CQ RADIO AMATEURS' JOURNAL

JANUARY 1953

35c

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The New Hallicrafters HT-20 is T.V.I. proofed!*

Here's the news you've been waiting for—a medium power transmitter (100 watts) that solves the problem of television interference once and for all. The Hallicrafters HT-20 is the answer. Completely tested in the lab and in the field, here is a transmitter that is truly T. V. I. Proofed.*

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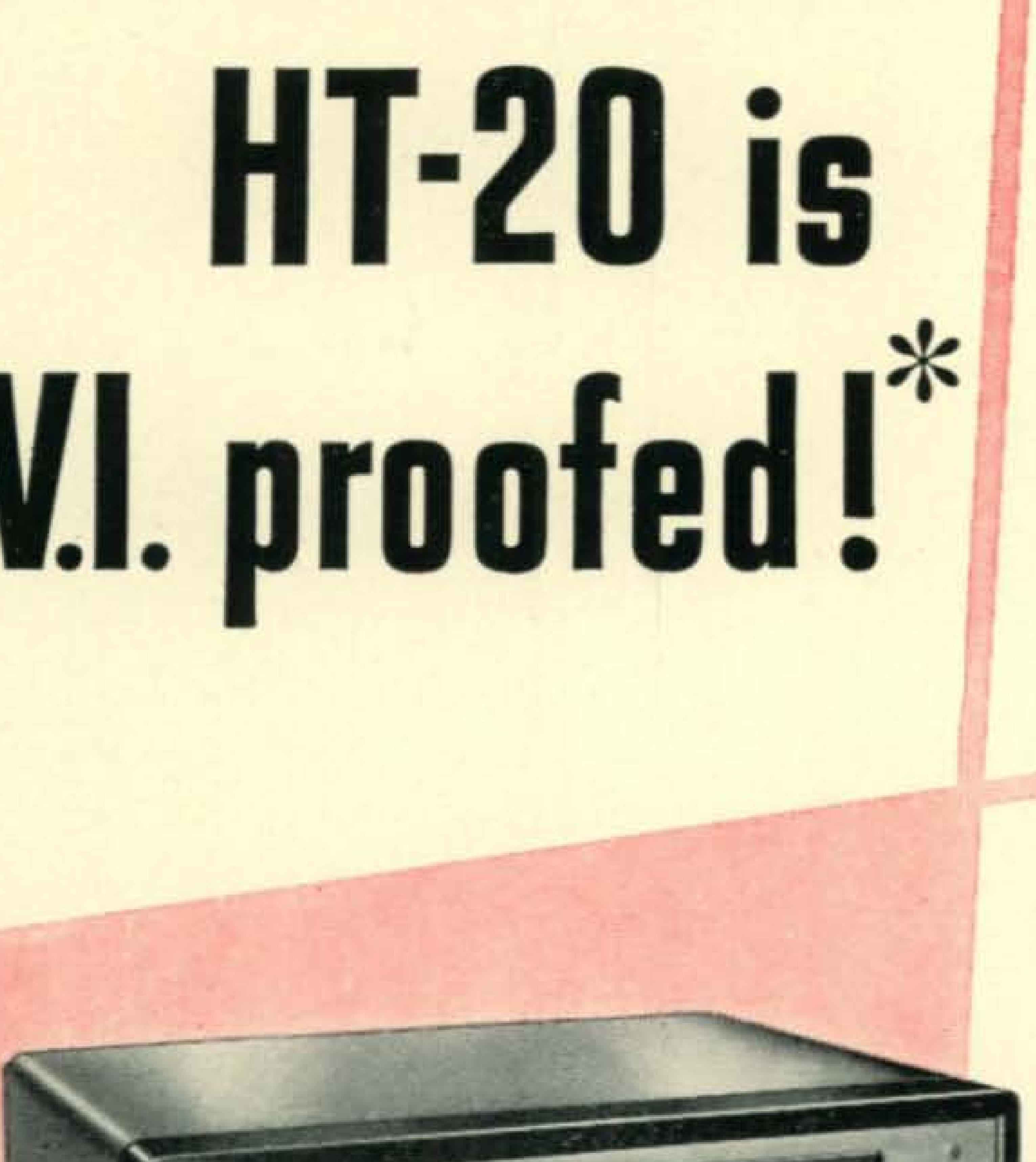
See this newest Hallicrafters—get the complete story of the finest transmitter, dollar for dollar, on the market today. Or write Hallicrafters direct for full details.



Check these features!

- **100 watts carrier power with high level (Class AB2) modulation on any band.**
- **Continuous coverage, with overlapping bands, from 1.7 to 30 mc.**
- **Compact, efficient design. Amazing for its power. The HT-20 is 20½" long, 11¾" high and 16¾" deep.**
- **Weight of transmitter, in cabinet, 105 pounds.**
- **All transformers and chokes operate "cool"—maximum temperature rise of 40 degrees. This means fewer replacements, long operating life.**
- **Operates equally well from relay rack or in cabinet on table top.**
- **Uses 117 volts, 60 cycle AC.**
- **Moderate cost.**

* **T. V. I. PROOFED**—means that this transmitter has circuitry specifically designed to eliminate spurious and harmonic energies that result in television interference.

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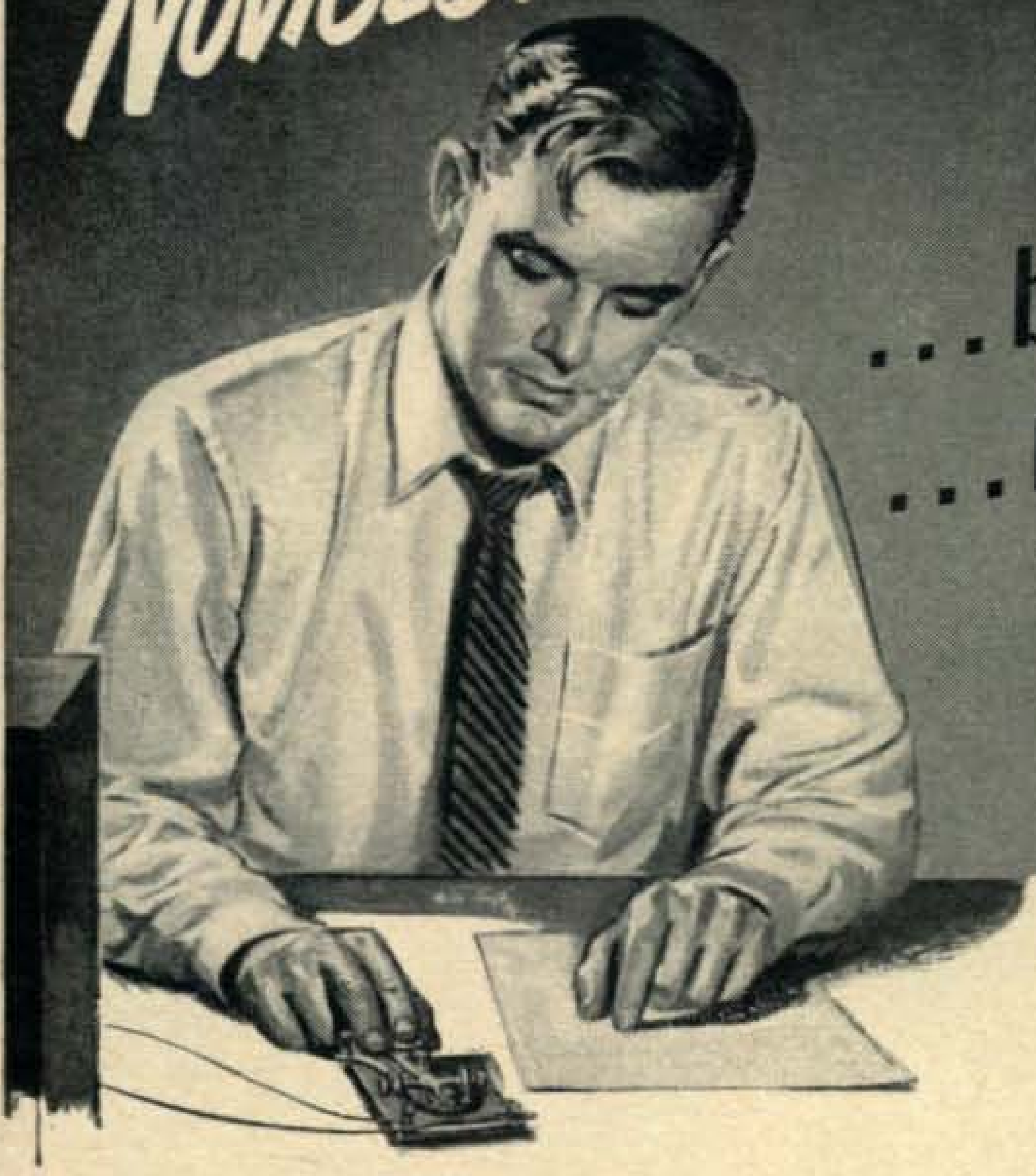

● **Low Price . . .** less than a pair of average receiving types! That's all you pay for this popular General Electric tube with 75-w-input wallop. In fact, the GL-807 gives you *more watts per dollar* than any other power tube!

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GL-807
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Filament voltage	6.3 v
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voltage	750 v
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input	75 w
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CQ RADIO AMATEURS' JOURNAL

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FEATURE ARTICLES

Departments

Miscellaneous

Feenix, Ariz.

Deer Hon. Ed:

Ah so!! The 1953 Janyouarry are here. With mixed emoshuns this year Scratchi are viewing it, although normally I hopping about with joys at the start of each year, as I can forgetting horribul things which having happened to me in the past year and starting with cleen slate. This time, howsumever, Hon. Brother Itchi and XYL Lil Watanabe are pulling big switch on my enthooseasm rite at the start. There skeem is diabolical, Hon. Ed., as they wanting me to make three resolooshuns for Hon. New Year and keeping them for at least one month.

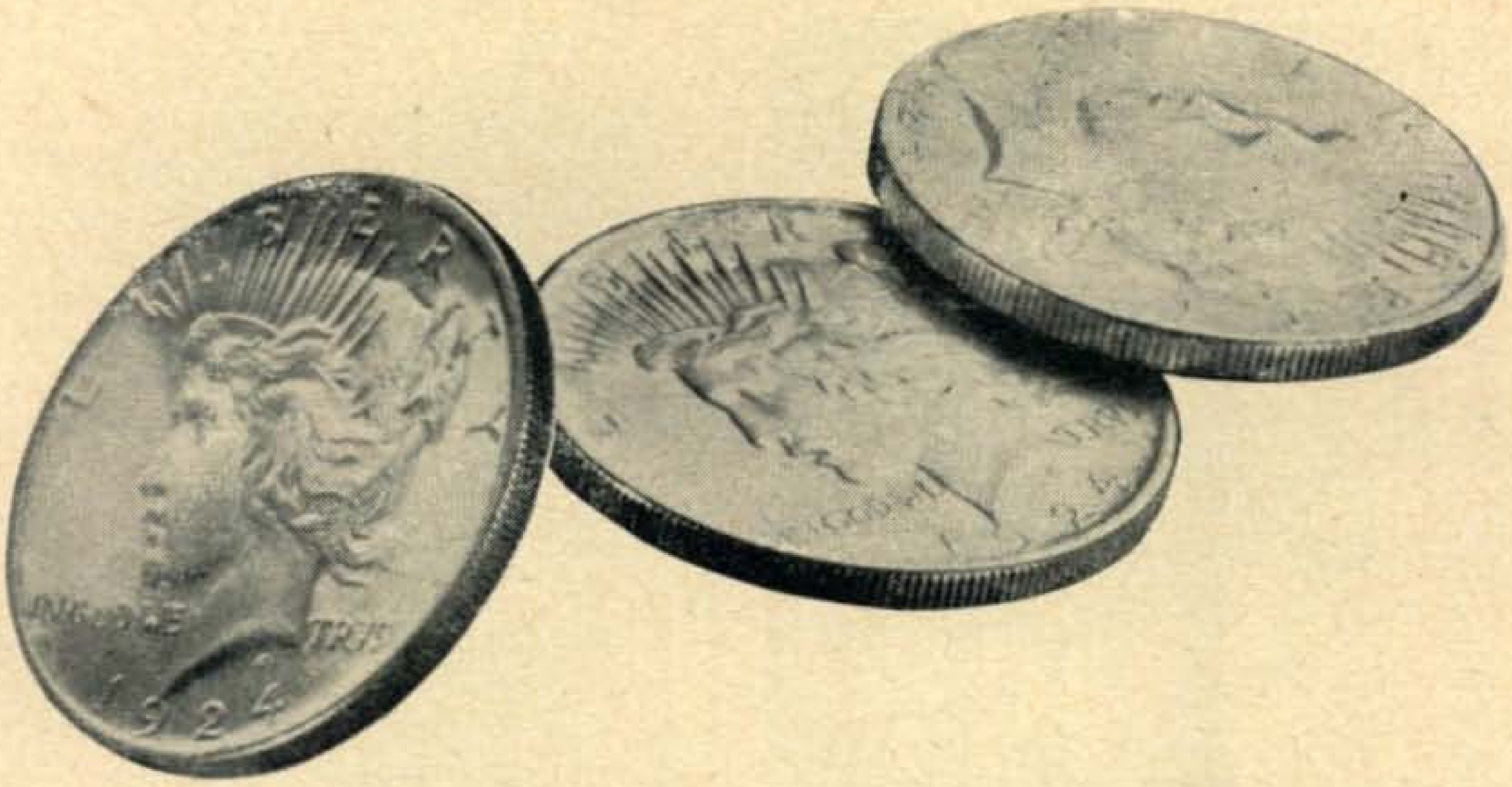
Also, adding QRN to QRM they are making it tough, because if I not keep resolooshuns, Lil not having any dates with me for a hole month, and I having to pay Hon. Brother Itchi 25 bux. Only a slitely bright side is that if can keeping my resolooshuns for a month, Itchi shelling out 25 bux to me.

When first heering of terribul idea they having, I not thinking there ghost of chance of me clamming onto 25 bux from Itchi, but new inspearshun just having are so clever are now sure that it are in the bag. All I having to do is make three resolooshuns that are so easy to keep that even Scratchi can't braking them. Much thought are being done, and of finally I coming up with three beauts: (1) I will not operate outside the amchoor bands; (2) I will not overmodulate; and (3) I will get no tickets from the FCC.

Sacremento!! Aren't they honeys? How can I miss? I using crystal control so can't going outside the band, I only work on see-w so can't possibly overmodulate, and then how can get ticket from FCC? Twenty-five bux, here I come!

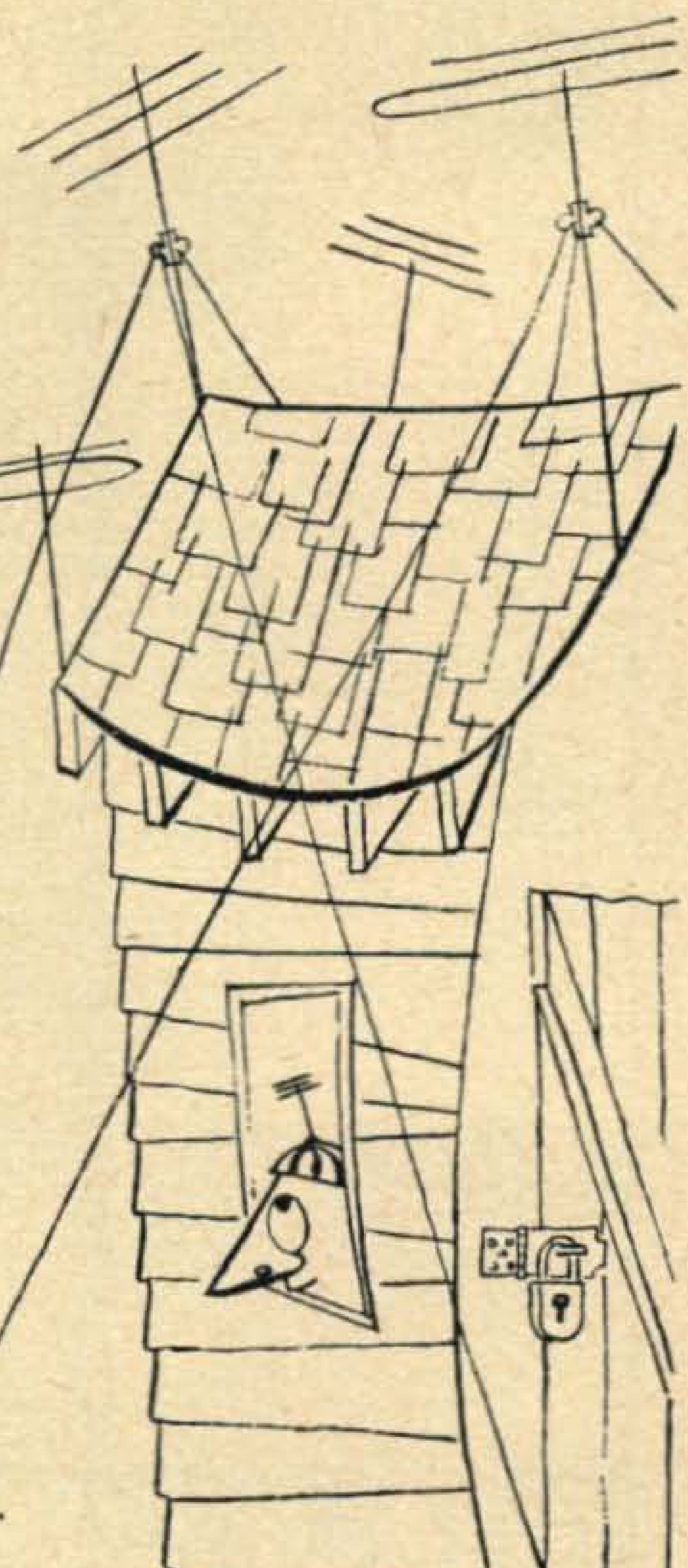
I nicely typing the three resolooshuns and showing them to Hon. Brother Itchi and gal-friend Lil, and they agreeing everything fine. Itchi saying even though they so easy to keep he still thinks he'll get 25 bux from me. Hah! Even if I lost it he wouldn't get it from me, but Scratchi not taking any chances, as my skeem are foolproof. To making doubly sure, I going into radio shack, turning on rig, taking out VFO, putting in crystal, tuning it up, hollering seek-you into mike a cupple of times, and making sure everything hunky-dory.

(Continued on page 6)



HAVE the Time of YOUR Life ....

AND GET PAID FOR IT!



Think of the hundreds of hours you spend in your shack, having the time of your life!
How would you like to get paid for it? You may **IF** . . .
IF you're a top-flight electronic engineer with an excellent communications background. **IF** you have an electrical engineering degree from an accredited college or university.
IF you have an inventive spark — a real urge to create something new and better.
IF you meet all of these qualifications, National can offer you an exceptionally good salary, unusual social benefits and a really great gang to work with. Best of all, you'll get paid for doing what you like to do most!
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We promise a prompt decision.

W. A. Ready
President, National Company, Inc.

Write to Industrial Relations Dept., **NATIONAL CO., Inc.**, 61 Sherman St., Malden, Mass.

(from page 4)

Later that day I sitting into patio, absorbing sum of the Arizona sun, trying to figure out how to spend that 25 bux, when thought are suddenly coming to me. Supposing that I were to going on air and rig developing 1/c case of parasiticks, or maybe sum toob are going bad, or sumthing. No, by gollies, that would cheating me out of 25 bux. Only thing for Scratchi to do is staying off air for a hole month, then are absolootly sure of getting the money.

Next afternoon are sitting in shack, wondering whether I should cleening sodder off the floor where it had fallen, when Hon. Brother Itchi coming in, tossing me a long envelope, and saying "Looks like you owing me 25 bux as one resolooshun are certainly broken." Hackensake! The envelope are from the FCC monitoring station. I opening it up and hurriedly reeding it. Brother Itchi are wrong. Scratchi not braking one resolution—he braking all three! FCC notice saying that I are heard on air calling seek-you when being off frequency and overmodulating. It saying "please notifying . . ."

Well, that's life. Easy come easy go. No dates for a hole month, and I owing Itchi 25 bux instead of vice versy. But how in the name of crystal control can having such a poor signal from rig in short time I testing on air yesterday? My rig may not look like it turned out on factory production lion but are usually working hunky-dunky. This worrying me so are deciding to looking over the transmitter.

Are hardly getting chassis out of rack when noticing that oscillator toob are missing. Well for . . . of all the . . . I'll be!! My crystal oscillator toob gone, so stage is parasiting, and FCC listening. How come? I never taking any toobs out of rig. As matters of fact, last time we replaced a toob it were in TV set, when Itchi getting toob of mine and . . . WHEN ITCHI GETTING TOOB OF MINE!!! I quicklike rushing out of shack into living room and asking Itchi where he getting toob he putting in TV set. Hon. Ed., wanting two gesses on where he got it? Right the first time . . . . out of the oscillator stage in my rig. At that I getting reel mad and I telling Hon. Brother Itchi off in no uncertain terms. I just getting second wind to mentioning other things about him I not like when he collapsing on floor with laughter. After he calming down he telling me he sorry, it all his fault, and he giving me the 25 bux.

So, for once, Scratchi not getting blamed for sumthing that not his fault. Of course, still having to explain hole thing to gal friend Lil, but she not knowing oscillator toob from doubler toob, so everything looks rosy for 1953. Happy New Year.

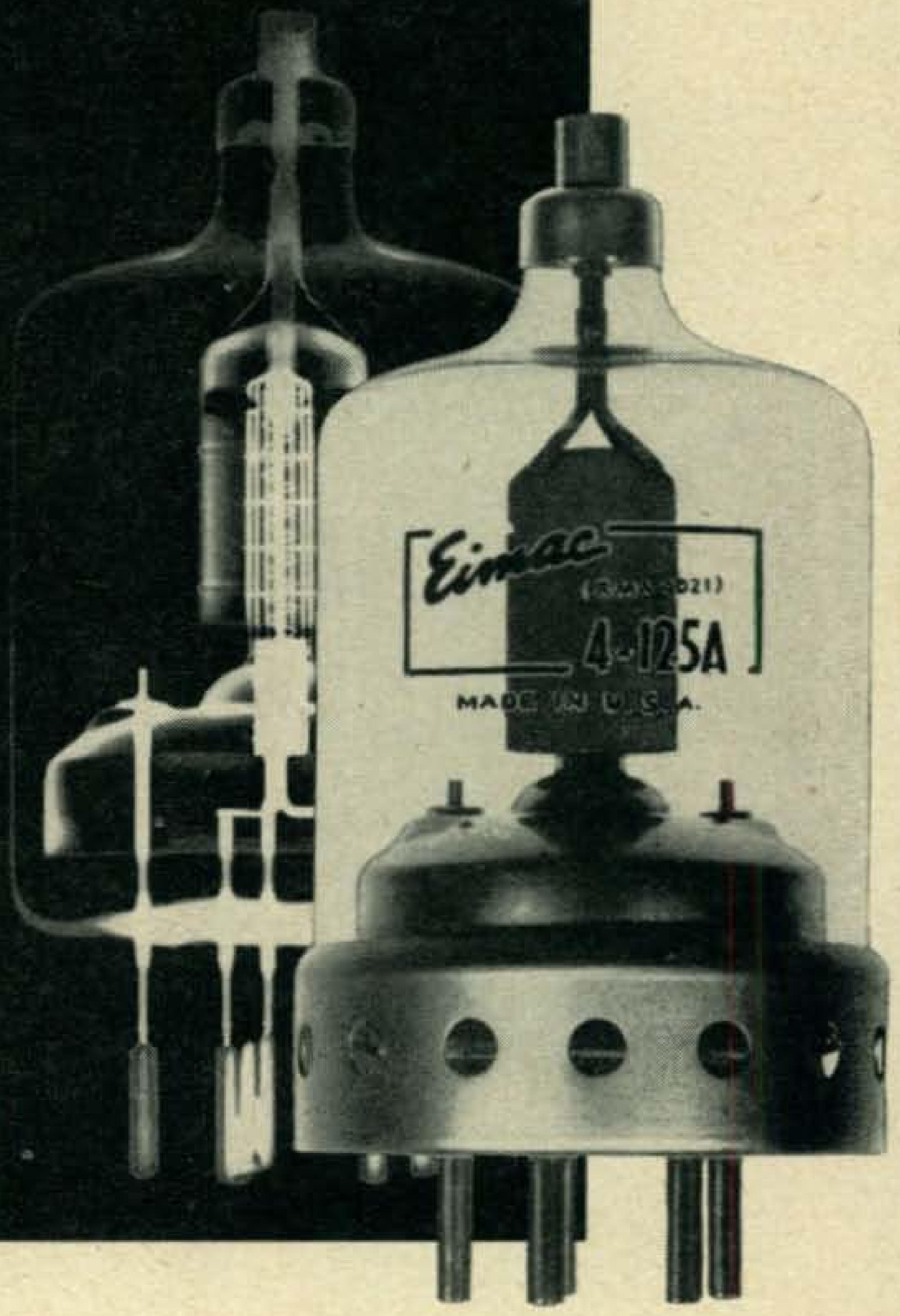
Respectively yours,
Hashafisti Scratchi

A Correction!

Outboard VFO
(October, 1952 — page 54)

Condenser C3 is not required in this circuit. It should be removed in order to improve stability.

Any Way You Look At It...



....the Eimac 4-125A is designed for economical, outstanding performance.

TYPICAL OPERATION
(Frequencies below 120 mc.)

Radio Frequency Power Amplifier and Oscillator Class C Telegraphy or FM telephony (key down conditions, one tube)

D-C Plate Voltage	2500 volts
D-C Screen Voltage	350 volts
D-C Grid Voltage	-150 volts
D-C Plate Current	200 ma.
Driving Power	3.8 watts
Plate Power Input	500 watts
Plate Dissipation	125 watts
Plate Power Output	375 watts

Long service, low replacement costs, high output with low driving power and all-around outstanding performance are some of the reasons why Eimac's 4-125A is the most popular 125 watt tetrode. This power tetrode enables the use of simple circuit design and minimizes TVI grief. Through the extremely low grid-plate capacitances of the 4-125A neutralization problems are non-existant in most cases. Two 4-125A's in typical class C telegraphy or FM fone operation, with five watts of driving power, will handle a kilowatt input—or a pair in high level modulated service will take care of 750 watts input. Rated at a maximum plate dissipation of 125 watts, the 4-125A is excellent for use as an oscillator, modulator or amplifier. If you're rebuilding or planning a rig, you'll find the 4-125A a money saving way to get top performance.

The 4-125A radial-beam power tetrode has the Eimac features of a pyrovac plate, controlled emission Y3 grid wire, low inductance leads and input-output shielding. For further information, or a free copy of the handy 28 page booklet, "Care and Feeding of Power Tetrodes", write our Amateurs' Service Bureau.

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ZERO BIAS

E D I T O R I A L

VALE 12:112

On December 3rd, 1952, the FCC announced the deletion of Section 12.112, proposed under Docket 10237. This was the portion of that Docket relative to the establishing of "calling and answering" segments in many of the amateur bands.

Although a number of amateurs were in favor of the philosophy of this proposal, the vast and overwhelming majority were rightly terrified at the scope of Section 12.112. Not only would it set a precedent in the amateur service, but it would have drastically further impoverished the already "frequency poor" amateurs. While no one will doubt that certain features of Section 12.112 were in the "public interest" (as outlined in the September issue of *CQ*, page 9) they were at the same time at cross purposes with the foundation of amateur radio. To all outward appearances it looked very much as though someone was interested in "selling amateur radio down the river." A possible important point overlooked by many amateurs is that Commissioner Sterling, W3DF, was not in Washington and did not take part in the formulation of Docket 10237. It is felt, in many circles, that had he been present the Docket would not have been released.

About the only favorable remark made on Docket 10237 was that it appeared possible that the Commission was seeking to thwart the requests and informal proposals for "private" ham calling and answering frequencies. The suggestion has been made that by submitting an "outlandish" plan which would cause practically every amateur to scream, the proposition could be dispensed with in one fell swoop. Right or wrong, this is an interesting conjecture.

The demise of Section 12.112 was due to the 640 comments filed on this Docket. The importance of these comments cannot be too heavily emphasized. Along this line, *CQ* will soon attempt to publish some remarks made by Commissioner Sterling before the New York Radio Club in mid-December. They will again indicate the workings of the "Administrative Procedures Act," and its relation to the amateur service.

VHF Department

Bill McNatt, W5FEW rather unexpectedly resigned as our VHF Editor just before the closing date of the January issue. As a result there is no "The VHF News" in this issue. In its place we have substituted, at the last minute, the "Amateur Teletype" column scheduled for appearance in the February issue. Our thanks to W2NSD for his cooperation in supplying this column on a single day's notice.

Every effort will be made to re-establish "The VHF News" department as soon as possible. No department on this subject will appear in the February issue, but in the March issue we will present a special feature story on the European VHF picture.

February "Feature DX Issue"

Next month *CQ* will publish its first "Special Issue" on the subject of DX. It is shaping up into one of the most interesting issues for 1953. The material has been especially selected to be of interest to the maximum number of readers.

Look for it!

"Special Mobile Issue"

In answer to many requests another "Mobile Issue" is being prepared. It will be released in the early spring.

This second "Mobile Issue" will feature a single-sideband mobile transmitter and, of all things, a "dial-less" VFO. But, confidentially, the staff is working on something really hot. . . . A new type of noise limiting device which is a very radical departure from contemporary design.

The Cover

Faye Emerson types out one of the first messages to our Servicemen overseas on the teletype network described on page 29. Looking on is her husband Skitch Henderson, Wayne Green (W2NSD), and Bill Halligan, Sr. This project sponsored by Hallicrafters and the VIM Stores in New York City was a tremendous success, besides further demonstrating the usefulness of teletype for high speed message handling.

SELECTIVITY... in a Communications

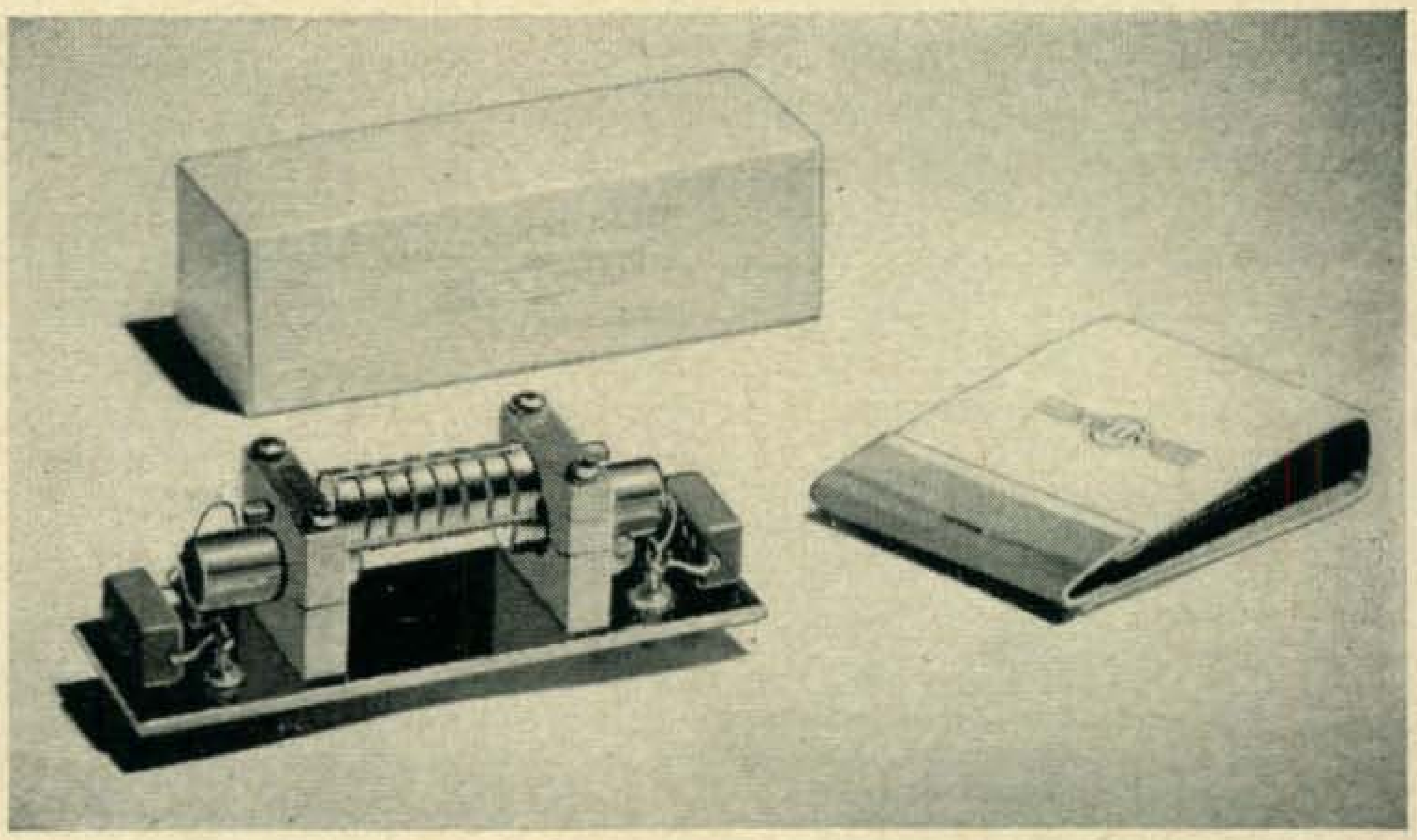
The selectivity curves shown here tell the story of a new concept in receiver performance. The Mechanical Filter recently developed by Collins and incorporated in the 75A-3 receiver represents an entirely new approach to the attainment of selectivity. Using resonant mechanical elements rather than tuned electrical circuits, the Mechanical Filter gives a close approach to the ideal rectangular selectivity curve. Each 75A-3 receiver has plug-in provisions for two Mechanical Filters. A 3 kc Filter is standard factory equipment and when still greater selectivity for CW operation is desired, the 1 kc plug-in unit is available as an optional accessory. With both the 1 kc and 3 kc Filters in the receiver, a switch on the front panel provides instantaneous choice of selectivity characteristics. When required, the crystal filter may also be switched into the circuit to notch out interfering signals and heterodynes.

The nearly flat top and sharp cutoff at the sides of the selectivity curve of the 3 kc Mechanical Filter permit all AM signals to be tuned so as to accept the carrier and either one of the sidebands at will, while the other sideband is rejected. Thus much distortion due to fading is eliminated, and susceptibility to interference is greatly reduced. Alternatively, both AM and SSSC signals may be received with carrier supplied by the BFO; and the ideal selectivity curve of the Mechanical Filter permits full advantage to be taken of the benefits of local carrier reinsertion.

Because of the Mechanical Filter's straight-sided selectivity curve, the 75A-3 receiver can be tuned near a strong signal without responding to that signal. As the receiver is tuned across the band, signals suddenly appear and disappear. This is because of the absence of broad skirts which "drag out" the tuning of conventional receivers.

All of the proven features of the 75A-2 have been retained in the 75A-3. These features, such as crystal controlled front-end, highly stable variable frequency oscillator, and accurate dial calibration, to name but a few, combine with the new Collins Mechanical Filter to give unequalled performance.

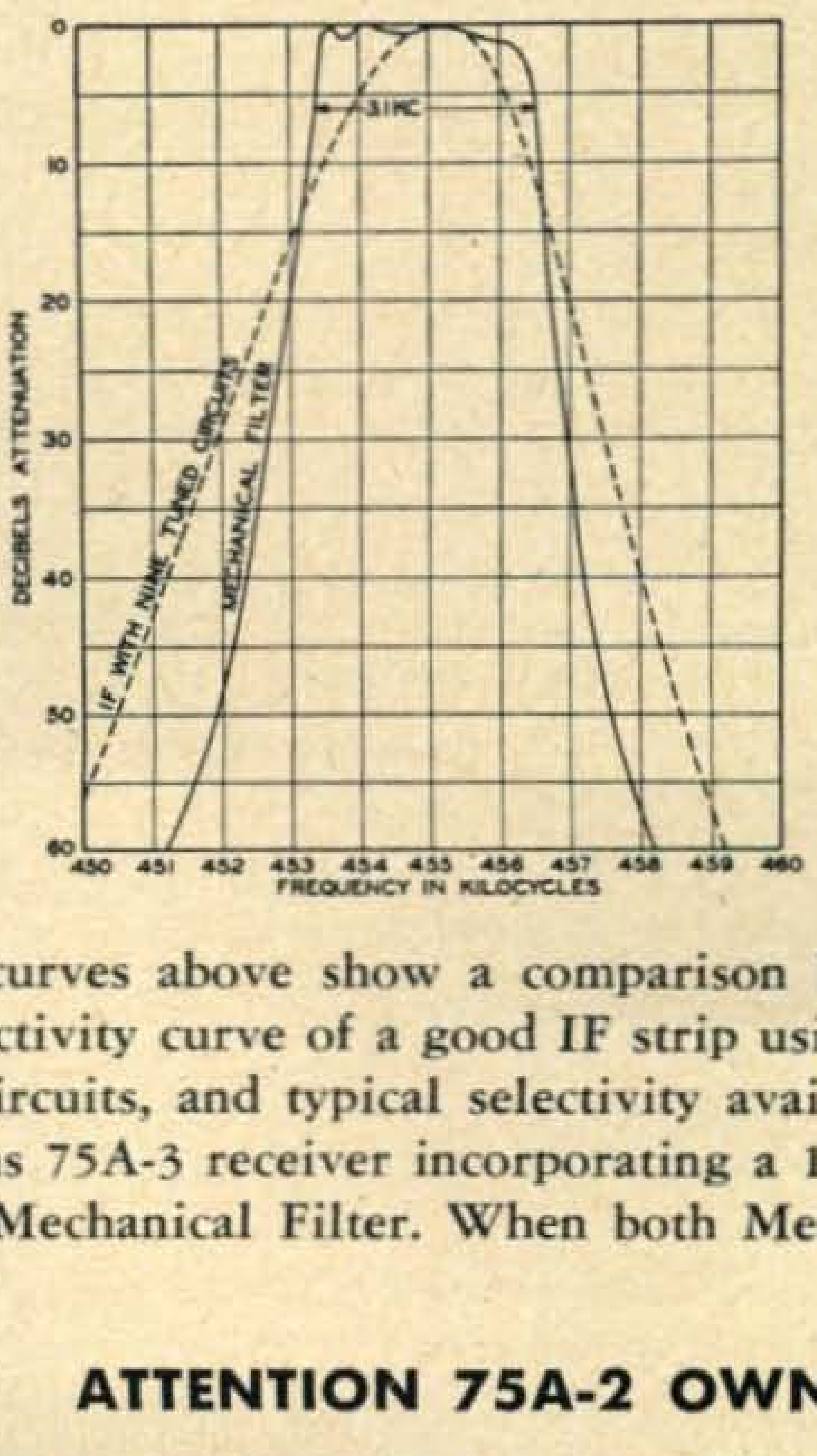
Whether you ragchew, handle traffic, or work dx, here is the receiver for solid contacts. The straight-sided, flat-topped, selectivity curve and the excellent frequency stability of the 75A-3 make it a natural for the single-sideband operator.

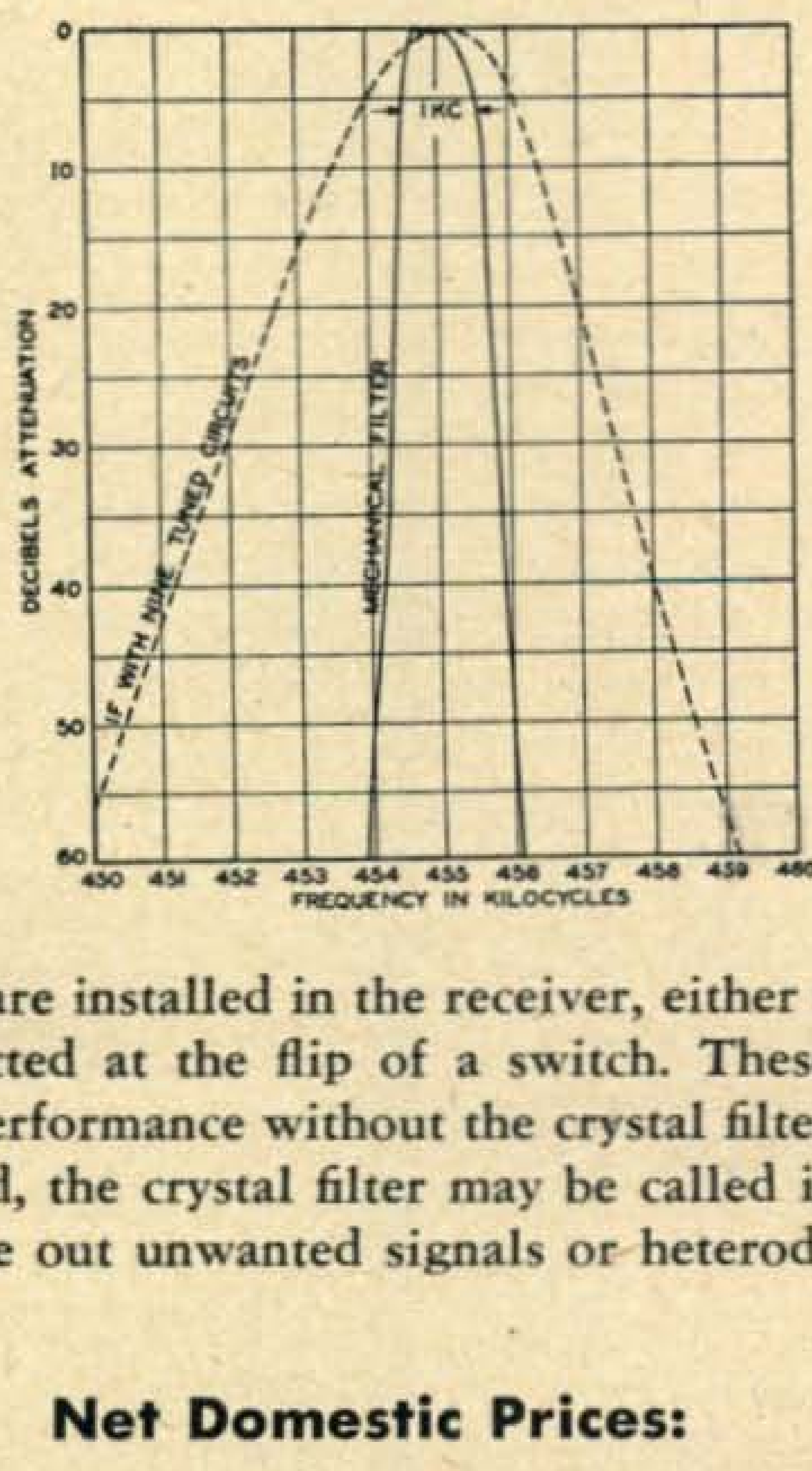


The Mechanical Filter is a resonant mechanical device that is coupled into the receiver's 455 kc IF strip by means of magnetostriction. As shown here, it consists of three general sections: an input transducer, a mechanically resonant section consisting of a number of metal disks, and an output transducer. A 455 kc electrical signal applied to the input terminals is converted to a 455 kc mechanical vibration at the input transducer. This mechanical vibration travels through the resonant mechanical section to the output transducer, and is converted to a 455 kc electrical signal which appears at the output terminals. The Mechanical Filter is enclosed in a hermetically sealed case and requires no adjustment.

never before achieved Receiver

The Collins 75A-3 with Mechanical Filter. A 3 kc Mechanical Filter is installed at the factory. The Filters are plug-in units, and a 1 kc Mechanical Filter may be installed at any time.





The curves above show a comparison between the selectivity curve of a good IF strip using nine tuned circuits, and typical selectivity available in a Collins 75A-3 receiver incorporating a 1 kc and a 3 kc Mechanical Filter. When both Mechanical Filters are installed in the receiver, either one may be selected at the flip of a switch. These curves show performance without the crystal filter. When required, the crystal filter may be called into play to phase out unwanted signals or heterodynes.

ATTENTION 75A-2 OWNERS

75A-2 owners can return their receivers through the Distributor to be modified at the factory to incorporate the new Mechanical Filter arrangement. Modifications can be made, effective immediately, and will consist of the installation of a 3 kc Filter, minor repairs and complete realignment of the equipment. Modification, F.O.B. Cedar Rapids $125.00

Conversion kits are available from your distributor, complete with instructions and a 3 kc Mechanical Filter. Conversion Kit $100.00

Net Domestic Prices:

75A-3 receiver including 3 kc Mechanical Filter $530

1 kc Mechanical Filter plug-in unit, $75

10-inch speaker in matching cabinet, $20

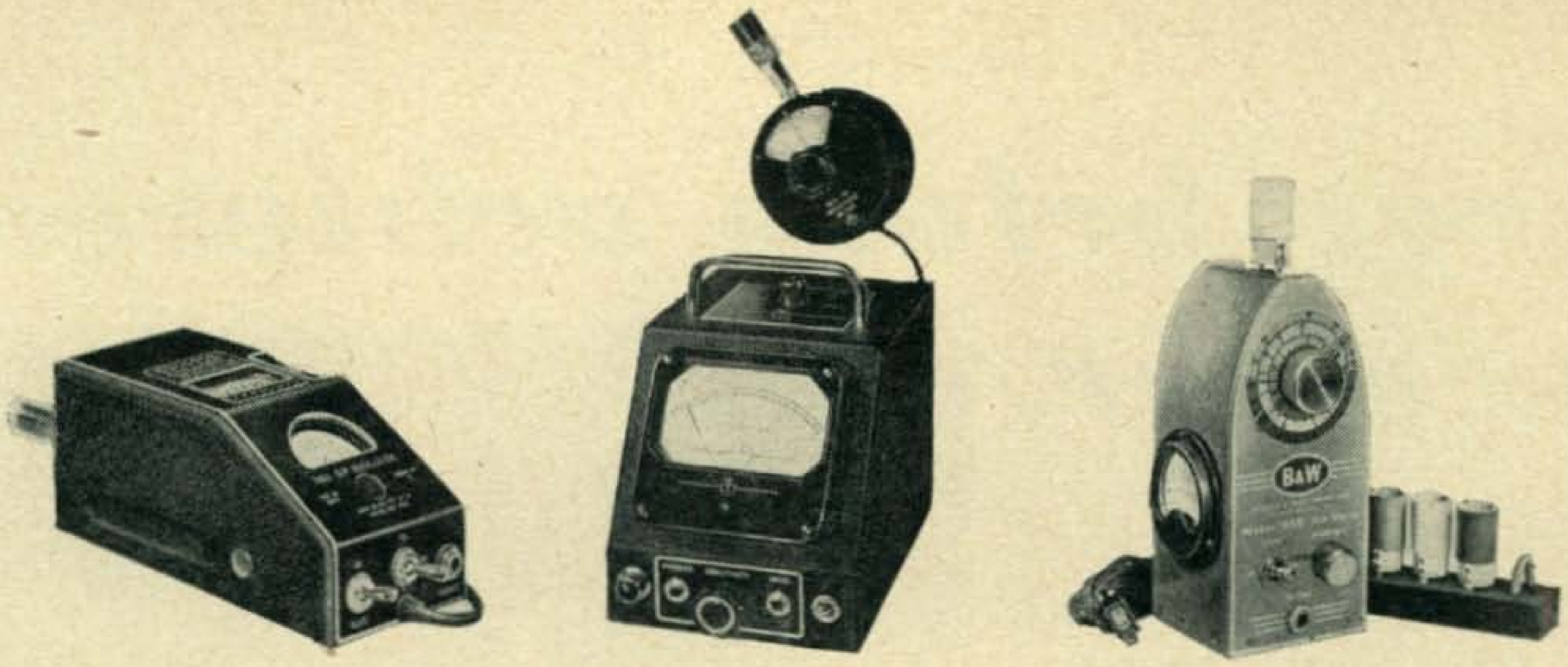
8R-1 plug-in crystal calibrator $25

148C-1 plug-in NBFM adapter .. $22.50

For the best in amateur radio, it's . . . COLLINS

COLLINS RADIO COMPANY, Cedar Rapids, Iowa

11 W. 42nd St., NEW YORK 36 **1930 Hi-Line Drive, DALLAS 2** **2700 W. Olive Ave., BURBANK**



Subject: Grid Dippers

E. MILES BROWN, W2PAU in collaboration with W. M. SCHERER, W2AEF

c/o CQ Magazine, 67 West 44th Street, New York 36, N. Y.

During the past year the back issues of CQ most frequently requested from the Circulation Department by our readers dealt with the grid-dippers. This did not come as a particular surprise, because CQ had pioneered this field since the close of World War II. The lack of information was being rather heavily stressed by the large number of Novices and new amateurs. Frankly, they knew of grid-dippers, but many of them were not too sure if they were any good, or how they could be used. Hoping to nullify this situation, for which we feel wholly responsible, CQ is pleased to present the following resume on grid-dipper design and operation.—Editor.

When, in the course of hamming events, it becomes necessary to seek out the cause of TVI, parasitic oscillations and off-frequency warnings from the FCC; when that new antenna won't load the rig; when you need an r-f signal to test out the new pre-amp; when your home workshop special doesn't work the way the article said it should; when by-passes just don't by-pass—then brother, you reach for the "grid-dip oscillator!" Small wonder that this simple device has won a place near the top of the list of test equipment necessary for proper operation of a ham station.

The fields of application of the grid-dip oscillator are apparently limitless. Several articles on this subject have already appeared in the periodicals[1], [2], [3] and a wealth of information is available in the instruction books supplied with the commercial and amateur versions of the instrument. But, despite this thorough coverage of the subject, *CQ* still receives many requests for additional information on how to use the "dipper." It is also surprising to see how often we note a fellow amateur struggling to get an answer to his particular r-f measuring problem, using a grid-dip oscillator under conditions where it couldn't possibly do a good job.

The purpose of this article is to review some of the previously published material on the use of grid-dip oscillators, and to attempt to point out some of the possibilities for confusion that might be encountered in their use.

General Circuit Description

In order to operate a device properly one must understand what it is and why it works (women drivers notwithstanding!). So let's spend a little time on the general subject of grid-dip oscillator design.

It is certainly safe to assume that all grid-dip meters include a tuned circuit. This usually consists of a variable capacitor and a series of plug-in coils which provide a wide-range frequency coverage. The tuning dial should be calibrated—preferably direct-reading in terms of frequency. The readability and ease of dial adjustment are important design factors. The accuracy of the dial determines the potential precision of frequency measurements made with the unit. The most expensive commercial jobs are hand calibrated and can usually be relied upon to have a dial accuracy of better than plus-or-minus 2%. Somewhat poorer results might be expected from a unit with a pre-calibrated dial, although the grid-dip meters examined by the authors were fairly good in this respect. The accuracy of a home-made device depends on the care taken with the initial calibration and the inherent stability of the components. No instrument of this type will remain accurate under conditions of extreme abuse, so don't expect precision from a unit which has been dropped on the floor hard enough to deform the case or condenser frame, or from a coil that has been too intimate with a hot soldering iron! Lastly, keep in mind that the grid-dip meter is *not* designed to be a frequency standard.

The tuned circuit section of the grid-dipper may be used a passive absorption wavemeter. This possibility is noted here because it is often convenient to use the unit without plugging it into a power source.

The tuned circuit must be used in connection with some form of oscillator. Almost any type of oscillator circuit may be used. The most popular one for this application seems to the Colpitts, using a split-stator tuning condenser connected between the grid and plate of a triode oscillator tube. This circuit offers possibilities for good high-frequency performance, as the tube capacitances are effectively in series. It also provides reasonably uniform feedback across the tuning range. By using resistors, rather than chokes, in the grid and plate leads, the number of stray reasonances may be minimized. The Colpitts circuit is not too well suited for very low frequency operation, but fortunately it can be converted into a form of Hartley oscillator by the addition of a coil center tap[3]. The Colpitts has another advantage for dipper applications—both sides of the coil are "hot" with respect to ground. This implies that r-f energy may be coupled from either end of the coil using loose capacitive coupling.

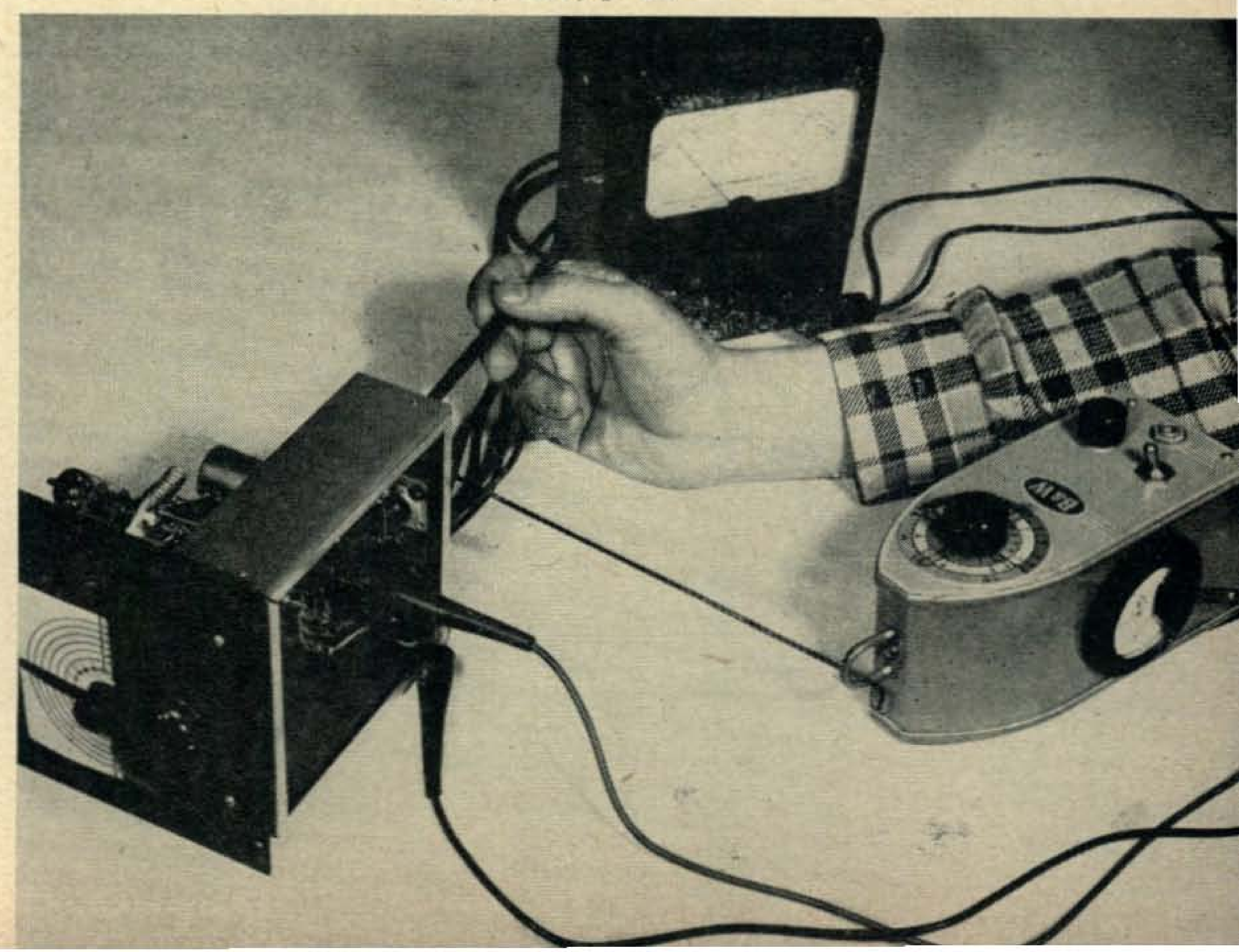
Although the design of a suitable oscillator looks easy at first glance, it isn't! The activity of the oscillator should be uniform across any one tuning range, in order to avoid the necessity for frequent re-setting of a meter sensitivity control. Stray resonance effects might produce spurious dips in grid current as the oscillator is tuned across a band. Resonances of the instrument case, the tuning capacitor frame, and the power cables must be eliminated. The tuning capacitor grounding contacts, if any, should provide electrically quiet operation. In short, there's more to the design of the oscillator than just picking a schematic at random.

Before deciding which design is best for you, test a sample unit—check it over the entire tuning range to determine whether oscillations of reasonable amplitude are maintained throughout each band, and watch out for spurious dips in the important bands.

Some form of indicating device must be used to denote the presence and magnitude of oscillations in the grid-dipper oscillator circuit. Usually a d-c meter is employed to measure the grid current of the oscillator tube. Some successful designs have used a "magic eye" tube in lieu of the meter[4]. It is worthy of note that the sensitivity of the meter has some bearing on the ultimate sensitivity of the instrument when used as an r-f voltmeter (more on this point later). In general, it is desirable to use a sensitive meter to provide good up-scale indications of grid current without the necessity of running excessive power in the oscillator circuit.

With a tuned circuit, a tube, and a meter, we have the makings of a tuned r-f voltmeter. Fortunately, the circuit changes necessary to adapt the oscillator to this function are very minor. The grid and cathode of the oscillator tube can act as a diode rectifier, to measure the r-f voltage developed across half the tuned circuit. This is accomplished

1. "About Grid-Dip Oscillators," Bane, CQ, March, 1947; p. 13.
2. "Applications for the Grid-Dip Oscillator," Scherer, CQ, Jan. 1949; p. 30.
3. "Extending the Range of the Grid-Dipper," Scherer, CQ, April, 1950; p. 28.
4. "The Poor Ham's Grid-Dipper," Johnson, CQ, March, 1951; p. 20.



This is the very handy use of a grid-dip oscillator as a signal generator to facilitate initial alignment of a two-meter converter. The VOM is connected in the converter circuit to show grid current of the mixer tube (see the W2PAU converter in the November 1952 issue). The converter oscillator is disabled, and the grid dipper is feeding the high impedance end of a quarter-wave antenna by means of loose capacitive coupling.

by simply removing the plate voltage from the oscillator. The sensitivity of this type of r-f voltmeter will depend to a certain extent on the meter used. However, there is a defin te limit to the sensitivity that can be realized, since in any simple vacuum tube diode detector, the phenomena of "emission potential" produces a small meter reading even under no-signal conditions. Signals which are small compared to this "emission potential" will generally be masked by it. This is the chief reason why most conventional grid-dip meters are limited in their ability to detect weak r-f signals. Secondly, the relatively high grid-leak resistance required for good oscillator operation tends to limit the sensitivity. Various attempts, in some designs, have been made to overcome this inherent weakness through the application of a small amount of plate voltage to the dipper circuit when in the "detector" position. The resulting feedback increases the apparent "Q" of the tuned circuit. As in the old-fashionel regenerative detector receivers, the sensitivity is greatest just before the circuit breaks into oscillation[5]. This stunt is not generally employed in commercial or amateur units because the circuits which tend to provide the greatest sensitivity are not suited for wide-range frequency coverage and good grid-dip action.

Sensitivity Controls

To enable the r-f meter to handle a wide range of input voltages, some sort of sensitivity control is desirable. This control is also of value in setting the indication of oscillator grid circuit to a mid-scale value. (Despite the best efforts of expert designers there is bound to be some variation of activity across any given tuning range, with the oscillator usually becoming least ambitious on the higher frequency ranges.) A variable resistor, connected as a shunt across the d-c meter, or as a multipler in series with it, will serve the purpose. This type of control reduces the meter sensitivity.

Another type of control has been devised which offers some operational advantages, namely, the "current bucking" control. This circuit serves to push a controllable direct current through the meter in the opposite direction from the normal grid current flow. It behaves like an electronic meter zero adjustment. By moving the meter zero setting below the calibrated scale zero, the amount of up-scale swing due to grid current may be adjusted. This system has one main advantage. Suppose, for example, that the oscillator is producing a total grid current of two milliamperes, and some disturbance causes the current to drop to 1.9 milliamperes. If a shunt resistor were across the meter to reduce the meter indication from 2.0 ma. to, say, 0.5 ma., the drop would be reduced by the same percentage, so that the dip would be from 0.5 to 0.475 ma. If, on the other hand, instead of shunting the meter to reduce its reading we move the meter zero downward and amount equivalent to 1.5 ma., the normal meter reading will be 0.5 and the full original dip of 0.1 ma. will be retained. In other words, the bucking type circuit tends to magnify the effects of disturbances of oscillator activity—just what we want in a grid-dip oscillator. Of course, it isn't all clear profit because the use of the bucking type circuit brings up another problem—that of meter scale linearity. Unless the unit is operated at full sensitivity when it is used as an r-f voltmeter, small voltage indications may fall below zero on the scale, and the meter indications

5. "The Regenerative Wavemeter," Grammer, QST, Nov., 1949: p. 29.

Here W2SPV is using a grid-dipper as a non-oscillating detector to check the modulation quality of his 144-Mc transmitter, described elsewhere in this issue. The dipper coil was placed quite close to the final coil in order to insure that the actual output signal was being monitored. The circular box in the antenna jack of the transmitter is a dummy load.

cannot be used to judge actual percentage changes in the voltage being measured. In the preceding example, the actual change was from 2.0 to 1.9 ma., or about 5%. The meter in a bucking circuit however might show a change of 0.5 to 0.4 ma , or 20%! This would certainly lead to some rather startling antenna gain figures, for example. Oh yes, let's not forget that several grid-dipper designs are available that do not use a sensitivity control under "normal" operating conditions.

Given the basic tuned-circuit/r-f voltmeter/oscillator combination described above, certain refinements practically suggest themselves. If we're going to use the unit as an r-f detector, it might be nice to arrange a system for plugging a pair of headphones into the detector circuit to provide a means of listening to the signal being detected. This converts our instrument into a passable 'phone transmitter monitor. If the headphones are left in the circuit when it is switched to the oscillating condition, we have the equivalent of a regenerative receiver, which can be used for monitoring the frequency and tone of CW signals.

Since the oscillator generates an r-f signal which may be used for testing receivers, etc., it might be desirable to provide some system for applying modulation to the signal. Though a modulated oscillator probably won't produce the highest quality type of AM signal, it still might be useful for tests involving the receiver audio system, or for detecting and identifying the grid-dipper signal.

Mechanical Features

The nominal solution to the problem of arranging the various components of the basic instrument into a convenient assembly is one which has resulted in many different mechanical layouts. Each has its merits, and possibly a few disadvantages. Ideally, the unit should be small enough so that it can be fitted into the tightest working space where the circuits to be checked are located. The tuning d al and the meter should be easily visible when the unit is in use, and the weight of the assembly should be small so as to avoid fatigue when using it during a long series of tests. A power supply must be included; if it is built into the probe with the coil and variable condenser it will naturally increase the weight. If it is separate, a flexible cable must be provided between the probe and the power supply—another possible source of trouble, then there's one more box to occupy bench space. A battery power supply is handy for those outdoor jobs, but batteries have the nasty habit of going dead at just the wrong moment. In short, each version of the grid-dipper now commercial available has certain advantages and disadvantages—study all of them thoroughly before making a choice.

Summarizing the material outlined above, we have shown that the grid dipper is a device capable of serving as five basic instruments:

1. **Grid-dip oscillator (g.d.o.)**
   A calibrated r-f oscillator equipped with a meter indicating the oscillator activity.
2. **Oscillating detector**
   Equivalent to a simple regenerative receiver for detecting r-f signals by the heterodyne method using headphones.
3. **Non-oscillating detector**
   For the detection of r-f signals using the built-in meter to measure relative signal strengths, or using headphones to detect the presence of AM on the signal.
4. **Signal generator**
   To generate strong r-f signals of known frequency. Modulation, if provided, will probably be a combination of AM and FM.
5. **Absorption wavemeter**
   A passive calibrated tuned wavemeter.

The Grid-Dip Feature

Let's first consider the possibilities of the unit operated as a grid-dip oscillator. When an oscillator is coupled to a circuit which is capable of taking r-f power from the oscillator, its activity will decrease. This is analogous to the situation encountered in a transmitter output stage—when an antenna is coupled to the transmitter and starts to draw power from it, the amount of r-f voltage floating around in the final tank is reduced. Obviously, if the load circuit is tuned, it will accept power more readily at the particular frequency where it is resonant. If the grid-dip oscillator is coupled to a non-resonant type of load (such as a low inductance link feeding a pure resistance) power will be accepted by the load over a wide range of frequencies, and the effect on the oscillator will be a general reduction of grid current regardless of the oscillator dial setting. It may be virtually impossible to detect resonant effects in a circuit of this nature. If, on the other hand, the oscillator is coupled to a low-loss parallel-tuned L/C circuit, power will be absorbed most efficiently at the resonant frequency of the load circuit, and a well-defined dip in the oscillator grid current will be noted as the oscillator is tuned across this frequency. The higher the 'Q" of the coupled circuit, the sharper the dip.

Any electrical circuit which displays resonance effects may be investigated using the grid dipper. Parallel-tuned L/C circuits, sections of r-f transmission lines, quartz crystals, antenna elements, filter sections, r-f choke coils (with distributed capacity), r-f by-pass capacitors (with lead inductance), stray resonant circuits formed by long wiring leads and their associated stray capacitances . . . the list is probably endless. Before attempting to use the grid-dip oscillator to check the resonant frequency of any electrical system, it's quite important to figure out in advance just what sort of circuit is involved. Unless one can visualize the nature of the resonant circuit, it is difficult to determine how to couple the power output of the grid-dipper into it.

Single Tuned Circuits

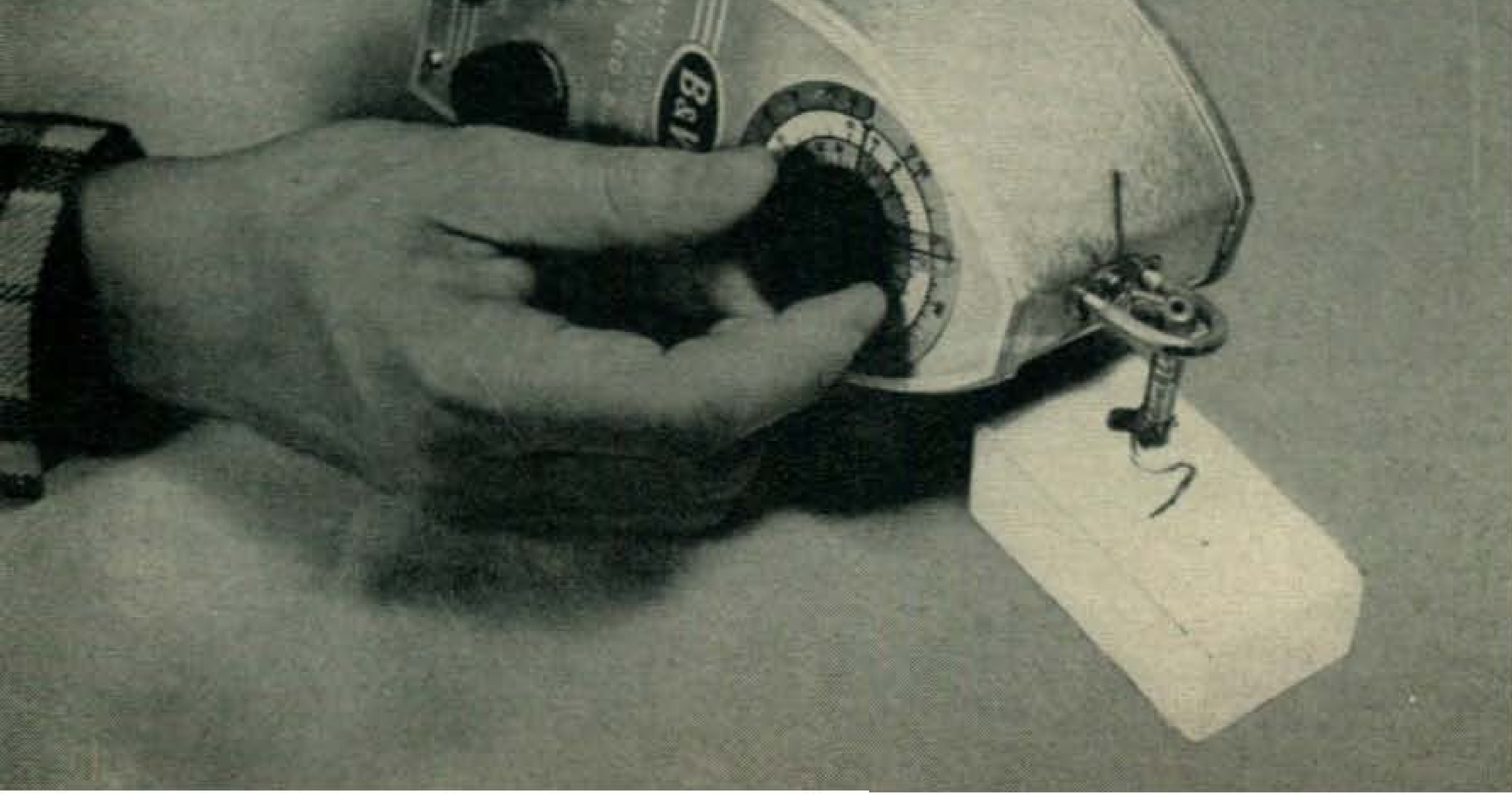
Let's take a simple example—a parallel-tuned circuit consisting of a coil and its tuning capacitor.

In practice, this arrangement is frequently encountered in oscillators, transmitter interstage and output tank circuits, wavetrap circuits, v.h.f. receiver front ends, antenna tuners, etc. From experience with transmitter circuits, most of us know how such a circuit behaves when power is fed into it at its resonant frequency. If one end of the coil is grounded, high r-f voltages appear on the other end. If the coil has a center tap and this is grounded, both ends of the coil become hot with respect to ground. Most of us are also familiar with the means used to transfer power from one tuned circuit (the g.d.o. coil) into another (the circuit under test). If we can get the driver coil close enough to the driven coil we can provide mutual-inductance coupling between the coils. Tightest coupling will exist when the driving coil is actually placed inside the driven coil, with the coil axes parallel. Some degree of coupling may be obtained by placing the coils side-by-side, with their axes parallel. And that's the logical way to approach a simple single-tuned circuit with the grid-dip oscillator.

However, suppose the coil is inside a shield can, or is so arranged that we can't move in close enough to it with the dipper coil? Well, what do we do in a transmitter in order to get power from a driver stage into the following grid coil when we can't arrange the layout so the coils are close together? One way out is to use capacitive coupling. Since both the grid-dipper tank circuit and the circuit under test are high-impedance circuits (at resonance), the amount of coupling capacitance required to transfer power between the hot ends of the coils may be very small. Occasionally, adequate capacitive coupling may be obtained by bringing the end turn of the dipper coil, or one of the coil plug leads, close to a hot lead on the tuned circuit under test. If this is not sufficient, a little extra capacitance may be added in the form of a "gimmick" (Yep, that's an accepted term in the radio business!), made by wrapping one end of a short length of insulated hookup wire around one of the coil prongs of the dipper, and the other end around one of the hot leads on the tank circuit under test. The loosest possible coupling should be employed, since the added stray capacitance on the grid-dipper coil will tend to upset its dial calibration. The wire should be insulated at *both* ends—it merely provides a small amount of coupling capacitance and an extension lead between the dipper and the circuit under test.

Another means of transferring power between two widely-separated tuned circuits is by link coupling, and this system may also be used with the grid-dipper. In fact, some commercial models of the dipper are furnished complete with a small link-coupling device. In general, the links should be small, and exhibit as little self-inductance as possible, in order to avoid resonance effects in the links themselves. The transmission line between the links should be short, for the same reason.

It often happens that the parallel-tuned circuit under investigation is not composed of a single coil and compact capacitor, but rather consists of stray-type reactive elements. For example, we often employ r-f choke coils to serve as blocking devices to prevent r-f currents from flowing into a circuit. It is desirable to have an r-f choke look like a very high impedance at the frequency it is supposed to block. The highest impedance obtainable in an r-f choke occurs when it looks as if it were a parallel-resonant circuit. Resonance effects are present because the distributed capacitance between coil turns acts like a tuning capacitor across the coil winding. We can therefore treat the r-f choke like a combination of inductance and capacitance, and "dip" it just like any other tuned circuit. In the photograph which illustrates this application of the dipper, mutual inductance coupling is employed, and both terminals of the choke coil are insulated from



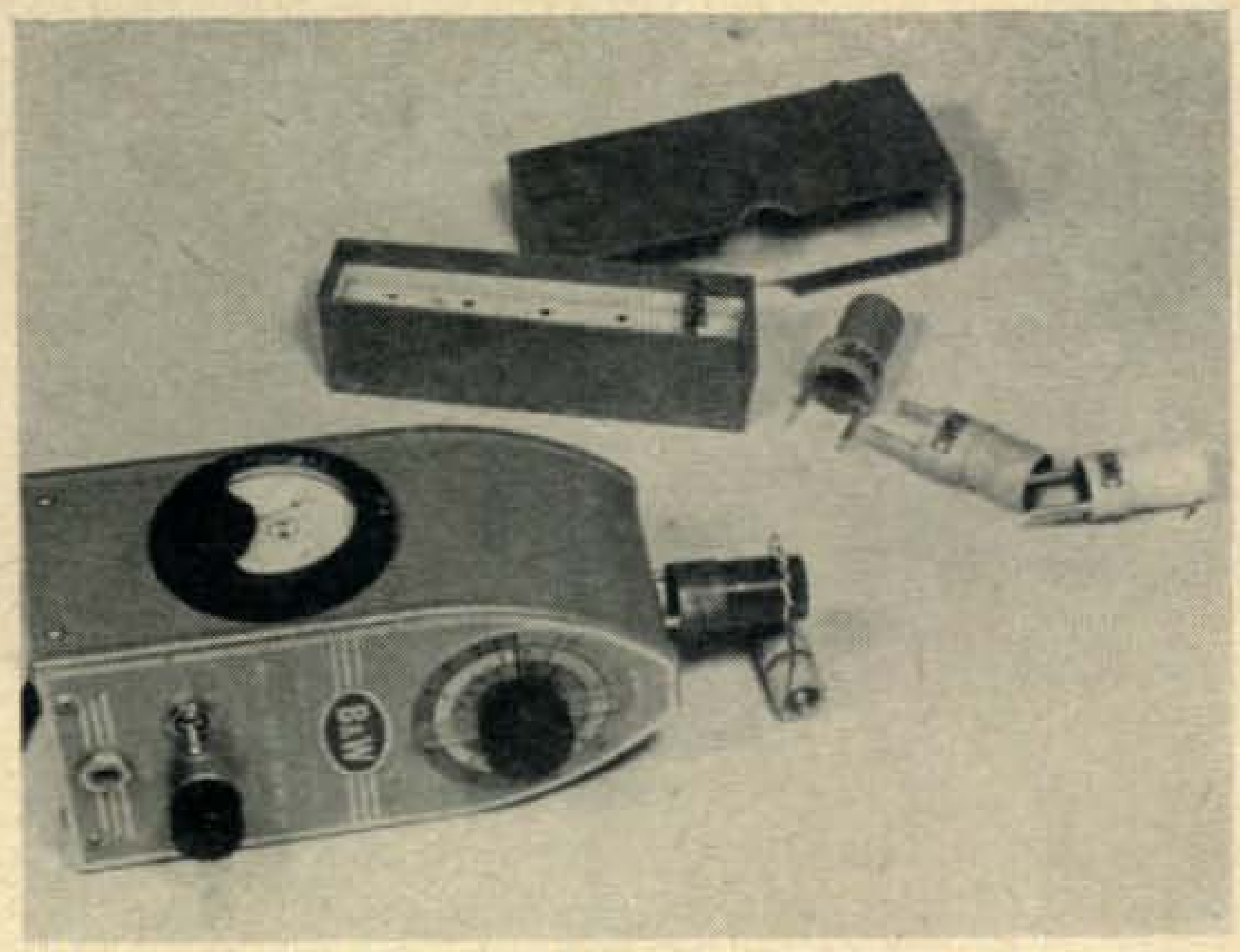
This is the method of determining the natural resonant frequency of a common v.h.f. r-f choke coil. In this case, the choke is acting as a parallel-tuned circuit, in which the capacitance is formed by the stray capacitances between the individual turns of the coil. Note that both ends of the coil are insulated from ground and dressed away from grounded objects. This choke had a pronounced dip at 130 mc.

ground. Multiple-winding chokes may display more than one resonance.

The converse of the case just described might be a capacitor with distributed inductance in its leads or internal structure. In an r-f by-pass circuit we generally desire the lowest possible impedance from the by-passed point to ground. At low frequencies, most capacitors look and act like capacitors—the effects of lead lengths, etc. are neglible. But at very high frequencies, the inductive effects are noticeable, and the impedance of the by-pass actually rises with increasing frequency. It is often handy to know at what frequency the inductive and capacitive effects tend to cancel out and produce the best by-passing action. This can be checked by connecting the ends of the capacitor leads together to form a one-turn loop, which can be treated as a simple parallel-tuned circuit. The dipper can then be inductively coupled to the single turn loop. The resonant frequency as determined by this method is actually the frequency of best by-passing action, but it should be remembered that at frequencies above the resonant point the capacitor acts more like an r-f choke! The approximate resonant frequency depends so much on the type of capacitor being choked that it is impossible to estimate the frequency range in which you should start looking; typical paper-roll type units may resonate in the low megacycles, micas may go up into the hundred-megacycle or so range, and some of the tiny ceramic units now available will probably resonate beyond the range of most ham "dippers!"

Even the simplest single-tuned circuit displays "parasitic" resonances. The coil, as we have pointed out, has distributed capacitance between its turns. The leads to the tuning condenser and the frame of the condenser have inductance. Thus, in addition to its main, low-frequency resonance, the circuit will exhibit additional resonances where the v.h.f. effects come into play. Such resonances are often a serious problem in high-powered transmitter circuits where the components are necessarily large. Coupling the grid-dipper to these "invisible" resonant circuits is a problem that requires the use of good judgment and common sense, because it is next to impossible to predict just where the "coil" section of the parasitic resonance is located and where the "condenser" is! In fact, these circuits quite often do not take the form of "coils" and "condensers" but rather are more similar to transmission lines; a condition which merits a separate discussion.

To best approach such a set-up, couple the grid-dipper coil as closely as possible to the wiring loop formed by the leads between the coil and the capacitor. In the case of a transmitter, the "capacitor" might well consist of the tube capacitances and not the big variable! After a little experience you'll be able to judge quite accurately where the long leads will resonate, and where the "hot spots" of the parasitic circuit are located. There's no set rule. We can't even say that the plates of the tubes are "hot" at the v-h-f resonant ferquency because of the long leads inside the tube! The accompanying photograph shows a typical approach. We were able to couple sufficient energy by placing the dipper coil close to one plate lead, which probably gave a combination of inductive and capacitive coupling. Here's a good point to remember: when such a situation as this exists, it is often possible to increase the coupling by reversing the position of the coil in the grid-dipper—it may produce addition, not concellation, of the two modes of coupling.



Using the g.d.o. to check the resonant frequency of a paper tubular capacitor with the leads short-circuited. This one "dipped" at about 3 megacycles. The dip may be hard to find on some units because of their high Q at resonance.

It's wise to spend a little time after you build a new rig searching out the various stray resonances. It pays off. The unit shown in the photographs had a strong resonance right in the middle of TV channel 6! It would have been a durned sight easier to make minor changes in the wiring layout to QSY that peak to a less occupied frequency than it would be to shield the entire transmitter to the extent that would prevent radiation of the strong channel 6 harmonic! By luck, however, the grid circuit of this particular rig resonated on a different frequency. If it had resonated on channel 6 also, think of how difficult it would have been to clean up that tendency of v.h.f. oscillations.[6] Similar remarks apply to receiver circuits. It took a grid-dipper to locate the stray resonance in an r-f choke used in the plate circuit of our two-meter r-f amplifier which was causing said r-f stage to pass along more noise at the i.f. of 7 mc. than signals at 144 mc.!

Before leaving the subject of single-tuned circuits, a few practical operational tips are in order. Generally, when attempting to "dip" circuits associated with tubes, the *filaments* as well as the plates should be off. This is due to the fact that the grid and cathode of any tube act as a diode. This diode, connected across a tuned grid circuit, can so "de-Q" the circuit that the dip on the g.d.o. meter may be broadened beyond the point of recognition. Another

6. Orr, "The Pursuit and Elimination of Parasites" CQ, Dec., 1950, page 24. This is a must for the transmitter designer!

illustration of this problem is the input coil of a grounded-grid r-f stage. Under normal operating conditions the coil acts as if it is loaded by a parallel resistance of about 100 ohms! It's vitally important, however, for proper performance of the stage, that it be tuned to resonance.

Antenna coupling circuits (in transmitters and receivers) should be checked without the antenna connected, at first, since the antenna will load the coil and may introduce spurious resonance effects. At the higher frequencies, when the antenna is disconnected, the coil will most likely be detuned because of stray reactances in the antenna connector system. We usually pull out the input link or un-solder the tap on the input coil to be on the safe side.

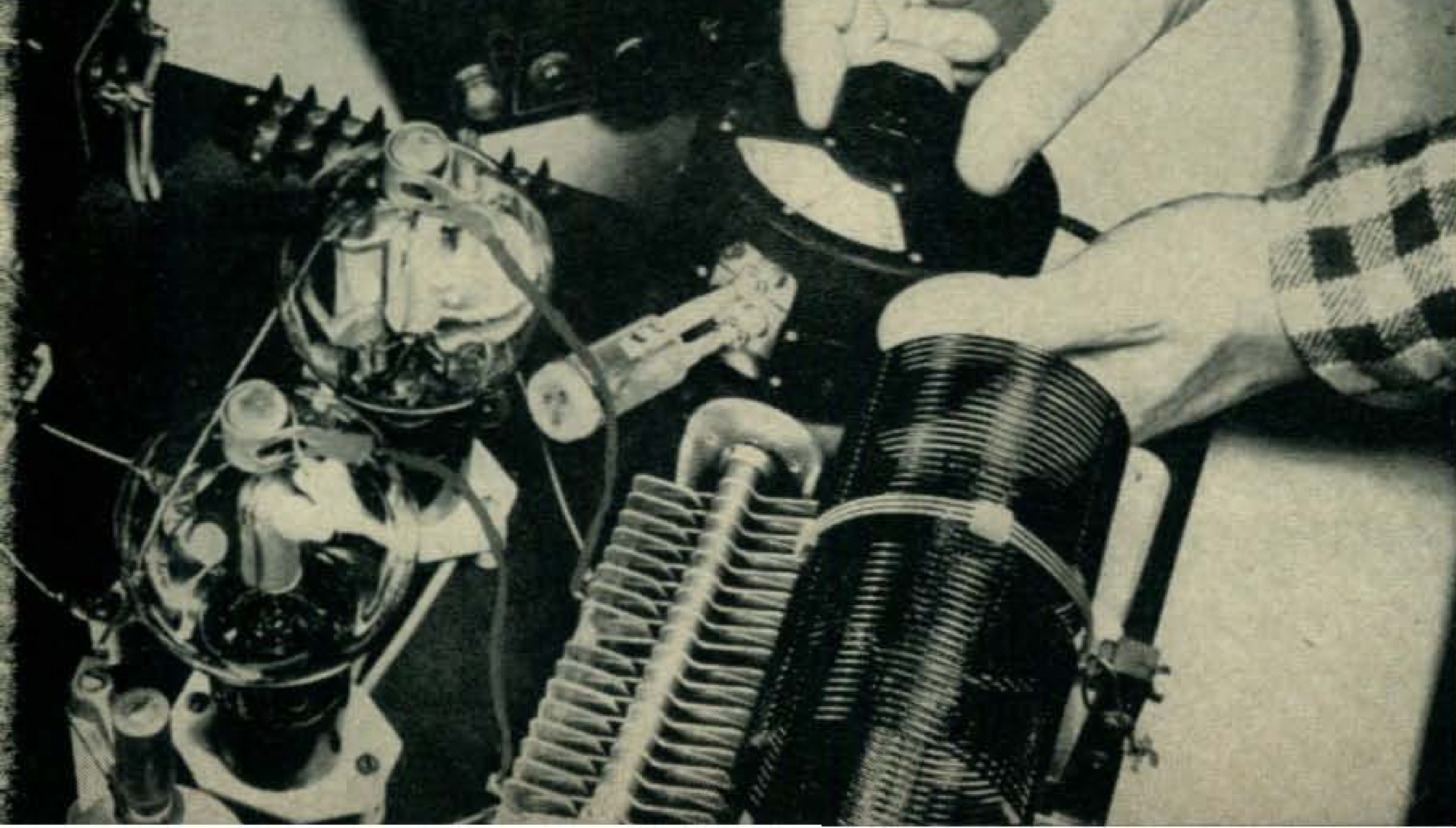
When working in the close confines of modern miniaturized chassis, it may be hard to tell whether the grid-dipper is actually coupled to the desired tuned circuit or to some other circuit resonant near the same frequency. The quickest way to check this point is to de-tune the desired circuit slightly, using its trimmer, or by touching a "hot" section of said circuit with the tip of a wooden lead pencil. (We've found that a "subtle" de-tuning of this nature is more indicative of resonance on the v.h.f. bands than the "brute force" method of shorting the coil with a metal screwdriver or the like. Admittedly, more drastic de-tuning than the pencil provides may be required on low-Q low-frequency circuits!) This sort of test probing may also furnish interesting information on the distribution of r-f voltages around the circuit. The "hotter" the point of contact of the pencil tip, the more noticeable the reaction of the grid-dip meter.

Transmission Lines

In some ways, transmission lines act like simple tuned circuits. Consider a length of transmission line with one end open-circuited and the other short-circuited. At some frequency this line will appear to be ¼ wavelength long. If power is coupled into the transmission line at this frequency, the line will behave like a simple parallel-tuned circuit. A high r-f voltage will appear across the open-circuited end, and high current will flow through the short circuit.

Knowing the physical length of a transmission line and the "velocity of propagation" factor for that type of line (obtainable from the handbooks or the manufacturer's catalogues), we can calculate the frequency at which the line will be ¼-wavelength long. On the other hand, knowing the resonant frequency (which we can easily measure with the grid-dipper) we can determine the effective length. A full wavelength in space (expressed in meters) is equal to 300 divided by the frequency in megacycles. To convert meters to inches, multiply by 39.4. The wavelength in a transmission line is less than the wavelength in free space, so to get the length of transmission line equivalent to a wavelength in air so we simply multiply the wavelength in air by the "VP" of the line; which may run around 0.66 for flexible coaxial line, around 0.80 for twin lines, about 0.99 for open-wire lines, etc. The grid-dipper can be coupled to a shorted section of transmission line by considering the shorting jumper as a low-inductance link, and coupling the dipper to it. In the case of coaxial cable, it may be necessary to form a small loop of the inner conductor outside the shield when short-circuiting the line, to provide a link to couple into. If it's impossible to get at the shorted end of the line, measurements may be made at the open end, by using capacitive coupling techniques as described for simple tuned circuits. This method is disadvantageous in that the added capacitance de-tunes the transmission line as well as the g.d.o.

A transmission line which is not short-circuited



Checking the frequency of a stray resonant circuit formed by the leads between the plate caps and the associated circuit elements in a medium power transmitter. The coupling in this case is probably a combination of inductive coupling to the loop formed by the leads, and capacitive coupling between the dipper coil leads and the plate caps of the tubes. It was no surprise to find it resonating in the middle of TV channel 6!

at either end can resonate as a ½-wavelength section. To check this mode of resonance, we should couple to the center of the line, though it may be difficult to obtain enough coupling. Try reversing the coil, if at first the dip is not sufficient. Obviously, in the case of coaxial lines at ½-wave resonance, we cannot couple in the center, so we must couple on an end, using capacitive coupling techniques.

Everything that was said above with regard to ¼-wave line sections also applies to ¾, 5/4 and any *odd* number of quarter-wave length sections. In addition, everything that was said about ½-wavelength lines also applies to full-wavelength, 1½ wavelength etc. lines. Thus, it is necessary to do a little preliminary calculation to estimate in what general frequency range the line under test will act as a ¼-wavelength line, or what have you. If the physical length of a section of line is not known, a link can be hooked across one end, the other left open, and a series of checks made to check the various odd-quarter-wave resonances. From these readings the fundamental resonance can be found.

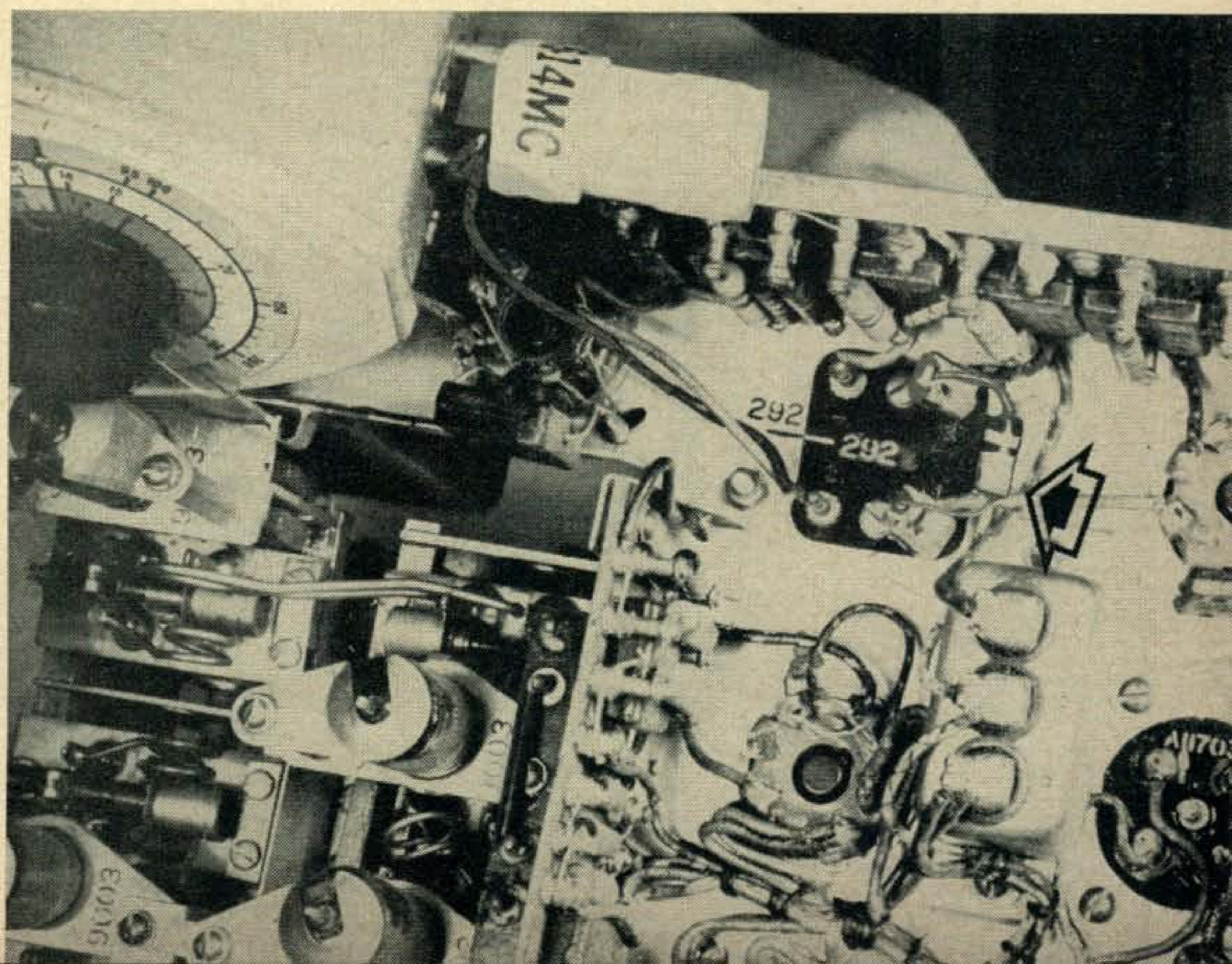
For example, suppose we had a roll of RG-8/U, and wanted to determine its length. Coupling the grid dipper into a short-circuit on one end (better use an ohm-meter to see if the other end is open circuited!) we might find dips at 22.9, 16.3 & 9.8 mc. Looking for a common denominator in this series, we note that 9.8/3 equals 16.3/5 and 22.9/7 or 3.25 mc. A dip would be located at 3.25 mc also, if we had looked there. So the line is effectively ¼ wavelength long at 3.25 mc or 92 meters. Electrically, it would be a full wavelength at 23 meters. Allowing 66% for the velocity of propagation, the line is then 23 x .66 or 15.2 meters physical length (600 inches). This example also serves to illustrate the numerous modes of resonance that may be encountered when using a non-terminated length of transmission line. Little wonder that they sometimes lead to confusing results in antenna measurements!

Obviously, all these remarks on transmission lines apply only to sections of lines which are actually open or short circuited—if a line is connected to a load such as an antenna, all bets are off! If it is desired to check a line when it is connected to a load on its far end, arrange to short-circuit the load end, and use capacitive coupling methods on the "sending" end. Be sure to use low-inductance leads to accomplish the short-circuiting, otherwise stray inductance in the shorting lead may upset the readings.

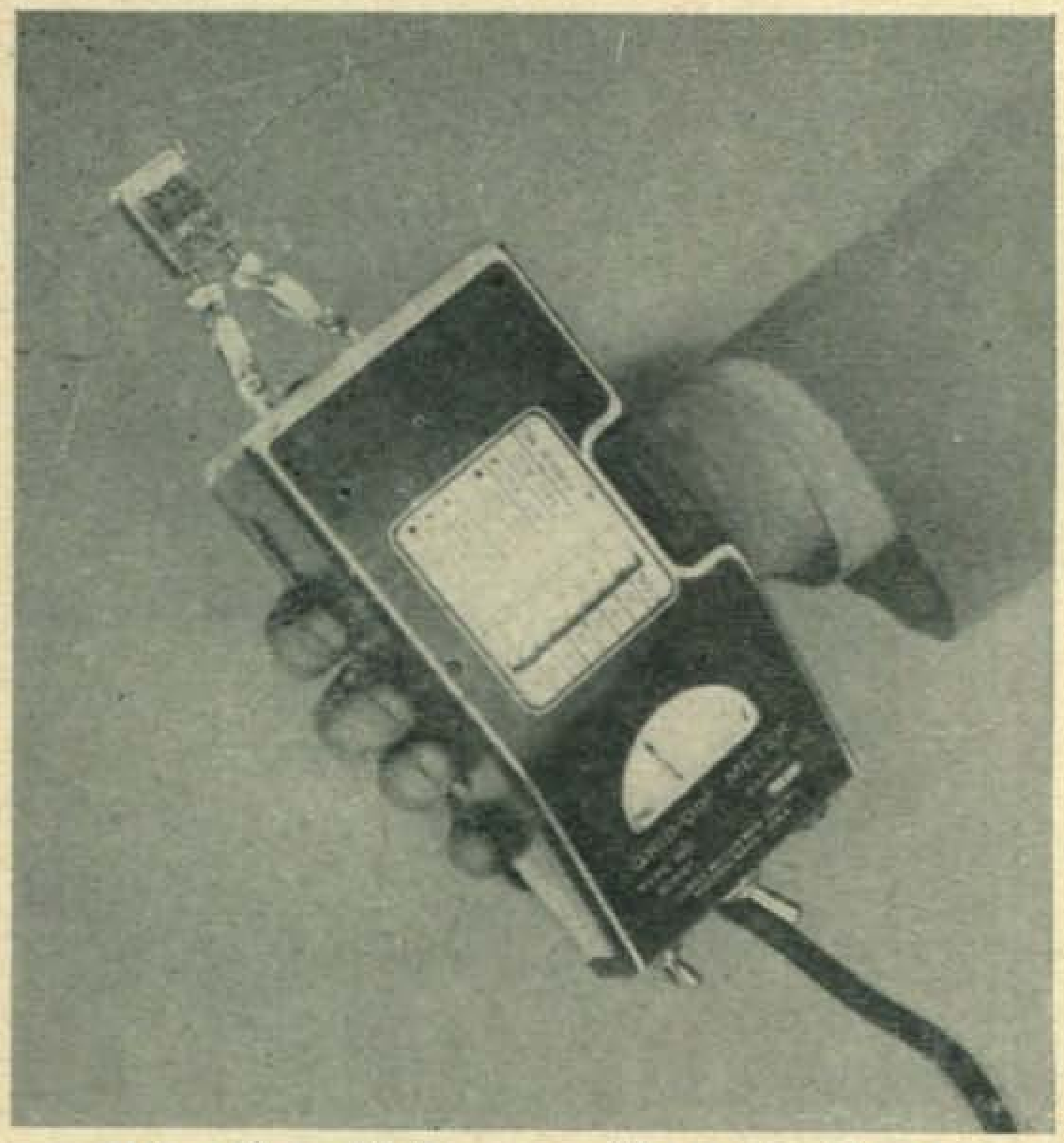
Coupled Tuned Circuits

When tuned circuits are coupled together, the problem of determining the resonant frequency of an individual section of the combination is somewhat complicated. One approach is to separate the circuit under test physically and electrically from the other sections of the network. This is often easy to do in the constructional phases of a job, but once the job is finished it may be impracticable. For example, in constructing a TVI filter, one might take the trouble to pre-align the individual series-tuned and parallel-tuned traps which make up the filter to the desired rejection frequencies before combining the sections in the final arrangement. (Series-tuned traps, incidentally, can be short-circuited and treated as parallel-tuned circuits.) After assembly of the unit, it is extremely difficult to adjust to the proper trap resonances because in a typical filter all adjustments interact.

It must be admitted that the pre-alignment method described above is not fool-proof. Often the slight changes in tuning which may be involved in moving the components to their final location are too important to neglect. One of the best puzzles we've run into is how to line up the coils of a Wallman cascode r-f amplifier for v.h.f. use. Essentially, this circuit has three parallel-tuned cir-



Here we are poking into a BC-624 to check the resonant frequency of one coil of a double-tuned shielded i-f transformer. Note the clipped-in resistor across the other winding of the transformer, and the use of a short piece of hook-up wire wrapped around the coil prong of the grid dipper, which provides coupling into the shielded circuit. This one checked right out on 12 mc.



Using the grid-dipper oscillator circuit as a crystal oscillator to check the activity of a fundamental frequency crystal. In this arrangement the dipper circuit becomes a Pierce oscillator. The tuning capacitor should be set at or near minimum capacitance.

cuits, wired in series with each other. The capacitors of the parallel-tuned sections usually consist of tubes capacitances only. It's well-nigh impossible to separate the components of this circuit for alignment with a g.d.o., which simply means that we're still using the old cut-and-dry design methods on this circuit! Neither is it practical to separate the primary and secondary windings of a typical r-f or i-f transformer; their tuning adjustments interact. The safest procedure in this case is to swamp out the Q of the unused winding by clipping a loading resistor (in the order of about 10,000 ohms) across it. This will also drop the Q of the coil under test but by judicious selection of the value of loading resistance it should be possible to retain reasonable sharpness of dip and still minimize the effects of tuning of the loaded coil.

We might refer back to the paragraph where we mentioned the method of checking for resonance effects, using a lead pencil or the like as a test probe. This method is also valuable whenever coupled tuned circuits are being checked. And don't forget that often it isn't obvious that two circuits are coupled—for example, the tuned circuit in the signal input grid of a receiver mixer tube is often coupled (accidentally or deliberately) to the oscillator tuned circuit.

And the antenna feed line is usually coupled to a resonant antenna. . . .

Antennas

Much has been said about the use of the grid-dip oscillator to tune antennas. It is true that the natural resonant frequencies of a radiating wire can be determined quite nicely with a grid-dipper by treating it in much the same fashion as the transmission lines described above. But when we hear a ham talking about the way he pre-tuned his close-spaced five-element Yagi array using only a grid dip oscillator, we wonder just how the design was accomplished. Coupled antenna elements are as hard to deal with as coupled tuned circuits. Take an element out of an array and both the element and the array are de-tuned. Even if it were possible to check the individual element resonant points, how would one be sure just what significance this data might have in calculating the directional pattern or feed impedance of his beam antenna? In short, it is the opinion of these writers that grid-dip oscillators may be used effectively to test single-element antennas (straight or folded dipoles, ground planes, mobile whips, etc.), but it is extremely difficult to obtain useful data on a beam array with the unaided g.d.o.

Before attempting to test an antenna with the g.d.o., stop to figure out the current and voltage distribution of the antenna. If it is a center-fed straight dipole, on its fundamental frequency it will be current-fed, and the feed point should be shorted for the test. On the second harmonic frequency the same antenna will be voltage-fed, and to test the array on this band the feeders should be removed and the two sections of the antenna treated separately. A ground plane antenna or a resonant mobile whip is usually fed at a low-impedance point, so the feed point should be shorted. An end-fed Zepp antenna is a tough one to describe, because the feed line is actually part of the radiating system. About the safest statement to make here is that precise tuning of the antenna itself or the feed line itself is not generally required in a system of this type. By tuning the feeder reactance at the sending end, with an antenna tuner, one can make the antenna take power, and if there's enough wire up in the air, it will radiate!

To couple the g.d.o. into an antenna: If coupling at a high voltage point use the methods of capacitive coupling described earlier. To couple at a current feed point, the feed line should be *removed* and a shorting jumper installed in its place. (The line must be removed, otherwise it will represent a resonant system loosely coupled into the antenna, because of the fact that the short-circuiting jumper has a finite impedance and allows the feed line to absorb energy at the frequencies where it resonates.) Then the dipper can be coupled into the jumper to check the various modes of resonance of the antenna. In order to provide an easy means of coupling to the jumper, it may be formed into a one-turn link coil. The length of the wire in the jumper should be very short compared to the length of the antenna, despite this coiling.

When coupling into a high-current point of an antenna element with no split at the feed point (this test would be merely of academic interest, because addition of a feeding system would undoubtedly de-tune the element), it may be possible to obtain sufficient coupling by placing the g.d.o. coil as close as possible to the antenna element. Since this system provides a combination of capacitive and inductive coupling it would be well to try reversing the position of the coil in the grid-dipper for best coupling. Another stunt is that of clipping a test lead across a short length of the element at its center and coupling into this clip lead.

Quartz Crystals

If a quartz crystal is connected into the coil terminals of any of the popular Colpitts-type g.d.o. circuits, the g.d.o. becomes a Pierce-type crystal oscillator. The crystal will oscillate on its fundamental frequency in most cases. (Most crystals up to about 10 mc. are fundamental cuts. Above this frequency they are likely to be third or fifth overtone units.) The activity of the crystal will vary as the tuning capacitor of the g.d.o. is rotated; peak activity will occur at a point near minimum capacitance setting. The meter of the grid-dipper gives an indication of relative activity of various crystals. While the crystal is oscillating in the dipper circuit its frequency can be checked on a calibrated receiver or frequency standard. It should be noted, however, that the operating frequency of a crystal depends greatly on the constants of the circuit in which it is used. In fact, it will be apparent that the tuning dial of the g.d.o. affects the frequency of the crystal signal considerably.

To check the activity of overtone crystals: Energy may be coupled into a crystal from the dipper coil by connecting across the crystal terminals. At the frequency where the crystal looks like a series-resonant circuit it will produce a very sharp dip, and the relative strength of overtone modes may be judged by the amount of the dip.[7]

Measurement of Capacitance and Inductance

The grid-dip oscillator can be used to measure the resonant frequency of a capacitor and inductor. If we know either the inductance or the capacitance in a tuned circuit, knowing the frequency we can calculate the unknown element with a fair degree of accuracy, using the simple resonance formula. Most manufacturers of commercial grid-dip oscillators provide figures on the actual inductance of the coils for their units, so the unused coils of a set may be used as inductance standards. It is not hard to build up a collection of accurate capacitance standards. A small variable capacitor calibrated directly in micro-micro farads is also a handy grid-dipper accessory. Certain commercial coils (such as the *B&W Miniductor* line) are sufficiently consistent in production that the manufacturer rates the coil in microhenries per inch. The scientifically-inclined ham should make an effort to acquire suitable standards of inductance and capacitance for use in conjunction with his grid-dipper; it's easy to measure effective r-f reactances by this technique, though extremely difficult by most other systems available to the Ham.

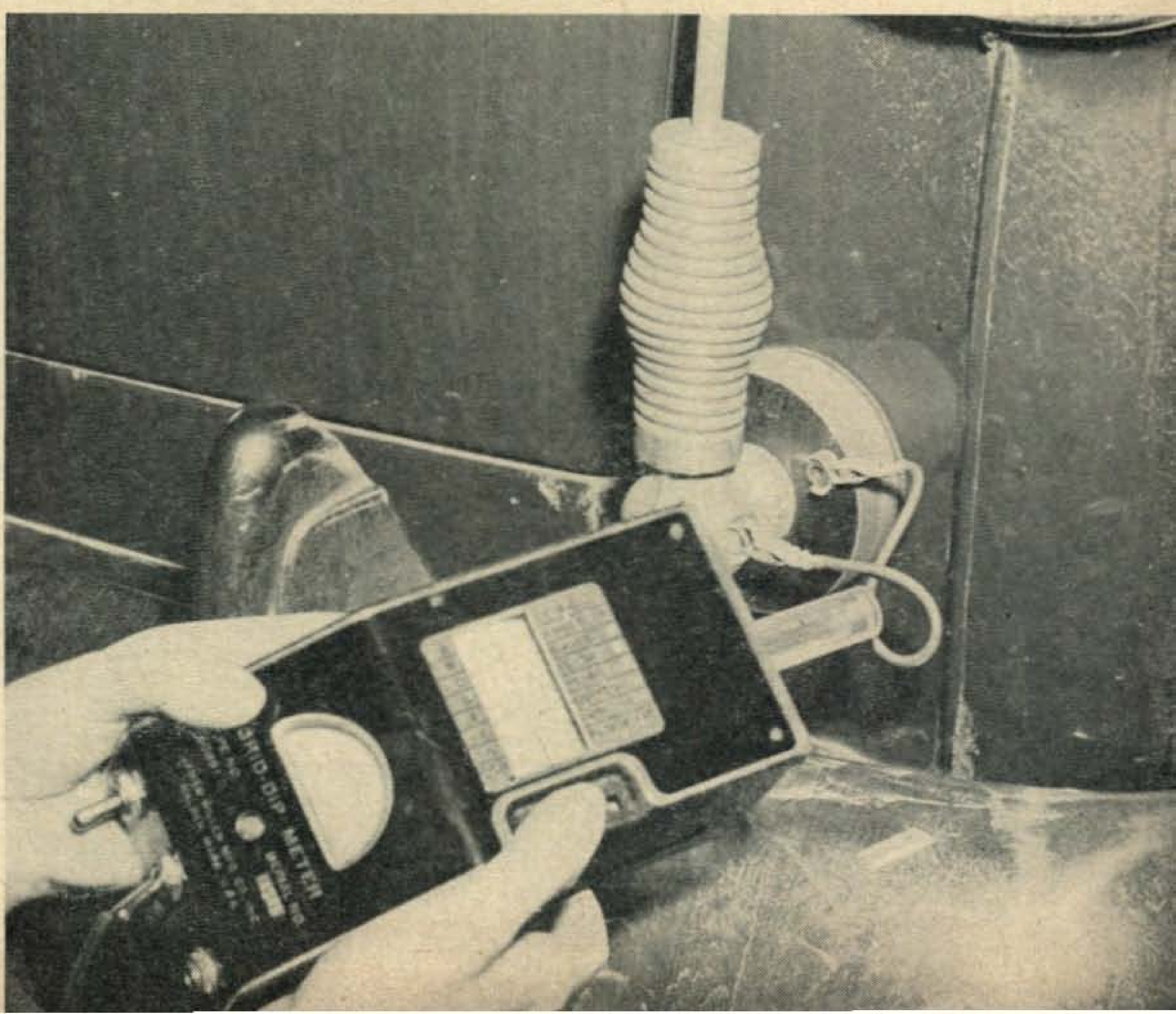
Other Functions of the Grip-Dip Oscillator

Here we are, almost out of space, and we haven't mentioned the other important applications of the grid-dip oscillator. This is probably due to the fact that the grid-dip function is so unique to this type of instrument that this particular application is not as widely understood as the others. After all, we've had absorption wavemeters, test occillators, oscillating c-w monitors, etc. in our ham shacks for years, so we'll kinda skip over these points hurriedly.

Oscillating Detector

Using the grid-dipper as a simple regenerative receiver gives us the most sensitive means of detecting the presence of weak unmodulated r-f signals. It also provides information on the ap-

7. Simms, "Checking Crystals for Overtone Activity", QST Sept., 1951, p. 59.



This is a popular method of checking the resonant frequency of a mobile antenna. Note that the feeder has been removed (inside the base insulator) and a low-inductance link coil substituted across the base.

We can also use the dipper to check the activity of a crystal on its overtone mode. In the case illustrated, the grid dipper showed that the 8-Mc crystal also displayed a strong series-resonant effect at 24 Mc.

proximate stability and tone of the signal being received. About the only elaboration necessary here is to caution the reader that he should check the circuit of his particular grid-dipper to see whether it is suitable for his type of headphones. Some circuits require that a resistor be added in parallel with crystal headphones to provide a d-c return. Other circuits might connect the 'phones in the B-plus lead, which would be bad for crystal phones. Also keep in mind that the headphones are connected to *your* head when you're probing around in the innards of a transmitter! BE CAREFUL!

Non-Oscillating Detector or Monitor

The dipper may be used as a tuned r-f voltmeter to detect the presence and approximate magnitude of a signal applied to the dipper's tuned circuit. Every remark which was made relative to coupling power from the dipper into an external tuned circuit applies equally well to the situation in which it is desired to couple power from an external circuit into the grid-dipper coil. Numerous applications of this feature will present themselves—the dipper may be used as a field-strength meter obtaining its signal from a small pickup antenna. It can be used to check the activity and frequency of oscillators in transmitters and receivers. It can be used to search for spurious output signals from a transmitter. Though the typical grid-dip oscillator is not sufficiently sensitive to detect signals capable of causing TVI in the fringe area, it is a valuable tool in tracking down obvious causes of TVI and during the preliminary cleaning-up processes. Don't expect to have 100% success in "sniffing" out a micro-watt size signal in the output stages of a kilowatt rig, either. After all, the grid-dipper has only one tuned circuit in it, and a single circuit does not provide enough selectivity to permit it to read a very weak signal in the presence of a very strong one even though the frequencies may be quite widely separated. If, in searching for a meter reading on a harmonic frequency of the big rig, you notice an up-scale reading on the dipper meter which seems to be relatively unaffected by tuning, it's probably normal, and due to overloading by the main output signal. This effect may mask the weak signal you're looking for. In spite of this tendency, however, it's surprising how well the dipper shows up spurious off-band signals.

Another point to watch out for in using the dipper as a field strength meter—make certain that the signal shown on the meter is the one you want to read. If the dipper is close to the transmitter it may be receiving most of its input signal via the power lines, or by radiation from the output circuits of the transmitter, rather than from the antenna system. For similar reasons, we have had little luck in attempting to use the dipper to check for standing waves on open-wire antenna transmission lines. It is also extremely difficult to arrange pure inductive coupling (or pure capacitive coupling) to the transmission line, therefore the standing wave pattern measured is likely to be a combination of the r-f voltage standing wave pattern and current standing wave pattern—not much use for accurate work.

Don't forget the earlier discussion of meter linearity—if you're trying to measure percentage change of voltage or field strength, it's best to run the sensitivity control in the fully "on" position.

Signal Generator

There are plenty of times when it's handy to have a wide-range medium-powered signal source in

(Continued on page 66)

Getting on Novice Phone

E. MILES BROWN, W2PAU and EDWIN T. KEPHART, W2SPV

c/o CQ Magazine, 67 West 44th Street,
New York 36, N. Y.

Part II of Two Parts

In the first part of this story, the authors described this simple 144-mc phone transmitter. It uses two 6AG7 tubes in the frequency multiplier stages and ends up with a 2E26 final amplifier. It is modulated by a 6SN7 and a 6V6 in the popular gating circuit. In this part of the story the authors show how the transmitter was wired and describe a small power supply.—Editor.

Wiring

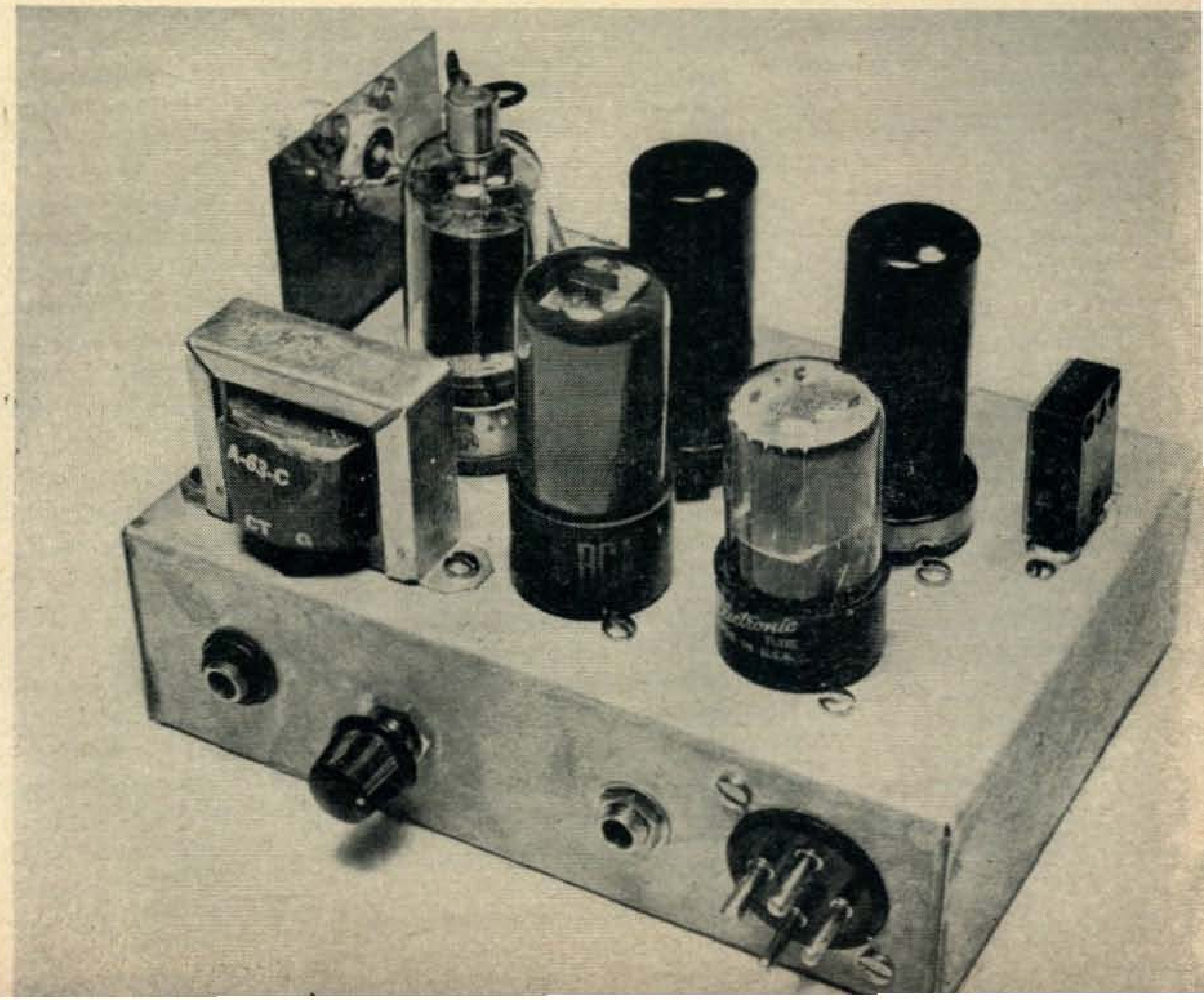
Lay out the resistors and condensers (also your wire, tools), and everything else you may need. To one side, place the schematic drawing along with a colored pencil. Red will do nicely. As each connection is made and each part is installed "chalk it out" in color on your drawing. This is done by drawing a line over the ink line of the drawing, indicating that the wire or part is installed. When your rig is completed, your drawing will be completely "chalked out" in a new color.

The authors recommended the use of *Cinch-Jones* type *8EM* and *8EC* sockets for a particular reason. These are "saddle" type sockets with four ground lugs, located under *terminals 2, 4, 6 and 8* required for short ground connections. Substituting another type socket might increase the length of ground lugs, located under these terminals.

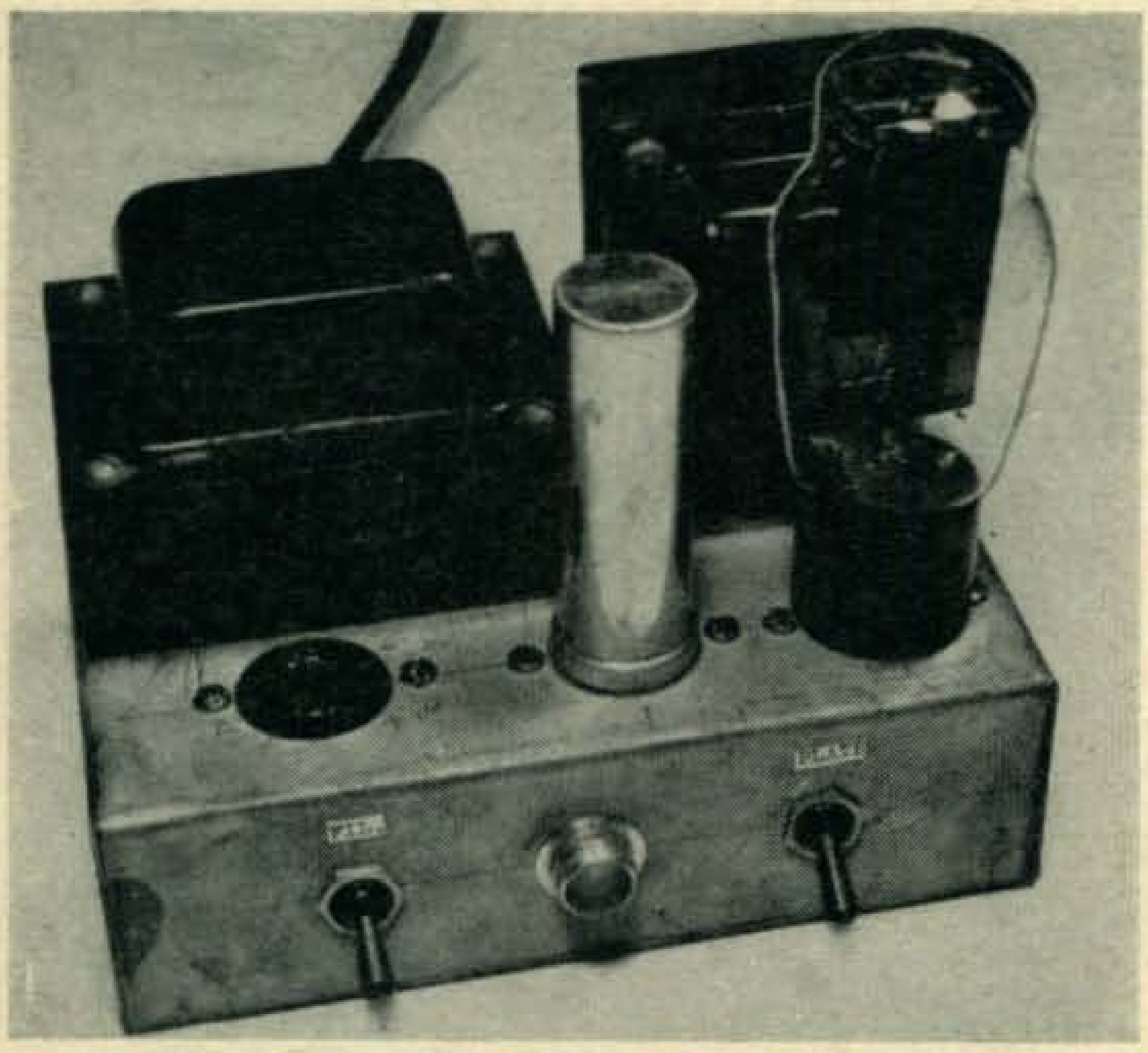
Using a length of bare wire—ground *terminals 1, 2, 3,* and *5* to the nearest ground lug on *socket V1* (6AG7). In each case make the lead as short as possible, running from the bottom hole of the socket terminal to grounding lug. Ground *terminals 1, 2,* and *3* to ground lug under *pin 2* on socket *V2* (6AG7). On *socket V3* (2E26) ground *terminals 2, 4, 6* and *8* as follows; bend each tube socket terminal over, bringing it as close as possible to ground lugs underneath. With as short a piece of wire as possible make the ground connections. Ground socket *terminal 1,* by bending over to *terminal 8* and grounding to the same lug as *terminal 8.* Ground socket *terminals 1* and *2* on *socket V4* (6V6) to ground lug underneath *terminal 2.* Ground *terminals 1* and *8 on socket V5* (6SN7) to ground lug under *terminal 8.* Lastly ground *terminals 1* and *3* on *power socket P1* to ground lug under *terminal 4* of *socket V5.*

In wiring the filament circuit bend the wire from the socket terminal down close to the chassis and bring it up at next socket terminal. This will keep the filament circuit out of the way of future parts installation. As each step is taken do not forget to "chalk out" the drawing.

Wire in *R1* between *terminal 4,* socket *V1* and the ground lug directly under *terminal 4;* then



The transmitter may be easily constructed on a single chassis for the r-f section and the modulator. Note that the male power plug in the foreground is a part of the chassis in order to prevent accidental electric shocks. The control visible on the rear skirt is for setting the "resting carrier level."



Power Supply used with the Novice phone transmitter. The empty socket is the female connection for the output voltages.

run a *yellow* lead from the back terminal of *crystal socket S1* to the top hole of *terminal 4, socket V1.* Wire in *R2* between the bottom hole of *terminal 4, socket V2* and the ground lug directly under *terminal 4.* Wire in *R3* between the bottom hole of *terminal 5, socket V3,* and the tip connection of *jack J2* (do not solder). Connect stationary contact connection of *J2* to ground lug on frame of jack with a short length of bare wire. Wire in *C8* between the tip connection of *J2* (Solder *R3, C8,* and the connection, together), and the ground lug under *terminal 4* of *socket V3,* taking care to keep leads as short as possible. Wire in *C6* between *terminal 5* of *sockets V2* and *V3.* Wire in *C4* between the bottom hole of *terminal 6, socket V1,* and front terminal of crystal *socket S1.* Run a length of bare wire between *terminal 8* of *socket V1* and the lower stator connection (fixed plates) of *C1.* Connect *C5* between this same stator connection and the top hole of *terminal 4* of *socket V2.* Mount *R6* on terminal strip between *sockets V1* and *V2,* mounting it between the front and back lugs. Tie two back lugs together with a short length of bare wire. (This may be done by bending the lead of *R6* around both lugs and soldering.) Wire in *C14* between *terminal 6,* of *socket V2* and the ground lug under *pin 6,* and *C13* between *terminal 5* same socket and the same ground lug. Keep the leads as short as possible; as a matter of fact, the condenser should just fit, leaving no lead between it and the lugs. Mount *R5* across *socket V2* between *terminals 1* and *5.* Run a length of *green* wire between *terminal 6* of *socket V2* and the front lug connection of *R6* mounted between *V1* and *V2.* Connect *R4* between this same point and *terminal 6, socket V1.* Run a short length of bare wire from *terminal 8* of *socket V2* to the lower stator connection of *C2.* Run a length of *green* wire between *terminal 8* of *socket V4* and *terminals 3, socket V3;* connect *C7* between this terminal and the *ground lug* under terminal 2. Connect *R12* between *terminals 3* and *4* on *socket V4,* connect *R7* between *terminal 3* on *socket V4* and the lug nearest the bottom of chassis of potentiometer *R8.* Connect top lug of potentiometer, *R8,* to the ground lug under *terminal 4* of *socket V4* with a short length of bare wire. Connect one green lead of transformer, *T1,* to center terminal (wiper) of *R8;* connect the other green lead of *T1* to *terminal 5* on *socket V4.*

Tape up bare end of black c.t. lead of *T1* and tuck away along bottom of chassis. Do not cut off the black lead as it might reduce the salvage potentialities of *T1* for future construction. Run blue lead of *T1* to *terminal 5* of *socket V5,* and red lead to rear mounting lug of terminal strip between *socket V1* and *V2.* Connect *R13* between *terminal 2 socket V5* and back lug (junction of *R6* and red lead of *T1*) of terminal strip. Connect *C11* across socket *V5* between *terminals 2* and *4.* Connect *RFC3* between *terminal 3* of socket *V5* and tip connection of phone jack *J1.* From tip connection, wire *R11* to shell (ground) connection of *J1.* Connect *R9* between tip connection of *J1* and *terminal 6* on *socket V5.* Connect *C10,* positive end, to *terminal 6* of socket *V5* and negative end to ground lug under *terminal 6, socket V1.*

To *pin 2* of power socket *P1,* connect *two red* wires. Run one to the junction of *R7, R6* and the red wire from *T1* on terminal strip (back connection); run the other red wire to *terminal 3* of *socket V4.* From the same pin continue with a length of *red* wire across chassis through grommeted hole to single insulated terminal on top of chassis. Connect *C9* between grounded foot of mounting lug and insulated lug of this single terminal strip. From insulated lug (junction of red wire and *C9*) connect *R14* to tip connection of neon socket *N1.* Ground shell connection to mounting bracket of lamp socket. To tip connection of lamp socket connect *C15* leaving other end free for further connection. This completes the wiring of the rig with the exception of *RFC1, RFC2, L1, L2, L3,* and *L4.*

Coils

L1 consists of 7 turns of *B&W Miniductor #3007,* and is made as follows: Cut off 7½ turns from the coil with a sharp knife or fine saw. Loosen ¼ turn from each end and straighten out. Mount coil *L1* between stator connection of *C1* and front tie point of the terminal strip at junction of *R6, R4* and green wire going to *terminal 6,* socket *V2.* When mounting trim off ends of coil leads to fit. The relative position of the coil can be seen in photograph of underside of chassis. *L2* consists of 7 turns of *B&W Miniductor #3003* and is made by following the same procedure as for *L1. RFC2* is home made, and is wound as follows: Wrap 7 turns of #20 AWG bare copper wire around the shank of a #28 drill leaving one inch leads on each end. Remove coil from drill and stretch out to leave a space about equal to wire diameter between turns. Bend one lead at right angles to coil and cut off to 3/16". Solder this end to the center turn of *L2*. Connect *L2* in circuit between lug mounted on ceramic stand off pillar (junction of *C6*), and stator terminal of *C2* at same time arranging *RFC2* to connect to *terminal 6, socket V2*. Make sure the turns of *RFC2* and *L2* have not become shorted or grounded. *L3* is also home made and consists of 5 turns, #12 AWG enameled solid wire (antenna wire), ⅝" in diam. Wind the 5 turns around a wooden dowel ⅝" in diam., leaving ends of coil 2" long. Bend leads at right angles to coil and stretch out coil to make it 2" long. Plug in *V3* (2E26) and put on its plate cap. Now fit coil *L3* between plate cap, through grommeted hole in chassis to the stator of C-3. CAUTION—Do not apply force to the plate cap during this "fitting"—the 2E26 glass envelope is quite thin! Space coil so leads are about equal length. Remove plate cap from tube and solder to the coil.

Mount *RFC3* between center of *L4* and the junction of the red wire and *R14* on insulated tie point. *L4* is made from 2 turns of insulated hook-up wire (any color) ⅝" in diam., slid between the center turns of *L3*. The ends of *L4* are connected to the antenna terminals. The antenna terminal mount is made from a scrap piece of metal . . . aluminum, copper, or steel may be used. In our case, a scrap piece of flashing copper was obtained gratis from a local roofer. (See page 31 of December issue for layout.) Your choice of antenna and feed will govern the type necessary. We recommend use of co-ax output. A "Balun" (J. R. Smith: "The Balun——Theory and Design," CQ, Feb. 1952, page 24) can be used between the transmitter and antenna feeders if a balanced feed system is desired. Connect free end of *C15* (other end connected to neon lamp socket) to center terminal of co-ax receptacle, or, if balanced feed was chosen, the terminal nearest the front of the chassis.

If you have followed each step and have chalked out your drawing, the construction job should now be completed. Go back and check to see that no errors have been made and that there are no solder drippings which might accidentally cause short circuits.

Power Supply

In order to use this rig, we will have to have a power supply. It requires approximately 325 volts d.c. (the rig will probably take over 350 volts without cooking—less than 325 volts might be used, but the output falls off rather rapidly with lowering of voltage) at 100 ma. for plate supply and 6.3 volts a.c. or d.c. at 3.5 amp. for the filaments. *Figure 4* shows a schematic for a typical power supply, and *Fig. 3* the chassis drilling plan and arrangement for the power supply.

We are not going to go through the step-by-step procedure for the construction of this supply. If you have followed the technique of construction for the transmitter, by referring to the photograph, you should be able to construct the power supply on your own. The wiring layout is not critical. If you follow the mechanics of construction of the power supply as pictured, you will have a supply that is quite versatile. It may be unplugged and used to power other equipment, or used as a test supply when not operating this rig.

The power cord may be made by twisting four different colors of hook-up wire together, and

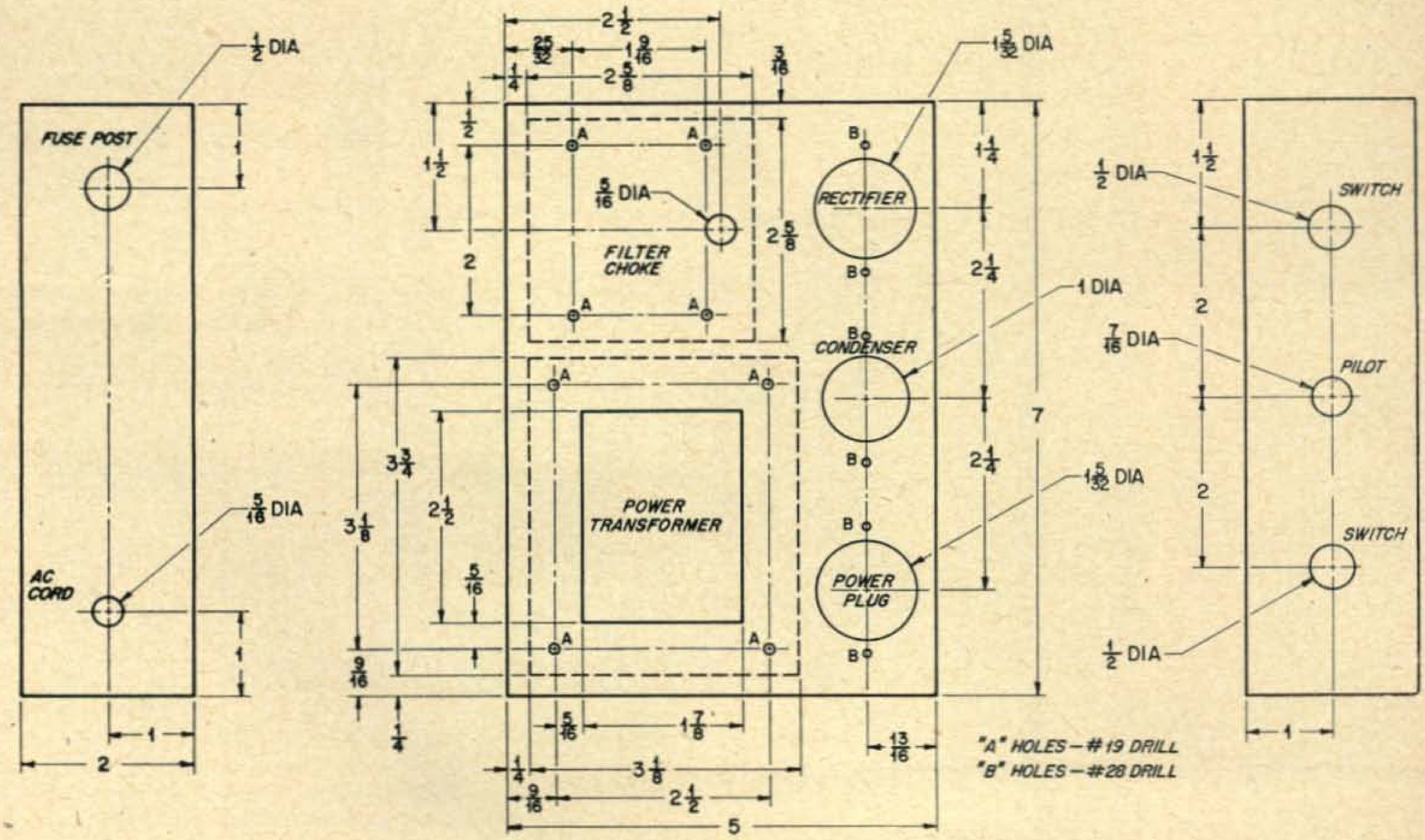


Fig. 3. Power supply chassis using the parts indicated on the following page.

R1—50,000 ohms, 20w.

C1,C2—Dual 15 μfd., 450v. (Cornell Dubilier UP15D45, Mallory FP258)

CH1—filter choke, 7h., 140 ma., (Stancor C-1421)

T1—power transformer, 360-0-360, 120 ma. (Stancor PM8410, Thordarson 24R05)

SW1,SW2—s. p. s. t. switch (Birnbach #6220)

P1—power socket, 4 pin, (Amphenol 77MIP4)

Pilot lamp—(GE #47)

Fuse post — (Littlefuse #342001)

Rectifier socket—8 pin (Amphenol 77MIP8)

Pilot Lamp Socket — miniature bayonet (Dialco #610-121)

Power cord — (Belden 1725)

Grommets—5/16" dia. (Walsco #3342)

Chassis—5x7x2 (Bud #CB629)

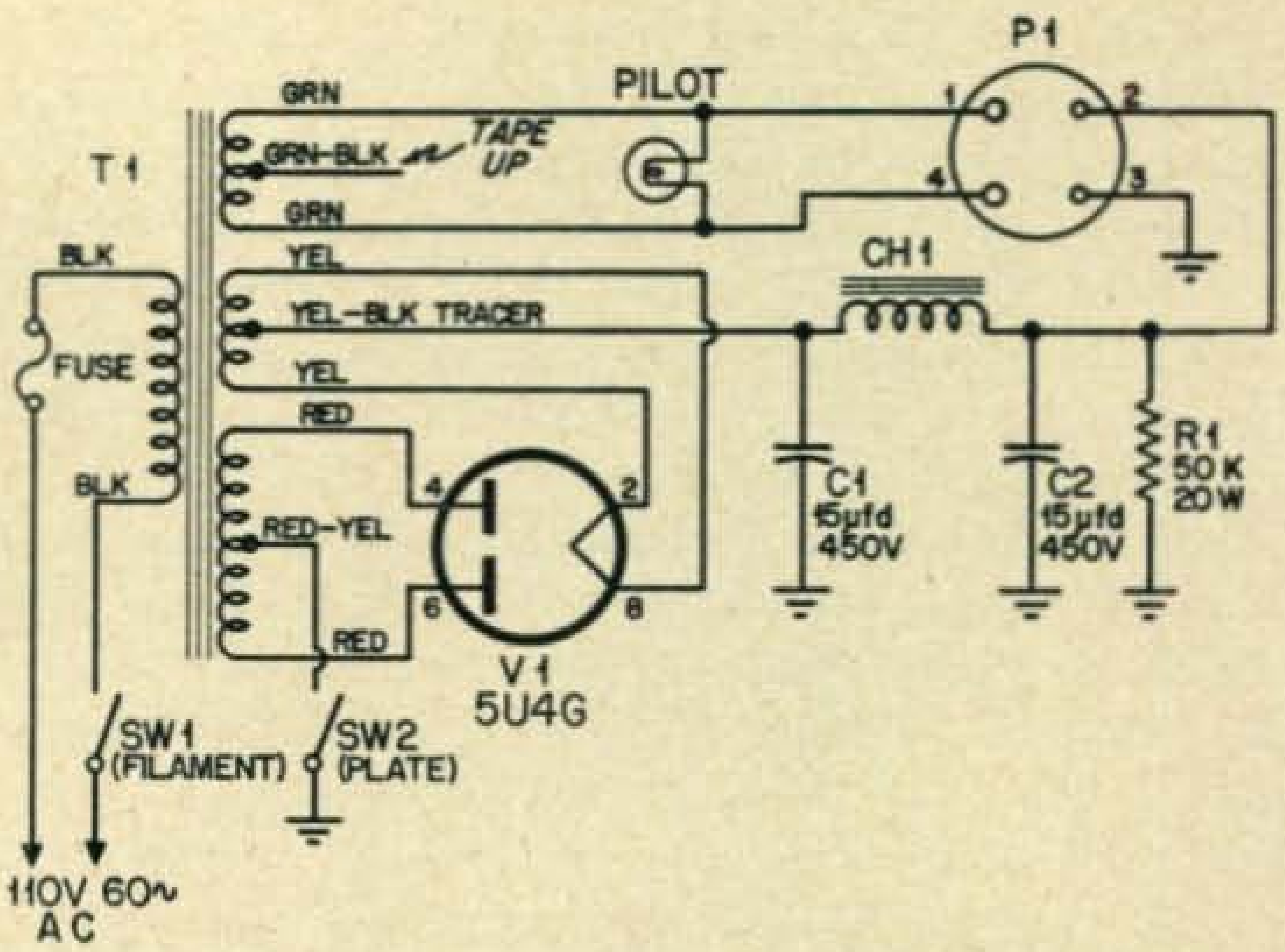


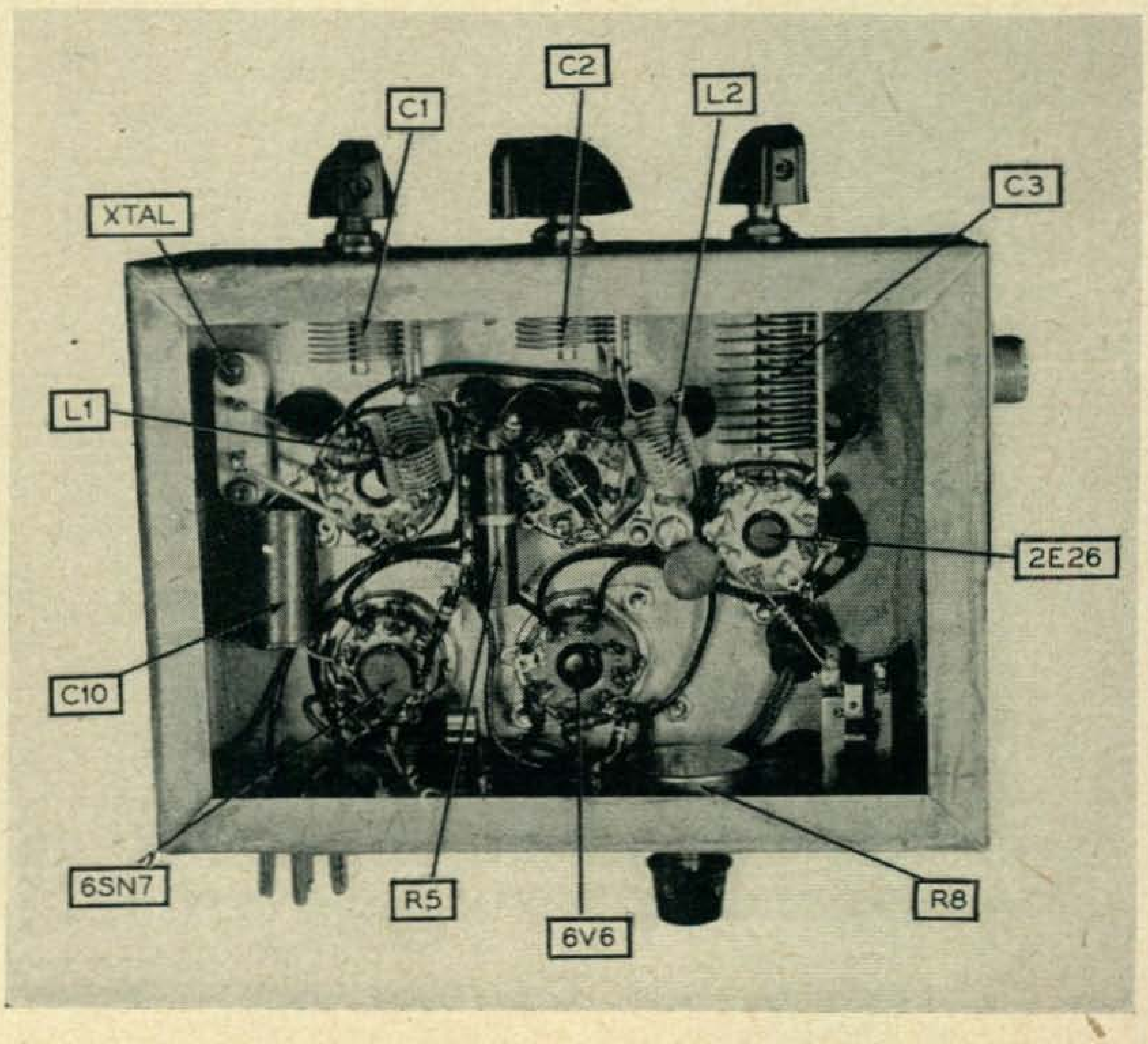
Fig. 4. Power supply schematic and parts list.

connecting to appropriate plugs. We suggest you use *white* for filament ground, pin 1; *black* for filament, pin 4, *yellow* for *B*-negative, pin 3 and *red* for *B*-positive, pin 2. Make up a cable no longer than 3 feet as the filament voltage drop may be too great unless one goes to a larger size of wire for the filaments. For mobile use this rig may be operated from either a dynamotor or vibrator power supply providing the required voltages.

Tuning Procedure

Let's try the rig out! Connect the power cable between the power supply and the transmitter, and plug in all tubes. Plug in the a-c cord, and turn on the filament switch, leaving the plate switch off. All tubes should light. Plug in a 8-Mc crystal (between 8.0555 Mc. and 8.1666 Mc. for Novice channels), and a 0-3 ma. meter in *jack J2*. (This may be a multimeter set on a range to read about 2 milliamperes.) Turn *R8* to full clockwise rotation. Turn on the plate switch on the power supply chassis. The neon output indicator should show a small red glow on one of its electrodes, indicating that plate voltage is on. Slowly rotate *C1*. About mid-range a slight kick should be noted on the meter. If a neon lamp is held close to *L1*, it should glow if the oscillator is working properly. Tune *C2* to bring the grid current up to maximum. This should occur near the minimum capacity sett-

(Continued on page 68)



This underside view of the transmitter chassis shows the location of some of the principal components. With a modest 5-watt output this unit makes an excellent "first phone" transmitter for the Novice license.

Automatic Antenna Changeover

G. FRANKLIN MONTGOMERY, W3FQB

Contributing Editor, CQ

The subjects of "break-in" and "antenna changeover" have been discussed from many angles. The approach offered in this article is not entirely new, but is rather one that required just a little extra "know-how" to make it operate successfully. See if you don't find it the answer to a CW man's prayer.—Editor

Most amateurs agree that their best receiving antenna is the transmitting antenna. There are good reasons for the agreement. First, the transmitting antenna is usually placed in the best of several positions available for it. And second, if a transmission line is used, some effort is spent in matching the line to the antenna, and the line itself reduces local noise pick-up. Both factors increase the received signal-to-noise ratio over that obtainable from a makeshift length of wire.

In phone operation, there is no particular difficulty in switching the antenna from receiver to transmitter—it is easy to wire an antenna changeover relay to operate from the usual push-to-talk switch— but CW presents a problem. Complete break-in is impractical with a single antenna unless one is prepared to use a fairly complex electronic transmit-receive arrangement similar to that of a radar system. *(Alternatively, complete break-in could be achieved with an antenna relay light and fast enough to follow keying, but there seems to be none. The clatter from the ordinary kind, even if it were fast enough, is sufficient to drive the XYL home to mother.)* Many amateurs obtain nearly break-in operation by using a foot-switch to control the antenna relay, but this method still means something else to do at each standby.

The automatic method described below achieves near break-in and takes the work out of it. The concept of the method is not new. Goodman[1] set forth the idea behind it in discussing break-in several years ago, and Hairston[2] has used an almost identical scheme for switching the transmitter VFO to permit near break-in with amplifier keying. As modified for antenna switching, the system uses an ordinary antenna relay and an auxiliary time-delay circuit for controlling it.

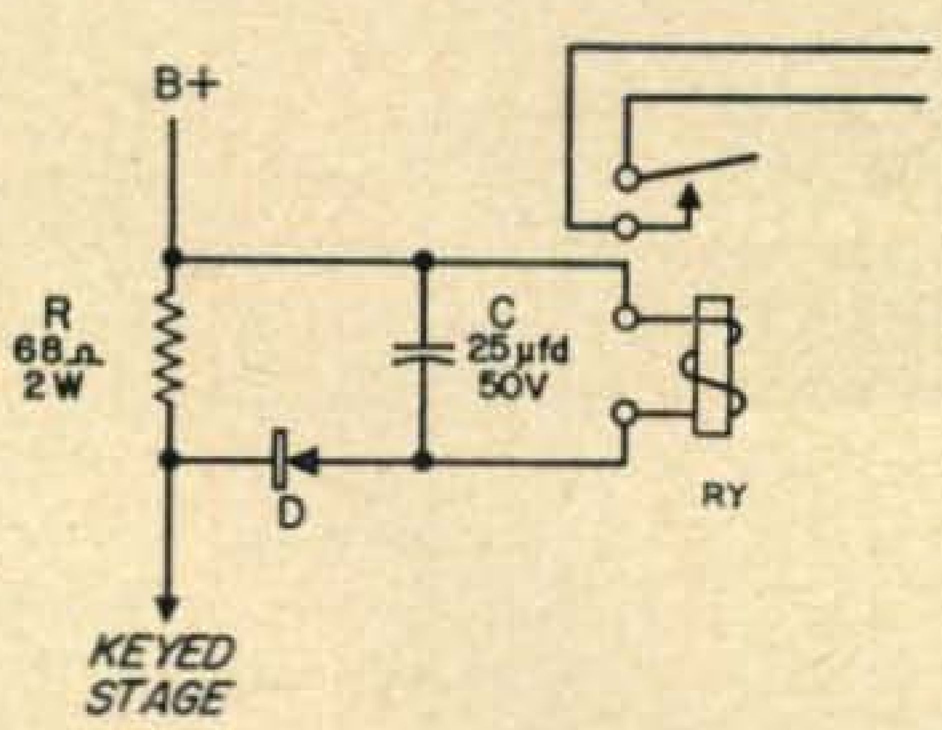


Fig. 1 Simple time delay circuit inserted in series with the plate supply to the oscillator, buffer, or one of the keyed stages.

How It Works

The time-delay circuit incorporates a second relay and works as follows. When the transmitter key is closed, even momentarily, the time-delay relay closes, operating the antenna relay and switching the antenna from receive to transmit. The relay remains closed for a certain time interval after the key is released, and at the end of this time interval, the relay opens and the antenna is switched back from transmit to receive. The "dead" interval following keying may be adjusted so that the relay will ordinarily open in the pauses between transmitted sentences, or between words, or even between letters, as the operator may wish.

Figure 1 is a simple diagram of the time-delay circuit. *R* is a small resistance connected in series with the plate supply to one of the keyed transmitter stages. Whenever the key is closed, the transmitter plate current generates a small voltage drop across this resistor. The polarity of the drop is such that condenser *C* is charged, through rectifier *D*, to the same potential as that of the drop. *Ry* is a sensitive, fast-acting relay. It will close at some instant before *C* has reached its full charge, and since *C* charges very quickly, the relay closure is practically synchronous with the first dot sent by the transmitter. When the key is released, the voltage drop across *R* vanishes, but because of the connection of the rectifier, condenser *C* can discharge only through the relay coil. The discharge process takes considerable time if the relay coil is a high-resistance one, so that the relay will not open until some time after the key has been released. The time interval is lengthened if the ca-

1. "Improved Break-In Keying," Byron Goodman, QST, March 1948, p. 64
2. "A Simplified Break-In System," M. A. Hairston, CQ, July 1951, p. 22

pacity of *C*, relay resistance, relay sensitivity, or the initial voltage drop across *R*, is increased.

Figure 2 is a complete diagram of the antenna changeover system. A 115-volt, a-c antenna relay is shown, although a d-c relay could be used if a supply for it were available. *Sw1* controls the a-c power, and *Sw2* allows the antenna relay to be closed for tuning-up purposes. The values given for *C* and *R* are representative only, and adjustment will probably be required to suit individual installations. In my case, the circuit operates in series with the supply to a final amplifier drawing 150 milliamperes. Smaller currents will generally require a larger value of *R*, and vice versa. In

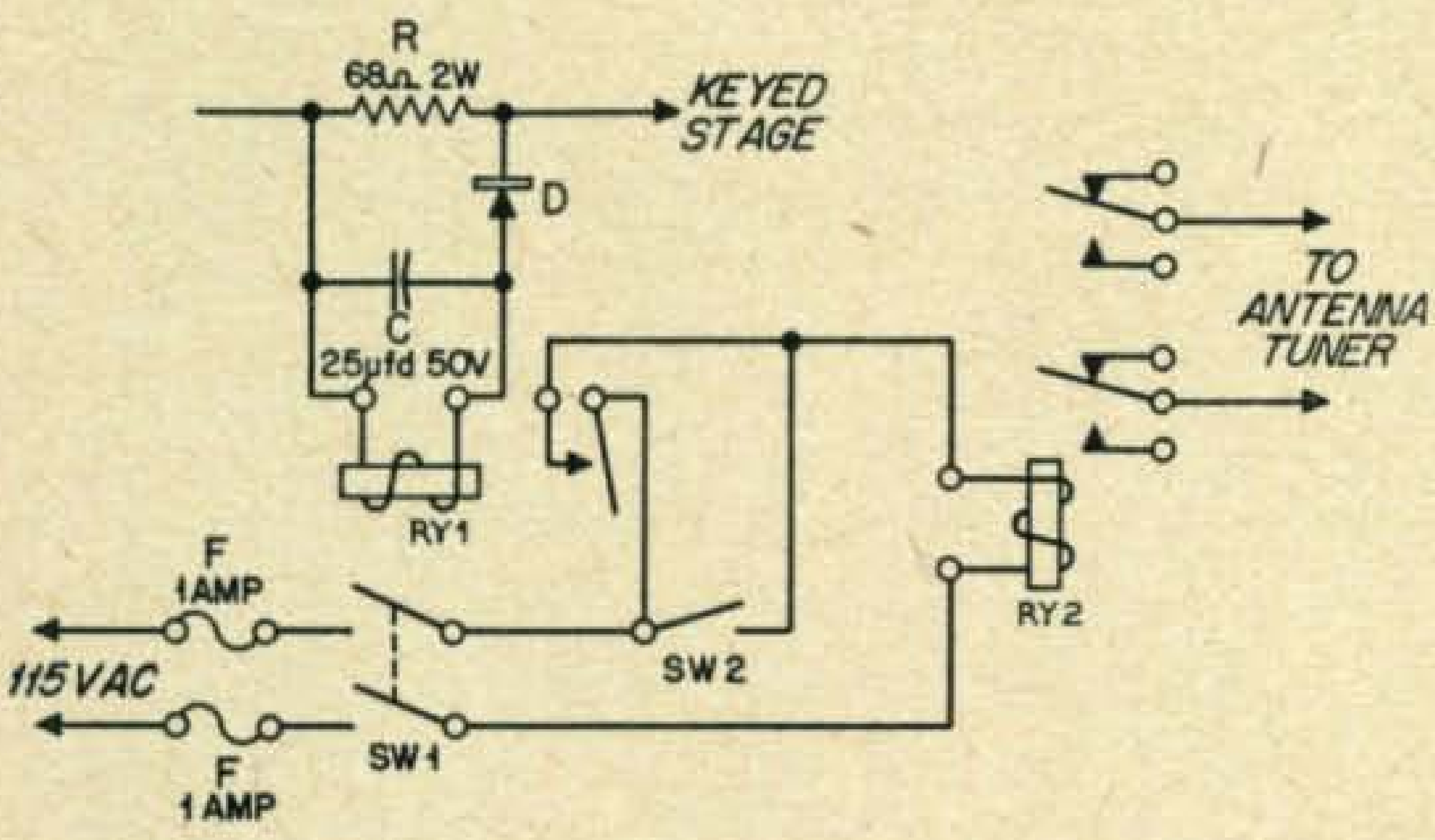


Fig. 2. Wiring schematic of the automatic antenna changeover system used by the author. The type of relays used in this circuit are sufficiently uncritical that exact duplication is not necessary. However, just for the record: Ry1 was a Struthers Dunn, type 28XAX040, 5000-ohms, 6-volt coil rating. Ry2 was a Leach Relay Co., type 1177-CBF with a 115-volt coil.

addition, the capacity of *C* must be varied experimentally to give the "dead" time that pleases the operator,* although this interval may be varied over a small range by changing, if possible, the spring tension and armature travel of *Ry1*.

Hooking It Up

Connections to the antenna terminals of the changeover relay may be made in any way desired. The antenna transmission line can be switched to separate transmitter and receiver antenna tuners, or the link from a single tuner can be switched between transmitter and receiver. Usually, it is preferable to perform the switching in a low- or medium-impedance line, because the relay insulation is then subjected to lower radio-frequency voltages than would otherwise exist, and the r-f losses will be less. An additional contact is available on some antenna relays, and this contact may be wired to short-circuit the receiver input while transmitting and thus reduce receiver overload.

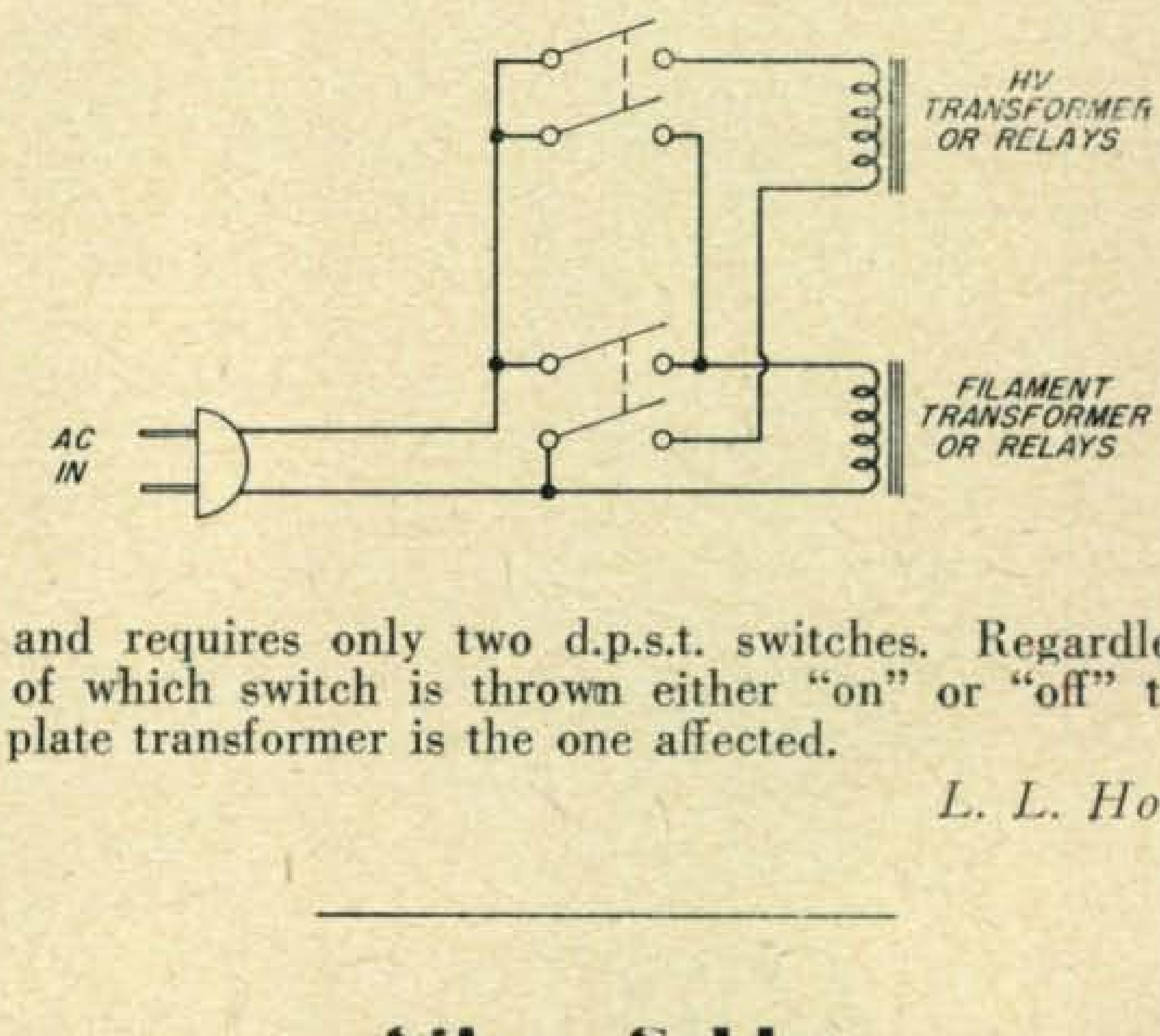
Before installing the circuit, several safety precautions should be observed. *R* may be connected either in series with the B-plus supply to a keyed stage or in series with a cathode return. If the point at which it is connected is a high-voltage point in the transmitter system, a protective cover should be placed over the relays and their connections to prevent accidental contact by the operator and the danger of shock, and the coil insulation of *Ry1* should be sufficient to prevent breakdown between the coil and the field structure of the relay. The 115-volt circuits should be fused, as shown, and it is a good idea to ground all of the metal structures of the relays that are not parts of either the control or the radio-frequency circuits.

* The recovery time with the constants shown is about one-half second. Additional control of this interval may be obtained by shunting the relay coil with a variable resistor whose maximum resistance is about twice that of the relay.

Inside the Shack and Workshop

Another Foolproof Switching Sequence

While this switching sequence in the old story of "filaments on first and off last" is not new I have never seen it in print. It is remarkably foolproof



and requires only two d.p.s.t. switches. Regardless of which switch is thrown either "on" or "off" the plate transformer is the one affected.

L. L. Horr

Silver Solder

Before using a new soldering iron tip brighten it up with a fine file and then tin it with "E-Z Flow" silver solder. This coating will last a long time and will prevent the tip from corroding or pitting. "E-Z Flow" is one of the few solders that will solder stainless steel and can be obtained from most refrigeration and building supply houses.

Silver solder can also be used for repairing a mobile antenna. A steel rod can be inserted inside the antenna-whip section and between the broken pieces. "E-Z Flow" silver solder will easily repair this break. This type of solder can also be used for soldering outside feeder connections, beam antennas and even routine under-the-chassis connections. A small amount of silver solder will go a long way.

Richard E. Downing, W4TZY

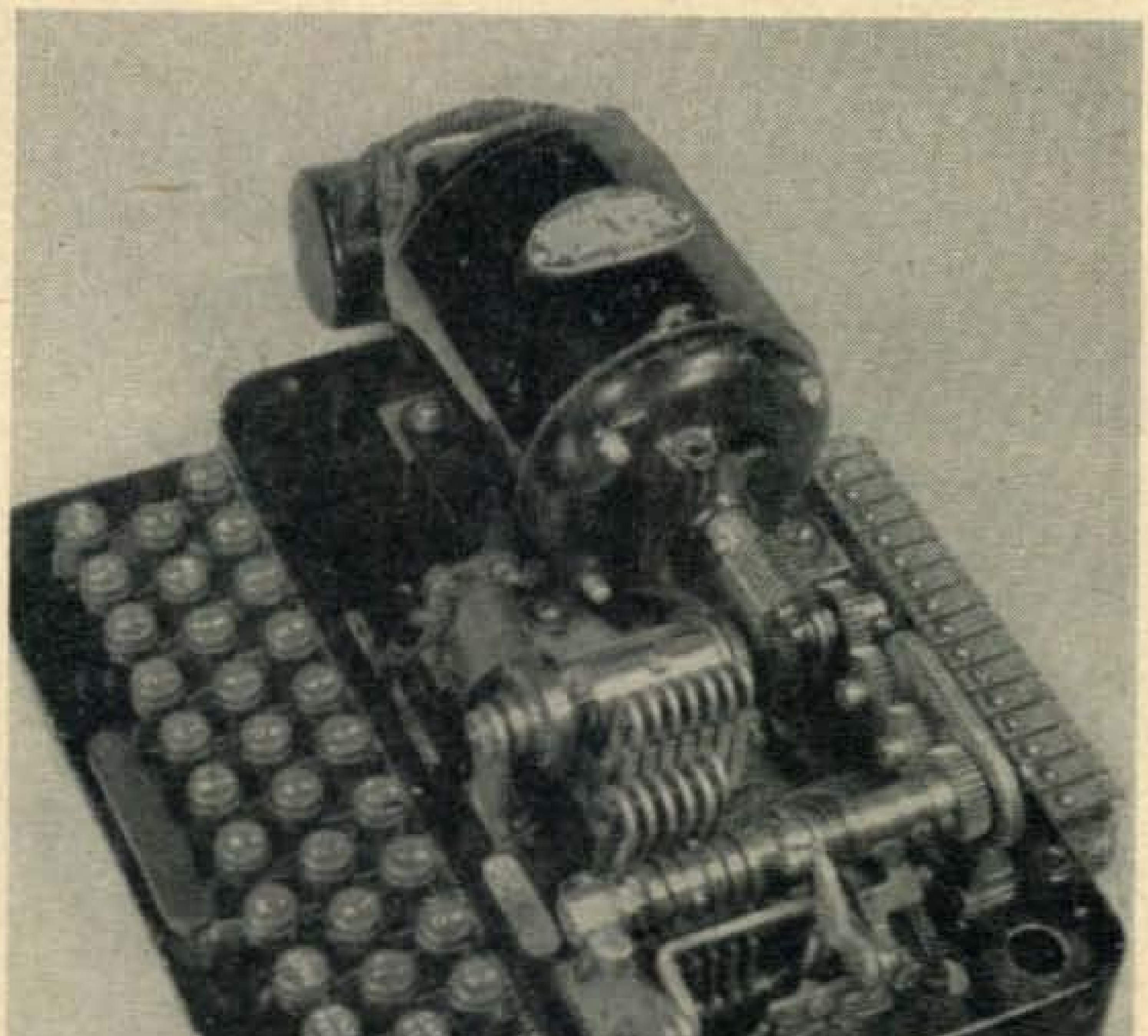
Amateur Teletype

As Reported by
WAYNE GREEN, W2NSD
1379 East 15th Street
Brooklyn 30, New York

Pictured above are a few of the celebrities attending the opening of the Hallicrafters/Vim "message center" in New York City. Using the facilities of amateur radio thousands of people were able to send Christmas Greetings to their Servicemen relatives overseas. Grouped around W2NSD while pounding out the messages are Faye Emerson, Bill Halligan, Sr., Skitch Henderson, Conrad Nagel and Herb Sheldon.

December Publicity

Early in December the New York group of the *Amateur Radio Teletype Society* was called on to help out in an ambitious program to take messages from the public to be sent to Servicemen free of charge. With the help of Hallicrafters, a headquarters was set up in the large *Vim* store, just off Times Square on 42nd Street, and for one whole week there was a solid mass of people pushing and shoving their way into the room to file amateur radiograms. All messages were punched into teletype tape and sent, via two meters, on the temporary setup of my station, W2NSD, to the headquarters station of the *VHF Teletype Society* (John Williams, W2BFD, operator) where they were separated into areas of destination and retransmitted to other teletype stations, which were set up to handle traffic for these destinations.



The model 12 keyboard. The contacts in back plug into the regular teletype table top. Notice how the motor drives both the receiving distributor (nearest the motor) and the transmitting distributor.

The opening evening of this venture was a miniature Hollywood with Faye Emerson, Skitch Henderson, Conrad Nagel, Herb Sheldon, a broadcast over WNBC, and almost complete confusion everywhere. We had planned on having to handle only a few thousand messages, but the tremendous publicity for this program and the numerous newspaper advertisements just about swamped us. Fortunately, teletype can handle a lot of traffic in a short period of time.

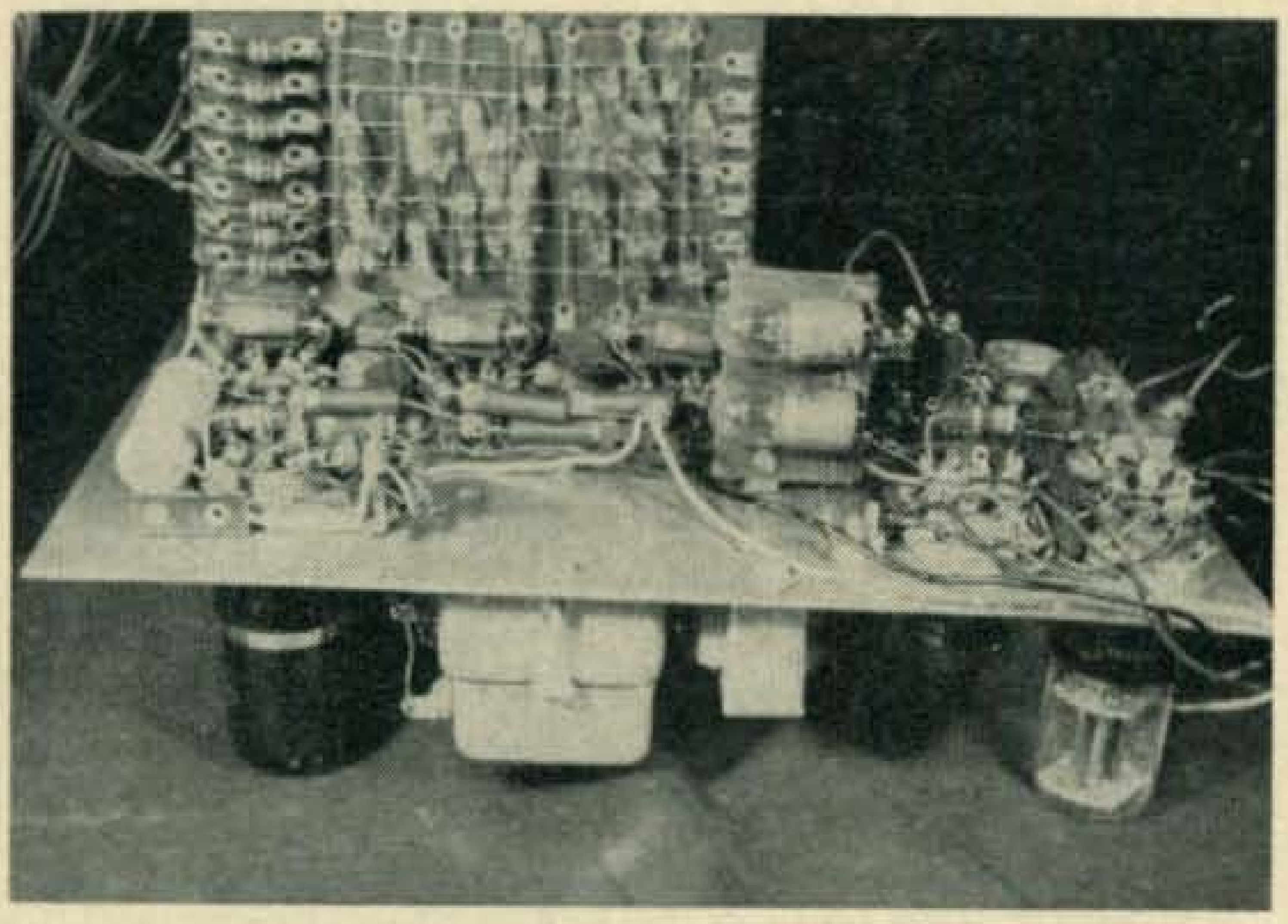
Certainly a lot of credit is due the group that made possible the dispersion of this swamping load of messages. The bulk of the Pacific traffic was routed through W2VNJ to W2BO and W2AEE. Most of the European traffic was routed through W2QGH to W2PHO and others. The Stateside and part of the European traffic was routed through W2MXJ to W2EC and W2GP. W2AXC helped out on the overloads. This sure was a monumental task and the smoothness of its working was due to the well organized ARRL traffic nets and the efficacy of the teletype system for handling a large number of messages from a single terminal point.

November Publicity

Not to be passed over lightly is another job turned in annually by W2BFD: the collection of the New York State election returns. Back in 1948, when John first made his permanent installation in the

New York City Municipal Building of the complete two meter teletype station (built at his own expense for both equipment and time), amateur teletype proved itself to the officials involved by reporting the results of the New York State vote hours ahead of the regular wire services. These results were used on not only the City Station, WNYC, but on some of the network stations. Quite a bit of the operation was televised. Again during the last national election, amateur teletype brought in all of the New York State results hours ahead of the wire services, which were concentrating on the national results and had no time to worry about New York State.

The collection of the results was made via the Civil Defense network which sent in the individual tally from each county, by phone or CW, to the State Control Center of the New York State Civil Defense operating under the call letters W2JVG. At this point the information was put on the two-meter radioteletypewriter circuit going to the Municipal Building. A temporary printer was installed in the main studio of WNYC which printed from this two-meter circuit and fed the data to a battery of 100 clerks and adding machine operators. This data



Bob Weitbrecht, W6NRM, set to work on the problem of an electronic distributor for a teletype tape transmitter and came up with a fairly simple answer to the problem. Here is the unit he built. It contains ten tubes and includes a tone oscillator for the standard teletype tones. The large neon bulbs are a voltage regulator; the small ones form a phantom switching network.

was then placed on a blackboard and used by the WNYC announcers. Every so often the circuits would be reversed, and the totaled results would be fed from the studio back over the teletype circuit to the Control Center and thence to the many operators involved, so that they could keep up with the progress of the election.

It is not possible to list all of the hams that had a hand in this undertaking, but special mention should go to W2VNJ, who was in charge of the phone operation, and W2VVP, who was in charge of CW at the State Control Center. Vincent Kenney, W2BGO, the State Civil Defense Communications Officer, was installation chief. W2QGH handled the Control Center end of the teletype circuit, while W2BFD and W2GFV held down the WNYC end of the circuit. Also of great help were W4HHQ in Fountain City, Tennessee, and K4WDF in Fort Bragg, North Carolina, who relayed many returns from the 75- and 80-meter upstate stations who were victimized by miserable band conditions.

This election return problem gave the amateurs one more chance to actively show the populace and city officials that ham radio is of value to them. All of us should keep in mind the importance of this sort of thing to the continuation of ham radio.

In Times To Come

As amateur teletype gains more and more adherents the prospects become better for getting the interest of the commercial companies to turn out equipment especially for the hams. During the last year the ranks have swelled and there soon may be a good enough market to induce the production of converters and teletypewriters. *Hallicrafters* is working on the problems involved in radio teletypewriter communication and has come up with some pretty good answers.

True, the expense of getting on the air with teletypwriter will probably be quite a bit higher with new equipment, but is this really much of a problem? Right at this moment the average Ham teletype setup costs about $125, not including the regular station receiver and transmitter. When you consider what the possibilities are for this ridiculous expense it is fantastic. The teletype station operator can sit down to a typewriter at his leisure, turn on another station's machine by remote control, send as long a message as he wants to, ring a bell at the receiving station for an immediate answer, or wait for the other operator to answer at his own leisure if he happens not to be around at the time. Unlike phone operation, the typer has plenty of time to pay attention to how he says things so that the enjoyment of communication is far greater than you could normally expect for a ham QSO.

In all probability the commercial teleprinter equipment will be boiled down to three types of units. There will be the teletypewriter, which will be about the size of a standard electric typewriter, and will be completely noiseless in the station receiver. These units may be available for less than $400 and will double as regular typewriters. There will be the receiving converter unit which will plug into the receiver and furnish the d-c pulses for the printer. This unit will probably cost about $150, or slightly less. The third unit is the frequency-shift oscillator which probably can be made available for $75 or less. Under these conditions, the entire bill for brand new equipment is then about $600, which in these days doesn't seem like too stiff a price.

Let me emphasize that these units are not yet available and that at present we have to be satisfied with the venerable model 12 printers and home-made converters. We are still in the "Old Days." We are still faced with the small annoyances of the 12; its clatter which sounds like a model T on a cobblestone road, and the uproar in the receiver from the sparking distributors and latch magnets, which forces us to build electronic keyers or rewire it with shielded wire, plus the ridiculous size of the monster. Of course, it does have two saving graces: its veritable indestructibility and its price of $55—— a steal.

Technological Report

One of the problems facing the amateur teletype fraternity has been the shortage of keyboards. We have been unable to use quite a few of the machines

(Continued on page 54)

Monitored by LOUISA B. SANDO, W5RZJ

959-C 24 Street, Los Alamos, New Mexico

Just this week (mid-November) a second book by W2OLB, Amelia, has come off the presses. Titled "Kay Everett Works DX," and published by Vanguard Press, it is a sequel to Amelia's first book, "Kay Everett Calls CQ." In the first story Kay became exposed to ham radio and started to learn the code toward getting her license. In the present story she receives her ham ticket and gets on the air with the help of a local ham, for whom she works. Secret radio plans are stolen from the ham's father, and Kay becomes involved in a mystery that she helps solve by her DX contacts. Explanations of ham terms and activities are clear and interesting so

DJIAC, Kaethe Behrens

any non-ham reader can understand and enjoy the story. Although it is fiction and most of the characters are imaginary, it does include such actual YLs as KL7AX, Verna St. Louis; VE6MP, Maude Phillips, and W2IXY, Dot Hall. An especially good book for any teen-age girl who is interested in ham radio, or one whom would like to get interested in the hobby ——though most any YL will find it entertaining.

YLRL Nets

Two new CW nets have been added to the YLRL nets already in operation. They are both 80-meter CW nets. One on 3680 meets Monday nights at 2245 PST with W7GLK as net contol; the other on 3915 Wednesdays at 0900 PST with W6PJF as NCS.

For other YL nets, check this column in your November issue. The following changes should be noted, however: On the 20-meter phone net on 14,240 each Thursday at 1400 EST, W3UUG is NCS. On the Mid-Atlantic States 75-meter phone net on 3900 each Wednesday at 0800 EST, W3MAX (OQF) has replaced W4CWV (LKM) as NCS since Annette has moved to Florida. The California 75-meter phone net is on 3915 each Wednesday at 900 PST—NCS is W6PJF.

Club Notes

The October meeting of the **YL Club of Los Angeles** was held at Maxine's, W6UHA. A special meeting, since it was the club's 6th anniversary, a total of twenty turned out to celebrate the occasion, including: WN6s: QDG, JCA, CQV and OBZ; W6s: WRT, QOG, GKJ, TDL, UHA, KYZ, PJU, WSV, LBO, MFP, KER, NLM, NZP and CEE; the XYL of YSK (future ham) and Joan French, also a student of ham radio.

One of the highlights of the meeting was a tape recording the members made over the telephone to W6NAZ who was at home taking it on her tape recorder. The tape was to be sent to Lou, W6VWR, their member who is seriously ill at Good Samaritan Hospital in Los Angeles, and has not been allowed any visitors. Another highlight was the reading of a letter by Clara, W6DTL, from Diana, ZS6GH. Diana visited the club and the homes of a number of the YLs several years ago. A special attraction of the meeting was a delicious luncheon served by Maxine and her mother.

The Los Angeles Club's November meeting was a most interesting one. W6PJU's daughter-in-law, a former Navy nurse aboard a hospital ship showed colored slides of some of the "police" action and activities in Japan and Korea. She had climbed Mt. Fuji, been inside Buddhist temples, went to Japanese resorts and behaved like Japanese travelers (including sleeping on straw mats on the floor!), been inside geisha houses, been to tea ceremonies, been present at Japanese weddings and funerals, besides being at the front when casualties had come in—she had some great pictures.

W9GME and W9SEZ chasing spooks instead of DX.

The Los Angeles Club announces that to earn their LAD 'N LASSIE certificate the number of required contacts has been reduced to ten; i-e., QSO ten different members of the club. All contacts must have been made since January 1, 1952. Send confirmations to club secretary Gilda Shoblo, W6KER, 3715 Liberty Blvd., South Gate, Calif.

(Continued on page 62)

Conducted by HERB BRIER, W9EGQ

385 Johnson Street, Gary, Ind.

Use of Procedure Signals

Listening in the 3.7 mc. Novice band, I am impressed with the operating proficiency of the average Novice operator, especially when he did not have to demonstrate any to obtain his license. Significantly, the errors they make parallel almost exactly those made by more-experienced amateurs in other bands. This probably means that errors in procedure by Novice operators are made because they are imitating what they hear.

There are about a dozen procedure signals, besides "Q" signals used by amateurs. Six of the most common ones will be discussed here. They are:

R—Received, copied 100 per cent.
A R—End of transmission, End of message.
K—Invitation to transmit. Go ahead.
KN—Go ahead one specific station. All others keep out.
SK—End of a series of transmissions.
CL—I am closing my station.

An example of the correct usage of each will be followed by descriptions of common errors to be avoided.

R: "WN9EGQ de W9EGQ R Thank you.. . ." W9EGQ is replying to WN9EGQ, and the single R means that the transmission was copied 100 per cent. W9EGQ then proceeds with his own transmission.

More often than not R is misused: "WN9EGQ de W9EGQ R R R Sorry I missed part. . . ." Translated literally, this means that W9EGQ copied WN9EGQ 300 per cent, but he still managed to miss part of what was sent—a pretty good trick in any book. Do not send R if solid copy has not been made. Also avoid sending R and then reviewing the entire transmission with OK on this, OK on that and OK on the other thing. The other fellow will take your word for it.

K: K has two logical uses. **". . . .CQ de W9EGQ K"** shows that the general call is completed, and W9EGQ is listening for replies. ". . . .WN9EGQ de W9EGQ K" W9EGQ has just completed a transmission to WN9EGQ, and he is telling him to transmit, but there is no objection if other stations wish to join the conversation.

KN: KN is probably the most pointed of all procedure signals. **". . . .WN9EGQ de W9EGQ KN"** means "Go ahead WN9EGQ. All other stations keep out. I do not want to talk to you." This signal is more useful to a rare DX station, who is swamped with calls, than it is to the average U.S.A. amateur. Some amateurs, however, have gotten into the routine habit of using it, when they would welcome other calls. Even more foolish is the occasionally observed use of **KN** after a CQ. The CQ invites any station who wishes to call, but **KN** tell them not to.

AR: ". . . .WN9EGQ de W9EGQ AR" means that contact has not yet been established between the stations. Another use of **AR** occurs in traffic handling, when it is used to show a clear break between the end of a message and say any subsequent material. ". . . . Write soon. Love—Charlie **AR QRU** (I have nothing more for you) WN9EGQ de W9EGQ K"

SK: SK is probably the most often misused procedure signal of all. Literally it means "This is the last transmission I shall make during this contact." What it usually means is "This is my final transmission in this contact, but I shall make at least one more to answer your final transmission." In phone work, this system has developed the "final", the "super final", and the "super-dooper final" transmissions, a rather ridiculous state of affairs.

Using SK as it is intended to be used avoids all confusion. End all transmissions with K, even while you are kissing good night. Then, after all good-by's have been said, simply reply to your exhausted opponent's final transmission with **"SK WN9EGQ de W9EGQ."** This indicates, clearly and unmistakably, that the contact is ended.

The confusion that can be caused under extreme conditions by the incorrect use of **SK** is being currently demonstrated by a very rare DX station on 14-mc CW. He concludes every transmission with **SK,** thereby telling those that are waiting to work him that he is open for other calls. As a result, his attempts to copy replies to his transmissions are invariably interfered with by other stations calling. Probably he is pained by the lack of courtesy of U.S. amateurs because of this; whereas it is actually his own fault—no, I am not going to mention his call letters. I may want to work him myself some time.

CL: The use of CL requires no explanation. Just add it after your call letters on your final transmission.

As can be seen from the above, the commonly used **AR K, AR SK,** etc., ending signals are usually incorrect. I can see little harm in them, but it is just as easy to use the standard ones.

Complete Novice station of Phil Murray, WN9SNI, Indianapolis, Indiana. In the foreground is the TR75, 60-watt transmitter. To the right is the S-38B receiver, topped off by a four-watt 3.7-Mc transmitter, and the modulator for the 146-Mc 30-watt transmitter, which is to the right of the clock. A small oscilloscope, a vacuum-tube voltmeter and several control boxes are also visible.

Letters And General Comments

This letter tells its own story. "Dear Editor, I am just an SWL (short-wave listener), but I sure enjoy CQ. Today is my thirty-third birthday, and my Mother gave

(Continued on page 50)

Men of Radio

WILLIAM R. WELLMAN

PART V

At this point in our series the author discusses the contributions of Pickard and his crystal detector, Dunwoody and his carborundum detector, the Edison effect, Fleming and his 2-element valve, and the momentous discoveries of a great inventor, Dr. Lee De Forest, who gave us the triode vacuum tube.—Editor.

With radio in the commercial stage, development was greatly accelerated. This was, of course, due to the demand for increased and improved services, a demand which did not exist while the art was in the laboratory stages. As an example of the stepped up progress, the case of the spark transmitter may be cited; this transmitter had barely become well established as the principal, if not the sole generator of radio waves when it was threatened with oblivion by the arc and the alternator. And, as might be expected, the march of progress was not limited to transmitting equipment; receiving apparatus made great strides too. The coherer was superseded by the magnetic detector soon after Marconi's trans-Atlantic success. Fessenden's electrolytic detector was soon outmoded by various types of crystal detectors and these, in turn, were eventually made obsolete by the vacuum tube, radio's magic lamp.

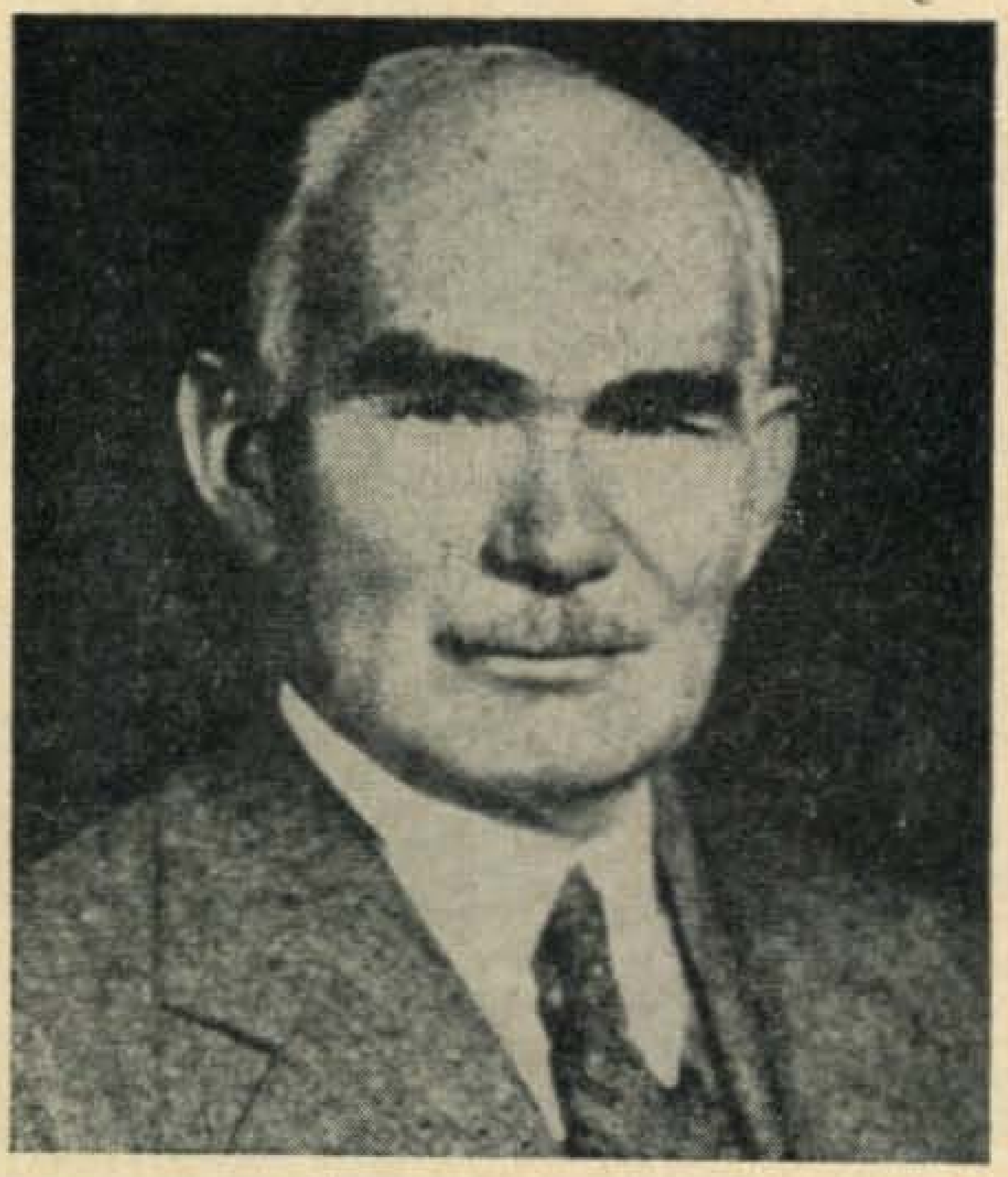
It should be clearly understood that the perfection of a new type of transmitter did not mean that all the older apparatus was relegated to the scrap heap overnight; nothing could be farther from the truth. Many of us can remember that vacuum tubes, in a rather well developed form, were available at the time broadcasting made its bow in 1920, yet crystal detectors continued to be used for some years thereafter for entertainment purposes and in some commercial installations too. They are still used by students and young experimenters and constitute a valuable training device.

Fessenden, DeForest and many other experimenters had long recognized the weakness of the coherer and all were working toward the invention of an improved, more reliable receiving device. Fessenden's development of the electrolytic detector and DeForest's invention of the "Responder" might, from one point of view, be considered parallel lines of investigation and, almost at the same time, two other experimenters arrived at results that were similar and produced different versions of the now well-known contact detector.

Greenleaf Whittier Pickard

Greenleaf Whittier Pickard, graduate of Massachusetts Institute of Technology and grandnephew of the famed American poet John Greenleaf Whittier, became interested in radio in 1898 and worked at the Blue Hills Observatory at Milton, Mass. under a grant from the Smithsonian Institution. Later, he became associated with the engineering staff of the American Telephone and Telegraph Company.

During 1903, Pickard began an investigation of the rectifying properties of various kinds of minerals, particularly those occurring in crystalline form. He made early trials with iron oxide and magnetite, a magnetic ore of iron. He found that pieces of some minerals possessed the unique property of conducting radio waves, or any alternating current, much more easily in one direction than in



Lee DeForest (1873-)

the other. Today, we refer to this characteristic as unilateral conductivity. The crystallized mineral was usually held in a cup or clamp and connection was made to it through the medium of a very light wire contact which barely touched the surface of the crystal; this was the "cat whisker" of early broadcast days.

Further work with hundreds of crystal varieties yielded the famous "perikon" detector in which two dissimilar minerals were held in close contact. The two minerals were usually red oxide of zinc and chalcopyrite, a copper ore. Pickard's most effective detector did not appear until 1906, when he was able to obtain good crystals of silicon; these appeared to be more stable and more uniformly sensitive than most of the other varieties tested.

H. N. C. Dunwoody

While Pickard was going ahead with his experiments, General H. N. C. Dunwoody, of the United States Army (and later a vice president of the early DeForest company) discovered the rectifying ability of carborundum. This mineral is artificially produced by fusing together, in the intense heat of the electric furnace, a mixture of coke, sand, sawdust and salt. It was discovered by E. G. Acheson in 1891. One of the hardest of all known substances, it is now in almost universal use as an abrasive, but at that time was just beginning to displace the less efficient natural abrasives such as emery.

Like Pickard, Dunwoody had learned that many minerals were capable of rectifying radio waves, and he too conducted a long series of tests with many varieties and which eventually led him to carborundum. The result was a fairly sensitive detector which did not require a light contact as did many other substances.

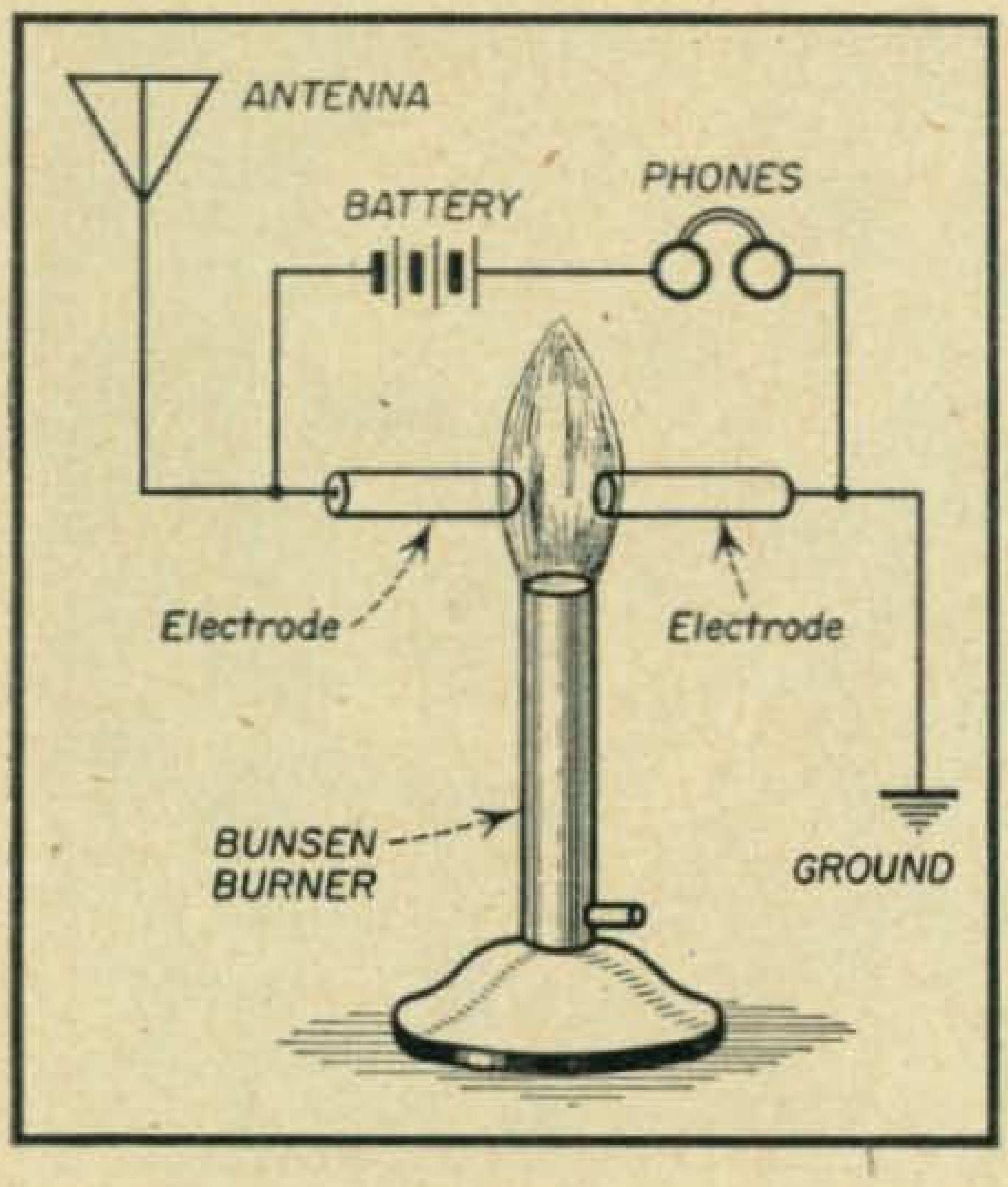


Fig. 1. DeForest flame detector

The outcome of the two independent lines of research by Dunwoody and Pickard was that crystals of galena (lead sulphide) were found to be by far the most sensitive and this mineral continued to be popular for most applications until well after the advent of broadcasting. On the other hand, the light, delicate cat whisker contact needed for galena was found to be a distinct disadvantage in some types of work. At sea, for instance, a rugged detector not subject to derangement by vibration was urgently needed and for this purpose the carborundum detector excelled.

Vacuum Tubes

A reader who takes only a casual interest in the history of radio might easily come to the false conclusion that the vacuum tube followed the crystal detector in a rapid sequence. This is far from true, and in fact the roots of vacuum tube development go back to 1880, long before crystals came upon the scene. So that we may gain a proper perspective of tube development, we must now reverse our more or less chronological progression and go back to that period.

In that year, Edison was deeply engrossed in perfecting the carbon filament incandescent lamp. Early objections to the lamp included the rather rapid failure of the filament on account of breakage at one of the terminals, coupled with a premature blackening of the bulb. This blackening occurred in the form of a deposit on the inner wall of the bulb, and in an attempt to eliminate or reduce it, Edison prepared some lamps with a tinfoil coating on the outside of the bulb and then applied an electrical charge to the foil. There is no record that this procedure served to eliminate or even diminish the blackening, but in 1883 he noticed that when a galvanometer was connected between the foil and the positive leg of the filament (lamps were then operated exclusively on direct current) a minute current flowed through the instrument. When the galvanometer was connected to the negative filament terminal, there was no current flow. This observation is the basis of electronic flow in tubes and has been called the "Edison Effect."

Sir John Ambrose Fleming

Sir John Ambrose Fleming, British scientist, was the first to put the Edison effect to practical use. Fleming had worked under James Clerk Maxwell at Cambridge and later was appointed electrician with the Edison Electric Lighting Company of London. While in the latter position he had occasion to study the odd deposit on the walls of lamps. In his own account of the research, Fleming stated that the discolored, burned-out bulbs almost always had a rather uniform blackish coating over the entire inner surface of the glass, except in an area that lay in the plane of the filament; most interesting of all was the discovery that the clear area was on the side of the filament loop opposite the point of breakage or burn-out.

Fleming dropped his investigation for a while, and in the interim Sir William Preece offered the opinion that the deposit was caused by the throwing off of carbon molecules by the filament. In 1888 Fleming resumed his study, using specially constructed lamps with metal collector plates sealed within the bulbs. Eleven years later, when he became advisor to the Marconi Wireless Telegraph Company he went to work on the problem of developing an improved detector. After a long series of tests involving many types of rectifiers, he hit upon the idea of using his special lamps for the purpose. His "oscillator valve" was immediately successful and from that time on was used in many Marconi installations.

Lee DeForest

The tube detector might have remained a mere competitor of the crystal except for the work of Lee DeForest who added the grid and thereby paved the way for the more important applications of the tube: amplification and oscillation. DeForest's achievement has been called the most important in the whole history of radio and all technicians will agree that this statement is by no means exaggerated.

DeForest was born on August 26, 1873 at Council Bluffs, Iowa and spent most of his boyhood at Talladega, Alabama. His father, a Congregational minister, was president of Talladega College for Negroes and it was expected that Lee would follow in his father's footsteps and become a minister also. It was soon evident that his interests were in things mechanical and for some time he was a participant in a struggle between his own desire to become an inventor and his father's wishes. Finally, at the age of sixteen, he composed a rather formal letter to his father setting forth his ambition to attend Sheffield Scientific School at Yale. His father finally gave in but not before giving him a lecture on the cultural values of a classical education.

He entered Yale in 1893 and his record there for the most part indicates that he exercised good judgment in selecting a scientific course but his progress was far from easy due to the limited family finances. By working after school and during summer vacations he was able to keep going and soon embarked upon a series of inventions that in his mind, were designed to make him financially independent. Unfortunately, not one was a success. His financial troubles were increased by the sudden death of his father during his senior year. Mrs. DeForest, with three other children, moved to New Haven and it was largely due to her efforts and management that he was able to continue with his college work and go on to post graduate courses. He received his doctorate in 1898.

It is certain that Dr. DeForest's interest in radio began during his years at Yale. He was fascinated by the lectures on Hertzian waves given by Professor Bumstead, and for his thesis selected a research project in the reflection of Hertzian waves from the ends of parallel wires. Early in his career he determined to make contributions to the art that would at least rank with those of Marconi.

The "Responder"

His first job after leaving Yale was in the dynamo department of the Western Electric Company, in Chicago. The salary was small—eight dollars a week—but he was at least able to support himself and even went ahead with plans for engagement to the girl of his choice. Within a short time he was promoted to the telephone laboratory of the company, but although the work was cleaner and lighter he did not show a keen interest in it. Instead he was spending much of his free time, evenings, at the library searching through old periodicals for records of experiments in wireless detectors. At length he came across what he was looking for—a description of an obscure test made by a German. The magazine article described a rectifier made up as follows: a piece of tinfoil was laid upon a glass plate. A razor cut was then made across the foil and a drop of water placed over the cut, bridging the gap. DeForest had absolutely no facilities for experimenting in the rooming house where he lived, but by using his lunch period and other spare moments at the plant he constructed the detector and found that it really worked, although it was crude and unreliable. In his enthusiasm, he began to work feverishly on the "Responder," as he called it until finally he began to encroach more and more upon company time. His superior could see no value in the work, at least to Western Electric Company; he could not visualize that firm ever becoming interested in wireless. In a rash moment he told DeForest to do as he pleased. DeForest took him at his word, and from that moment on devoted the full eight hours to the "Responder."

Very soon he came to the conclusion that a new job was in order—one that would lead to recognition of his abilities. He made a new connection with a Professor Johnson, manufacturer of heating controls and president of a newly formed wireless

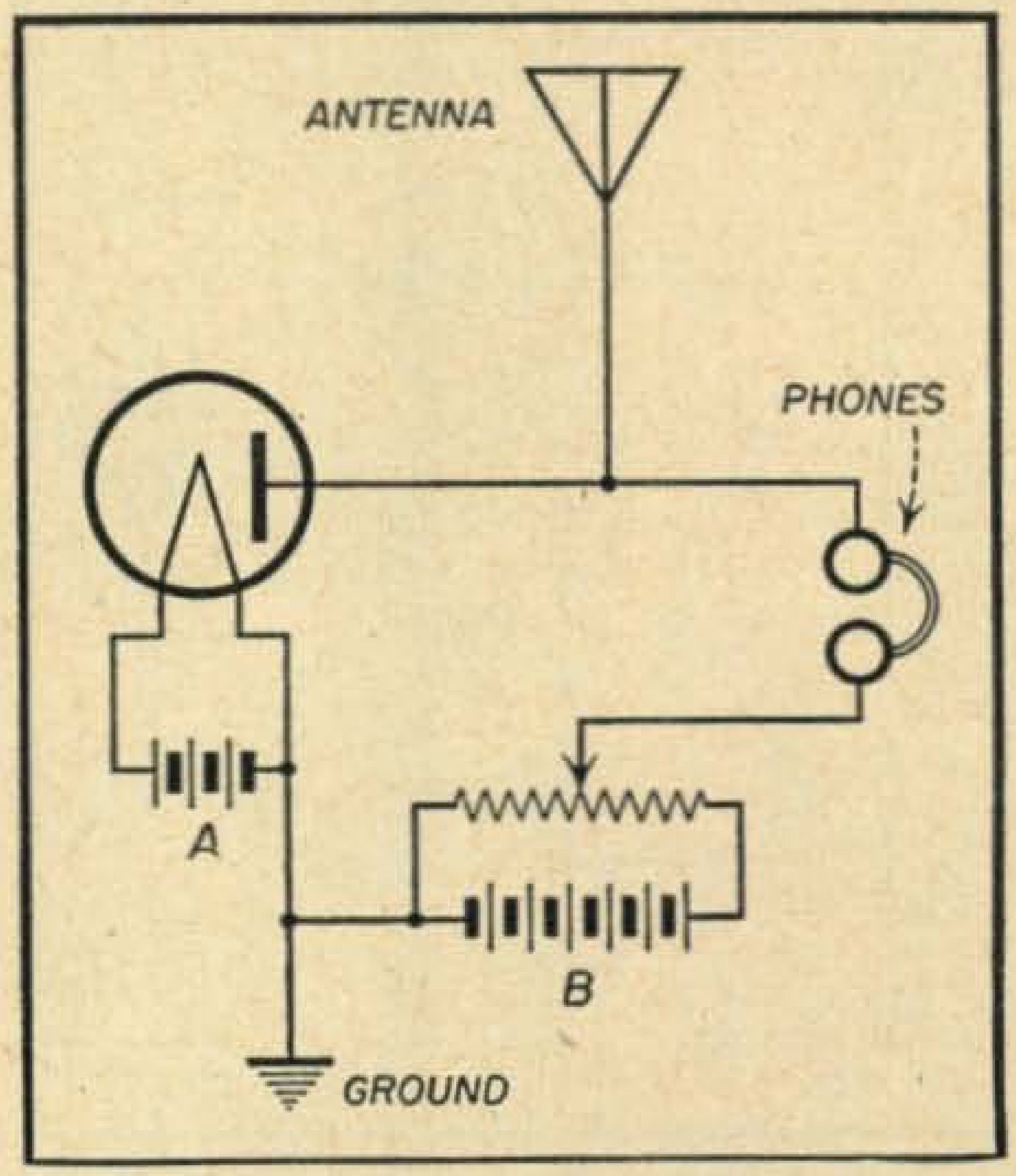


Fig. 2. DeForest tube detector. First use of plate battery.

company. The Johnson Wireless system was based upon clearly unworkable principles, and DeForest soon tired of making endless unsuccessful tests. One day he secretly substituted his "Responder" for Johnsons detector, with excellent results. It happened, however, that the test was witnessed by one of Johnson's assistants, who reported the matter to his boss. Johnson immediately demanded that DeForest turn over the "Responder" to the company; the demand was refused and DeForest was again out of a job.

For a while he managed to get along on a ten-dollar a week job as assistant editor of an electrical journal, meanwhile continuing his research. He applied for his first patent, on the "Responder," in 1900 and soon after gave up the editorial job so that he could devote full time to his career as an inventor. During this period he was financed mainly by friends.

In 1902 an association with Abraham White, a Wall Street promoter, led the formation of the American DeForest Wireless Telegraph Company. The objective of the company was the development of a wireless communication system based upon two ideas: the "Responder," and an alternating current transmitter as opposed to the prevailing d.c.-powered spark coil using the hammer-type vibrator. The soundness of the latter idea was borne out in the early transition from induction coil to transformer. Stations were installed atop the Castleton Hotel on Staten Island and on the roof of 17 State Street, Manhattan. From a publicity point of view, at least, the new company was a huge success. Certainly, DeForest did receive a great deal of valuable publicity and recognition from the operation. He was hailed by large sections of the press as the American rival of Marconi and much stress was placed on the speed of communication; according to the accounts, DeForest apparatus permitted transmission at 40 words a minute as compared to 15 for the Marconi system.

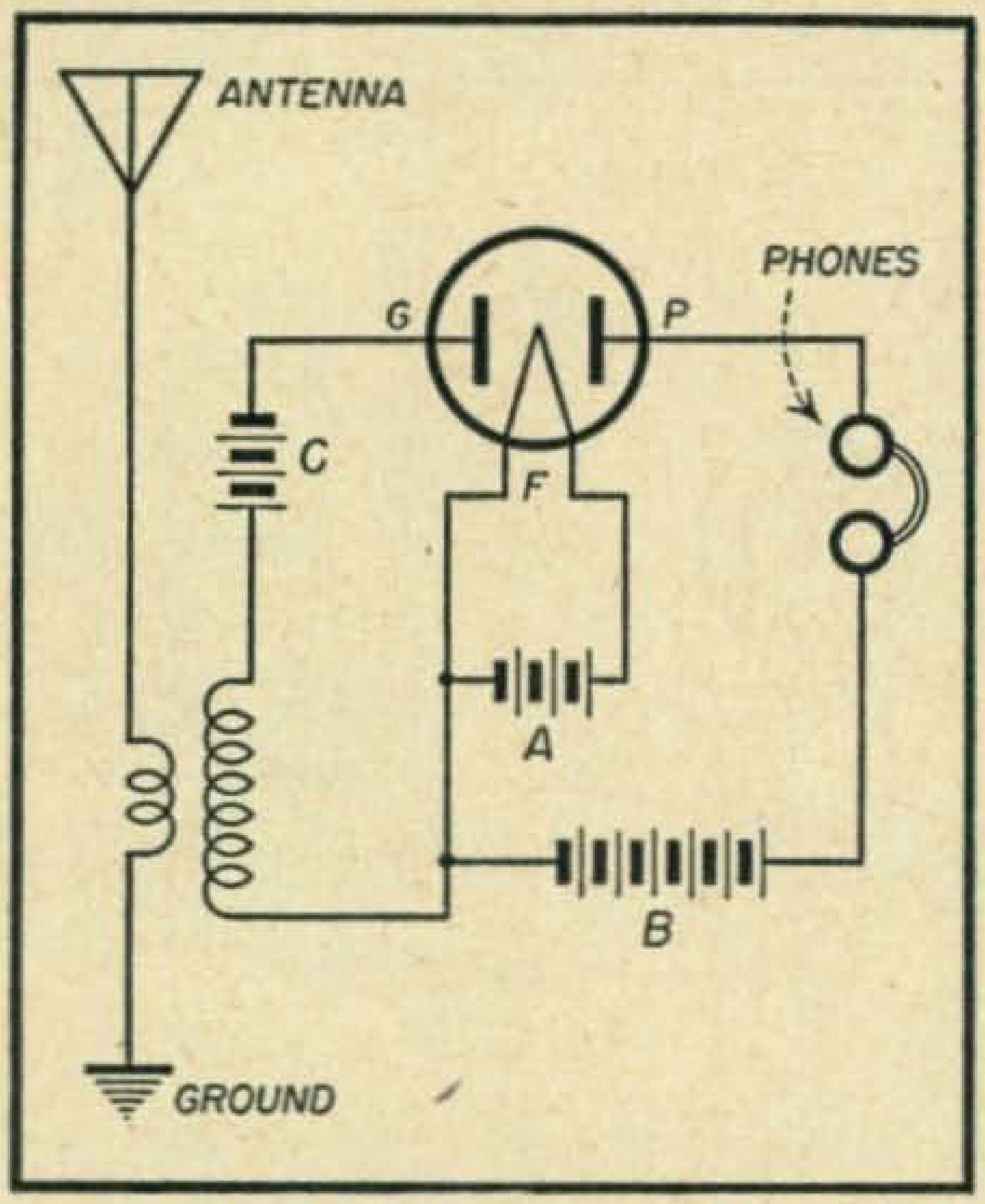


Fig. 3. DeForest Audion with solid grid. First use of "C" battery.

During the lifetime of the first DeForest company, many historic "firsts" were achieved; these included: the first wireless system operating as part of a commercial telegraph system; the first point-to-point commercial circuit on the American continent and the introduction of an American system in the U. S. Navy in competition with British and German systems.

In his new venture, Dr. DeForest encountered disappointments, too. The Marconi company claimed sole rights to the use of the coherer in combination with the elevated antenna and ground connection; a long court fight followed. Then, DeForest, in the belief that Vreeland, and not Fessenden had invented the electrolytic detector and encouraged by some improvements he himself had made, began to use the device in his system. Fessenden's firm sued successfully, at some financial loss to the DeForest company. As a fitting climax, the financial fortunes of the company took a further downward trend due to stock-jobbing operations of promoter White and raiding of the company treasury by one of the officers. The result was the eventual collapse of the enterprise and prosecution of DeForest and other company officials by the Federal government.

The charges against DeForest, brought by the government in 1913, included the claim that he had attempted to defraud through the use of the mails in advancing "the ridiculous claim that it would be possible to transmit the human voice across the Atlantic before many years." Dr. DeForest was completely cleared of the charges and less than two years later radio telephony across the Atlantic from Arlington to Paris, once a "ridiculous claim," became an accomplished fact.

The "Audion"

These developments have taken us a bit ahead of the principal theme in this story—the development of the three-electrode tube. Although the "Audion" first appeared in 1906, the original idea came as the result of an experiment made in 1900 while DeForest was still working on the "Responder." His account of this experiment states that on September 1900, he and an associate were trying to discover what effect, if any, the operation of a spark coil transmitter had on the light produced by a Welsbach burner. Apparently there was some effect, because the light of the burner increased when the coil was energized. DeForest and Smythe, the associate, followed this line of research enthusiastically for a while in the hope that the effect was due to radio waves; DeForest had an idea that it might be developed into some kind of flame-type detector. One thing they failed to take into account was the effect on the burner produced by the sound waves set up by the spark. This, DeForest said later was a very fortunate omission, for otherwise he might never have resumed the research which eventually led to the invention of the audion.

Although it is not generally recognized, it is a fact that the audion was the result of attempts by DeForest to develop a detector based upon the action of ionized gases in an open flame. He returned to the subject in 1903, convinced that the use of hot gases offered good possibilities for detection. When he took stock of the possible methods, he saw that there were three avenues of approach: (a) an open flame; (b) a carbon arc; and (c) gases heated by an incandescent filament within an enclosed area.

A gas flame detector corresponding roughly to the sketch of *Fig. 1* was arranged and afforded good results. As will be noted from the diagram, the device consisted of two electrodes introduced into the flame of a Bunsen burner; a local battery, *B*, was the source of current. With this device, DeForest was able to copy signals from ships in the harbor.

More important was his enthusiasm which led to further experimentation.

A carbon arc was tried, but the idea was dropped almost immediately on account of the noise generated. He and his assistant, Babcock, then turned to the third possibility--a detector based upon the employment of gases heated by means of an incandescent filament. Numerous attempts to make their own special lamps resulted in failure and this part of the work was then turned over to McCandless, a manufacturer of miniature lamps. Dr. DeForest states that at this point in his investigations he was totally unaware of the existence of the Fleming valve; at any rate, it is obvious that the use of a plate battery distinguished his invention from Fleming's.

The McCandless firm turned out for DeForest a special lamp with a platinum electrode sealed within the lamp bulb and this became the first vacuum tube detector to use two local current sources—one for the filament, the second for the plate. This was developed in 1905 and the method of using it is illustrated in *Fig. 2.*

The Triode

Next step in the development of the audion was the addition of the third electrode; at first it was not perforated as a modern grid would be, but was a solid electrode, similar to the plate and placed on the opposite side of the filament as shown in *Fig. 3.* At this time, the first use of a third, or *C* battery was recorded; this was connected as shown in the sketch. Needless to say, this tube was a decided improvement over its predecessors.

The third electrode just described was not only a solid element, but was evidently located about as far from the filament as was the plate. DeForest then arrived at the conclusion that more efficient operation would be attained by locating the control electrode between the filament and the plate. It was obvious from the first that the electron flow would be impeded by imposing a solid piece of metal between filament and plate. A piece of sheet platinum was then made up and drilled with numerous holes to permit passage of electrons. This was sent to McCandless and sealed inside a lamp. The discovery that this device with its control grid was not only a superior detector but that, most important of all, would amplify feeble currents, led to vast changes in the radio industry. The patent on the audion amplifier, No. 841,387, was granted on January 15, 1907—the most valuable patent in the entire radio field and one of the most valuable ever issued by the United States Patent Office.

An inventor who has just developed what he feels is a revolutionary device would naturally look around for the firm that he feels is in the best position to use it. In Dr. DeForest's case, the logical choice was the American Telephone and Telegraph Company. He took his audion amplifier to the company at a time when his own firm was in severe financial difficulties. The telephone engineers looked and listened with evident interest, but with no comment. When DeForest demonstrated the tremendous gain of his amplifier by dropping a handkerchief in front of the input device and producing a loud thud in the headphones, they were incredulous, but weeks and even months passed without an offer. After a nerve-wracking wait, DeForest was approached by an attorney who claimed to have no connection with the telephone interests, but who said that he had a client who appeared to be interested. The offer was $50,000, and in his financial circumstances, DeForest had no choice but to accept. Later, it was discovered that the rights had indeed been bought by AT&T and the story leaked out, according to DeForest and his biographers, that the AT&T board of directors had been prepared to pay, and in fact had voted $500,000 for purchase of the rights. It should be noted here, that the arrangements between AT&T and DeForest gave the former the rights to use the audion only for telephone purposes; DeForest retained the rights to use the invention in radio work. But it is almost impossible to emphasize the tremendous advancement that resulted from the use of the invention in telephony; to put it quite plainly, DeForest's

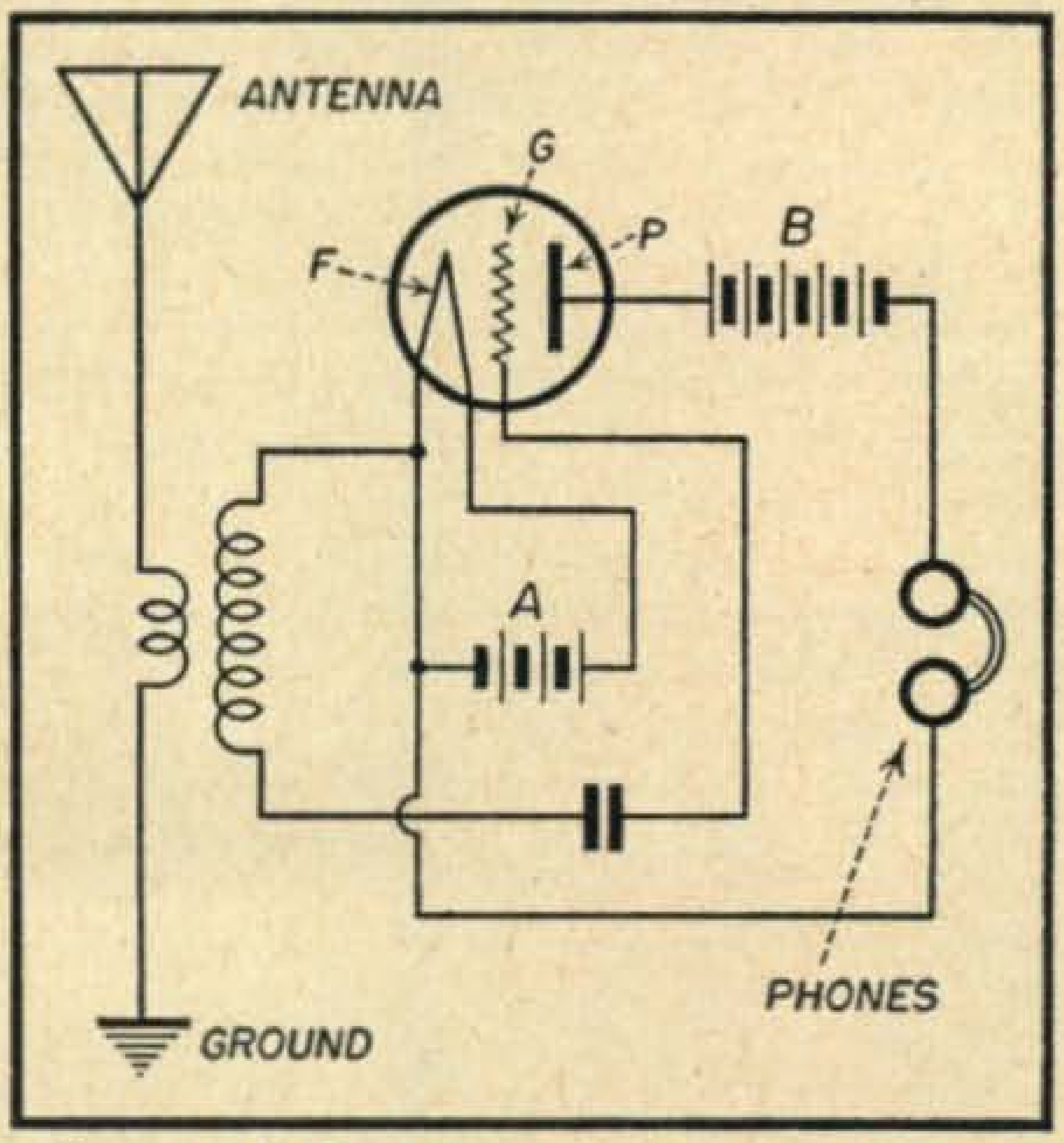
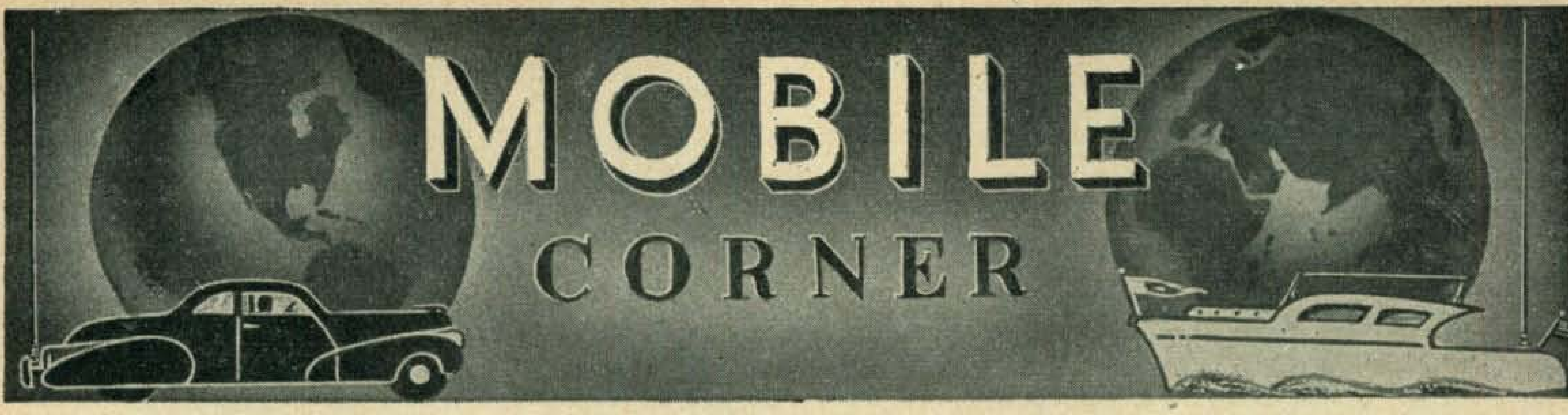


Fig. 4. DeForest Audion. About 1907.

invention made trans-continental telephony possible and by 1915, coast-to-coast conversations had become a reality.

Dr. DeForest went on to make other very valuable contributions to radio, and particularly radio telephony in his laboratory in the Bronx. He was a pioneer in the field of radio broadcasting and was the first to broadcast grand opera. His work in the field of sound motion pictures is too well-known to require discussion. But of almost equal significance was his discovery of the principle of feed-back, or regeneration. It is true that a gigantic battle over the possession of the feed-back patent rights raged for years with DeForest and Armstrong as the contestants. In the end, the U. S. Supreme Court decided, in 1934, that DeForest and not Armstrong was the prior inventor. That, however, is another story that will be covered in a later installment in this series.



By Fay Gehres, W9AIN, for

The Tri-State Amateur Radio Society

A New Type of "Mobile Corner"

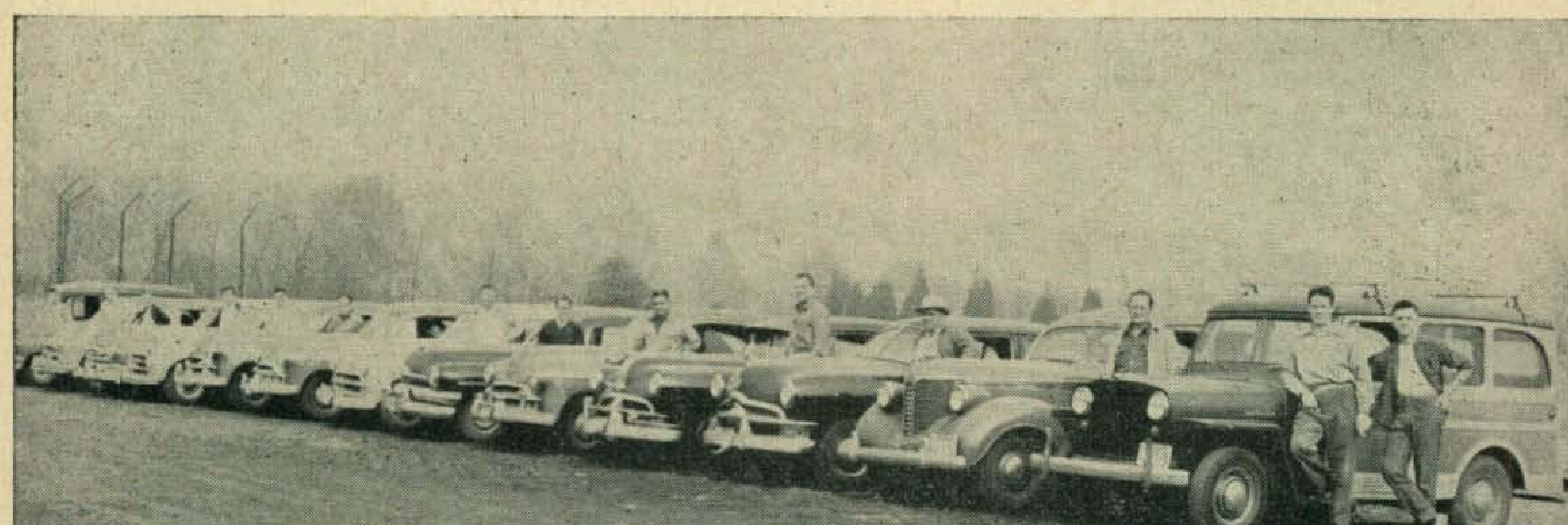
Due to the pressure of his work in the State Department, "Andy" Anderson, W3NL, reported last May that he felt it might not be possible for him to continue handling the original "Mobile Corner" department. The past few months have shown that it is not likely that his work will diminish, and so, with regret, Andy has decided to relinquish editorship of the column.

Naturally, with the heavy emphasis that CQ has placed upon mobile operation, this caused us no small amount of concern. Somewhere along the line of attempting to find a replacement, someone came up with the idea of presenting a monthly column in a somewhat unusual fashion.

The idea finally decided upon was to have a different mobile club prepare the column each month. This would "personalize" the column to a greater extent than if it was "edited" by one individual. Mobile clubs, or ham clubs with a mobile group are probably the most active in the hobby today. We felt that a report, by clubs, of their "doings" would make interesting reading—see what you think of this first column by the Evansville Club.

During the past thirty-five years the Amateur Radio fraternity has seen its hobby pass through many important and interesting phases. It began as ordinary wireless with noisy spark transmitters. Then, during the first World War, we witnessed the perfection of the vacuum tube, which, for the first time, enabled us to realize an input as high as fifty watts. Not only was the vacuum tube transmitter quiet and more efficient, but vacuum tubes made possible amateur radiotelephone where the male species at last could talk loud and long.

The automobile and amateur radiotelephone seemed destined to become a natural mode and phase of amateur operations. In 1934 W9AIN applied for and obtained an experimental license as W1OXDD for investigating the use of mobile radio at 31 megacycles. A 19-tube final amplifier and superregenerative receiver gave promise of a useful signal, but additional power and more stability was desired. The second phase employed a 35T final amplifier, with an Ultra-Skyrider receiver and was maintained in operation for several years. The frequency was finally raised to 160 megacycles, using a 815 final amplifier and a composite crystal controlled superheterodyne receiver. Frequency modulation employing a reactance modulator proved that reliable communication could be maintained for a distance of approximately twenty miles. The antenna mast was a 36-foot *Premax* vertical support mounted on the left running board. Pictures of this mobile installation in a



The Tri-State Mobiles in review. Representing approximately 25 per cent of the club's total membership, they are, from 'eft to right: W9KIE, W9KVL, W9HRH, W9SWN, W9SHQ, W9NAT, W9ZZY, W9GFS, W9AIN, W9KVE, W9CZF, W9MJV, W9RCD, W9MWM, and Skip Johnson, SWL.

1938 Plymouth panel truck appeared in many radio magazines.

The end of the second World War, the reopening of the amateur bands and the large surplus markets presented an opportunity for mobile operation for every amateur. W9MRR and W9BLF were among the first in the field to exploit these conditions, and immediately realized transcontinental contacts beyond their fondest dreams. W9ANG and the late W9KMI were building their mobile transmitters over in Mt. Carmel, Illinois, and their subsequent thirty-mile contacts into Evansville proved that ten-meter mobile operation was here to stay. W9THD constructed a highly efficient eight-watter, about which an article was ultimately published in *CQ*. W9MDX and W4LLR followed by devising mobile installations which excited much local interest; their operations proved both entertaining and useful during the extensive trips which their business necessitated. Another project was completed by W9AZJ, who returned from the service and converted his 31-megacycle police transmitter to 10. W9UIA followed his lead, using the same conversion procedure.

The **Tri-State Amateur Radio Society** began to hear more regarding mobile operation, automobile noise suppression and the merits of various types of installations. W9IMI in Boonville, W9GWL in Griffin and W4JQV joined the rush to share in the new amateur practice. W9NEC, W9BJZ and W9JUU were next to be heard. By the middle of 1950, W9KVK was licensed and went mobile along with W9AIN, W9GFS, W9KVL, W9ERN, W9JUH, W9UNT, W9DFD, W4NUQ and W9CZF.

In order that contacts might be more easily established, a common frequency of 29.6 megacycles was chosen. Spinning the receiver dial was thereby eliminated, and break-in was a certainty. This common frequency principle proved so beneficial that it has been continued to the present time.

A further determination of mobile capabilities was sought by W9ANG, W9KVK, and W9AIN who conducted a series of evening tests, using various powers, altitudes and antenna polarization. With the aid of W9FZX in Carmi, Illinois (now W7EUO), it was found that good communication could be maintained with twenty watts power over a thirty mile distance, but maximum cross polarization range was only 15 miles. Using a higher altitude at each end, W9KVK and W9AIN were able to establish 75-mile contacts on several occasions. These were from picked spots, while the cars were standing with the motor dead. W9ANG at Mt. Carmel could be copied and two-way contact maintained over a distance of approximately 35 miles with the units in motion at both ends. All of these tests were conducted on different occasions in order to determine maximum ground wave possibilities. W9KVK and W9AIN have logged ground wave fixed stations more than 100 miles in each direction from Evansville, although we were never successful in two-way communications due to cross polarization of antennas and the high noise level at the fixed stations. Louisville, Ky., Indianapolis, Ind., Edwardsville and West Frankfort, Ill. and Nashville, Tenn. have all been received on a mobile receiver atop a hill where the only noise was that generated by the tubes near the sensitivity limit.

W9QLW and W9KVE working in cooperation with the Evansville office of Civilian Defense approached the city officials with a proposal relative to the future emergency use of discarded 31-megacycle police transmitters and receivers. With the aid of Mr. Walter Schuler, head of CD communications, the city granted the **Tri-State Amateur Radio Society** twenty-five mobile transmitters and receivers. This equipment was to be loaned to club members for amateur use, providing they installed and maintained the equipment for emergency service. Almost immediately all were spoken for and by spring of 1952 had been installed. Since then, monthly EC drills have been held, and many simulated disasters carried out. Drills last from one to two hours with net control being alternated between various members. Simulating the disaster effect of mock floods, tornados, fires, enemy attack, and earthquakes, the local drills have been interesting and educative. Plans are now under way for a second fixed club station to operate on the lower frequency emergency channels for intercity connections. Evansville, Indiana, and the Tri-State section is well protected through amateur radio communications in case of an emergency. The mobile amateurs will be operating from their automobiles long after all other modes of communications are washed out. Just as long as there is a battery within reach or a little gasoline available, our amateurs will be able to operate. No matter what the cause may be, our aim is to provide the necessary communications the people may need.

A few other prominent mobiles who have participated in our program are: W9UMS, W9JTU, W9MJU, W9YPF, W9JUH, W9RCD, W9CVN, W9JLE, W9CGM, W9DGA, W4OGB, W4RYM, W9ZZY, W9BBN, W9BAX, W9KAH, W9DDV, W9HTT, W9MFT, W9MOH, W9KIE, W9MWM, W9EHU, W9JFJ, W9LXW, W9HRH, W9SWN, W9NAT, W9NJR, W9OVB, W9NZC and W9RDJ.

Another mobile activity which we are pleased to note in our section is that of the visiting mobiles. W4IWD visits us from Louisville almost monthly, and W4SWD, W9JYP, W9IXO, W8TFG, W8JBL and W4UKM travel this way regularly and have been contacted many times. W8KFT, W4VFA, W6LBU, W4NXN, W9PYK, W9ENQ, W8EMD, W9EQZ, W9ABG, W9EH, W9FYR, W4PFZ, W9NJE, W9EVC, W8BFH and W3QQZ have been contacted while in our vicinity.

Many of our members work a lot of mobile either in travel or on vacation. W9KVE has traveled to Florida and the west coast while working mobile: W9KVK and W9NEC, to the west coast. (The latter is now W6PKM.)

Five-meter mobile, circa 1934. The brain-child of W9FGS and W9TGT, it was the first, though dubiously successful, mobile in the Tri-State section

A few of the boys exhibit their direction-finding antennas. From left to right: W9KIE, W9UMS, W9EHU, W9KVE, and W9DGA.

W9JUH to Oklahoma, **W9IMI** to Texas, **W9CGM** to New York, **W9UMS** to the Rockies, **W9KVL** to east and west coast, **W9ZZY** to west coast, **W9JTU** to Florida and Colorado, **W4JQV** to Florida, **W9GWL** to the Rockies and **W9SWN** to the west coast. Many fellows have been able to work "back home" when the proper skip was present. A number of lasting friendships have also been established with local amateurs when entering a strange city. Highway directions, hotel and motel information have proved very helpful through amateur radio. Visits to other clubs while traveling have been an interesting diversion.

The **Tri-State Amateur Radio Society** is not a large club, although we count approximately sixty members out of some ninety licensed amateurs in the area. All members are active in club affairs and on the air. Almost all are now mobile equipped and get on at various times of the day or week. Our club, in addition to the Hamfest, sponsors other activities such as participating in Field Day, a two-day hobby show and a five-day Fall Festival each year. With the help of our XYL's and friends we have food provided for the Field Day, the Fall Festival and a large basket for the Hamfest. The XYL's also have their own monthly meetings where they play games, have picnics, or even have a speaker to talk on some subject of interest. **W9MOH** and **W9MFT** are the wives of W9KVE and W9JTU and both are active on the air mobile.

At various times a group of our mobiles have planned a week-end trip to other cities to meet other mobile operators. Amateur mobile has been employed on long trips to college football games and on short trips to IRE meetings which are held in Evansville and Owensboro, Kentucky. In case of car trouble amateur radio has proved a reliable help in securing gasoline for dry tanks, a push for a dead motor or a tool to repair some part of the automobile.

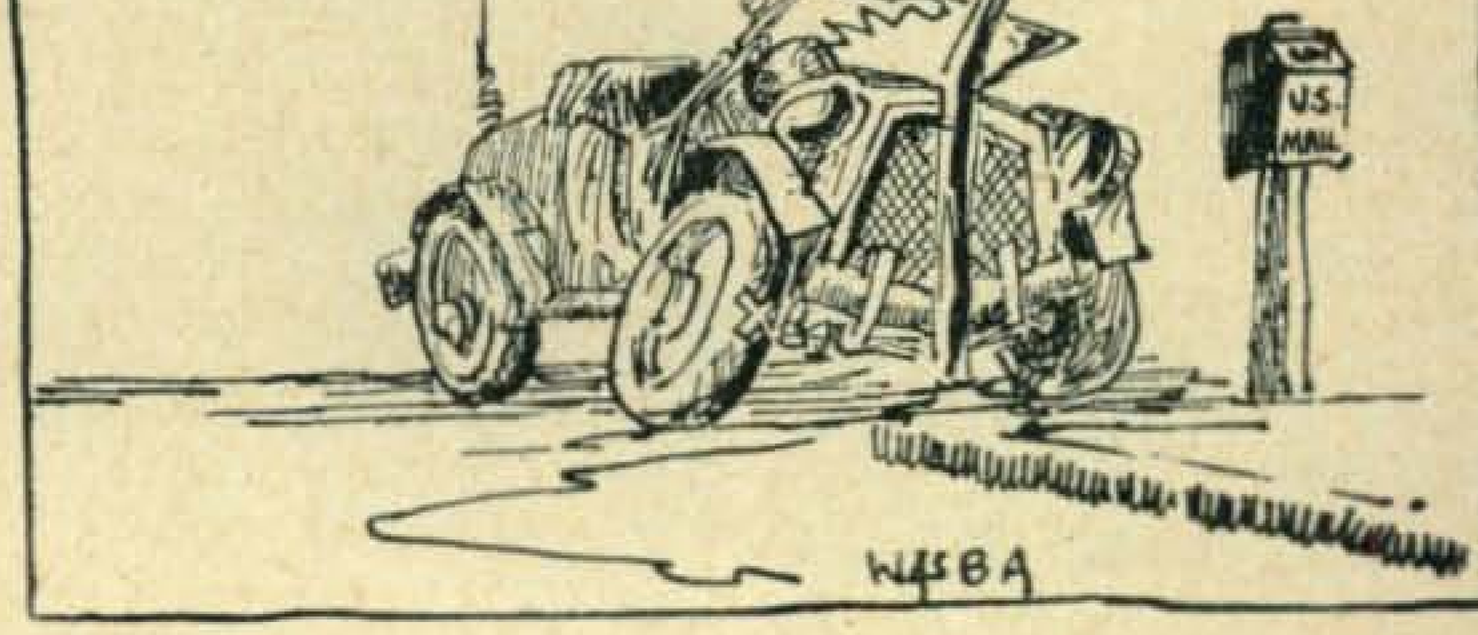
Hamfests and picnics have always been popular with the mobile amateur. Our mobiles always attend the V.H.F. picnic at Turkey Run State Park, the Indiana Radio Club Council picnic, the Mammoth Cave picnic and other not too distant gatherings. Fishing parties to Kentucky Lake, Crab Orchard Lake and Scales State Park are also in great demand by our mobile fraternity.

Our club annually sponsors a Hamfest in Evansville and for the past three years mobile interest has been the predominating feature. Contests such as measuring actual transmitter power output with a Bird wattmeter or for the best commercial and home built mobile are usually staged. Mobiles from over one hundred miles become our guests for a day and many friendships of the sight-unseen, r-f variety are made permanent at these personal meetings. Our club feels indebted to the many fine amateurs who annually visit us during our September Hamfest.

Our mobile gang of the Evansville-Henderson area have also had a great deal of fun during our annual mobile transmitter hunts. W4RYM and W4PKX engineered our last hunt in May of this year when the location selected was at the junction of the Green and Ohio Rivers. It was possible to arrive at this point from only one direction, although many dead-end roads came within a mile or so of the actual hiding place. W9EHU traveled the shortest distance possible, in an arc of 270 degrees, to win this contest in fifty-five minutes.* Then, after the prizes had been won, the mobiles were directed to the camp where they were plied with plenty of home-made ice cream and cake. They returned home tired, but happy and well fed.

Mobile operation has, in short, offered to us new fields for experimentation and development, and a welcome diversion from the everyday scheme of fixed operation. It is, in addition, an inestimably valuable community service—One more brilliant facet of our hobby of hobbies.

* Loop antennas are popular for such a hunt and work into the mobile converters with good efficiency. One 20-inch diameter turn of ¼-inch copper tubing connected at the open end with a 35 $\mu\mu$f. capacitor to tune to 29.6 mc. makes a good, rugged loop. A broom handle secured to the tubing opposite the tuning capacitor provides a means of holding the loop above the car while in motion. The converter is fed through RG-8/U, RG-58/U or similar cable and is connected at a point approximately four inches to one side of where the handle joins the loop. The outer jacket of the co-axial cable is soldered exactly at the handle juncture.



Don't Forget!

to watch for our feature *DX ISSUE*—

Next Month!

Ionospheric Propagation Conditions

Forecasts by GEORGE JACOBS, W2PAJ

3620 Bedford Ave., Brooklyn 10, New York

With the start of a new year it seems appropriate to review the trend in propagation for the past year, and see if we can hazard an opinion as to what the ionosphere may have in store for us during 1953.

In general, ionospheric conditions during 1952 were just about what one would expect during the years of declining sunspot count. The following table shows the monthly average sunspot counts dependent on observations made at the Zurich Observatory and its stations in Locarno and Arosa, Switzerland:

Month	Count	Month	Count
1951			
Nov.	52.4	April	28.8
Dec.	45.3	May	22.9
		June	36.2
1952		July	39.3
Jan.	40.2	August	55.0
Feb.	21.6	Sept.	27.0
March	21.2	Oct.	23.7

As we can see, in a period of a year, the average monthly sunspot count fell from readings in the fifties to values in the twenties. This drop in sunspot activity and its associated decrease in the sun's ultra-violet radiation had its effects upon DX conditions. Because of the decrease in ultra-violet radiation from the sun, the ionosphere was in a weaker state during 1952 than during any year since 1946. This resulted in increasingly poor high frequency reflections from the ionosphere. I believe everyone will agree that ten and twenty-meter DX conditions were considerably poorer during 1952 than during 1951. Although complete data has not yet been analyzed, it appears that forty and eighty-meter DX conditions were about the same as they were during 1951.

As for 1953; well, the sunspot count is still going down, and will do so for the next two years. DX conditions during the next two years therefore, are likely to be even more difficult than they have been this past year. I am preparing an article discussing the subject of sunspots and their effects upon Amateur Radio, which will appear in a subsequent issue of *CQ*. At this moment it is sufficient to say that generally, DX conditions during 1953 will be somewhat poorer than they were during 1952, especially on the ten-meter band and to some extent on the fifteen, twenty and forty-meter bands. East-west circuits, for example, U.S.A. to Europe or U.S.A. to Far East, will be more effected than will be such north-south paths as U.S.A. to South America or South Africa. Ten meters will open only for the north-south paths, twenty meters will be quite poor until April, then with longer hours of daylight, the band will pick up considerably until October. Fifteen meters should be fair until February and then will open only on north-south paths, until next November. Forty meters will be fair until February, pick up a bit on all paths during the latter part of February, March and April and become somewhat poorer during the summer months, as a result of higher atmospheric noise levels. Eighty meters will continue about the way it has been during November and December, until April, when higher noise levels will result in poorer DX conditions on this band.

With the poorest shortwave radio conditions of the eleven year cycle expected during this and the next year, these *Propagation Forecasts* can play an even more important role as an aid to you in determining the best periods for working DX. With this in mind, it is *CQ's* desire to expand somewhat the analysis covered in these articles. Since space is the restricting factor, a revision of the format may be necessary. We intend to let you, the reader and user of this information, decide upon it. For the past two years these articles basically have been composed of four topics:

> **Ionospheric disturbances are most likely to occur on Jan. 1, 14-16, 19-23 (severe), and 24-27. There may be unusual aurora conditions associated with the severe disturbances.**

1. Discussion of fundamental propagation principles.
2. Discussion of general propagation conditions.
3. Propagation charts for paths to all areas of the world, centered on Washington, D. C., St. Louis, Missouri, and Sacramento, California.
4. Ionospheric disturbance warnings.

I now intend to include the following:

5. Propagation charts for certain paths, centered on other areas within the United States in addition to the present ones.
6. For our overseas readers, propagation charts, centered on Europe, Asia, Latin America and Australia.
7. Discussion of extraordinary or rare DX paths that may open during a particular month.

Obviously it will be impossible to include all seven items every month in the three to four pages allotted in these articles. I therefore request that you drop me a card or letter, letting me know of your preferences among the seven topics mentioned as well as any other suggestions or recommendations that you may have. I intend to re-arrange the format of these articles to include as many of the topics in which your letters indicate an interest.

(Continued on page 65)

ALL TIMES IN E S T

EAST COAST TO: (Centered on Washington, D. C.)	10 Meters	15 Meters	20 Meters	40 Meters
Scandanavia	Nil	0900-1100 (0-1)	0800-1200 (2)	2000-23ι (0-1)
Great Britain & Western Europe	0900-1100 (0-1)	0930-1330 (2-3)	0800-1330 (2-3) 1330-1530 (3-4)	1700-2000 (3-4) 2000-0300 (2-3)
Balkans	Nil	0900-1100 (1)	0730-1230 (2)	1600-0000 (2-3) 0000-0300 (1-2)
Central Europe	0900-1100 (0-1)	0900-1130 (2-3)	0730-1400 (3)	1630-2200 (3) 2200-0300 (1-2)
Southern Europe & North Africa	1000-1300 (1)	0830-1430 (3-4)	0700-1300 (3) 1300-1700 (3-4)	1630-2100 (4) 2100-0230 (2-3)
Central & South Africa	0930-1200 (1)	0730-1400 (1) 1400-1530 (2-3)	0700-1400 (0-1) 1400-1700 (2-3)	1600-2330 (1-2)
Near & Middle East	Nil	0800-1000 (1)	0700-1100 (1) 1100-1200 (2)	1700-2000 (2-3) 2000-0100 (2)
Central America & Northern South America	1200-1600 (1)	0830-1500 (3-4) 1500-1730 (4-5)	0700-1500 (3) 1500-1900 (4)	1700-0730 (4-5)
South America	1000-1500 (1-2)	0730-1500 (1-2) 1500-1730 (2-3)	0700-1600 (1) 1600-1900 (3) 0100-0300 (1-2)	1730-0500 (3-4)
Hawaii	1400-1600 (1)	1230-1630 (1-2) 1630-1900 (3)	1200-1700 (2) 1700-2030 (3)	2200-0900 (3-4)
Australasia	Nil	1700-1900 (1)	0830-1100 (2) 1100-1800 (1) 1800-2000 (2)	0100-0800 (1-2)
Guam & Pacific Islands	Nil	1630-1800 (1-2)	1030-1230 (1) 1600-1930 (2)	0230-0730 (2)
Japan	Nil	Nil	1700-1900 (1-2)	0300-0700 (1)
Philippine Islands & East Indies	Nil	Nil	1700-2000 (0-1) 1000-1200 (0-1)	Nil
India	Nil	Nil	0830-1000 (1) EA	1730-2030 (0-1)E 0630-0800 (0-1) A
West Coast, USA	Nil	1200-1600 (2) 1600-1730 (3)	1000-1630 (2-3) 1630-1830 (3-4)	2000-2200 (4) 2200-0900 (3)

ALL TIMES IN C S T

CENTRAL USA TO: (Centered on St. Louis, Mo.)	10 Meters	15 Meters	20 Meters	40 Meters
Great Britain & Western Europe	Nil	0900-1100 (1-2)	0800-1400 (2-3)	1630-0300 (2)
Central Europe	Nil	0900-1100 (1-2)	0800-1200 (2)	1630-0230 (1-2)
Southern Europe & North Africa	1000-1300 (1)	0800-1400 (3-4)	0700-1300 (3) 1300-1600 (3-4)	1630-2100 (4) 2100-0230 (2-3)
Central and South Africa	0930-1200 (1)	0700-1300 (1) 1300-1500 (2-3)	0600-1300 (1) 1300-1630 (2-3)	1630-2300 (1-2)
Central America & Northern South America	1000-1500 (1-2)	0800-1500 (3-4) 1500-1630 (4-5)	0700-1500 (3) 1500-1800 (4) 0100-0300 (2)	1800-0600 (4-5)
South America	0900-1500 (2-3)	0730-1500 (2) 1500-1700 (3)	0600-1600 (1) 1600-1830 (3) 0100-0300 (2-3)	1730-0400 (3-4)
Hawaii	1300-1530 (1)	1200-1600 (3) 1600-1800 (3-4)	1130-1700 (2-3) 1700-2000 (3-4)	2100-0900 (3-4)

ALL TIMES IN C S T

CENTRAL USA TO: (Centered on St. Louis, Mo.)	10 Meters	15 Meters	20 Meters	40 Meters
Australasia	Nil	0930-1100 (0-1) 1700-1900 (1-2)	0900-1130 (2-3) 1130-1800 (1) 1800-2030 (2)	0130-0630 (2)
Japan	Nil	1730-1830 (1-2)	1600-1900 (2-3)	0200-0700 (2-3)
India	Nil	Nil	Nil	1700-1930 (0-1)E 0600-0730 (0-1)A
Philippine Islands & East Indies	Nil	Nil	1700-1900 (1-2) 1000-1200 (0-1)	0400-0800 (0-1)

ALL TIMES IN P S T

WEST COAST TO: (Centered on Sacramento, Calif.)	10 Meters	15 Meters	20 Meters	40 Meters
Europe	Nil	Nil	0730-1000 (2)	0100-0400 (0-1)
South Africa	1000-1300 (0-1)	0800-1030 (1) 1030-1300 (1-2) 1300-1600 (2-3)	0630-1230 (0-1) 1230-1400 (1-2) 1400-1730 (2)	1530-2000 (1) 2000-0000 (0-1)
Central America & Northern South America	1000-1400 (1-2)	0730-1530 (4-5)	0700-1400 (3-4) 1400-1730 (4) 0030-0230 (1)	1730-0500 (4-5)
South America	0900-1400 (1-2)	0800-1430 (2) 1430-1600 (3)	0600-1400 (1) 1400-1530 (2-3) 1530-1800 (3) 2300-0100 (1)	1800-0200 (3-4)
Hawaii	1300-1500 (1)	1100-1530 (3-4) 1530-1630 (4-5)	1000-1600 (3-4) 1600-1830 (4-5)	1900-2030 (4) 2030-0100 (1-2) 0100-0700 (2-3)
Australasia	1500-1700 (1)	1300-1700 (1) 1700-1830 (2)	0900-1100 (1-2) 1100-1930 (1) 1930-2030 (1-2)	2230-0630 (2-3)
Japan	Nil	1500-1630 (1-2)	1330-1700 (2-3) 1700-1900 (3-4)	2300-0800 (3-4)
Philippines & East Indies	Nil	1500-1730 (2)	1400-1900 (1-2)	0200-0600 (2)
Marshall Islands	1300-1500 (1-2)	1200-1700 (2-3) 1700-1800 (3-4)	1200-1800 (2-3) 1800-1900 (3)	2200-0600 (3-4)
Guam & Pacific Islands	1330-1530 (1-2)	1300 1730 (2-3)	1230-1800 (2) 1800-1930 (2-3)	0330-0800 (3)
East China (Hong Kong)	Nil	1500-1800 (2)	1500-1730 (2-3) 1730-1900 (3)	0200-0600 (2-3)
India	Nil	Nil	1700-1900 (1-2)	0200-0500 (1)

Symbols For Expected Percentage of Days of Month Path Open:

(0) None (1) 10% (2) 25% (3) 50% (4) 70% (5) 85% or more

Special Note: The letter "A" appearing after the expected percentage figures is used to denote that the azimuth of signal arrival will probably be best over the "Asiatic Path." The letter " E" denotes an azimuth favoring arrival over the "European" path.

Gathered by DICK SPENCELEY, KV4AA

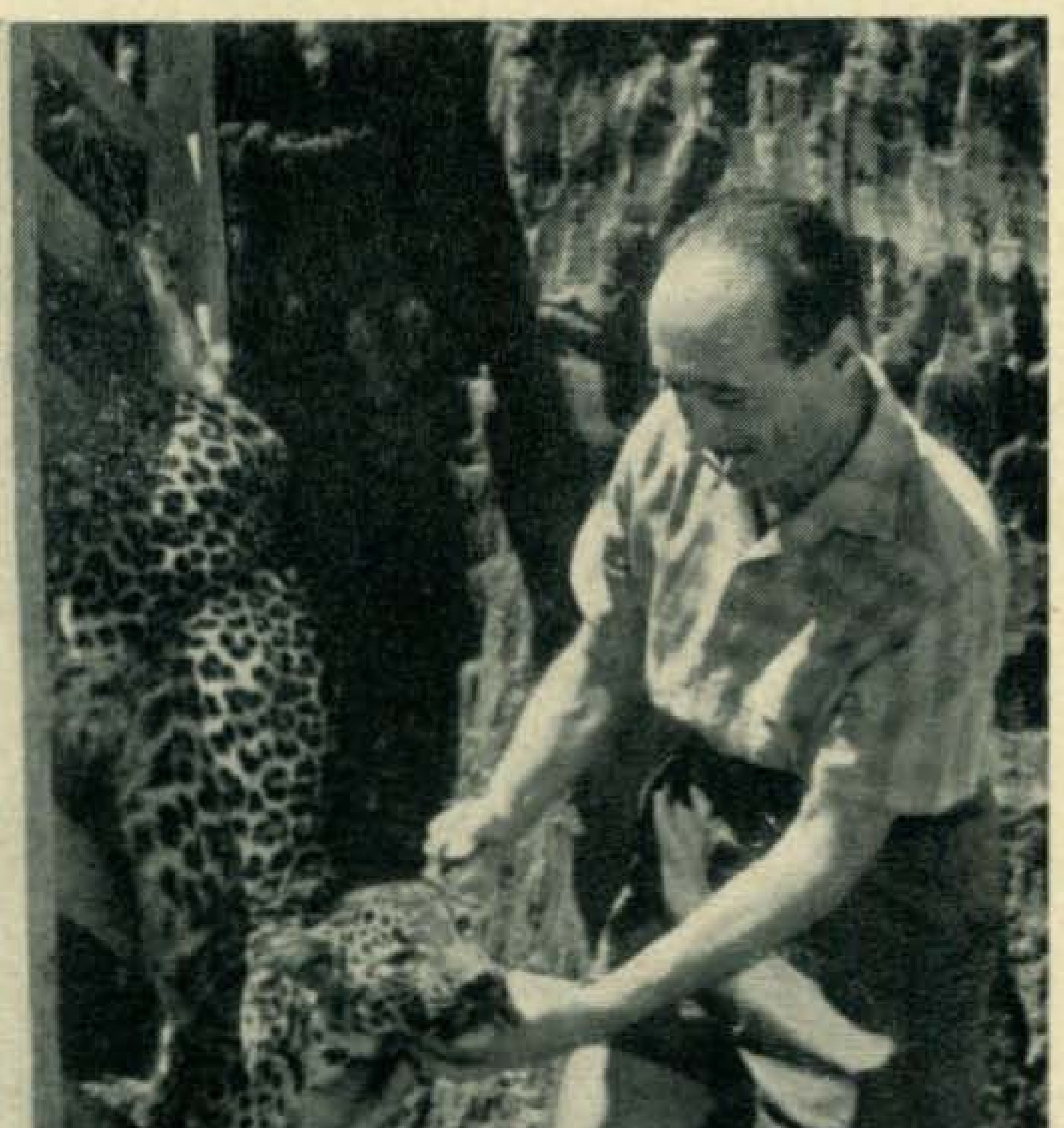
Box 403. St. Thomas, Virgin Islands

Our heartiest congratulations go to the following station upon achieving WAZ:

No.282 W6HJT Cam Pierce 40-203

Our very best wishes for a Happy New Year go to all DX'ers. May 1953 bring you many additions, DX and otherwise, and may your QRM be low!!

This is our first opportunity to say a few words on the CW portion of the recent *CQ* DX brawl which turned November 1st and 2nd into very busy days. Conditions seemed to range from fair to not-so-fair. The 14-Mc band, as usual, took a lot of punishment during daylight hours but collapsed early in the evenings. This was more than compensated for by the amount of DX showing up on 7 Mc.



Bob Oqnibene, ex-IIIR still does not have equipment to operate from Chandraghona (Chittagong) in East Pakistan. But Bob has switched from hunting DX to hunting leopards, with some success!

and the advent of that new, and very interesting band, 21 Mc., in contest competition. 3.5 Mc., from a Virgin Island viewpoint, was marred by large overdoses of QRN but plenty of business was consummated there with the help of such as DL7AA, G2PL, OK1MB, G5VB, DL1FF, PAØIP and G2VD. 28 Mc. activity was greatly curtailed for the probable reason that most stations felt that results there would not justify the trouble of QSY'ing. Outstanding on most bands were the signals of DX stations, to mention a few; 4X4RE, 4X4BX, 5A3TR, OK1HI, CE3AG, KH6IJ, KP4JE, KP4KD, PAØVB, ZL3OA, KC6QY, EA8AW, KZ5DE, ZL2KX, TI2TG, TA3AA, VP9BF, ZL1MQ, OZ7BG, EA1BC, ZS2A, ZC4RX, OE13HL, SP3PF, VK3HT, F3NB, CX1BZ, YU1AD and CE4AD. Each year sees this contest gaining momentum and it is generally agreed that it is *THE* contest of the year. Clean operating tactics were the rule and we won't be far wrong when we say a grand time was had by all. Final tabulation of scores is promised for an early date this year.

At Time Of Writing

MP4BAU, Qatar, has been active on 7012 kc. from 0030 to 0130 GMT. QSO's have been noted with W8BHW, W2CTO, W4CEN and W2LV. OK1MB usually acts as Master of Ceremonies. QTH has been received as: Adi Lawyer, Qatar, Persian Gulf, or, via RSGB. . . .Old QSO's for Qatar have been submitted for additions as follows: MP4BAM, 10/17/49, by W8JIN and MP2BH, 3/16/48, by F8BS. Better check your logs.

SV5UN has been active on Rhodes. He is W3CHV from the radio ship "Courier." Skeds are maintained with his brother, W3EWR, on 7010 between 0100 and 0300 GMT and on 14030 1300 GMT. See QTH's.

ZC5VS, Br. North Borneo, promises to be on 14-Mc CW very shortly. This apparently confirms the ZC5 prefix for this area, according to Fung, VS6CG, who has seen his license. QSL's may go via VS6CG. See QTH's.

ZS9I, Bechuanaland, has been quite active of late, handing out QSO's on 14, 7 and 3.5 Mc. See QTH's . . . .From W3GAU we hear that VU5RB will be active on the Nicobar Island group with 350 watts and beam. No date given. . . .From CT1CL, via W5ALA and the West Gulf Bulletin, we are informed that CT1GP is now active from CR8AB with low power. QRO will take place about the first of the year. . . . Via VK3CX we hear that Kashmir may be proclaimed a republic during the week of Nov. 22nd 4UAJ and 4UAK have been active there.

This is the neat set-up of Alfredo Quintana, CE3DZ in Santiago, Chile. Al is very well known to the DX fraternity and holds WAZ 40-190.

4UAG is presently active in Karachi, Pakistan. 14090 1130 GMT. See QTH's. . . .VK9GM, Norfolk Island, has been heard 14030 1130 GMT. . . .CR9AF T8 has been S8 here recently on 14010 1100 GMT . . . C8KP has been worked by a few. He gives his QTH as Box 102 Lanchow, Kansu, China. We await further word here to see if we have a Zone 23 possibility . . .OQ5AV, formerly in Elizabethville, has now moved to Usumdura, Ruanda Urundi. We await official notice of the change of prefix from OQ5 to OQØ for this territory. . . .CE3AG awaits official word as to when, or if, Naval vessel will leave for Easter Island this winter. . . .It will be Arnold, CE3CZ, who will accompany CE3AG, to handle the phone end and not LU3CZ as erroneously mentioned in Nov. CQ. Sorry.

Exploits

W8BHW hits 239 with YJ1AB, ZD7A, MP4BAU and VS2CE while **W8JIN** tags along with 238 by adding MP4BAM (Qatar), EA9DC, VS2BD, ZD7A, LB6XD and VS5ELA. . . .**CE3AG** ups to 232 with such as KAØIJ, SV5UN and FR7ZA. . . .**W7PGS** comes up to date with MP4BBD, LZ1KAB, LB6XD, FR7ZA, ZD7A and VP2GH to reach 197. . . .**W1JYH** eases to 217 with VS2CE while W6VE stops at 216 with MP4BBD, FR7ZA and ZD7A. . . .**W2HAZ** deletes PK4DA but remains even at 112 with PJ2AD. . . .**W5MPG** ups to 200 with VK1PN (Heard Is.). . . .**CE3AB** A3'd with 18 additions raising his phone total to 181. . . .Don, **W6AM**, finally nabbed LB6XD to reach 239. His phone total went to 165 with VP8AU and ZD7A. . . .**ZD7A** also rang the bell at **W6AMA** for No. 233. . . .**F8BS** is now 229 with ZD7A on 21 Mc. and MP2BH (Qatar '48). . . .**OH3OE** adds six for 118. . . .**W1NWO** arrives at 202, phone only, with VQ8AL and OY4T. . . .**W1MCW** continues to 198, A3, with FB8BA. . . .**W6RBQ** checks in with four new ones which put Bill on 213. . . .**KL7PI** ups to 160 with 6L6MY, VP5BF and HB1JJ/HE while Pat, **W2GVZ**, reaches 172 with ZD7A.

W3GAU goes to 238 with ZD7A while Ev, **KP4KD**, reaches 195 with same plus ZS7D. . . .**W5CKY** nabbed 4UAG, Pakistan. . . .**W5FXN** goes to 151 with VP8AU and KC6DX. . . .**W4TM** hooked CR8AB, 14100, 1600 GMT. . . .**W1BTE** skeds HR2ZE 7017 2400 GMT. . . . W4CEN snagged YJ1AB, M1A, MP4BAU, C8KP and SV5UN. . . .**W5AVF** added SP9KKA, ZS7D, CR5AC, HR1AT and ZD4AB. . . .Dottie, **W3JSH**, added six including VR2CG in the **CQ** Contest. . . .**W2DKF** nabbed ZD7A and VK9GM (Norfolk Is.) on 7020. . . .**VK3KB** overheard HZ1MY in contact with CR8LI, 14020. . . . **W3LPF** added ZS7D for a new one. . . .**W2CTO** hooked MP4BAU and 4X4RE 7 Mc. . . .Best stuff at **W4KE** were FQ8AR, FQ8AP, 4X4DF, IT1AGA, PJ2AD and FP8AP. Lloyd also nabbed VE7APL for his first W QSO from Canada. He is ex-G3MG. . . .**VK5BY** pulled in FQ8AR for No. 199.

21 Mc.

This band continues to show promise with openings more frequent and of longer duration as we come into the Northern Hemisphere winter months. More and more countries are appearing on the band and it is certainly pleasant to have relatively QRM—free DX QSO's in comparison with the goings-on on 14 Mc. We trust that a further exodus will populate this band, thus relieving crowded conditions on 14 Mc. until an optimum of activity is arrived at favoring DX work on both these bands.

TI2TG is now on 21 Mc. His first QSO was with W6NGA. . . .**W4COK** has raised his country total to 61 with the following additions: 4X4RE, ZK2AA, EA9AP, TI2TG, CN8MI, LA4K, ZS3K,GD3UB, YU3BC and ZB1CG. . . .**G3GUM** heard TA3AA working FR7ZA . . . .**GM3CSM** nabbed ZD9AA and KV4AA. . . . **G5RI** reports ZS8MK is building new rig for 21 Mc. 8MK operates from Maseru, Basutoland, in December . . . .**DL1FF** hooked OA4C and KV4AA. . . .**TI2TG** keyed with VR2CG (2030 GMT) and I1XK. . . .**VP7NM** is a newcomer to 21. . . .**W2WZ** nabbed ZD7A, FF8AG, CN8MI, YV5DE, OQ5CP, ZE3JO, ZS3K, I1IT, LA9C and an OE during contest. . . .**W3AYS** spent entire contest time on 21 making 80 contacts in 17 zones and 35 countries including TA2EFA and HZ1MY. Just missed were CR7AL, ZK1AA, ZLIMQ and VR2CG!!

21 Mc. Countries worked:

W4COK	61	DL7AP	37
G3GUM	53	G6GN	36
G8KP	50	KP4KD	32
PAØKW	46	W6DFY	31
G2VD	45	G8OJ	31
W2WZ	43	G5BZ	26
G6QB	42	GC3EML	26
W6VX	42	TI2TG	23
KV4AA	42	G3FXB	21
G2BJY	41	G3AJP	21
GW3AHN	41	TA3AA	20
W4KRR	40	W5FCD	17
W3AYS	38	DL1MN	17
G5RI	38	G3ABG	16
CE3AG	38	VK4FJ	13

Photo by W6MUR

Bob Hanley, ZK1BC, Rarotonga, Cook Islands has been mighty generous in handing out QSOs from this rare spot on the globe. Bob is noted for his excellent fist and the electronic key seen on the operating table. Bob is back in ZL-land.

160 Meter Notes

A reminder: 160 Meter DX tests will be held on January 11th and 25th. For further details see the note on page 37 of the December CQ.

In answer to a query from G. C. Allen, Surrey, England. (Call not given) **W6AM** advises that he will be on 160 meters during the ARRL February and March contest. This will give Don four week-ends on that band in which he will attempt to work as many stations as possible.

We wish to remind foreign listeners that U.S.A. stations east of the Mississippi River are allotted the following frequencies on 160 meters: From 1800 kc. to 1825 kc. and from 1875 kc. to 1900 kc., while stations west of the Mississippi River use from 1900 kc. to 1925 kc. and 1975 kc. to 2000 kc. Stations in KZ5, KP4, KG4 and KV4 are allotted the latter frequencies. W6AM may be usually found on 1997 kc. and KV4AA will be found very near 1898 kc. for all tests.

Re. 1951 CQ World Wide DX Contest Results

Dear OM:

"First, on behalf of the DX committee, let me apologize for the results appearing so late. This job of checking Contest Logs and then finally tabulating the results is no picnic, and not a job for the inexperienced. Originally W6PQT, who had plenty of time on his hands, volunteered to do the entire job. Unfortunately, he became ill and had to drop this work, but I am very happy to say that Mac, although in a sanitarium, is getting along fine.

"After some delay in arriving at a solution, W6IBD volunteered to get a group of DX men from the Southern California DX Club and tackle this extremely important piece of detail work. These boys dug in with both hands and we can certainly thank them for getting the results published.

"Now that the machinery is functioning I will guarantee the results of the 1952 contest will be earlier, by several months. Although W6ENV has been my right-hand man in all this DX work, our business traveling plans prevent us from devoting too much consistent time to the detail work of Log checking although, of course, our close association with W6IBD we know will not leave anything lacking.

"Once again let me heartily thank the boys in the Southern California DX Club for their help."

73, (signed)
Herb Becker, W6QD
DX Committee Chairman

Fourth from the left in this photo is F9RS, then F8BO and then F3YL his wife. (But who's that in the number three spot? Ed.)

Here and There

Some sort of Russian contest was heard on the morning of Nov. 17th. **UI8KAA** and **UR2AM** put in S8 signals here but refused to answer calls outside of the "WSEM" bloc. Those boys are missing a lot of fun. . . .**W9FID** advises that the CALLBOOK will soon come out with a DX section. Thus DX QTH's may be kept up to date at less cost. . . .**VS9AD**, Aden, Has been heard by W4CEN, 14100. See QTH's. . . .Bob, **W9NN**, returned from an 8000 mile West Coast trip where he met W6SYG, W6CG, W7AH, W7JYZ and many others. Contacts were maintained on all but four days via a mobile rig with W9OAV A3. . . . **VK7RK** seeks to complete WAZ with FF8 contact. . . . **W3CRA's** rig was visited by lightning while Frank was away. It did nasty things to his HRO and other gear. . . .**VK3YP** will be operating from Garbutt, North Queensland with VK4 call. . . .**W4BRB** nabbed an OE13 on 3.5 and a 'touch and go' QSO with ZS9I, same band. . . .**OQ5LL** is back on air in new QTH 400 ft. over Congo River. . . .**KZ5BS** is ex-W5NEO/W6PGA . . . .**W2KDS** visited KV4AA and W2AOX is expected shortly, also W8EWS. . . .W4IKC/KH6ARC/KW6AR is now **KZ5IL** with CAA in C.Z. . . .**W3NGV** is ex-W6CNX . . . .**VR1A** visited KV3CX. . . . **FQ8AP** changes QTH and is now in Fort Archambault FEA. . . .**TA3AA** blames low contest score (!!!) on his directional rhombic. . . .**K6DL** is ex-W5OM. . . .**VK7RK**, Ray, takes the W.I.A. DX column over from VK4QL for a couple of months. . . .**G3AAT** will set up shop in Greenland . . . .**W4JUJ** rec'd BERTA Certificate No. 625. . . . **VP9BF**, very active in contest, is W3PDX. . . .**TI2TG** got his QSL returned from VS4AC with a notation that no VS4 has been active there since 1946. . . .

The Oct. issue had KP7LI scaling mountain peaks. This should have read "FN8AD". Joe tells us that walking upstairs is enough trouble. . . .**KV4AQ** is dickering for a kw-rig via W4GHP. . . .**W6BES** has been getting a bunch of QSL's for HL1SP. George has no info on the guy. . . .**KJ6AW**, ex-W7NFY/WØECY, writes he is very active on 14210 A3 and will be on Johnson Is. until March 1st. Other active KJ6's are KJ6FAA, who mostly handles traffic to KH6, and KJ6AV, who operates now and then. KJ6AW, Shell, runs 500 watts to PP 810's with 810 modulator. . . .**KC6DX** is now in Memphis, Tenn. All QSL's to W4LRO please. . . . **DL2RO** is G2DC while **DL4JN** is W4LAP. . . .**W3AS** rec'd DUF certificate.

QTH COLUMN

MP4BAU	Adi Lawyer, Qatar, Bahrein Island, Persian Gulf.
SV5UN	(W3CHV) via W3EWR.
VS9AD	Flt. Lt. Dave Hicks, Officers Mess, R.A.F. Tarshyne, Aden
ZC5VS	(Sandarkan, No. Borneo) F. S. Hugh. QSL via VS6CG
ZS9I	Near Maun, Bechuanaland. QSL via S.A.R.L.
4UAG	P. O. Box 486, Karachi, Pakistan.

Second Edtion of the TRIPLE CHECK DIRECTORY

Certainly one of the most unusual publications to come to our attention is the Greater Dallas-Fort Worth Area "Triple Check Directory." This slick paper 52-page booklet is a survey of about 1250 Hams encompassed in a 75-mile radius centered on Grapevine, Texas.

The idea is to present for each and every amateur in that area a complete listing of operators, QTHs, phone numbers and operating habits or activities. Then the operators are listed by last names, the clubs are listed, the organized nets and finally all the calls by towns. If you're careful you can also pick out the fellows with phone patches!

W5RHW, W5TDM and W4FWT deserve a lot of credit for the time and effort put into this publication. It is certainly very sorely needed in many communities plagued with CD problems. The cost of the booklet has been absorbed by advertisers including; Bill Sutton's in Fort Worth, Crabtree's in Dallas, The Adleta Company, Andrews Towers and Wilkinson Brothers.

Copies of the "Directory" are available at 10c in coin from the Amateur Radio Directory Committee, 3632 Bellaire Dr. N., Forth Worth, Texas.

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- PRECISION INSTRUMENT DESIGN AND CONSTRUCTION.

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POWER UNIT: 5⅛" wide; 6⅛" high; 7½" deep.

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- For measuring capacitance, inductance, Q, mutual inductance.
- For preliminary tracking and alignment of receivers.
- As an auxiliary signal generator; modulated or unmodulated.
- For antenna tuning and transmitter neutralizing, power off.
- For locating parasitic circuits and spurious resonances.
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W6AM	239
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W3GAU	238
W8JIN	238
W6GRL	237
G6RH	237
W3KT	237
W8NBK	237
W6SYG	237
W6ADP	236
W6MEK	236
W3EVW	236
W3CPV	235
W7AMX	235
W2AGW	233
VE4RO	233
W6AMA	233
W6MX	232
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W6FSJ	222
W6DZZ	222
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W6PB	221
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W6TT	218
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W6RW	209
W6EFM	209
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W6DI	204
W6PKO	204
VK2DI	204
W6AVM	204
DL7AA	204
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W6IBD	202
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VE5JS	200
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W6SRF	198
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W6BAX	197
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OK1FF	194
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W4CYY	174
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W6NTR	173
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W6WWQ	172
PY1ARL	171
OK1HI	171
VK2HZ	171
W6BAM	170
DL1AB	170
W6PZ	169
W5AFX	169
G2VD	169
W6JZP	168
W6ANN	167
VK3CN	167
W6BVM	167
I1XK	167
W6DUC	166
KH6MI	166
W6CEM	166
W6JK	165
VE7GI	165
W6LRU	165
W6RZE	165
W6PM	164
ZS6A	164
W6EAK	163
W6YZU	163
G5GK	163
VE7VO	162
ZS6DW	162
I1IR	162
W6PDB	161
OK1SV	160
VE3EK	160
W6PUY	160
JA2KG	160
KH6MG	160
W6ATO	160
WØFFV	158
W6CYI	157
WØOUH	157
G3TK	157
W6BUY	157
W6QD	157
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W6KEV	154
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W6FHW	153
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KP6AA	152
VK2QL	151
VK2AM	151
W6LEE	150
W6FHE	150
W6EYR	150
W6LER	150
OK1CX	147
W6LS	147
W7KWC	147
KH6PY	147
W7DXZ	146
W6AYZ	146
W9NRB	145
VE6GD	146
W6MUC	145
OK2SO	145
ON4TA	144
G3BI	144
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KG6GD	143
W3IXN	141
W6AOD	140
VK2PV	140
W6ONZ	139
W6ID	138
ZC1CL	138
OK1WX	135
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W2ZVS	129
W5KC	128
W4LZM	124
W6UZX	123

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Input Voltage	Output Voltage	Output Current in ma.	SPECIAL PRICE
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5.8	375	325	35.00
5.8	600	175	29.50
12.3	375	325	39.50

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Input Voltage	Output Voltage	Output Current in ma.	SPECIAL PRICE
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6.0	600	270	35.00
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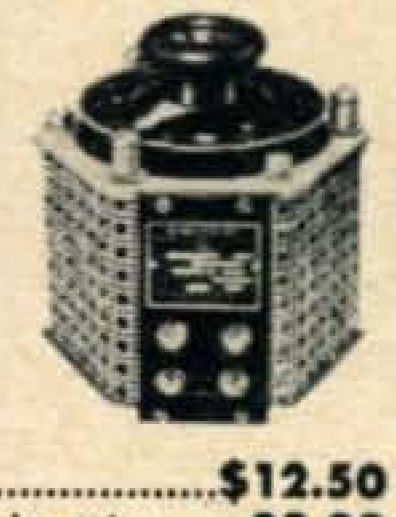

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NOVICE SHACK

(from page 32)

me a subscription as a birthday present.

"I have been paralyzed since birth, and I enjoy listening to Hams on my S-38B receiver and sending them reports. Will you print a request for Hams to exchange QSL (confirmation) cards with me? 73," Lou—J. L. Schuh, 907 West Main, Russellville, Ark.

Bob, **WN4VKE**, calls attention to a serious problem. "OM, Just the other day, I worked a WN9. He gave me the T9X report (meaning 'Your signals are extremely steady and have a pure tone'—Herb) I was expecting. As soon as I finished this contact, another WN9 called me. He told me that my signal was T7C ('moderate "hum" or ripple modulation on the signal, which also has a keying chirp'—Herb). He further told me that my signal had sounded the same during the previous contact.

"I have now corrected the fault. But I would like to emphasize the importance of giving accurate reports. The first one made me feel good, but I would prefer the truth. . . . Transmitter is a **TR-75-TV2**. Receiver is an **S-40B**. Have worked forty states, with thirty-eight confirmed"—Bob, WN4VKE.

While every Ham should give as accurate "tone" reports as possible, as it may save someone getting an

WN9QQK/8 (Home location: Chicago) operating portable last fall in New Era, Michigan. Transmitter is a converted BC457, with 75 watts input. Receiver is an NC57.

FCC discrepancy report, FCC regulations definitely require that every amateur must have and regularly use monitoring equipment to insure that his transmitted signal meets all legal requirements. See page 39 of November, 1952, CQ for a description of an excellent monitor.

Bill, W4VUA, Kingsport, Tenn., has been a busy boy. "Dear Herb, I was a Novice 4½ months before getting my General Class license. I made my 500th contact the day I got the new license. I worked forty-four states, VE2, VE4, WP4RE (Puerto Rico) and VP7NV (Bermuda). Transmitter runs forty watts input, antenna is a folded dipole constructed of 300-ohm ribbon, and the receiver is a home-built one. Are there any challengers of my Novice record?——Bill, W4VUA.

David, **WN4WDI**, has a record to boast of too. "Dear Herb, The other night, I worked YV5ES, Caracas, Venezuela, on a frequency of about 3702 Kc. I wonder if this isn't the first YV/WN contact. It started at 8:40 P.M. and lasted until 9:04 P.M. . . .I have also worked thirty-one states, VE2, and VE3. Rig is a converted **BC 457**, with fifty-five watts input into a ½-wave doublet, forty feet high. Receiver is an **HQ 129X**. . . .I am fifteen years old and am now waiting for my General Class license. Oh yes. Cast my vote against Novice bands on the 7-Mc. and 50-Mc. bands—David, WN4WDI.

Phil, **WN9SNI**, writes, "Dear Herb, I thought I'd send you a picture of my station. Although I have had my call since last April, I haven't had much chance to use it, because I am in the Army, stationed at Ft. Knox, Ky. Do get home to Indianapolis on weekends. So far, I've worked thirty-two contacts in six states. . . . For the 3.7-Mc band, I have a **TR-75TV**, which permits me to run sixty watts input, without TVI, a ½-wave "Zepp" antenna, and an **S-38B** receiver. For "two", I run thirty watts into a small transmitter and use a **Sylvan** converter in conjunction with the **S-38B** for reception. . . .I expect to take my General Class exam next spring, if I am not shipped out of the country before then. I'm taking a course here in Armored Radio Maintenance, which should be helpful, if I ever want to convert some **surplus** equipment—Phil, WN9SNI.

Bob, **W9SQP** is puzzled. "Hi, Herb, I think that there has been a joke somewhere. . . .I **have** retired my BC 454, but not in favor of an S-38B. It is an S-53A that I have. Also, I have had my General Class ticket now for a month. I can't recall writing to you and telling you that I took the exam. I think one of my friends around here wrote to you or something, cause I didn't. I'd like to know who it is. Some mystery, hi." (A mystery is right. Bob must have had his eyes shut when he wrote the last time and didn't see what he wrote. Anyway, both letters are in the same handwriting—Herb.) . . .By the way, do you know of any **WN's** on 27 Mc. That is about the deadest band, is it not? I've never heard a soul up there"—Bob, W9SQP.

Just to prove that the **Novice Shack** is always on the job, I want Bob to meet Penny, WN4WYA. "I am faced with the problem of 27 Mc. I have a **Lettine 240**, and it is comparatively easy for me to get on 27 Mc. . . .It would cost about ten dollars, but it is foolish to spend the money if no one else is on eleven meters. I am hopeful that through your column I may contact some one on the band or, at least, some one who is interested in it"—Penny Cassels, **WN4WYA**, 733 Ideal Way, Charlotte, N. C.

Actually, there are many Novices whose transmitters will operate on 27 Mc. Unfortunately, most of them listen on the band and, hearing nothing, do not get on it. Of course, the band is dead much of the time, especially at night. But, as I have pointed out before, any time the 28-Mc band is open, the 27-Mc band is also open. Just as a suggestion; Novices interested in 27 Mc. might concentrate on the band on week-ends.

Ruth, **WN1WED**, wrote such an interesting letter commenting on things **Novice**, that I wish I could quote it verbatim. Instead, let's sample it here and there. "Dear Herb, The OM and I have decided that the reason it is so hard to raise Novices unless you are right on their frequency is that most of them use their receivers to monitor their sending. The OM solved the problem here with a monitor operated by a relay. When I throw the send-receive switch, the following happens: switches antenna from receiver to transmitter, disables receiver, applies plate voltage to the transmitter and the monitor (which is powered from the transmitter), and transfers the phones from receiver to monitor. We use phones most of time, because house noises do not interrupt our contacts, nor does the code disturb the junior operator.

"Then there was the old timer—since 1912—who, when he heard my call asked, 'What is the N for?'

"I am heartily in favor of mailing QSL cards in envelopes. Besides protecting them, the Post Office will return undelivered ones to you instead of destroying them, if you include your return address on the envelope. Also, I think you should mention that the Post Office would be pleased, if not delighted, to receive one of those "Change-of-Address" cards from every ham, with his call listed as the "old" address and his full address in the new-address space.

"One feature of our station is that all power circuits come through one "emergency" switch. Throwing it shuts off all equipment. Very helpful in preventing burning out the soldering iron or some other piece of equipment when one gets called to the phone. Also, we have the radio area separately fused. If we pop a fuse, we are not in the dark. . . .The OM and I each build our equipment. I use a 6AG7—1625 on 3.7 Mc. It also tunes up nicely on 27 Mc. The receiver is an **HQ 129X**. Although I can get on the air any time, I confine my operating to the less crowded hours, to reduce the interference for those who can only operate in the evening. So far, I've worked six states . . . .The OM and I expect to go up to Boston next week. He to take his Novice exam, and I to take the Technician one—I'm still not quite sure enough of my code to try for my General Class license. . . .This is the end of my tale. And a long one it has been. I always enjoy reading of the experiences of other Novices. I hope they enjoyed hearing something of us"—Ruth Ann Parker, WN1WED.

Mick, **W5UTE/4** gets around. From Jackson, Mississippi, he wrote, "Hi Herb, I am now ex-WN5UTE. I worked thirty-eight states on the 3.7-Mc Novice band, running twenty to thirty watts. Antenna was a coaxial fed doublet, twenty-feet high. Receiver an **SX28**. I have a thirty-five WPM code certificate that took me

three months to get. I am fourteen years old. I am now on 7 Mc. with 150 watts input to a BC 458."

Mick's next letter came from Tallahassee, Florida, to continue the story——twenty-eight countries and nineteen zones worked on 7 Mc. Now, he is going to 14 Mc!

Question Box

Dear Herb, Some time ago, I asked you for some help in eliminating my second harmonic. Your suggestions did the trick. Now, I have another problem: BCI. Everytime I press the key, the broadcast receiver blocks or whistles like the dickens. The transmitting antenna is about twenty-five feet from the broadcast receiving antenna at the closest point.—W5TLQ

Ans. A wave trap installed in the receiving antenna as close to the broadcast receiver as possible and tuned to your transmitter frequency should reduce or eliminate the trouble. Wind thirty turns of No. 22 to No. 28, insulated wire on a 1½-inch diameter form and connect a 150-$\mu\mu$fd. variable condenser across it. Connect in series with the antenna lead and tune for minimum interference. Once adjusted, it will not require readjustment, unless you disturb it or change frequency an appreciable amount.

Fellows and Girls, your letters and pictures are what keep the **Novice Shack** going. Keep writing. I read every letter and answer everyone I possibly can. Especially needed are pictures of you and your station. You don't have to have an elaborate, expensive layout for a picture of it to be interesting to other Novices. We all suspect what can be done with a $500 receiver and a $1,000 transmitter. And all hams dream of having something at least that good. For the **Novice Shack**, however, we will be happy with something a little less elaborate.

And you 146-Mc operators; do not be so bashful with pictures of your stations.

Until next month. 73, Herb.

Inside the Shack and Workshop

Call Letter Sign

An extremely neat and attractive call letter sign for the amateur station can be made from wooden letters of the sort that may be purchased at the local 5 & 10. These wooden letters and numerals, which are usually 2½-inches high and ½-inch thick, are intended as toys for children and cost little.

The neatest way to mount these letters is on a ½-inch wide strip of ⅛-inch thick wood, which should be eight inches long for the average two-letter call and ten inches long for a three-letter call. The bottoms of the letters may be fastened to the wood strip by gluing or by running small flat-head wood screws up through the wood strip. When completed the call letter sign may be painted with black enamel.

As an alternate method of mounting, the letters may be glued or nailed to the face of a board and the sign fastened to one of the masts or the outside of the shack. In that case the board is best painted a light shade and the number and letters enameled black, so that they will stand out effectively against the background.

Charles Felstead, W6CU

A Correction!

THE JUNK-BOX JEWEL

(November, 1952—page 47)

The value of filter choke T2, not shown in the parts list, is 10h., 90 ma.

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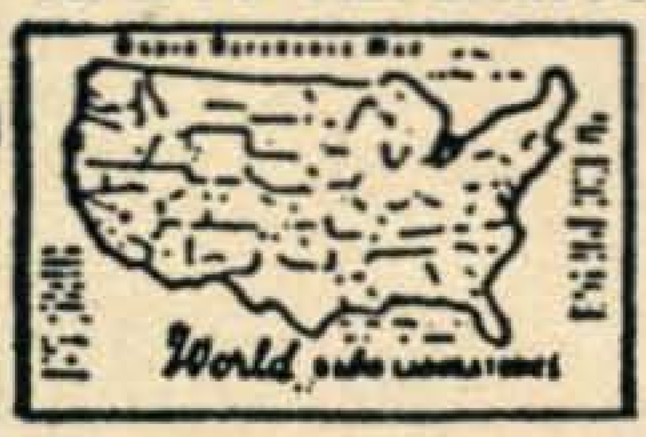

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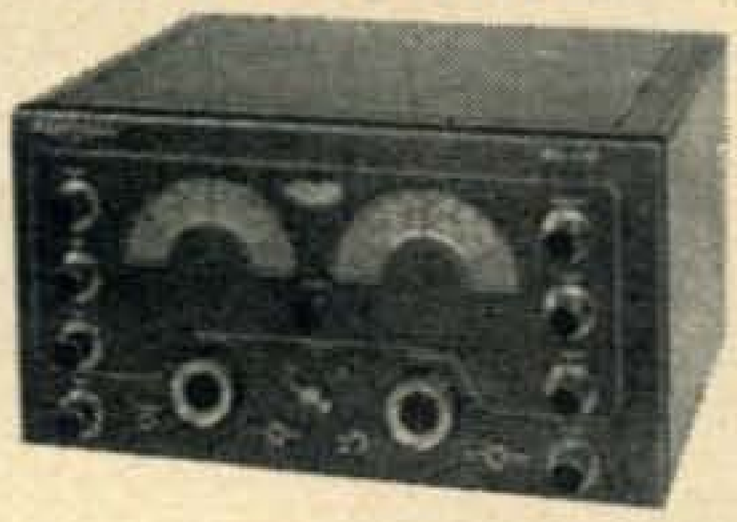

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- ☐ HRO-60 Info
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Address________
City________ State________

AMATEUR TELETYPE

(from page 30)

which have been made available to us, since they were built for receiving only, and had no keyboard. Several of the gang have been hard at work trying to solve this problem. The other day I found a message on my printer from W2BFD to the effect that he had finally come up with a workable solution. His message to me had been typed with a *converted typewriter.* John had invested in an old beat-up scrapped Remington Standard typewriter. He bought the thing from a typewriter shop for three dollars; though he should have paid no more than a dollar. He took off the top, leaving only the keyboard. Under each key, he mounted a small brass screw for a contact so that the key levers would hit them when pressed. All of the contacts were wired to a set of five selenium rectifiers which he made from one single $1.20 selenium unit. These rectifiers formed a matrix to present the transmitting distributor with the correct teletype code for each letter.

The transmitting distributor still remains a problem. John used the one built into the tape equipment for use with the tape transmitter.

WOCIH

Let me introduce you to one of the new members of the teletype gang. He is Paul Leslie, WØCIH, of Superior, Nebraska. Paul ordered his model 12 printer from W2BFD about three months ago, and has now received most of the equipment. He is 28 years old, still single, avidly interested in amateur radio and runs a radio and TV sales and service business. He is a college graduate (E.E.) and own his own plane, complete with a 75-meter rig. On of his other hobbies is photography.

He has a pair of 826's on 10-6-2 meters runnin about 250 watts, complete with beam antennas. Fo the lower frequencies there are assorted transmitter and a Globe Champion for 75 meters and the 408 kc. MARS net. Receiver is a NC-183D. Paul is no hard at work on the receiving converter for th teletype machine and expects to get it finished b the time the filters come from New York and th remainder of the printer arrives. What Paul want most now is some interested amateurs in his vicinit to compare notes with and to help run tests.

Miscellaneous

Quite a few of the members of the *Teletyp Society* are active on 75-meter phone. I found thi out in the Sweepstakes Contest, a yearly ARRL promulgated chaos, which roared through the band recently. The first station I heard coming throug from California was W6EKO, one of the RTTY'er and he was calling me. Soon afterward I contacte W5MYI in New Mexico, W9SKF in Wisconsin, an a host of others. W6AM was hard at work rolling u the points, but he did admit that he might try RTT soon. Word has arrived from WØBP to the effect tha he now has his VT keyer going (this is the uni described in the April 1952 *CQ*). As he says, ". . .i is so quiet it almost takes static out of the receiver." Commenting on the lack of amateur teletype o the low frequency bands, a sore point with thos hundred or so stations that have been all set to g for almost a year now, he points out: "I hav

(Continued on page 56)

HARRISON HAS IT! MILLEN GRID DIPPERS

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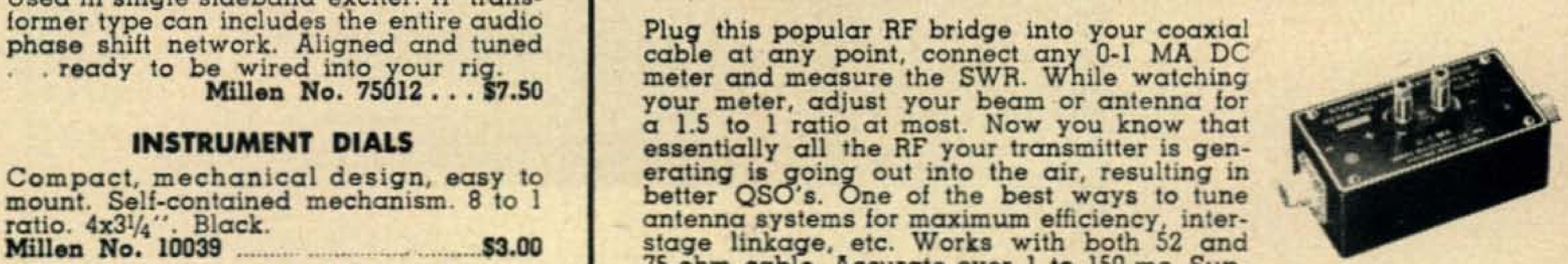

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3½" diameter dial.	No. 10008.	$1.14

STANDING WAVE RATIO BRIDGE

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(from page 54)

watched millions of nimble brown foxes leap over poop-tillions of indolent dog's vertebrae until I am just as tired. I would settle for any lowly louse stumbling over a housefly if a legitimate ham was the cause." Amen.

W6NWM, too, has installed a VT keyer, but with a few changes. Johnny has rewound the printer magnets so that they have about a thousand ohms d-c resistance, a much better figure to use with tubes. He used number 40 wire for the selector magnets, and 38 for the start and operate magnets. The keyer tubes are 6BL7's, which are twin triodes. Four of them in the circuit allows one extra triode to operate the tape advance magnet for tape work. Now his machine operates noiselessly and can be used for a mill to copy 40 meter CW.

One other hint which Johnny brings up has to do with his receiving converter, a unit similar to the W6AEE converter described last month. He suggests the use of a pair of .006 μfd. condensers connected from the grid of one 6V6 to the plate of the other, multivibrator style. This is supposed to help prevent chatter in the polar relay, giving a more positive contact from mark to space, thereby reducing noise.

I don't as yet have the details, but it seems that some of the gang that have the more modern printers such as the model 15, 19, and 26, the printers which have only one magnet, are able to operate this magnet directly from the 6V6 d.c. amplifier in the converter without needing any polar relay or flip-flop circuits.

W8HP and W8BYB are still going at it hot and heavy up in Detroit, using tone modulation. They use AM tone on 11 meters and FM tone on 10 meters, with most of their work on 10 meters.

Model 21A printers are still available from W1AFN and W6CLW. Proscrastination is the thief of teletype machines. Go ahead and wait until they are expensive, if you want to.

Every now and then I get a letter from some one asking about reference books on teletype. However, until a few days ago, I had not yet found any. Then W2ZU sent me a copy of the Army Technical Manual: "Installation and Maintenance of Telegraph Printer Equipment." This book may or may not be available, but I suggest you get in touch with the Gov't Printing Office in Washington, ask for TM-11-353 and see what happens. The manual does

(Continued on page 58)

(from page 56)

not go into the older machines such as the model 12, but it certainly does a fine job on the basics and later models. Those of you with friends in the Bell Company may be able to persuade them to get you one of the small pocket maintenance manuals which they have for their teletype repair men.

Frequently I get letters from men who are at present working with teletype, either for a private company, or the Government. These gentlemen almost invariably want to know where they might get an old printer, something such as a model 14. Ha! Many of them have never seen the model 12, since it has been retired by most of the wire companies for several years. Let me make this clear: There are a few of the newer model teletype machines now in use in the amateur ranks, but most of these came from war surplus, which is long gone. All of the presently available machines are the model 12, a perfectly good machine, if a bit aged.

Tone Frequency Standards

The difficult part of making a standard for the two teletype tones is in getting the original callibration. There are, however, several methods of finding these tones.

The two frequencies used for teletype work are 2125 cycles and 2975 cycles. These two tones have a special relationship which makes them quite satisfactory for such work. They are not any multiple of each other, therefore distortion caused by fading cannot change one into the other. They are both multiples of 425 cycles, the mark signal (2125 cycles) being the fifth harmonic, and the space signal (2975 cycles) being the seventh harmonic. Thus, one good way to make a standard for the tones is to build a 425 cycle oscillator.

A good source of this frequency would be the tuning fork, if it were available so tuned. Since it isn't, here is a fairly simple method of tuning the fork: Get two tuning forks, one for a standard and one to be adjusted. Also get a clock with a sweep second hand. Forks of 426⅔ cycles are generally available since this is "A" of physical pitch or Diatonic scale. These forks may be purchased at scientific supply houses for as little as $1.50.

The frequency of one of these forks may be reduced by filing at the base between the tines. Use a small round file, and make frequent checks against the standard fork. When adjusted to exactly 425 cycles there will be 100 beats per minute against the 426⅔ cycle standard. Good quality forks have a duration of well over a minute, but if yours do not have a long duration, they may be tuned for 25 beats in 15 seconds. Once you have the fork tuned to 425 cycles, you should be able to synchronize the teletype tone oscillator with it.

Many of you may have access to one of the high quality commercial audio oscillators such as the General Radio or Hewlett Packard. Even these are only approximate, though, and the calibration should be checked against the audio tones from WWV or WWVH. The best way to do this is to hook the audio oscillator to the vertical plates of an oscilloscope and the horizontal to the receiver output. You can then observe the Lissajous figures and check the oscillator callibration at 2400 cycles and 3000 cycles (four and five times the 600 cycles WWV tone). The 440 cycle tone gives check points at 2200, 2640, and 3080 cycles.

(Continued on page 60)

(from page 58)

At least one of the gang (W2BFD, naturally) has built a special self-contained oscillator which can be sent out to fellows who are building their tone oscillators, so that they will have a good standard. This unit only gets around to six or seven stations a year, though, since most fellows hang onto it for a few weeks. Then there is the possibility that this might get bumped off frequency on one of its trips.

In the Los Angeles area W6CMQ will give you an on-the-air broadcast of his W.E. model 8A standard oscillator which has been checked with the 2125 and 2975 cycle standard tones sent out by telephone from 195 Broadway, N. Y. C. As CMQ says, "All it takes is a friend in the right place, and the woods are full of telephone men."

Another trick is that of using two crystals that give an audio beat of either 425 cycles or two for each of the two tones. These, mounted in a Collins dual crystal holder, make a fine standard. W7VS has one now and there may be more around the country. The crystals are in the 1700 kc. band. A good circuit for this is on page 59, December 1950 *Radio and Television News.*

Still another method has been worked up by W6CLW and W6GFI. This does not give the exact frequencies, but does produce 2130 and 2970 cycles with good accuracy. Use two Boston gears mounted on the printer sync motor shaft. These gears are called "change gears" in the catalog. They have ⅜ faces and are cast iron, about 5″ and 3½″ in diameter. They have 71 and 99 teeth. A small headphone magnet set near the rotating gear is used to produce the tones.

I'm still not out of devious ways of getting these tones. Several of the gang have visited their local radio station and used their audio oscillator. Most of them have good ones. Some of the fellows have taken a recorder, wire or tape, and recorded the tones at the radio station for use at home. If you do this it is a good idea to put a WWV standard tone on the tape or wire as a reference so that you know the recorder is still playing at the same speed. W2BFD will supply you with a phonograph record with the WWV standard tones and the two teletype tones on it for a dollar. Same program on a spool of wire same price. If I can get him interested in a tape machine, perhaps, soon, tape will be available.

The present amateur standards call for an accuracy of plus or minus ten cycles for the audio tone oscillator. Are you with it?

Outten A Limb

I would like to try something as an experiment. Recently, I became the proud owner of a tape recorder. What I propose is this: since one of my main problems is time, and since your problem is usually a lack of information, why not ask me your questions on tape, then I can answer you on the same tape, saving much time at the typewriter. Please do not send in information or addresses on tape, only questions. With tape I should be able to give you much more complete answers to your questions than I ever possibly could via letter.

I have been in communication with W8BAJ, W6TD, W7MWZ, and several others via tape now and find that this is indeed a lot of fun. No QRM either. No missed schedules. Let me hear from you. Make my mailman sweat.

YL'S FREQUENCY

(from page 31)

LARK, the Ladies' Amateur Radio Klub of Chicago, is making great strides as a club, now having an active membership of thirteen. Their October meeting was held at the QTH of W9BCB, Helene, where new officers took over from their capable first chairman, W9GME, Grace. W9LOY, Cris Bowlin, is now president; W9MYC, Gladys Jones, vice president; W9SJR, Bernice Schmidt, secretary-treasurer. W9SEZ also entertaned the YLs of LARK at a "spook party," with W9FZO, SSL, SJR, GME and their OMs as guests.

WAS/YL

For some time YLRL has been offering a WORKED ALL STATES-YL award. Here are up-to-date rules for earning the certificate.

1. The WAS/YL award, Worked All State-YL, is available to all amateurs.
2. Two-way communications must be established on the amateur bands with all 48 of the United States. Any and all amateur bands may be used. A QSL from the District of Columbia may be submitted in lieu of one from Maryland.
3. Contacts with all 48 states must be made with stations operated by licensed women operators.
4. Contacts with all 48 states must be made from the same location. Within a given community one location may be defined as from places no two of which are more than 25 miles apart.
5. Contacts may be made over any period of years provided only that all contacts are from the same location as defined in #4.
6. 48 QSL cards, or other written communications, from stations worked confirming the necessary two-way contacts, must be submitted by the applicant to: Lou Littlefield, W1MCW, 19 State Ave., Cape Elizabeth, Maine. Sufficient postage must be sent with the confirmations to finance their return. The YLRL will not be responsible for any loss or damage to same.

Southwestern Division Convention

A big convention of the year was that of the Southwestern Division held at San Diego. Special feature for the YLs was a YLRL luncheon held at the Cafe Del Re Moro in Balboa Park. W6MWU, Mary Poe, president of the San Diego YL Club was to preside but as she was ill W6ZYD, Jean, did the honors. There were thirty-five at the luncheon. In addition to the San Diego area YLs several from Los Angeles attended, as well as one from Montana and several from Arizona. Another get-together was the YL breakfast held on Sunday, October 12th, with twelve YLs attending.

QSLs, PSE

Another plea for QSLs—this time from SWL Louis Schuh. Louis has been paralyzed all his life. He says he can't get his ham ticket for it is impossible to master the code, but he does find pleasure in listening on 75 and 20 phone. He sends out SWL cards but finds QSLs slow in returning. Maybe some of you can help along in a good cause. Send your QSL card to him at 907 West Main, Russellville, Ark.

Here and There

Congratulations and best wishes to Ellen White, who is now operating as W6YYM/1. Seems Ellen and her

OM joined the ARRL staff in September, Bob as ACM-CW and Ellen as ACM-Phone, and both are happy working at their hobby. Their QTH is Bolton, Conn., where they are operating all bands (except 160 and VHF) phone and CW.

A nice note from **W7KOY**. Gert is Class A now and is operating 75 phone with the same 40 watts she used on 10. Finds it FB and has been checking in on the Early Bird Transcontinental Net at 3:45 a.m.—(only the Jr. ops could get us up at that hour!). Gert and her OM took in the San Diego convention while vacationing.

We are sorry to have to record the passing of **W1BDN**, May Smith, of Manchester, N. H. May was in her eighties and for a long time held the distinction of being the oldest active YL. She was Class A and worked 10, 20 and 75 phone and 80 CW. She learned code in her teens and as far back as 1880 she was part-time operator on a telegraph line in northern New York State. She had held her amateur license since 1920 and the calls W1DBE, W1BAE and finally W1BDN. She was the sister of the late W1HPM, and the aunt of W1MZ. Any of you who have a file of **CQs**, check back your March '47 issue for interesting photos of W1BDN taken in 1920 and again in 1930.

The N's have been dropped from the calls of **W9SJR**, Bernice; **W9SEZ**, Eleanor; **W9SYX**, Peggy, and **W9QYG**, Verona. Verona is forsaking W9-land for sunny Arizona. . . .Congratulations to **W9KQC**, Virginia, on the arrival of her first harmonic, on November 11th, and named Valerie. . . .**W9FZO**, Helen, has taken up flying to keep pace with her OM's numerous hobbies. Perhaps we'll be contacting her aeronautical mobile one of these days. . . .**W9BCB**, Helene, will be joining the 20-meter phone girls soon since the FCC gave her an OK on her Advanced Class license.

W3JSH got a kick out of seeing her QSL card in the picture of Hilde's (DJ1AD) shack in this column in the October issue, as did the fellow who designed it. He is W3SFA, OM of W3SVY, Lorelei, who just recently passed her General Class and has been a regular on the 3610 CW net.

DJIAC

Several months ago DJ1AD, Hilde, was written up in these pages. At the time DJ1AD wrote us, Kaethe Behrens, DJ1AC, was visiting her OM in Frankfort, where he works as a railroad inspector, so we have only recently had news of Kaethe's activities.

Kaethe writes that her OM is an old-time ham, licensed in 1932, and is active under the call DL3VR. His pre-war call was D4RWJ. Kaethe, herself, has had her license only about six months and in that time has been active on all bands except 10 meters, working either CW or phone with NBFM. Her rig is a three-stage transmitter (VFO-BU/FD-PA), running about 100 watts on CW and 70 watts on phone. Her receiver is a 7-tube super, the same as Hilde's.

"My rig is not self-made," explains Kaethe, "because it is the station my OM used before he went to Frankfort. He is now running another station there under the call DL3VR, and when he is on a visit in Luebeck he runs my rig under the call DL3VR/A—for a second station from another place you have to use your call with a third letter 'A'."

She goes on to say, "You are right in thinking that DJ1AD and I became interested because our husbands are hams, too. I learned from Heinz, my OM, all I needed for the license exam, and sometime I worked before with his station so I learned it rather quickly. The license exam is not very difficult in Morse—you need 60 letters p.m., but it is rather difficult in technical things, especially if you want a license for your own station. If you want only permission to use the station of your husband or another already licensed station it is not very difficult. You then get the call of this station with a third letter 'M' after the call—such as DL3VR/M—that is in German 'Mitbenutzung.' (Bet a lot of W's would like that arrangement!)

"There are some other German YLs, but I have never heard one, besides DJ1AD on CW or working DX. They work German or European traffic. I am very much interested in DX work and in CW also.

"As to family, we are both alone, as there are not yet any harmonics. But especially now where Heinz is about 650 kms from here we are certainly enjoying ham radio very much.

"Please QSP my 73 to all readers of CQ."

Thanks, Kaethe, and we'll be looking for you on the air.

33, and see you next month, **W5RZJ**

PROPAGATION

(from page 41)

General Propagation Conditions—

January, 1953

The following is a brief commentary on expected propagation conditions for amateur circuits from the United States to the five major areas of the world. For times of the most probable band openings for any particular circuit refer to the "Propagation Charts." Basic propagation data used in this analysis appears in the National Bureau of Standards, Series-D Publications, "Basic Radio Propagation Conditions", and is prepared for a smoothed sunspot number of 30, centered on January, 1953. **NOTICE, THAT STARTING THIS MONTH, CHART TIMES ARE GIVEN IN LOCAL STANDARD TIME, NOT GMT. NO CONVERSION IS NECESSARY.**

Europe

Ten meters practically nil. . . .Some fairly good openings expected on fifteen meters from Eastern and Central U.S.A., but tapering off somewhat from the almost daily openings of November and December. Fair possibilities on twenty with conditions very much the same as during December. Forty meters still rather spotty, with openings most likely to occur on propagationally good nights (WWV N6 or better). Eighty meters will open during the same periods shown for forty. On many nights when the MUF drops below 7 Mc., forty may be dead to Europe, but eighty may be open. DX possibilities on 160 meters on these circuits are believed to be at their best during January, and the band may open on a few nights during the month from the East Coast, U.S.A.

South America

As usual, DX conditions are expected to be very good on these propagationally stable circuits. A few day openings may occur on ten meters, with a good many openings (almost daily), expected for the fifteen and twenty-meter bands. For night-time circuits, the forty and eighty-meter bands should be capable of solid circuits to Central America and Northern South America. Less favorable conditions exist to countries south of the equator because of the higher atmospheric noise levels and ionospheric absorption associated with the summer season now at these latitudes.

Africa

An occasional ten-meter opening possible with more frequent openings expected for fifteen and twenty. Some forty-meter night-time openings possible from many African areas north of the Equator to most Eastern and Central areas of the U.S.A. Eighty meters should be fairly good for North African paths, but will become progressively poorer as the path becomes more southerly in direction.

Australasta

Ten meters nil, except for a few openings from the West Coast, U.S.A. Conditions on fifteen meters expected to be poor with very infrequent openings. Conditons on twenty expected to be only fair at best. Some forty-meter openings possible, but not much expected for eighty. As we approach the Equinox, (March 21), conditions will tend to improve on some of these paths.

Asia

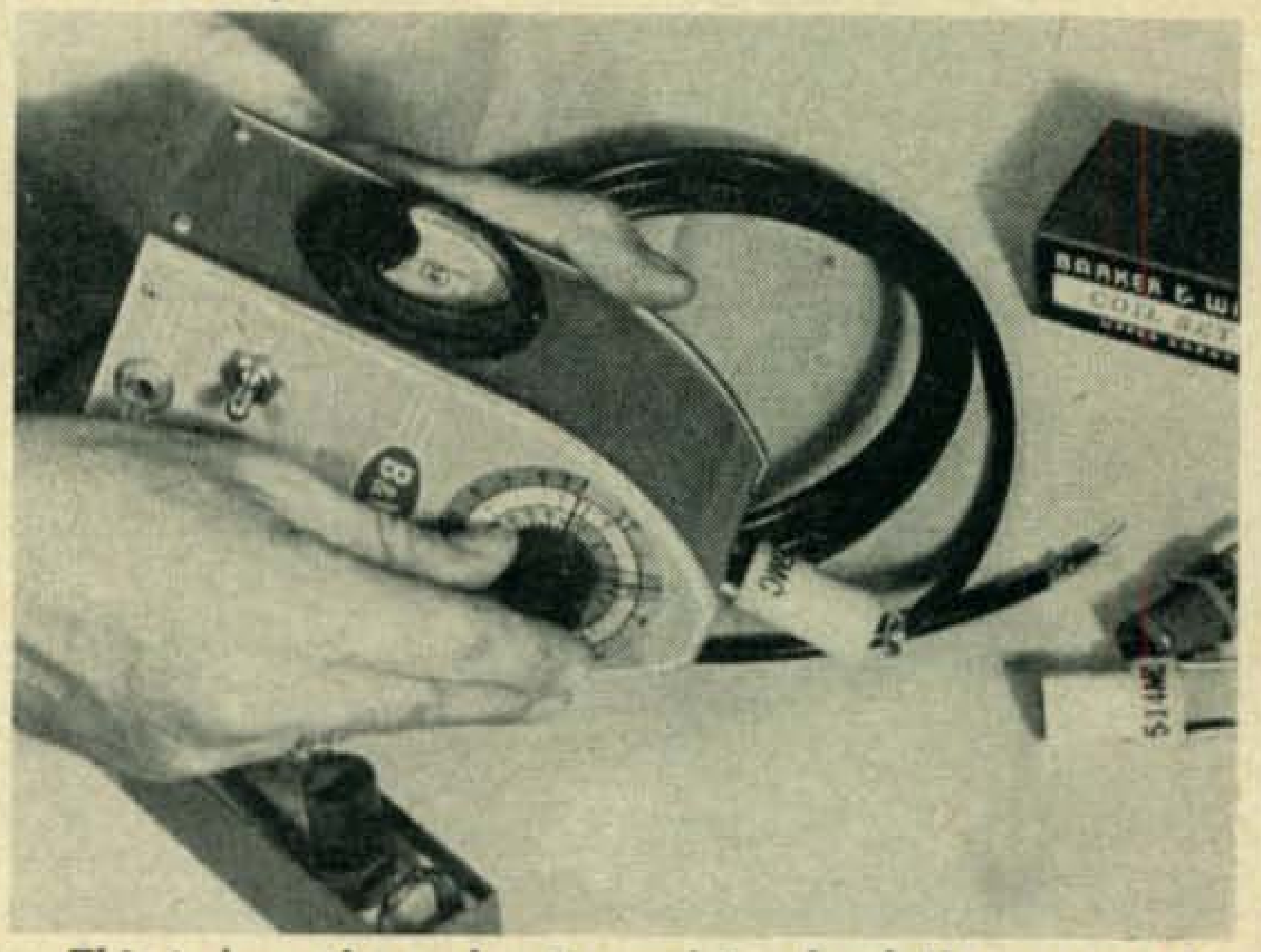
Ten meter activity nil. Fifteen meters poor with only an occasional opening possible from East Coast, U.S.A. to Middle and Near East, and Central and Western, U.S.A. to Far East. Fair openings possible on twenty from some areas of the U.S.A. to Near and Middle East and Far East. Some forty-meter openings expected to the same areas. Asiatic circuits that are expected to arrive from either the long or short great circle paths, are shown in the charts followed by an E or an A. The letter E indicating the great circle path is over Europe and A indicating that it will be over Asia.

GRID DIPPERS

(from page 22)

the ham shack. You can use it for numerous receiver tests. The signal can be substituted for the normal oscillator signal of a superheterodyne receiver if it is suspected that the oscillator is out of order. Why build an oscillator for that breadboard receiver you're experimenting on, if you have a dipper on hand already? You can put the dipper on a local TV channel and proceed to go out and mow the front lawn just to prove to the neighbors that your transmitter isn't the only device that can produce TVI! Or you can inject the relatively pure output signal of the grid-dipper into a TV set to demonstrate that sometimes a clean signal on an authorized ham frequency can cause TVI. You can also use the oscillator of the dipper to drive antenna measuring equipment, such as the "Antennascope."[8]

Some models of the grid-dip oscillator provide means for modulating the signal omitted by the device. Others are arranged so that a modulating signal from an external source may be inserted into the headphone jack. Better check the design of your particular dipper, before attempting to modulate in this way.



This is how the g.d.o. is used to check the resonant frequency of a section of coaxial transmission line open-circuited on one end and short-circuited on the other. This line, about nine feet long, resonated at 19 Mc. The dip will be quite sharp due to the relatively low Q of the line.

Absorption Wavemeter

One of the earliest devices for measuring wavelength of a signal was the absorption wavemeter. The dipper, whether it is plugged into the power line or not, may be used as a simple L/C tuned circuit to suck power out of any circuit carrying r-f currents. One precaution should be observed while using the dipper in this fashion around high powered (or even moderately-powered) transmitter stages. Do not couple enough power into the device to flash across the insulation of the internal wiring. The old-fashioned absorption wavemeters had little inside the box except the tuning condenser, and it didn't particularly matter if that flashed

8. Scherer, "Building and Using the Antennascope", CQ. Sept., 1950, p. 13 also, CQ Nov., 1950, p. 28.

over. The dipper, however, has a tube socket, several small coupling capacitors (which may also be used to insulate the unit from the power line) and a tube, all of which may be damaged by application of excessive voltages, so take it easy!

It would not be possible to include all the potential applications of such a versatile device as the grid-dip oscillator in an article of this type. For further information refer to the articles mentioned in the footnotes, and study the instruction booklets available from manufacturers of these instruments. Happy Dipping!

1952 CQ World Wide DX Contest

We have rounded up a few scores for the fourth CQ World Wide DX contest which may give you an inkling of what the final and official totals will look like. The following are "claimed" scores:

Multiple Operator, All Band, CW.

TA3AA	332,304	W7DL	100,000
W6AM	226,000	G2BOZ	65,800
KV4AA	200,736	VP9BG	40,000

Multiple Operator, All Band, Phone.

TA3AA	232,000	W6NIG	60,700
HC2JR	111,000	W8NGO	26,000
I1BDV	71,000	VP9BG	17,600

Multiple Operator, Single Band, CW.

W6RRG	68,800 14 Mc.	W6EAE	43,400 14 Mc.

Multiple Operator, Single Band, Phone.

W6HOH	17,000 14 Mc.	TG9RB	10,100 14 Mc.

Single Operator, All Band, CW.

CE3AG	335,434	DL7BA	67,000
KP4JE	284,000	G2VBA	67,000
W8JIN	215,259	W5FNA	60,000
ZE3JP	210,000	W6FSJ	57,000
FF8AG	207,276	W7PQE	51,000
VP9BF	181,000	PAØVB	50,000
W2WZ	140,500	PAØWAC	50,000
TI2TG	136,160	VE3CCK	49,000
W1RY	132,000	KH6LG	46,300
KP4KD	119,210	W4KE	42,300
W3GRF	106,575	W3LXE	40,700
W6DFY	104,611	G4FN	37,543
DL7AA	101,000	W6MUR	33,400
W6EPZ	93,000	W2EQS	29,000
YU1AD	88,000	W5CKY	25,900
KG4AF	84,800	W6BYH	25,300
W7PGX	84,000	GM3CSM	18,445
PAØKW	74,000	W6QD	18,400
G3FXB	71,000	W9FID	17,884

Single Operator, All Band, Phone.

CE3CZ	245,769	W8NXF	25,500
W1ATE	131,000	CT1JM	23,000
VQ3BU	58,000	W8LIO	22,700
DL4EA	56,900	W9EZD	16,700
OD5AD	40,000	OH5NQ	16,100
VE3KF	37,800	W3LXE	15,400

Single Operator, Single Band, CW.

W6BAX	83,600 14 Mc.	W9FID	17,800 14 Mc.
W6IBD	65,000 14 Mc.	W6RW	13,600 7 Mc.
W3JTC	62,928 14 Mc.	W3AYS	11,000 21 Mc.
W6CUQ	31,000 14 Mc.	W4KRR	7,900 21 Mc.
W4KFC	20,200 7 Mc.	W4COK	6,500 21 Mc.

Single Operator, Single Band, Phone.

W9NDA	19,000 14 Mc.	W6FSJ	16,700 14 Mc.
W6YY	19,000 14 Mc.	W6IBD	14,000 14 Mc.
KH6LG	18,900 14 Mc	CE4BX	7,600 28 Mc.

The Newcomer's Buyway

"The Dispatcher"

Here's a Controlled Reluctance microphone assembly designed to handle the most severe requirements of radio amateur rigs. The "Dispatcher" is supplied with two-conductor shielded cable, and it's wired to operate both microphone and relay circuits. This field-proved unit is used extensively in police, railroad, airport, and all emergency communications work where dependability is vital. Of special interest to "Hams" is the large, easy-to-use grip-bar and positive action of the heavy-duty switch. Firm downward pressure on the grip-bar locks the switch—so you can "yackety-yack" all night without lifting a finger! The "Dispatcher" is immune to heat and humidity and will stand up under rough usage. It is manufactured by Shure Brothers, Inc., 225 West Huron Street, Chicago 10, Illinois. It's a high-impedance unit with a high output level of minus 52.5 db. Lists at $35.00. See the "Dispatcher" at your Distributor for further details, or write Shure Brothers, Inc., 225 West Huron Street, Chicago 10, Illinois.

NOVICE PHONE

(from page 24)

ing. Re-tune *C1* for maximum reading on the grid-current meter. This should be at least 1.5 ma. If grid current cannot be made to reach this level, try swapping the 6AG7 tubes. Check and see if the cathode return lead of *V2* is as short as possible. Check your plate voltage—to be sure. When grid current is brought up to at least 1.5 ma. (the more the better!), tune *C3* to resonance. This will be noted by watching neon lamp. The lamp develops a distinctive purple glow when r.f. is applied. Tune for maximum glow. Connect the antenna or a dummy load to the output connector. Couple *L4* to the plate coil as tightly as possible, returning always for maximum neon bulb glow. *WARNING! L3* has the full power supply voltage on it! *Be CAREFUL!* Note, in some cases, that the glow in the neon lamp decreases as *L4* is coupled more tightly to *L3*. Set it at maximum glow.

Adjust *R8* to a point where the neon lamp glows slightly. Plug in the microphone. The microphone may be any good quality carbon microphone. We use the microphone section from a surplus telephone handset; however, any T17-B or similar microphone would fill the bill. Modulation should cause the brilliance of the neon output indicator to increase.

The antenna should be coupled tightly to the final stage for proper operation of this rig. If sufficient loading, indicated by maximum neon lamp glow, cannot be attained by moving *L4*, try increasing the number of turns of *L4* to a full 3 turns. Listen to your modulation in a receiver tuned to your frequency, and you should note that the modulation is clean cut and crisp. Output of this rig can be monitored by a field strength meter: the meter should kick upwards with modulation

If the rig does not behave properly on the first try, check the frequency of the tuned circuits. It is suggested that you procure a grid dip meter and measure their resonant frequency. If the leads are too long on *L1* and *L2*, they will not resonate at the proper frequency. This may cause a low grid drive to *V3* (2E26). If the construction has been followed to the letter and the parts have been installed in accordance with the photographs one should have little difficulty in getting this rig to perk off at the first try.

Performance

This little rig has proven to be especially worthwhile due to its portability and simplicity. It has done yeoman's duty as a portable net control station for the Southern New Jersey Emergency Net. Several have been constructed and used as mobile transmitters operating from battery powered vibrator supplies. One such rig was used successfully by W2EGP to communicate with New York City from a portable location at Seaside Park, N. J. We feel it is quite capable, despite its modest 5 watts output. See you on 2!

Classified Ads

Adverising in this section must pertain to amateur radio activities. Rates 25c per word per insertion for commercial advertisements. 5c per word for non-commercial advertisements by bona fide amateurs. Remittances in full must accompany copy. Phone orders not accepted. No agency or term or cash discounts allowed. No display or special typographical ad setups allowed. "CQ" does not guarantee any product or service advertised in the Classified Section. Closing date for ads is the 25th of the 2nd month preceding publication date.

SELL: Best offer, new crystals Bliley 3524.2 kc., Nebel Lab 4025 kc. Used few hours, Bliley 7232.3 kc., Bliley 7294.7 kc. W5RZJ, 959-C 24th, Los Alamos, New Mexico.

ELDICO GRID DIPPER complete $18, Instructograph, A.C. model with manual and ten tapes, $25. John Higgins, 38 Marwood Rd., Port Washington, New York.

NOVICE TRANSMITTERS. Complete with tubes, power supply, crystal, all parts. 35 watts (6L6) Kit $24.95, wired $29.95 75-150 watts (6AG7-807-807) Kit $49.95, wired $64.95. Modulator for above transmitters Kit $19.95, wired $26.95. Send postal card for information. Dixon Electronics Co., 13444 W. McNichols, Detroit 35, Mich.

ANTENNA TROUBLE? Solved—send $1.00 with your problem. "Money back guarantee." Antenna, P. O. Box #44, Wakefield, R. I. Custom manufacturers of antennas.

FOR SALE: Collins 75A1 HT6, S-40, HQ129, and BC459 W2NBM, John Urban, 140-34 Holly Ave., Flushing, N.Y.

CRYSTALS: FT-243's—3000 to 8500 kc ± 2 kc, $1.00 each, .01% $2.00 each. Hundley Crystal Co., 2951 North 36th, Kansas City 4, Kansas.

DON'T FAIL! Use the time-tested "Surecheck Test." Novice, $1.50; General, $1.75. Amateur extra available soon. Amateur Radio Supply, 1013-7th Ave., Worthington, Minn.

SELL: BC-610E with tubes, cables, BC-614-E speech amplifier, coils and tuning units. $650. F. Minturn, Box 252, Boston 1, Mass.

WANTED: Navy Selsyns. 1G, 1F, 1CT, 1DG, 5DG, 5F, 5CT, 6G, 7G, etc. Top prices paid. Electro Sales Co., Inc. 110 Pearl St., Boston 10, Mass.

QSL's-SWL's. Super-gloss. 10 colors, four card stocks, seven styles. Samples 10c. Almar Printing Service, Dept. 10B, 602 Barker Bldg., Omaha, Nebraska.

WANTED Teletype Keyboard for type 12 printer. W6QEO, Sacramento, Calif.

FOR SALE: Snoopers (Aug.-Sept. CQ) Custom Built by W7HEA. Bishop's Radio Service, 207 E. Toppenish Ave., Toppenish, Wash.

DXers! "Hams Interpreters"—ham words and phrases translated into 7 languages—$1.00. For SWL's, "World Radio Handbook"—complete information on international stations, $1.50 "How to Listen"—for SWL Novices, 40c. World Radio Publications, 1000 Connecticut Ave., Washington 6, D. C.

RADIO AMATEUR and commercial license preparation. International morse code transcribed on magnetic tapes, recording wire and long playing microgroove discs. Disc-A-Method Recording Company, 317 E. 48 St., N. Y. C.

WANTED: ART-13 Transmitter and any or all accessories. State price and condition. Write C. Porter, 8545 11th Ave., Silver Springs, Md.

QSL's. TOP quality at fair prices. Samples? Write W9BHV QSL Factory, 855 Burlington, Frankfort, Ind.

BC610 parts wanted. Give price and condition first letter. L I Radio Company, Box 474, Montrose, Pa.

NATIONAL 173: and speaker $135.00 FOB Arvada, Colo. Gerhardt Janke, 8300 W. 38th Ave., Wheat Ridge, Colo.

SELL: Teletype midget printers model 21A, Model 12 page printers, Distributor motors, control panel relays, miscellaneous parts, teletype tape transmitters. Will trade. Tom Howard, W-1-AFN, 46 Mt. Vernon St., Boston 8, Mass. (Richmond 2-0916).

TELETYPE WANTED: Cash for one model 15 or 19 in good condition. Eugene A. Wille, W9EKU 3435 North 47 St., Milwaukee 16, Wisc.

10, 15 & 20-METER BEAMS, Aluminum Tubing, etc. Perforated Aluminum Sheet for shielding. Radcliff's Fostoria, Ohio.

SALE HRO-5OT receiver. Perfect and looks like new highest bidder over $250.00. W4VZQ 1040 Moore St., Harrisburg, Va.

WANTED: APN, APR, ART-13 DY-17, TRC-2, PE-162, SCR-694, BC-1306, PE-237, GN-58, GN-53, GN-45, SCR-284, BC-654, PE-103, PE-104, BC-221, BC-348, BC-312, BC-342, SCR-522, RA-62, RA-34, BC-611, TCS, Test equipment, Technical Manuals, Panadaptors. Arrow Appliance, Box 19, Boston 1, Mass. (Lynn 8-3100).

BARGAINS: New and reconditioned Collins, Hallicrafters, National, Hammarlund, Johnson, Elmac, Harvey-Wells, Babcock, Gonset, Morrow, RME, Millen, Meissner, Lysco, Workshop, HyLite, others. Reconditioned S38 $29.00. S53 $49.00. S40A, $69.00. S40B $79.00. SX43 $119.00, S76 $129.00, SX71 $149.00, SX42 $199.00, SW54 $35.00, NC57 $69.00, NC125, NC173, NC183, HFS, HRO5TA1, HRO7, HRQ50T, HRO50T1, HRO60, HQ129X, SP400X, RME84, RME45, VHF152A, HF10-20, Lysco 600, Collins 75A1, 75A2, 32V1, 32V2, HT9s, Viking transmitters, etc. Shipped on approval. Terms. List free. Write, Henry Radio, Butler, Mo.

ELIMINATE TVI! Shield your rig. #26 gage heavy plated bright steel. Perforated 75 #53 holes per inch. Easily cut, formed and soldered. Sheets 20" x 28"—Two for $3.50, five for $6.50 postpaid. West of the Mississippi 20c. extra per sheet. Sample for dime in stamps. Dept. 12, Republic Television, Inc., Dumont, New Jersey.

QSLs! QSLs for OMs! Samples 10c. Tooker, Lakehurst, N.J.

WANTED: All types of receiving and transmitting tubes. Surplus receivers and transmitters. Williams Electronics Co., 168 Washington St., N. Y. C.

VOLT-OHM-MILLIAMETERS: Pocket Size AC/DC Ranges 750 v., 150 v. and 15 v.; 150 ma. and megohm—$8.75. W2OXR, R. Gross, 11 Belmont Terrace, Staten Island, 1, New York.

QSL CARDS?? Superduperable samples 25c. Sackers, W8DED Holland, Michigan.

BUILD 5DAS 2-ELEMENT BEAM: Complete plans $3.00, state band. W5DAS, 2940 Elm St., Dallas, Texas.

FOR SALE: Highest bid Collins 32V-1 transmitter. W4AD, Box 793, Rome, Ga.

BARGAINS: EXTRA SPECIAL: Motorola P-69-13 Mobile Receivers $29.50; Globe King $315.00; HT-9 $199.00; HRO-50 $275.00; Lysco 600 $109.00; HRO-7 $199.00; Collins 75A1 $275.00; HRO-5T $175.00; SX-71 $159.00; SX-42 $189.50; SX-43 $129.00; HRO-Senior $119.50; RME 2-11 $99.50; RME-45 $99.00; Meissner EX Shifter $59.00; S-40A or SX-16 $69.50; VHF-152 $59.00; HF 10-20 $59.00; Globe Trotter $79.50; Meissner Signal Calibrators $24.95; MB611 Mobile Transmitters $19.95; 90800 exciter $29.50; RCA Chanalyst $69.50; XE-10 $14.95; Gonset 10-11 converter $19.95; and many others. Large stock trade-ins: Free Trial. Terms financed by Leo, WØGFQ. Write for catalog and best deal to World Radio Laboratories, Council Bluffs, Iowa.

SALE: Transmitter BC-1072A, new, 150-200 Mc., 115V AC operation. Tubes, 1-6J5, 1-807, 1-2X2/879, 1-9002, 1-6SN7GT, 2-826, 2-9006 listing over $40.00. Contains Variac, milliammeter, AC blower, many other parts for $29.50; United tapped 500 mill modulation choke for $25.00; Acme-Delta swinging choke 5-25H. 500 mill for $15.00; Smoothing choke 8H. 500 mill for $15.00; HRU-28 "putt-putt" consisting of a single cylinder, air-cooled, 2 cycle 3¾ horse-power engine, directly connected to a DC generator of 2,000 watts, rating 27.5 volts at 70 amps., automatic voltage regulator for adjustment 12 to 35 volts DC, control box containing switches, voltmeter and radio filter, price $60.00. W3CZE, 418 10th St. N.W. Washington 4, D. C.

FOR SALE: Transmitters, tubes, parts. Write for list. Warren Rudolph, Winchester, Va.

HARVEY WELLS Power Supply for TBS-50 $25.00. Converted Mark II for 75-meter Phone-CW operation, 35 watts input. Crystal Mike, Plate Modulation $25. Will sell together or separately. Rev. Robt. Mark, W3KOJ, Wellsboro, Pa.

WANTED: APR-4, other APR-, APT; ARC-1, ARC-3, ART-13, BC-348, BC-221, etc.; TS-12, 13, 35, 120, 146, 155, 173, 174, 175, 323, other "TS"-; particularly microwave equipment. Spectrum Analyzers; G-R, Ferris, L&N; 723A/B, 3C22, all tubes: Manuals, Meters, Parts, Cable Littell, Farhills Box 26, Dayton 9, Ohio.

"Bud VFO-21 with 80-meter coil—best offer" W9JWN 2251 S. 105th St., Milwaukee, Wisc.

JOHNSON VIKING VFOs assembled, wired, tested, complete with all tubes, ready to go, $54.95. Normally available for immediate delivery. We also supply the new Johnson Viking II, wired and tested, at $319.95. We trade and offer terms. Write for latest used equipment list. W1BFT, Evans Radio, Concord, N. H.

B&W MODEL 600

Dip Meter

★ Frequency Range—1.75 to 260 MC. in 5 Bands
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★ Wedge-shaped for Easy Access in Hard-to-get-at Places
★ Rust Proof Chassis, Sturdy Aluminum Case
★ Monitoring Jack and Diode Switch
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PRICE $48.00 net

A HIGHLY USEFUL INSTRUMENT FOR THE

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The New B & W Model 600 Dip Meter provides you with a convenient means of doing the job in a minimum of time with dependable accuracy.

It is an extremely sensitive and reliable piece of test equipment having innumerable uses in the Ham Shack, Service Shop, Electronic Laboratory, or Production Plant.

Armed with this versatile and indispensable instrument, you eliminate the guess-work during measurement of—tank circuit frequencies, antennas, feed line systems, parasitics, and other pertinent tuned circuit characteristics, with speed and accuracy.

The handy instruction manual furnished with each instrument covers full information on how to use the Model 600 as an Absorption Meter, Auxiliary Signal Generator, R. F. Signal Monitor, and several special applications as well. See it at all leading electronic parts distributors throughout the U. S. A. and Canada; or write for descriptive bulletin.

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237 Fairfield Avenue • Upper Darby, Pa.

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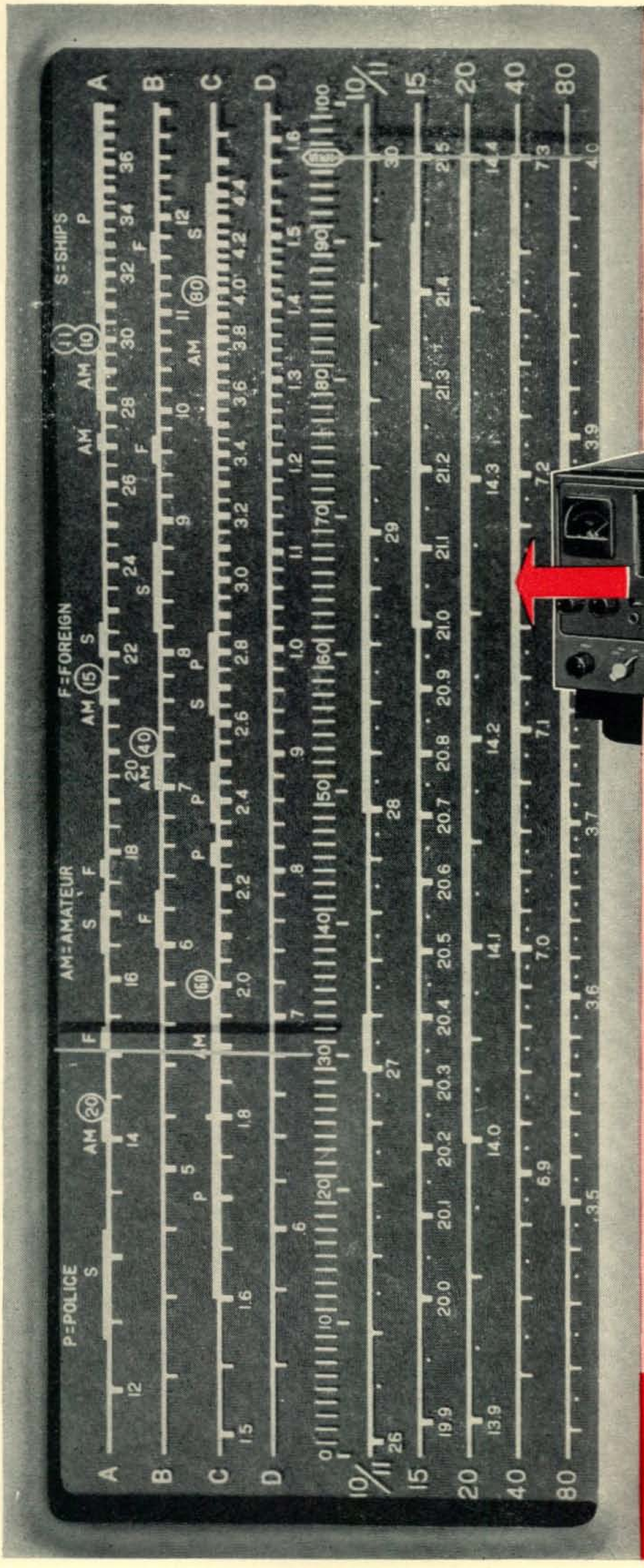
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