and will twist so as to change the plane of polarity 90 degrees. This is demonstrated with the two sectoral horns shown in *Fig. 5.*

The seamless copper tubing, which after convoluting looks similar to bellows, is usually silver plated to provide a good electrical conducting surface, thus reducing the attenuation to a very low order. This seamless flexible guide is very useful in making elbows as well as other simple or complicated bent assemblies. An illustration of this use is shown in *Fig. 6.* It is also used in making flexible couplings and step transformers. Step transformers as shown in *Fig. 7* are a convenient means of connecting two pieces of "plumbing" of somewhat different cross-sections. The transformer shown will electrically and mechanically match a .400" x .900" I. D. waveguide on one end and a .500" x 1.125" I. D. waveguide on the opposite end.

The vertebra type previously mentioned is not expected to be in much demand by amateur and

similar groups as its chief application is on shock mounted equipment.

Due to the fact that flexible waveguides have a slight radius in the corners unlike the rigid surface which it matches, the inside cross-section may be different than that of the rigid guide. However, appropriate plate, choke and contact flanges or fittings are available for both. A table showing some flexible waveguide sizes and their equivalent in rigid guides are shown in Table 1.

In waveguides which have a rectangular or nearly rectangular cross-section the larger inside dimension is usually slightly greater than twice that of the smaller inside dimension. The larger dimension determines the lowest frequency which can be transmitted through the guide, while the smaller dimension is chosen so that only the dominant mode will be transmitted within the normal frequency range of the waveguide. This smaller dimension also determines the voltage at which flashover occurs.

Of general interest is a table showing a few sizes of round guide and the approximate frequency range in which they may be used.

Handling Flexible Waveguides

The amateur experimenter or student will come to learn that great care must be observed in attaching fittings to waveguides. These may be soft soldered on with a torch much in the same method which a plumber would use in soldering fittings to water tubing, with the notable exceptions that in the case of the waveguide good alignment must be maintained and no holes or cavities at the joint can be tolerated, nor can there be any surplus solder permitted to remain on the interior of the guide. Any of these factors could cause serious reflections which would result in an increase of the standing wave ratio.

If the application warrants, sections of flexible waveguide may be soldered directly to a rigid guide, thus eliminating connecting flanges.

Again the importance of using great care in attaching flexible guide to rigid sections or to flanges should not be underestimated. Wherever components of an assembly are soldered together it should appear to the wave motion as a continuous path without any abrupt change in dimensions such as would be created by a ridge or lump of surplus solder or by cavities caused by a

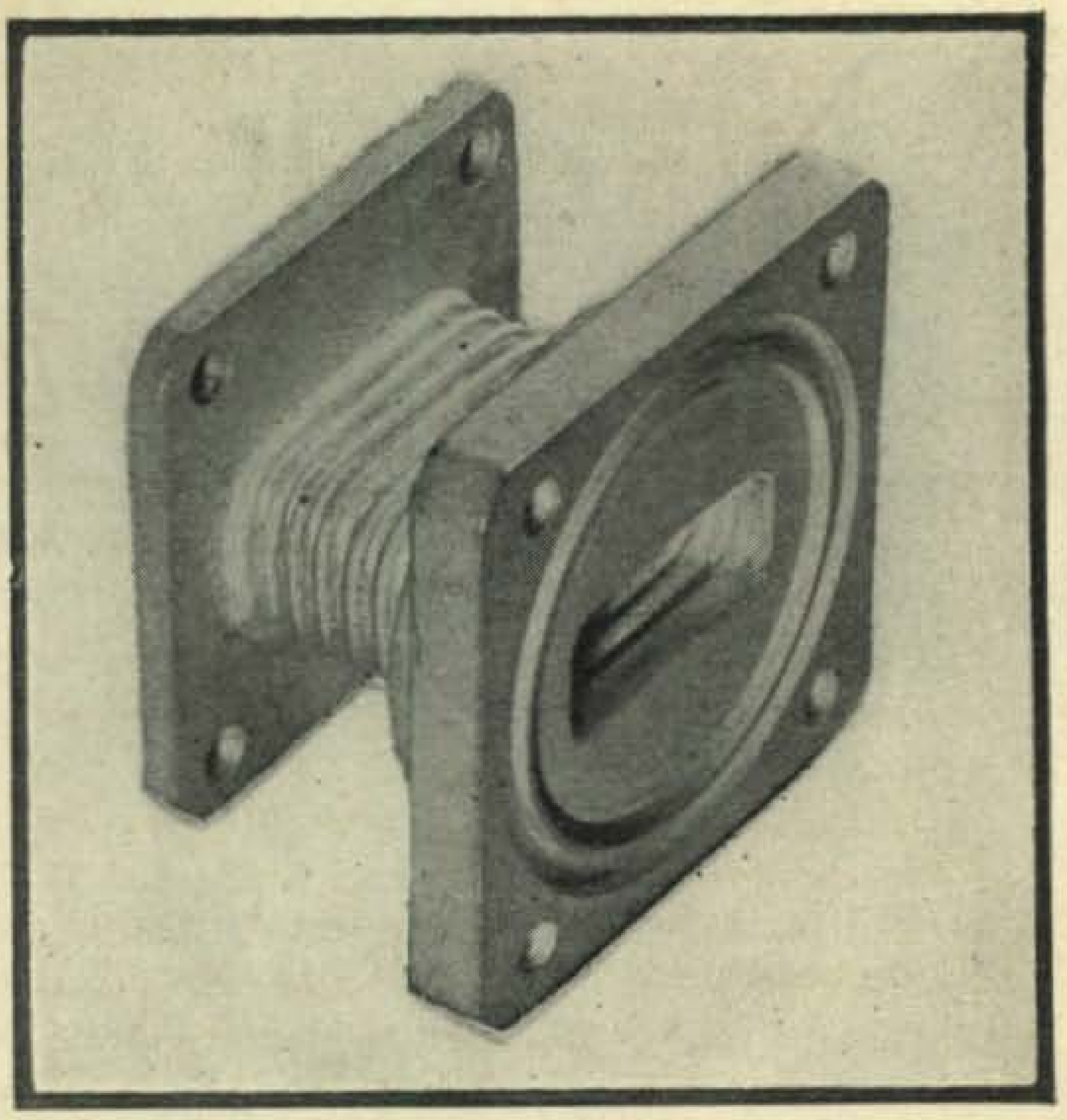

Fig. 7. Flexible Step Transformer for connecting and matching waveguides having somewhat different cross-section. The nominal V.S.W.R. of such a transformer would be 1.05.

separation between the guide and its flange wherein the solder has not properly flowed. In most cases, reflections which cause high standing wave ratio occur near the ends of the guide at the point of attaching the flanges.

Characteristic impedance is a term often applied to transmission lines used at lower frequencies. As this quantity is difficult to define, calculate and measure in connection with waveguides it is quite common to use voltage standing wave ratio (VSWR) as this is much more easily measured and usually tells us a great deal about what we want to know. Such measurements may be made by several methods, the travelling detector probably being the best known. Directional couplers and impedance bridges are also being used at present for SWR measurements in waveguides. Attenuation measurements are made by employing a travelling detector with an r-f probe which is used in conjunction with a spectrum analyzer and calibrated attenuator.

It was mentioned earlier that some types of flexible waveguides have a jacket of synthetic rubber molded over them. In addition to this,

[*Continued on page 59*]

TABLE 2

Round Guide O.D. in Inches	Approximate Wavelength Range in Cm
3	9.6 to 10.9
2	6.2 to 7.2
1	3.1 to 3.6
⅞	2.7 to 3.1
9/16	1.7 to 2.0

TABLE 3

Waveguide Material	Attenuation Db per foot
Rigid Bronze—Silver Plated	0.03
Convoluted Copper—Silver Plated	0.04
Interlocked—Silver-Laminated Bronze.	0.07

DIRECTION INDICATOR

For Rotary Beam Antennas

WILLIAM A. WOEHR, W9WOP*

A low-cost simplified direction indicator using a minimum of parts

With the increasing use of rotary beam antennas in the 20, 10, 6 and 2-meter bands, the need for a low-cost, simplified direction indicator is becoming greater every day. Various systems have been used, the expensive ones usually giving the best results, while the least expensive have been rather crude at best. The system to be described is an adaption of a potentiometer circuit, brought up to date with the advent of Ohmite Manufacturing Company's new unit known as the RB-2. It features good results at low cost.

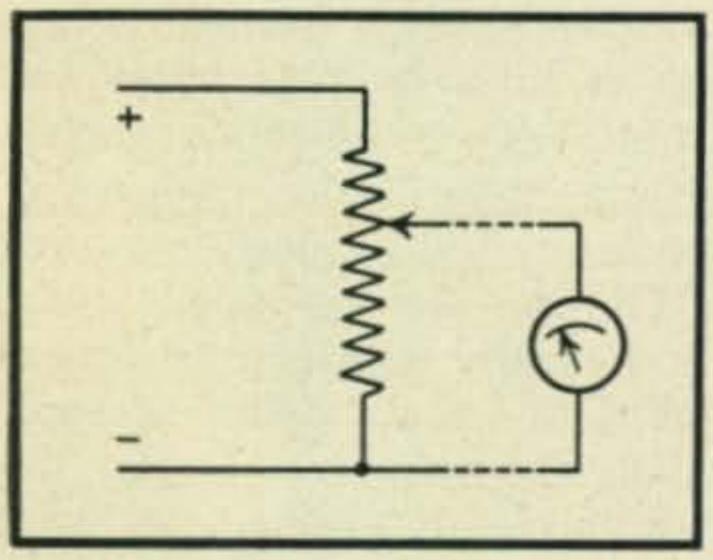

Fig. 1. Basic circuit for direction indicator potentiometer.

Basic Circuit

The basic circuit is shown in *Fig. 1*. The potentiometer is a 600-ohm unit having practically a 360° winding and unlimited rotation. This is the sender and its shaft is turned by the rotation of the antenna. The indicating meter should have a 0-1 ma movement. An adjustable series limiting resistor is so arranged that the meter will read exactly full scale with the potentiometer set to the point of maximum meter deflection. An actual hookup is shown in *Fig. 2*. Here we see that the two ends of the potentiometer winding are brought very close to each other, thus forming the resistance element into nearly a closed circle. The two ends of this element are spaced less than one degree apart and the moving contact will short both of them as it passes across this point. However, the 200-ohm, one-watt resistor in series with the battery will limit the current drain to 30 ma. This occurs at only one step out of the 400 total for the complete 360 degree rotation.

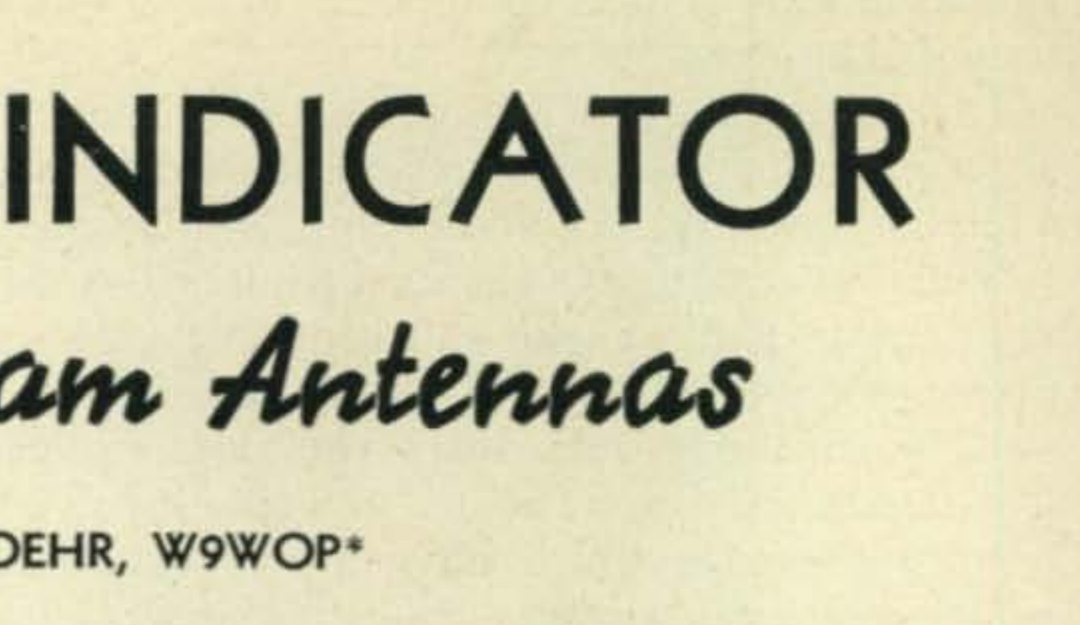

Fig. 2. Circuit hookup of complete rotary beam direction indicator system.

In *Fig. 3* is a graph showing meter readings plotted against settings of the RB-2. This represents laboratory tests which can be duplicated in actual operation using the components shown. Incidentally, the one-watt resistor in series with the battery can be a carbon-composition type or wirewound, and any value between 200 and 250 ohms will be suitable as final circuit adjustment is made with the meter series resistor.

Battery Operation

This direction-indicating system has been designed for use with a six-volt battery. However, 4½ volts or as high as 24 volts can be used provided there is an appropriate meter circuit arrangement. The meter may be any conventional type having an 0-1 ma movement, although the 0-½ and 0-2 ma types will also give very good results. There have been a few microammeters in the 4″ size offered on the surplus market that would be quite suitable if one is lucky enough to obtain such a meter. Be sure to use the correct value of

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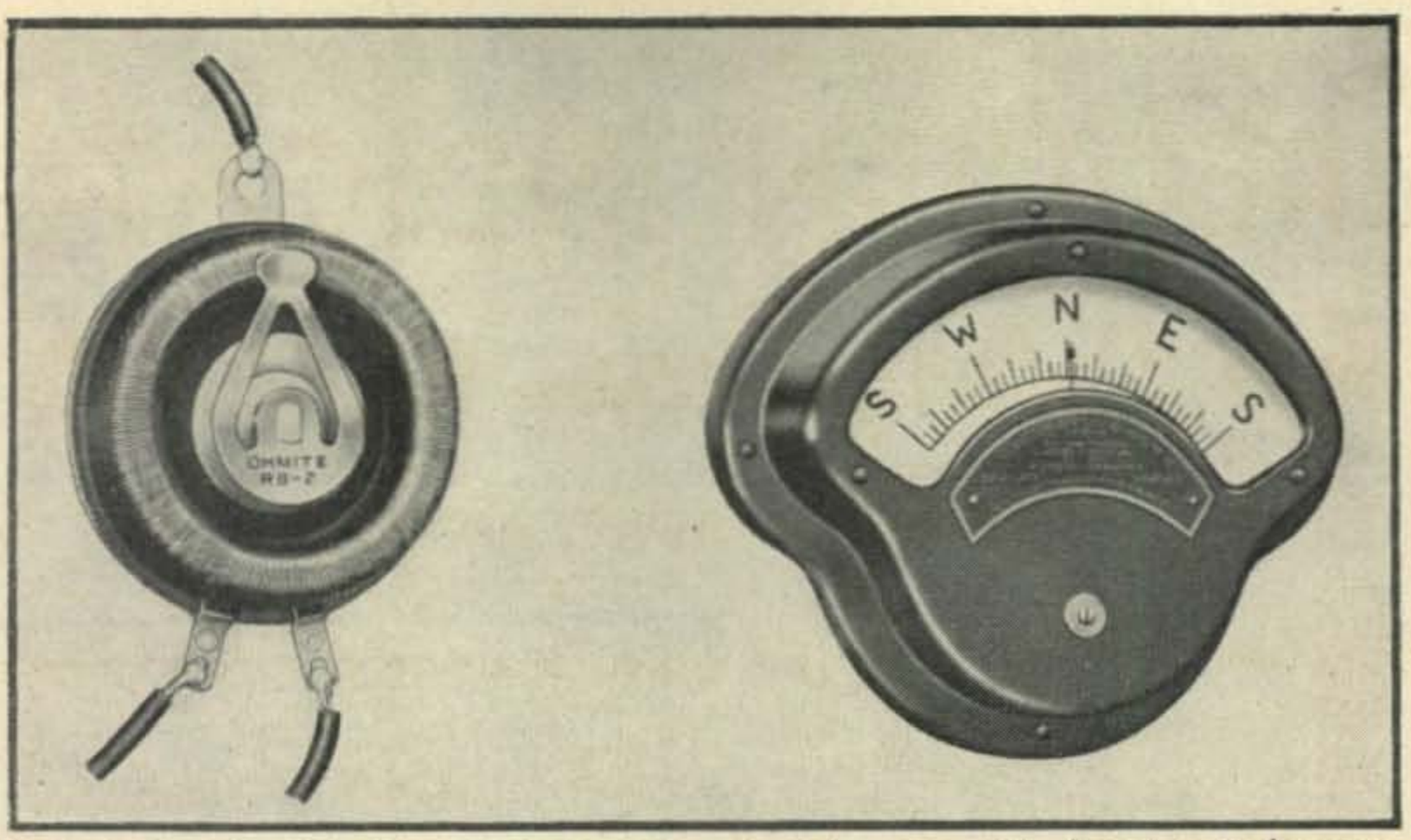

Indicating potentiometer and 0-1 ma fan-shaped meter with direction indicating scale substituted for numerical markings.

series meter resistor so as to allow adjustment of the meter to exactly full scale deflection with maximum voltage setting of the RB-2. If a 0-1 ma meter having a disc rectifier attached is available, six volts from a filament transformer could be used instead of the battery. However, the battery arrangement is much simpler, costs less and inherently has excellent voltage stability. Since the drain is only a few milliamperes the battery should have very long life.

The RB-2 potentiometer is usually mounted on the antenna mast or tower in such a way that its shaft will be rotated in step with the antenna rotation. Suitable means should be used to protect the potentiometer from the weather. No ventilation is needed for cooling this unit since the wattage consumed is so low that practically no heat is given off. Since low voltage is used no special precautions are needed in wiring, in fact, bell wire or telephone wire can be used if desired as the current drain is only a few milliamperes. If ground connections are near, one side of the circuit could be grounded, thus eliminating a run of one wire. The system is so simple that no trouble whatsoever should be encountered in getting everything to function properly.

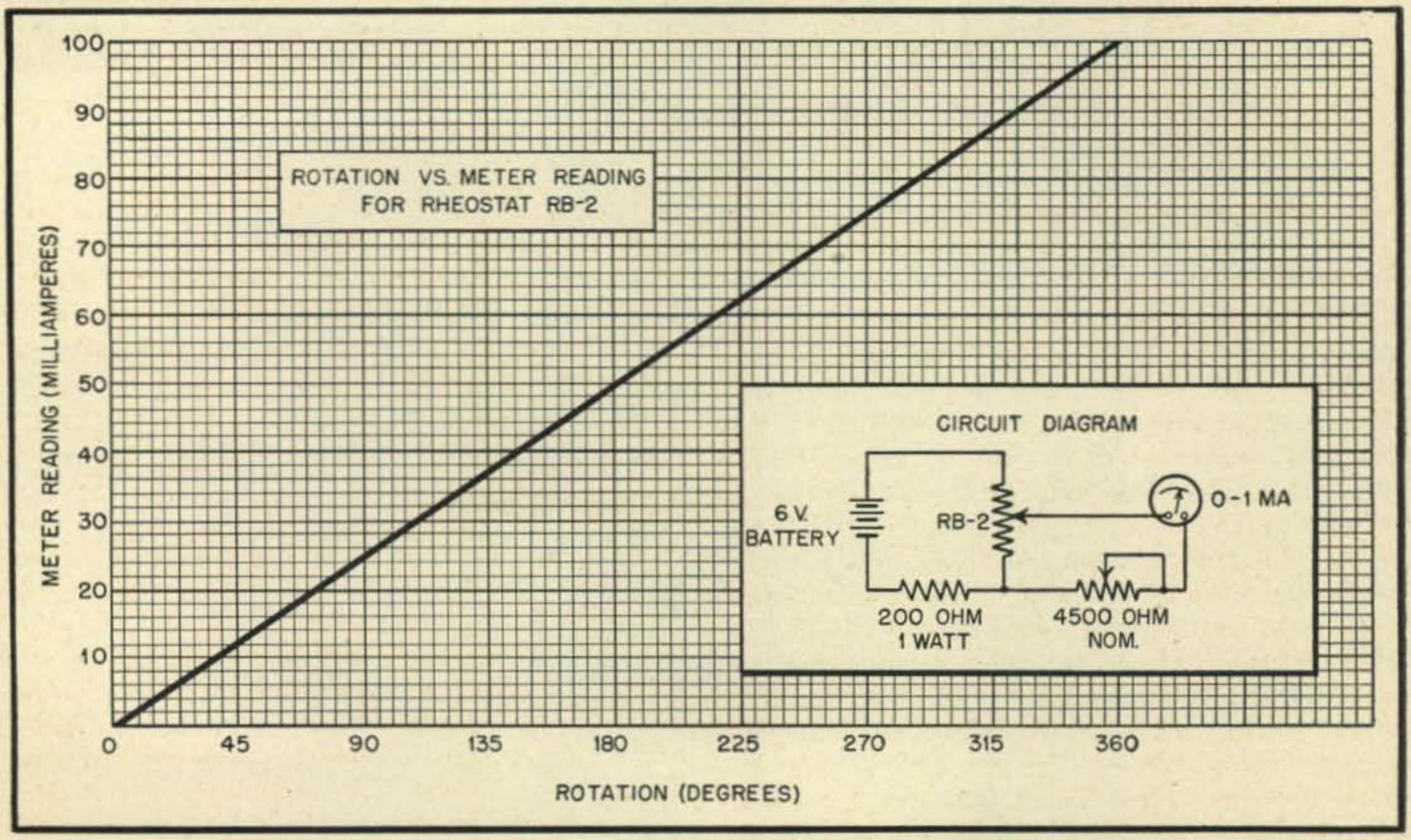

Fig. 3. Indicator meter readings plotted against potentiometer setting in degrees. 360° rotation is indicated on the face of the standard milliammeter.

The Great Sunspot Enigma

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and

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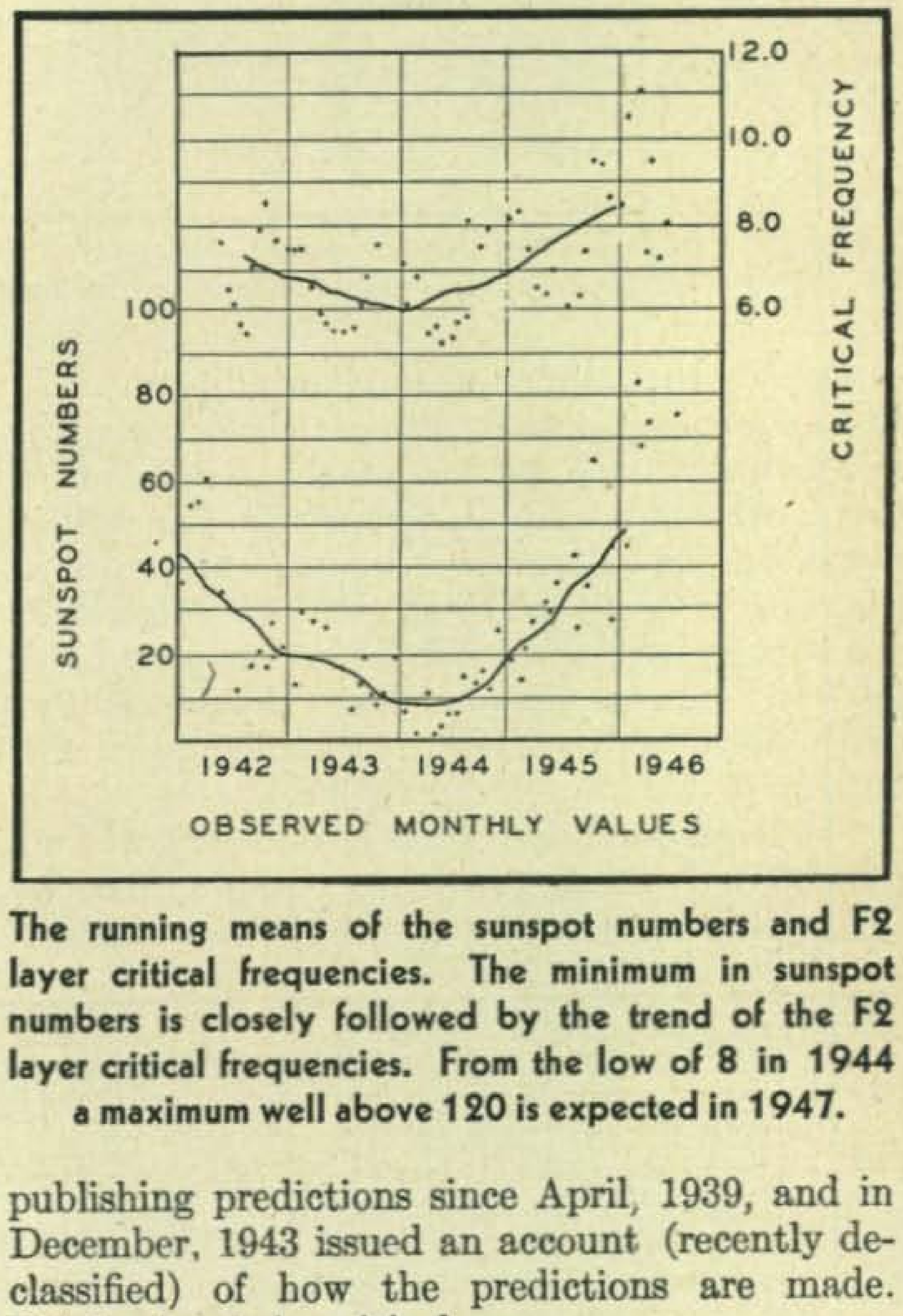
OF THE GREATEST IMPORTANCE to long distance radio communication on this earth of ours, are tiny disturbances on the face of the sun just barely visible to the naked eye when viewed through smoked glass. These blemishes on the smiling face of Old Sol exert a remarkable influence on the behavior of that tenuous layer of ionized gas upon which we depend for skywave QSO's; in fact it can be said that we transmit, or don't transmit, depending on the state of the sun's complexion. Your dyed-in-the-wool radio ham, instead of staying up all night in pursuit of the Will-o'-the-Wisp DX, might save himself some trouble by waking up during daylight hours long enough to investigate a few solar, as well as lunar phenomena.

Sunspots affect radio, all right; there can be no doubt of it. Most of us have seen curves of sunspot activity compared with F2 layer critical frequencies, and have marvelled at the correspondence. And, of course, it is only human to speculate on the appearance of the curves if the moving hand of fate were urged, so to speak, to move ahead a little faster. But here, in the realm of the future, scientists as well as laymen disagree. According to one school of thought, the sunspots are expected to behave in 1947 as they did in 1927; according to another, sunspot history in 1947 will be more likely to repeat that of only one decade before. This may sound academic, but the effects are important; if radio predictions are based on one school of thought, they will come out roughly either 25 per cent high or 25 per cent low, depending on which school is right. Here, at any rate, is an argument in which everyone can take sides; and everybody owning a shortwave receiver can see for themselves, in time, which side won.

Data on sunspots have been collected for a long time—in fact, since the year 28 B.C. by the Chinese, in case you were wondering—but it is only within relatively recent years that they have been put to use in predicting radio transmission conditions. The United States National Bureau of Standards has in point of fact been publishing predictions since April, 1939, and in December, 1943 issued an account (recently declassified) of how the predictions are made. Briefly, here's how it's done.



The running means of the sunspot numbers and F2 layer critical frequencies. The minimum in sunspot numbers is closely followed by the trend of the F2 layer critical frequencies. From the low of 8 in 1944 a maximum well above 120 is expected in 1947.

Determining DX Predictions

First, the curve of monthly averages of relative sunspot numbers reported by the observatories are smoothed by what is called a 12-month running mean. This averages out the month-to-month variations by taking into account all the measurements made during the preceding and following 6-month periods. This 12-month running average of sunspot numbers agrees very closely with a similar average of critical frequencies (the best measure of the ionosphere's reflecting power), for a given hour of the day. Consequently an extension of the averaged sunspot number curve, once decided upon, can be used as a basis for calculating ionosphere behavior. Data taken from this curve are cor-

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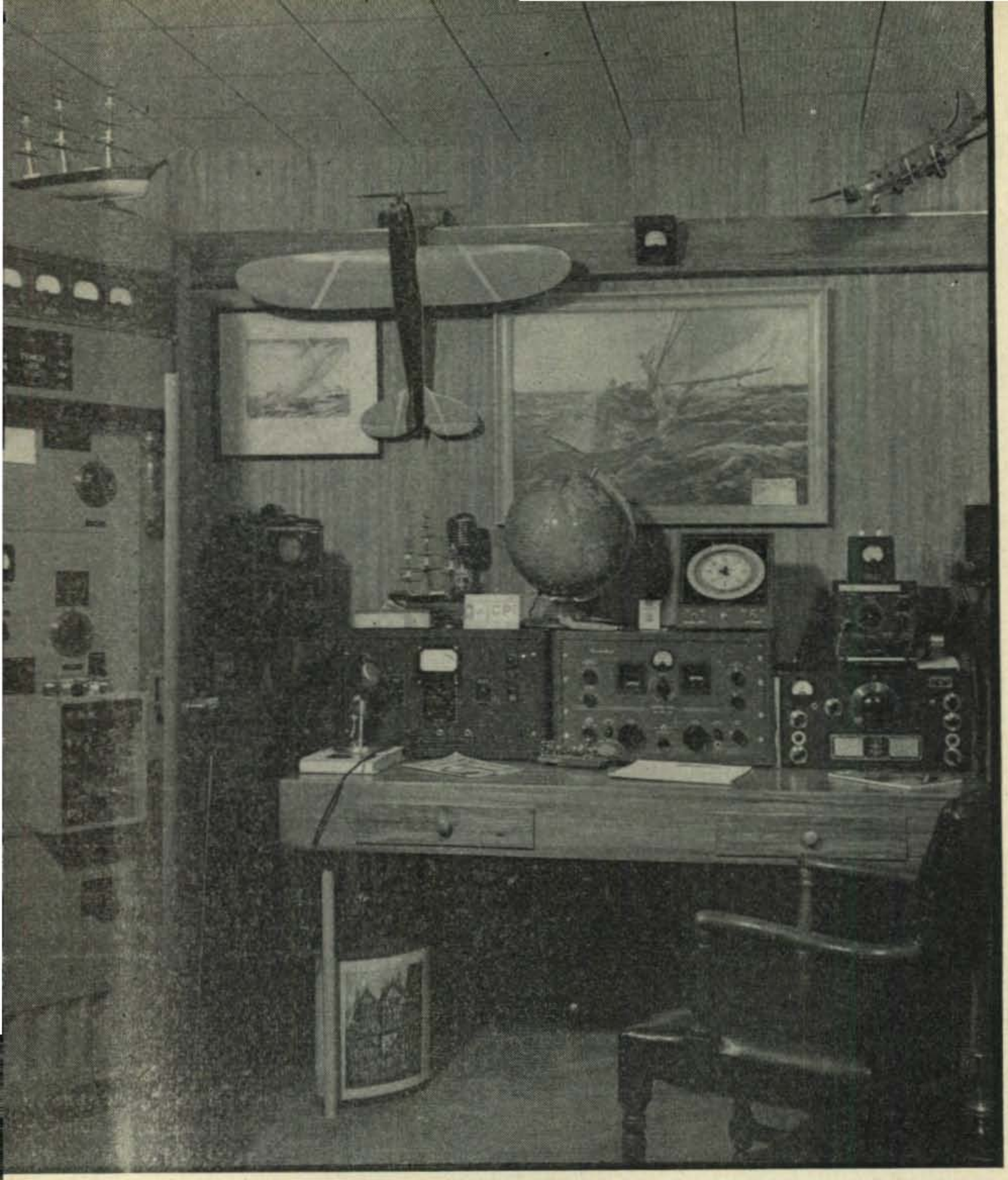
DEPARTMENTS



The unusually complete station of W1CPI, better known on all bands as "Skipper." The transmitter is a 1 kw Temco with automatic bandswitching from 80 to 10. The radio room is a completely sound proof, acoustically perfect, shielded and insulated. Besides the Super Pro, HRO, LM 15 frequency meter, scope and other miscellaneous pieces of test equipment W1CPI has an antenna setup rivaling most commercial stations. A Gordon Specialties Co. rotomount on top of a 54 foot Harco tower handles a 3 element 20 meter beam. For 10, a Johnson Q Beam 52 feet high is used. On 7 mc a 60 foot high half wave doublet and on 75 a phased 3 element array between two 80 foot towers is used.

- *Monthly DX Predictions*
- *UHF*
- *CQ DX*
- *YL'S Frequency*
- *Parts and Products*
- *Postscripts*

Monthly DX Predictions - - NOVEMBER

OLIVER PERRY FERRELL*

Comments and Problems

Comments from the users of the Band Predictions are invited and are of interest to CQ and to the IRPL. If you have some transmission problem directly involving conditions for DX-ing or want to know what would be the best average hours for working a certain city from your location you are invited to write to the Propagation Editor, CQ Magazine, 342 Madison Ave., New York 17, N. Y. Please enclose either a penny postal or a stamped self-addressed envelope for reply. Allow 7 to 10 days for reply.

WAR-TIME RESEARCH in the physics of the ionosphere has revealed a surprising number of new discoveries. In thinking back however, once the general theory has been established, it is quite an interesting feat to apply our new found knowledge to instances of historical DX. One of these concerns the possibility of working trans-Atlantic or trans-Pacific DX on 5 or 6 meters. In 1936 to 1938 there appeared every likelihood that 56.0 mc signals could break through, but somehow it never came about. This did not seem right according to our old theory of the ionosphere. Many a DX man has wondered if the English 5 meter stations were actually heard in South Africa and Australia, or if someone was pulling the gullible Americans' leg. The developments in ionospheric physics which have been brought about by the excellent international and Allied cooperation have recently indicated that these 5 meter instances were not only true, but had our knowledge reached the present strata, could have been equalled and probably bettered.

From the studies of the National Bureau of Standards and the equivalent physical research organizations of our Allies, we have learned that the ionopshere can be divided into four longitudinal sections. Each of these sections has its own individual characteristics. Previously, it had been postulated that the ionosphere and radio transmission as well, were alike in all equal

Propagation Editor, CQ

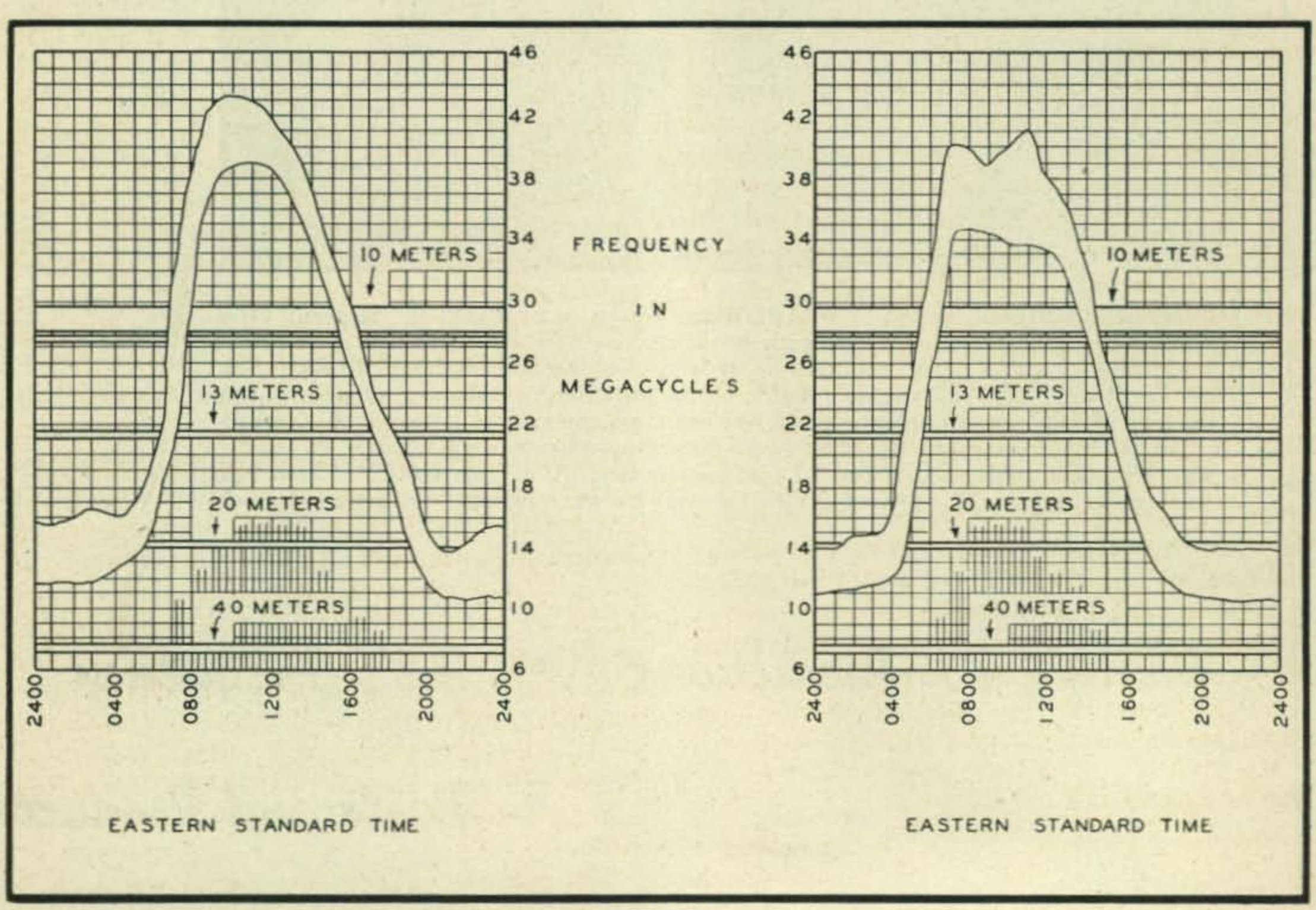


Fig. 1. (left). MUF East Coast of United States to Central Europe. November 1946 average conditions. Fig. 2 (right). MUF East Coast of United States to South Africa. November 1946 average conditions.

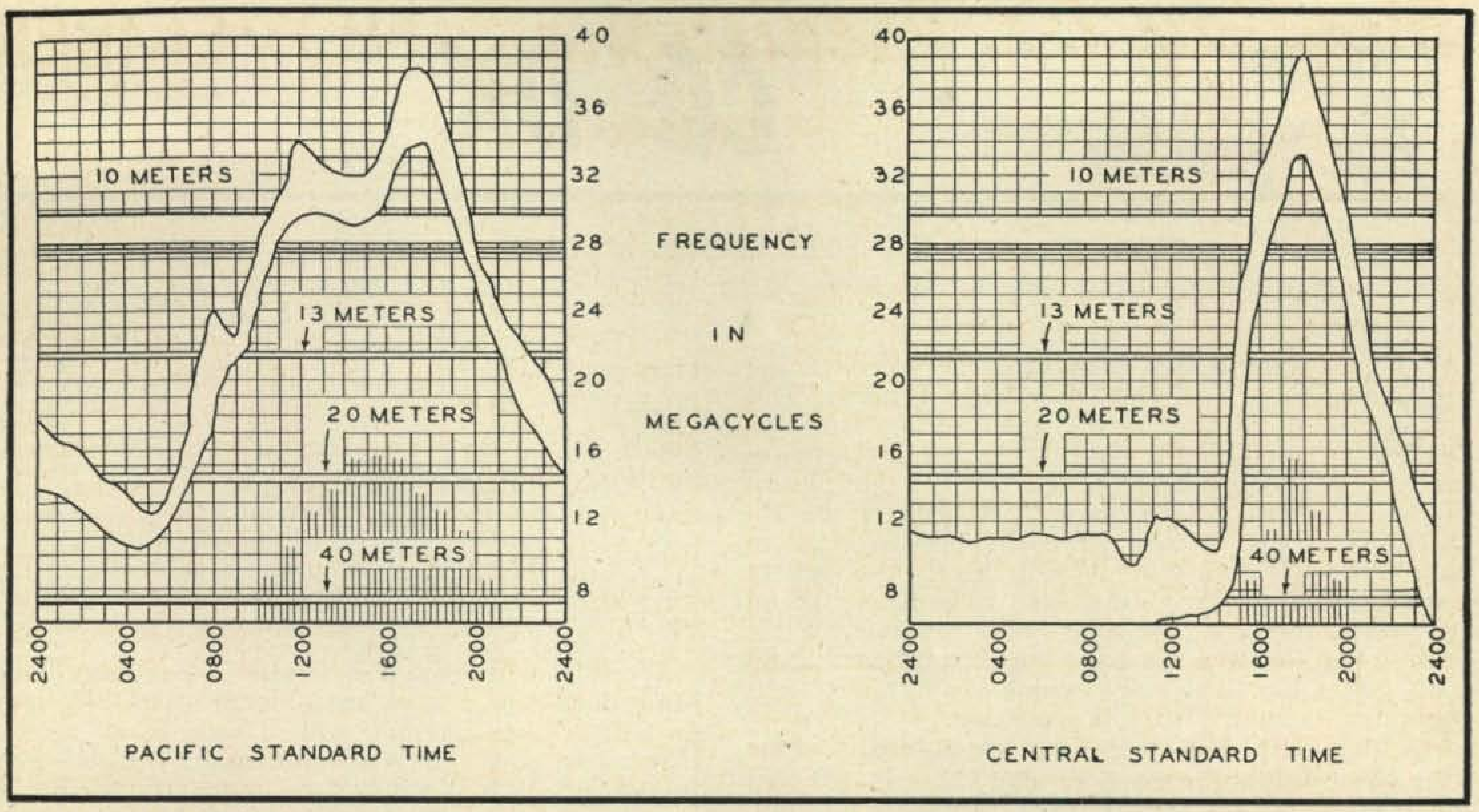


Fig. 3 (left). MUF West coast of United States to Australia and New Zealand. November 1946 average conditions. Fig. 4 (right). MUF Central United States to South China Sea area and Philippines.

latitudes. The disproving of this former thesis has been a big step forward, although it will undoubtedly be a shock to many to learn that as a whole the North American continent is the poorest place in the entire world for h-f and v-h-f radio transmission.

As expressed in the October predictions the possibility of a 6 meter breakthrough from Hawaii to the West Coast can no longer be ignored. The data relative to this prediction is pictured in *Fig. 5.* This represents the iso-ionic lines for 2500 mile radio transmission at 1600 hours PST on an average day of November, 1946. F_2 layer transmission from Hawaii to the West Coast is generally accomplished in one hop. In other words, on an average day the maximum usable frequency (MUF) from Honolulu to Los Angeles will be approximately 49.0 to 51.0 mc. To the San Francisco area it is only expected to be one megacycle less. On any day that conditions are somewhat better than average (remember that this prediction is made three months in advance and is based upon the minimum expectations) a full 6 meter opening may be expected. This graph of iso-ionic lines is only good for 1600 hours PST and the conditions represented are localized to this Pacific Ocean area.

The Month of DX

November generally stands for the most outstanding month in DX. This is due to the transition of the summer static and absorption belts to positions below the equator. This year, November will be particularly interesting. The wholesale improvement over 1945 will be noted by those operators who were confined to 10 meters after V-J day and obtained a very poor impression of the true conditions on 10 meters. Personally, I believe the DX of 1946 and 1947 will long be remembered.

In *Fig. 1* the North Atlantic path from the W1-W2-W3-W8 and portions of the W4-W9 and WØ areas to Central Europe indicates that 10 meters will be particularly active. The 10 meter band will be expected to open on an average day between 0700 and 0730 hours EST and close between 1530 and 1600 hours EST; excellent strength signals about 0930 to 1130 hours EST. The highest maximum usable fr.equency (MUF) may be expected to be 43.5 mco Amateurs interested in the chance opening f 6 meters to England might lsiten for the sound transmitter of the London television station on 41.5 mc which has resumed operations in our morning hours. Rather surprising conditions are expected from the area east of the Mississippi River to South Africa as illustrated in *Fig. 2.* The band opening on 10 meters appears to be 0600 hours, which is somewhat earlier than usually encountered; particularly good signals from 1000 to 1200 hours EST. Twenty meters will probably be very active to Europe around 1600 to 1900 hours EST and to South Africa from 1430 to 1630 hours EST.

The general outlook for North American to South American conditions is very favorable. The MUF, represented by the top or outside

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CQ DX

By HERB BECKER, W6QD

[Send all contributions to Herb Becker, 1406 South Grand Ave., Los Angeles 15, Calif.]

THE past month has brought forth more of the same thing . . . if you know what I mean. DX seems to be overflowing again into 28 mc, as well as on good ol' 40. By the way, what the deuce is going on on 40 meters? Remember our phrase (pre-war) "Life begins on 40." A flock of the 20-meter boys, who couldn't get to first base carrying on a 100% QSO with other Ws on 20, have tossed in some more inductance, managed to land on 40, and netted themselves good solid 100% contacts. While riding high on 40 a few have knocked off some good DX QSOs, too. The more I think of 40, the better it sounds . . . think I'll try it some day.

A little bird (and I won't say which bird) told me the other day he heard a strange thing on 20 c.w. This strange thing signed W1SZ! Imagine that . . . Roddy learning the code again and getting back on the air. 1SZ is Sales Mgr. of Submarine Signal, but I don't suppose his getting that 20-meter c.w. going again has a thing to do with it.

Remember K6GAS, Henry Lau? He is now KH6AW on Oahu. W6QL dropped in the other day to say he worked VO6H Goose Bay, Labrador, phone. His nickname, "Boc." W6QL has 95 and 62, which means pre- and post-war respectively. Oh, yes, also said XZ2KM is a nice one on c.w., which reminds me W7ETK worked him gives his QTH: 379 Dalhousie St., Rangoon, Burma.

W1QV has been knocking 'em off quite regularly and you will find most of his in the Frequency section that follows. 1QV did say, however, that he heard W6GRL working G5RW, who was operating portable in Rhodesia. Bob says KA1CM is now in Poquonnock Bridge, Conn., his call now is W1PEB, although he will probably be heading for the west coast very shortly to settle down. We surely have a lot of post-war "native sons" out here . . . wonder what there is about this here state!!!

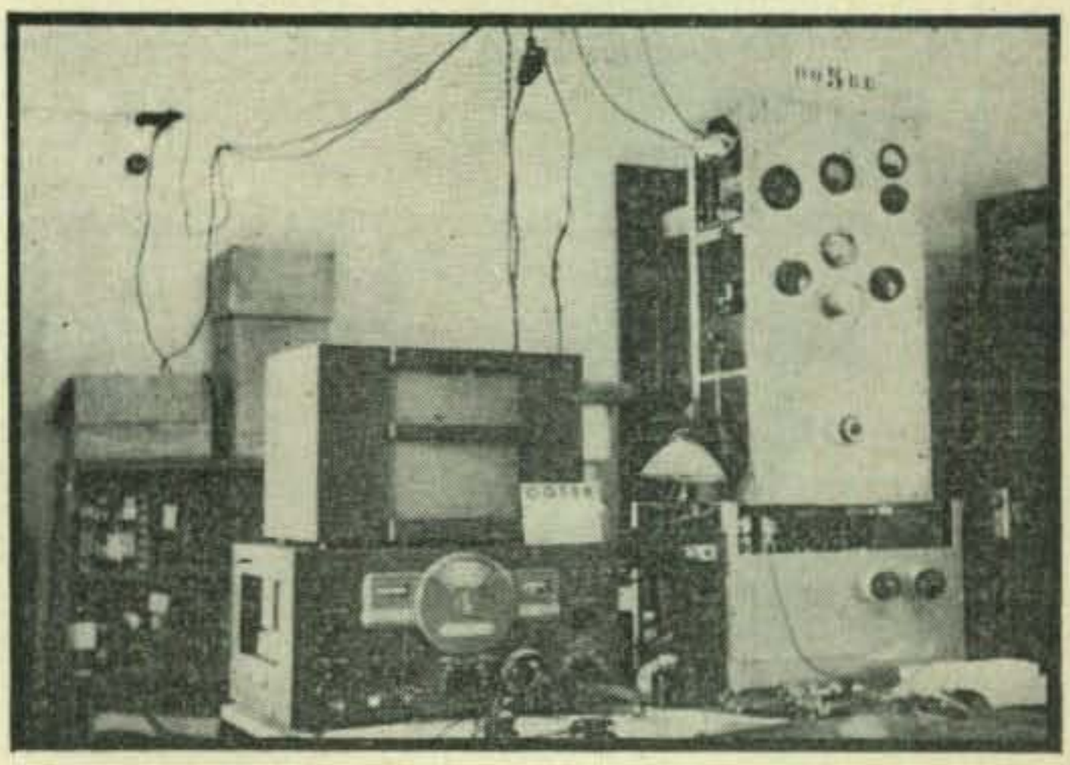
I'm going to try listing all the important DX stations in one fell swoop. The frequencies have been reported in various contributions from you DXers and I'll not attempt to put them in any kind of order. Let's see how it goes. Phone will be "f" and the other stuff will be just plain.

PK6TC	14088	ZP6AB	14075
PK6HA	14094	VS1BX	14080
C3CW	14079	C3YW	14090
ZS6FC	14099	PZ1FM	14175
AX5QC	14079	VP5AA	14102
PY6AG	14120	OX1A	14090
PZ1RM	14115	VQ8AD	14095
PY3PA	14108	ZD4AB	14120
GM8MJ	14116	VP3JM	14085
CT2AI	14103	ET3Y	14135 and 14350
ZC1AR	14087		
I1ND	14093	EL3A	14080
YI3CE	14100	OK1AWX	14055
LA3GA	14109	OH5HQ	14085
EI6G	14114	UA9DP	14055
VE8AW	14119	UA3BM	14035
PZ1AM	14086	PK5AR	14310 f
OA4X	14111	PK6AW	14340 f
VS1BS	14090	PK6DB	14320 f
W4FGW/J2	14130	J9AAR	14235 f
HK4AF	14099	J9AAB	14290 f
VS7ES	14089	OX1AD	14370 f
VS9AN	14093	FG3FP	14350 f
VU2FX	14105	ZP2AC	14385 f
EL4A	14126 and 14340 f and cw	ZP8CN	14370 f
		LS1SI	14180 f
VO5Z	14130	PZ1A	14350 f
EZ4X	14112	HP1A	14349 f
VS4JH	14087	UA9CB	14055
CX1DZ	14119	W9CAC/TF	14250 f
VP4TR	14099	VP6PC	28050
EA8H	14132	VQ2FR	28250
FQ8AL	14094	VQ2PL	28040
FM8AD	14086	ZS6FU	28100
VO6H	14192 f	VR2AB	28450
XZ2KM	14052	VP4TE	28750
VP5AA	14102	ZB2A	28100

Word from WØFWW indicates he has been doing some pretty good work with his 20 watts. He uses an 8JK rotary antenna, and as soon as he runs a little more power, he will be breaking into the DX fraternity. W3EWN has been concentrating on 10 meters, and the following are a few of his best ones along with their QTHs: VP6PC, P. O. Box 116, Bridgetown, Barbados; VQ2FR, P. O. Box 111, Mufulira, Northern Rhodesia; VQ2PL, P. O. Box 3, Livingston, Northern Rhodesia; ZS6FU, P. O. Box 7028, Johannesburg, South Africa; VR2AB, P. O. Box 338, Suva, Fiji; VP4TE, Major Louis Kerr, (who used to be VP3BG) Royal Signals, British Army, Trinidad, British West Indies.

W3EWN has worked forty-two countries on 10 post-war, while his total was 121 pre-war. His rig consists of a single Eimac 304TH with 500 watts input. Although a W3, Jimmy is located in Spring Hill, Alabama, which I understand is just west of Mobile. It must be a good location because he bought the place.

While we are in the south, we will pick onW5LDH who kicks in with a little information for the first time. Phil is getting a big kick out of his DX and is working such stuff as KF6SJ, FM8AC on 20, and KZ5AD and VO3O on 80. He lists a few stations and their QTHs as follows: CX4CS, Joe Goyret, 1012 Blanes St., Montevideo, Uruguay; CX5AY, Alexandro San Martin, Box 37, Radio Club del Uruguay, Montevideo, Uruguay; YV5AN, Genaro,



OQ5BR, Albert Counotte, Leopoldville, Belgian Congo. Station uses push-pull 807s, SX-23, and delta-matched doublet running North-South.

Box 1666, Caracas, Venezuela; LU5CZ, George, Buenos Aires, Argentina; OA4F, Box 981, Lima, Peru; HK3DD, Percy, Box 1642, Bogota, Colombia.

W6EAK doesn't have very much room in his back yard for antennae, but he does have plenty of room straight up, so he shoots a half-wave length of 2½-inch thin-wall dural pipe which is in turn mounted on a 2 x 2 on his roof, the whole thing being 75 feet in the air. EAK feeds this thing with 300-ohm twin-line into a quarter-wave stub. He says it scares him to death sticking straight up in the air, to say nothing of the neighbors.

It is good to hear from W3AYS. At the present time, he is in Dayton, Ohio, but expects to leave Wright Field and go back to Baltimore in the very near future, so you will probably hear him pounding away on 20 and 40. More QRM for the East coast.

For those who want the QTH of W6VKV/I6, here it is: M/Sgt. Donald C. Morehouse, U.S. Army Radio Station, APO 843, c/o P. M. New York. Also, if you want to send a card to EL5B, use the same address as EL4A which happens to be APO 605B, c/o P. M. Miami, Florida.

Our old friend G6WY, H. A. M. Whyte, writes a DX column in the British magazine "Short Wave." Good old "HAM" has been in the racket a long time, and I wouldn't be a bit surprised if we lift a few items out of his column from time to time.

In a recent letter from EL4A, he points out that a lot of the boys who are now living in Liberia got a tremendous bang out of using his station to talk to their girl friends, wives, etc. back in the States. He says the boys really are cooperative, and, naturally, being able to use his station makes him feel sometimes as if he were running a Cupid's department.

These fellows are amazed at the way the signals of the American hams come breaking through, and it seems that this happens about an hour before EL4A can get through to them. Cliff also mentions that as the evening progresses, signals from different points will stand out. Even stations that are only twenty-five miles apart; one night one station will be up, and the next night another one. As I have said before, EL4A uses 400 watts on c.w. and 450 on phone. The antenna is a single wire, two wave lengths long, which runs to a tower about forty feet high. At present, they are keeping regular nightly contacts on phone with Hawaii in order to be of some help on the special flight of the B29 "Dreamboat." We expect to get some photographs of EL4A one of these days.

Our erstwhile editor, W2IOP, says that he is so busy, he doesn't get on the air as often as he would like, but he has been able to pick up a few addresses for you fellows, and here they are: CX4CZ is Box 37, Montevideo. VQ8AD is old VQ8AH and his QRA is Paul Caboche, Rose Hill, Mauritius.

W6AM now operates part of the time from his new superduper location in Rolling Hills. Incidentally, Don has obtained Rt. 1, P. O. Box 73 as his mailing address in Rolling Hills, California. For those of you who wonder where it is, Rolling Hills is right next to San Pedro, which is about five miles from Long Beach. Frankly, a lot of the natives in L. A. don't know where Rolling Hills is, and this information might enlighten them too. Don mentioned working VK4LZ, who is a projectionist in a movie house. He has his ham rig there, too, running 15 watts. His assistant is VK4CG and I presume he assists in running the machine as well as the station. VK4LZ mentioned while talking to W6AM that the picture they were running at the time was "Thrill of Romance," with Van Johnson. What a business!! By the way, someone said that Don's new street address in Rolling Hills might be 88, but I don't believe it.

Reports have been received from Billy Lyerly of Fort Worth, Texas, and Roger Legge, both of whom are not yet Hams, but nevertheless they are intensely interested in the DX situation. For example, Roger relates that K6JEG, who is now on Palmyra Island, expects to be back in Hawaii around the first of November. In case any of you fellows need QSLs for pre-war contacts with KG6JEG on Jarvis Island or KF6JEG, Canton Island, his address will be Henry K. Lee, 12 Kauila Street, Honolulu 52. Also, from Roger we hear W2LFI/FF8 now has his new call FG3FP located in Dakar. He lists quite a flock of good DX stations and the best ones are listed with our frequency list elsewhere in this column. Billy says W8QEN/CT2 is apparently back in the States, because mail to him is being returned, probably indicating his base has been de-commissioned. OZ5UQ gives his QTH as Box 4, Northaaby, Denmark. Also it appears that UA9DP is located in Sverdlovsk, Siberian USSR.

W9AIO, Royal Higgins, threw a key into a transmitter a couple of weeks ago and knocked off a few UA's as well as FG3FP. Royal is using a couple of 4-250A's with about a kw input. He is on the verge of trying out one of those narrow band FM exciters, so if you hear his line of chatter on the 10-meter FM band, you might give him the business.

A note from W2QCP tells us he is ex-W8ACY. You fellows will probably remember Bruce, and he is now located in Rochester, New York. He is doing his share of DX. Some of the better ones include ZP8CN, ZP2AC, J9AAB, J9AAR, and FG3FP. Another one we are glad to hear from is W8PQQ. He sends in the QTHs of a few stations which may come in handy for some of you fellows. Here they are: TR1P—(28 mc phone) Everett Keener, 114 AACS Sq., A.P.O. 498, C/O P. M. N. Y., N. Y. Stn. now QRT, but has sent many QSL cards . . . Tripoli, Libya. ZB2A—c/o C.S.O., RAF, Gibraltar (28 Phone). FM8AC, Robert Martinon, Box 260, Fort-de-France. W9CAC/TF, 136 ACS Sqdn., A.P.O. 610, c/o P. M. N. Y., N. Y. W8SIR/VP9, Lt. D. C. Fugman, A.P.O. 856, c/o P.M. N. Y., N. Y. In return W8PQQ wants the QTHs of CP5EA, OX1WB, and OX1Z.

W8LFE says CR6AF has ordered a new HT-9 transmitter, as well as a new receiver, and will be on the air with it very shortly. Although LFE hasn't had much time, he does manage to get on and work a few of them such as UA9CB, UA3BH, VP2MT, LS1SI, FG3FP, and PZ1A. W8LFE, many of you recall, is director of the BC station WOSU in Ohio State University in Columbus. George mentions

[*Continued on page 44*]

U H F • • •

By JOSEPHINE CONKLIN, W9SLG*

CAN WE GET SOME international 50-megacycle DX this winter? That is the question! The October ionosphere data for Washington-Honolulu shows that frequencies as high as 39 mc are predicted to be good—and some individual days may well exceed that. A nice thing about F-layer work is that it is rather predictable, especially as to the time to try it—namely, a time that is approximately early afternoon at the middle of the path between you and the other station. During November-February, especially the latter, there may be days when G5BY and others across the Atlantic, and K6's in the Pacific, will come through if they get on the air at the right times. There may even be W1-W6 or W1-W7 work by F-layer.

In the meantime, it is very evident that the boys who are using the 50-mc band for "local" contacts out to 400 miles are really having a grand time. They repeatedly mention the ease of doing this, compared with blasting through a lot of heterodynes on 80-meter phone. C.W. as well as phone works well. So does m.c.w. if you are interested in it.

Ten meters should produce some good 300-mile or 400-mile consistent ground-wave work, but usually it does not. Why? Probably because few stations try to put up an array that will bring down the angle of radiation. Putting it a little more accurately, what is needed is an antenna that radiates considerable power at angles within a few degrees of the horizontal. Three-element beams are often satisfactory, though the somewhat more complicated arrays used by many stations on six meters should be better. Horizontal polarization is getting to be the rule on this band, probably a combination of the pre-war use of horizontal antennas in the midwest, coupled with recent use of horizontals by Ed Tilton, W1HDQ, and others in New England.

Let's look in on the Eager Beaver net in the midwest to see what can be done on this six-meter band day after day. WØZJB near Kansas City, with an antenna only about 25 feet off the ground, had been holding regular nightly schedules with a number of stations in Kansas around 100 miles away, including WØOTV in Manhattan, a new addition to the net. The latter uses only a 6L6G doubler and a three-element beam! Vince Dawson, WØZJB, lists some of his more distant contacts up to nearly 400 miles, as outlined below.

On August 13, he worked WØNFN in Solon, Iowa, and WØCHI at Grand Junction. On the 15th, he worked NFM again for an hour. On the 17th, he hooked W9QUV in Moline, Illinois, 295 miles away. On the 26th he contacted WØNFM, WØIFB, WØCHI and W9QUV, then heard W9ZHB at 353 miles. WØYUQ in Kansas also heard W9QUV in Illinois, a distance of 400 miles. ZJB's schedules with NFM are now on a nightly basis on c.w., and he appears to get W9QUV any time that their beams are pointed at each other. Contacts with the latter were still holding up nightly on September 10, while NFM at 250 miles and the others slightly nearer are considered to be like local contacts. Vince has not been able to work W9ZHB but has frequently heard his signal.

Then, too, there is the two-meter band. Some of the more carefully constructed stations are able to pull 200-mile signals through regularly, although the tendency to use sloppy equipment seems to ruin the ability to contact the frequently-heard, more populated centers. W3HWN's experience along this line is to the point. Paul frequently sits back and listens to New York stations say, "no DX is coming through," when actually their signals are R5 to R7 in Mechanicsburg, a good 200 miles away. One Sunday morning he tuned in a nice carrier—which later turned out to be W2JWO in Patchogue, Long Island, who has done some fine DX work although he had not heard any DX coming through during the day. Most of Paul's DX work in July took place after 10:30 p.m., EDST, to be sure. Paul rebuilt his 16-element beam on a 60-foot platform which puts the top of the beam 70 feet high. Since putting up this job, he has heard New York stations every night on two meters.

Very definitely, the 2-meter stations that get out from 200 to 300 miles are generally better constructed, with beams better placed and with more elements, than is the case with the 50-mc stations. Of course, there are the exceptional six-meter rigs too, like that at W9ZHB, but very good work as outlined above is being done with quite ordinary outfits.

As more of the gang get active, and the novelty of 40-meter c.w. wears off, we expect to see more activity on both six and two meters. Then, too, these are fine bands for Class-B phone work.

What Ranges are Possible

Most of the boys by now recognize that 56 megacycles was good for one or two hops up to about 1200 miles or more each, with a cross-country record set up on a multiple hop. Fifty megacycles may possibly do better because F-layer hops of 2000 miles or so are a distinct possibility at the highest point of the cycle about 1948/1949. At the ultra and super-high frequencies, however, very little of this sort of thing is in the cards, although some 2-meter DX has been encountered in recent years, of the 1200-mile variety. On the other hand, low-atmospheric-bending signals are encountered, like the 200-mile-plus contact of W3HWN on two meters.

If good antenna gain is used, these contacts are limited primarily by the peculiar conditions that are encountered. In some parts of the world, these odd conditions are normal rather than abnormal. The lower California coast is not bad that way, and there is a place around Arabia to Bombay where 1700 mile radar reflections have been reported. We looked at a map and saw that 1000 miles might be the figure intended, but whatever it is, that is real DX for a wavelength of a few centimeters!

For that matter, there was a statement made at the recent URSI joint meetings with the Institute of Radio Engineers in Washington that ten-centimeter radar has been picked up between Cape Cod, Mass., and the coast of Nova Scotia, which was 280 miles away. If moderately strong radiation at Cape Cod created relatively weak reflections from the

*Conklin Radio Co., 6800 Clarendon Road, Bethesda 14, Maryland

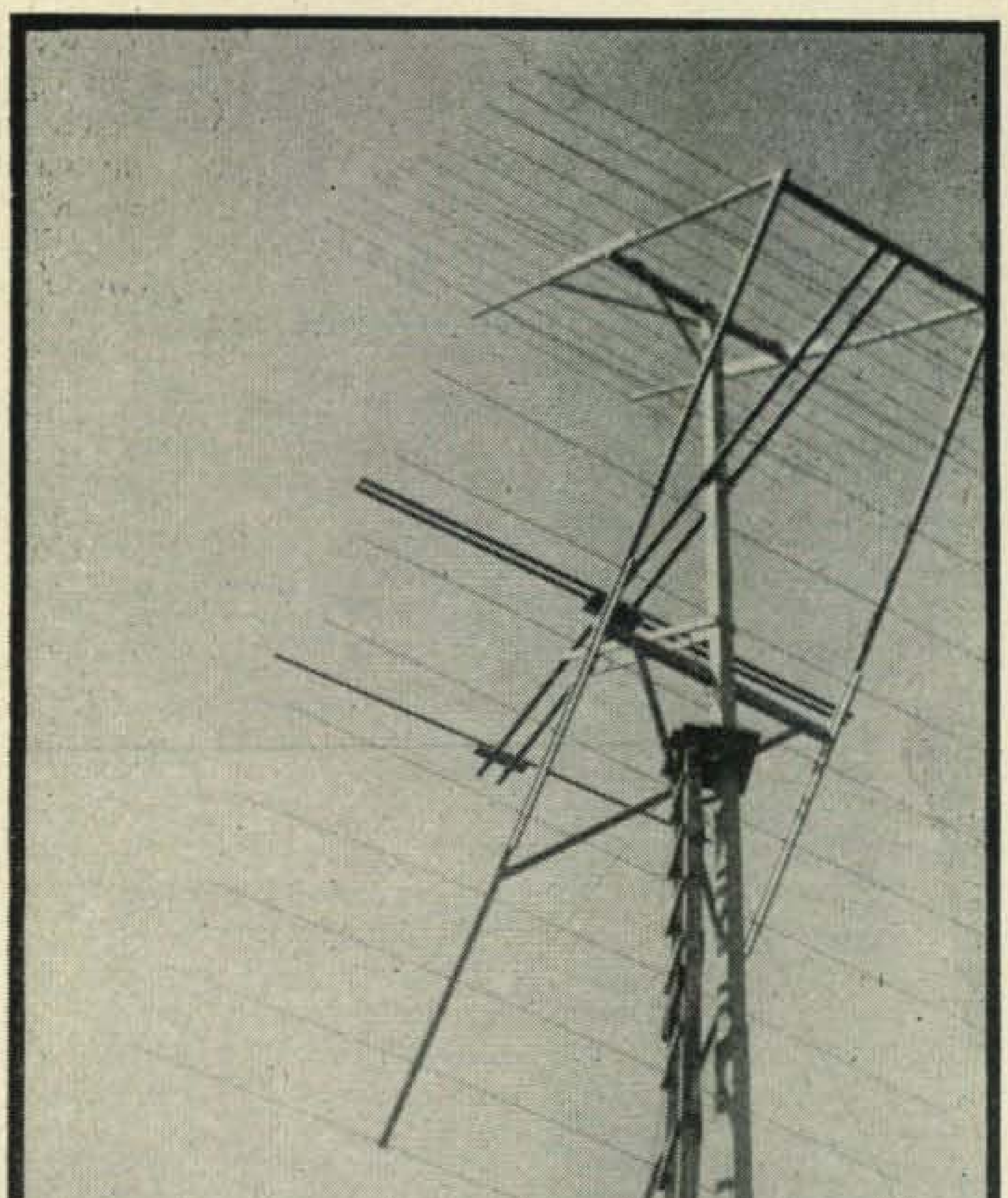
Nova Scotia coastline which in turn were picked up at Cape Cod, it should be a cinch for an amateur on Nova Scotia to put out a strong enough direct signal to bridge the gap.

Here is a chance for some of you W1's to make a nice DX contact on just about any UHF band, up to the highest. It will set a record for 144 megacycles or higher!

50-Mc Skip DX

Conditions in August held up rather better than in prewar years, then dropped out. No reports of September openings have been received so far. For that matter, we are amazed that there have been no reports of aurora-type DX on six meters, which can be had by pointing beams in a northerly direction, particularly using c.w. There were several storms—a very severe one around July 26, and several more in September, which should have been good enough to support contacts at distances of 300 to 600 miles. The 300-mile contacts can be had with ground-wave signals and there have been sporadic-E hops nearly that short, but right now this range of distances is definitely in order during ionospheric storms. When you hear WWV send W-W-W-W instead of N-N-N-N, point that beam *north!*

To bring the skip DX reports up to date, we shall first review dates mentioned last month as has been our practice. On August 1, W9ALU worked W1-FJN; on the 9th, he hooked W1NWE/4 in Florida, W8CIR/1 and W1JLK/1 in Massachusetts. W6-OVK heard VE7AEZ on the 11th.



Horizontally polarized square-co ner reflector used on 50mc by Glenn Harnishfeger, W9QCY, Fort Wayne, Indiana.

August 12. WØZJB worked W5JGV/7. W9QCY heard two W1's

August 13. W9QCY in Fort Wayne heard a W4, and contacted W4FLH, W4IUJ, W4GJO. WØZJB heard no skip DX.

August 14. WØZJB in Gashland, Mo., near Kansas City, worked W4GJO.

August 17. WØZJB worked W8TDJ who was swishing in and out.

August 18. W9QCY hooked W4GJO and W4QN, then heard W5AJG. The two W4's were morning and late afternoon, representing two openings. Gosh, where was the rest of the gang when these W4's kept popping in? WØZJB contacted these same two W4's after nine o'clock in the morning. He says that their signals stayed in until after six in the evening, and that they were having a field day all by themselves. Then ZJB also heard W5AJG for an hour and then W5LOW—ex W9BDL—at Corpus Christi. Last month we reported that W9ALU also heard these W4's plus W4FLH.

August 19. W2BYM and W4GJO were worked by WØZJB.

August 24. This was another good day. WØZJB started by working W1KMZ/3 at 10 o'clock in the morning, followed by Robbie, W4EDD/3. Then he heard W3IUN and drove to Topeka, Kansas, where he heard the band reopen to bring in W2BYM and W7IYW of LaGrande, Oregon. Vince was so unhappy that he telephoned home to get another operator on his rig, to hook W4HVD, W5WX, W4-GJO and W4QN. W9QCY heard a portable W4 in Kansas, and other stations with a very fast fade; he must have been on the edge of the skip—or, rather, directly under the patch of sporadic-E layer which did him very little good. However, he did follow it up a bit later with contacts with W5WX and W5FRD. In Amarillo, W5WX worked W3-OMY, W9ZHL, W9QCY, W9PK, W9QUV, W9-NFM/Ø and WØZJB—the last three being in that Eager Beaver net that stretches from Kansas to Illinois and keeps the band warm in the midwest.

August 25. Out in Tucson, W7QAP abandoned his rig to go visit W5JGV; they were barely awake when they got in on the morning opening with a contact with W5FRD and heard W5AJG, the latter on m.c.w.

Other Six-Meter Activity

During the early summer, some of the old-time five-meter boys, like W8JLQ, mentioned that "even W9QCY is now using a low antenna." But Glenn has now corrected that. While the driven element is only 35 feet above the ground, it has a director, plus a large horizontal square-corner reflector.

Jim Brannin, W6OVK, again reports on activity in the Bay area. W6IWS in Brookdale, California, is looking for six-meter schedules; he is near Santa Cruz. W6WFC, across the mountains from OVK, will soon have a whole kilowatt on six meters, with rhombic antennas, for a trans-Pacific try; he is at Half Moon Bay. W6NNS in Hayward, W6EUL in Vallejo and W6WKL in East Oakland are now active—the latter being ex-W7IFL of 5-meter fame from Cheyenne.

Harley Christ, W9ALU, is working his DX with only 15 watts on a pair of 24G tubes, and is still waiting for that post-war converter.

[*Continued on page 54*]

The YL's Frequency

by Amelia Black, W2OLB

SINCE the beginning of ham radio there have always been squabbles between hamming husbands and their wives as a result of the intrusion of ham radio into the social life. We have always felt that the hobby could be a source of mutual interest and pleasure instead of a cause of arguments if a little more common sense and discretion were applied on both sides.

The ham's wife may resent amateur radio because of the amount of time or money spent on the hobby and because of the little time the OM has for any activity other than hamming. Often the OM tries to push her into the hobby, thus causing her to resent it rather than accept it.

Some wives complain that their husbands are not interested in anyone who isn't a ham. Naturally, it's fun to be with someone who "speaks the same language," but only a rather narrow minded person completely limits his circle friends to one type.

Another complaint is that visiting hams come too often or stay too late. The visitor should use discretion himself, and where he fails to apply it, the OM should see to it that ham visitors leave at a reasonable hour. Obviously the XYL is on the spot for fear of being criticized as a poor hostess.

The ham usually brings up these points. He wants his wife to appreciate the hobby more, and is unhappy because she won't become licensed herself.

He wants to share his pleasure in the hobby with his wife and feels that if she understands it better, she will enjoy it as much as he does. This is reasonable enough, but if he tries to insist that she become licensed, she builds a barrier against radio, where a different approach might make her take to it of her own accord. She on her side should not have blind resentment against it, but should at least investigate the hobby and give it a chance to interest her.

The wife should be reasonable and not try to drag the OM off in the middle of a contest, and the OM in turn should know when to put aside his hamming and join her in the social activity she may have in mind.

We are not saying that the wife must become a ham herself, though the most enjoyment is probably achieved when the hobby is shared equally. In touching on these few points we're merely suggesting a little more moderation—and more consideration for each other. As we realize that this is a highly controversial subject, we will welcome any comments—or even arguments—that we might better present the views of all.

News of the Month

We received a nice letter from W7JFB, Miriam Brown, who is now active on 20 fone and 80 c.w. She has regular skeds with Lizette Wolf, W7HDS, for Thursdays on 14,260 kc at 1 p. m. PST and invites other YLs to join them. Any gals who are interested can either listen in at that time or drop her a line at Box 859, Route 5, Everett, Washington. Miriam's main ham interest is working toward WAS and contacting other YLs.

Liz Zandonini, W3CDQ, of Washington, D. C. reports that she's also looking for YLs and can be heard many evenings on 7220 kc.

YLs seem to enjoy working each other, and this idea is being further sponsored by the New York City YLRL club, which is planning fone and c-w roundtables at first on 28,880 kc and later on the other YLRL frequencies of 3610 kc and 7220 kc. Incidentally, any interested girls are invited to join these gabfests by speaking over a YL's rig, whether licensed or not herself. We might further mention that anyone who is interested in this activity—anywhere in the country—might drop us a line, and we'll try to help out. Hams who would enjoy introducing new YLs to the hobby should let us know so that they may be placed on a list of "cooperators."

Della Parker of Westville, N. J., writes that when South Jersey was shifted to the second district, her call was changed from W3AFZ to 2AFZ, which she's now signing on 10 meters. Della, by the way, is a commercial operator with a government agency, handling traffic.

Under YL-DX W1FTJ comes through again with countries 48, 49, and 50 postwar: UO5VW, ZL2GO, and TA1N.

W9ZTU, Mickey, has informed us that she's finally recovered sufficiently from her auto accident to leave for California. The OM's is stationed at Camp Beale, so Mickey's new home will be Marysville, California.

Some of the newest YL calls are: W7JWC, Manila Beebe now of Kirkland, Washington (XYL of

[*Continued on page 46*]

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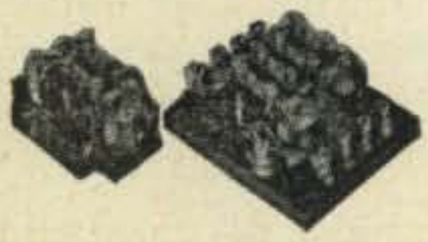
RELAYS



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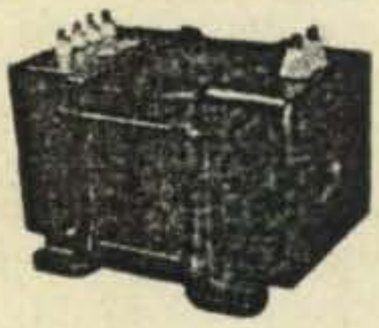

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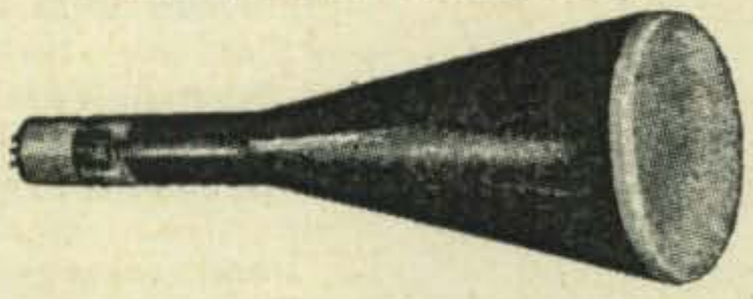

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15 kc to 600 kc. 6-tube receiver with: AVC-Band pass filter-Audio filter — Noise limiter — Precision tuning with a Vernier dial—Voltage regulated power supply, with three tubes, for 60 cycle, 115 volts. Can be battery operated. Complete with spare parts box weighing 73 lbs., spare tubes and inst. book.

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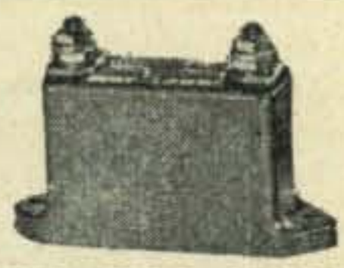

SANGAMO MICA CONDENSERS

F3L .0003 mfd 8000v list $29.	$3.75
F3L .0015 mfd 8000v list $31.	4.00
F3L .002 mfd 8000v list $32.	4.00
F3L .005 mfd 8000v list $40.	4.75
F2L .001 mfd 5000v list $14.	1.95
Solar type SX .0015 mf 3000v list $9.95	.75

D.C. HAND GENERATOR Type GN-45-B

Output: 6 volts at 3 amps & 500 volts at .14 amps. Rated speed: 60 r.p.m. Used but in perfect cond..... **$8.50**

Antenna loading coil, Heavy duty, with six (6) variable taps. 6¾" long x 4¾" dia..... **$2.95**

NEW ARC-5 SUPERHET RECEIVERS. Tubes (included) 3—12SK7; 1—12K8; 1—12SR7; 1—12A6. Range (specify freq. desired): 190-550 Kc; 1.5-3 mc; 3-6 mc; 6-9.1mc. Power: 24-28 VDC. Romote control unit and Dynamotor and tubes **$25.50**

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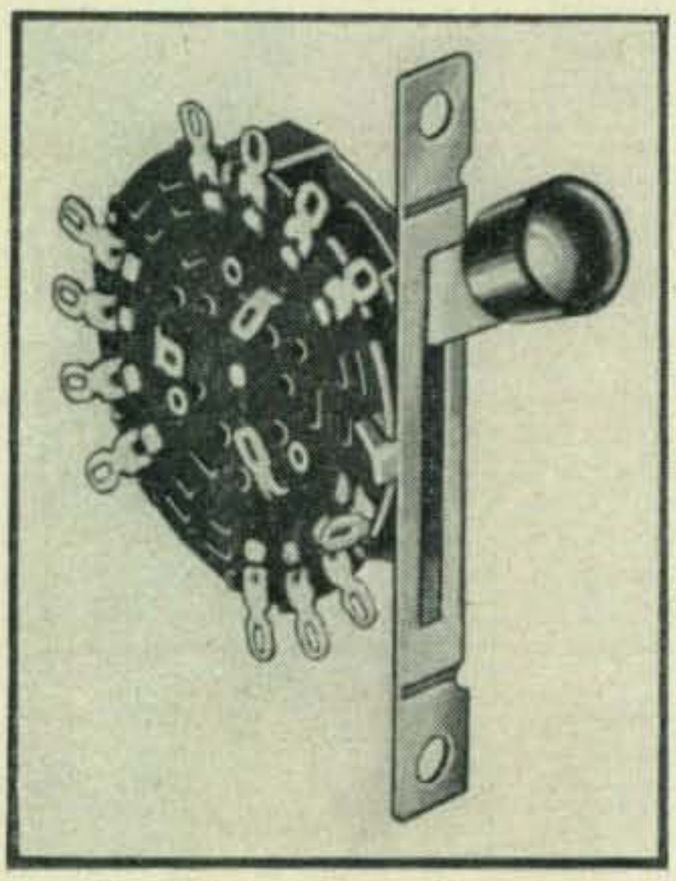
parts & products

Lever Action Switches

A new line of Lever Action Switches has been announced by the P. R. Mallory & Co., Inc. These new switches are known as the Mallory 5000 and 6000 series.

The new Lever Action Switch offers a total of 26 circuit combinations, 13 each shorting and positive



non-shorting, including two, three and four positions, all with positive indexing at 20 degrees between positions.

The switch contacts will make and break 120 milliamperes at 100 volts d.c. and 50 ma at 250 volts d.c., both based on resistance load for 10,000 cycles of operation. Contacts will carry 10 amperes without excessive heating. Current carrying capacity will vary with different load, frequency and voltage conditions.

For complete information write for Engineering Data Folder, "Mallory Lever Action Switches, Series 5000 and 6000." Address requests to P. R. Mallory & Co., Inc., 3029 Washington St., Indianapolis 6, Ind.

Color Code Guide

Allied Radio Corp. announces the release of their new RMA-JAN color code guide for radio resistors. Three rotary discs are provided for setting the code colors and corresponding resistance values which are brought into alignment automatically. Code colors may be set to show corresponding resistance values, or resistance values may be set to show corresponding code colors. Includes data covering resistance tolerance and complete listing of RMA-JAN 10% resistor stock values. Available from Allied Radio Corp., 833 West Jackson Blvd., Chicago 7, Ill.

Radio Reference Data Handbook

"Reference Data for Radio Engineers," radio handbook published by Federal Telephone and Radio Corporation, American manufacturing affiliate of the International Telephone and Telegraph Corporation, has been reissued in revised and enlarged form as an aid in the fields of research, development, production, and education.

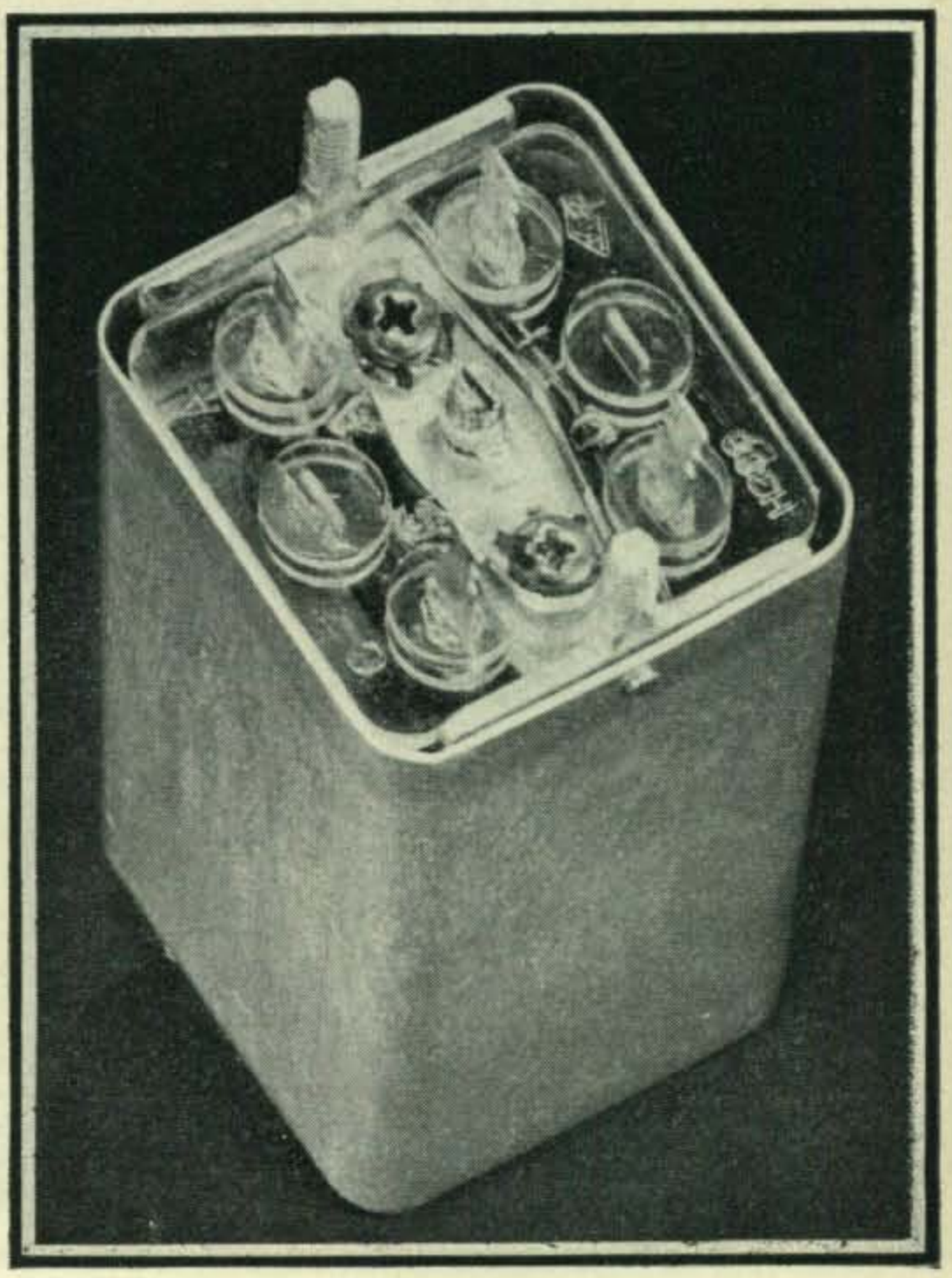
The Second Edition retains all the material that proved highly useful and popular in the First Edition, with much additional data. The Second Edition has been expanded to 336 pages and now has over 400 illustrations, more than twice as many as in the original edition. The format is completely new and modern and a complete subject index has been added.

Specifically the data on radio propagation and radio noise has been rewritten with special emphasis on the practical aspects involved. Because of its importance in television and radar as well as modern laboratory technique, the information on cathode-ray tubes has been considerably expanded. As revised, the section on wave guides includes equations for both rectangular and circular guides, plus illustrations of field distribution patterns. The number of mathematical formulas has been increased and now includes formulas on amplitude modulation, frequency modulation, and pulse modulation. Revision in all cases either brings the material up to date or makes it easier to use.

I-F Transformers

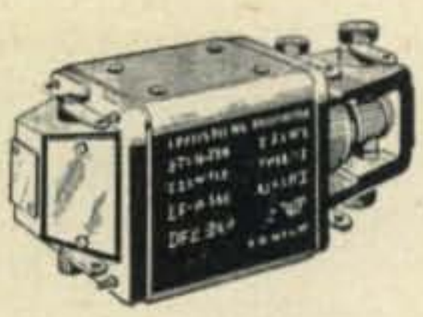
A set of new i-f transformers designed to meet the highest standards of performance in high frequency FM and AM has been placed on the market by the National Company, Inc. of Malden, Mass. All operate at 10.7 mc and can be employed unchanged on the new FM band.

Iron core tuning is used in the transformer and the tuning does not affect the bandwidth of 100 kc for the IFN or 150 kc for the IFM. The discrimi-



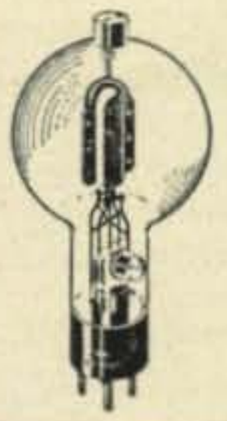
"TAB"

That's A Buy



EICOR DC Dynamotors new Gt'd Overseas packed—ANinsp. Hi-eff. Input 12V/8A or 24V/4A, output 500V/50ma. Input same output 275V/110ma & 12V/3A "TAB" SPECIAL EACH UNIT **$1.95** OR Both units (2) with filter **$3.49.** Wgt. 9 lbs. 7 3/4" L x 2 7/8" H x 4¼" W. Each Unit Conservatively rated. Can be used on 6V.

RCA 808 JAN-CRC New Gt'd Fil. 7.5V/4 Amp. Plate 1500V/200 Watts Rated 140 Watts output each "UHF" (List $7.75) "TAB" price $2.70 @ 2 for **$5.00**
Johnson UX sockets No. 224 (60c) 2 for . **.49**
GE&Wst 807 JAN (LP $2.75) 1.35 @ 2 for **2.50**
GE&Ray 955 JAN (LP $2.85) .65 @ 2 for **1.25**
VT127A/100TS UHF 100 watts 2 for... **7.50**
872A JAN GTD New & sockets 2 for.. **5.75**



Condsr oil A'VX 1510, 0.5mfd/1500WVDC Two for	$1.15
Condsr oil CD-TLA, 2mfd/600WVDC Two for	.79
Molded .01mfd/600WVDC-100 for $7.50, 1000	30.00
Buss & Littelfuses 3AG/250ma, 48 for	1.00
GR Variac 200 CU new G'inps 860W	13.95
GR Variac 100Q LN G'insp 2KW	25.00

PANADAPTOR BC1031A —3" SCOPE COMPLETE Panoramic scope similar to Panoramic Radio Corp. SA3-T-200 used with any radio rcvr having IF 450 to 750KC. Gives visual indication 100KC either side of freqs tuned. Complete with all tubes 115V 60 cys inpt "TAB" SPECIAL..... **$49.95**

Condsr 0.5mfd/600WVDC Bathtub, 5 for	$1.00
Condsr 10mfd/600WVDC (2/2.5mfd&5mfd) 2 for	2.50
Condsr 20mfd/600WVDC (1-2-4-5-8mfd) 2 for	5.00
Condsr 3mfd/330VAC/1000WVDC GE 2 for	2.50
Condsr 2mfd/2000WVDC W&CD 2 for	4.25
Condsr 10mfd/660VAC/2000WVDC GE ($22)	2.70
Condsr 15mfd/660VAC/2000WVDC GE ($29)	3.90
Condsr 2mfd/12500WVDC Wstghse ($210)	25.00
Condsr 1mfd/25000WVDC Wstghse ($395)	75.00
Condsr 6mfd/1500WVDC oil, with ins'ltors, 2 for	5.00

RCA 6AC7 Boxed New JAN, 4 for	$3.00
GE 446A/2C40 RCA Lighthouse tube ($11)	6.95
GE 1641/RK60 FW.H.V. Rect ($2.75)	1.95
WE 307A RF. Pent (L.P.$13)	5.95
WE 339A RF. Pent (L.P.$24)	6.95
RCA 2V3G JAN H.V. C'Ray Rect. 16500V	.75

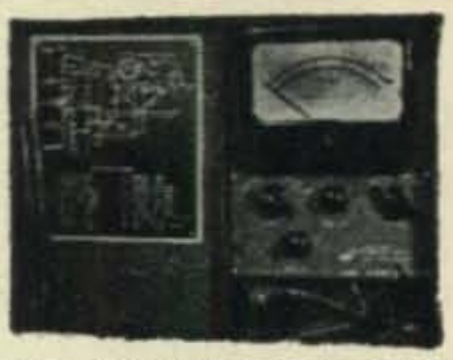
829/3E29 JAN boxed gt'd with SOCKET	$4.50
5CP1 JAN & SOCKET $7.50; 3BP1 JAN & SOCKET	3.95
WE 368AS Tube UHF 20Watt to 1700 mc's new	7.95
WE 703A Tube UHF 20Watt to 1000 mc's new	5.95
WE 717A Door Knob Tube new ($7.50)	1.95
805/905-VT143 JAN & socket $6 @ 2 for	9.90

957 Acorn JAN new (L.P.$3.00)	$1.25
RX215 Raytheon new (L.P.$24.30) FW 500V/15A	7.95
VR150 JAN new (L.P.$2.80) 75 @ 2 for	1.30
GE Vacuum Condsr 50mmfd/16000V Z-690	3.95
RCA 30 JAN (L.P.$1.20) .65 @ 2 for	1.10
RCA 1E7G JAN (L.P.$2.80) $1.50 @ 2 for	2.50

"TAB" Special

Navy TBY portable ultra Hi-Freq. 28 to 80 mc's transceiver Voice & CW Spot calibrated, including crystal calibrator, all tubes, adj. ant; phones mike, carrying case including Vibratorpack, non-spill storage battery and manuals. Tubes 1E7G, 959, 2/30&958A's CK1005;
SPECIAL..... **$39.00**

V	OHMS
0-3	1000
0-10	10000
0-30	100 M
0-100	1 Meg
0-300	10 Meg.



ELECTRONIC VOLT-OHMMETER BRAND NEW U. S. ARMY TYPE 1-107-F PRECISION UNIT. "TAB" special **$24.60**: Additional V.T.V.M. Loctal tube I LE 3/SP Sig C **$1.15**

Kenyon Pwr Trans BC412 C'Ray tube, fil. & P 2500V	$5.95
Thord Hi-Fi PP6L6 output 3800 pri, tap sec	3.00
Choke GE 10Hy/250ma/110ohms, two for	2.80
Kurman adj 1000 cy AC source New G'I	.97
Vitreous Res. 17500ohm 25 W Tap at 7500, 3 for	1.00
IRC WW Resistor 100000 ohms 40W ea.65 2 for	1.00

WESTON 476 sq 3" B'Case 15VAC ($10)	$4.25
WESTON 506 Rd 2⅛" B'Case 250maDC ($8.50)	3.95
WESTON 506 Rd 2½" B'Case DB–10 +6 500/600L	3.95
WESTON 517 Rd 2½" B'C AC 150Voltmtr ($10.75)	2.95
SIMPSON 25 Rd 3½" B'C DC ONE ma ($10	3.00

BC412 Sweep Ckt 'scope conversion kit	$18.00
McElroy AN/GSC-T1 code practice set	22.50
Crystal Rectifier Test set TS-268U	18.00
Heineman 0322 magnetic ck't bkr. DP 10amp	2.95
Heineman 0322 magnetic ck't bkr. SP 8&25amp	2.95
W.E. 250watt Trumpet & Nine Drivers	125.00

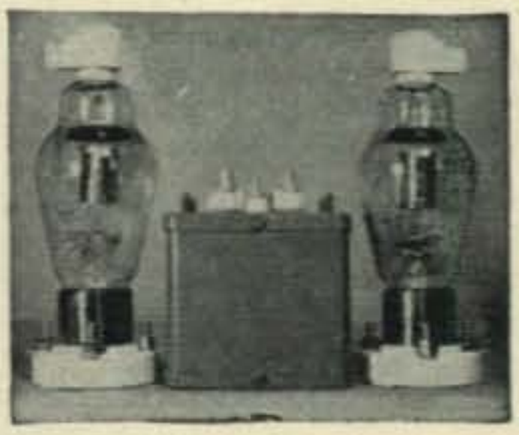
WE115V/60 cy pri, 640 VCT or 1360 & 1650Vno CT 300 ma, hmt'clly cased **$4.95** ea. 2 for	$7.00
Choke hmt'clly cased 10HY/440ma/85 ohm	4.50
Cased 500 ohms L to grid transf. S.C.	1.20
Cased plate to line, 500 ohms S.C. spec.	1.20

Transformers & Chokes New G'insp all 115V 60 cy Pri

Transformer C'Ray 4000V/2ma shielded GE	$3.95
Transf C'Ray Fil. 6.3V/2A, 2.5V/1.75A, GE	3.00
Transf 1600V/2ma, 2.5V/1.75A, 6.3V/0.6A GE	2.95
Transf Bias Sec 90,80,70V at 1 amp GE	2.95
Tnsf Fil 6.8V & 4V/10A, 6.5V/6A, 5V/3A, 5V/3A	3.95

Collins transformer mfgrd Chicago Transformer Co.
Sec. 1100VCT/212ma, Pri 115V. 50/60 cys.
& Two 10Hy/100ohm/250ma GE Chokes **$7.95**
Raytheon cased 840VCT/110ma, 530VCT/21ma, 5V/3A, 5V/3A, 6.3V/1A, 6.3V.3A, HV ins ($28) **2.50**
Two for $4.50: Five for $10, ... 25 for **45.00**

750VCT/220ma $3.25: 800VCT/270ma	$3.95
Tnsf P&F 1330VCT/170ma $4.95: 6.3V/8A	1.65
Auto Trans 115,160,170,180V/1.95-1.73Amp	2.95
Two 6.3V/.3A, 7V/14A, 5V/6A, 5V/3A, GE	5.95
W.E.Tnsf 115V/60cy pri 5V/26Asec. 5000V. ins	4.50
Kenyon 115V/60cy pri 5V/60A sec H.V. ins	7.95



Raytheon 866A filament transformer 115V 60c pri, 2.5Vct 11A Sec and Two new RCA 866A tubes..... $5.90
With Millen caps and sockets..... $7.00
Raytheon Transformer only..... $3.25
Combination Two 872A's KENYON TNSF, SOCKETS New gtd..... $12.00

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nator output is linear over the full 150 kc output and remains symmetrical regardless of the position of the tuning cores.

Insulation is polystyrene for low losses. Mechanical construction of this new item is simple and compact. The transformer is one and three-eighths inches square and stands three and one-eighth inches above the chassis. It is available for delivery at the present time. Several variations of the above transformer have previously been manufactured by the National Company.

Transmitter Tester

Manufactured by Electronic Specialty Co., a complete transmitter tester is now available. The Ranger Model 905 *Trans-meter* is a portable transmitter test instrument with self-contained batteries. It is not meant to replace precision laboratory instruments, but is intended for use as a handy indicating instrument to aid in adjustment and operation of transmitters.

The Trans-meter may be utilized for nine different functions, including field strength meter, wave meter, percentage of modulation indicator, a-c or d-c vacuum tube voltmeter, phone monitor, and neutralizing indicator. The accuracy of all measurements will be within 5%. Frequency range is from 1600 kc to 65 mc. Tube lineup consists of a 1S5 r.f. and audio rectifier and a 3Q4 output amplifier. Details may be obtained by writing Electronic Specialty Co., 3456 Glendale Blvd., Los Angeles 26, California.

Silicon Crystal Converters

Compact silicon crystal converters for use as first detectors in high frequency superheterodyne receivers have been announced by the Electronics Division, Sylvania Electric Products Inc. The crystals which are permanently preset in a small cartridge measuring approximately ¾" long and ¼" in diameter are available in three types designed for frequencies up to 10,000 mc. Unlike vacuum tubes, crystal converters require no filament or heater supply and take only a fraction of the physical space. Low thermal noise and i-f impedance are other important features.

Type 1N21B is designed for frequencies in the region of 3000 mc and is rated as follows; conversion loss, 6.5 db maximum; thermal noise ratio, 2.0 maximum; 1-f resistive impedance, 200 to 800 ohms. Corresponding characteristics for types 1N23B and 1N25 crystals are as follows: 10,000 mc and 1000 mc; 6.5 db and 8.5 db; 150-600 and 100-400 ohms.

The efficiency of these crystals in the microwave region suggests several interesting possibilities, such as; rectifiers in wave meters, monitors and field strength meters.

Cathode Type R-F Amplifier Tube

Two new miniature cathode type r-f amplifier tubes, the 6BD6 and 12BD6 are now being produced by Raytheon Manufacturing Co., Newton, Mass. Designed to replace bulkier or obsolescent tubes, such as the 6D6, 6U7G, 6K7, 6SK7, 12SK7GT, &c., the new Raytheon 6BD6 and 12BD6 are the electrical equivalent of the 6SK7 and 12SK7.

Outstanding features of Raytheon's new miniature cathode type r-f amplifier tubes, the 6BD6 and 12BD6, include a very desirable and practical remote cut-off characteristic, zero-bias operation without cathode resistors, proper operating characteristics with or without series screen-dropping resistor, and production of maximum usable stable stage gain, regardless of GM, at radio and intermediate frequencies.

Low Mu Triode

A new triode transmitting tube, Type GL-5C24, designed for service as Class A and Class AB$_1$ audio frequency amplifier and modulator has been announced by the Tube Division of General Electric Company's Electronics Department at Schenectady.

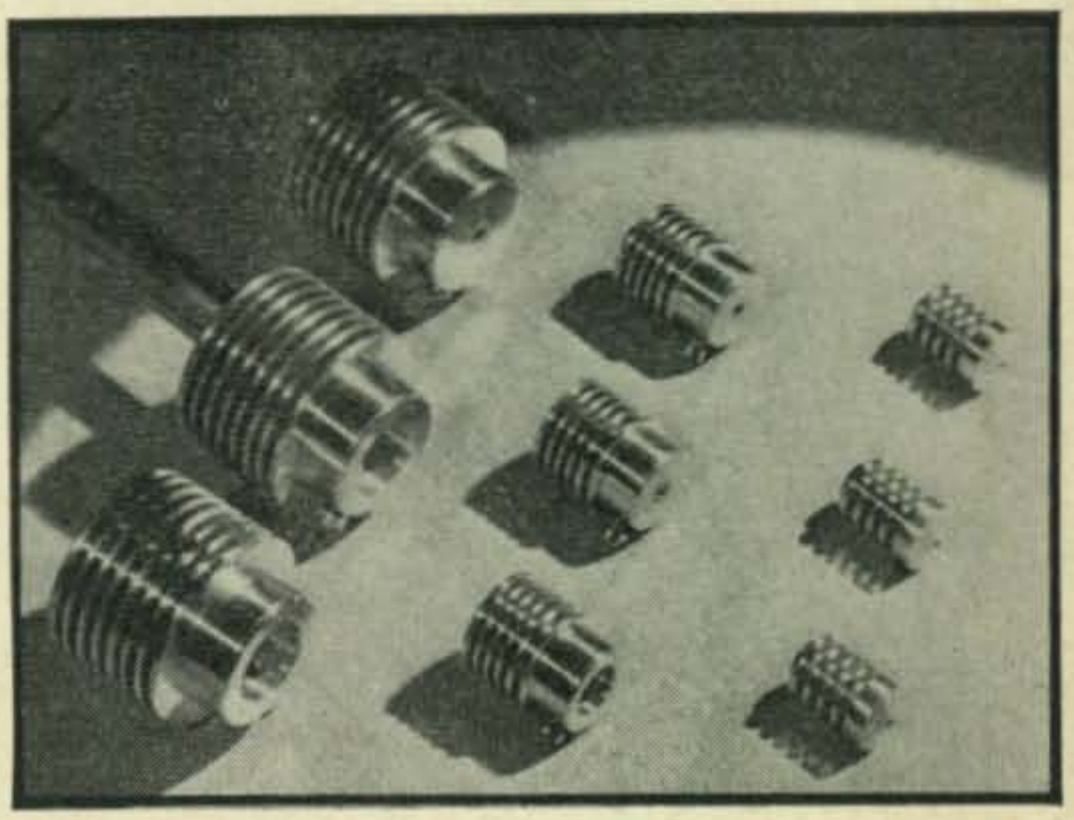
Typical operation as a Class A amplifier and modulator for the GL-5C24 is: d-c plate voltage, 1500 volts; peak a-f grid voltage, 150 volts; power output of 55 watts. At maximum ratings of 1750 volts the plate input is 250 watts. The mu of the tube is 8. The d-c plate voltage of the GL-5C24 when used as a Class AB$_1$ amplifier and modulator is 1750 volts. Maximum signal plate input is 300 watts.

Further technical information on the new GL-5C24 is available on request to the Tube Division, Electronics Department, General Electric Company, Schenectady, N. Y.

Heat Dissipating Connectors

Eitel-McCullough, Inc., of San Bruno, California, announces that their HR Heat Dissipating Connectors are now available.

Eimac HR Heat Dissipating Connectors are used to make electrical connections to the plate and grid



terminals of Eimac and other vacuum tubes, and, at the same time, provide efficient heat transfer from the tube element and glass seal to the air. The HR Connectors aid materially in keeping seal temperatures at safe value.

HR Heat Dissipating Connectors are machined from solid dural rod, and are supplied with the necessary machine screws. Complete specification and data sheets are available upon request.

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ALL STANDARD LINES

- **RECEIVERS —**
  Hallicrafters — Hammarlund — National — Cardwell — RME — Collins — Pierson
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  Temco — Hallicrafters — Collins — Meck — Abbott
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  Bogen — Thordarson — Masco — Bell — Eastern — Webster — etc.
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  All good makes — Harrison has it!— Complete stock

HSS OIL CONDENSERS

1 mfd, 5000 Volt. With standoff insulators.....**$3.95**

2 mfd, 1000 Volt. Compact round type. Mounts in 7/8" hole. FOUR for.....**$2.34**

MORE AND MORE NEW MODELS ARE

NOW IN OUR STOCK FOR IMMEDIATE DELIVERY

Get *yours sooner!* Send your order to Harrison, NOW!

COAXIAL RELAY

Constant 52-ohm impedance. Throws antenna line from receiver to transmitter. Handles 750 watts of RF. Has three connectors for PL-259 Plugs. 115 Volt AC coil. Price Bros. model 6350.....**$7.35**

Same, with additional NC and NO contacts to control receiver, ECO, etc. Model 6351. .**$8.33**

Rotary Coaxial Coupling

52-ohm constant impedance slip ring coupling. Made for Signal Corps by Lapp, to feed rotary antenna. Head, 1 7/8" dia. machined from brass. Copper feed line 7/8" dia. is 51" long. Coaxial sockets at each end. HSS.....**$7.75**

HSS TUBES

Brand New, perfect, 805—**$5.75**
3E29 (829B)— **$4.79**

COAXIAL CABLE

RG-8/U 52-ohm Impedance. FB for feeding beams, etc. Handles a KW with high efficiency. New, perfect cables.

110 foot length with two PL-259 coaxial plugs. Total list price **$39.28! HSS...$4.98**

65-foot length with one plug—List **$22.59.**

HSS.....$3.45

Cut to size in one piece within −0% to +20% of length ordered. Full measure!

JAN.Type	*Impedance*	*O.D.*	*1-100' 100' and up*	
RG-8/U	52 Ohms	.405"	9c	6c
RG-11/U	75 Ohms	.405"	10c	7c
RG-13/U	74 Ohms	.420"	14c	10c
RG-39/U	73 Ohms	.312"	11c	8c
RG-58/U	55 Ohms	.195"	8c	5c

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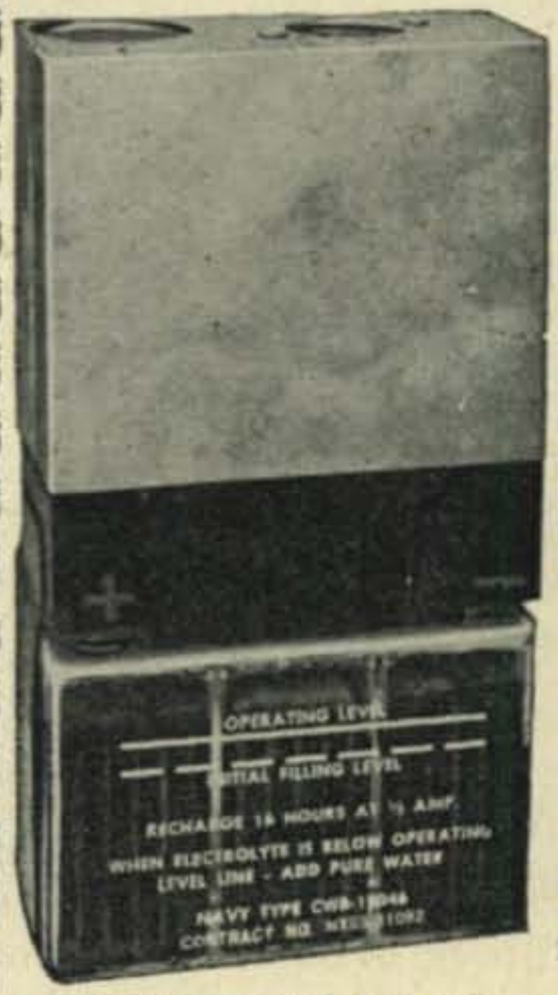
HARRISON SELECT SURPLUS

Your assurance of good, usable, guaranteed, surplus material at sensationally low prices—TOP VALUE ALWAYS! Come in and browse through our large HSS Department.

RECHARGEABLE POWER PACK



One of the most sensational HSS values ever offered! This modern, Navy accepted pack will save space, weight and money. Ideal for portable transmitters, receivers, test equipment, remote controls, etc.

Only 3 lb., 10 oz., complete! 1¾" x 3⅝" x 6½". Delivers—135 volts at 20 ma in *continuous* Military duty or 30 ma, or more, in intermittent Amateur service; 67½ volts at 5 to 8 ma; 1.5 filament or 6.3 heater, bias, and microphone voltages.

NON-SPILL storage battery can be recharged over and over for a penny or two.

Brand new, with fully charged battery, and instructions. Complete, ready to use **$5.50**

SPARE BATTERY

6 volt. Fully charged **$2**

BATTERY CHARGER

Noiseless, Selenium rectifier type, to trickle charge these or any other small batteries. 110 Volt AC..... **$2.97**

BC-406 15-TUBE UHF RECEIVERS

Been getting such FB reports from our customers about these swell Signal Corps Radar receivers that we just *had* to get more for you!

Six acorn tube RF circuit, tuned to 205 mc; four IF stages; Thordarson heavy-duty power transformer delivering 350 volts at 145 ma; four choke and oil condenser filters; 115 volt, 60-cycle operation; chassis 10½" x 25½" in metal case. Slightly used but fully guaranteed.

Complete with tubes: 5—954, 1—955, 4—6SK7, 2—6SJ7, 2—6N7, 1—5T4.

Instructions and diagrams for easy conversion to a *hot* 10 (also 6 and 2) meter superhet receiver are included. Parts alone are worth much more than our low HSS Price **$19.98**

MAIL ORDERS? Certainly! Just list everything you want (items in this ad, or any ad, magazine or catalog) and include remittance.

Vy 73 de

Bil Harrison, W2AVA

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[JAMAICA BRANCH—172-31 Hillside Ave.—REpublic 9-4102]

CQ DX

[from page 35]

that our old friend John Kraus, W8JK, is in the same building, and is on the staff as associate professor, so if you have any questions on your 8JK antenna, that is where the guy's located.

W8BKP has a new Vee Beam 6¾ waves per leg and apparently is doing a good job for George. He has worked Asia afternoons, which is something. For example, there is CR9AG, VS1BX, PK1RW being heard as late as 2:00 p.m. EDT. George has worked a total of 105 countries on 10 and 20 phone and c.w. On 20, he has worked 78. He has obtained permission from a farmer neighbor to use some of his acreage and extend his Vee beam into a rhombic. The present antenna situation at 8BKP is as follows: Vee beam, double Bi-square 28 mc, 3 elementary rotary 28 mc, 2 section 8JK 14 mc, and a "lazy H" for 28 and 14 mc.

W6ANN is still batting them out and was kind enough to give the QTHs of a few stations, such as: VS1BU, Alfsea Sigs, Singapore; VS1BX, Po/Tel, V. Thorne, R.N.A.S., Simbawang, Singapore; PK6TC, Sgt. Ten Thyssen, 290a NEI Air Force, Biak, Dutch New Guinea; UA3DA, Box 88, Moscow. W6PBV sends in a list of stations he has worked post-war, 21 zones, 42 countries, grand total 24 and 49.

VK2AHM, after reading about W6FMO and his low-power exploits in the May DX column, thought he would put in his two-bits worth. He is running 4 watts input on phone and 5 on c.w, the rig consisting of a 6K7GT oscillator driving a 807 plate modulated by a 1J6G. Power is from a vibrator supply for the r.f. and 135 volts of B batteries for the modulator. Antenna consists of 3 Vee Beams made of galvanized wire and spaced for 20 meters. Two are 8 waves per leg and the other one 6 waves. Grand total countries worked is now 70, and the maximum power used was 6 watts.

W9VKF, Pete Morrow, has just reached his 100-country mark. That is his all-time total. The last two stations were OX1AA and EL5B. Apparently, Pete, has never used over 100 watts, but now is going to raise it up a notch. W8ERA has worked a number of good ones on 20, and I am including some of them in our list of frequencies elsewhere in this column. W6REH says his card to OX7AD was returned by the Danish Government Office with a notation that the station was unknown. W6PGJ says that AC3SS wants it understood his address in the Call Book is incorrect. He is not located in Tibet, but is in Sickkin, a state in British India. The rest of his address is O.K. PK6TC told W6CEM to QSL to Box 400, Rotterdam, Netherlands.

Now about WAZ and countries. Around the first of the year, we expect to start the list of zones and countries. At the present time, W2IOP is working vigorously getting out zone maps. We are going to use the pre-war zone set-up. My operative, No. 1492 (that's what I call Larry) tells me this time the map will be in color. Here's all you have to do to get your call entered in the zone and country list. Submit a report of all zones and countries worked, giving the call and the date worked of at least one station in each zone and country. We will file these, and thereafter, when you work new ones, it will only be necessary to submit the call and date worked, and it will then be added to your totals.

As previously outlined in this column, we expect to show post-war totals as well as grand totals. They will be listed in sequence on the post-war basis, how-

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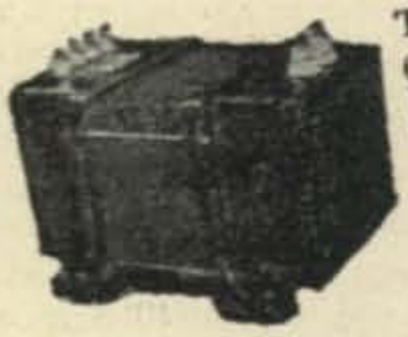

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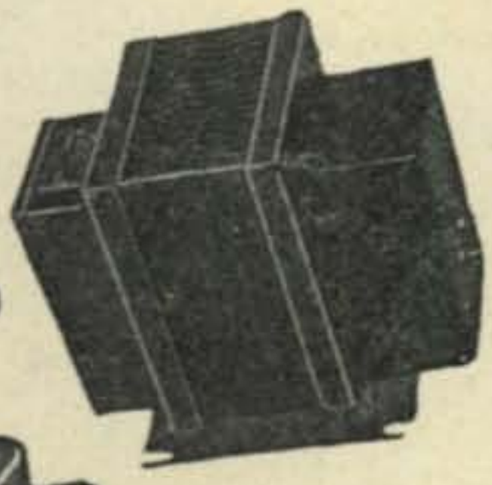

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MODULATION TRANSFORMER
Modulation Transformer perfect for inputs up to 300 Watts—Class C loads on primary No. 1 14000 Ohms —Primary No. 2 is designed for screen of Tetrode or Pentode—primary will match 811,809, TZ20 and TZ40 Tubes. Complete factory specifications and circuit diagram included **$4.95**

A GOOD BUY—Full Wave selenium rectifier perfect for bias application—use your DC relays from an AC source—unit is very small and compact. Only requires 3" x ½", made by G.E. **$.89 or 5 for $4.00**

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Transformer—Wonderful Buy—10 Volts @ 10 Amps; 680 Volts C. T. @ 125 Mils; 6 Volts @ 4 Amps..... **$2.98**

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Workshop Associates 2 meter, 6 element beam—run 200 Watts input; get a kilowatt effective power into the ether—most beautiful 2-meter beam we have ever seen..... **$19.00**

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G. E. Pyranol 2 mfd. 4000 Volt filter 23F47 ..... **$5.50**

G. E. Pyranol 4 mfd. 2000 Volt filter 22F66 ..... **$4.25**

Aerovox filter conds. 6 mfd. 1500 Volts. **$2.25**

MISCELLANEOUS

Antenna Change-over relay. Leach Type 1357 DC—13F—DPDT—plenty of spacing—mounted on low-loss bakelite..... **$2.50**

APC Padders—Screw driver adjustment from 4 to 75 mmf. a complete assortment of 6 padders. Special..... **$1.49**

1000 KC. Xtal precision AT Cut mounted in standard holder..... **$4.95**

500 mil 3½ millihenry **RF choke** 154U National..... **$1.29**

Weston—No. 476 0-130 Volt AC 3½" Meter; special..... **$4.95**

Adel Cable Clamps perfect for Coax RG8/U, RG11/U, etc..... **12 for $1.00**

United Electronics 812 H tube..... **$6.50**

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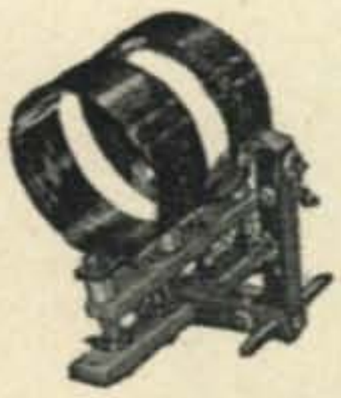
Eimac VT 127/100 TS Tube..... **$3.25**
Socket made of **Mycalex** for above Tube. **$1.25**

Heat radiating caps for VT 127...2 for $.25



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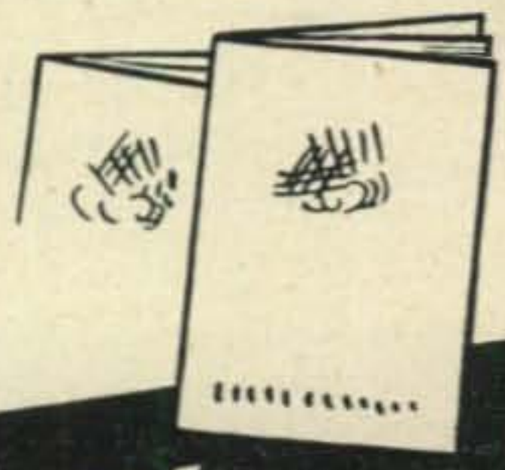

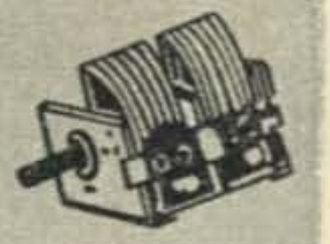

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ever. We do not intend to list anyone showing countries only, so you better dig out that old zone map and get things started. No stations will be listed strictly on a pre-war basis. In other words, you guys have to be active and have a post-war total of some kind to get in the list. This will probably affect a lot of the old timers, but if they are not active now, there is really no point in listing them. "Yeah, that hits me too, but keep your shirt on, I'll get in the list someday."

For the time being, we must settle tentatively on a list of countries to use as a guide, but obviously, this is subject to change if boundaries change throughout the world. We will try to arrive at a list fair to everyone, and at the moment, I am in the process of getting together with By Goodman and the boys of the R.S.G.B. You fellows get busy, dig out that map, compile that list of zones and countries, and shoot it into me. Then after I obtain a staff of "secretaries" to check this list, will! get them in print as soon as possible.

That winds up this little session, but remember this, when you use a v.f.o. use discretion with it, and you know exactly what I mean without going into detail. A lot has, is, and will be written on how to work DX with a v.f.o. but you, as an individual, know better than anyone when the thing is being abused. So much for that. See you in December!

YL FREQUENCY

[*from page 38*]

W7IGM); W2RZW-Edna Geist, W2RAS-Edna Liebmann, W2QFN-Edith Pringle, W2QPA-Frances Mayer, W2REY-Pam Katzall of New York.

YL of The Month, Clara Regar, W2RUF

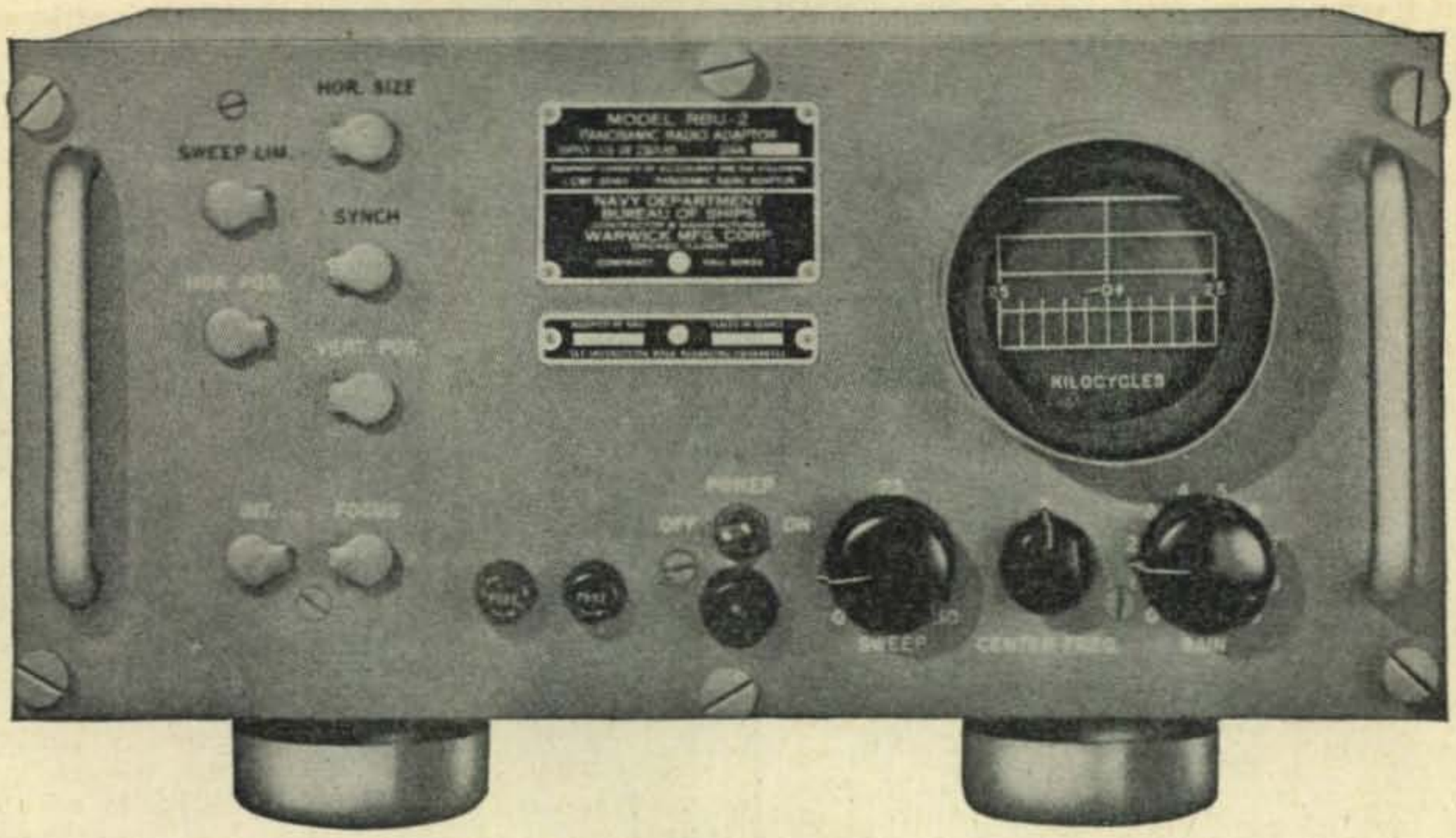
Our YL of this month, Clara Regar, W2RUF, is better known as W8KYR, which call she received in 1933 and held until August of this year. Due to upstate New York shifting from W8 to W2, she received W2RUF ("real understanding female" says she).

She became interested in radio in 1932 when her brother, W8AOM, had his station in her home. One day when he was having difficulty getting a message through on 75 meter fone, he asked her help, thinking that a voice of higher pitch might help. The other amateur was able to receive the message perfectly and after that asked to talk to Clara when contacting John. She began to talk more and more on the air and was soon studying in earnest for her own ticket, which she received the following year.

In 1935 Clara went on to receive her Class A ticket, but has hardly used it as she perfers pounding brass. Always interested in traffic, she was an active member of the AARS pre-war. She is definitely adverse to contests and is of the opinion that such activities should be restricted to less than the full part of the band, so that those not interested could still enjoy a chat. She does enjoy rag-chewing and is a member of the RCC.

Her awards have included a 35 wpm code proficiency certificate, three public service certificates for good work done in floods of the years 1936 to '38, and a citation from Western Union for aid during the New England hurricane. For several years before the war Clara was emergency coordinator. She was also code instructor to a group of men and boys and was instrumental in their receiving tickets. Many of these later joined the army as radio men.

Clara is a long-time member of the YLRL. Incidentally, she was originator of "33", which ex-



Navy Panoramic Adaptors!

The Panoramic Adaptor tells you at a glance what is going on over a wide area of the band. When attached to your receiver, the adaptor will visually indicate whether there are signals present within the area covered. It will show the relative frequency of each signal, relative signal strength, the type and percentage of modulation. This Navy unit was built to rigid specifications without consideration of cost. It will allow you to locate "holes" in crowded bands, detect weak signals, and contribute generally to the improved operation of your station. The RBV-2 covers a continuous band of frequencies 100 Kc. wide. Operates on 115/230 V.A.C. 50/70 cycles. New and packed in original crates. Tropicalized.

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The BC-322 is a complete, portable radio communication set. It is light enough to be strapped on the back and powerful enough for dependable voice transmission over a range of 10 to 20 miles. Frequency band 52 to 65 Mc. These sets are new in original crates. The low price includes tubes, handset, telescopic antenna, batteries and battery adaptor, and carrying case. $75.00 F.O.B. Chicago. Model BC-222 has two bands but otherwise the same as the BC-322. Frequencies from 28 to 38 Mc. and 38 to 52 Mc. These sets have been in service but have been renewed by the Government. New batteries. No carrying case.

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Clara Regar, W2RUF

presses friendship between YLs, and was recently appointed editor of the YLRL "Harmonics" for the coming year.

Neither Clara's husband nor son is interested in radio. The latter has just returned from serving in the Army Air Corps at Guam. Clara was a piano teacher until the shortage of help forced her to enter her husband's shop as secretary and general assistant.

Her radio room is off the kitchen, so that she can QSO while preparing meals without burning them. At the present time she can usually be found most evenings—with one eye on her roast—on 7220 kc.

SUNSPOT ENIGMA

[*from page 30*]

rected by means of what is known as a "trend curve" which is based on all the measured ionosphere data of records at the ionosphere station making the prediction. This trend curve is really an experimental determination of the relationship between sunspot numbers and critical frequencies at a particular geographical spot on the earth's surface, since the ionosphere is not equally affected at all locations by a given amount of solar activity. After correction by the trend curve, other correction factors taking into account the monthly and hourly variations about the smoothed average values, must be multiplied in. These monthly correction factors must also

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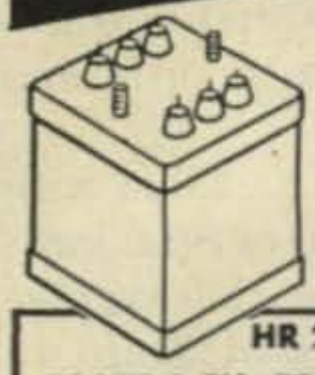
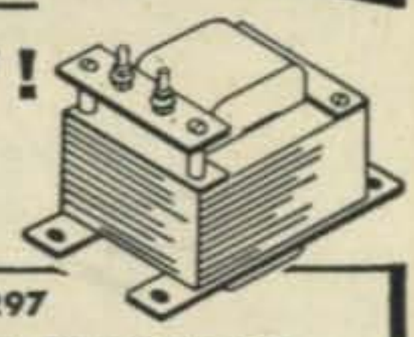


Here's a whopper of a sale on scarce transformers and chokes that hams and servicemen would give their left eye-teeth for! Every transformer listed is brand new, hermetically sealed and has 115 volts, 50/60 cycles primary. Don't delay! Get here by bus, bicycle or rocket—*fast!* Clip the coupon and mail it NOW!



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770 V. CT at 280 ma.
750 V. CT at 175 ma.
5 V. at 6 amps.
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Shpg. Wt. 15 lbs.
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Shpg. Wt. 8½ lbs.
2.95
Size: 4¾" x 3⅝" x 5" H.

HR 298
PLATE & FIL. TRANSFORMER
800 V. CT at 100 ma.
500 V. CT at 15 ma.
5 V. CT at 3 amps.
Shpg. Wt. 12 lbs.
3.49
Size: 4⅞" x 3½" x 5" H.

SPECIAL COMBINATION OFFER $8.95

Filament transformer listed at left (HR 303) plus two brand new 872A tubes complete with sockets, all for only $8.95. Offer limited so order now. Ask for Stock No. HR 99.

HR 299
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876 V. CT at 161 ma.
5 V. at 3 amps.
Shpg. Wt. 19 lbs.
3.49
Size: 4⅛" x 5⅛" x 7½" H

HR 300
PLATE & FIL. TRANSFORMER
800 V. or 720 V. CT at 185 ma.
5 V. 3 amps.
5 V. 3 amps.
6.3 V. 9.6 amps.
6.3 V. at 0.6 amps.
6.3 V. at 0.6 amps.
Shpg. Wt. 16 lbs.
3.95
Size: 6" x 4½" x 4⅞" H

HR 301
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740 V. CT at 125 ma.
5 V. at 3 amps.
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FIL. TRANSFORMER
5 V. CT at 6.75 amps.
5 V. CT at 6.75 amps.
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3,500 Volt Test
Shpg. Wt. 12 lbs.
3.95
Size: 3" x 5" x 6" H

HR 304
FIL. TRANSFORMER
6.3 V. CT at 5.1 amps.
6.3 V. CT at 1.2 amps.
1,780 Volt Test
Shpg. Wt. 7 lbs.
1.69
Size: 2⅝" x 2⅞" x 4-7/16" H

ZPS 556
FIL. TRANSFORMER
6.3 V. CT at 4.2 amps.
1,780 Volt Test
Shpg. Wt. 5 lbs.
1.39
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HR 305 FIL. TRANSFORMER
6.3 V. CT at 22 amps.
6.3 V. CT at 2.4 amps.
6.3 V. CT at 2.25 amps.
6.3 V. CT at 0.6 amps.
3.95
Size: 4¼" x 4½" x 4¾" H

HR 306 FIL. TRANSFORMER
10 V. CT at 13 amps.
10 V. CT at 6.5 amps.
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3.95
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553	8.5	125	161	3⅛" x 3⅝" x 3⅞"H	5	1.39
554	8.	175	127	3⅝" x 4⅛" x 4¾"H	10	1.69
555	5.	200	80	3⅝" x 4 13/16" x 5¾"H	10	1.69
1,780 VOLT TEST						
HR 307	20.	75	334	2¾" x 2½" x 3½"H	5	1.29
HR 308	12.	135	127	4¾" x 3½" x 4⅝"H	5	1.49
HR 309	10.	150	134			
Dual Choke	10.	150	134	3¾" x 3¾" x 4"H	5	2.49
HR 284	17.5	20	330	1⅞" round x 2½"H	2	.69
HR 310 600 ohms line to 6 ohm V.C. +17 db level				1⅞" round x 2½"H	3	.89

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be experimentally determined from measurements made at the ionosphere measuring station making the prediction. In this way, the averaged sunspot data are translated into radio transmission data for a particular hour, month, and location.

As an example of the results obtainable with this technique, the National Bureau of Standards predicted in December, 1945, that the average midday F2-layer critical frequency at Stanford University, California, would be 8.6 megacycles during April 1946. Actual measurements made at the University during that month showed the average to be 9.6 megacycles! This accuracy of prediction, (i.e.,—within approximately 10%) can be considered to be normal; on occasion even closer correlations have been obtained.

The Experts Disagree

It is in extending the sunspot number curves ahead for the next few years that the authorities disagree. A. H. Shapley, writing in "Terrestrial Magnetism" for March, 1944, presents a curve of estimated relative sunspot numbers up to the year 1950. His extrapolation looks like a very logical extension of the data covering the years from 1900-1943; in this period two unusually high peaks of sunspot activity were observed, one in 1917 and one in 1937, along with two smaller peaks centered about the years 1907 and 1927. Assuming that the large and small peaks continue to alternate, Mr. Shapley suggests that the next maximum of the relative sunspot numbers may be of the order of 80 and may occur in 1949.

This prognostication apparently wasn't good enough for M. Waldmeier of the Swiss Federal Observatory, Zurich, Switzerland. In an article appearing in "Terrestrial Magnetism" for July, 1946, Waldmeier refers to an entirely different method of figuring the magnitude time of occurrence of the next sunspot maximum. According to this calculation, the maximum may be expected to occur as early as the year A.D. 1947.6 by which time the maximum relative sunspot number may be as high as 139. Says Waldmeier; "We should therefore expect a very rapid increase of the solar activity leading up to an unusually intense maximum."

This prediction, which is seen to be in sharp variance with Shapley's earlier estimate, leads to some interesting conclusions when applied to radio transmission. For conditions existing at Stanford University, California, (roughly 30 miles south of San Francisco), a calculation based on a maximum sunspot number of 80 shows the corresponding maximum usable frequency for the F2-layer and a 2500-mile hop, to be 39 megacycles. On the other hand, if Waldmeier's figure for the sunspot numbers is used, the maxi-

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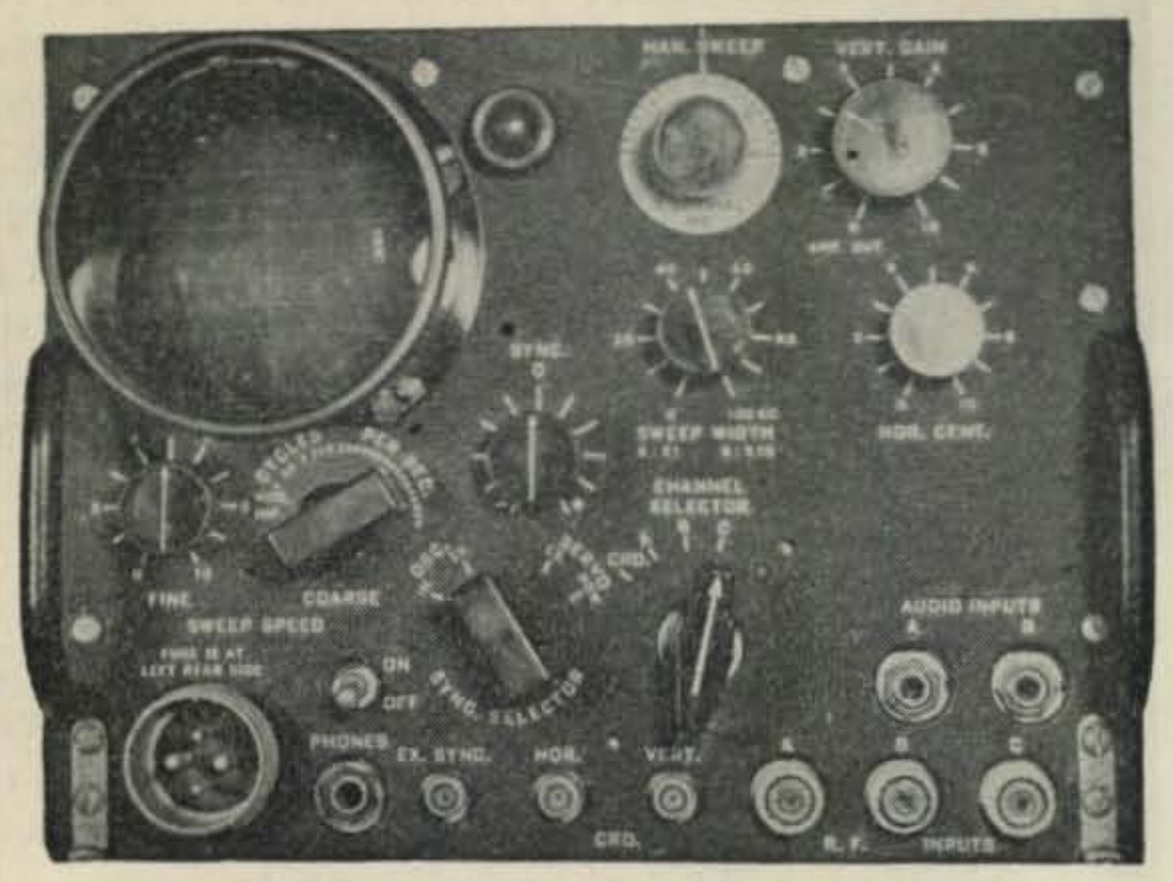

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3″ scope tube plus 20 tubes.
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Wt. 40 pounds. Size 8″ x 10″ x 20″.
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Transmitting Tubes—new original boxes
G.E. 814 Pair **$11.45.**
RCA 8012 UHF triode full efficiency to 500 mc—pair **$8.95.**

Selsyns 5G bronze cases 110 v 60 cycle 4″ x 5″—pair **$11.50.** Like new.

Selsyn hookup cable Simplex 8 conductor, shielded and weatherproofed ½ diameter, very flexible **$.11** per foot, new.

BC 406 receivers 205 mc 15 tube with 10 meter and broadcast FM conversion instructions. Final clearance price with 2 spare 954 tubes **$19.50.**

High power modulators Aircraft Accessories Corp., Signal Corps. Model MD1/FRC modulators brand new original boxes; consists of 2-500 watt modulators complete with power supplies in one cabinet: size 1′ x 2′ x 5′ 110 v 60 cycle ac less 11 tubes. Secondary RF load 2300 ohms or 4600 ohms. Original cost $1500, your cost **$325.00.**

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NAVY MODEL *Portable Short Wave*

*RADIO RECEIVING SET

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● ***Set*** covers frequencies from 5 to 13 megacycles which includes American and foreign short wave broadcast bands on 25, 31 and 49 meters; as well as some commercial aircraft stations. You will be able to hear South American, European and American short wave broadcast stations.

Instruction Manual

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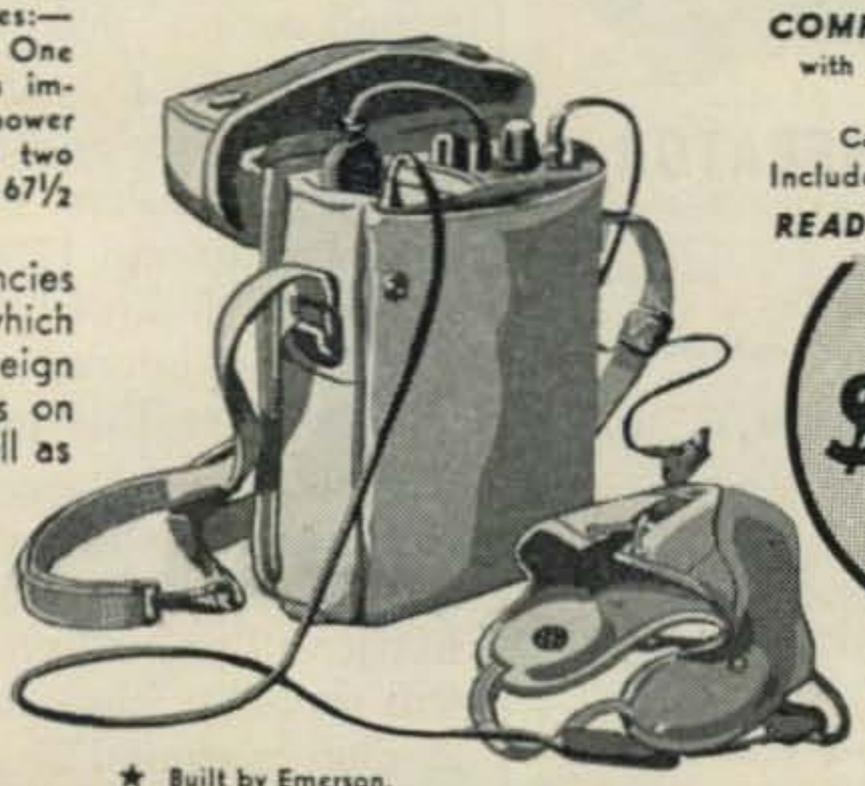
Can be easily converted as Standard Broadcast Receiver!



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5 to *13* megacycles
FREQUENCY RANGE

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mum usable frequency becomes 50 megacycles. It should be remembered that the figures of 39 and 50 megacycles represent average values; it is to be expected that on some days the actual maximum usable frequencies may be as much as 15 per cent higher or lower than the average. It seems quite likely, therefore, that if the figure of 139 is true, the 6 meter band may be useful for F2-layer transmission for a substantial portion of the time during the coming maximum of the sunspot cycle, which may be expected to occur as early as next year.

Six meter DX enthusiasts, whose hopes may have already been aroused, will be interested to know that the most recent sunspot number information seems to support the Waldmeier point of view, although the evidence is much too scanty to warrant any definite conclusions at this time. (The smoothed running mean is, of course, always six months behind the current information.) So far, at any rate, it looks as though we may enjoy a quick maximum and a high one.

DX PREDICTIONS

[from page 33]

line in all the graphs, will probably be about 44.0 mc at 1300 hours EST. Ten meters will not close down until as late as 2100 hours EST on some evenings.

The trans-Pacific conditions from W5-W6-W7 to Australia are still good. An erratic 10 meter opening is expected from 1230 hours PST to 1630 hours PST with much better conditions after 1500 hours till closing at 1900 hours. There is an excellent indication that on 10 meters some openings covering the entire United States may occur after 1900 hours EST. Over this path good conditions on 20 meters are expected around 0730 to 0930 hours PST. The East Coast opening will remain around 0630 EST (*Fig. 3*).

The general conditions from W9-WØ and W5-W8 to the South China Sea area indicates, *Fig. 4*, that a sharp opening on 10 meters may be expected around 1730 to 1830 hours CST. This should be followed by a 20 meter opening between 2000 hours and 2130 hours CST. Transmission over this path is expected to be very erratic.

The trans-continental conditions from the East coast to the W6-W7 area indicate that the MUF will probably exceed 42.5 mc. Ten meters will probably close around 2000 hours EST and 20 meters around 2330 hours EST. In the graphs the inner line represents the optimum working frequency (OWF), or the portion of the frequency spectrum where dependable point to point communication may be maintained. The shaded

section near the base line of each graph represents total ionospheric absorption. For further details see the predictions, September, 1946.

The predictions for November were based upon currently observed geomagnetic, solar and ionospheric data and are portions of the Central Radio Propagation Laboratory series D and series F of the National Bureau of Standards. Users of the predictions are invited to write the Propagation Editor, c/o CQ Magazine, 342 Madison Ave., New York 17, N.Y., relative to any problems or comments.

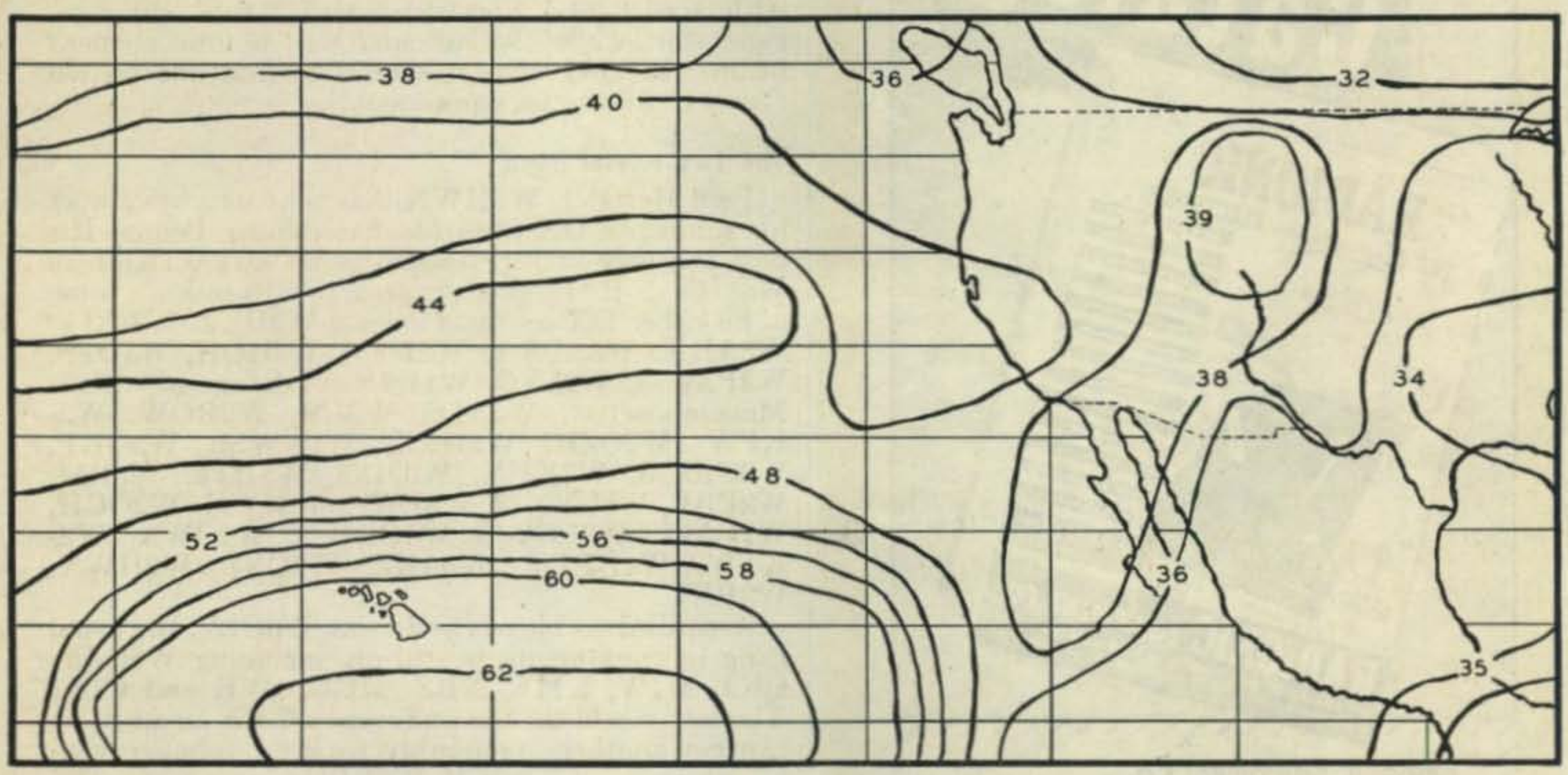

Fig. 5 The iso-ionic lines for the average day at 1600 hours PST. The constant lines represent the maximum usable frequency as determined by the inset number in megacycles. The distance from Hawaii to San Francisco is the approximate average for a single hop F2 layer transmission.

UHF

(*from page 37*)

VE7NM worked his DX with a 6L6 modulated oscillator taking 11 watts input. It was modulated with a 6D6-42. Receiver was a 3-tube super-regenerator, while the antenna was a four element beam. W7QAP says it sounds to him like an old report of five-meter equipment.

The Two-Meter Band

Paul Hertzler, W3HWN, has sent us a review of his summer's DX from Mechanicsburg, Penna. His best DX was on July 5 when he hooked W1KOE in Wakefield, R. I., at a distance of 310 miles. Some of his other DX contacts include W3HUZ, W3CGV, W3AHN, W3ABS/2, W2DFV, W3HOH, W1OFS, W2PAU/8, W2LVQ, W1DJE (exchange of calls—Massachusetts), W2AES, W2ER, W2ROW, W2-KPW, W2OZH, W2DAX, W1NWM, W3GKP, W9STX/3, W3KUX, W3JDQ, W3HJT, W3BM, W2PBV, W8CYN/3, W3EWA, W3CCH, W2OCH, W2GMT, W3FCV/3, W4CDG/3, W2OWA, W2-KTW, W4HPJ/3, W3ARZ, W2CNP, W2HWX, W3BNU.

According to Lloyd Broderson, W6CLV, the usual gang in Sacramento is still on, including W6GZY, QKJ, MIW, KME, NRZ, MGC, BVK and CLV. The latter sold his car and went off the air until he can get another—preferably with no upholstery so he can run coax around! W6RBQ of two-meter DX fame is up for ARRL director. W6ZF is back from Tokyo and is getting set up.

In Redwood City, California, W6OVK says that two-meter activity and interest is still on the upswing. New crystal-controlled transmitters have shown up. The use of beam antennas and superheterodyne receivers is accounting for many new long-distance contacts on the band. W6TCP and W6AHW are two of the stations that have recently contacted W6LSX at Watsonville across a very mountainous path. W6NDN of Watsonville has made his first Sacramento contact, with W6PIV. W6OVK also raised PIV, and is continuing his regular R9 schedule with W6BVK up there. This hop and W6NNS's with W6LSX have brought about considerable new effort on the part of the more ambitious boys who want to duplicate this long-distance home-to-home work. W6PSQ from beyond Fresno has been coming through at W6OVK. PSQ worked some of the fellows on Mt. Diablo and Mt. Hamilton; he was also heard by W6NDN and W6TCP at Hayward. W9OAW/6 and W6QR have crystal-controlled rigs in their cars and have been doing very well on DX. W6NJJ contacted W6WAI at Forestville, some 50 miles air-line from San Francisco. W6OVK was able to work W6WAI and W6LSX. W6FCX is on at Skaggs Island near Vallejo. W6RKM is on with ten watts and a Yagi antenna. W6OVK has been able to work right alongside modulated oscillators by using a narrow-band receiver with about a 2 or 3 kc bandpass.

Up until the middle of September, Bill Smith of W3GKP in Silver Spring, Maryland, worked the following from the Washington area and from Skyline Drive: W9GBA/4, W3KEI, W3KCA/4, W6NFG/3, W3HWN, W2DFV, W2HWX, W2-BKB, W2AES, W3BM, W4CDG/4, W3KIE, W8-YIO/4 and W3AHN/2. The best DX in this list is 219 miles unless W3AHN is better, and includes six states. But then Bill had some fun of a new sort, and describes it in detail as follows:

He had been sitting all summer hearing all kinds of DX with his eight-element antenna and bedspring reflector, but working very little of it. W9STX/3 in Washington was experiencing the same thing, but possibly working even less. W3KUX and W4HPJ/3 have been hearing the DX on and off, but have been weeping along with Bill.

The usual situation when the band opens is that the W2's and northeast W3's come in for several hours, some of them R7 to R8 for hours, but after many calls there are no contacts. Then, late in the evening, the signals fade down, stations leave the air, and you get in one or two contacts if you are lucky. Bill heard stations beyond 100 miles on 17 days but during this time he worked only five stations beyond 100 miles, ranging from 109 to 219.

With this background, he goes ahead with a description of September 7 and 8. On the former, W8YIO/3 with a mobile rig went to White Oak Canyon on Skyline Drive in Virginia. Bill worked him at 7:00 p.m. and inside of a half hour was hearing and calling DX with no result, as before, but everytime W8YIO/4 called CQ, Bill could count three to eight DX stations calling him. Although W8YIO/4 made only six or eight DX contacts, the distances were very good, the best being W2JWO at Patchogue, Long Island, which measures about 320 miles! YIO closed down about ten o'clock while Bill at W3GKP kept trying until 11:15 when he had a contact with W2AES at Seaford, Long Island, 219 miles away. Then he had a poor contact with W3AHN/2 and secured. Sounds like Bill has too little power to combat that QRM, or the other boys don't have good receivers, doesn't it?

On the next afternoon, Sunday the 8th of September, Bill turned on the receiver at 5:45 and soon had a 125-mile contact, finding for the first time that the band could open up *both ways*. He stayed on for eight hours—until nearly two a.m. Monday—to work 28 stations, the best DX being W2JWO at Patchogue. W9STX/3 got 22 contacts and the local record, also working W2JWO but from a few miles farther than W3GKP's location in Maryland. W4HPJ/3 at Greenbelt, Maryland, got six and W3KUX got one. W3KKH in Baltimore got six or eight, including W2JWO at about 160 miles. W3KCA in Baltimore and W4CDG/3 in Towson were also working them. W3PV/3 mobile in Washington with a TR-4 also got out well.

Conditions were amazing, with signals R7 or better in both directions. Bill was hearing New York and Philadelphia stations at once and working them alternately, although they were *not* hearing each other. QRM here in Washington was at a minimum, with Baltimore stations way down and even local stations weaker than usual. It sounded just like 75 meters but without the heterodynes. One of the locals heard an unidentified W4, while W4IKX in Arlington, Virginia, heard a YL W1 in Connecticut but couldn't identify the signal. W4HPJ/3 also appeared to hear the latter station. On the next day, conditions were again back to "normal."

Above 200 Megacycles

W6NNS and W6OVK are stirring up activity on 235 mc, in the Bay area. Both are starting tests using crystal control and super-heterodyne receivers. They do not mention starting any campaign against modulated-oscillators as yet!

W6PSQ has been overheard to say that he has broken the 425-megacycle record.

W1BBM at North Harwich, Massachusetts, found the 425-megacycle band open to New York

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on eight days, according to his reception of WRJY on 438 mc, at a distance of 178 miles. Bernard thinks that the band is good, and capable of very fine work, but there is a lack of activity to make it good for DX. He is thinking of giving the 1217 mc band a try, and hopes to hear from anyone in Rhode Island, Connecticut or Long Island who is seriously interested. Bernard hopes, in that way, to slip in under ducts and get some of this really long DX, like the coast of Nova Scotia which has been seen by radar from a point near him.

Miscellaneous

Our best plans to attend the Horsetraders' Shindig in New York on September 15th went awry at the last minute. We had planned to see the gang there, and to find out why we receive so few reports of activity from the W1's.

The Sacramento Radio Club had an Old Timers' meeting on August 21—some of the members go back to 1905 and talked of coherers and straight gaps; now they are using flea-power on 144 mc!

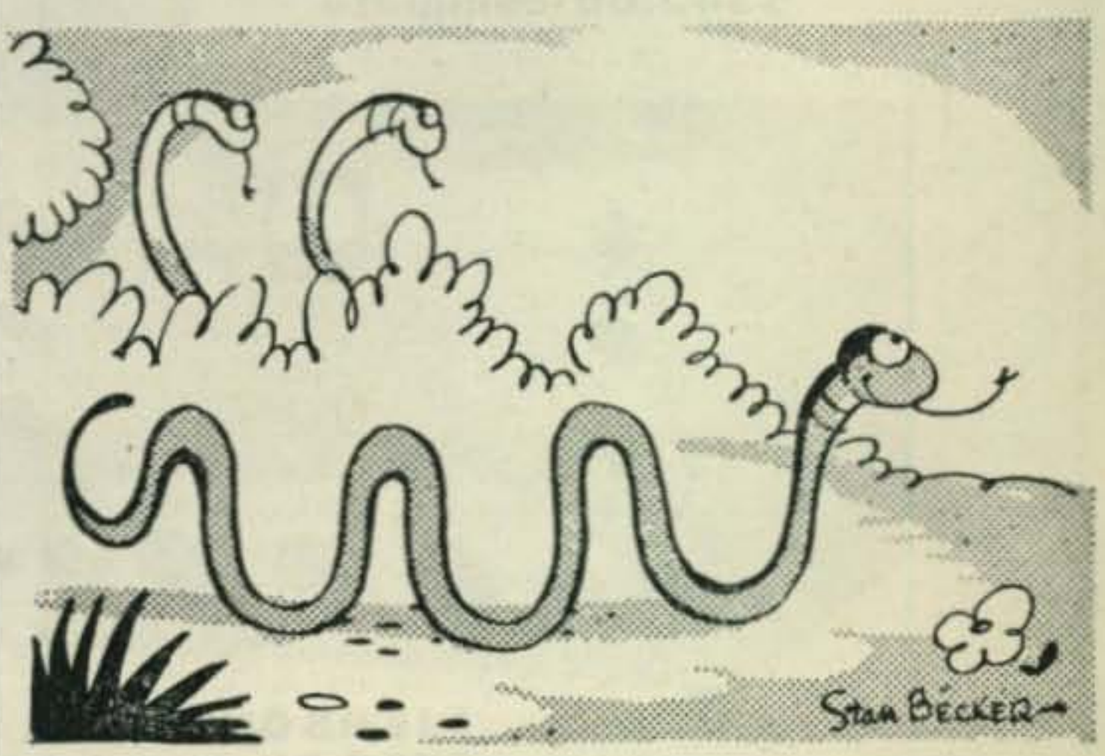
The York Amateur Radio Club (Pennsylvania) is very active, according to Walt Guise, W3BKB. There was a transmitter hunt on May 5, and a field day in June. A large get-together was held in August, attended by W1HDQ, a group of Washington, D. C. two-meter boys, and many others. Hundreds, in fact. The club has been very successful in encouraging two-meter activity in the area.

Vince Dawson, WØZJB, has been an active publicity man for the Topeka, Kansas, convention held on October 5 and 6. He has stirred up nation-wide interest among the six-meter band boys.

Don't forget to send the dope to us every month—when it happens, or by about the 25th so we can meet our deadline. Address your letters to Mrs. Josephine Conklin, W9SLG/3, care of the Conklin Radio Company, 6800 Clarendon Road, Bethesda 14, Maryland. In answer to many inquiries—yes, we do want active calls, DX worked, diagrams and photographs of equipment, antenna dope, and all that would be of interest to others. Send in your distance records, states and districts worked, and so on.

And another thing. We have had scores of letters, addressed as shown in the callbook, returned. We strongly recommend that you send a change-of-address notice to the post office wherever you were listed in both post-war and pre-war callbooks. And tell the Radio Amateur Call Book, 608 South Dearborn, Chicago, Illinois, what your present address is.

More next month, gang. In the meantime, send us the dope.



"His mother was frightened by a sine wave."

FLEXIBLE WAVEGUIDES

[*from page 27*]

fittings may be provided with a rubber gasket which does not affect the electrical continuity but permits the interior of the guide to be made pressure tight. This is especially essential where the flexible waveguides are used on microwave equipment which is flown to high altitudes as in aircraft installations. Thus pressurization of the guide and the connecting components is necessary. This is due to the necessity of sealing off the system so as to provide pressure within the guide and other components at near sea level pressure even at high altitudes, to prevent high voltage breakdown across the transmission line and to reduce the possibility of condensation, which of course increases the attenuation. Moisture in a waveguide can be extremely troublesome and microwave workers usually take precautions to keep the plumbing dry. For experimental work, flexible waveguide assemblies may be used without a molded covering, as amateurs are not apt to be interested in pressurized systems. Flexible guides are sometimes wrapped with synthetic rubber tape which affords some mechanical protection if and where the application warrants.

Flexible waveguides are not usually employed in great lengths, but a general rule at present is to

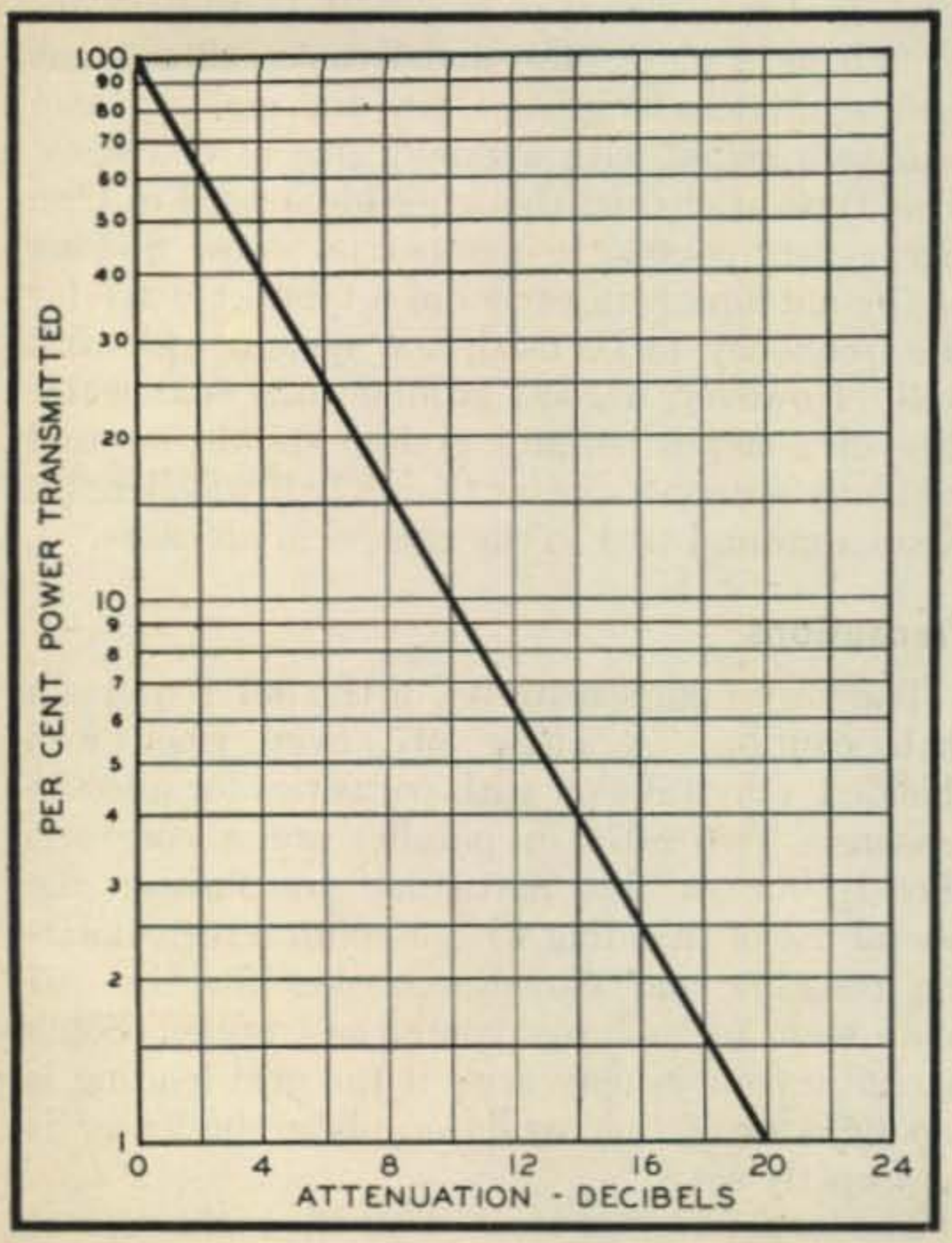


Fig. 9. Per cent power transmitted where a given amount of attenuation exists.

use the interlocked guide for applications where a long rugged line is required and the seamless and vertebra types for short adjustable couplings, especially if there is vibration or rapid flexure.

Flexible waveguide assemblies may have higher attenuation than similar assemblies made of rigid tubing, but the cost, convenience of installation, ease of making certain changes with flexible waveguide will certainly offset any slight electrical disadvantages which may be encountered by the experimental worker.

Table 3 shows an approximate comparison of losses in rectangular guide designed for the 3 cm region.

Of general interest may be the curve in *Fig. 9* showing the amount of power transmitted where a given amount of attenuation exists.

It is expected that considerable interest will develop among experimental workers in microwaves within the near future. Undoubtedly there will be many individuals and groups from the ranks of radio amateurs and others who will be using waveguides for the first time, and it is to these groups that the foregoing remarks may be of interest.

BACHELOR SPECIAL

[from page 12]

the use of a single wire antenna. Push-pull operation is preferred, but it is more difficult to couple a single wire to this type of circuit. A pi-network is used as a plate tank and is most efficient at feeding random lengths of wire and making them radiate a signal with a fair degree of efficiency. This type of circuit, though seldom used in ham rigs, is very popular in commercial work. So long as the antenna is in excess of a quarter wave for the frequency to be used, the system will work well. However, a good ground to a cold water pipe or a steam radiator system should be used with any antenna shorter than a half wavelength. Keep a ground tied to the chassis in all cases.

Precautions

The very high sensitivity of the 807 requires a little caution. A single 807, even when well shielded, may take off with parasitics for obscure reasons. Two 807s in parallel are a constant threat, but in this particular transmitter the liberal use of shielding with 50-ohm screen isolating resistors and parasitic chokes for the 807 plate seem to have overcome the trouble. Some parasitic trouble may arise if the grid loading is too light or if the oscillator plate condenser is improperly set.

The pi-network is located on the right rear of the main chassis and is easily adjusted. When tuning up the rig fully mesh the condenser on the

antenna side of the inductance and tune the condenser near the plates to obtain minimum dip in the plate current. Then slowly unmesh the antenna condenser and watch for an indication in the r-f ammeter. When a maximum reading is obtained, return to the plate condenser and start to mesh it. This should cause a further rise in antenna current. Then unmesh the antenna condenser further and see if any increase in antenna current occurs. If not, or if the r-f current should decrease, you have then matched the antenna to the pi-network and you should return the condenser to the last setting. Once a maximum reading is obtained in the antenna circuit a further increase may be obtained by increasing the screen voltage. You will find however, that beyond a certain point no further increase in r-f output will be obtained and only heating of the screens and a heavy plate current will result.

In general, the tuning of the oscillator in this circuit will dip the plate current to about 20 ma on the fundamental and about 35 ma on the second harmonic. A third harmonic output can be obtained, but it is seldom satisfactory enough to drive the final. The crystal should be mounted at least 18 inches from the final tank coil.

Operation

There is an old saying that the proof of the pudding is in the eating. When the writer made this rig he well realized that it would have limitations. For instance, there are many old wives' tales about parallel operation of tubes on the high frequencies. "Don't do it", they would say, while others would comment on the use of the pi-network on anything lower than 40 meters. But, when 20 meters opened, I found my random twisted length of 130 feet of antenna loaded nicely and getting out well enough to make WAC.

For this compact transmitter the total cost was less than $55. Some parts are not readily available and the reader is encouraged to do his own free wheeling.

Coil Data

L-1—**80 meter.** 42 turns No. 20 enamelled, close-wound on 1⅜" dia. form
40 meter. 20 turns No. 20 enamelled, space-wound on 1⅜" dia. form
20 meter. 10 turns No. 20 enamelled, spaced 1/16" on 1⅛" dia. form
All forms 5 prong

L-2—**80 meter.** 32 turns No. 14 enamelled, space-wound on 2¼" form
40 meter. 22 turns No. 14 enamelled, close-spaced on 1⅝" form
20 meter. 13 turns No. 14 enamelled, space-wound on 1¼" form
All forms 4 prong.

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FOR SALE: Supreme model 563 Audio Signal Generator, range 30-15000 cps, in perfect condition, $25.00. Matzinger, Box 409, Red Bank, New Jersey.

LOW DRIFT, mounted crystals within 10 kc. specified frequency, 3.5 and 7.0 megacycle bands. Holder prong spacing ½ or ¾ inches. $2.00. Breon Laboratories, Williamsport, Penna.

IF TRANSFORMERS for converters, AM-FM receivers. Slug tuned 6-13 mc. Heavy aluminum cans. Excellent buy. $1 each. Everett Taylor (W8NAF/9), 720 Ohio, Columbus, Indiana.

OFFER $2.00 apiece for one copy each of Jan. & Feb. 1945 "CQ." Sumner B. Young, WØHCC, "Maplewoods," Wayzata, Minnesota.

PRESELECTORS, 10 to 20 meters, self-contained power supplies—$19.95. 2-meter super-regen receivers. Write for details. Constant Electric, 112 Cornelia Street, Brooklyn 21, N. Y.

QSLs??? Samples 10c. "Lefty" Sakkers, W8DED, Holland, Mich. (Veteran)

QSL's .... Samples for Stamp .. Henry L. Carter, Jr ... W2RSW, 747 S. Plymouth, Rochester 8, N Y

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SALE, NC-2-40C, used slightly, $200. J. G. Ditmer, 2116 S. Frazier, Philadelphia 43, Penna.

SELL RME-45, like new, $160.00. W8VVD, 467 Park Ave., Birmingham, Michigan.

SELSYN MOTORS, limited supply, $7.50 per pair; 50 volts, 50 cycles, will operate perfectly on 60 cycle current. Ideal for antenna controls or wind direction indicators. Can be used as motor. See article in May "CQ." U. S. money order or check. I pay postage. No C.O.D. F. West, 4142 N. Broad St., Philadelphia 40, Penna.

SURPLUS BARGAINS: Pyranol capacitors 4000 working volts, .15 mfd. 75c; .25 mfd. 85c; 2 mfd. $3.35; 0-1 milliammeters, 3½" square case, $2.50. Write for list. Rubin Radio, Sycamore Avenue, Shrewsbury, New Jersey.

WANTED: Deluxe model Meissner Signal Shifter. State price and condition. WØTDH, 2823-A Lyon St., St. Louis 18, Mo.

WANTED: Articles, shorts, photos and comments for the "CQ" columns. For full details write W2IOP, CQ, 342 Madison Ave., New York 17, N. Y.

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19 TUBE SCR 522—100 to 156 mc, 4 channel crystal control, 832 final transmitter and superhet receiver. Receiver can be converted to continuous tuning. Complete with tubes and case. Price: new—$70.00, used—$55.00. Resistor Kit No. 1—125 mixed—$2.00; Kit No. 2—100 mixed—$2.00. 3E29 (829B) $4.75. RG8/U 50' length $2.00. RG59/U 72 ohm 6c/ft. New throat mike $1.25. HQ-129X delivered, $173.25 complete. Waterman Pocketscope $50.00. Dumont 5" oscilloscope $99.50. Castle Radio Supply, W2JBM, 677 Euclid Ave., Brooklyn 8, N.Y.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

of CQ, published monthly at Pittsfield, Massachusetts, for October 1, 1946.

State of New York
County of New York } ss.:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared John H. Potts, who, having been duly sworn according to law, deposes and says that he is the Editor of CQ and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business manager are: Publisher, Sanford R. Cowan, 1620 Ocean Ave., Brooklyn 30, N. Y.; Editor, John H. Potts, 154-18 35th Ave., Flushing, N. Y.; Managing Editor, Lawrence Le Kashman, 261 Central Ave., Lawrence, N. Y.; Business Manager, S. R. Cowan, 1620 Ocean Ave., Brooklyn 30, N. Y.

2. That the owners are: Radio Magazines, Inc., 342 Madison Ave., New York 17, N. Y.; John H. Potts, 154-18 35th Ave., Flushing, N. Y.; and Sanford R. Cowan, 1620 Ocean Ave., Brooklyn 30, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities, are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock, and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) JOHN H. POTTS, Editor.

Sworn to and subscribed before me, this 1st day of October, 1946.

(Seal.) CHARLES A. LAMBRECHT, Notary Public.

New York County Clerk's No. 14, Reg. No. 8L176. Commission expires March 30, 1948.

CONVERTING THE ART / 13

[*from page 17*]

ons are then made according to the schematic. hen operating on 10 meters, the transmitter ntrols *A* and *B* are tuned in the normal fashion one-half the required 10 meter frequency. The tting of controls *C*, *D*, and *E* are otherwise im- aterial, although *C* should be placed on a num- er that closes the internal switch in series with he key.

After throwing the four-pole switch to 10- eter operation the transmitter is turned on. une the doubler for maximum 813 grid current ith the function switch in "Tune" and the emis- on switch in the c-w position. Tune the 813 10- eter tank circuit for minimum plate current. he antenna or feeder may then be tapped on for he proper loading, about 180 ma. If the 813 id current is lower than its value on the other ands, a slightly reduced loading should be used. emember that the meter indicates the total athode current to the tube and not the plate urrent alone. It may be necessary to retune the ank after the feeder is connected, but the an- enna system detuning should not be too great, ince this is an indication that the antenna system ill not resonate.

General Operating Notes

When the emission switch is placed in the n-c-w position, when keyed, the transmitter will e modulated by the built-in audio oscillator. This type *of emission* is illegal for all but the igher amateur frequencies and the new 11 meter and.

Operators will find that it is very possible to une the ART/13 on a harmonic of the desired perating frequency. Quite likely this will only happen in the 80 meter and 40 meter bands. How- ever, if the readings of the numbers indicated by dial *C* are in proportion to the output frequency, his will probably never happen. For example, uning the transmitter up on 80 meters should ring dial *C* somewhere between readings 2 and 6. If a reading around 12 is obtained, the transmitter is tuned on a harmonic. The antenna current readings are not too reliable as the meter is operated by inductive coupling to the antenna lead.

The antenna used at W2GQM for all band operation consists of a 118-foot flat top tapped with a single wire feeder 17 feet from the center. On 75-meter phone, it acts as a single wire feed matched impedance half wave. On 40 and 20 meters it operates as a large T type Marconi, while on 10 meters it is used as matched im- pedance of seven half waves.

CQ Ad Index