JANUARY 1966
50¢—Bah humbug

73 Amateur Radio

PIONEERS IN MINIATURIZATION

OUNCER™

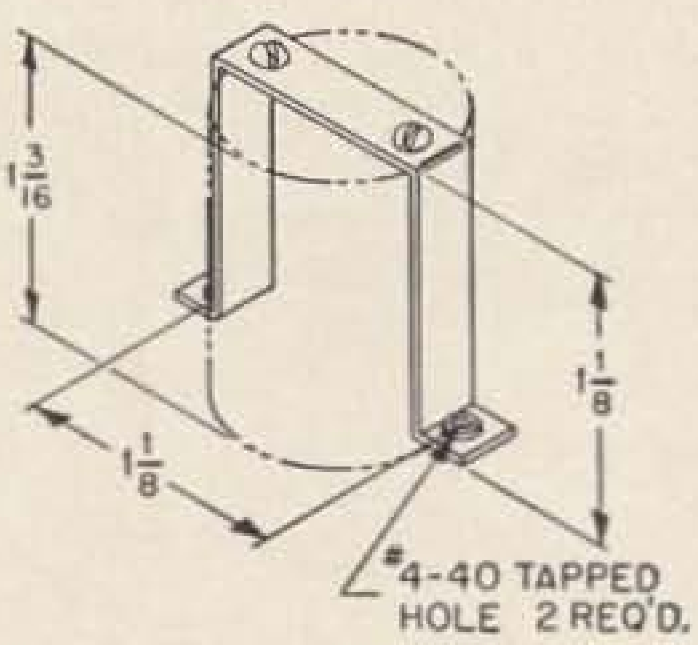
AUDIO TRANSFORMERS & INDUCTORS

FOR TRANSISTOR & TUBE APPLICATIONS

"O" Series

STANDARD OUNCER

Dia. .... 7/8"
Ht. .... 1 3/16"
Term proj. .... 5/32"
Mtg. .... 11/16"
Scr. 2-56
Wt. .... 1 oz.



0-BR

Ouncer chassis mount bracket

Hipermalloy Shield (0-17) shown slipping over ouncer unit

"P" Series

PLUG-IN OUNCER

Dia. .... 1 3/32"
Ht. .... 1 15/32"
Skt. .... St. Oct.
Wt. .... 2 oz.

For over thirty years UTC engineering and production talent has pioneered the development of high quality transformers, inductors, electric wave filters, magamps and high Q coils.

The UTC OUNCER series represented a break through in the reduction of size and weight. "O" series units are fully impregnated and sealed in drawn aluminum cases. Highest quality characteristics are inherent in the conservative design. With frequency response from 30 to 20,000 cycles $\pm$ 1 db, the UTC OUNCERS are ideal for ham, portable broadcast, high fidelity, concealed service, hearing aid and similar applications. A hipermalloy shield providing 25 db is available.

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OUNCER TYPES	Pri Imp Range, Ohms	Sec Imp Range, Ohms	Level Range, mw
INPUT & MIXING TRANSFORMERS	From 7.5 to 50,000	From 50 to ½ megohm	From 6.3 to 30
INTERSTAGE TRANSFORMERS	From 25 to 100,000	From 10 to 1 megohm	From 6.3 to 1 watt
OUTPUT TRANSFORMERS	From 4 to 30,000	From 3.2 to 600	From 6.3 to 1 watt
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Write for latest catalog of over 1300 STOCK ITEMS with UTC high reliability

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73 Magazine

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January, 1966

Vol. XXXIV, No. 1

Cover by Ray Sax WA2TKY

73 Magazine is published monthly (thank heavens it's not weekly) by 73, Inc., Peterborough, N. H. Zip 03458 (terrible number). The phone is 603-924-3873. Subscription rates $4.00 per year, $7.00 two years, $10 three years world wide. Second class postage is paid at Peterborough, New Hampshire and at additional mailing offices. Printed in Bristol, Conn., U.S.A. Postmasters, please send form 3579 to Good Old 73 Magazine, Peterborough, New Hampshire. Use your Zip Zone and save our shirt.

de W2NSD/1

never say die

Saucer talk

Ever since one of our IoAR Directors found himself an observer of a UFO back last January and thus the center of considerable official pressure to keep quiet about the whole thing, I have been reading, asking questions and thinking. I find that the more you read about the UFO's the more unquestionable becomes their existence.

One fact about the UFO's particularly has been bothering me. How do they communicate? If they were using radio on any frequency I think it is safe to say that someone somewhere would by now have heard it. But here we are with no indication whatever of any radio communications by the UFO people. How about that? Obviously they are using some sort of communication system, and a fairly sophisticated one too. Do you suppose that there is some way of talking at a distance without wires other than our familiar "wireless"?

Did someone say telepathy? Well, we do know that this works, though we don't know how to use it at will yet . . . or at least darned few people do. But we do have some people that are adept with it, few though they may be. And if the UFOers were using telepathy of some sort it seems rather likely that someone of us would have detected that, even though we only have a few such receivers. No hint of any telepathy reception.

Could there be something else? I think so. And we have some strong hints as to what it is too, only we don't know much about the whole subject yet. We just barely suspect that there is something and are a long way from being able to use it. We are (I suspect) on the verge of discovering a whole new field for exploration.

About 125 years ago . . . not very long . . . the early experiments with electricity were being carried out. Once electricity had been identified to some degree electro-magnetism turned up, and eventually electro-magnetic waves, which we started using some sixty years ago or so.

For some strange reason gravity is a force that has attracted little attention. Newton gave it some thought, presented us with the math which described its action, and things have pretty much rested there. Up here in New Boston, New Hampshire they've been encouraging anti-gravity research. Obviously a bunch of nuts. We all know that there never will be anti-gravity and that no one but a nut would bother to spend any time and effort trying to achieve the impossible.

Some years ago I met a chap who claimed to have a friend who had electrically generated a gravity field. Seems this friend had tried to demonstrate a working model of this to Dr. Millikan, but this august gentleman refused to observe the demonstration because such a thing was completely impossible. Nothing complicated about the gadget . . . you can make one yourself. All you have to do is put a high voltage on a condenser which you have hanging on a string. You will note that it swings out in the direction of the positive terminal. This is called the

Thanks Ted We take our "Specs" seriously

BOB WATERS W1PRI

THEODORE F. BRIX
FRESNO, CALIFORNIA

August 21 1965

Waters Manufacturing, Inc.,
Wayland, Massachusetts.

Dear sirs:

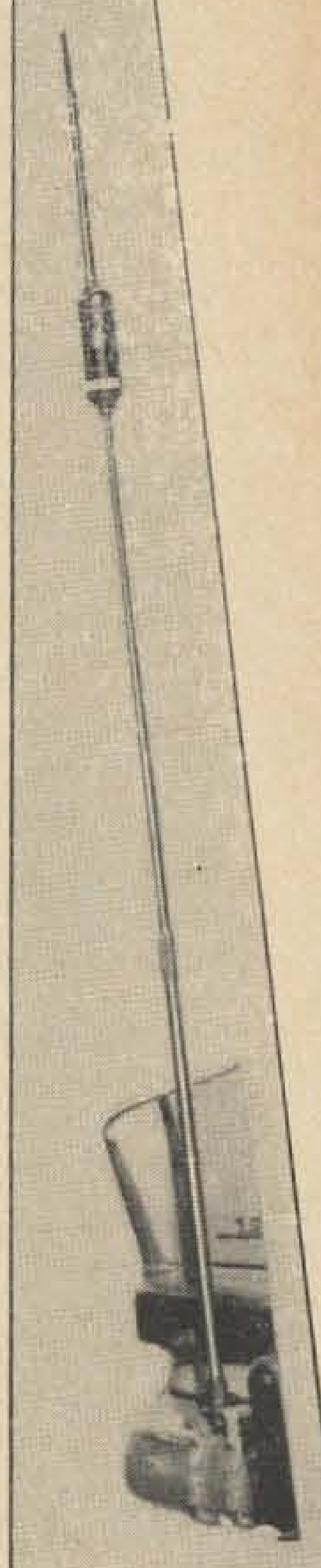
I have just purchased one of your Model #370 Auto-Match antennas for my mobile and have been very pleasantly surprised. The antenna which I previously was using was impossible to load without some form of matching device; I used a "Z" match with a condenser combination. When I installed the Waters, and after reading the literature I noted that you stated that it woul match into 50 ohms. This I could not believe however I decided to give it a try, so I removed the matching network and connected the 21' 52 ohm cable directly to the antenna base. Not only did it match perfectly but I also picked up slightly over 2 volts of r. f. measured on the field strength meter. Also I found that the transmitter tuned (final tank) exactly the same position as when the transmitter was used in the shack against a dipole fed with 52 ohm line. Now what puzzles me is; how your able to construct such a coil which will match into 52 ohms where most antennas require some sort of matching section? I have operated mobile for many years having been on the air for over 30 years. Without wanting you to give away some "trade secret" and so I won't have the coil x-rayed, I would like an answer. It really has me puzzled. Needless to say I am more than pleased with the performance which is much better than three other mobile antennas which I am comparing yours against - its far superior by actual measurement.

RECEIVED
27 1965
WATERS

Thanking you, I am

Respectfully yours

Theo. F. Brix W 6 qfr
5573 No. Van Ness Blvd
Fresno 5, California



WATERS
MANUFACTURING INC.
WAYLAND, MASSACHUSETTS

Biefeld-Brown effect, after Professor Biefeld of Dennison University who discovered it and T. T. Brown, a student of his, who has been carrying on the experiments since his death.

As I understand it from the latest reports I have read this principle has been used to make devices up to three feet in diameter which can support their own weight (see August 64 Popular Mechanics cover story) and further development is coming fast.

Where does this connect with amateur radio? Well, electro-gravitics have just barely been discovered now, but from the first look at the subject it seems quite possible that a whole body of developments will come from this basic discovery just as so many things have come from electro-magnetism. It seems quite possible that a communications system may be worked out using gravitics. It is too soon to promise much since no one has yet even discovered a detector to convert electro-gravitics into electrical impulses.

I remember trying to find out about the propagation of a gravity force when I was in school. It took quite a while to even get my question across because apparently no one in the physics department had ever considered that before. Their answer was that there was no propagation of the gravity force because it was always there. Huh? I suspect that gravity is propagated instantaneously and is not limited by the speed of light as are electro-magnetic waves, whatever they are. We still don't know what they are, you know. We have no real idea of what it is that goes to the moon and bounces back when Sam gets a head of steam going down there in Puerto Rico. Something does, obviously.

If gravity is propagated instantaneously then electro-gravitic communication would be fine for interplanetary QSO's, and possibly even intergalactic. We may find the new "bands" or whatever they are awfully busy when we get on there. Imagine if some isolated race, undiscovered on our planet, discovered radio and started tuning twenty meters some day. What a start that would give them. Of course they wouldn't be able to copy much for a long time . . . they would have to decipher our code, figure out sideband, dope out RTTY, multiplex and all that. That would take them quite a while.

It seems quite likely that whatever this communications system is, it is being used by the UFO's.

May I digress for a moment? I just happened to think of a little experiment that K1CLL tried some time ago. He got to

(Continued on page 110)

John Wonsowicz W9DUT
John R. Wonsowicz W9JFW
4227 N. Oriole Ave.
Norridge, Ill. 60634

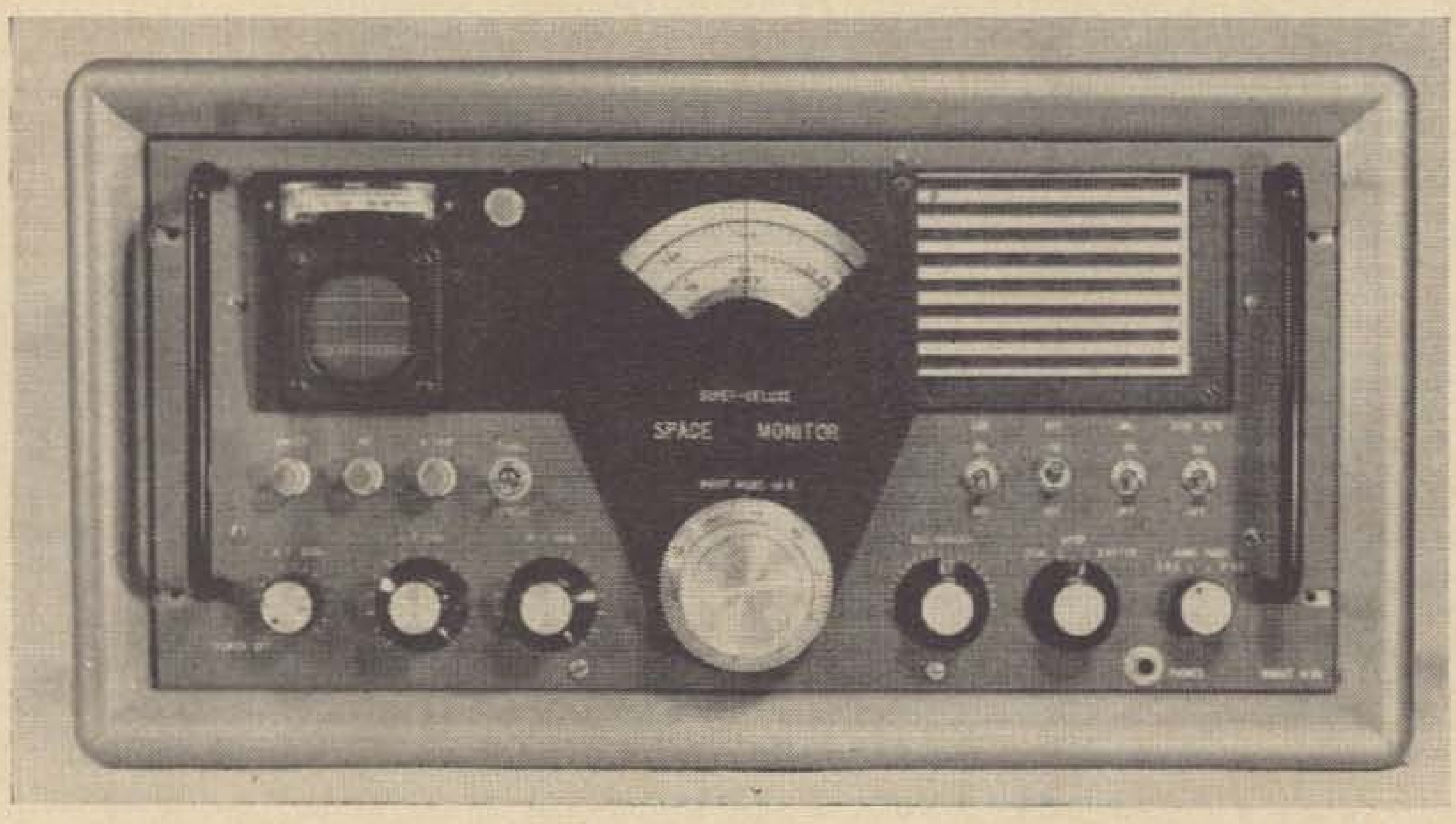
The Space Monitor

This receiver is a composite of previous receivers that I have described. All of the goodies have been retained and newer features have been added to bring this unit to the finest standards of the art. Although the receiver is designed primarily for two meter operation, it also does a good job on the congested twenty meter band with the 2.1 kc mechanical filter. The stability is excellent due to the rugged construction and local oscillator temperature compensation.

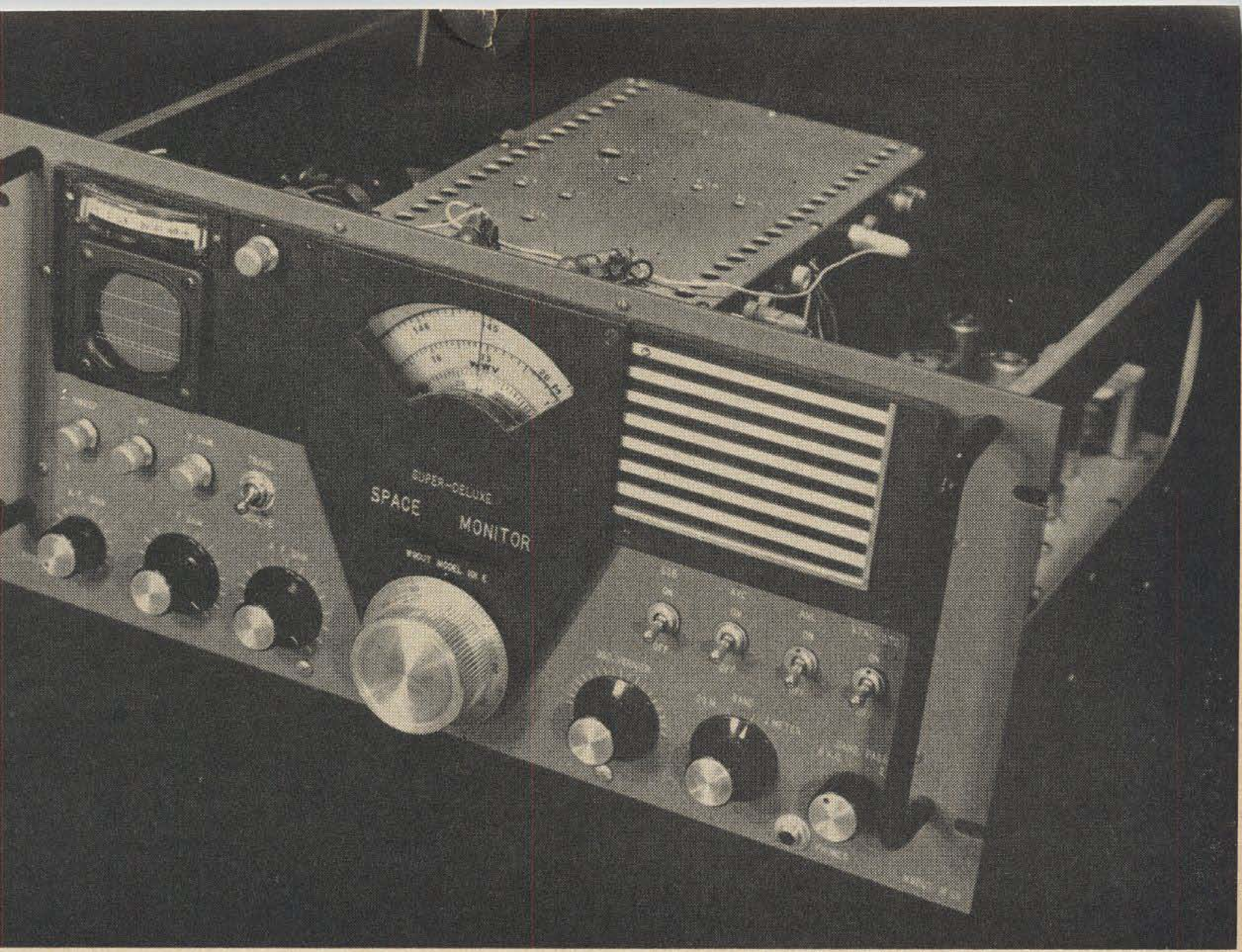
Basically there are two receivers in this package. One is a dual conversion aural receiver tuning from 13.5 to 18.5 mc. It has a bandpass of either 6 kc or 2.1 kc. The other receiver is a visual, or panoramic, receiver. It displays the received signal plus a portion of the band on a two inch cathode ray tube. The two make an excellent combination for the HF and VHF bands through the use of a two meter converter built in the package.

The two meter converter is a low noise, high sensitivity unit using a gold plated 416B in the preamp. Two meter sensitivity is in the order of 0.1 μv with a noise figure of 2.8 db. The basic receiver achieves the same sensitivity and noise figure. The panadapter provides a 0.5 μv sensitivity and a band pass of 300 kc at 3 db points. This response is obtained by overcoupling the first two stages of *if*, as shown in the schematic.

The *if* and rf stages employ separate gain controls to tame the strong signals and pick out the weak ones. By proper adjustment of



Front panel of the Space Monitor. The main tuning knob was turned on a lathe and a 2¾" Waldom dial plate fastened to it. The cut-out for the translucent dial was made by drilling a series of holes close together and filing out the arc. A flying cutter was used to make the holes for the panadapter tube and the speaker. Function labeling is engraved.



these controls, signals of 0.1 μv to 1 volt can be handled without overloading.

The signal strength meter is placed just above the panoramic scope tube so that signal strength and quality checks of received signals can easily be compared. This meter is hand calibrated to 60 db over S9 using 50 μv for an S9 signal. A zero set on the front panel allows the operator to compensate for signal to noise adjustments. All pertinent controls are located for the greatest ease of adjustment and can be identified in the front panel photograph.

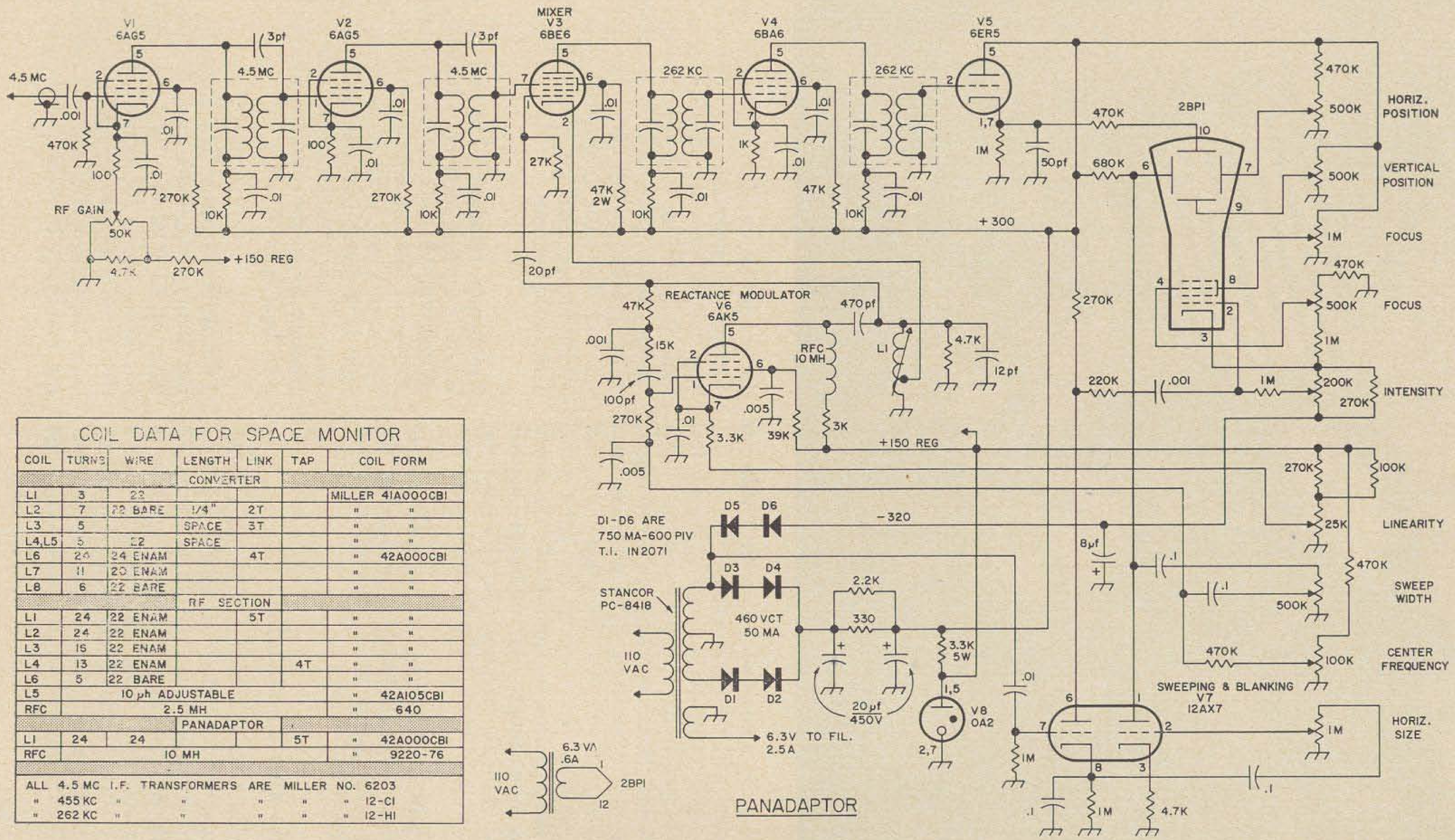
The grill to the right of the main tuning dial covers a small speaker that makes the receiver independent of all accessories except the antenna and power.

Circuits and construction

RF section. The rf section is built in a heavy cast aluminum box that once held a TN-1/APR-1 rf tuner that covered 40 to 90 mc. It was stripped and the only parts used were the box and gear train. The stability that a cast box such as this provides is a necessity for receiving SSB signals. The chassis part of the box is cut out leaving a ⅜ inch ledge for mounting an aluminum plate that is used for the rf components. To allow room for the two meter converter, the tubes, main tuning capacitor and *if* transformer were mounted upside down. The box is mounted with a angle bracket in the back. The front is held on with the gear train plate. The split and spring loaded gears are ideal and reduce backlash to a minimum.

Frequency standard. The crystal frequency standard in this receiver is basically the same as the one described in the October 1962 73. However, this one isn't modulated. Half of a 6J6 is a 1 mc crystal oscillator. The other half is a harmonic generator to give good markers up through two meters. A 75 pf trimmer across the crystal is used to adjust for zero beat with WWV.

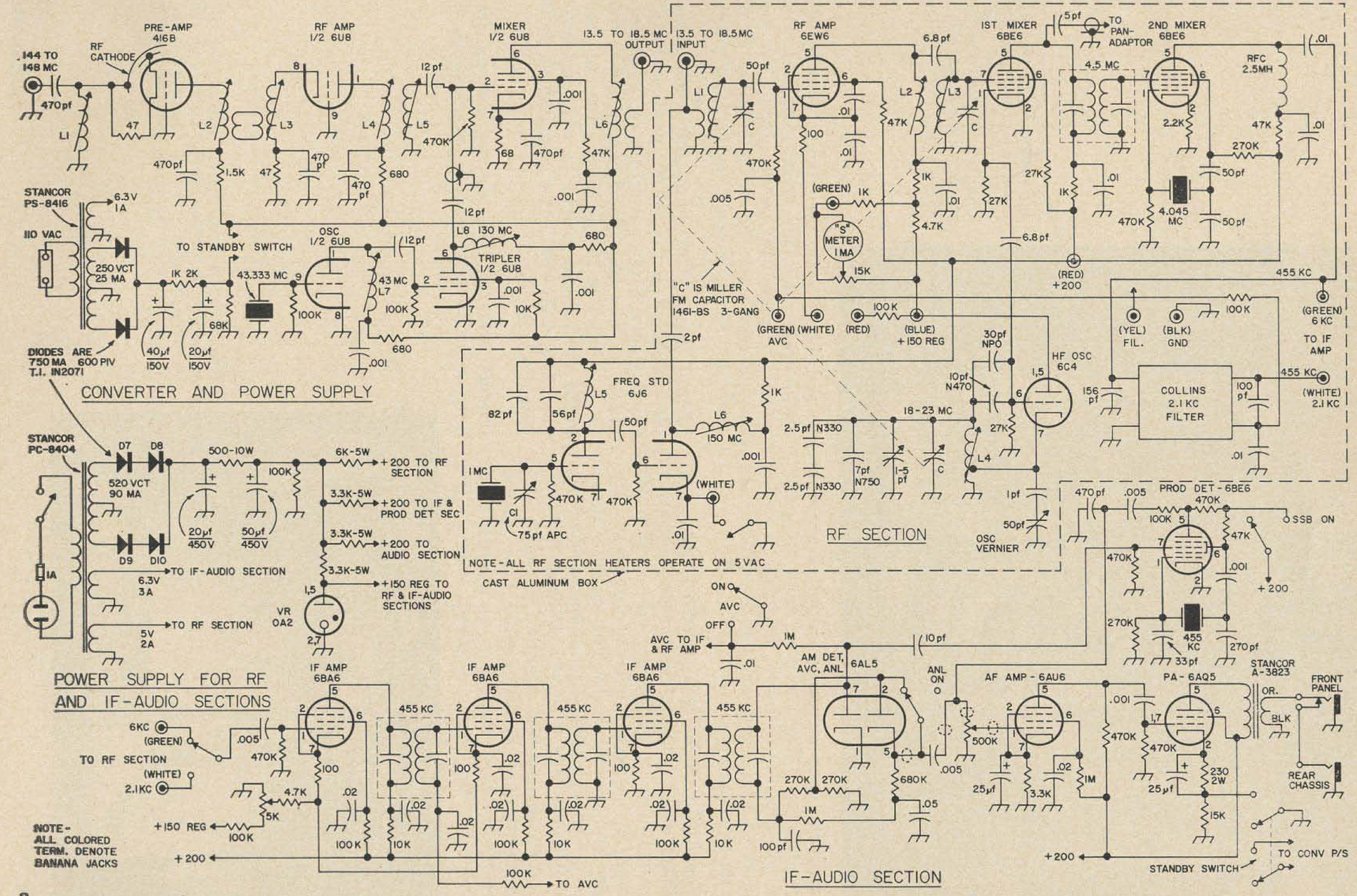
Two meter converter. The converter resembles the Bantam converter described in the first issue of 73 (October 1959.) A 416B preamp has been added for better performance. We didn't use a blower or cathode current meter since the tube is operated at a reduced voltage for maximum tube life. The tube has been



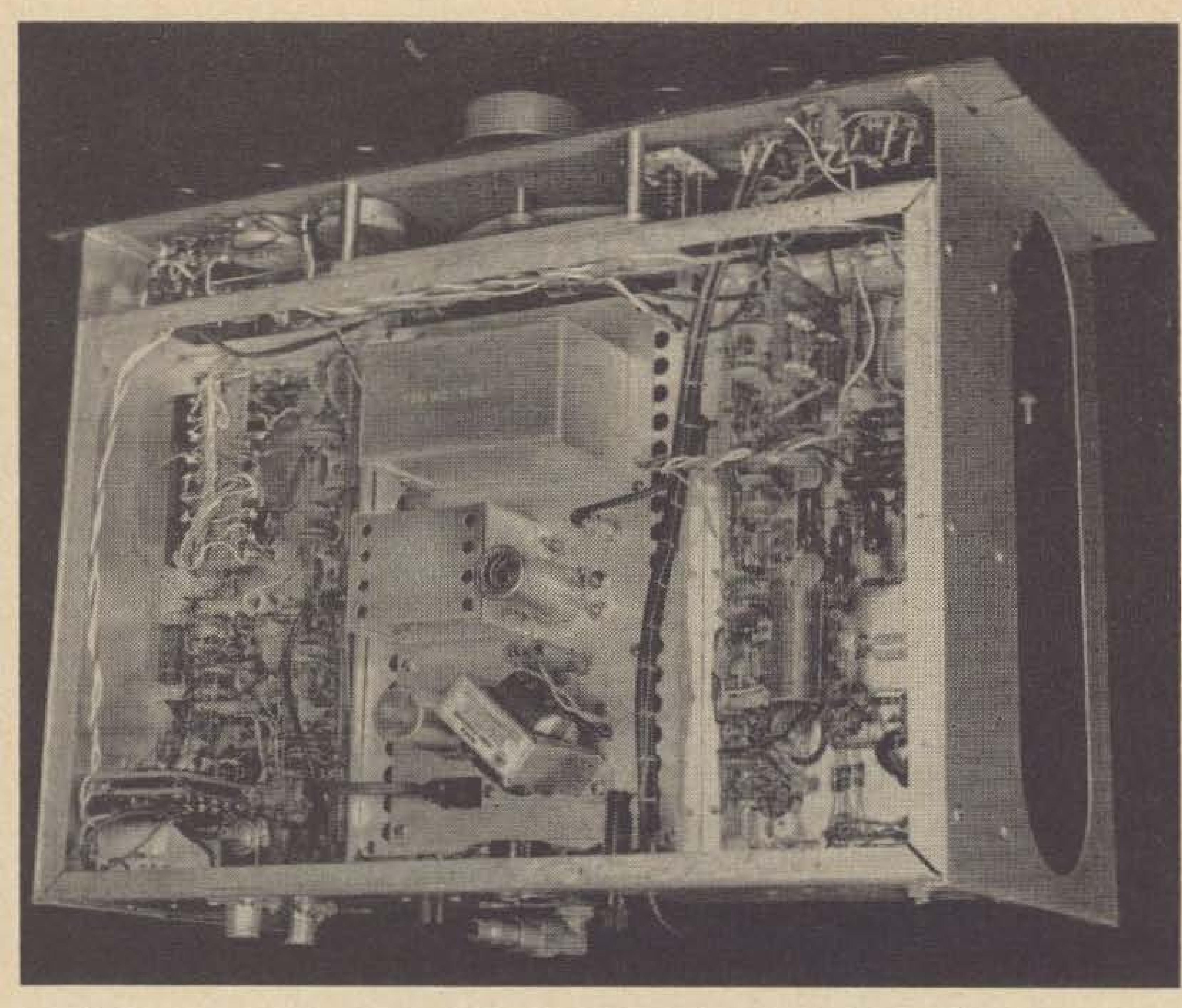
PANADAPTOR

COIL	TURNS	WIRE	LENGTH	LINK	TAP	COIL FORM
			CONVERTER			
L1	3	22				MILLER 41A000CBI
L2	7	22 BARE	1/4"	2T		" "
L3	5		SPACE	3T		" "
L4,L5	5	22	SPACE			" "
L6	26	24 ENAM		4T		" 42A000CBI
L7	11	20 ENAM				" "
L8	6	22 BARE				" "
			RF SECTION			
L1	24	22 ENAM		5T		" "
L2	24	22 ENAM				" "
L3	15	22 ENAM				" "
L4	13	22 ENAM			4T	" "
L6	5	22 BARE				" "
L5	10 µh ADJUSTABLE					" 42A105CBI
RFC	2.5 MH					" 640
			PANADAPTOR			
L1	24	24			5T	" 42A000CBI
RFC	10 MH					" 9220-76

ALL 4.5 MC I.F. TRANSFORMERS ARE MILLER NO. 6203
" 455 KC " " " " " 12-C1
" 262 KC " " " " " 12-H1



144 TO 148 MC
PRE-AMP 416B
RF CATHODE
RF AMP 1/2 6U8
MIXER 1/2 6U8
13.5 TO 18.5 MC OUTPUT
13.5 TO 18.5 MC INPUT
RF AMP 6EW6
IST MIXER 6BE6
TO PAN-ADAPTOR
2ND MIXER 6BE6
RFC 2.5MH
4.5 MC
4.045 MC
STANCOR PS-8416
110 VAC
6.3V 1A
250 VCT 25 MA
TO STANDBY SWITCH
OSC 1/2 6U8
43.333 MC
43 MC L7
L8 130 MC
TRIPLER 1/2 6U8
DIODES ARE 750 MA 600 PIV T.I. IN2071
CONVERTER AND POWER SUPPLY
"C" IS MILLER FM CAPACITOR 1461-BS 3-GANG
"S" METER 1MA
(GREEN) AVC
(WHITE)
(RED)
(BLUE) +150 REG
(RED) +200
455 KC
(GREEN) 6 KC
TO IF AMP
(YEL) FIL.
(BLK) GND
COLLINS 2.1 KC FILTER
(WHITE) 2.1 KC
HF OSC 6C4
30pf NPO
10pf N470
18-23 MC
FREQ STD 6J6
L6 150 MC
1MC
75pf APC
OSC VERNIER
RF SECTION
NOTE - ALL RF SECTION HEATERS OPERATE ON 5VAC
CAST ALUMINUM BOX
STANCOR PC-8404
520 VCT 90 MA
500-10W
6K-5W +200 TO RF SECTION
3.3K-5W +200 TO IF & PROD DET SEC
3.3K-5W +200 TO AUDIO SECTION
3.3K-5W +150 REG TO RF & IF-AUDIO SECTIONS
VR OA2
6.3V 3A TO IF-AUDIO SECTION
5V 2A TO RF SECTION
POWER SUPPLY FOR RF AND IF-AUDIO SECTIONS
PROD DET - 6BE6
SSB ON
AVC TO IF & RF AMP
ON AVC OFF
AM DET, AVC, ANL 6AL5
ANL ON
AF AMP - 6AU6
PA - 6AQ5
STANCOR A-3823
FRONT PANEL
REAR CHASSIS
IF AMP 6BA6
455 KC
6KC (GREEN)
TO RF SECTION
(WHITE) 2.1KC
+150 REG
+200
TO AVC
STANDBY SWITCH
TO CONV P/S
IF-AUDIO SECTION
NOTE - ALL COLORED TERM. DENOTE BANANA JACKS



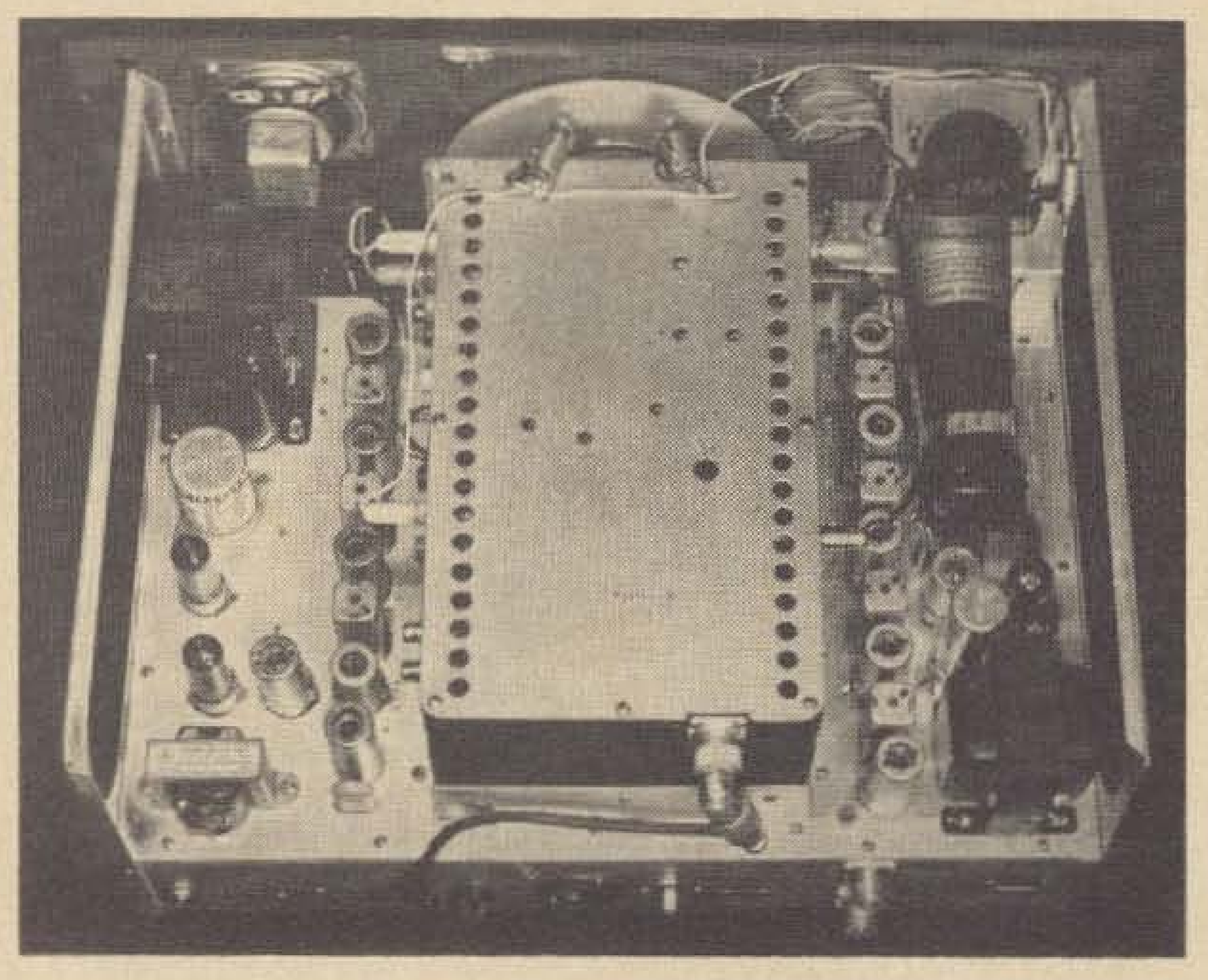
The bottom view shows the placement of the two meter converter over the rf chassis cut-out. RG-58A/U is used to transfer signals to the band switch in the upper right corner.

used for over a year with no decrease in performance. The converter with its power supply was bench tested as a module before securing it in place over the rf section in the cast aluminum box.

Panadapter. A lot of material has been published concerning the construction and use of panadapters so we won't repeat it. But after using it, we must emphasize that it's a necessity in all good stations. The circuit is similar to previously published ones, but mechanically it differs in that it is very compact. The only critical components are the reactance tube modulator and oscillator tank. We'd suggest that you follow the values and layout there carefully. The maximum sweep is about 260 kc and the pips are very sharp. Two signals 10 kc apart can easily be distinguished. The unit is complete with power supplies, so was easy to bench test before installation. Only vital controls are brought to the front panel.

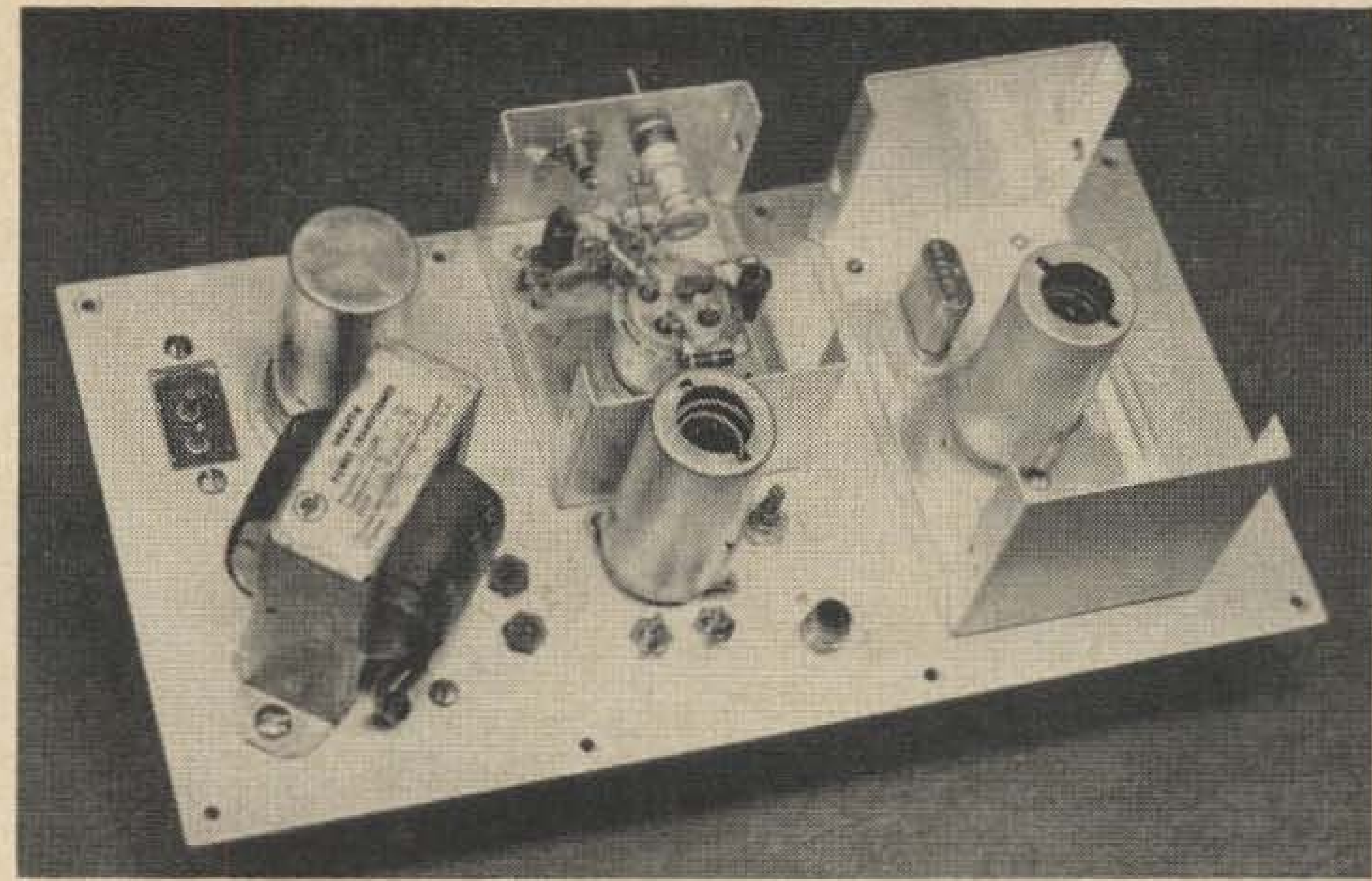
Main *if* chassis. This consists of an aluminum plate mounted over a cut out provided for it. On this plate is the power supply, audio amplifier, product and AM detectors and a 455 kc *if* strip. The *if* amplifiers were mounted in the usual in-line manner to avoid regeneration. The ANL and audio gain control leads should be shielded.

Product detector. The product detector for SSB and CW reception is energized by a



This top view from the back shows the arrangement of the panadapter at the right of the main rf tuner. The left side of the tuner contains the balance of the receiver.

Top view of the two meter converter showing the Minibox construction of the converter and pre-amp. On the left is the power supply. The center tube is the 6U8 mixer-amplifier. Behind it is the Minibox holding the 416B. The right Minibox contains the 6U8 oscillator.



switch on the front panel which turns on the B+ for the stages. The BFO uses a 455 kc crystal. The audio output is in parallel with the AM detector to the audio gain control.

Audio amplifier. The audio amplifier is standard. It produces about 2½ watts of audio output. The built-in speaker is plugged into one of the output jacks.

Main chassis. The main chassis is a 17 x 11 x 3 inch chassis. Three holes were cut in its top for the three subassemblies with a half inch strip between the holes.

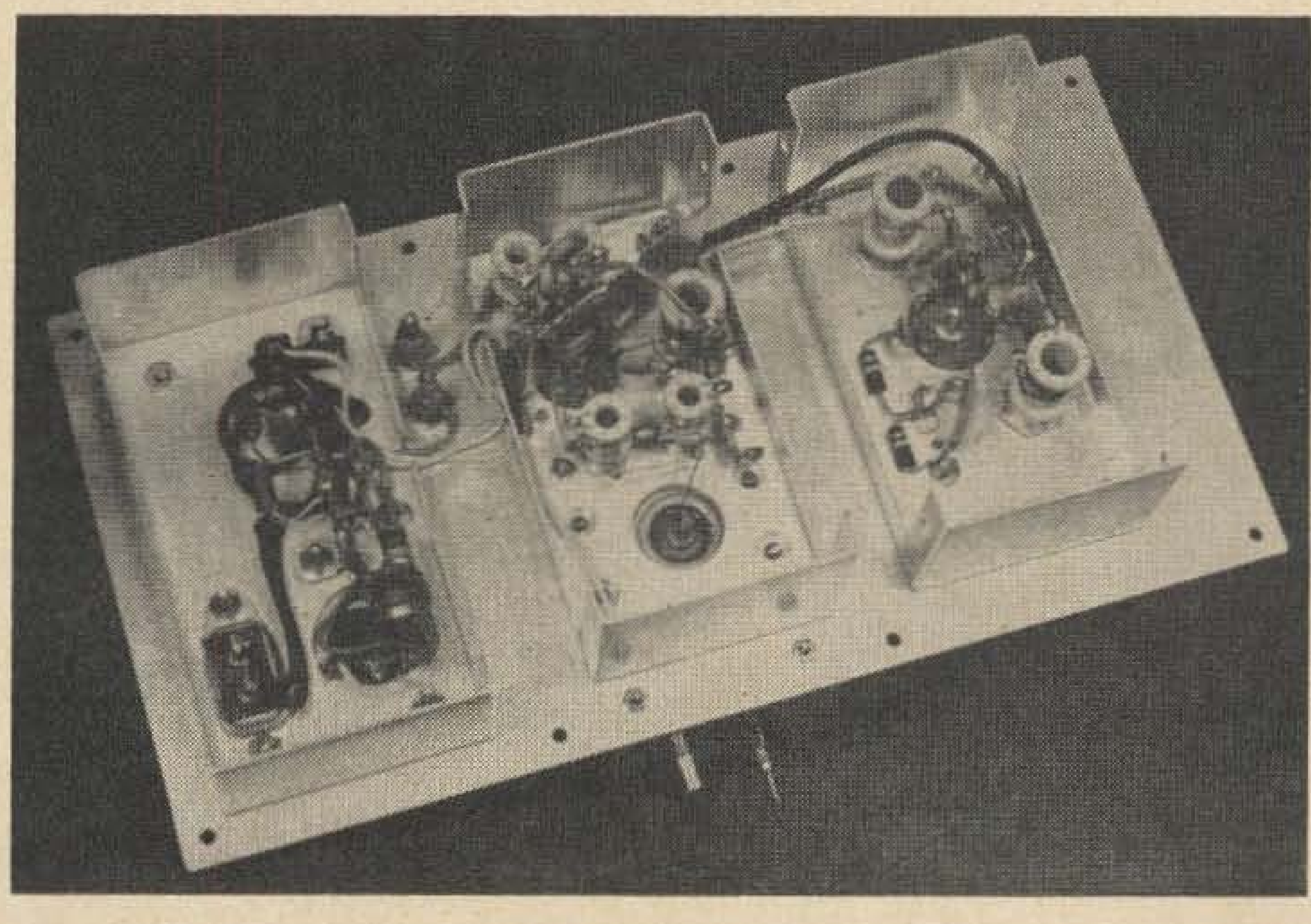
Front panel. The front panel is a standard 19 x 8-¾ x ⅛ inch gray crackle finish plate. The escutcheon for the dial was cut out of ⅜ inch aluminum plate and fastened to the panel with flat head screws. It is sprayed with black crackle finish and clear plastic. The frame on either side of the escutcheon is made of 1/16 inch aluminum with the same treatment. The dial plate was made by cutting two pieces of 1/16 inch plexiglass with a fly cutter and sandwiching the hand calibrated dial between them. The diameter is about 6 inches. The bezel and shield for the CRT were made by Millen. The S-meter is a 0-1 ma Simpson mounted upside down. The calibrated scale is quite easy to make with Datak letters on a piece of bristol board. The speaker grill came from a portable radio. All control labels are engraved for that professional look.

Results

Operating a receiver of this type is really a pleasure. Signals can be spotted on the scope and identified in the various modes and signal strengths. The gradicule on the face not only helps determine the percentage of modulation of the received carrier, but also gives the separation between signals. Those who construct this receiver will find it very worthwhile.

. . . W9DUT, W9JFW

Bottom view of the two meter converter. In the center housing is the 416B pre amplifier and 6U8 socket. Injection to the mixer is through a coaxial line running to the oscillator in the Minibox on the right. The two coil forms in the oscillator section are the oscillator and tripler coils. The compartment on the left is the converter power supply.



Ralph Schmidt WA6TSA
13701 Saigon Lane
Santa Ana, Calif.

Build a modern automatic keyer for under $20

A Unijunction Keyer for CW

To be sure, several good and easy to construct keyers have appeared in the past. Each has its own particular point of interest. To follow suit with another may be with little justification. However, it is the belief of at least one person that this keyer is different enough to have definite appeal to anyone who prefers compactness, portability and functional completeness in one package.

The popularity of past keyers has been tied up in the designer's definition of the term "automatic." Adjectives, such as fully automatic, semi-automatic, self-completing, dot-memory, etc., are added to help clarify the design intent. It is the intent of this article to describe a low cost keyer that is fully automatic, and self-completing (including the space-after-mark) in a very small package (1⅜" x 3⅛" x 5½"). It contains its own power source, a 9 volt battery, and has a built in sidetone oscillator.

A semiconductor device that is all but unknown among amateurs is put to good use in this circuit. Called the unijunction, it plays the central role in its operation and, thereby, deserves being discussed first.

The circuit of **Fig. 1** is an electrical equivalent of the unijunction. RB1 is related inversely to the current in the emitter, and will vary, for a typical unijunction, from several thousand ohms to just tens of ohms, as the emitter current changes from 0 to 50 ma. (For this typical unijunction, RB2 would also be several thousand ohms.)

Let us examine the circuit of **Fig. 2.** While the capacitor is charging, the unijunction has no effect. When the capacitor voltage reaches the threshold, current in the emitter causes RB1 to decrease and thus, for more current to flow. In a very short time, tens of microseconds, the capacitor "dumps" almost all of its charge into the low resistance emitter and soon will no longer supply enough current to the emitter to keep RB1 low. The diode becomes back-biased and the unijunction reverts to its "inactive" state, and the capacitor begins charging again. This is the sawtooth circuit that is used in the keyer. The G.E. *Transistor Manual* carries the discussion of unijunction operation to the next several levels of understanding.

The portion of the circuit consisting of the unijunction and the threshhold switch transistor Q2 actually comprise a basic keyer. Q3 is merely a relay driver and can be, just as well, the keying switch, to connect directly to a transmitter, with a properly chosen transistor. However, no attempt was made to find and try such a transistor since the relay circuit worked more than adequately and is much less restricted.

Fig. 3 has been provided to explain the operation of the keyer. The voltage across capacitor C1 is the most prominent waveform shown.

The self-completing characteristic is attributed to the fact that once the capacitor is discharged, (at t_1 or t_4) the key has no effect until the voltage rises above the firing point of the unijunction (at t_3 or t_5, respectively. This way, a mark or "on" condition and a space or "off" condition of standard length must be completed before any subsequent mark can be initiated.

The photograph shows two different stages in the evolution of the keyer. The unit on the left originally had the key wired permanently to it. The resulting key-keyer combination was still not obtrusive (after all, the key was not likely to be needed elsewhere.) However, the

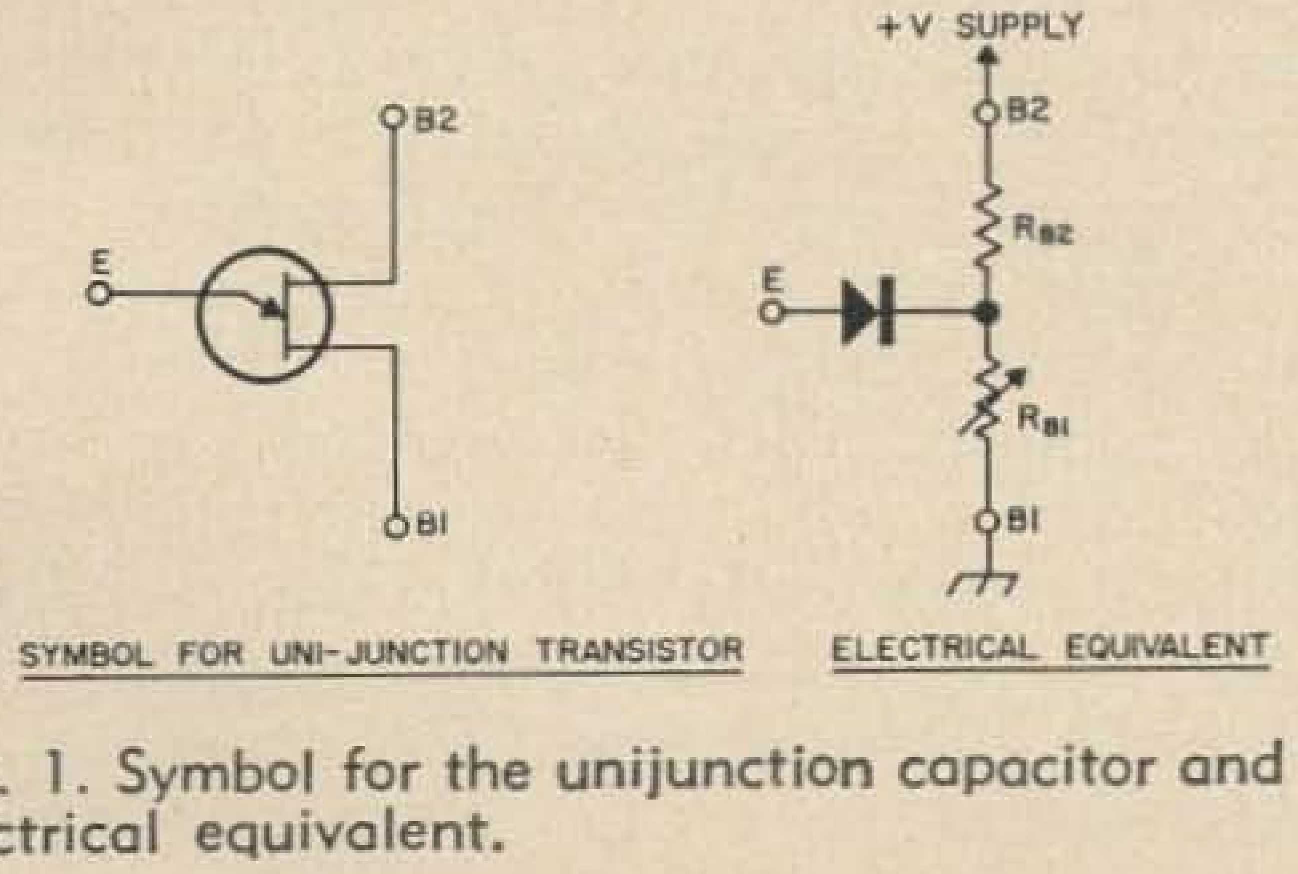


Fig. 1. Symbol for the unijunction capacitor and its electrical equivalent.

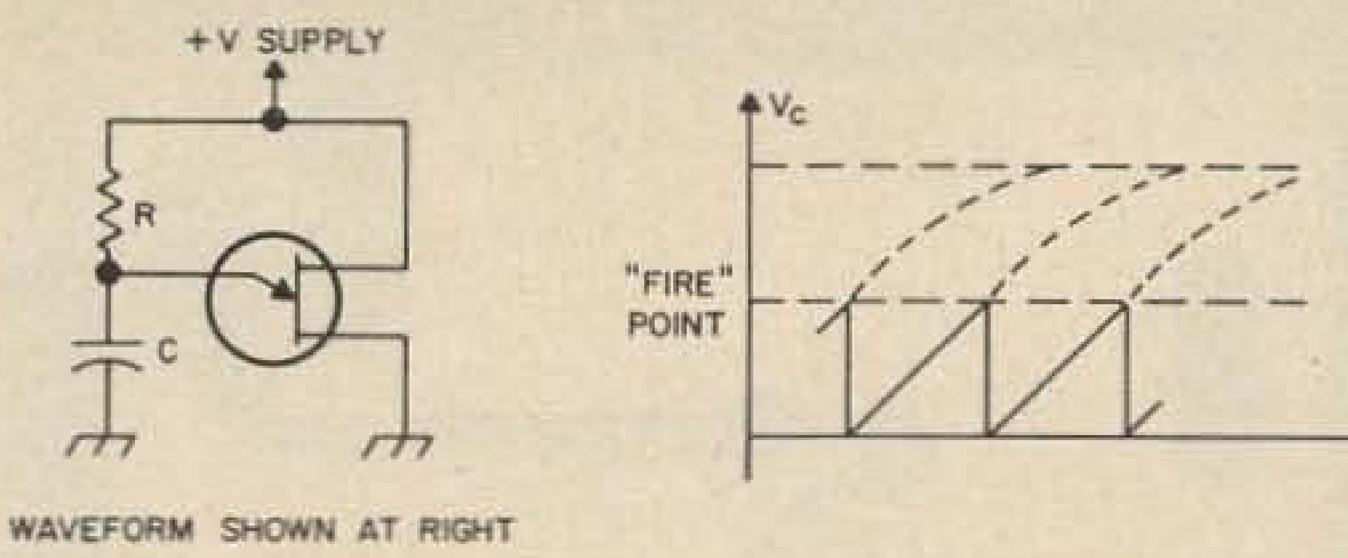


Fig. 2. Action of the unijunction oscillator.

desire for a built-in oscillator to monitor the output and a few design experiments prompted the building of the second unit with the requirement that the key disconnect from either unit. The speaker grille is visible along with a "speed control" knob. The original unit has trim-pot screwdriver adjustments. The meter case contains an outboard oscillator for keyer number one.

The finished unit draws less than 3 ma of current in standby and less than 10 ma with continuous marks (continuous dashes draw more than continuous dots.) It does not appear economical to use the "bargain" 30 cent battery that seems to be available most everywhere, even though they will probably last several weeks, depending on usage. This may be due to the fact that the relay can operate erratically if the battery voltage drops very much below 9 volts. It is rated to pull in at about 7 volts, although it can be mechanically adjusted for minimum spring tension.

In order to evade a perfectly good question, the price of building this unit will fall somewhere in the range of 8 to 38 dollars, from one who requires only the semi-conductors, the relay and case to one who buys all brand new sub-miniature components and a printed circuit kit. The average cost should, however, be

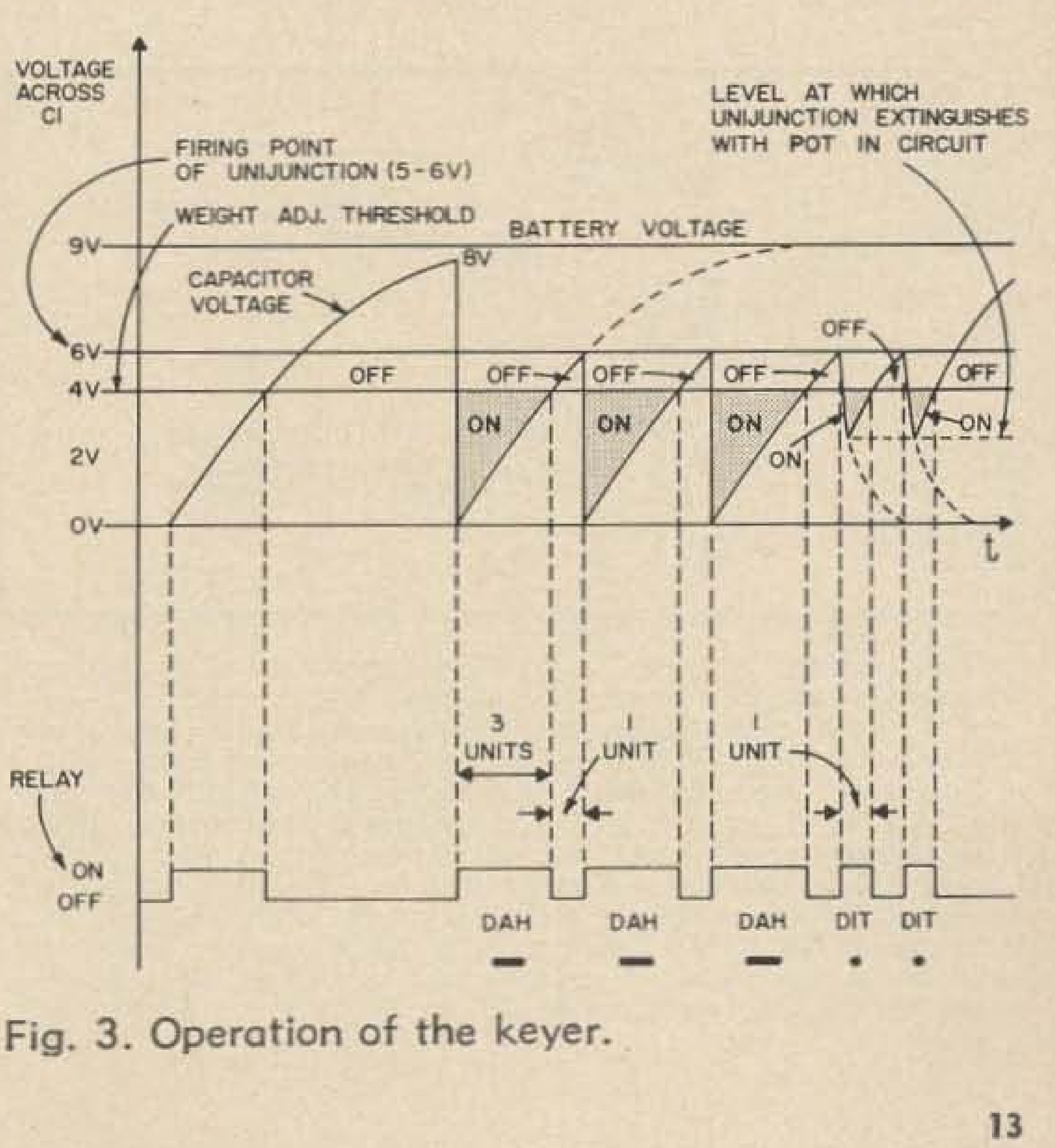
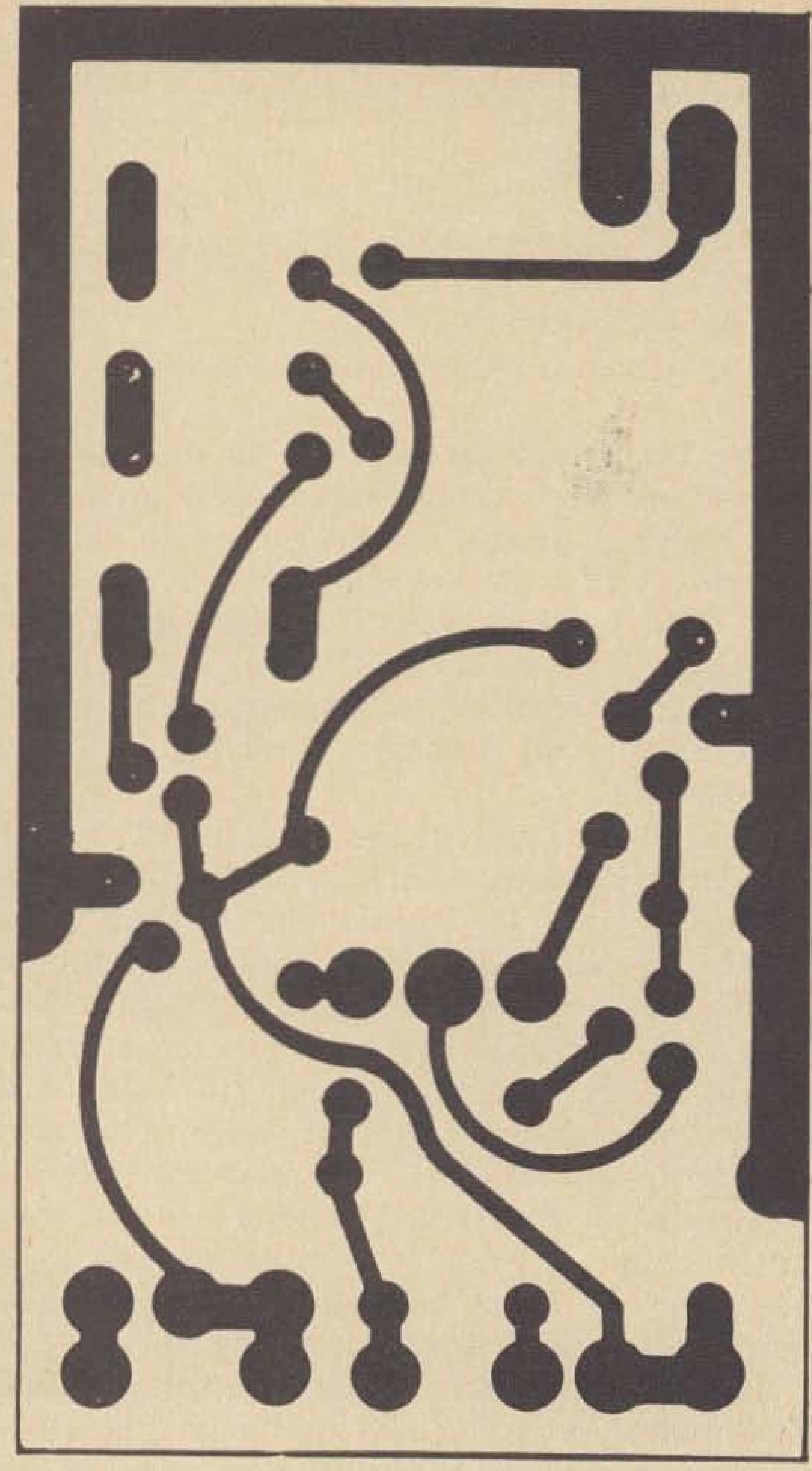
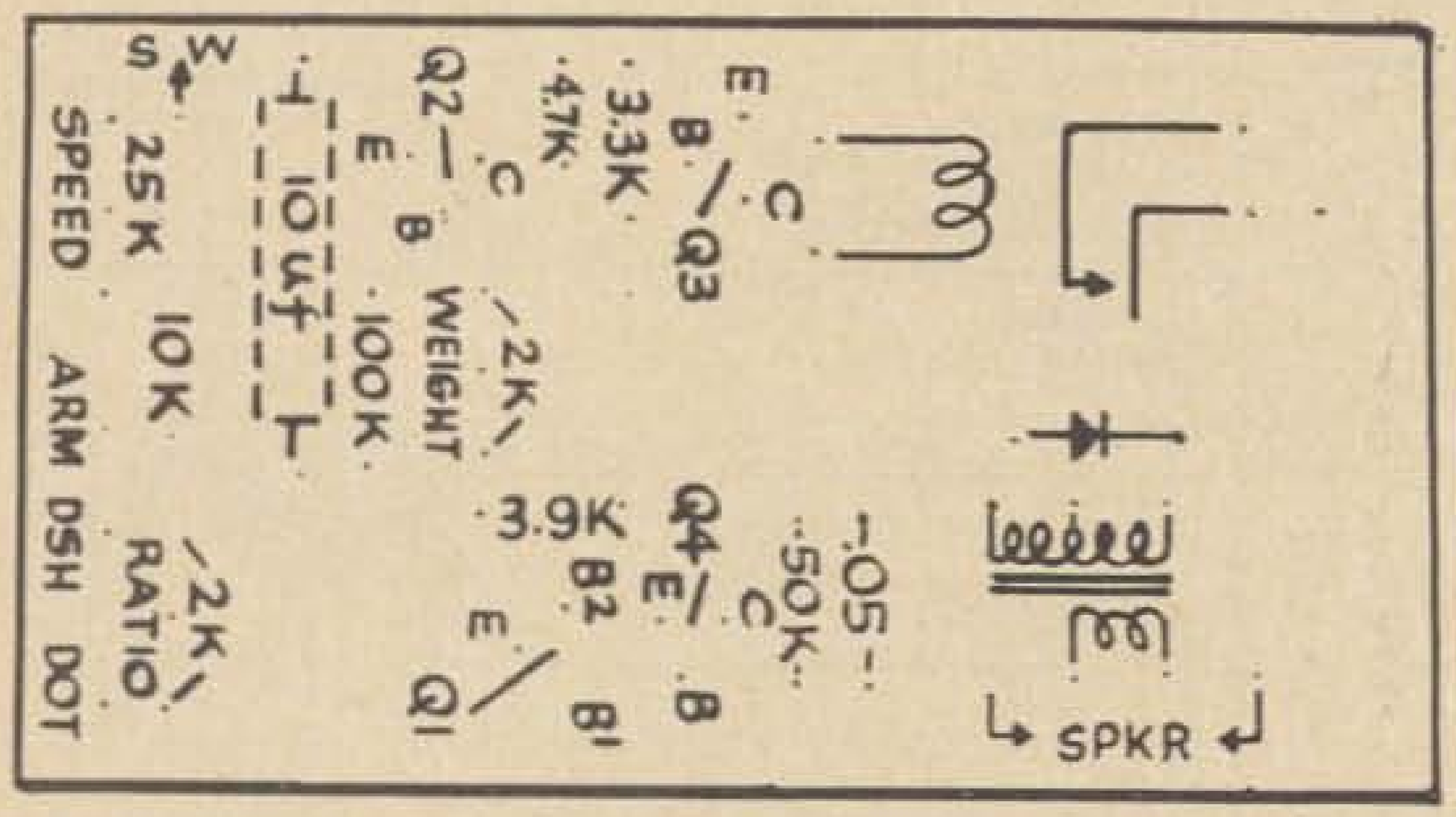


Fig. 3. Operation of the keyer.



Here's a full size layout of the Harris printed circuit board for the keyer. Note that the circuit has been modified slightly to eliminate the extra 1.5 v battery. The component side of the board is shown reduced below.



The easiest way to build this keyer is with the pc board from the Harris Company. The board is 2-3/4" x 5" and everything but the speaker and key jack fits on it. An ideal case is the inexpensive Bud 3006. The board comes with all **65** holes drilled and included with each board is a detailed instruction sheet and picture of parts layout as well as a list of the best parts to use and their source. You can build the complete keyer from all new parts with this circuit board for $18.50. The board is $4.50 or you can buy it with the transistors already mounted for $8.95. Write the Harris Company, 56 E, Main, Torrington, Conn.

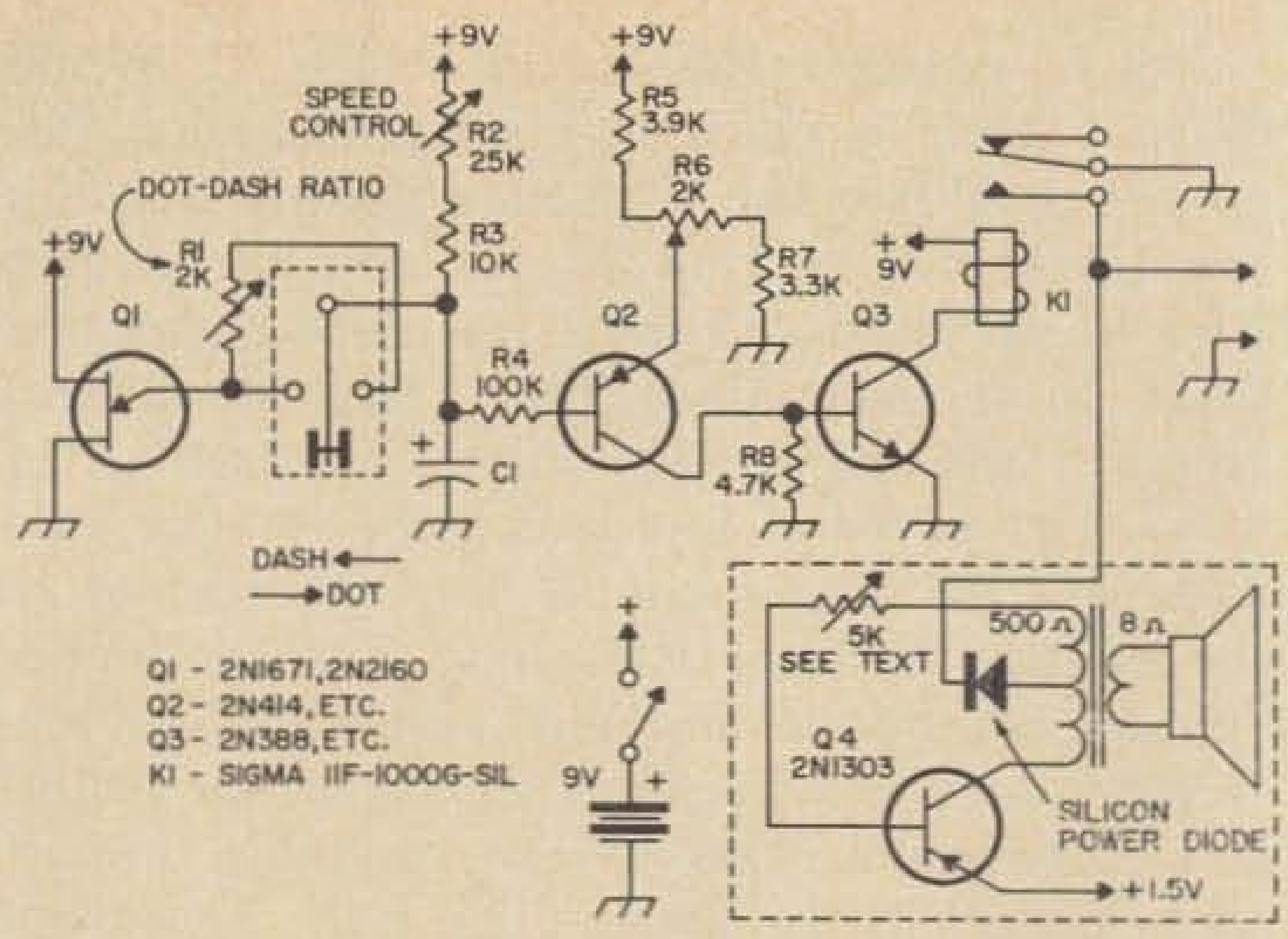


Fig. 4. The Unijunction Keyer for CW. Q2 can be relatively high beta (over 50) PNP transistor. Q3 is any NPN transistor. K1 is a Sigma 11F-1000G-SIL ($1.75).

somewhat less than the arithmetic average. Vague enough?!

The schematic (**Fig. 4**) shows, for the oscillator-monitor, the "CW Monitor" described in 73 on page 44, June '63 by WA2WFW. As a note of caution, however, an extra 1.5 v supply is recommended, as shown, since the power requirements for the oscillator are high enough to drastically load the 9 volt battery if used with a divider or zener diode supply to power it.

The values of R2 and R3 shown in the schematic are sufficient to provide a speed range of approximately 10 to 40 wpm, judged to be the most popular range among those who count.

R5, R6 and R7 are used to provide the resolution needed if a standard potentiometer (1 turn) is used. If a 15 turn, screwdriver adjust, trim-pot (Bourns type 3067, 10K-ohms, $1.65) is used, R5 and R7 are not needed.

It is strongly advised that adjustment be accomplished through the use of the meter method or any scheme that utilizes quantitative measurements and not to do it by ear. The difference would be readily apparent if one adjusted by ear first and then with a meter.

The meter method utilizes the fact that a dc meter will integrate a rapidly repetitive waveform to display the average value. A voltmeter is connected, through the relay, to any battery. Holding the key in the "dash" position, adjust the weight control until the meter reads ¾ of the battery voltage, connected through the relay contacts. Then holding the key in the "dot" position, adjust the dot-dash ratio control until the meter reads ½ of the battery voltage, connected through the relay contacts. Recheck the first adjustment. This completes the procedure. . . . WA6TSA

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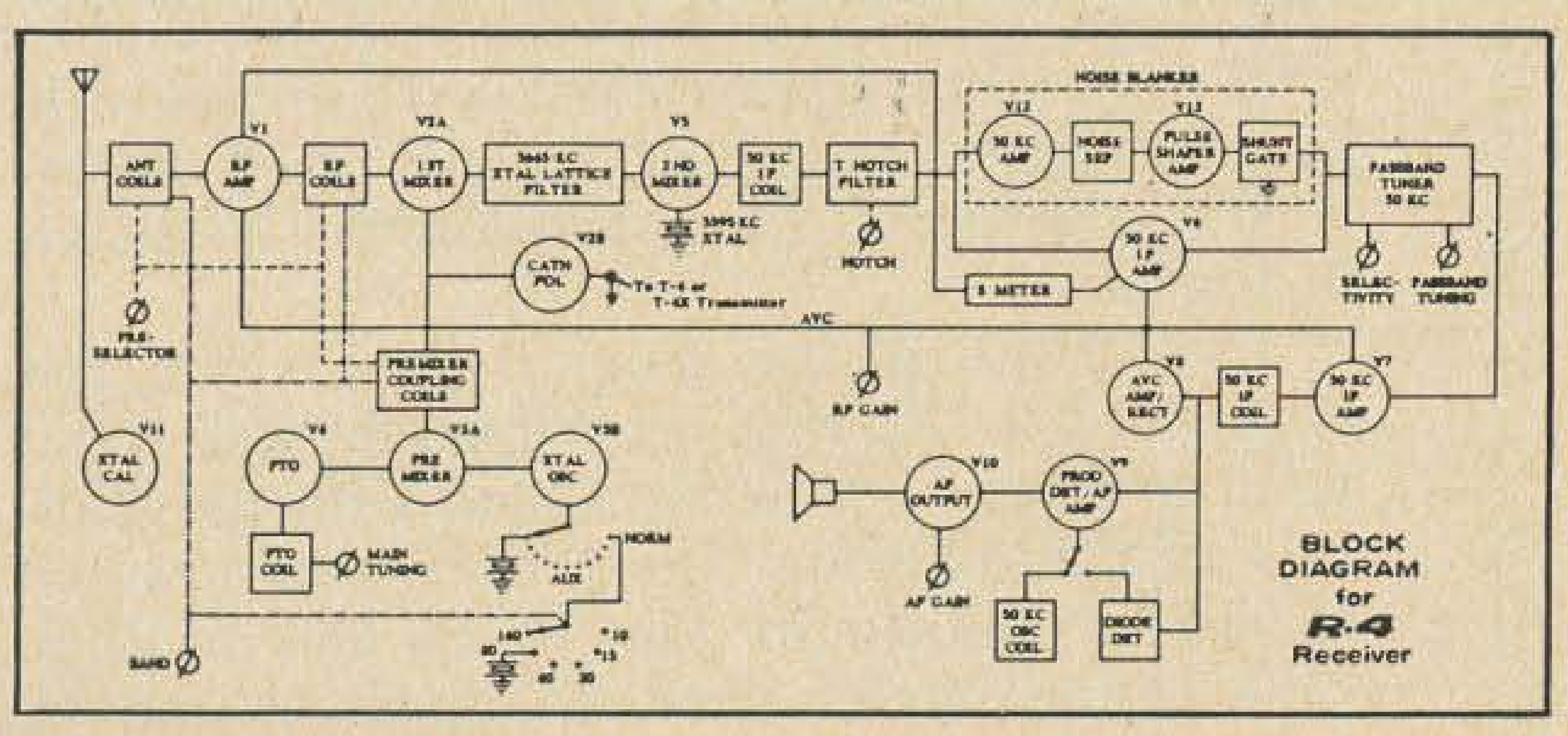
- **13 tubes and 7 diodes.**



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R-4A will incorporate minor production changes including a solid state VFO.

SPECIFICATIONS— Model R-4

FREQUENCY COVERAGE: 3.5-4.0 Mc, 7.0-7.5 Mc, 14.0-14.5, 21.0-21.5, and 28.5-29.0 Mc with crystals supplied. Ten accessory crystal sockets are provided for coverage of any 10 additional 500 KC ranges between 1.5 and 30 Mc with the exception of 5.0-6.0 Mc.

SELECTIVITY: Drake tunable passband filter provides:
.4 KC at 6 DB down and 2.6 KC at 60 DB down
1.2 KC at 6 DB down and 4.8 KC at 60 DB down
2.4 KC at 6 DB down and 8.2 KC at 60 DB down
4.8 KC at 6 DB down and 25 KC at 60 DB down
Selectivity switching is independent of detector and AVC switching.

I.F. FREQUENCIES: First I.F.—5645 KC crystal lattice filter; second I.F.—50 KC tunable L/C filter.

STABILITY: Less than 100 cycles after warm up. Less than 100 cycles for 10% line voltage change.

SENSITIVITY: Less than ½ uv for 10 DB signal plus noise to noise on all amateur bands.

MODES OF OPERATION: SSB, CW, AM, RTTY.

DIAL CALIBRATION: Main dial calibrated 0 to 500 KC and 500 to 1000 KC in 5 KC divisions. Vernier dial calibrated 0 to 25 KC in 1 KC divisions.

CALIBRATION ACCURACY: Better than 1 KC when calibrated at nearest 100 KC point.

AVC: Amplified delayed AVC having slow (.75 sec.) or fast (.025 sec.) discharge; less than 100 microsecond charge. AVC can also be switched off. 3 DB change in AF output with 60 DB change in RF input.

AUDIO OUTPUT: 1.4 watts max. and .5 watts at AVC threshold.

AUDIO OUTPUT IMPEDANCE: 4 Ohms and hi impedance for anti-vox.

ANTENNA INPUT: Nominal 52 Ohms.

SPURIOUS RESPONSES: Image rejection more than 60 DB. I.F. rejection more than 60 DB on ham ranges. Internal spurious responses in ham ranges less than the equivalent 1 uv signal on the antenna.

FRONT PANEL CONTROLS: Main tuning, AF gain, RF gain, AM-SSB/CW with slow AVC, fast AVC, or AVC off, function switch, band switch, xtal switch, passband tuning and selectivity, preselector, notch, and headphone jack.

REAR CHASSIS JACKS AND CONTROLS: S-meter zero, notch adjust, antenna jack, speaker jack, mute jack, anti-vox jack, accessory power socket, and fuse post.

POWER CONSUMPTION: 50 watts, 120/240 VAC, 50/60 cycles.

DIMENSIONS: 5½" high, 10¾" wide, cabinet depth 11⅝", overall length 12¼", weight 16 lbs.

AVAILABLE ACCESSORY: Model MS-4 matching speaker cabinet with high efficiency 5 x 7 speaker. Cabinet also houses the power supply for the T-4 or T-4X matching transmitters.

R. F. Van Wickle W6TKA
643 Aurora Avenue
Santa Barbara, Calif.

Two-Element Twenty-Meter Vertical Array

Here's a twenty-meter antenna that should, in theory, radiate a horizontal pattern similar to that shown in **Fig. 1.** The pattern is, of course, subject to being affected by nearby metallic objects, but from my own crude checks with a non-calibrated field intensity meter, and in QSO's, the actual pattern seems to approximate the theoretical. The vertical angle of radiation is quite low.

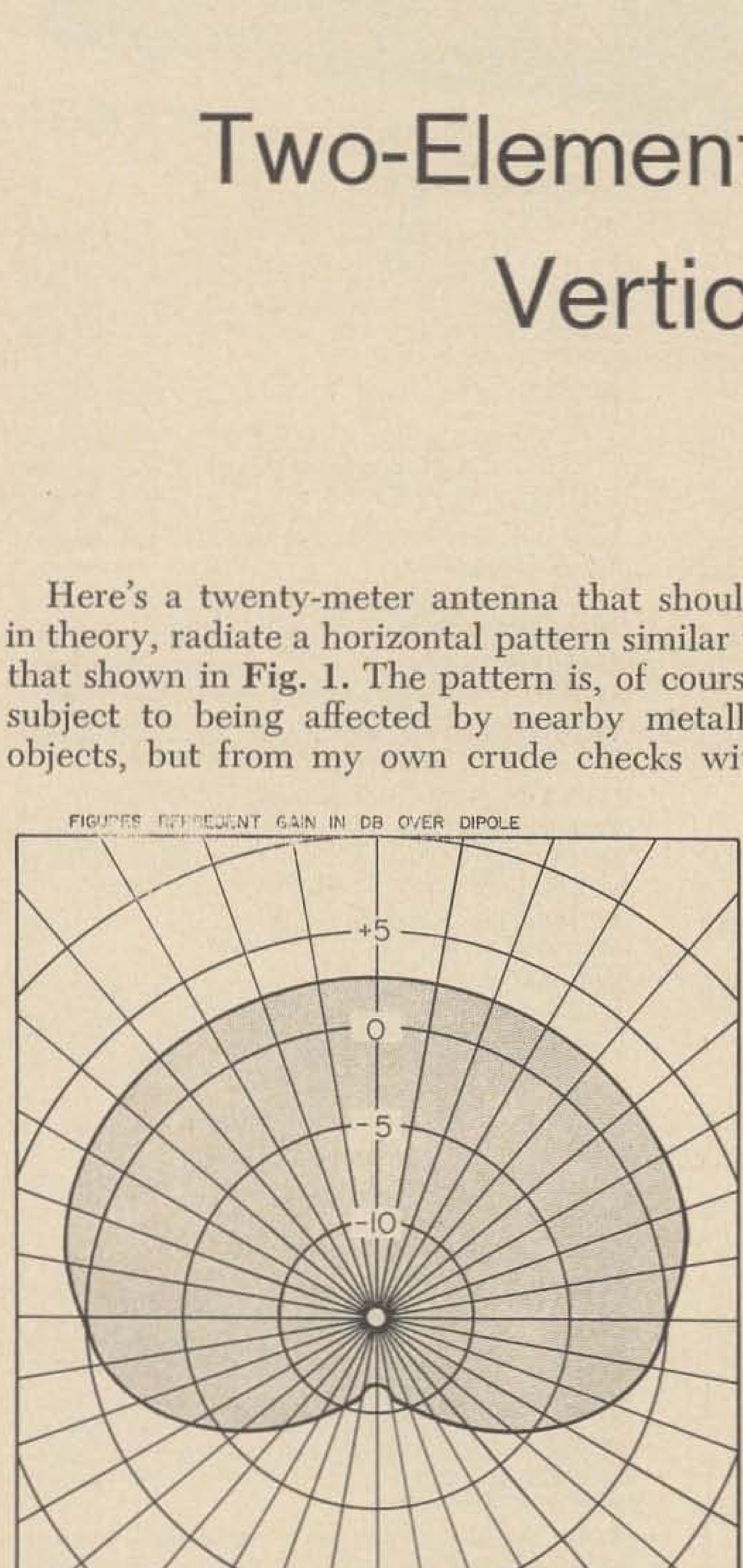


Fig. 1. Gain pattern of ground plane vertical antenna with reflector spaced 0.2 wavelength from the radiator.

An array of this type has a forward gain of approximately three db, and a front-to-back ratio of 15 db. I chose this particular antenna after concluding that a full-sized twenty-meter beam would dwarf my house and make it appear as though a large bird were hovering over it. And the asthetic aspects of a quad were something less than thrilling to my wife.

Since I had used a ground plane for a few months with fair luck on twenty meter RTTY, adding a reflector to the ground plane seemed to be a natural step. Of course, an obvious limitation to this type of array is that it is non-rotatable and you have to decide, before putting it up, in which direction to point it. My array, according to my Woolworth compass, is pointed across the center of the United States.

A schematic of the antenna array is shown in **Fig. 2.**

The VSWR of the ground plane alone, fed with RG-8/U 52-ohm coaxial cable, was about 1.2:1 and went up to over 1.5:1 with the addition of the reflector. The VSWR was lowered to 1:1, as shown in **Fig. 3,** by the addition of a gamma-match feed arrangement and by using eight drooping radials for the ground plane. Four of the radials, for which #12 copper wire was used, are slightly longer than a quarter wavelength at 14.1 mc and four are slightly shorter.

se of the ground plane radiator showing gamma
ıtch arrangement.

One of the radials is attached to the bottom the reflector element. Spacing of the radia- (ground plane) and reflector is 12 feet, or out 0.2 wavelength. The radiator is 16 ft 6 long and the reflector is 17 ft 9 in long.

Matching is accomplished by tapping the mma match up approximately two feet from bottom of the ground plane, and then mak- careful adjustments up or down in incre- nts of an inch or so, until minimum re- cted power is indicated. Pruning the radials, d adjusting their droop, then follows. This ocedure should enable you to obtain a WR as shown in **Fig. 1.**

Both the radiator and reflector are made aluminum tubing. The sections of the alumi- m tubing are connected by forcing a length dowel into one section, securing with a ew, and then forcing the other section over length of dowel extending from the first ction. The sections are connected electrically drilling through the aluminum and dowel,

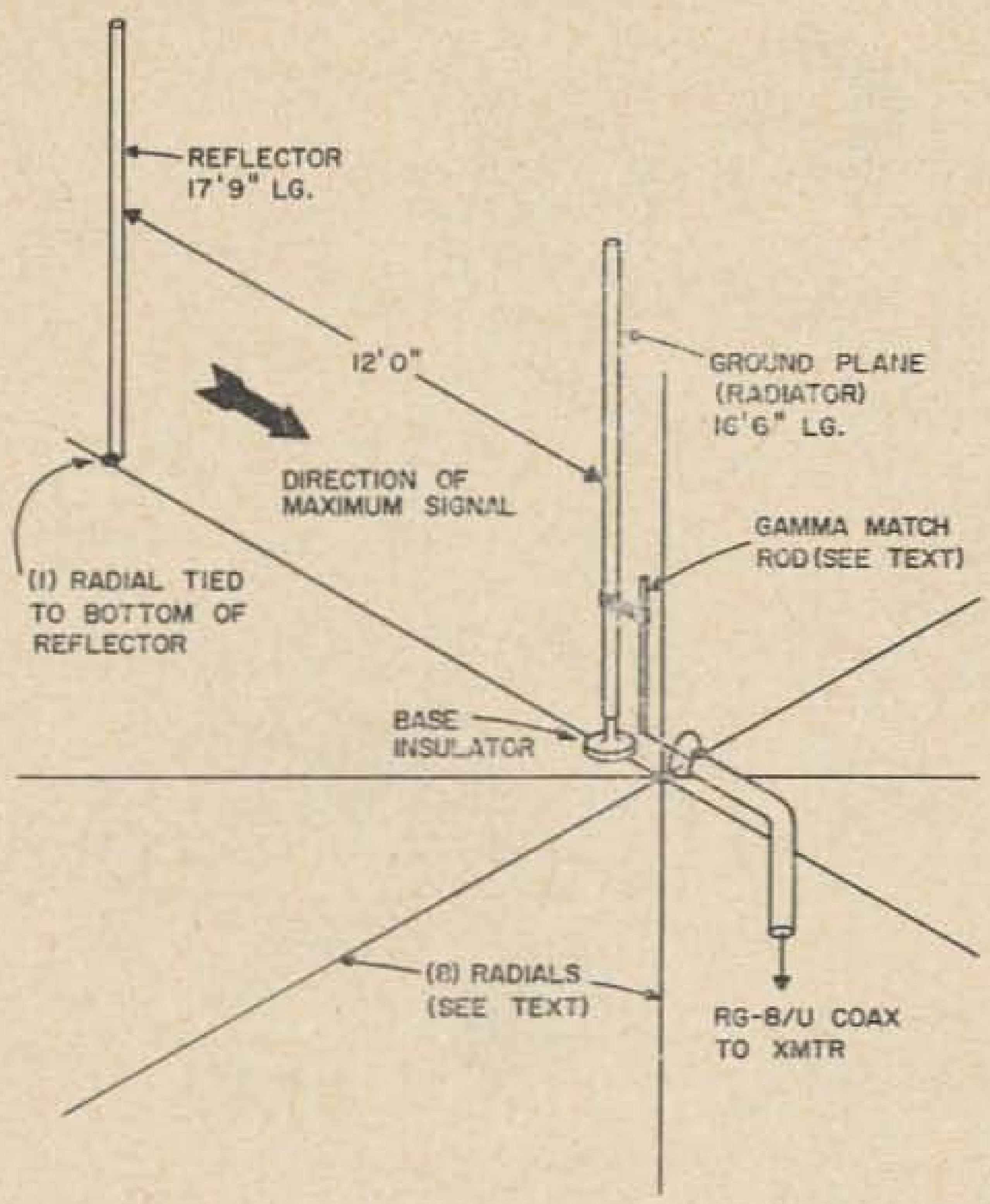


Fig. 2. Schematic of the antenna array.

on both sides of the joint, attaching screws, solder lugs and nuts, and soldering short pieces of #12 wire between the sections.

The top few inches of both the ground plane and reflector are made of ½-inch soft aluminum tubing, so that if pruning of the elements is necessary to an exact frequency it can be easily accomplished. A short length of dowel is forced into each of the tops of the elements (in the large diameter tubing) to prevent them from filling with water.

The radiator and reflector are guyed using egg insulators and plastic clothes line. A piece of phenolic rod of the same diameter as the inside diameter of the tubing is used as the base insulator of the radiator. The reflector is supported by a length of dowel, which is adequate insulation for this element, as the radials are merely laid on the roof and since the reflector is attached to one of the radials, an insulator at the base of the reflector would serve no useful purpose.

. . . W6TKA

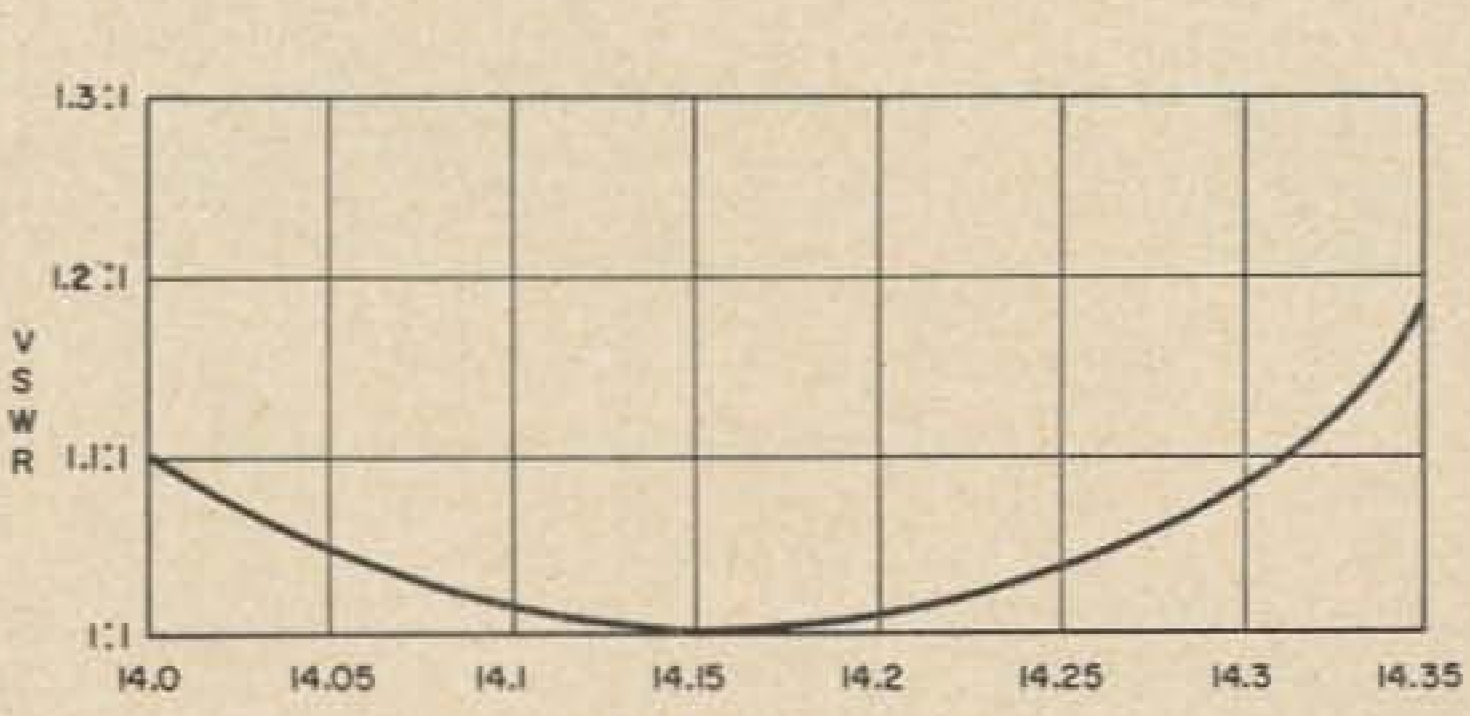


Fig. 3. VSWR vs frequency, ground plane with reflector.

They Said It Couldn't Be Done

"What? A female build a rig?" "You're nuts!" These were the comments I used to hear when I announced my plans. After months of constant ribbing about the subject, I decided to do something about it. Just where do you start, presuming you have never so much as tightened a screw on a chassis?

After building up my confidence, I set out to receive the aid of my husband to be, a die-hard home-brewer. His comments all amounted to: Sure I'll help you, provided you do all the work!

The beginning started with the help of his library of ham reference books. After boning up on various subjects, I was ready to be acquainted with the common everyday ham tools. I was shown how to use these *once*—then I was on my own. I soon learned that a valuable part of any hamshack is the junkbox. Using a small breadboard of perforated aluminum and various otherwise useless components, I learned the art of soldering, fastening screws, working with wires, and drilling holes. (How I hated to use that electric drill!) Once I had acquired the use of the equipment, I had to decide just what I would build. I didn't want anything too complicated; yet it had to be an accomplishment for me—something to be proud of. After studying several schematics I came up with the idea of building a low power six meter cw rig. It would be easier than building an AM rig, and yet it would be challenging.

Back to his junkbox I went to collect some of my parts; the others I managed, somehow, to get from other friends. After weeks of collecting my parts, and tools, I soon had a blank look on my face. (How should I begin?) With

Joan Vogt WA2YTK
182 Belmont Road
Rochester, New York 14612

Illustrations by Wayne Pierce K3SUK

some advice from the OM-to-be, we planned how I would arrange the parts. No one would ever believe that it might have taken me a half hour to figure out where to make a connection. Weeks, months, and seasons went by before the "VHF Special" was completed. The surprising part was that after I finished it, it tested out to work the first time. I was on the air! But more important, I had done it myself. You can too, why not try it.

Before you change your mind and start thinking up excuses to tell yourself, hear me out! Let us assume that you are a new "green" ham. You just passed your test, have your license framed in full view and are anxious to get on the air. You say to yourself "sure it's easy if you've got someone to help you design a rig and furnish parts, but what about me?" My reply would be to equip your hamshack with useful inexpensive reference material such as the magazine you are now reading. By reading various types of articles, you will be able to pick up many helpful hints and ideas to use. Handbooks, magazines, and pamphlets all contain descriptions of easy to build equipment.

Join your local radio club. Discuss your ideas with other hams. Ham's are very friendly people. You will probably meet someone in your own situation or someone who might be eager to help you.

There are some basic necessities which you will need for constructing your project. Take some of that "green stuff" out of your pocket and invest in a good set of tools. Screw drivers, long-nose pliers, diagonal cutters, a drill, a soldering iron, solder and an assortment of basic hardware are all essential for building. Anyone will tell you that inexpenive tools never last and are no bargain, so don't be afraid to spend a little extra to get quality tools.

Review your reference material and decide what you want to build. It might be a rig that has already been built or one you design, using parts of various schematics. Don't quit even if you think you just can't go on any further. The worst that can happen is that you'll swallow your pride and have to ask your fellow hams a question. No doubt, they'll only tell you once—so pay attention.

Make up your mind that you will succeed, and stick with it until you get it working. Don't be afraid to learn from your mistakes. Remember, the only difference between a successful builder and a failure is that the successful builder didn't quit when he came up against a problem. You, too, can be a successful builder!

. . . WA2YTK

Simplified RF Impedance and Power Measurements

Jim Fisk WA6BS

Of all the measurements that are made, the accurate determination of radio-frequency power and impedance present the most difficulty, particularly at frequencies above 100 mc. Many methods have been developed over the years for highly exact power and impedance measurements, but the majority of these techniques require accurately calibrated precision instruments. One method that has apparently been overlooked by most writers is the simple procedure presented here.

DB Loss	Power Ratio	DB Loss	Power Ratio	DB Loss	Power Ratio
0	1.000	2.5	.562	5.0	.316
.1	.977	2.6	.550	5.1	.309
.2	.955	2.7	.537	5.2	.302
.3	.933	2.8	.525	5.3	.295
.4	.912	2.9	.513	5.4	.288
.5	.891	3.0	.501	5.5	.282
.6	.871	3.1	.490	5.6	.276
.7	.851	3.2	.479	5.7	.269
.8	.832	3.3	.468	5.8	.263
.9	.813	3.4	.457	5.9	.257
1.0	.794	3.5	.447	6.0	.251
1.1	.776	3.6	.437	6.2	.240
1.2	.758	3.7	.427	6.4	.229
1.3	.741	3.8	.417	6.6	.218
1.4	.725	3.9	.407	6.8	.209
1.5	.708	4.0	.398	7.0	.200
1.6	.692	4.1	.389	7.25	.188
1.7	.676	4.2	.380	7.50	.178
1.8	.661	4.3	.371	7.75	.167
1.9	.646	4.4	.363	8.0	.158
2.0	.631	4.5	.355	8.5	.141
2.1	.617	4.6	.347	9.0	.129
2.2	.603	4.7	.339	9.5	.112
2.3	.589	4.8	.331	10.0	.100
2.4	.576	4.9	.324	20.0	.010

Table 1. DB loss versus power ratio.

Although many radio handbooks advoca the use of an RF ammeter and the I^2R fo mula to determine power into an antenna, th method is usually not very satisfactory. If tl standing wave ratio is greater than unity, tl current is a function of ammeter location alor the transmission line and the application I^2R simply aggravates the error. The use an RF voltmeter and the E^2/R equation pr sents the same problem.

Most commercial power measuring instr ments use calorimetric techniques, whe power is determined by measurements of ten perature, mass and time. Other instrumen use balanced resistance bridges, direction couplers and current across a calibrated loa The convenience of direct measurements cos money however and instrumentation of th type is prohibitively expensive.

The accurate measurement of RF impe ance presents many of the same vagaries power measurements. Commercial impedanc bridges are available that will measure com plex impedance directly, but again, are quit expensive.

It has been previously noted that whe power is supplied to a load that is not matche to the transmission line, the current and vol age distribution along the line must be know to accurately determine power. This voltag distribution may be determined if the stan ing wave ratio and the voltage at some a cessible point along the line is known. How ever, the application of this procedure r quires the use of a slotted line. At microwav

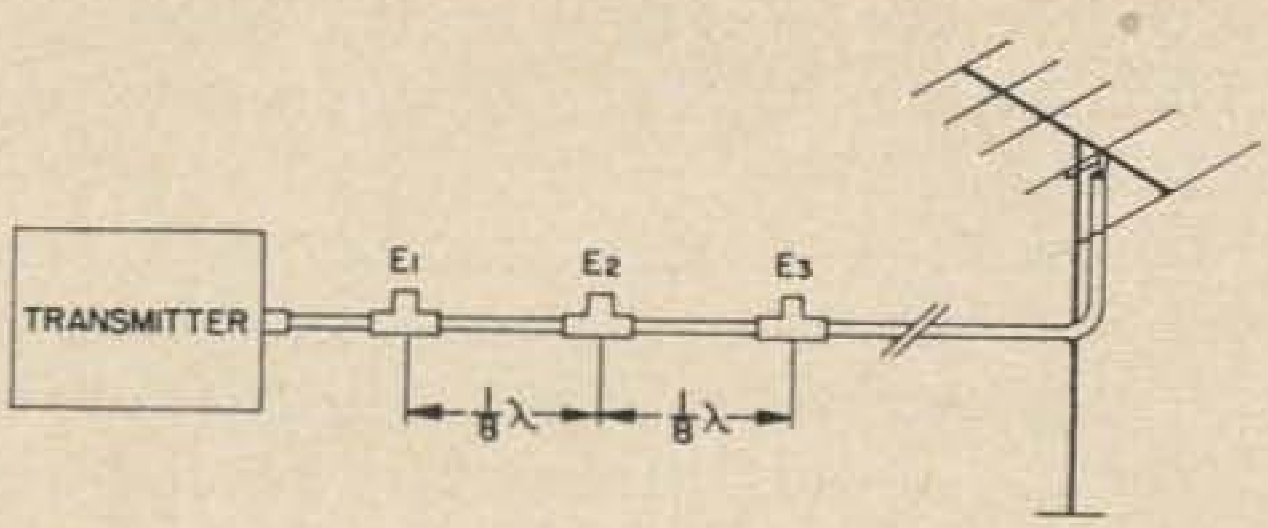


Fig. 1. Setup for measuring transmitter power.

frequencies the slotted line lends itself to both power and impedance measurements, but the associated arithmetic is nearly insurmountable. Furthermore, the slotted line becomes quite a massive structure at frequencies below 500 mc.

A fixed frequency adaptation of the slotted line technique which requires no sophisticated instrumentation was developed a number of years ago* but apparently it is not widely known. This technique, which uses three RF voltmeters spaced one-eighth wavelength apart along the transmission line, is adaptable to any of the amateur bands up to 1296 mc. In this method three coaxial tee connectors are installed one-eighth of a wavelength apart as shown in **Fig. 1**. The necessary one-eighth wavelength dimensions for the various amateur bands between 10 meters and 1296 mc using RG-8/AU type coaxial cable is listed in **Table I**. The length of transmission line from the last tee connector to the antenna may be any length that is suitable for your particular installation.

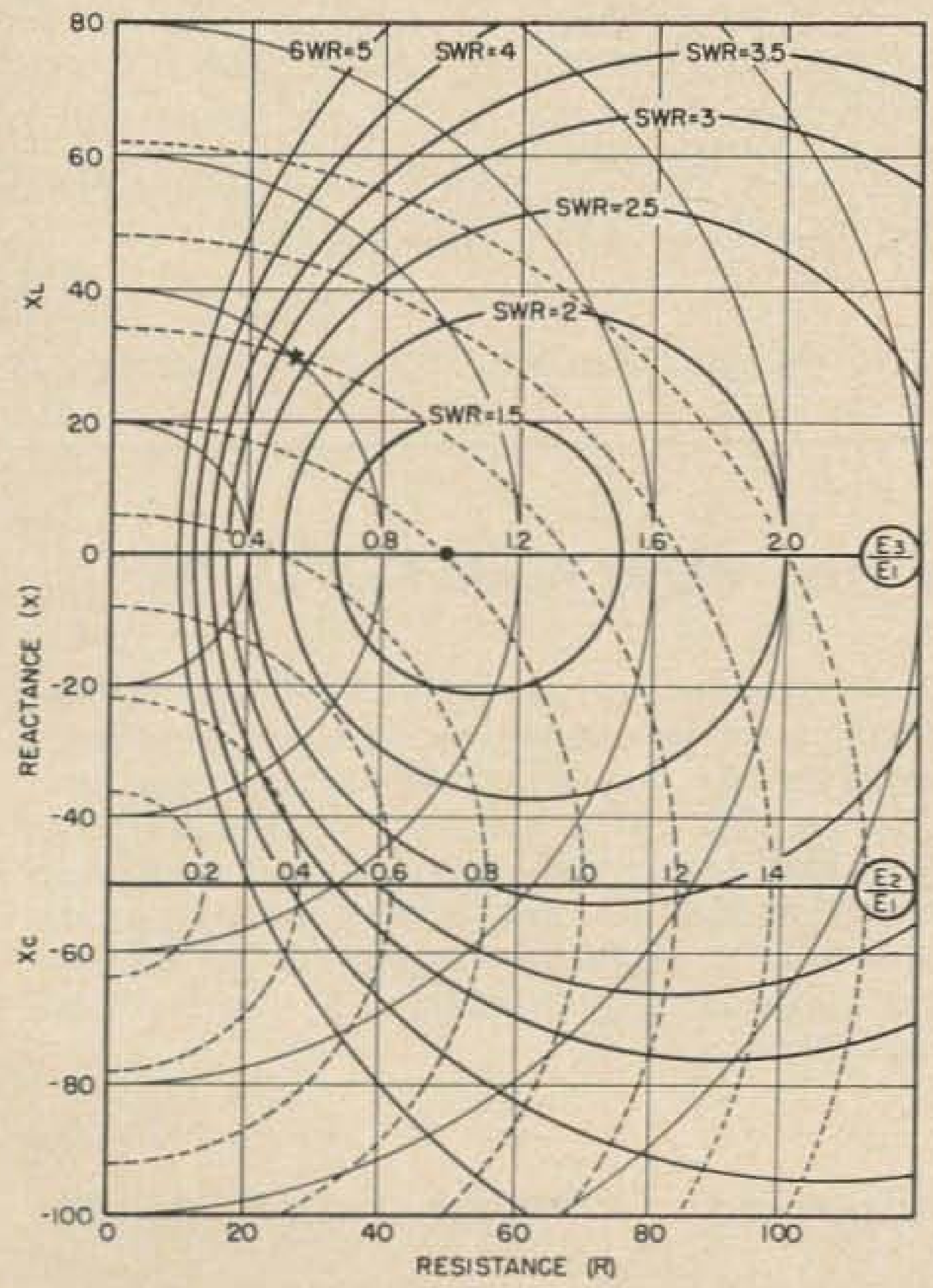


Fig. 2. RF power, SWR and impedance chart.

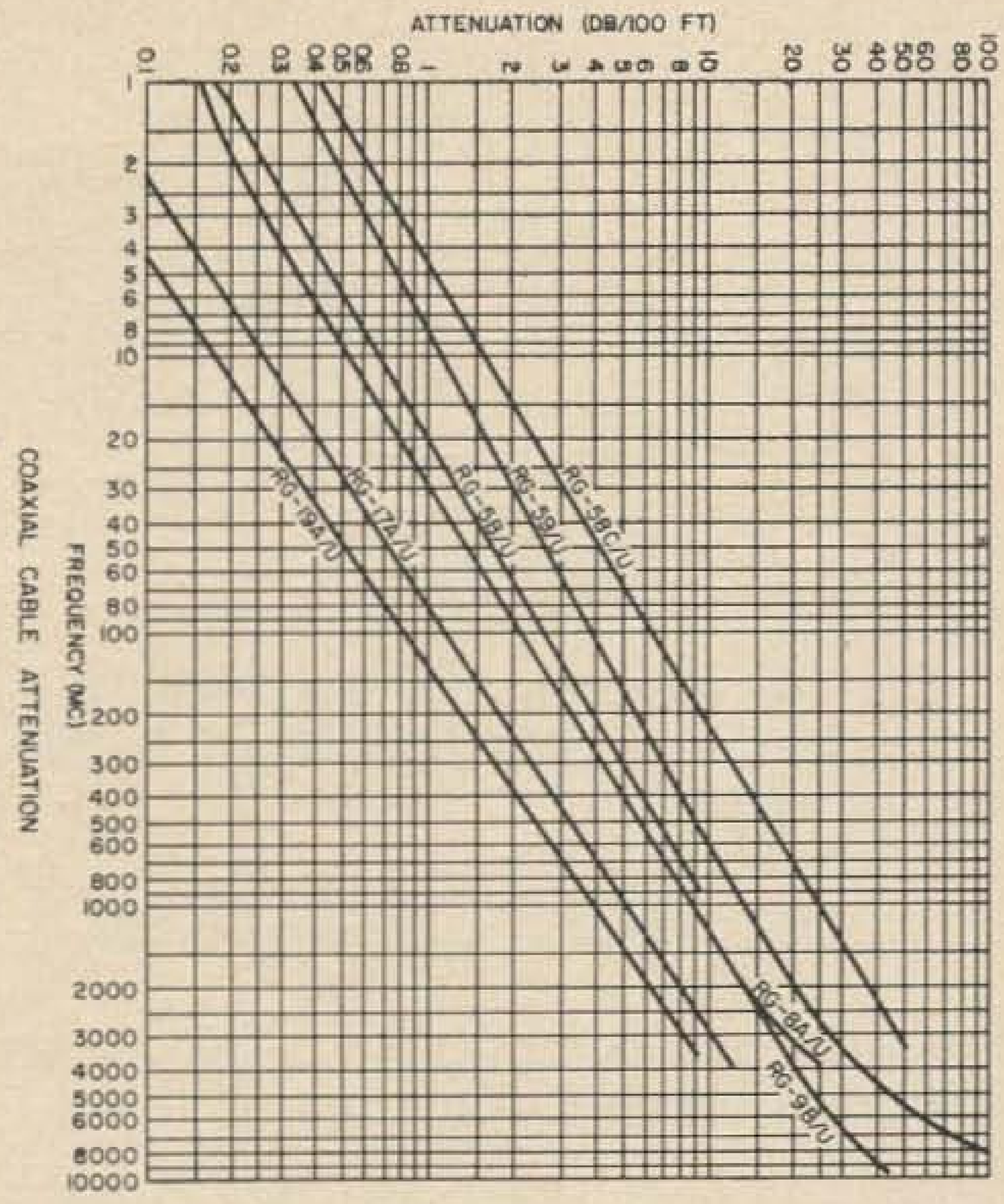


Fig. 3. Line loss versus frequency in coax cable.

Using a volt-ohmmeter or a VTVM with a suitable RF probe, the voltage is measured at each of the tee connectors. The voltmeter may be calibrated satisfactorily at 60 cycles because any errors due to frequency will cancel out in the process of calculation. Each of the measured voltages is indicated by E1, E2 or E3 according to the measurement point indicated in **Fig. 1**. The ratio of E2 and E3 to E1 is then used in conjunction with the chart in **Fig. 2** to determine complex impedance, SWR and RF power.

The use of these ratios is best illustrated by a typical example. Assume that at 50 mc the following voltages are measured: E1 = 30 volts; E2 = 36 volts; and E3 = 24 volts. Using these voltages, compute the ratios between E1 and E3, and E1 and E2 as follows:

$$\frac{E3}{E1} = \frac{24}{30} = 0.8 \qquad \frac{E2}{E1} = \frac{36}{30} = 1.2$$

These ratios determine which circles are to be used on the chart; in this case the E3/E1 = 0.8 curve intersects the E2/E1 = 1.2 curve at the point indicated on the chart by the small star. The impedance at connector E3 may be read directly from the chart as indicated by the intersection of the two curves. In this case the impedance is 27 ohms resistive and 31 ohms reactive (inductive) at connector E3. This corresponds to an SWR of approximately 2.75 to 1 as indicated on the chart.

* An adaptation of the three voltmeter method for measuring power and voltage at high frequencies, Research Labs., Elect. and Musical Industries, Ltd. (1941).

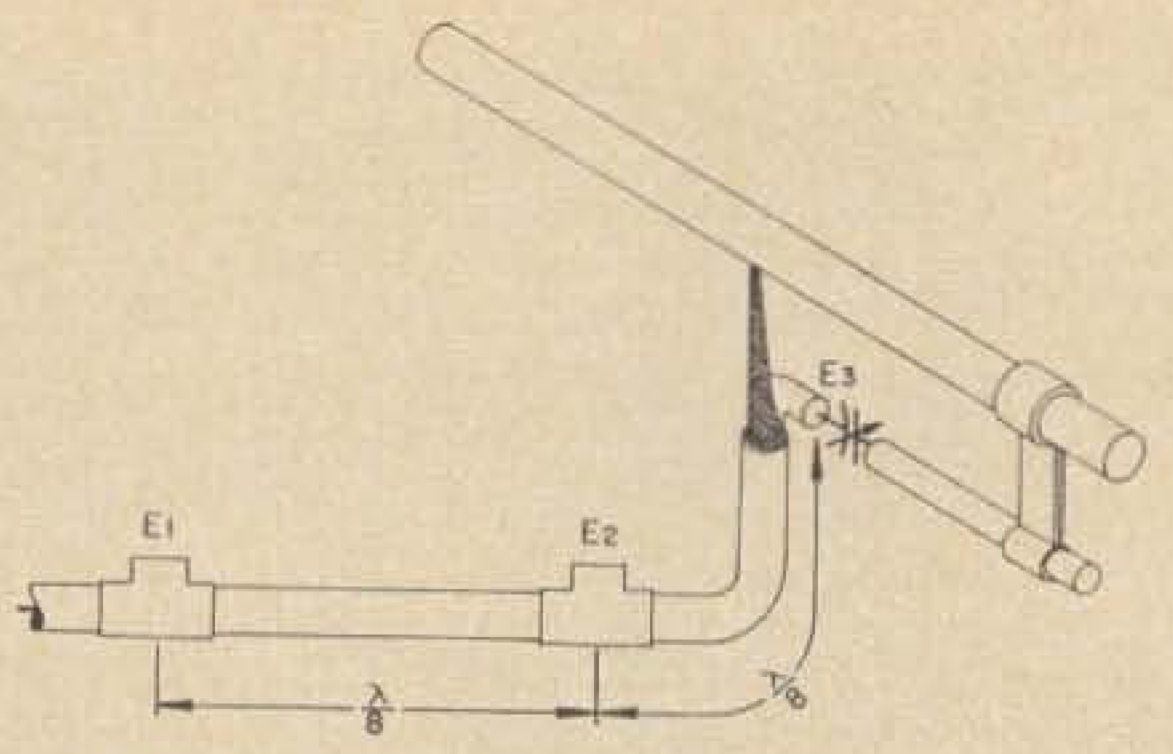


Fig. 4. Antenna matching.

The RF power in the transmission line at connector E3 may be calculated by the following relation:

$$\text{RF Power} = \frac{E_3^2\ R}{R^2 + X^2}\ \text{Watts}$$

From the previous example at 50 mc, the RF power may be calculated by

$$\text{RF Power} = \frac{24^2 \times 27}{27^2 \times 31^2} = 9.2\ \text{Watts}$$

It must be remembered that this is the power at that particular point on the line. The actual power arriving at the antenna will be somewhat less than this depending upon the SWR and line loss at the operating frequency.

The line loss versus frequency of various common coaxial cables is illustrated in **Fig. 3.** At 50 mc, assuming RG-8/U cable, the loss is 1.4 db per 100 feet. From **Table I,** 1.4 db corresponds to a power ratio of 0.725. In other words, if 100 feet of RG-8/U is used in our example, 0.725 × 9.2 watts or about 6.7 watts will reach the antenna.

The standing wave ratio found using this approach is the ratio at connector E3 and must be slightly adjusted to determine the actual SWR at the antenna. This is because the attenuation of the transmission line will make the SWR appear better than it actually is. The procedure for plugging in the necessary correction factors has been covered in a previous issue of "73".**

In addition to determining SWR, impedance and power at the transmitter end of the line, this method is also applicable for tuning antennas. In this case it has several definite advantages over SWR bridge or antennascope type measurements. This is because this method immediately indicates whether an antenna is inductively or capacitively reactive. The other methods show that the antenna is reactive, but not what kind or how much! When tuning a gamma match the advantages become quite apparent; any inductive or capacitive reactance of the antenna may be immediately tuned out and a good match obtained. Since an exact match is indicated when the voltages at each of the three tee connectors is the same, the setup shown in **Fig. 4** is more oriented toward antenna matching than that illustrated in **Fig. 1.** Antenna matching may be accomplished faster if three voltmeters are used, but it is not absolutely necessary.

One other advantage of this system is that the tee connectors may be left in the line at all times with no noticeable degradation to the radiated signal. There will be slight losses on 432 mc and up, but usually they will be negligible.

This method has been checked against commercial power and impedance measuring equipment and found to be very accurate. The only source of inaccuracy appears to be in the length of the eighth-wavelength lines; these must be precisely the right length at the operating frequency or rather large errors will be evident. However, considering the overall simplicity of this approach, this criticality in line length is really quite minor.

. . . WA6BSO

** That Elusive SWR, WA6BSO, "73", December, 1964.

Larry Levy WA2INM/1
Marlboro, Vermont

Get ready now for that Springtime mountain-topping!

A Six Meter Solid State Peanut Whistle

I've always wanted to own a walkie-talkie. You know, one of those little black box type gadgets with a whip antenna sticking out on the top, complete with ham frantically trying to climb on top of anything around to get height, while working a group of local stations. They can be found at most transmitter hunts. I've always felt that they have had an unfair advantage at hunts. This is usually at the time when I have reached the general area of the hidden transmitter, along with several others, and one of the hams, carrying one of those black boxes, starts searching all the good hiding places while I either have to stay in the car or miss out on what is going on while looking. Bah!

I decided to build one so that I too could get in on the fun. Tubes were out, after a quick look at the prices of batteries. Transistors are cheap, draw little current from cheap low voltage batteries, and are vastly more reliable. The receiver had to be a superhet to get the desired selectivity. The transmitter didn't need much power, so that a simple transistor overtone oscillator, driving a class C final, was enough. The power output is about 300 mw. The modulator uses three transistors and has more than enough gain to use a crystal or ceramic mike.

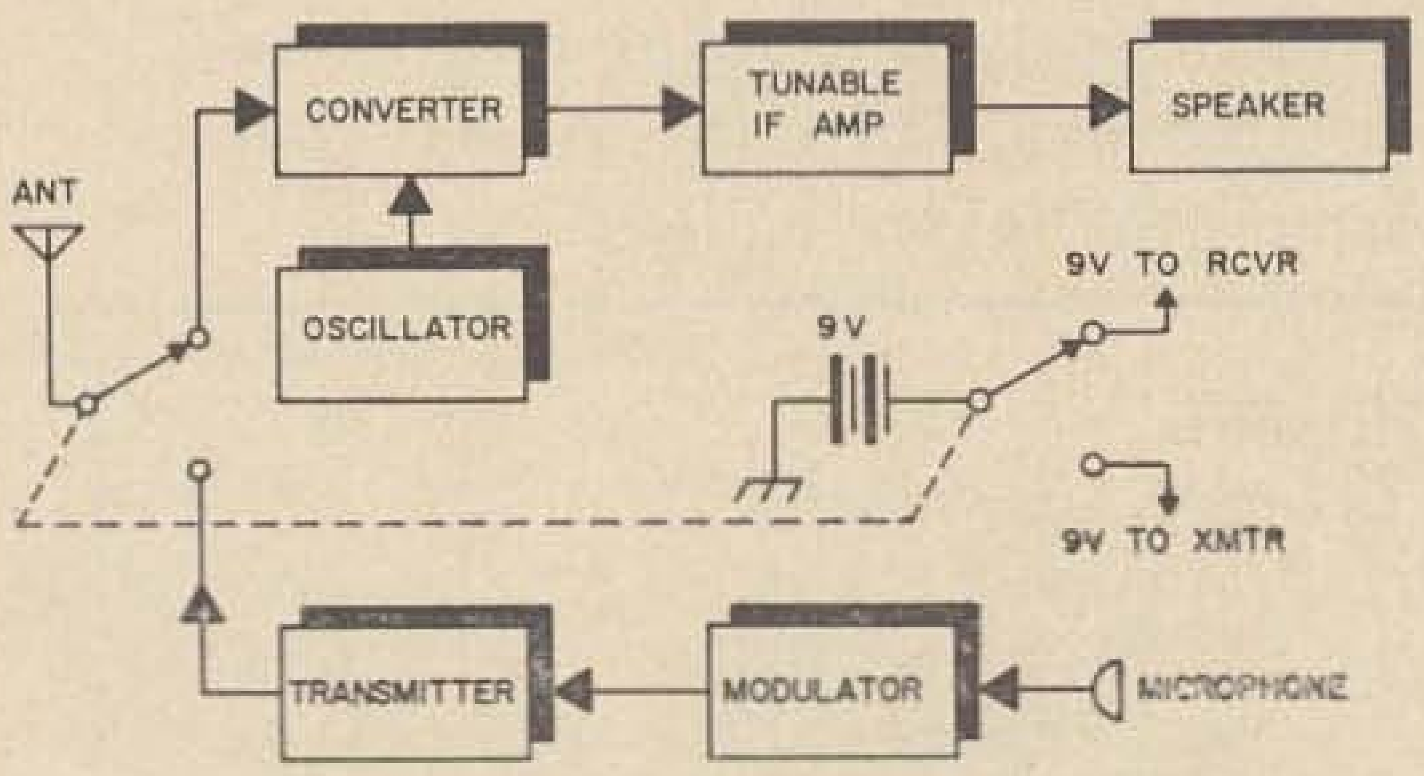


Fig. 1. Block diagram of the 6 meter transceiver.

The receiver is a double conversion superhet, with the first conversion crystal controlled, and using one of those Japanese six transistor portable radios for the second *if* and tunable oscillator. The use of the radio saves considerable time and money in the construction of a receiver. They have fairly good selectivity and sensitivity, an audio section, tunable oscillator, and some of them even have a tuned rf stage. The price of the parts to build one of them is considerably more than the cost of the assembled radio. They can be purchased new for about five dollars for a six transistor radio. This is just slightly more than the cost of the transistors needed to build one. Sometimes it is possible to pick up one with a damaged case for less money.

The converter uses three transistors. It has a tuned rf stage, an oscillator, and a mixer. The sensitivity of the overall receiver is better than one microvolt for a usable s/n ratio. The selectivity is about 10 kc at the 6 db points. While this is not the spectacular mechanical filter type selectivity that some people would like, it is quite a bit better than any superregen, and about as sharp as practical in a hand carried rig with a 1:1 tuning ratio. The tuning is sharp, but not so sharp that a station can't be tuned in with ease, provided that a fairly large diameter tuning knob is used.

The entire transceiver is powered by a single 9 volt battery, Eveready #2356 or equivalent. If space permits, six D cells will work. If you go hilltopping much, or are in an area where special purpose batteries are hard to come by, it may be better to use the flashlight batteries. At least you can get replacements easily. The Eveready #2356 or the flashlight batteries will work the receiver for several hundred hours if the transmissions are of a reasonable duration.

The rig can be built into a medium sized Minibox or any case that is handy. The one that I built was put into a case from one of the surplus "Gold Plated Specials" that have been available for several years at a reasonable price. There is enough spare room in the case for batteries, the rig and a recharger, if rechargable types are used.

Construction details

The easiest method of wiring, in general, is through the use of perforated boards with push-in terminals. Lafayette Radio sells boards made by Vector for reasonable prices, as well as the push-in terminals. A board 17" x 1¾6" can be cut up to make all of the necessary boards for the transceiver and still have enough left over for several other projects. The board is cheap ($1.25).

The converter (**Fig. 2**) can be made on a board less than 3"x4", if care is paid to layout. The layout is non-critical with the exception that the oscillator should be kept away from the rf stage to reduce the possibility of spurious responses and images. By wiring both sides of the board, much space can be saved. The coils should be on the side of the board away from the chassis to avoid detuning when placed in the case. If space is at a premium, the miniature ¼" coil forms can be used but the number of turns will have to be raised to about nine or ten and taps adjusted in the same ratio.

The transistors may be soldered in to the circuit if care is used not to overheat the transistor. A pair of long-nose pliers make an excellent heat sink. Tin the lead with a drop of solder, leave a small blob of solder on the junction to be soldered, and quickly melt the two blobs of solder together with a soldering gun or iron. This is the best method of soldering transistors, and is preferred to the conventional method of heating the entire joint to the melting point of solder and then applying solder, as the transistor is much cooler. I have soldered hundreds of semiconductor devices in this way without damage. If care is taken

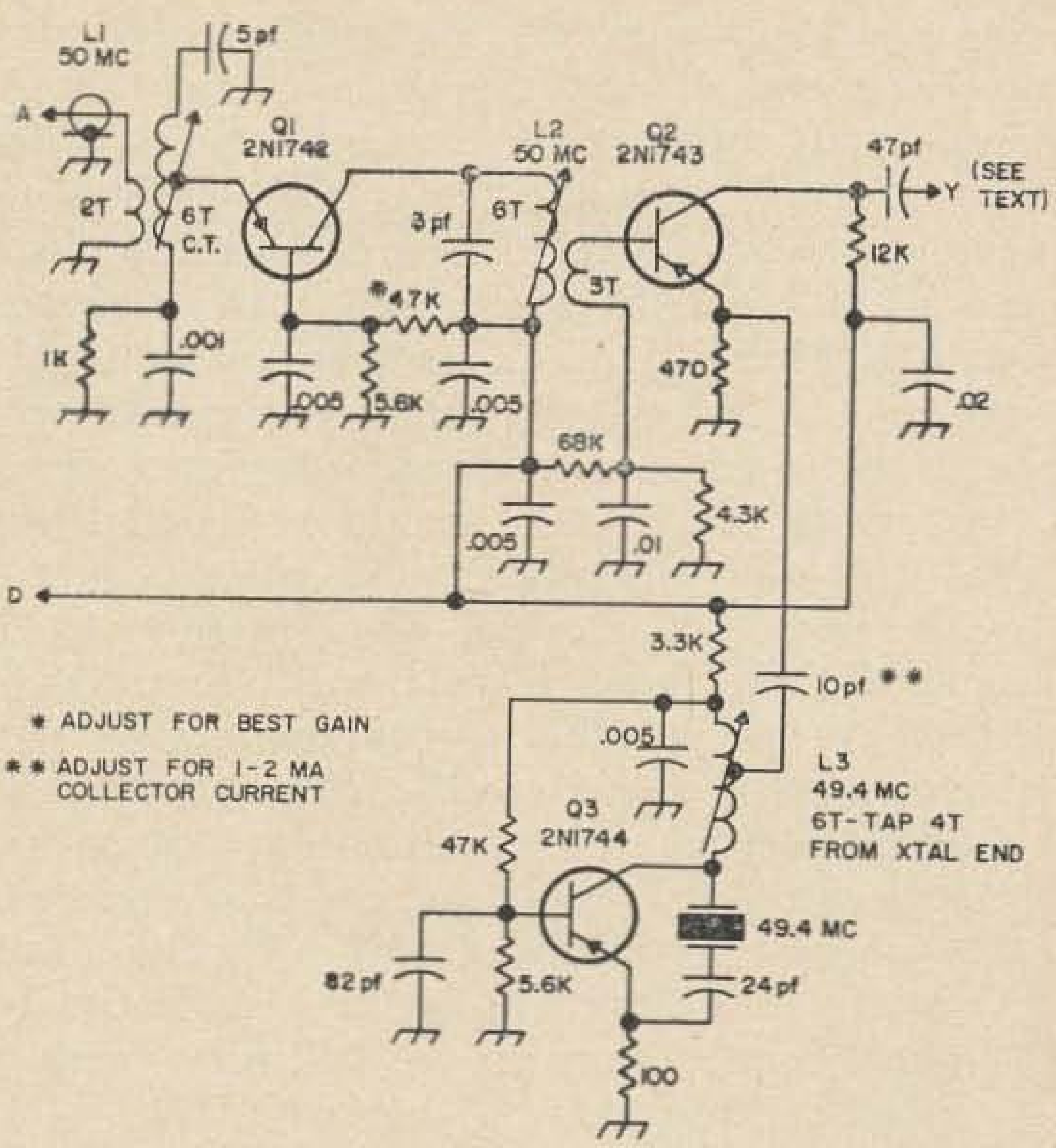


Fig. 2. Schematic of the 6 meter converter. Coils are on ⅜" slug tuned forms.

to melt the solder, and if low melting solder (60/40 or 63/37) is used, it results in a good joint. Caution must be used not to make a cold-solder joint which can cause intermittents and related problems. More caution must be used not to melt the transistor as well as the solder. With a little practice (Use a ¼" resistor and practice making a few joints. You should be able to hold the lead ½" away from the joint without burning your finger. Best method for testing heat transfer to semiconductor device. A slightly warm finger can be cheaper than a ruined vhf transistor) you should be able to quickly solder transistors into the circuit without making a cold joint or overheating anything. Soldering is preferred to sockets in portable devices that may be subjected to a few jolts. They don't fall out of their sockets or cause intermittents due to poor contact if they are soldered.

The xtal used is a 49.4 mc third overtone type, available from any of the crystal companies.

There are many good transistors that will work in the converter. The Philco types are excellent, but a little expensive. I have found a good source of inexpensive transistors that work almost as well. The Sprague RT-82, which sells for about 60¢, seems to work as well as the more expensive types. It is an excellent general purpose vhf transistor and has countless uses in converters, transmitters, and If amplifiers. See also the list in Nov. 73, page 34. Transistors Unlimited, 462 Jericho Turnpike, Mineola, New York, is an excellent source of new transistors, diodes, tantilum and electrolytic condensers, transformers, rf chokes, and many other parts at unbeatable prices. All of their merchandise is top quality and the prices are CHEAP! In a comparison check, six RT82's, chosen at random, were compared with a Philco 2N1742 as the rf amplifier in the converter. All of them worked as well, and there was no apparent difference in nf. Any weak station that could be copied with the 2N1742 could be copied equally as well with the RT82. A great deal for 60¢. In the final design, three RT82's were used in the converter. The other types mentioned were tried, most of them worked just as well, none worked better, all cost more. Design was based on the PxC equation, the transistors with the highest P (performance) with the lowest C (cost) were used, in keeping with the traditional ham design for the last fifty years.

Point Y (output, is connected to the BC receiver at the hot end of the variable condenser tuning the antenna coil. This seems to work the best of any place tried.

The transmitter (**Fig. 3**) uses a RT82 as the oscillator, driving a 2N1143 as the final. The crystals used are third overtone type. There are no special layout problems. Just keep the output away from the oscillator and there should be no problems.

The modulator can be built on the same board as the final. The general purpose audio transistors are the microphone preamp driving an audio output type transistor found in most portable radios. A 2N188A or GE-2 will work fine. The final is collector modulated through an autotransformer. I used a driver transformer with a 2000 ohm CT winding, applying the battery voltage to the center tap, and connecting the collector of the output transistor to one end of the winding and the collector of the modulator transistor to the other end. I did not have to modulate the driver, as I have read somewhere is necessary, to get good, clean modulation, sounding pretty close to 100%. I don't know if the impedances are perfect, but, as long as it works ok, who cares?? (I can just visualize some Electronics Engineer reading that last statement, calculating the necessary impedances, and start tearing his hair out when he sees the mismatch. At any rate, it works fine).

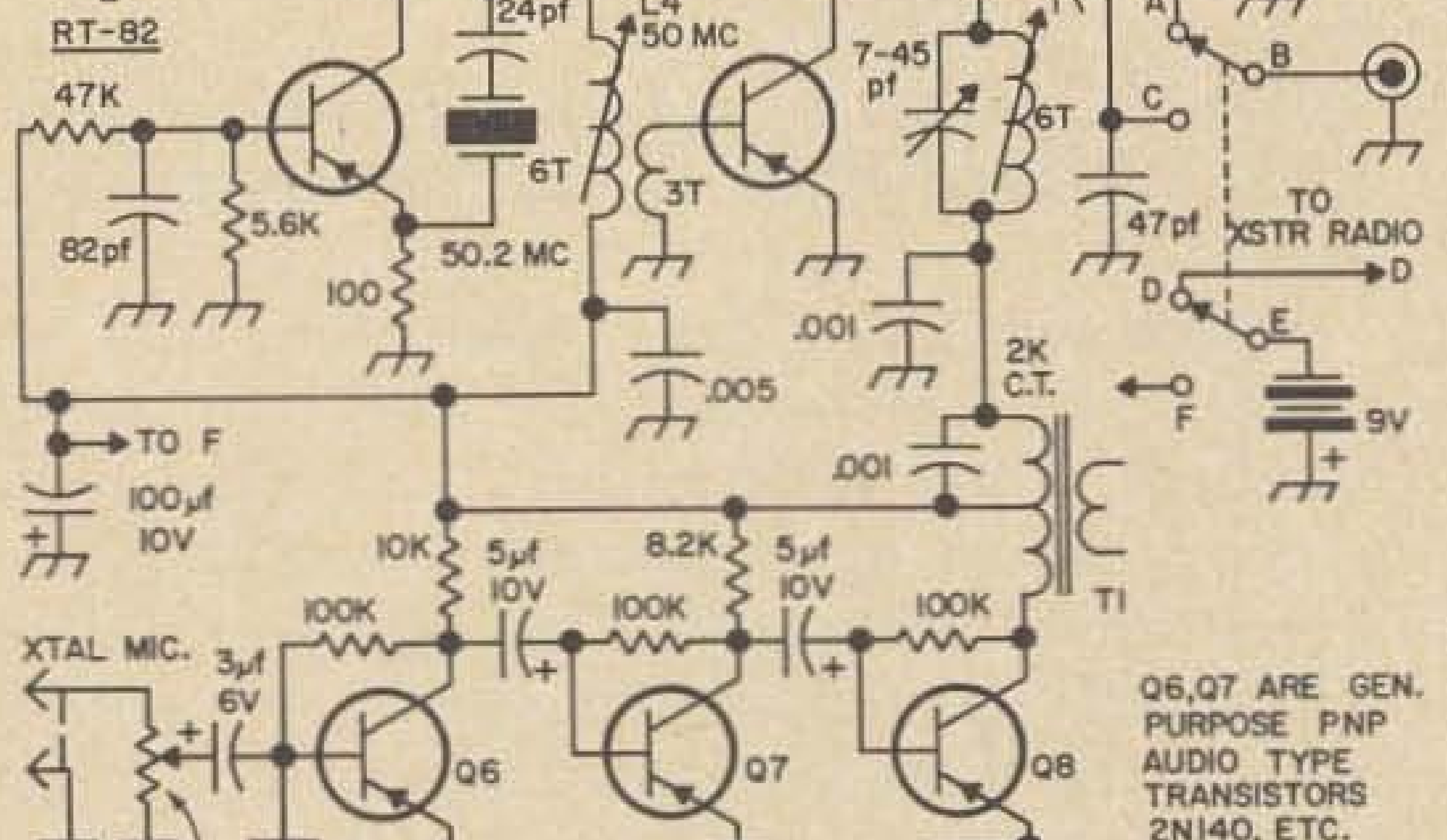


Fig. 3. The transmitter, modulator and basing of the RT-82's. Coils are 3/8" slug tuned forms.

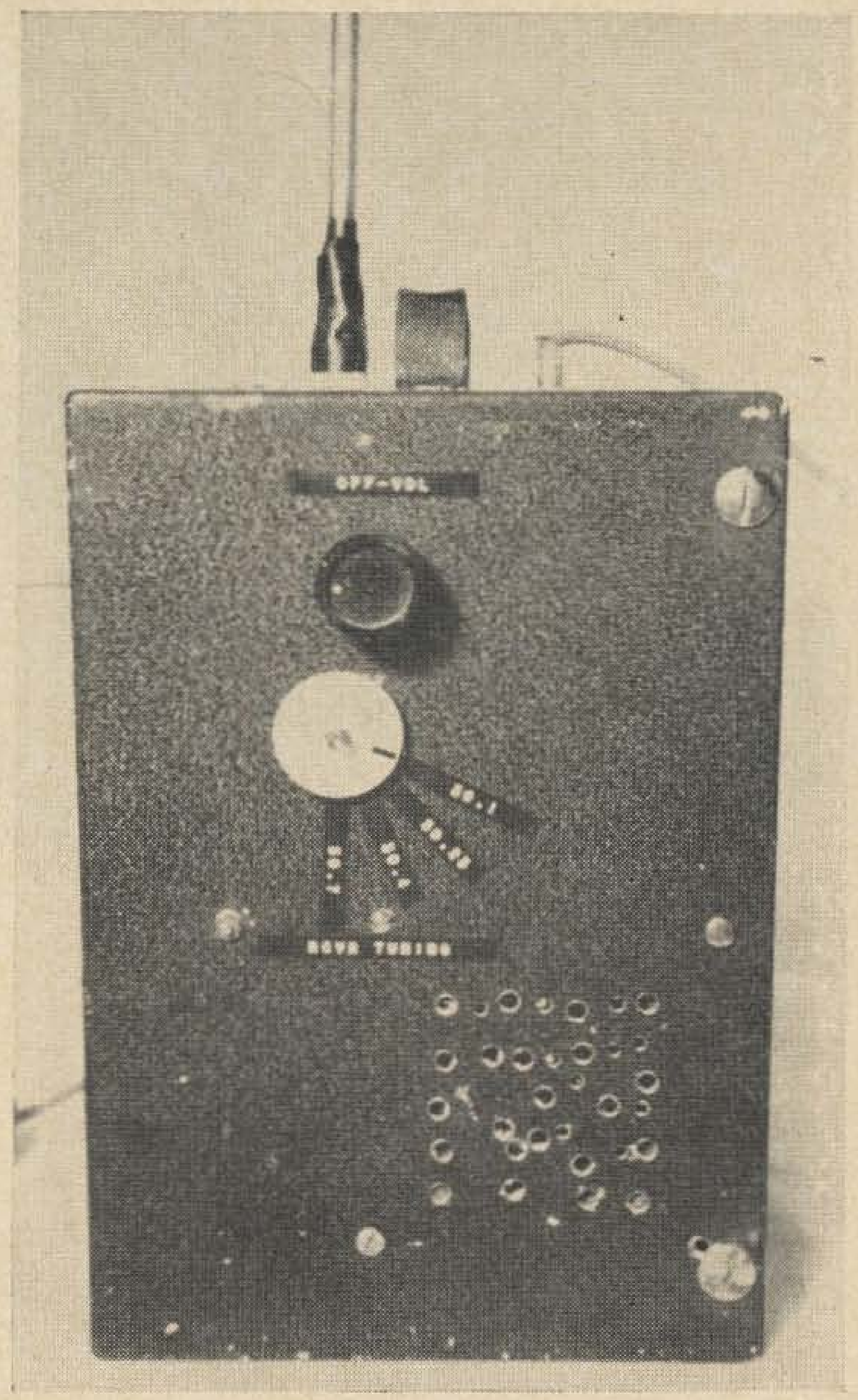
The completed boards are mounted into the case with machine screw type standoffs, three or four being all that is necessary to mount each board. The transistor radio should be of the type that has the tuning condenser coming out to the front panel with a directly driven shaft. Ones with dial cords are a problem to mount. The radio is removed from the case and the knobs are removed. The speaker leads should be removed from the speaker that is left in the case. The leads should then be removed and replaced with longer leads from the pc board to the new speaker. A 4" speaker works better than the ones that are usually supplied with the radios. It is preferable that the radio used have a positive ground (it should also be the type that uses a 9v battery for power) as it simplifies construction. The majority of the Japanese 6 transistor portables are 9v positive ground, but it should be checked anyway. If the radio is of the type that uses a volume control mounted on the back of the pc board, meant to be used with a knob that protrudes from the side of the radio, remove the control from the board, jump the switch connections, bring out three leads and replace it with one of the dime sized controls that mounts on the panel of the transceiver. A 10K type with a switch should work for most radios, and the switch can be used for the power switch for the rig. A shaft extension is brought out to the front panel (a long screw, of the same thread used to mount the control knob on the front panel of the case with two or three of the machine screw standoffs. The speaker is then connected to the leads connected previously. The power and ground connections are connected to the proper terminals on the tr switch. Be careful to observe polarities. The output of the converter is now connected to the "ant" connection of the variable condenser. The other units can be interconnected, the battery mounted and wired, antenna connections made to the tr switch, etc. A DPDT switch works fine as a tr switch. This should complete the construction of the transceiver.

Tuning, final adjustments, etc.

Apply power to the converter and the bc radio. Tune the oscillator slug (L3) until the stage is oscillating (an increase in noise should be heard in the speaker). Connect an antenna or signal generator and tune L1 and L2 for maximum sensitivity. By tuning the antenna coil slightly higher in frequency than the mixer coil, it should be possible to get fairly good bandwidth from the converter. Peak the antenna trimmer in the bc radio for maximum signal near the center of the desired segment of the band. Take a small screwdriver and CAREFULLY tune the if transformers for maximum signal. On some radios, slight regeneration may be noticed when all of the *if* transformers are tuned to the same frequency. If it is severe enough to cause a hetrodyne on all received signals, detune the transformers slightly. A slight amount of regeneration may be helpful in improving the sensitivity. With slight regeneration, the sensitivity may be as much as twice what it was when the *if* was stable, without affecting the useful nf of the receiver. This will require some experimentation to find the optimum amount. A weak signal will usually quiet the hiss.

Tune the oscillator coil of the transmitter (L4) until the stage is oscillating. Make sure that a dummy load is connected to the antenna (a 47 ohm resistor will do); then tune the final for maximum rf. Watching the S meter of a monitor receiver will tell you if the oscillator is working and when things are tuned for maximum. Turn the modulation control at minimum and connect the microphone. Slowly advance the control until modulation seems to be around 90%. The modulator has more than enough gain for a crystal mike, and the modulation control is necessary. Be careful about overmodulation as the final transistor can be damaged by high audio peaks. With the values given, there should be an adequate safety factor at 100% modulation. If the oscillation quits when the final is loaded or modulated, take a turn off of the secondary of L4 to reduce the coupling. This should complete the tune-up of the xcvr. Connect an antenna and repeak L1 and L5.

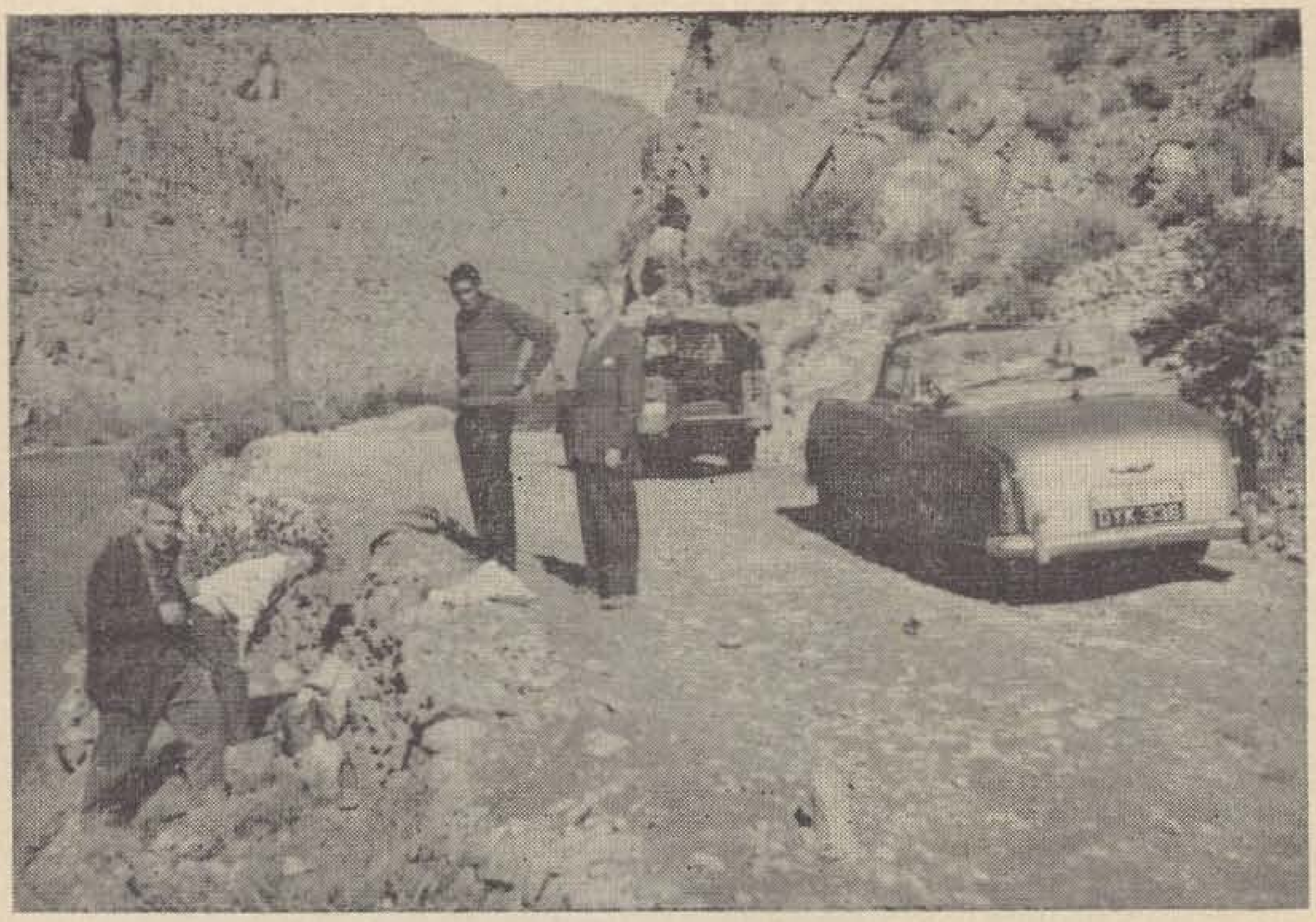
For portable use, a whip antenna such as the Lafayette 99 G 3017 will work fine. I have used the rig with this whip and a beam and the results have been fantastic. With the whip antenna, stations as much as 100 miles away have been copied Q5. With the beam, it seems to receive as well as my Clegg 99'er. The transmitter is good for working local stations and it is much fun to see how far you can work with a few milliwatts. It is amazing what can be done with such low power. It is also nice to know that you have a complete working transceiver that is all solid state.



The transceiver as built in the Gold Plated Test Oscillator cabinet. Using a neater cabinet is permissible.

With much careful searching of the junk box, the rig can be built for under $20 and for that price, it is hard to find anything that will work better or you can have more fun with. For those who are lazy, you can use one of the little printed circuit converters sold by Vanguard Electronics and save yourself the trouble of building the converter, although it costs somewhat more. I tried substituting the converter section with one that I borrowed with satisfactory results, although the one that I tried was one of their older models that I hear they have since improved. Replacing the 2N2190's with RT82's resulted in a considerable improvement in performance. There was no problem experienced with bc feedthrough with either converter. Warm up your soldering iron and GOOD LUCK!

. . . WA2INM



In the Gorges of Dades. Left to right, CN8BS, Mrs. Peycelon cooking the picnic, CN8BC and Mr. Peycelon.

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A Visit to the CN8's

There are many reasons for visiting CN8 land in winter. Firstly, of course, it is nice to escape from a European winter. Secondly, CN8 is a delightful place to spend a holiday. That is, of course, if your idea of a holiday is to see something which is really *different* from your usual home surroundings. Different people, different food, different architecture, different scenery, different climate but, above all, a different civilization and a different way of life.

If you want to take your own way of life with you, live as you do at home, eat your usual food, drink your usual drinks, and mix with the same sort of people you meet at home, then, of course, you had better stay at home.

Above all, if you are the type of person who is a salesman at heart and longs to sell your way of life to people with a different way of life, then you had certainly better stay at home.

But if you travel to try and see and understand the way other people live, then your second or third visit to Morocco will be most enjoyable. Why not the first? Well—the first will also be enjoyable, but it is only a sample, skimming the surface. Everything will be so exciting, so strange, so unusual that you won't be able to get further than the surface. On your first visit you won't be able to meet many of the local people. That comes later.

When you have tasted the sample, you will come back for more, and after having digested the sample you will be in a better position to appreciate the country on your second or third visit.

This was my fifth visit and the full flavour was beginning to come out, as we no longer needed to see the obvious "sights," the tourist sights.

Now if you are fortunate enough to be a radio amateur, you have an enormous advantage over others who visit these countries. You ve ready made introductions to a lot of ople—people you have talked to on the air; rhaps, even if this is your third visit, people 10 you have met in previous years.

So it was with me this time—my fifth visit th a number of interesting people whom I d met on previous visits and who were no 1ger strangers—people who introduced me to eir friends and so on.

This time we had a somewhat more com- icated plan because my niece, a school acher, who accompanied me had only fairly ort holidays. So we decided to go down r South at once into the Anti-Atlas Moun- ins (my niece had already visited the North several occasions) and return to Casa- anca to put her on an aeroplane for home hile other friends wrom Paris arrived the me day to continue the trip.

So we struck South at once and although e boat had reached Tangier at midday we ent on to Rabat for the night. Owing to the cellent roads, this is quite easy although on is occasion owing to unusually heavy rain me parts were flooded and necessitated a tour.

At Rabat our radio friends already began to elcome us. CN8MT, Hamid Talby and the cond operator, Pierre Boissonier, welcomed . Pierre took us to Hamid's home where we ere received in a beautiful Moroccan room id had the Moroccan "aperitif" of mint tea ith his charming Moroccan wife, who served many varieties of sweetmeats. Hamid, as well being a radio amateur with one station on M and another on SSB, is a violinist and had leave us early that evening to play at a con- rt. We went out to a typical Moroccan din- r in which the main dish was a Taiine of utton with almonds and raisins. We were ell and truly away from home already.

As we wanted to spend more time in the uth we left Rabat but knowing we would turn.

Next day a rapid run South to Assaouiro x-Mogador) where CN8BS had come spe- lly from Marrakech to welcome us.

So on South past Agadir—scone of the rrible earthquake of a few years ago—and up the Valley of the Souss which lies South the High Atlas Mountains, and is a won- rfully rich agricultural country with oranges, nons, grapefruit, bananas, olives and many her crops.

About 60 miles from the sea tucked in uth of the Atlas Mountains lies Taroudant. 1 amazing sight! An old Arab walled city ving much as it has done for hundreds of ars.

Our hotel was inside the walls—an old palace which one enters directly through an enormous gate in the city wall. The Palace was built around court yards and all the win- dows face on to courtyards in which grow banana trees, oranges and grapefruit.

On our arrival we heard music. A "Mous- sem" was in progress, that is, a celebration for a Saints Day, and we asked if we might attend. The hotel sent a boy to guide us.

From Taroudant we proceeded South to another delightful walled city—Tiznit. Here the main activity is the jewelry trade. Crafts- men make gold and silver jewelry of all kinds which the Moroccan women wear in profu- sion. Gold and silver coins are made into bracelets, necklaces, etc. We spent a most en- joyable time visiting the souks and seeing this unspoiled and little visited gem.

Then we proeeded into the very heart of the Anti-Atlas Mountains a range which runs parallel to the High Atlas at its western end and about 70 miles further south. Here a first class tarred road has been built to connect the first-class road from Agadir to Tiznit on to Tafroute, but after the first 20 kilometers the road becomes distinctly mountainous, climb- ing with many turns and twists over some of the magnificent ranges of the Anti-Atlas which are rose-pink in color.

Tafroute itself is located in the center of two concentric rings of mountains, the nearer ones being appreciably lower than the further ones so that both ranges are visible from Tafroute. A magnificent spectacle! The floor of the valley of the inner circle is covered with almond trees, and the annular valley be- tween the two ranges is rich with citrus fruit, dates, palms, almonds, olives, quinces and a curious form of palm producing a kind of chocolate. Here we were to spend several de- lightful days, wandering into the villages, making friends with the inhabitants, almost

CN8BB in his shack.

all of whom speak French. A curious fact is that a large proportion of the male population of this district goes to the North of Morocco from this valley to become the grocers and ironmongers of the rich agricultural district of Rharb.

At the end of our stay in Tafroute, my niece's holiday being nearly at an end, we made our way rapidly north to Casablanca. Here we were surprised to find a note in the hotel that a Mr. Soumet (of whom we had never heard) and some of the radio amateurs of Casablanca would call at our hotel at 19.30. The communications of the amateurs of Morocco were certainly good. Our arrival had been announced in advance almost everywhere we went!

As we had already made arrangements to dine at the house of the nephew of CN8BB, we realized we had a full evening in front of us. Punctually at 7.30 Mr. Soumet, CN2BS, and about a dozen of the radio amateurs arrived at the hotel, and I was introduced to the President of the Moroccan Amateur Radio Club—M. Mohamed Hamidallah, CN8AF—who, on behalf of the radio amateurs of Morocco presented me with a beautiful bronze and also a silver buckle, of a type much used in the South of Morocco. This was not only a charming gesture but a very handsome present but, above all, it gave me the opportunity to meet the radio amateurs of Casablanca who have recently completely re-organized their Society and are starting in earnest to rebuild the local Society which had become more or less defunct.

Next day the change-over took place at Casablanca and we proceeded rapidly to Marrakech.

The area between Casablanca and Marrakech is a rich agricultural area in which enormous acreages of wheat and other cereals are grown. Here, we saw the local inhabitants ploughing these fields with a single furrow plough usually made of wood, drawn by a camel or a mule or two mules or a horse, and a donkey, or whatever it was.

And so we arrived at Marrakech where I immediately called on my very good friend—CN8BB—Roger Davize, who had been in Morocco since 1917, got interested in radio more or less professionally in 1923 and has had his amateur license since 1937 when he lived in Casablanca. Now he operates from the French Consulate in Marrakech.

He runs an SB10 to a home made 813 final, an NC300 and a Moseley Triband beam. He is probably one of the most active of the Moroccan amateurs.

At supper at Manolos. Mr. Peycelon, CN8AV, Mrs. Peycelon, CN8BS and XYL, G3BID and CN8BB.

We spent some time in Marrakech visiting the famous souks, the beautiful Dar Si Said Museum, ex palace, and—for the first time on my many visits to Marrakech, the Bahia Palace was open to view by the public—a really beautiful palace.

CN8BS, Jacques Dupre—one of my very best friends in Marrakech—had arranged to come with us over the Tizn-Tichka Pass (over 7000-ft) down to Ouarazate to show us the beauties of the Dades Valley.

In Ouarzazate again we met many friends. Thanks to CN8BS we had previously been introduced to M. Piallet, who is Headmaster of the local secondary school whose number of pupils has risen from 150 to 350 in two years. We were privileged to visit the school and to see the exercise books of the pupils. While the buildings are not impressive; (it is an old barracks used as a school), the standard of education certainly is, and we were very much impressed by the high standard in all the varieties of modern subjects taught in this school, particularly when it is borne in mind that the majority of the children are Berbers: their natural language is Berber and before education can really begin they have to learn both Arabic and French since the Berber language is not normally a written language.

The keenness of the pupils to learn and the energy and dedication of the teachers was a revelation.

We lunched with one of the teachers and his wife—who also teaches—who gave us a delicious meal: We dined with M. Paillet who included an unusual Moroccan dish—Beef cooked with prunes!

On another occasion we were invited by CN8BC—Brahim Sidate, who is one of the Moroccan operators trained by CN8BS who now operates professionally in Ouarzazate, as well as having his own station. He and his charming wife entertained us in true Moroccan fashion. The first dish was—Two rabbits cooked with almonds and raisins—completely delicious, and then followed the famous kous-

kous which takes about 5 hours to prepare, and which his wife had been busy preparing all day. What looks like rice is not rice. It is small granules of different types of flour mixed by the cook immersing her hand in water and then gently rubbing it over the board covered with three kinds of flour until the flour becomes little globules the size of grains of rice. This was used as the base on which to cook chickens with raisins, almonds and currants. These are not the battery fed, factory produced, hygienic, tasteless chickens. The chickens which fend for themselves eat whatever they can find and are really deliciously flavoured. All this, including the rabbits, was so beautifully cooked that it falls to pieces and knives and forks are not used. You merely take a piece of the rabbit or the chicken, pull it off and eat it. In the case of the kous-kous, this demands a certain skill. One should insert one's hand well into the rice-like flour to get the moist part from under the chicken and then by gradually tossing this in a circular motion in one's hand, it gradually becomes a ball preferably centered on a raisin, or a piece of onion, and if one is sufficiently dexterous one is able to flick this ball straight into one's mouth. Needless to say we were not expert and caused great amusement to our Moroccan hosts who tried to teach us the method of making the ball of kous-kous.

The excursion up the Dades Valley was most exciting. The melting snows of the Atlas Mountains have, in thousands of years, cut a narrow, deep gorge into the mountains, and after passing through this gorge—about 1,000-ft deep and only a few yards wide the river waters a fertile valley in which apricots, almonds, dates, etc. flourish.

Here the style of architecture is peculiarly beautiful as they have built the type of village called Ksar, or Kasbah. There are made of mud and are often beautifully decorated but perhaps the most striking thing is their eye for proportion.

And so we returned to Ouarzazate.

Next day something extraordinary happened—extraordinary for the Moroccans but not for us. It rained! No rain had been seen in Ouarzazate for two years. The day it rained was to have been the Market Day, and we were looking forward to the market at Ouarzazate but when it rains in Ouarzazate there is no market day. We were somewhat surprised that the Market Day was called off owing to the rain until the locals reminded us that in England cricket matches are cancelled by the rain; in America baseball matches are cancelled by the rain, everywhere tennis is cancelled by the rain, so why not the Market Day.

We returned again to Marrakech to meet our numerous friends, and so gradually homeward over the rich agricultural area where we again saw the camels and the donkeys, the mules and the horses slowly ploughing the fields. Obviously this method of ploughing is so slow that it is not possible to plough all the available fertile land. Far from it. Only a small proportion is actually ploughed.

This led to the comment by us, as Europeans, whether it would not be better if these people had tractors and multi-furrow ploughs. Could they not produce much more wheat?

In America today a subsidy is paid to farmers who do not sow wheat, who restrict their acreage of cotton and on several other commodities payments are made by the Government in order to prevent an increase in the cultivated area. In France the Government pays a subsidy for tearing up vines.

Is it really more sensible to spend large sums of money on tractors, large sums of money on ploughs, and then have to pay out further large sums of money to persuade people not to use them?

Here there is less danger of the over-production which the West suffers. They can only plough a certain acreage in the day—quite enough to feed the local population but not enough to produce a serious surplus problem.

This is not to suggest that the single furrow wooden plough should be introduced into the wheat lands of the United States but it is to question whether in our so-called Western civilization we are right to pursue increased production until we achieve chronic over-production, only to have to give subsidies to prevent further over-production. It is to suggest that there is a balance between the insensate urge to over-produce which now seems to dominate Western minds and the older conservative continued use of primitive methods. Would it not be better if we were to devote a little more time, above all a little more thought, to the question of a balanced civilization rather than the blind pursuit of over-production, followed by the energetic pursuing of a sales campaign to cope with the accumulated surplus?

The failure of the Russian wheat crop has certainly helped the United States to dispose of a large amount of her surplus wheat but we should not let this obscure the main issue which is—do we want to insensate over-production followed by insensate sales campaign, or a balanced civilization? . . . G3BID

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The Pot-Box

How many times have you had to hunt through your junk box looking for a potentiometer of just the right value for a breadboard circuit? Finally, finding one you hope will do, you precariously perch the pot on the workbench and gingerly attach it to the circuit with clip leads. Then, ever so gently (for fear of upsetting the whole rat's nest of wires) you rotate the potentiometer shaft. Sometimes this takes a screwdriver and three hands, but somehow you manage. After trying two or three different potentiometers, you finally find one that's the proper range, and set it to the position that gives the desired circuit effect. Now you'll probably want to replace the potentiometer with a fixed resistor—but what value? Out comes the ohmmeter and more lead maneuvering. . . .

Well, with the "invention" of the Pot-Box, many of the difficulties just described are eliminated. Essentially a Potentiometer Substitution Box (much like familiar resistor and capacitor substitution boxes) the Pot-Box contains six decade-valued potentiometers, each wired to three binding posts on the front panel. Each pot has a knob; a pointer and calibrated scale (*not* shown in the photos) could easily be added, instead of using an ohmmeter to measure the resistance of the potentiometer at the given position.

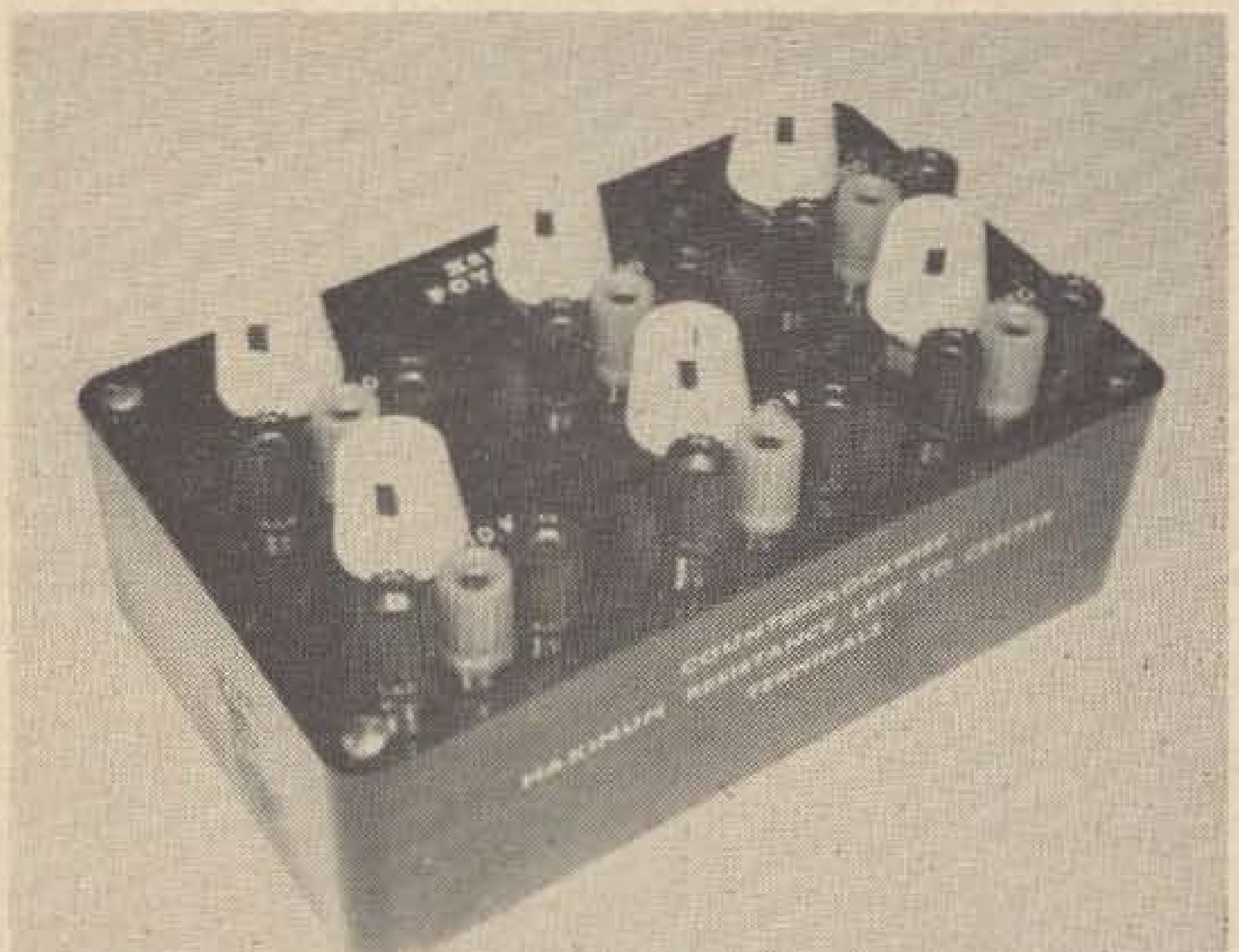


Fig. 1. First version of the Pot Box. It contains six potentiometers: 10 ohms, 100 ohms, 1000 ohms, 10k, 100k, 1 M. All are linear taper.

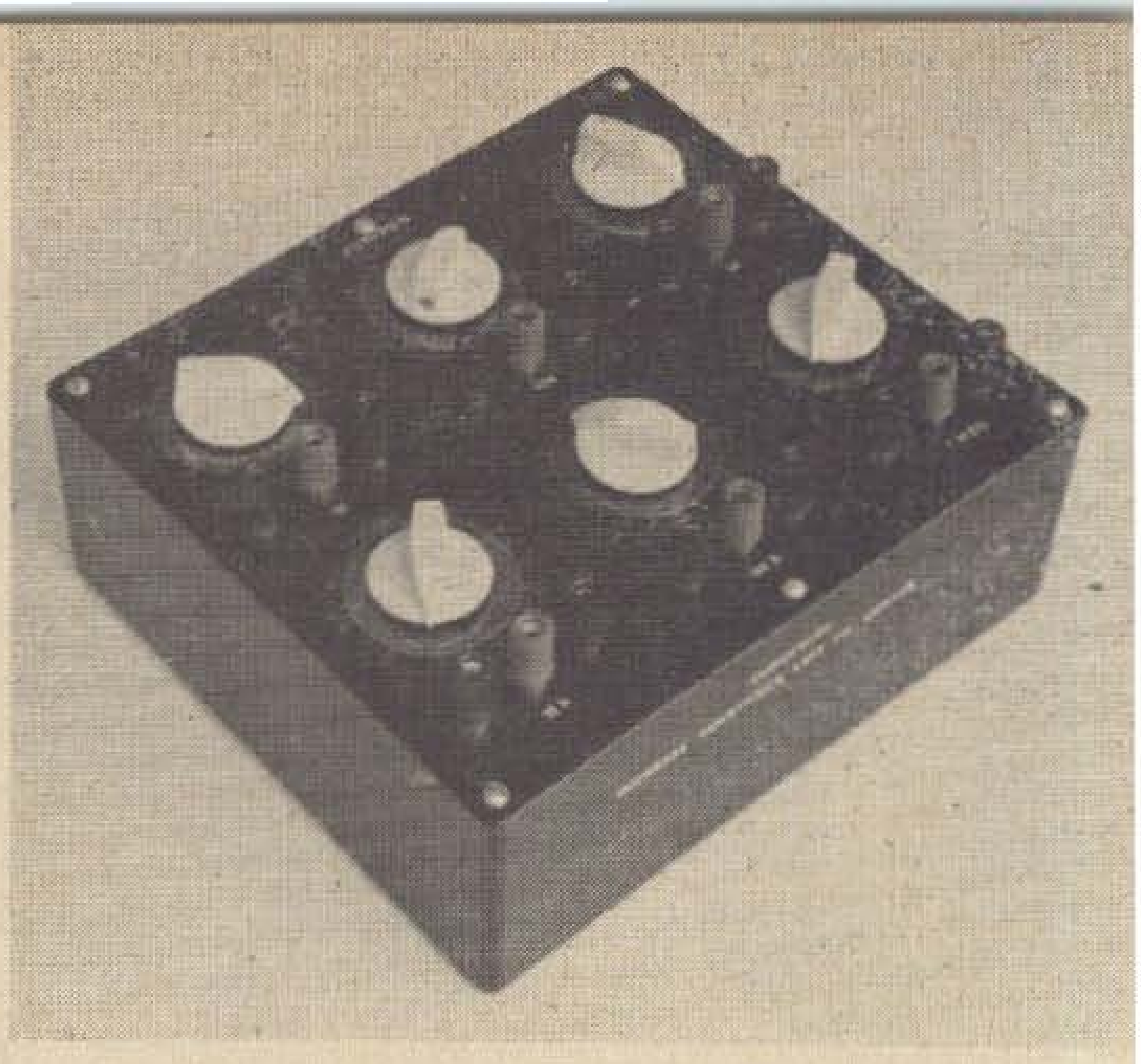


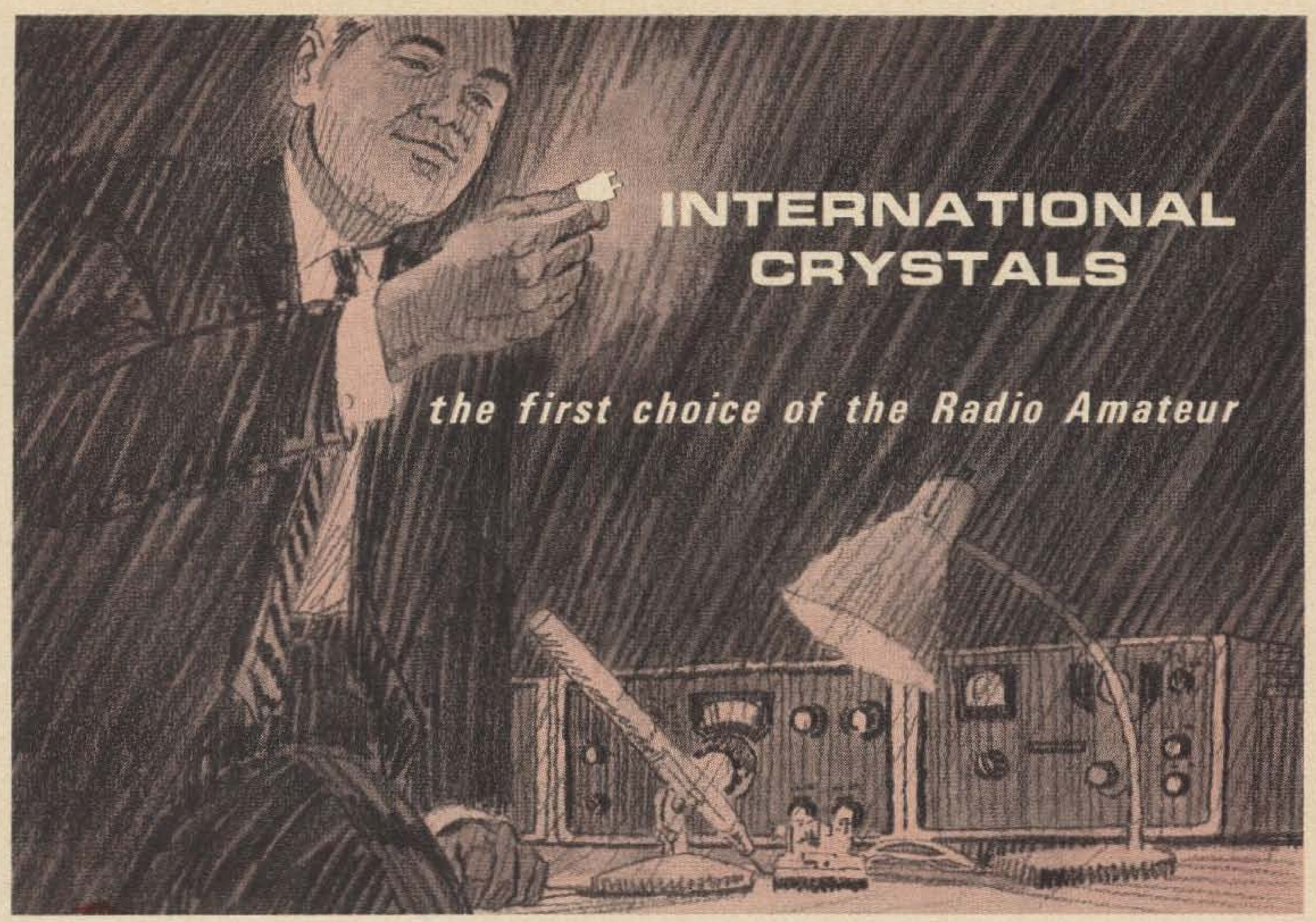
Fig. 2. The second Pot Box has calibrated dials.

In use, the 5-way binding posts allow wires, clip-leads, lugs, banana plugs and probe tips to be connected to either the clockwise-increasing or clockwise-decreasing resistance terminals of the individual potentiometers. As shown, center-to-left terminal results in clockwise-decreasing resistance (which is increasing current in most circuits). Although each potentiometer is separate, series and parallel interconnections can be made at the binding posts to obtain odd tapers (rate of change in resistance with rotation) and in-between potentiometer values.

Construction of the Pot-Box is straightforward. The author's first unit ended up too cramped, so a larger bakelite instrument case and panel are recommended. Bakelite is suggested, since it eliminates the need to insulate each binding post from the panel. An even larger box, perhaps with a masonite panel, might be used if you intend to add calibrated scales, which should show both clockwise-increasing and clockwise-decreasing values as determined by your best ohmmeter. Common 2-watt potentiometers were used in the model, but if you so desire, higher rated units may be used.

The convenience of the Pot-Box is hard to appreciate until used. Since being built, it has found repeated use at the author's workbench, from checking meter movements (use the Pot-Box in series with a battery and a known good milliameter. Start with a high value pot and work down), to establishing proper transistor biasing resistor values. In critical circuits, where a resistance substitution box jumps the gap, the Pot-Box is worth its weight in Green Stamps! Modest in cost, modest in size, and modest in effort, the Pot-Box is real robust in usefulness.

. . . K6UGT



THE AMATEUR WHO SELECTS INTERNATIONAL CRYSTALS FOR HIS COMMUNICATION GEAR PROBABLY KNOWS THESE IMPORTANT FACTS:

- Every amateur crystal is manufactured by the same skilled craftsmen who make International commercial crystals.
- International crystals are the product of a continuing research and development program.
- International crystals are designed and manufactured to operate under all types of field conditions . . . fixed or mobile.
- International crystals are used in all major makes of commercial two-way radio equipment.
- International customers include broadcast stations, airlines, military services, Civil Air Patrol, taxicabs.
- International crystals and electronic components are used in the United States missile and space research program.
- All International crystals are guaranteed against defective materials and workmanship for an unlimited time when used in equipment for which they were specifically made.

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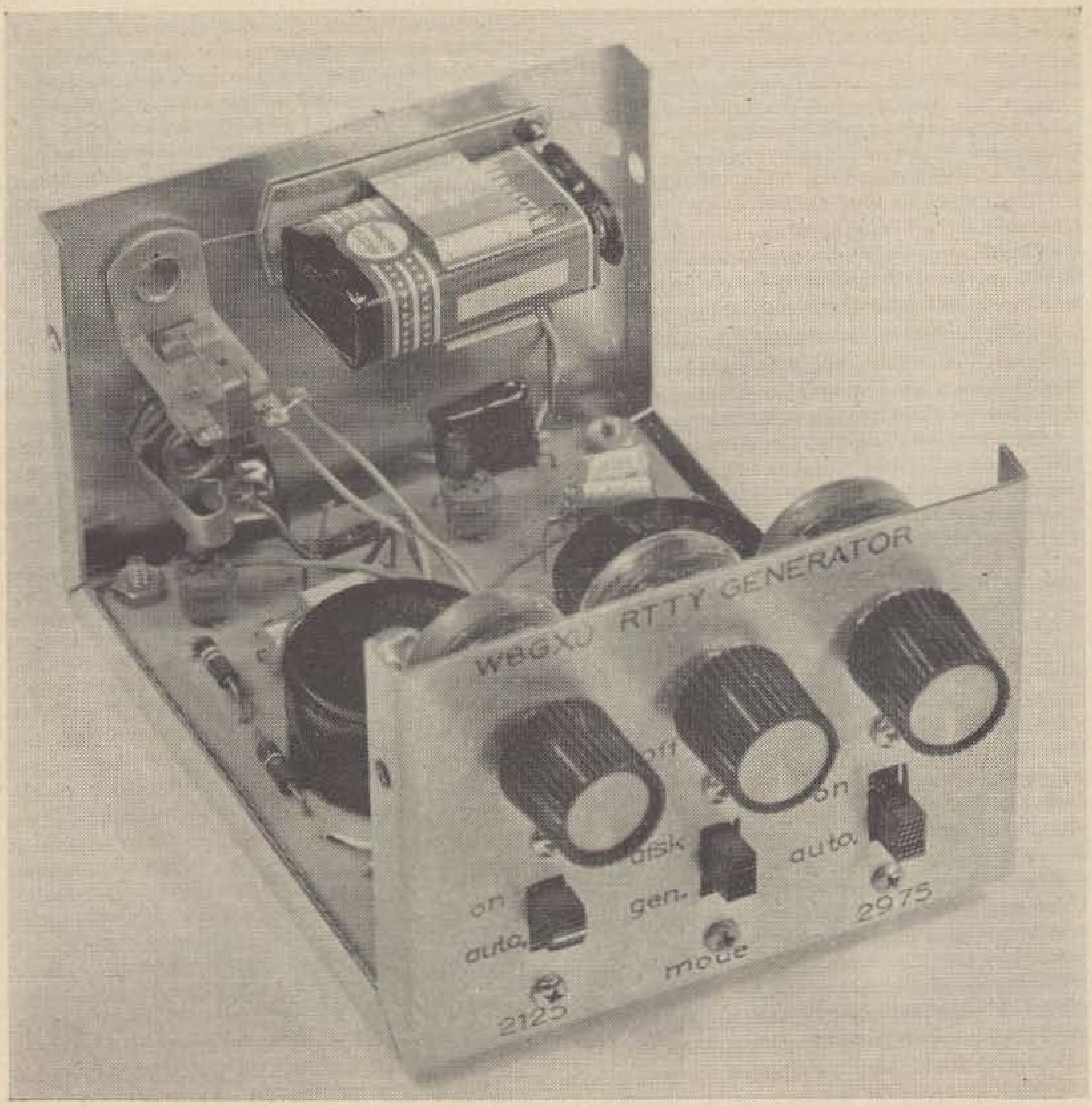


John Sakellakis W8GXU
2339 S. Taylor
Cleveland Heights, Ohio

A Signal Generator for the RTTY Man

(And for the AM and SSB man as well)

The serious RTTY experimenter is often plagued by lack of consistent signals on the air with which to test and adjust experimental terminal unit circuits. If one is blessed with a model 19, he can punch a test tape, feed it to an AFSK and he has a signal. But having only a model 15, I soon developed a tired arm from shifting the audio generator back and forth, from the mark to the space frequency. This being the age of automation, I came to the conclusion that there should be a better way.

The "conclusion" is shown in schematic form on **Fig. 1.** Basically it is a free-running multivibrator, modified to produce true square wave on its collectors. Each collector keys an audio generator, set to the mark and space frequency respectively. To simulate QSB on the air, the output of each audio oscillator is made variable. To simulate interference, each oscillator can be turned on continuously. This feature makes the unit useful in SSB and AM transmitter modulation checks. The tones are very clean sinewaves, at over one volt out. And just so the unit does not collect dust after that "perfect" terminal unit is built, it can be changed to an AFSK simply by "slaving" the multivibrator to the machine's keyboard switch.

Circuit description

The collectors of the multivibrator vary in voltage from about ground potential to full supply voltage, with the on and off period each set to near 22 milliseconds. When a collector is at supply voltage, it feeds forward bias to its

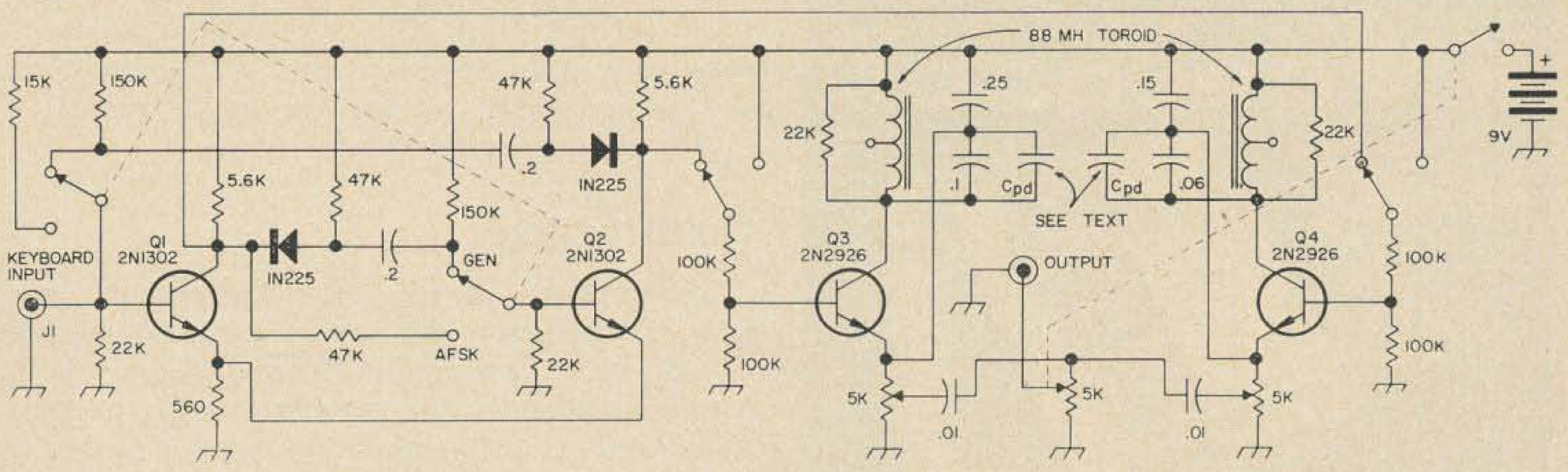
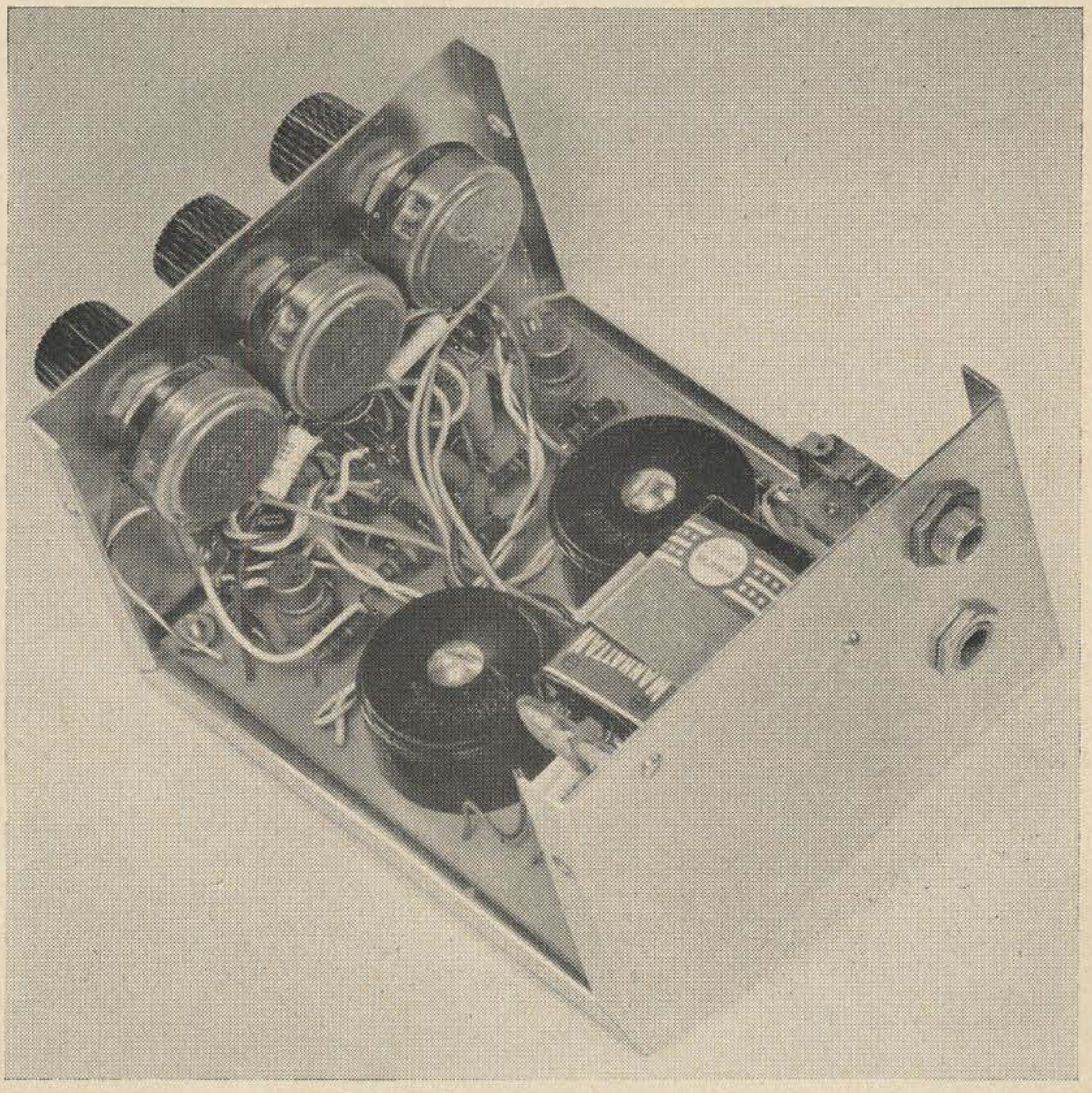


Fig. 1. This schematic of the RTTY Signal Generator shows the simple circuitry. The two 2N1302's form a multivibrator which alternately turns on the two audio oscillators.

oscillator turning it on. The audio oscillator transistors are high quality but inexpensive silicon transistors in a Colpitts circuit. The popular 88 mh telephone loading coils are used in the audio tuned circuits. The oscillator outputs feed a 5 K overall output control.

The bases of the multivibrator transistors can be switched to give either free running or "slaved" operation. In the "slaved" or AFSK mode, the free running multivibrator is converted to a variation of the Schmitt Trigger. The machine keyboard is plugged into J1. The keyboard is normally closed resulting in a short from base of Q1 to ground. With the base shorted, the collector of Q1 is at supply potential. The 2125 cycles per second (mark) oscillator is now on. With the collector of Q1 at supply potential, Q2 receives base current, dropping its collector to near ground potential. The 2975 cycles per second (space) oscillator is lacking base bias and is therefore off.

When printing, the keyboard circuit opens while forming the space part of the code. When the keyboard opens, the base of Q1 receives bias through the 15 K resistor, and the collector of Q1 drops to ground, removing



This view shows the various controls and the method of construction. The two 88 mh toroidal coils are in the center of the circuit board.

base current from Q2, whose collector now rises to supply voltage. The 2975 cycles per second oscillator is now on while the 2125 cycles per second oscillator is off.

Construction

Most of the parts except the controls and jacks were assembled on a perforated fiber board, and then mounted in a 4" x 5" x 7" Minibox. The 9 volt transistor radio battery which powers the whole unit at a drain of only 4 ma, is mounted on a clip on the rear of the box. The front panel is lettered and given several thin coats of clear acrylic spray. The lettering gives the unit that almost manufactured look.

Adjustment

If care is used in wiring, the only adjustments needed will be to set the oscillators to frequency. The best way to do this is by use of a digital counter, but an accurately calibrated audio oscillator will do in a pinch. The oscillators are each turned on continuously and small fixed capacitors (Cpd) are added across each tuned circuit to bring it to frequency. Small ceramic capacitors can be used for padding to frequency.

The multivibrator timing will be in the ball park if the components used are those indicated on the parts list. Accuracy here is not paramount. Anything close to 22 milliseconds by 5 milliseconds will do.

Uses of the generator

When this unit is completed, you have a very useful tool to aid you in perfecting terminal units. No longer is one dependent on an off the air signal, and yet all the variations of a real signal can be duplicated by this unit.

Normally, the machine is off. The keying magnet coil is wired to the experimental terminal unit with a small (10 ohm) series resistor. An oscilloscope is placed across the 10 ohm resistor and monitors current through the magnet coil. The results of any changes in terminal unit circuitry can now be monitored on the scope.

By turning one or both oscillators on continuously, the unit can be used as AM or SSB generator. The clean sine wave output can be quite handy in spotting distortion in transmitter stages.

And, of course, by plugging in the keyboard, you have an AFSK to modulate a VHF transmitter directly.

. . . W8GXU

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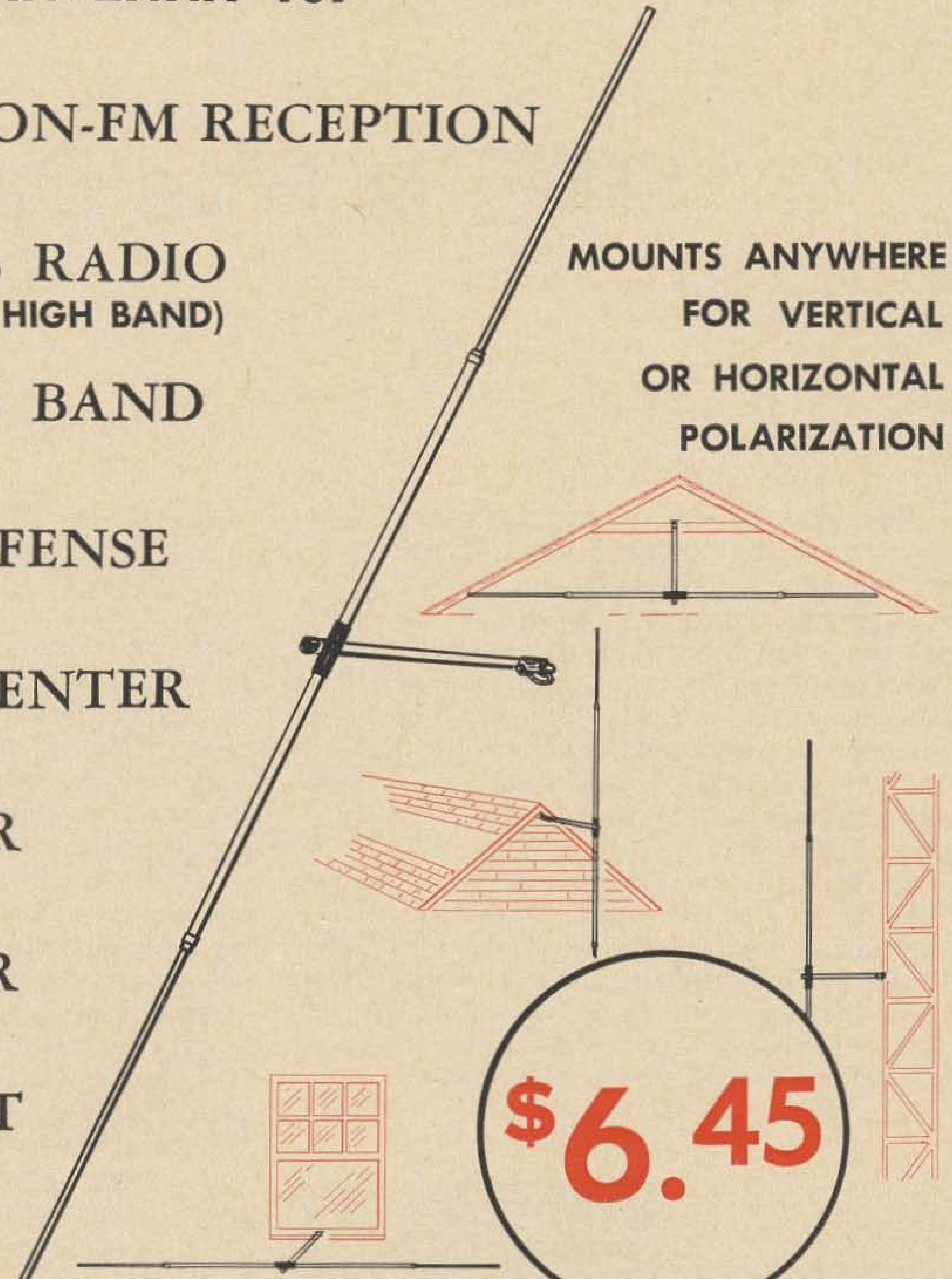

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"This is Fine Day"

Hamdom thrilled all over again the night three amateurs bridged the Atlantic and worked intercontinental DX for the first time. It happened forty-two years ago. At the time, every continent heard American signals and Americans heard some of the Europeans. Yet, no one could make a contact. Finally a Frenchman suggested experimenting on a lower wavelength. Down went the barrier and the famous Franco-American "two-way" crossed the sea.

Following the success of the second Trans-Atlantic tests in December 1921—both American and Canadian signals "got across"—the American Radio Relay League dreamed of intercontinental ragchews and a world-wide net. Hams, fired with new enthusiasm, set out to oblige. But, when QSOs continued to elude everyone, the ARRL announced the third Trans-Atlantic test for December 1922.

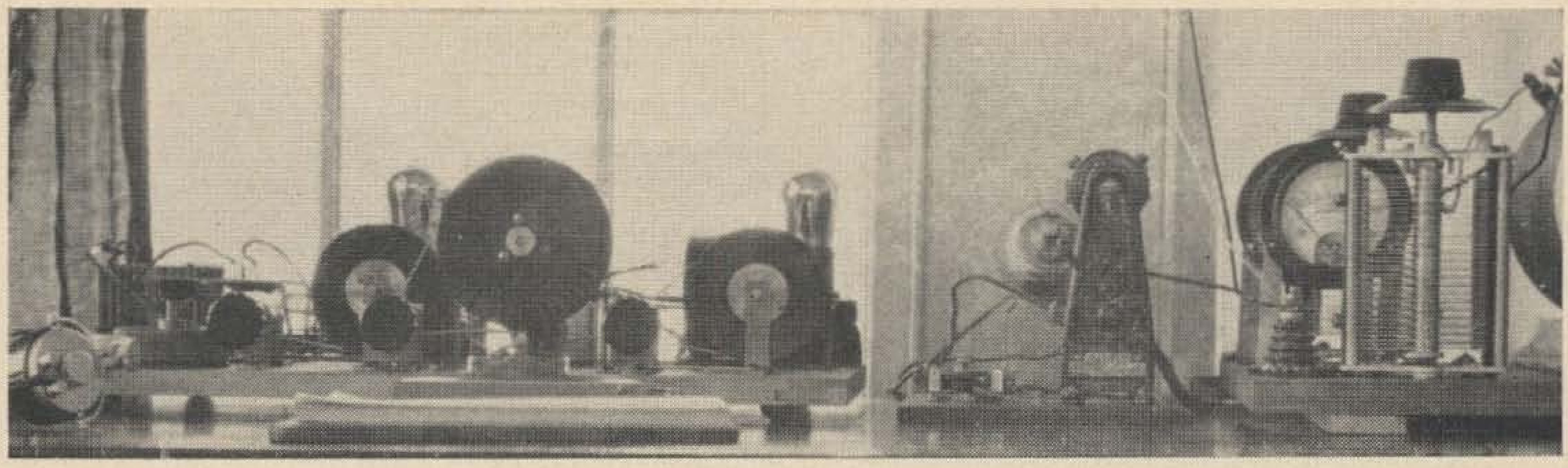
The pushpull-parallel transmitter Fred Schnell used at 1MO for the historic intercontinental amateur QSO.

This time the Europeans transmitted too. In a two-part program, Europe listened for North American signals during the first half and Americans and Canadians stood-by for the second. How close the League's "dream" lay to fulfillment quickly became evident when European amateurs snared scads of United States stations during the American 1200-mile qualifying trials alone. Later, when the test came off, American signals descended on Europe like crows onto a corn field. And, for the first time, *America copied signals from two of the countries on the "other side."*

Spurred by the unqualified success of the third Trans-Atlantic test, the ARRL scheduled a fourth for twelve months later. Again amateur excitement flamed fever high. But the fire died down before the fourth ever materialized. One month before, two New Englanders worked the same French station on the same night. In a message to America the Frenchman said, "This is fine day!" How true! It brought the harmonically related wavelengths to amateur radio and ushered in the era of world-wide DX.

DX fever

Ham enthusiasm rocketed sky-high following the outstanding success of the third Trans-Atlantic test of December 1922. Every United States district got across. British hams heard



The "pile-of-junk" receiver Schnell used to receive 8AB's transmissions.

161 Americans and Canadians; French and Swiss amateurs, 239. And, for the first time, French and English signals spilled over the Atlantic onto American soil. All in the 200-meter range. "Why then," asked the amateurs, "no contacts? What elusive secret holds back QSOs?"

Pacific DX seemed easier. Daily, new records came to light. Amateur 6ALE in Reedley, California, pushed his signals into 1-land and believed he set a CW record. (1ES in New England copied him on 208 meters for several minutes). 6ZAC in Wailuku, Maui, Hawaii, then startled hamdom with a list he sent to ARRL showing 5-, 6-, 7-, and 9-district stations he copied regularly. Some 6's and 7's found conditions so excellent they broadcasted messages "blindly" to 6ZAC. Providing harmonic QRM from NPM's arc transmitter at Honolulu stayed weak, they received acknowledgement of their transmissions either by cable or mail.

Now a buzz of comment disproved 6ALE's claim to a record. Complainants cited 6XAD's

Deloy at his operating table with Grebe 13 receiver on the left.

performance from Avalon, Catalina Island, California. He not only repeatedly copied stations up and down the Atlantic seaboard and put his signals into their territory, he worked many of those he heard. And he didn't use a kilowatt either. Four Western Electric VT-2 tubes made up the transmitter and only a detector and two audio stages the receiver. Numerous 8's in New York state roared from the earphones with such volume 6XAD copied them 100 feet away. 3AQR at Hershey, Pennsylvania, worked him just about any time he pleased as did 3ALN in Washington, D.C.; 8JL, Cleveland; and 9AJA in Chicago. But to cap the lot, word arrived from "down under" that Sidney, Australia, heard 6XAD's signals too.

About this time relaying showed it could hold its place in the crowd also. On the spur of the moment one night, ARRL headquarters at Hartford, Connecticut, originated a message for Hawaii and sent it out over their station 1AW. It read, "What time is it there?" In four minutes and eighteen seconds they knew. "Eleven thirty-five." A new record. From Hartford to Sleepy Eye, Minnesota, to Hawaii; and back over the same route. Ten thousand miles in just over four minutes. With such performance how much longer could intercontinental QSO's hold out?

In Europe, DX fever prevailed too. But methods differed. Where United States hams built sturdy, professional rigs and concentrated on relaying, the "Continental crowd" stuck more to breadboards for easy experimenting. Nevertheless, they all aimed for the same thing – intercontinental QSOs. Not corralled between 150 and 220 meters like the Americans, many foreign hams experimented on the shorter waves. One of these experimenters, Leon Deloy, operated on various short wavelengths from his home at 55 Boulevard Mont Boron, Nice, France. Night and day a 45 meter signal poured forth in his shack from 435


AMERICAN RADIO RELAY LEAGUE
Amateur Radio Station
282 Fern Street,
West Hartford, Conn.

1MO

Radio F8AB You called ARRL

This will confirm communication with you on ______ at ______ M., E.S.T. Wave ______ meters.

Your Signals were heard on Nov 25-1923 at 9[00] To 9[59] P. M., E.S.T. Wave 100 meters.

Will be glad to give you a description of 1MO if you want it, OM. Hw?

Hurrah!!!

Best 73, F.H. Schnell Operator

F. H. Schnell "FS"
Traffic Manager, A.R.R.L.

You sent code GSJTP

The QSL card Fred Schnell, 1MO, sent 8AB after receiving his signals November 25, 1923.

miles away. Deloy possessed a vast background of experience with the higher frequencies through his work with the French government communications activity. Operating under the call 8AB, his 900-mile shortwave contact with Scotland stood as a record of the day.

During the third Trans-Atlantic tests, only 8AB and two Englishmen, 2FZ and 5WS, managed to force their signals across the Atlantic to America. However all arrived weak. Following the tests, Deloy dropped back from 190 meters to the shortwaves where signals seemed to "go places" with less effort. England immediately confirmed his 100-meter signals loud and clear. Continuing to operate in this area where his confidence lay, where boundaries of nations disappeared, and where confusion reigned from lack of national prefixes, Deloy pondered the weakness of his one kilowatt signals in America. Why did American signals come in so loudly? Many boasted only flea power. Determined to find out, he booked passage for America.

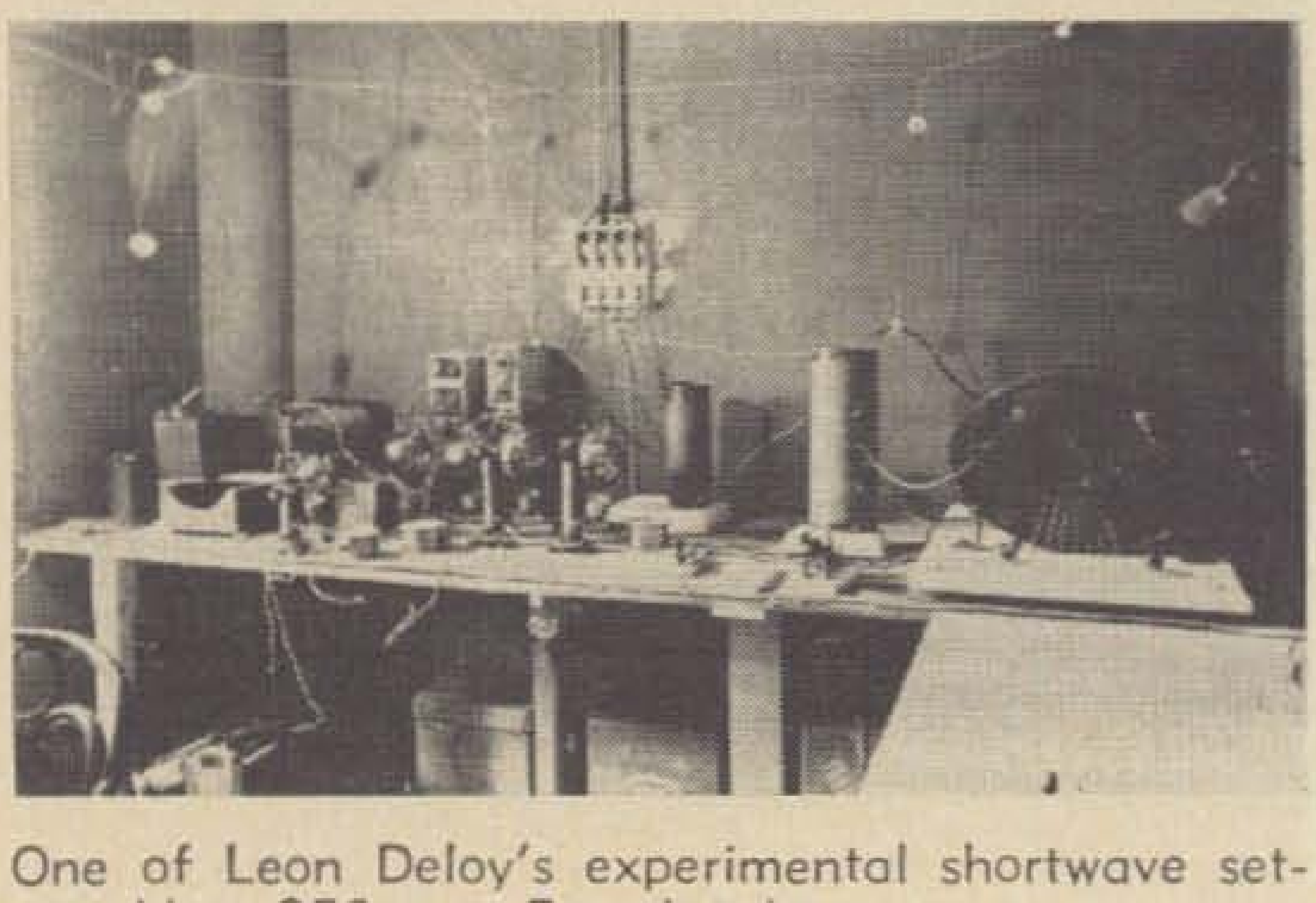
Already familiar with America from his World War I stay three years before in the service of the French government, France's leading amateur timed his visit to coincide with the 2nd National ARRL Convention held in Chicago September 12 to 15. Delighted to see such a distinguished visitor, ARRL officials asked him to speak. They knew the interest his monthly QST column held for the group. Equally conversant in English or French, Deloy explained the tendency of French amateurs to experiment rather than relay, and informed the gathering that the fourth Trans-Atlantic tests just three months away would find three new French kilowatts vying to reach American ears. To the honor of "first French station to hurdle the Atlantic," Deloy vowed to increase 8AB's renown by winning out over competition and participating in the first intercontinental QSO.

Deloy talked with as many hams as possible at the convention to learn all he could of American methods. Later, he visited a number of the leading amateur stations. His visit lasted one month. Back on the east coast, 8AB and Fred Schnell, ARRL's Traffic Manager, agreed to conduct tests as soon as possible to try to establish the first intercontinental contact. Deloy promised to wire 1MO when ready. Before sailing, 8AB dropped in on John Reinartz at South Manchester, Connecticut. There 1XAM's tuned feeder system immediately captured his interest. Tuning equalized the current in the antenna and counterpoise decreasing the input power and raising the efficiency. Intrigued, 8AB departed for France determined to adopt the idea as soon as he got back.

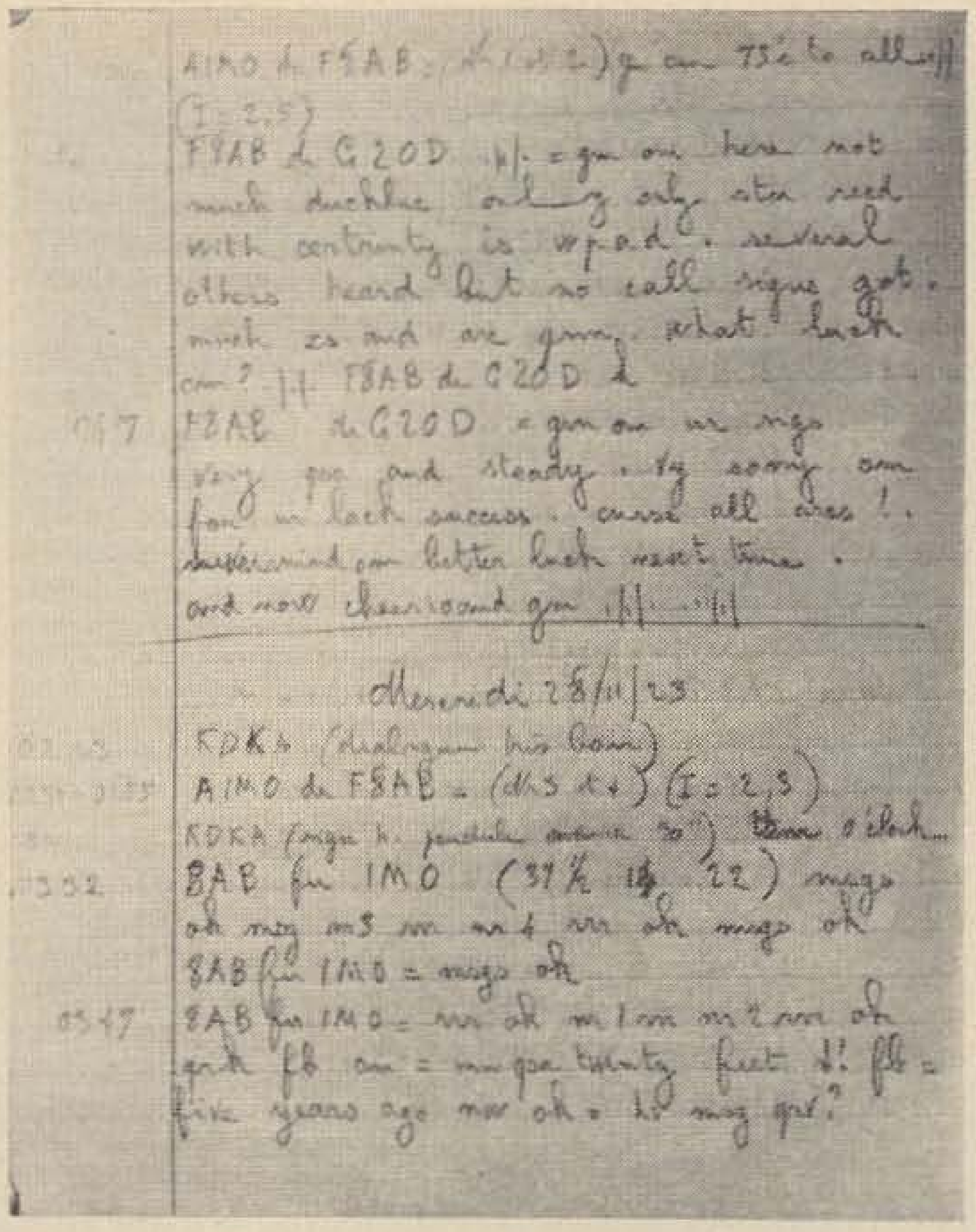
Over the waves

Deloy's cable to Schnell started things humming in 1MO's shack. "WILL TRANSMIT ON *100 METERS* FROM 9 TO 10 PM EST NOVEMBER 25 – DELOY". Out came the American Beauty soldering iron. Amid acrid fumes of heated rosin mingled with sweat, Schnell raced against time. The receiver needed some redesign. Peaked for reception in the amateur 150- to 220-meter range, Schnell felt it inadequate for the lower wavelength. Soon a new front end replaced the old. Otherwise, the set remained much as it was: a couple of cardboard tubes with a few turns of wire in an ordinary tickler circuit, a four-plate condenser, and a detector followed by one audio stage all spread out across an open breadboard. In the words of some ARRL officials at the time, "Just a pile of junk."

On the night of November 25th, Schnell and QST Editor, K. B. Warner, sat in the heated sun parlor of their shared home at 282 Fern Street, West Hartford, Connecticut. Outside snow lay on the ground. The remodeled, nondescript receiver spread before them already tuned to 100 meters. A clock indicated eight



One of Leon Deloy's experimental shortwave setups. Note 250 watt French tubes.



Part of Deloy's log book record of the famous intercontinental QSO. Note the "A" before 1MO and 1XAM used by him to designate American stations. International identifying prefixes didn't go into effect until January 1, 1929.

fifty-two. They waited. Faces tense with anxiety and expectation, they watched the remaining minutes tick by. Now only five . . . three . . . two . . . With fifteen seconds to go, they unconsciously bent forward concentrating on the background noise coming from the loudspeaker.

At Nice, France, a city back from the Mediterranean sea with mountains in the distance, the climate of Miami, Florida, prevailed. In a few minutes the clocks would strike three. Above a certain three-story house an inverted "L" four-wire-cage flat-top swayed slightly in the night breeze stretched tightly between 3-foot spreaders 76 feet above ground. A 46-foot-long two-wire lead-in slanted down from one end and disappeared into a lighted third-story room. Completing the radiating system, a cage counterpoise three feet in diameter extended nearly under the antenna from the radio room to a terminus six feet above ground. Inside the room, his features bathed in the soft glow from a pair of 250-watters, Leon Deloy sat at the operating table his hand poised above the key. He waited for 200 GMT sharp.

Before him spread a breadboard transmitter patterned after the modified Hartley of John Reinartz. However, in place of the single 50-watt tube used at 1XAM, Deloy used a pair of S.I.F. 250-watt French tubes in parallel. The plate to filament resistance of a French 50-watt tube served as a grid leak—a suggestion of another American amateur, T. Appleby. To the right of the transmitter lay the high voltage power supply. Four transformers, with primaries in parallel and secondaries in series, raised Nice's 110 volt 25-cycle house current to 5000 volts and socked the oscillator plates with raw a-c.

The receiver sat at Deloy's left. A Grebe-13. This special amateur receiver contained one stage of tuned r.f. loosely coupled to a detector and tuned from 80 to 300 meters. In addition to this professional job, Deloy possessed other receivers including an experimental superhet. As he watched the final seconds tick by, he wondered if tonight's attempt would bring success. A previous try with 1CKP of Connecticut from January 26 to February 3 the past winter, failed. One second left! The hand over the key moved. Lights in the shack dipped and a loose lamination buzzed.

Promptly at 9 PM a strong, fluttering gargle snapped the tension at 1MO. Readability extended to twenty-five feet. Deloy, or some local? Impatiently Schnell and Warner waited as the operator slowly sent. ARRL came through first followed by the cipher group GSJTP. Then all doubt vanished. The calling station signed 8AB French! Deloy sent for one hour. A call from 1MO to John Reinartz determined that 1XAM received the Frenchman's signals equally well. There two stages of audio behind a Reinartz tuner produced room volume from a loudspeaker. Schnell cabled Deloy the good news.

Encouraged by Schnell's cablegram, 8AB sent two messages "blind" the next night. One conveyed most hearty greetings from French to American amateurs; the other proposed trying a "two-way" near 100 meters the following night. The second message fostered a beehive of activity at 1MO and 1XAM. One hundred meters lay outside the amateur band; to transmit on that wavelength required a special license. Could they get one in time? Schnell cabled 8AB acknowledgement of both messages. The next day he and 1XAM dashed to Boston to plead their case with the Radio Inspector. Both emerged with a temporary ticket. Back at their stations, Schnell tuned to 110 meters and Reinartz settled on 115. Ready at last, they nervously awaited the transmission from France.

Deloy didn't keep them waiting. At 9:30 PM his 3-ampere signals pounded in again as he called America for one hour and sent two more messages. Then he signed asking for a QSL. Schnell pressed his key. One and a half amperes surged through balanced feeds. One excited the six-wire cage antenna twelve inches across and 70 feet high; the other, a six-wire counterpoise with the wires fanned out at one end. Behind the 120-cycle note, four 50-watters operated in a self-rectified, pushpull-parallel circuit with 1500 volts on the plates. Five kilocycles away, Reinartz transmitted too. If one couldn't get across, perhaps the other would. Schnell finished his long call and signed 1MO. Tension soared.

Deloy came right back. Asking Reinartz to QRX, he sent the following to Schnell: "R R QRK UR SIGS QSA VY ONE FOOT FROM PHONES ON GREBE FB OM HEARTY CONGRATULATIONS THIS IS FINE DAY . . . " A few messages followed then some rag-chewing with the Frenchman by Warner, Reinartz, and Schnell. Finally, as daylight broke in southern France, transmitter trouble developed at 8AB and Deloy hurriedly left the air.

Conclusion

The 3400 mile 8AB-1MO/1XAM contact awakened American hamdom to the value of shortwaves. As more and more amateurs listened on 100 meters, 8AB's range extended to California then on to the countries "down under". Western hams in the United States who already received 200 meter "heard" reports from as far away as New Zealand, envisioned the shorter waves transforming these reports into intriguing QSOs. Now American amateurs shouted for what they wouldn't use a few years before. The resultant clamor, with full ARRL support, fell on friendly Government ears. On July 24, 1924, the Department of Commerce reduced the existing band from 220 to 200 meters and assigned the harmonically-related bands to the hams.

Leon Deloy on the streets of Nice, France, 41 years after the famous Franco-American QSO.

As Americans hams became active on the new bands, contacts soon jumped national boundaries and ran into the same difficulty Deloy experienced some time before—identification. A 2AB might operate in Spain, France, or the United States. Deloy solved the problem by writing initials ahead of the call. In his log book "G" stood for Great Britain and "A" for America. Later, "intermediates" between calling and called stations helped. But the problem stayed unsettled until January 1, 1929, when prefixes agreed to at the Washington International Conference went into effect.

Today, Fred Schnell operates from Florida under the call W4CF. Leon Deloy whom a Canadian once called "the father of shortwaves", remains inactive in Monaco landlocked by a Principality law that forbids transmission outside the country. Reinartz, whose transmitter circuit all three stations used, in later years operated K6BJ in California until he became a silent key October 5, 1964.

. . . W2AAA

Jim Fisk WA6BSO

Transistor Meter Amplifiers

Sensitive meter movements are the backbone of all accurate electronic measurements but their expense limits their use to all but the most costly instruments. If you have priced a 0-25 or 0-50 microampere meter in the past few years you know why inexpensive meter amplifiers are useful. At one time sensitive meters could be obtained quite inexpensively on the surplus market, but nowadays even surplus meter prices are prohibitive.

With transistors it is quite easy to build a meter amplifier that is inexpensive, portable, and extremely sensitive. Depending on the planned usage, several types of amplifiers are available which are suitable for this purpose. These circuits vary all the way from the most simple to the quite exotic. Of course, the simple circuits are limited; the more sophisticated circuits allow for such things as gain control, linearity and meter zeroing. In most cases drift in a properly designed unit will be negligible.

Most amateurs are familiar with the simple meter amplifier circuit shown in **Fig. 1.** This arrangement has been used extensively in transistorized "grid-dip" meters and other units where only relative readings are of interest. In this circuit the only components are a transistor and its associated battery; you can't get much simpler than that! Admittedly, this circuit is very limited and suffers from several serious disadvantages. Probably foremost among these limitations is that the gain is dictated completely by the transistor. Furthermore, if the transistor is chosen without a little forethought, meter drift may become very serious. For this reason, a silicon transistor with extremely small reverse leakage should be used. Linearity may also be a problem in some applications, but where only relative readings are of interest, this may usually be neglected.

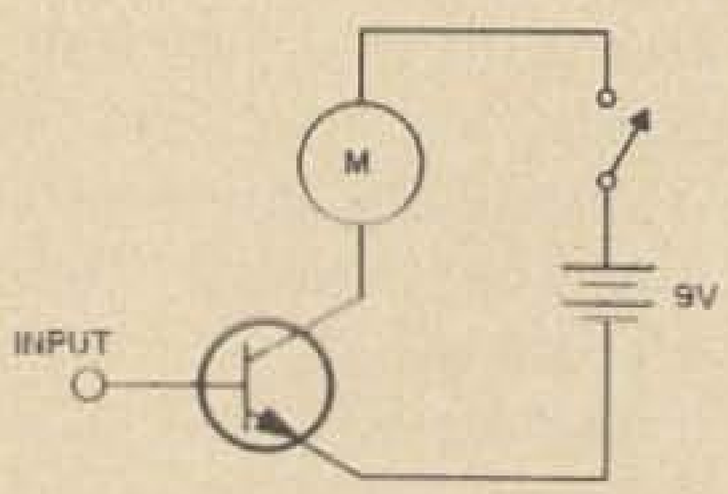


Fig. 1. Simple meter amplifier.

A more generally useful transistorized meter amplifier is shown schematically in **Fig. 2.** This bridge type circuit overcomes the major disadvantages of the simple circuit by the addition of three resistors. The gain control and the transistor form one leg of the bridge while the zero control forms the other. Since the circuit is essentially a voltage amplifier, gain is easily controlled as is linearity. In the simple circuit previously described, the gain was dictated by the current gain of the transistor, but in the bridge arrangement almost any desired amount of gain may be obtained by the proper choice of resistances.

In the bridge circuit a small current at the transistor base is amplified by the transistor to a larger current in the collector; the increase in collector current reduces the voltage at the collector and unbalances the bridge. The amount of unbalance is indicated on the milliammeter. Since the voltage gain of a transistor circuit is proportional to the collector load resistance, this circuit may be adjusted to nearly any specified gain. Because of its shunting effect, the optimum value of zero adjusting resistance is determined by circuit gain.

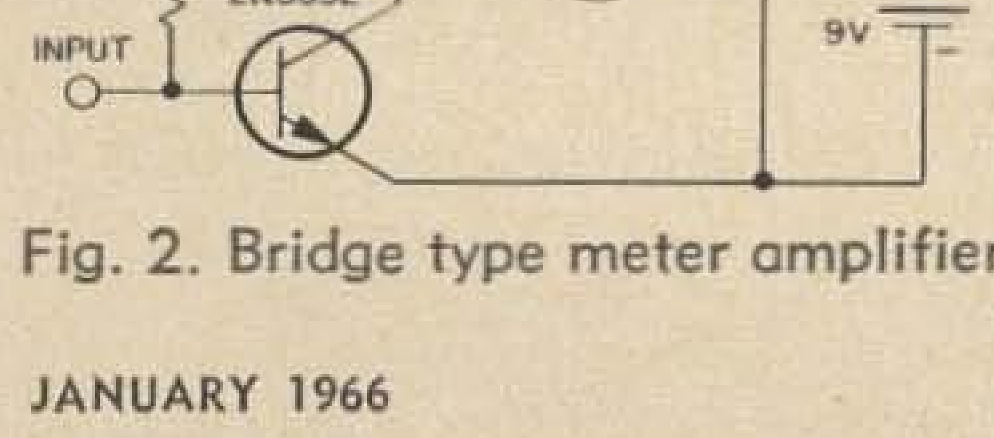
It is not absolutely necessary to use the 2N3392 transistor shown in the diagram, but other transistor types will likely require different resistance values. This particular transistor was chosen on the basis of cost (69¢) and low leakage current (0.1 microampere at room temperature). Silicon transistors are recommended for this circuit because they are less susceptible than germanium to the effects of temperature.

As shown in **Fig. 2**, the gain of this circuit may be varied to almost any desired amount. In the most sensitive arrangement (gain of 75-100) a one milliampere meter movement may be used to measure a full scale current of ten microamperes. This is sensitive enough for nearly any application; if used in a voltmeter, this corresponds to 100,000 ohms per volt.

One small word of caution should be extended concerning the choice of a meter movement. A good name brand meter should be used if at all possible. Most of the cases of nonlinearity associated with this circuit have been traced to inexpensive meters. The low cost Japanese meters are particularly bad in this respect; scale nonlinearities on the order of 20% are not unusual, at least on the units I have tested. Of course, it's like anything else, you pay your money and take your choice.

Adjustment of this circuit is simplicity itself. With no input, turn the circuit on and adjust the zero gain control so that the needle is off the pin. Use a little care during this initial operation because the circuit will probably be extremely unbalanced. The use of a small shunting resistance or "meter protector" is recommended in the initial phases of zeroing to prevent damage to the instrument. After the initial zero is obtained, each time the gain potentiometer is changed it is necessary to re-zero the circuit.

The meter is calibrated by applying a known current to the base of the transistor and alternately adjusting the gain and zero controls until the desired full scale reading is obtained. For instance, 10 microampere amplifier could be calibrated with a 1 megohm resistor in series with the transistor base and a 10 volt battery. This arrangement would provide 10 microamperes full scale. To check linearity, a 2 megohm resistor (5 microamperes) should provide a half-scale reading.



GAIN	R1	R2
5-10	1K	50K
10-40	5K	20K
40-80	5K	10K
75-150	10K	5K

Fig. 2. Bridge type meter amplifier.

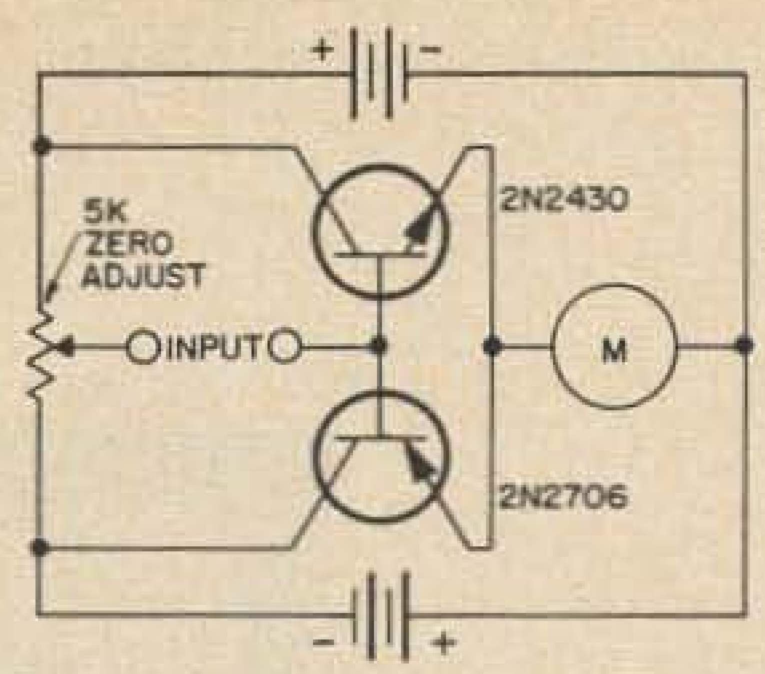


Fig. 3. Null amplifier.

Incidentally, one advantage of the bridge type meter amplifier is that zero current may be set at any point on the meter. In other words, a regualr meter could be used as a zero center instrument. If the 10 microampere circuit were adjusted to zero center, a 5-0-5 microampere device would result; just try pricing an instrument with that sensitivity! Use of very large currents with a zero center may not provide useable results however, because the circuit does not have much negative range.

A simple meter amplifier designed for use with zero center meters and useful in null networks is illustrated in **Fig. 3**. It is particularly useful in instruments where high-accuracy measurements are necessary but a relatively rugged inexpensive meter movement is required.

In this circuit a pair of complimentary transistors are operated in push-pull. The current gain of the amplifier with the transistors shown varies between 50 and 100, the nominal range of the transistors shown in the circuit. If more gain is desired, the transistors may be cascaded. Due to the complimentary nature of the circuit, it is extremely stable with temperature; drift of between 0.2 and 0.1 microamperes has been experienced over a three hour period.

The resistance of the potentiometer is not at all critical; it is used simply to center the needle of the meter. Almost any junk-box potentiometer will work.

Although the use of matched transistors is not required, the unit will be considerably more stable if matched devices are used. The Amperex 2N2430 and 2N2706 may be obtained as a matched pair under the part number 2N2707. The matched pair is only about 10¢ more than the individual transistors so is well worth it in terms of the excellent results obtained. The main disadvantage of this circuit is that both negative and positive batteries are required, but considering the simplicity of the circuit, this is not considered to be too serious.

. . . WA6BSO

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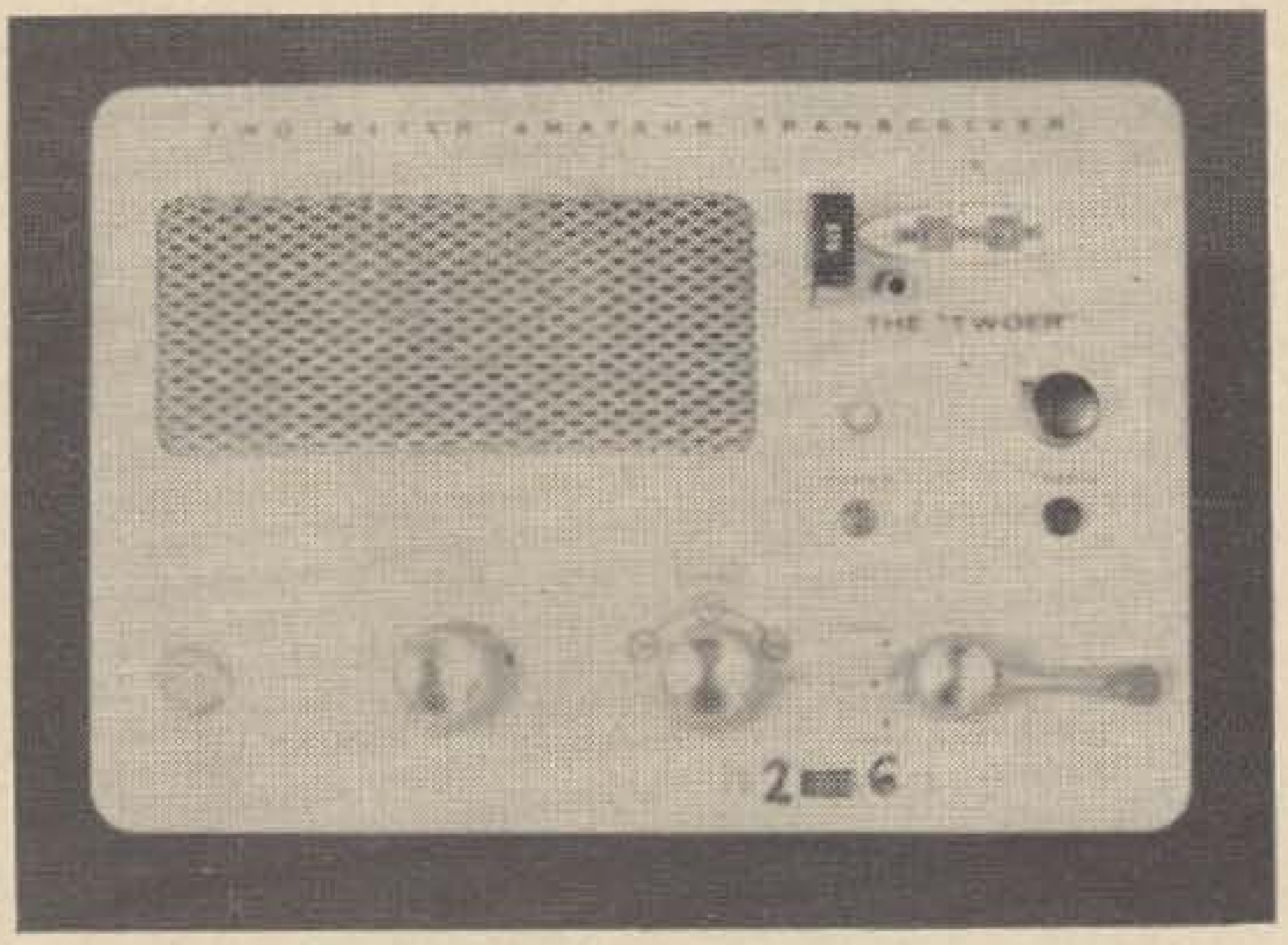


The Twixer

Add six to your Two'er

After building a simplified 6 meter version of K8KDX/6's 6 and 2 meter portable[1], I became intrigued with the idea of adding 6 meter (50 to 52 mc.) coverage to my Heathkit Two'er.

It was desirable to get a rig which used as much of the Two'er's circuits as possible. Fortunately, by reworking the power supply a bit, one section of the Tx/Rx switch was freed to be used to switch the 6 meter antenna. The Tx/Rx switch will now serve whichever rig is on. Band switching is done in the filament line, and the tubes are wired to allow for 6 or 12 volt operation. The result of this article is a 6 and 2 meter rig in the Two'er case. Handy!

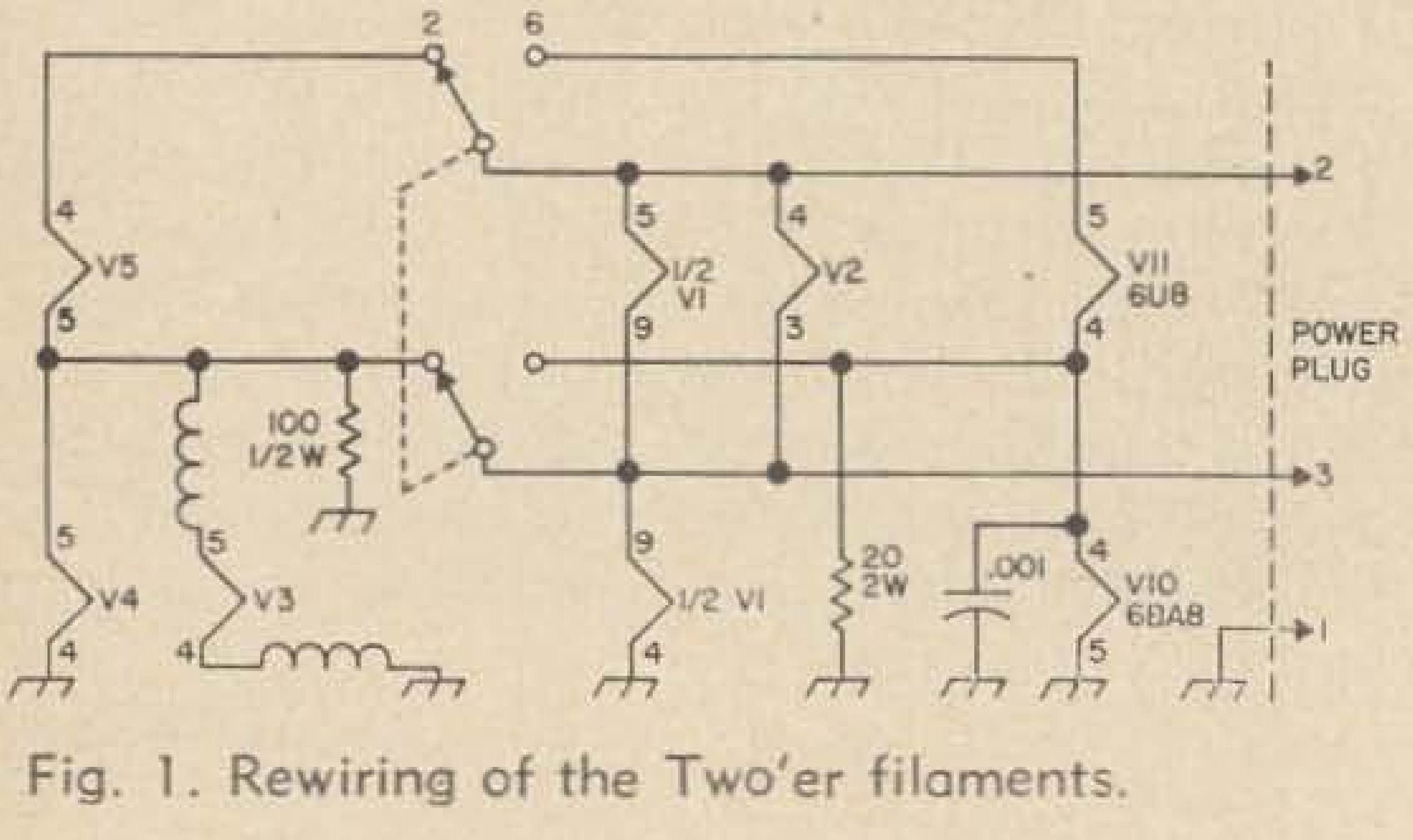


Fig. 1. Rewiring of the Two'er filaments.

The receiver uses a 6U8, the triode half as a super-regenerative detector, the pentode half as an RF amplifier. The regeneration pot on the rear apron controls either the Two'ers detector or the new 6 meter detector. In my unit, setting the pot on 2 meters proved to be satisfactory on 6 also. The Two'er detector plate choke is now common to both bands as is the audio section.

The triode half of a 6BA8 function as a third-overtone oscillator to drive the pentode half which doubles to 6 meters. This allows the use of 8 mc crystals. I have found this transmitter to be quite adequate for local work. The Two'er audio section supplies modulation in transmit.

Changes

The addition and changes were done in four parts.

PART 1 Filaments and filament switch.

1) Add the dpdt slide switch between and below the Two'er tuning capacitor and Tx/Rx switch. Be sure this switch will clear the variable capacitor and the outside case.
2) Wire the Two'er filaments (as shown in

1. 73, March 1963, page 32. *A Six and Two Portable.*

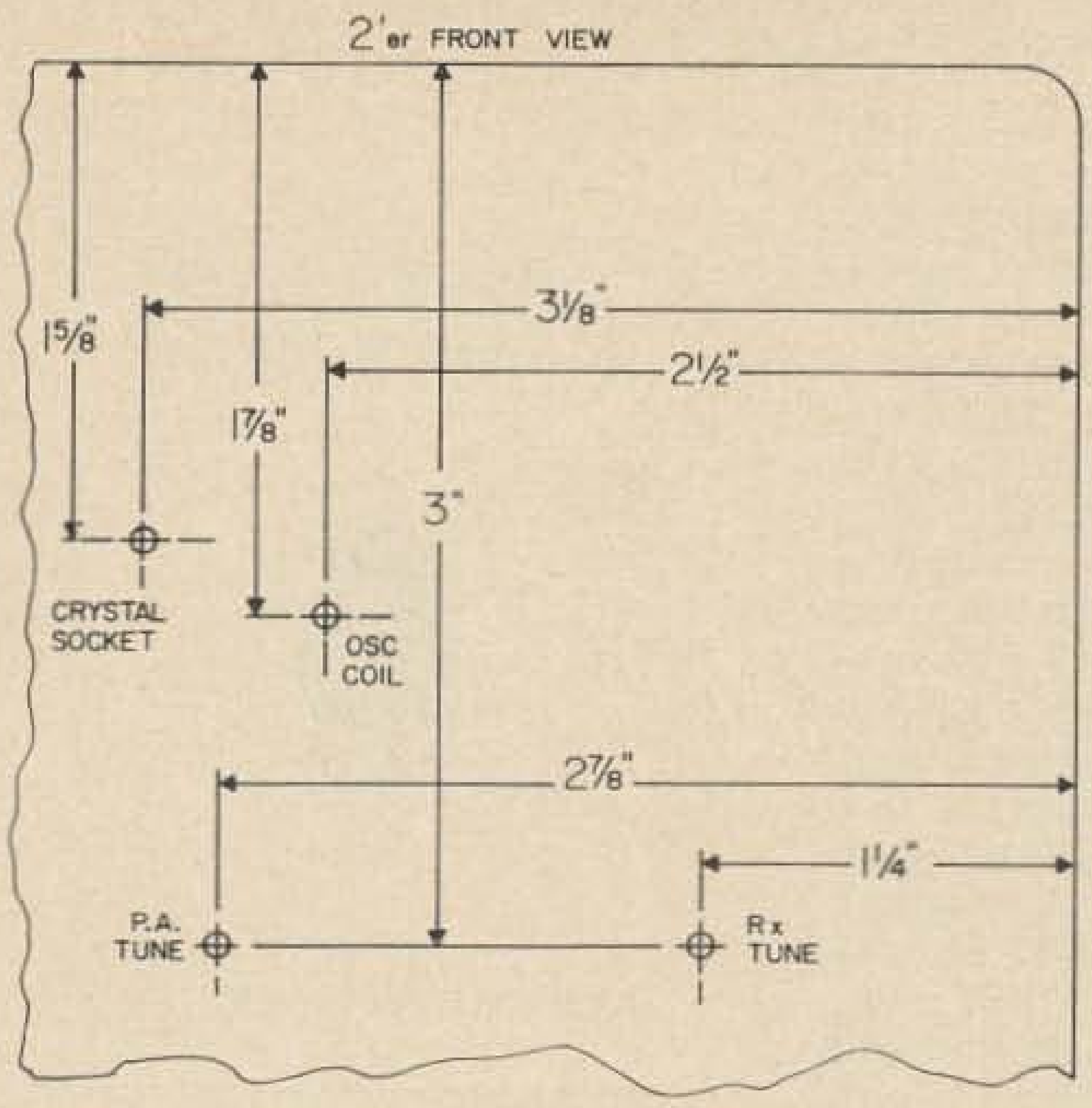
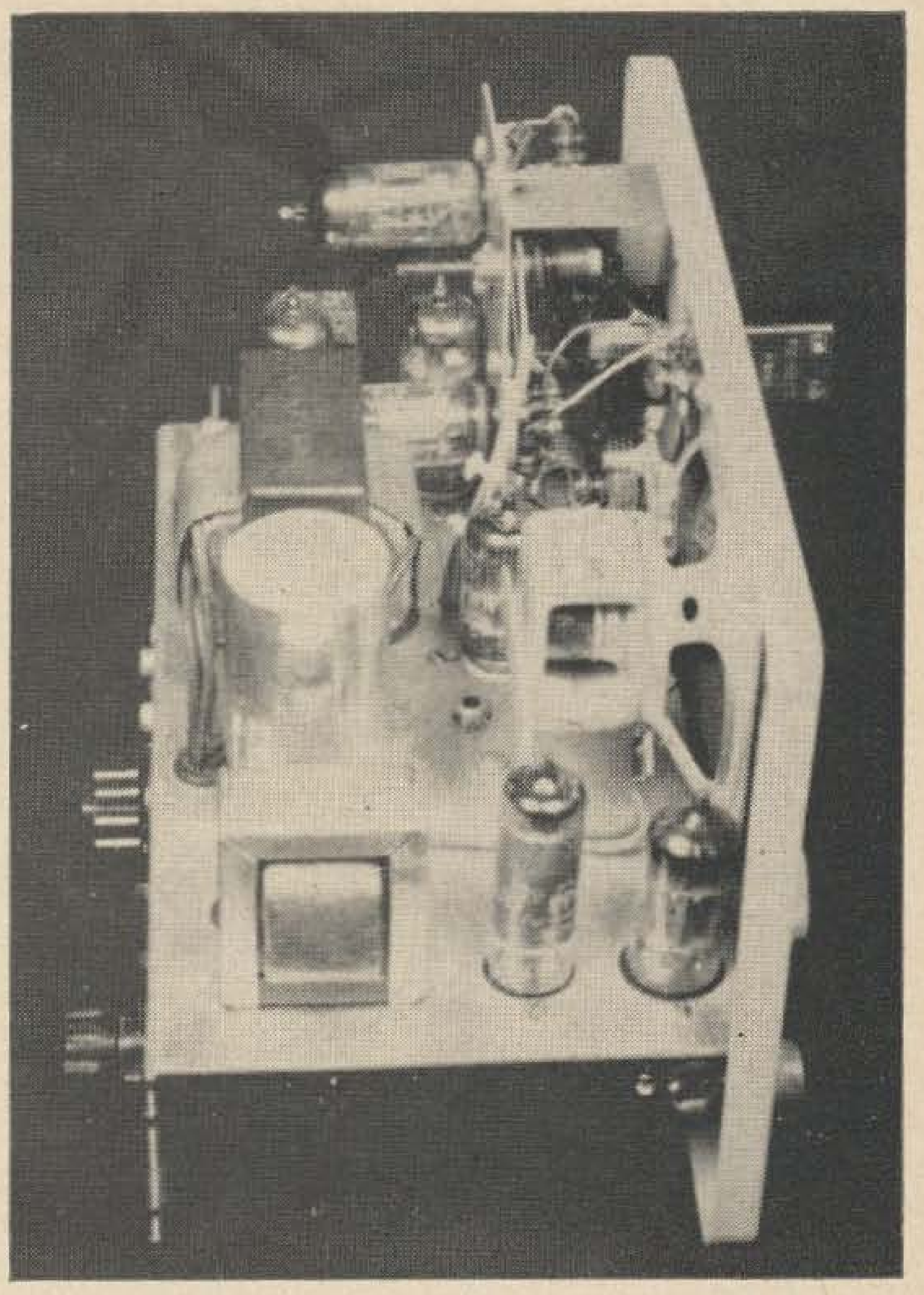


Fig. 2. Upper front panel additions to the Two'er.

Fig. 1) to the switch. The 6 meter filaments will be added later.

PART 2 Tx/Rx switch, antenna jack, and power supply.

1) Move the wire from lug 2 of switch **Z** to lug 1 of terminal Q. (use longer wire)
2) Remove the wires from lug 3 of switch **Z**. One wire goes to lug 3 of capacitor I; remove this wire completely. The other wire goes to lug 3 of terminal AA; this wire now will go to lug 2 of terminal S.
3) Remove the output detector diode, terminal F, jack G, and associated wiring. Mount the type antenna fitting you intend to use in the vacant hole.
4) Add a heavy wire from lug 3 of switch Z to the new antenna fitting. Keep this wire away from the chassis.
5) Replace R14 with a 4 H 100 ma choke. Move C31 and C32 to make room for the choke.
6) Change R15 to a 2.2k 2W.



Top view of the Twixer showing the subassembly in place.

PART 3 Upper front panel additions.

1) Since most hams will be using junk box parts, **Fig. 2** only shows where the component should be centered.
2) Drill the necessary holes and mount the components (except the Receiver variable tuning capacitor).
3) See Fig. 4 for details on the receiver tuner. Mount the receiver variable.
4) Install L11 just above and behind terminal capacitor, the other end goes to C15 in the Two'er.

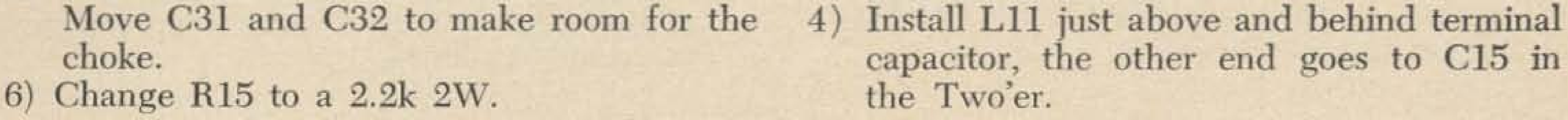
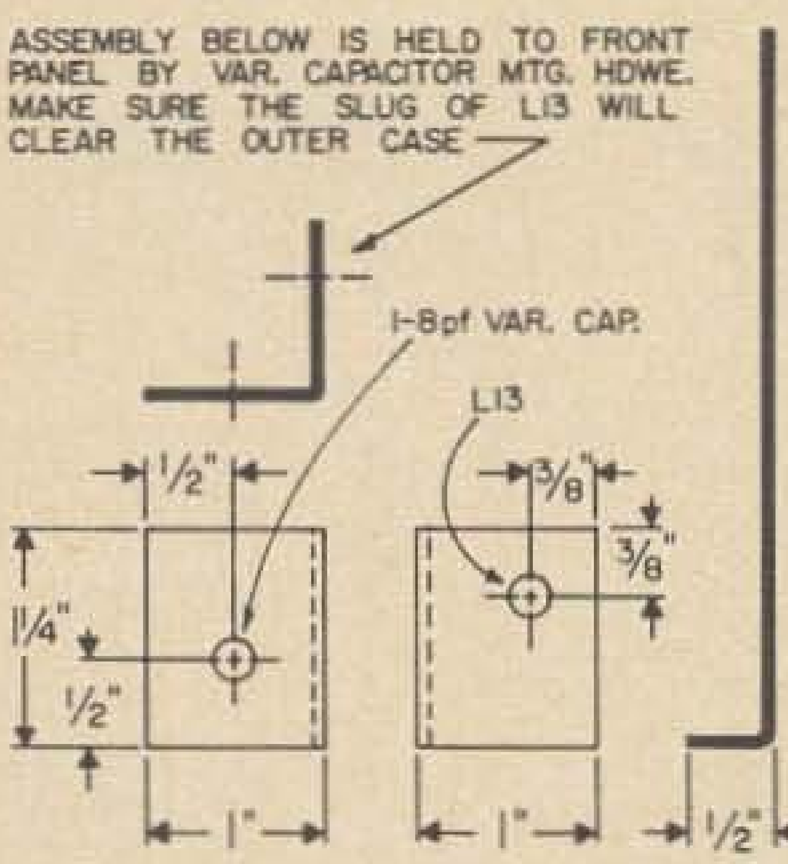


Fig. 3. Schematic of the added six meter components. Cathode resistor of the 6U8 is 470 ohms. L10 is 25 turns #28 enamelled of 1/4 inch iron core form. L11 is 7 turns #16 tinned, 3/8 inch diameter, spaced one turn. Link is one turn #20 insulated. L12 is 6 turns #28 enamelled on 1/4 inch iron core form. Its link is 1 turn #20 insulated. L13 is 6 turns #28 enamelled on 1/4 inch iron core form. RFC is two layers #28 enamelled close wound on 3.3 k 1/2 watt resistor.

5) Install the .001 μf capacitor at L10. Also run a 22k resistor to lug 2 of terminal AA.
6) Run the other end of the .001 μf capacitor to the crystal socket. Also put in the 50 pf capacitor.

PART 4 New subchassis.

1) Make the new subchassis as shown in Fig. 5. The ½ inch lip will have to be notched to fit around V4. The panel should be bolted in 1⅞ inches from the Two'er front panel, after it is wired.



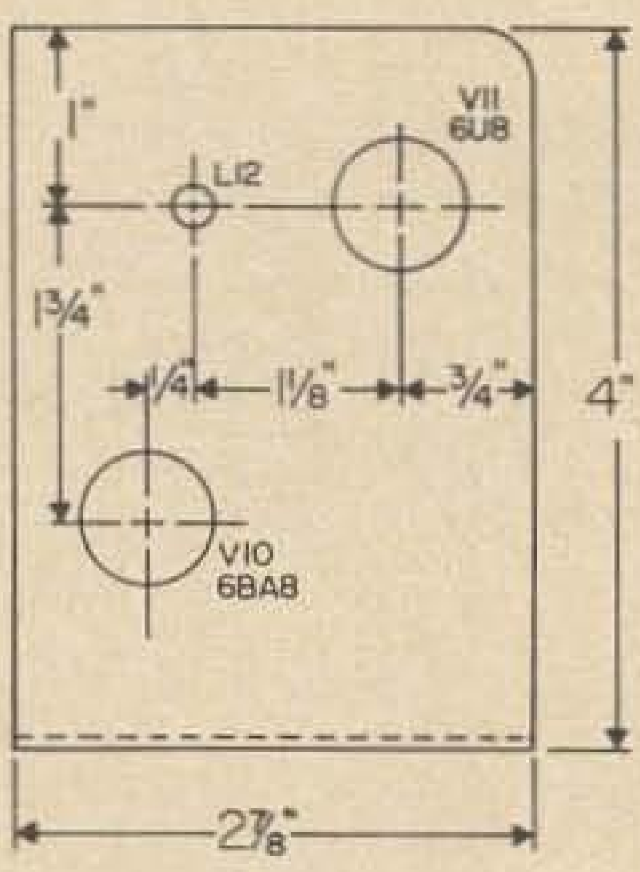


Fig. 4, left. Details of capacitor and coil tuning assembly.

Fig. 5, right. Details of the new subassembly. Front view of the Twixer.

2) Install sockets for V10 and V11.
3) Wire up the sockets. All leads going to front panel controls, or to the Two'er circuit, should be left long enough.
4) Put the panel in place and drill convenient holes for mounting. Also drill holes for running the wires from this assembly through the Two'er chassis.
5) Make a strap to secure the upper end of this assembly to the front panel.
6) Secure all the loose leads from the new assembly (see Fig. 3).

TESTING

1) Put the filament switch in the 6 meter position. Turn on the power. If the filaments light, and there is no smoke, adjust the Two'er regeneration control of the regenerative hiss. Adjust L13 to get the tuning range to 6 meters. On a weak signal peak L12.
2) Plug a 8 mc crystal for 6 meters into the new crystal socket. Put the Tx/Rx switch in the Tx position. Adjust L10 for maximum output (use a grid dipper in the diode position) at 24 mc. Adjust the 3-15 pf capacitor for maximum 50 mc output (use a small pilot lamp for a dummy load).

That's it. You now have a Twixer Two'er.

. . . WØHMQ

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6M	300-C	50-54	14-18	$12.95 ppd.
6M	300-J	50-52	28-30	$12.95 ppd.
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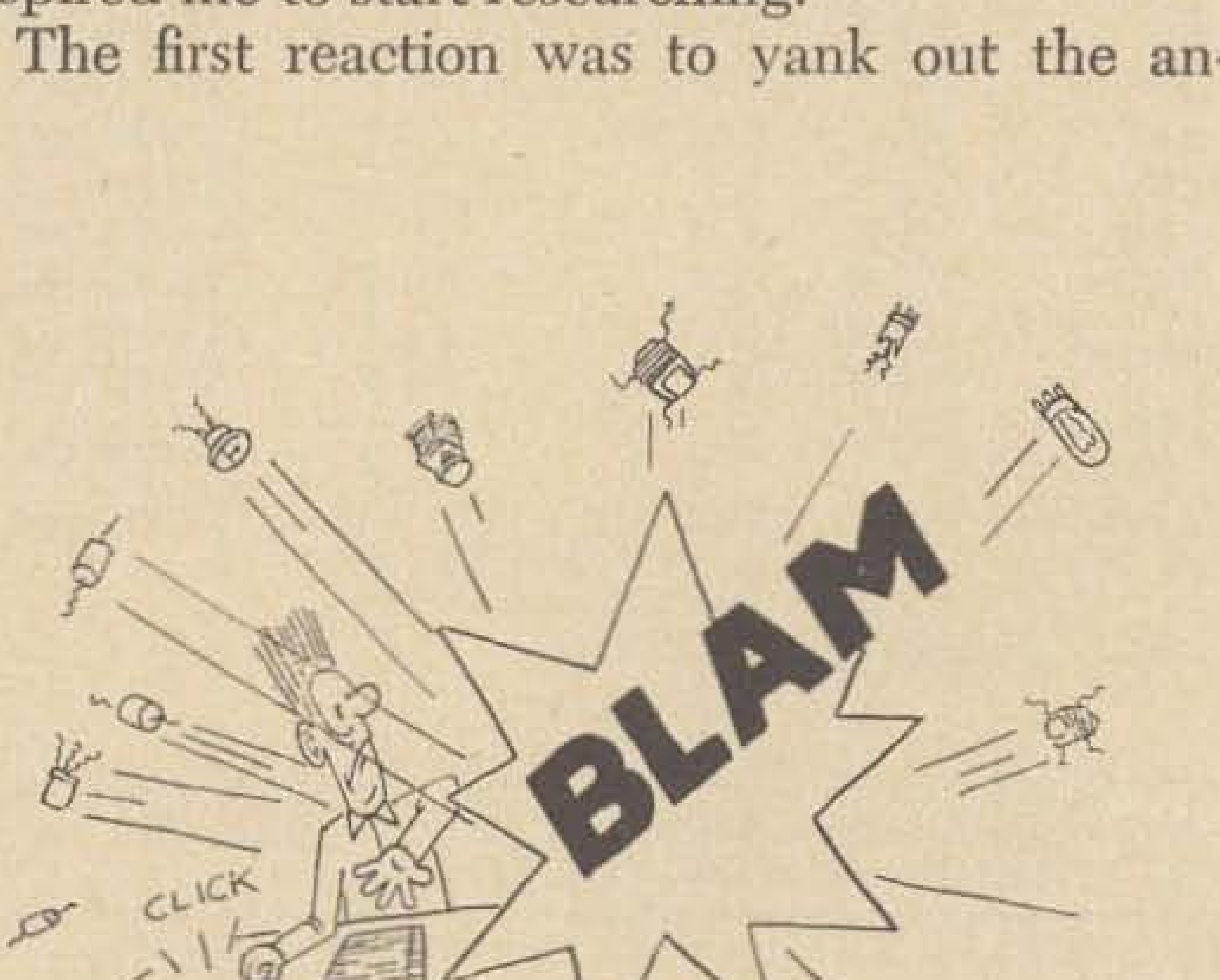
A Line About Line Noise

The other day the family left me alone with the house and it was peaceful. I sat down at the rig with full intentions of enjoying a few hours of DX-chasing or rag-chewing, whichever seemed most probable. With the earphones in place, the warmed tubes of my hearing aid greeted me with the loudest racket I have ever heard. My S-meter spun over to S-9+ without a signal coming through. Needless to say, my spirits dropped to rock bottom and my relaxation was shattered. After a few choice invectives, I started to turn to a new mystery book. However, having had this experience before, something inspired me to start researching.

The first reaction was to yank out the antenna lead to the receiver. When this was accomplished, the noise stopped. Here was my assurance that the interference was probably generated by a source outside of the shack. I knew what I could do: call the power company. The power company has a group of trained men whose job is to track down radio interference emanating from their installations and they usually locate the trouble. However, I also had learned another thing: it is much better to tell the power company approximately the location of the noise or where I thought it was being caused. Such information can speed their search immeasurably. This meant I must embark on a small transmitter hunt with my mobile gear. Tracking down line noise is no art and takes little skill. It takes patience. It can be done with a mobile amateur receiver or with a transistorized broadcast receiver, but the latter is not as sensitive, does not have an S-meter and is not too directive. Consequently, it is better to use mobile gear for this work.



Last winter I was cursed with a noise which was intermittent—loud crashes every few seconds—as if two wires were striking together or as if a branch was hitting a live wire every time a gust of wind came along. It was a dark, blustery, cold and snowy night, but I was an angry ham and as long as I could not have fun indoors with the rig where I belonged, I bundled up and faced the storm. In my mittened hand I clutched a broadcast receiver which led me directly to the feed-line coming down from a cubical quad on the roof of a neighbor's house. This, I was aware, was not connected to his receiver or transmitter. Each time I placed the receiver against the coax, I received energetic blasts of noise. Yet I knew that there was no power up there to generate noise—even static charges could not be responsible for it. Then I discovered the same racket on my own feed-line. The noise was being picked up by the antennas and coupled through the feed-line to the BC receiver. I quit and returned to another mystery novel. The sequel to the story is that after having been plagued for months by the same noise in various degrees of strength, the power company came out and removed from a high wire, a piece of baling wire which had been used to tie up newspapers. The news boys had tossed it over the lines several blocks from my QTH.

There you are—look for bailing wire!

To assist me in obtaining the general direction of the noise and to save gasoline at the outset, I always peak up the signal with my beam. In almost every case, it shows definite directivity. Then I scramble out and light off with the mobile gear, drive down the street in that general direction watching the S-meter rise or fall. It is not long before I locate a place where the noise reaches a crescendo. Nevertheless you can be fooled. Line noises have a tendency to have peaks and nulls as you travel along their path. The interfering signal also has a propensity to travel down the ground wires of the poles and show up loudest at a spot a long way from where it is generated. Then you really have a problem. The power company men are the only saviors in such cases.

Now comes the situation when you pinpoint the noise, not on the power company's lines, but in and around a private dwelling. Here, like TVI, diplomacy is necessary. The noise might be interfering with the TV in that house and in many other houses thereabouts and is being blamed on you, the nearest ham. So it is always better if the power company makes the call for you. They will as a rule. The nastiest situation of this nature was the noise which had been plaguing a well known ham for months. The noise always came on at a certain time each morning, just when DX was at its best. The power company informed the ham that they had traced it to a certain address and had ascertained that it was a heating pad. The heating pad belonged to a lovely old lady who suffered from arthritis. What to do? The lady couldn't be asked to forego the use of her pad. So I suggested that a letter be written to the manufacturer. Sure enough, a new heating pad arrived in a short while. But, how embarrassing! That very day the power company men informed the amateur that they had discovered a cracked insulator which was the source of the disturbance. At the hour the noise commenced, someone (possibly the lady) always pulled a load from the line and the insulator commenced to arc. There was a new heating pad and no noise!

One must never forget the electric tool—the electric razor (I hate them, but many people would not use anything else)—the vacuum cleaner,—the mix-masters, the electric drills and saws—and the fellow who always tunes his car when the DX is hottest. I am still trying to get a cure-all for vacuum cleaners, as they, of all the above, stay on the longest in hands of a meticulous housekeeper. My neighbor's vacuum cleaner makes more noise than my wife's and that is bad enough in some parts of the house. In other parts of the house I do not hear it. It depends on the wiring. What to do? Even the power company says trial and error—cut and try—sometimes a line filter, sometimes a capacitor, but each is ad hoc. You can't argue with a neighbor over that and as for the XYL . Please clean when I am at work. Thanks.

The power company volunteered a good one about a disturbance which bothered TV, BC and all the neighbors for a good distance around. After a long chase along their wires, after visiting various homes where the noise seemed strong, one power company man pulled a fuse in a private house and the noise ceased. Then, ascertaining that nothing was plugged into the particular line, he put the fuse back into its socket and the noise arose once more. Only because someone, at that moment, rang the *door bell* was any thought given to that little noticed, but important household appliance. Inspection showed, when the bell transformer was located, that it was in deplorable condition. It had been arcing to its case for so long that it was covered with soot—and it had not actually shorted out! So watch out for the door bell transformers.

I had a really fine noise when I lived in an apartment. I was ready to take an oath that a bootlegger was operating in or near the building and was sending CW with a raw note. I do not recall how I made the discovery, but the culprit was a cheap tropical fish tank thermostat. It would keep coming on and off with very fine rhythm, and sending out a strong signal through the lines.

Other annoyances can be butter conditioners in refrigerators, the machine in the store down on the corner which keeps the peanuts warm, a cheap house fuse (a lot of people use them), and a loose connection in a light cord. There is hardly any use in mentioning neon signs and fluorescent lights because they should be the first suspect if present. Diathermy once was a great cause of concern when considering interference but lately it has been tamed and properly shielded. Some TV sets can cause interference, but that source is very rare.

The power company tells me that in areas close to salt water the spray and the mist can deposit a coating on insulators which will then produce a corona. Furthermore, atop certain poles are large knife switches for power company use and they become crusted with salt and dust and soaked with moisture. When that happens a resistance is built up between the blade and the other element of the switch and arcing occurs.

But don't get caught off guard—one day I couldn't hear a thing on 20 but a raucous roar. I did everything but turn off the final. When I did that, the noise abated. I turned it on and in a few minutes it was there again. It wasn't the blowers, but it was a loquacious tube. I replaced the tube and the noise was in the past. A faulty TR switch can also cause you no end of annoyance.

I have found that the power companies are always willing to help you if you keep after them. It is human to travel the easiest path. So it may require several calls. It may take a letter to the local FCC office to stir them up. One amateur near me made a log of the number of times and the dates he called the power company without any response. Suddenly he received a landline call that they were coming to his area with a van load of gear from the state capital. That did it. The noise stopped before they arrived. The visit was repeated three times until they found the culprit. The old gag about the toothache vanishing as you approach the dentist's office.

The big big difficulty is that the power company men work when I work and you work and everybody but the night shift works. Day time! The noise generally comes at night when dampness settles and homes draw a heavy load. That is why it may take coaxing to get the power company men to acceed to your schedule and the noise schedule as well. Don't give up! The criminal may give you trouble, but it will eventually be silenced.

In summation, first try to locate the source of the line-noise. Then call the power company. If one call does not bring results or a representative, make several calls. They may be very busy. If that fails, contact the nearest FCC office explaining the situation. They may contact the company or come out with their own equipment. The most important thing is not to take line-noise as a matter of course. Make every attempt to have it tracked down. It is not something which should be accepted as inevitable. Good hunting!

. . . W4NJF

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Assembling the Sideband System

In the previous articles of this technical series on sideband, we have examined virtually all the "building blocks" that go to make up a sideband system, in either the transmitter or the receiver. Now it's time to see how these blocks go together to form a complete system, as well as to find out how to test and measure the performance of the finished system.

First, though, let's review the "building block" concept. It's an idea which is becoming more and more popular with professional designers, since it makes their job so much simpler. Basically, any electronic circuit (no matter how complicated) can be thought of as a "black box" with its input, output, and supply voltages specified. Given a large enough number of types of these "black boxes," a designer can put together any type of system by simply using the boxes as building blocks, joining the output of one to the input of the next and arranging them by function so as to come up with the system he wants.

All of us do this to some extent in our stations; the transmitter is one building block, the microphone another, the antenna still a third, and the receiver a fourth. We choose what we like for each of these four blocks, connect them all together properly, and come up with a station.

Similarly, the specific circuits discussed in earlier articles in this series can also be considered as blocks, and hooked together in a nearly infinite number of ways to provide the sideband station you prefer.

In using the building block concept, two factors are of extreme importance. Whenever two blocks are joined, they must be compatible both in signal level and in impedance. Thus you wouldn't connect a coax-output-only

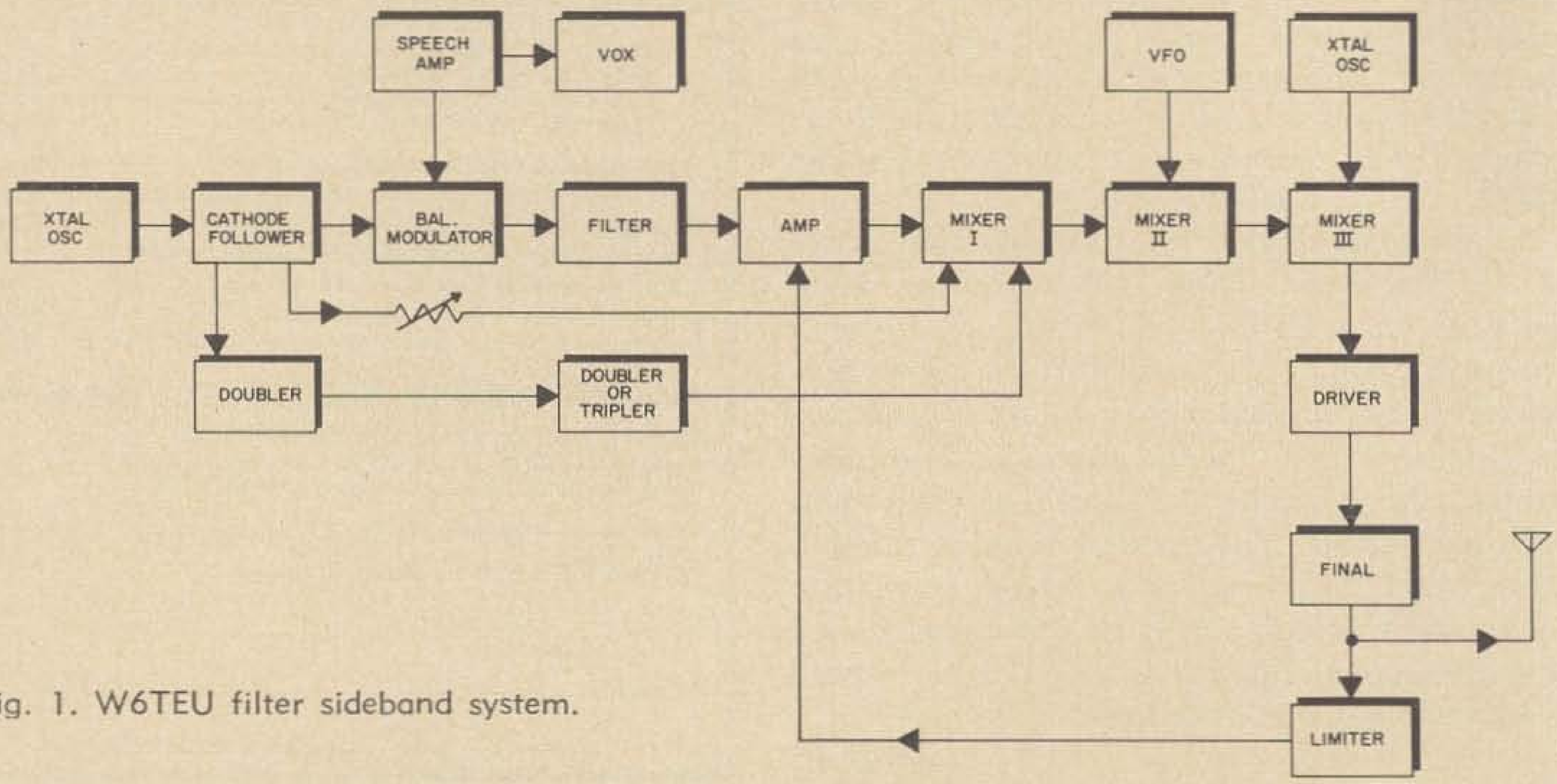

Fig. 1. W6TEU filter sideband system.

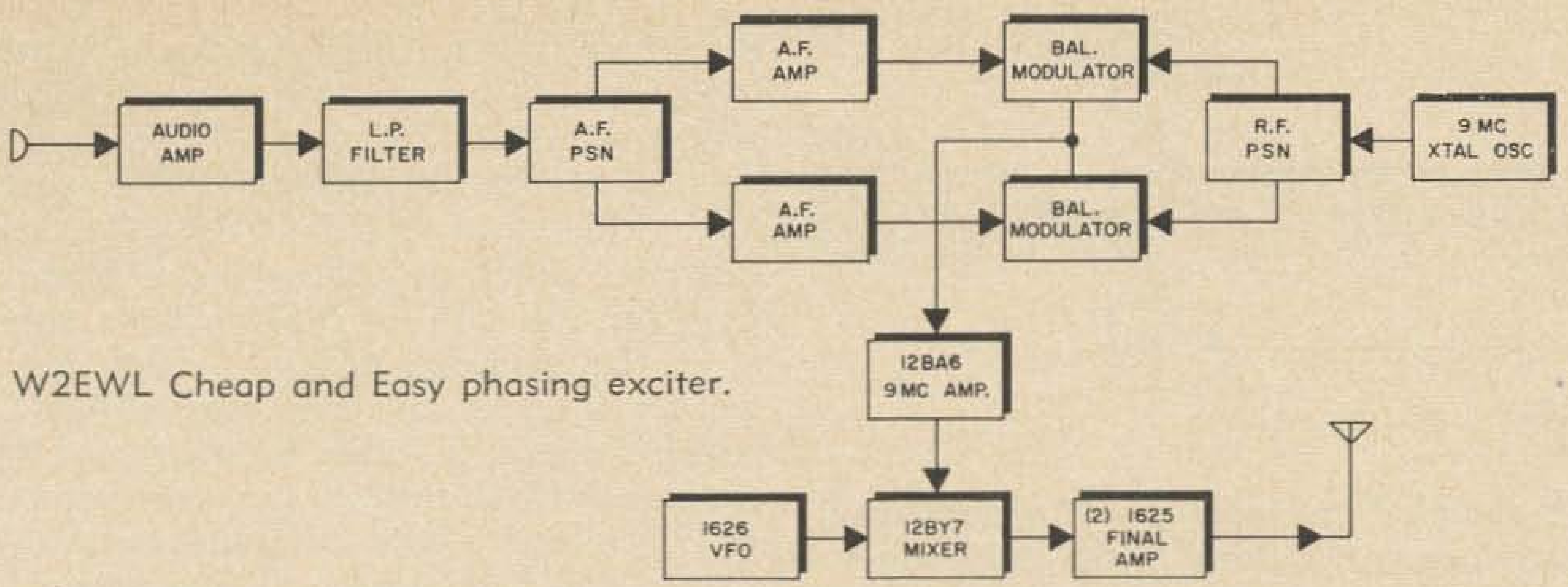

Fig. 2. W2EWL Cheap and Easy phasing exciter.

transmitter directly to twinlead; you'd put an antennna tuner (another block designed specifically for matching purposes at each end or "interface") in between to make everything work.

Most of the circuits discussed so far are fairly compatible; input and output requirements of each are described in the original discussions and won't be repeated here. A few just don't work out right without matching blocks between.

To show how the blocks can be put together into a number of different systems, let's look at some of the more popular homebrew sideband systems from the recent past, as well as at one commercial transmitter.

The W6TEU filter system

A good starting point is the W6TEU "Sideband Package" first described in the June, 1958, issue of *QST*. A block diagram of this unit is shown in **Fig. 1** (for the schematic, see the ARRL manual *Single Sideband for the Radio Amateur*—or draw your own by filling in the blocks with the circuits from previous articles in this series).

The block marked "speech amplifier" is a conventional audio amplifier such as that used in any modulator, giving approximately 30 volts peak audio output from a crystal mike (but only about 2 volts are normally used—the rest is reserve). The resulting audio feeds a two-diode balanced modulator.

The balanced modulator also receives rf input from a 450 kc crystal oscillator, through a cathode follower used for impedance transformation. An unusual feature of this circuit is that the crystal oscillator output is also doubled, then passed through a stage which can be switched to either double or triple, giving an output frequency which is either 4 or 6 times that of the crystal. This is used later to provide choice of sidebands.

Output of the balanced modulator goes through a 455 kc filter, which may be either a mechanical or a crystal lattice type (W6TEU used a crystal lattice). The filter output is upper sideband, and passes through a class A voltage amplifier before reaching the first mixer.

The other input to the first mixer is the 4x or 6x crystal frequency mentioned earlier; the output of this mixer is always at 5 times the original crystal frequency. Since the 455 kc input was upper sideband, the output will be upper sideband if the injection is at 4x, and will be inverted to lower sideband if the 6x injection is used. This trick provides a choice of sidebands with no compromise of filter characteristic.

Carrier output from the cathode follower is also provided to the first mixer through an "injection" potentiometer, to allow AM operation if desired.

The 2250 kc output of the first mixer then goes to a second mixer, where it is heterodyned against the output of a VFO operating in the 5250-6250 kc region; the output of this mixer is between 3 and 4 mc, usable on 75 directly and capable of being heterodyned again to higher bands. This heterodyning occurs in the third mixer, where a crystal oscillator provides the transfer signal.

Output of the third mixer goes through a chain of linear amplifiers, at ever-increasing power level, to the antenna. A bit of outgoing

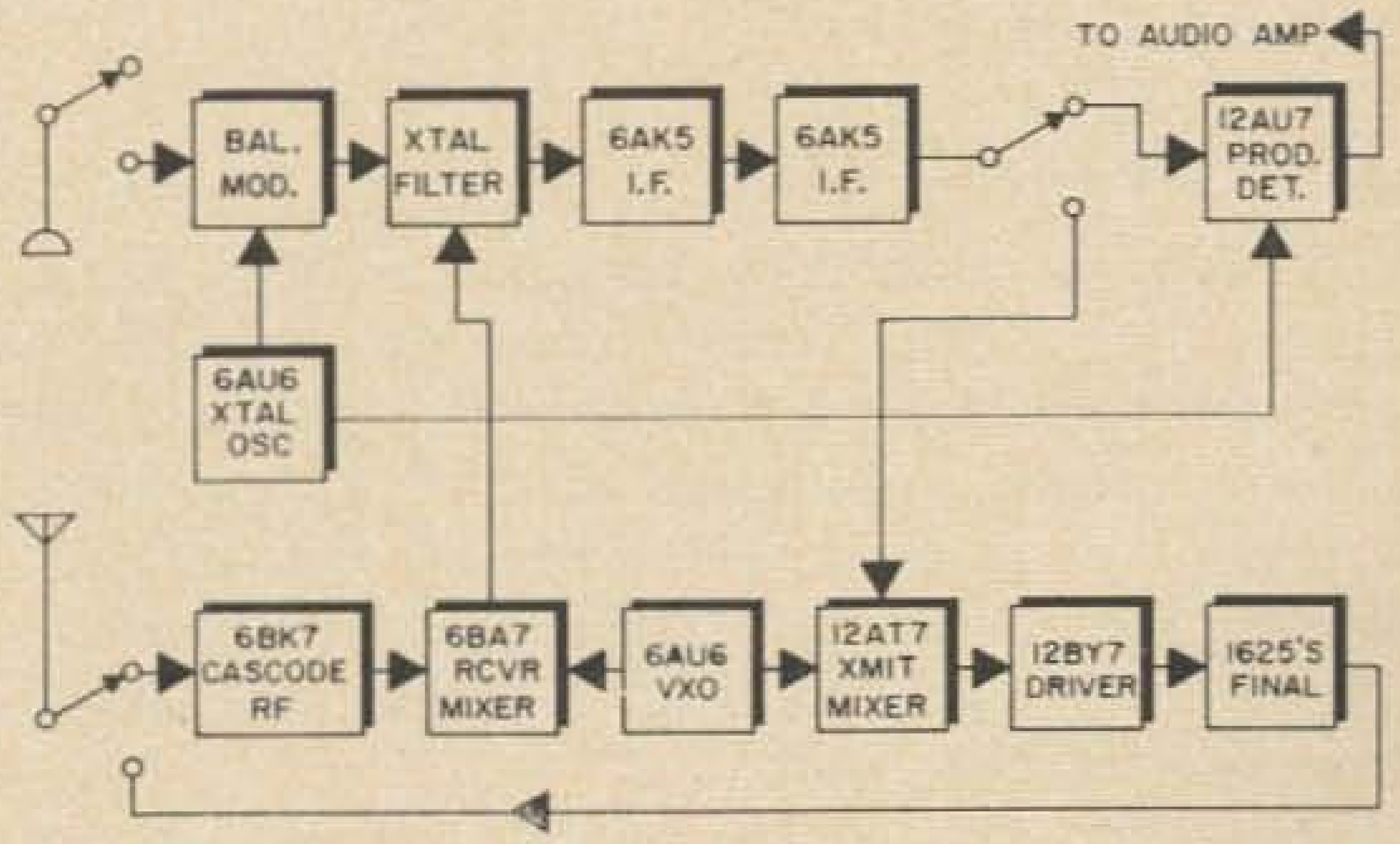

Fig. 3. W3TLN SSB transceiver.

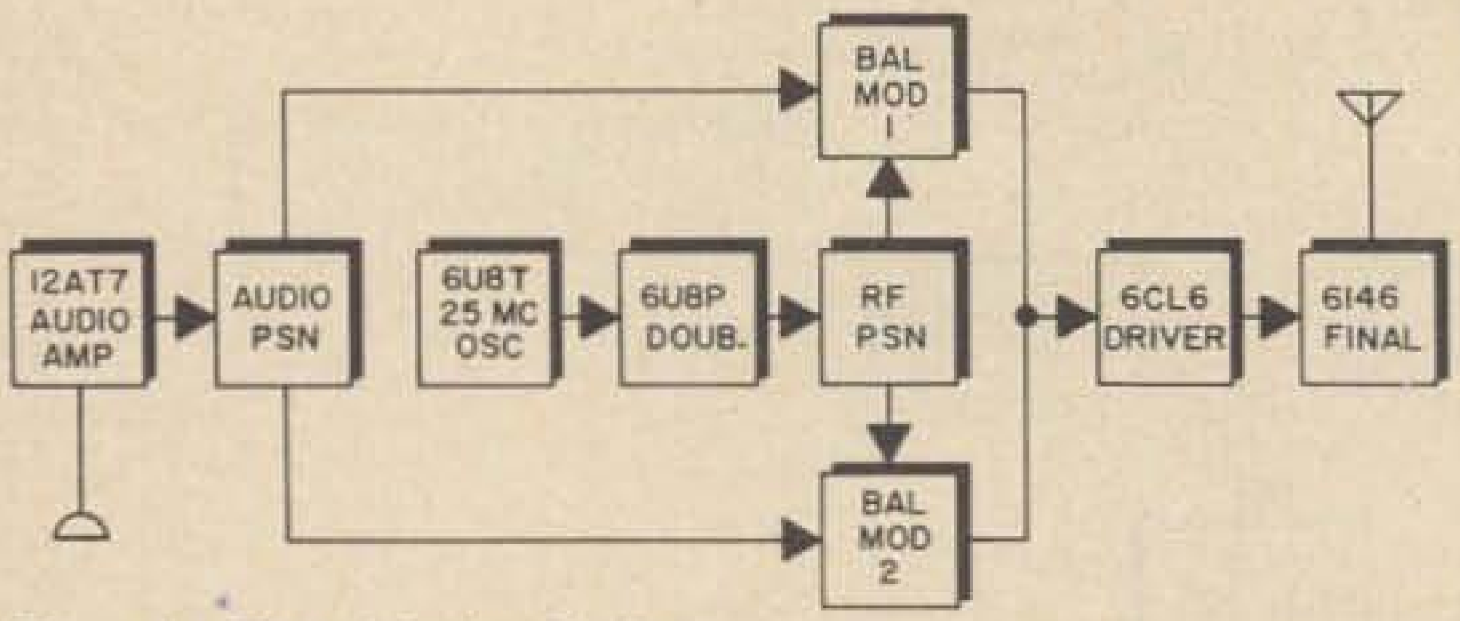

Fig. 4. The Little Feller.

signal is sampled and used for automatic gain control, to prevent limiting in the linear amps.

The W2EWL phasing exciter

This exciter is a filter type, and has been highly popular with those liking filter exciters. One of equal popularity among the phasing set was W2EWL's "Cheap and Easy SSB," originally described in QST for March, 1956.

The block diagram of this unit appears in **Fig. 2**; the schematic is in the ARRL publication mentioned earlier.

Like the W6TEU rig, this uses a conventional audio pre-amp without about the same characteristics; it feeds a cathode follower for impedance matching, and the audio then goes through a low-pass filter to remove everything above about 3 kc before reaching a commercial phase-shift network.

Output of the phase-shift network feeds a pair of triode amplifiers, which in turn drive (through transformers) a four-diode balanced modulator.

The rf input to the balanced modulator originates in a 9 mc crystal oscillator, passes through an rf phase-shift network, and then meets the audio in the balanced modulators. A tank circuit in the balanced-modulator output does the phase addition and cancellation which gets rid of one sideband, and a voltage amplifier brings the wanted sideband up a bit in level before it reaches the mixer.

The mixer's other input is from a VFO operating near 5 mc, and mixer output goes to a pair of 1625's (or 807's) which feed the antenna directly.

The SSB transceiver

The great similarity between a SSB transmitter and a SSB receiver has prompted several designers to combine the two into a single system; quite a number of SSB transceivers are now on the market. One of the original designs was that by W3TLN, described in June, 1959, in QST. **Fig. 3** shows the block diagram of this unit.

Audio in the W3TLN unit comes from a carbon mike, eliminating the pre-amp used in the other two systems examined. It goes directly to a bride-type balanced modulator, which gets its rf from an 8553 kc crystal oscillator. Output of the modulator goes to a filter which passes 8550-8552.7 kc, and the sideband which gets through the filter is then amplified by two class A voltage amplifiers.

In the transmit position, output of these amplifiers goes to the transmitting mixer, which receives its other input from a variable crystal oscillator which can tune some 50 kc on 15 meters. Mixer output feeds a 12BY7 driver, which in turn pushes a pair of 1625's which are hooked to the antenna.

In the receive position, incoming signals go through a cascode rf amplifier into the receiving mixer, which also is fed by the VXO; output of this mixer goes to the filter input, and the output of the amplifiers following the filter is switched to a product detector which gets its BFO signal from the 8553 kc crystal oscillator.

Switching from transmit to receive is done primarily by supplying or removing plate voltage from the various tubes; only two signal-carrying leads are switched, one at the antenna and the other at the *if* amplifier output.

The Little Feller

One of the simplest of all single-sideband transmitting systems is Lester Earnshaw's "Tucker Tin Two" apparently first described in "The Sidebander" and later picked up and modified by a number of other people. One of the most interesting versions of this system was "The Little Feller," first put together by W5ORH and reduced to duplicatable form by W5BCS, and described by them jointly in the November, 1962, *VHF Horizons*.

Fig. 4 shows the block diagram of "The Little Feller," and you'll notice that it uses only four tubes (outside of the power supply) to give SSB output in the 50 mc band.

Audio passes through a 12AT7 preamplifier, although a carbon mike is used (purpose of the carbon mike is to reduce highs without resorting to an audio filter). It passes through a homebrew phasing network consisting of two capacitors and one resistor, then goes to a pair of two-diode balanced modulators.

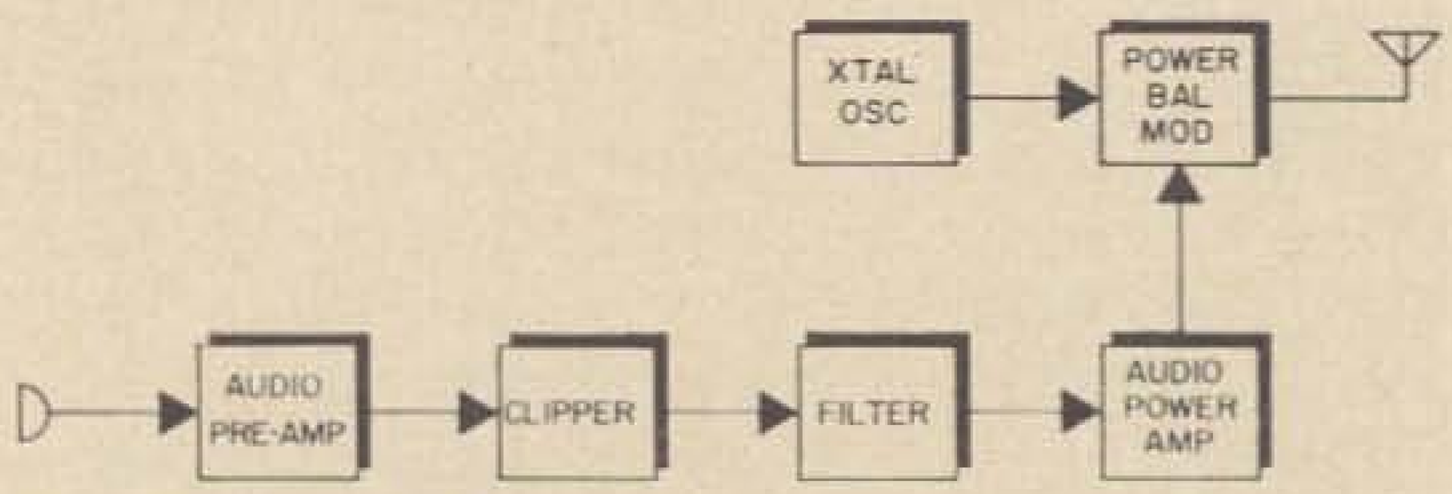

Fig. 5. The DSB, Jr.

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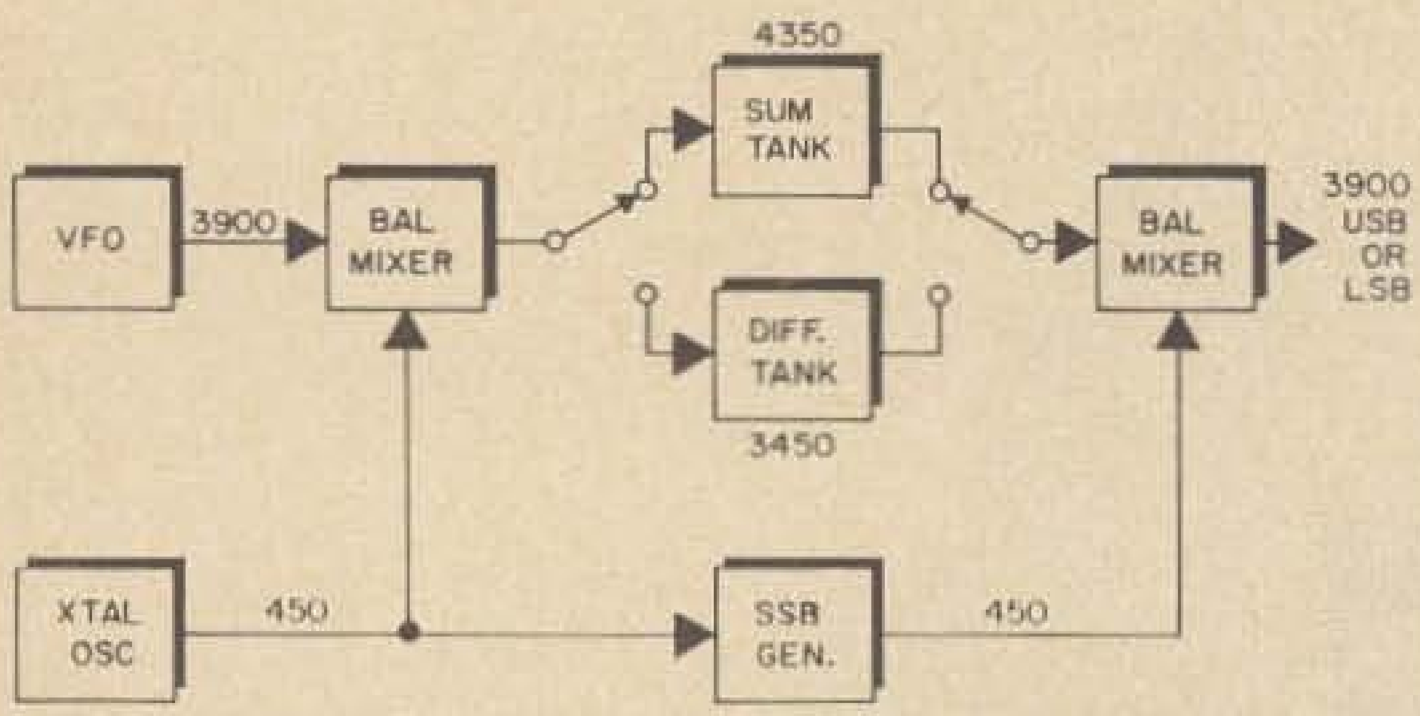

Fig. 6. Getting USB or LSB at the VFO frequency.

The rf for the balanced modulators comes from a 6U8 oscillator-multiplier, which uses a Robert Dollar circuit to get 25 mc output from the triode half with an 8.3 mc rock, then doubles in the pentode. An RC rf phasing network is used between the multiplier and the modulators.

SSB output from the common tank circuit of the modulators is amplified in a 6CL6 driver, operated class A, and then goes to a neutralized 6146 output stage. And that's all there is to it.

Double sideband—the DSB, Jr.

Double sideband is just about as simple; the G-E Ham News "DSB, Jr." circuit also used four tubes to get comparable output. The block diagram appears in **Fig. 5**, and is applicable to almost any DSB system.

Audio passes through a single stage of amplification, and is then clipped and filtered to increase the average power level. Next, it goes to a low-power (less than 1 watt here) power amplifier, which drives the balanced modulator.

RF for the balanced modulator input comes from a triode crystal oscillator, operating at final output frequency. The balanced modulator itself is of the active type, using two power-output tubes; this is the biggest difference between DSB and SSB so far as the system goes. Output from the balanced modulator goes directly to the antenna, and you have a functioning DSB rig.

Many variations of these five systems are possible; in addition, there's nothing to stop you from going back through our preceding articles and putting together the blocks in your own way, to come up with still a different system. At least one fellow has tried following a phasing system with a filter, to get all the advantages of both techniques (he says it works fine).

The sideband VFO

At this point, you have a complete sideband transmitting system—but you still add quite a few conveniences to it. Things such as VFO control, VOX circuits, and T-R switches make life much easier.

Common usage of the VFO in sideband operation is by the heterodyne technique; this minimizes any frequency instability of the VFO, an important consideration when you consider that 50 to 100 cps is the maximum drift allowable in sideband.

Phasing rigs generating their sideband at 9 mc usually use a 5 mc VFO, so that the VFO output may be *added* to a 9 mc upper sideband to get USB output on 20 meters, or *subtracted* from the same 9 mc signal to get LSB on 75.

Another VFO technique, passed along by W5QMI in *QST* several years ago, uses two balanced modulators to give the choice of USB or LSB, at the VFO output frequency. A block diagram of the technique is shown in **Fig. 6**.

From the VFO, the rf signal is fed to a balanced modulator along with the crystal frequency of the sideband exciter (which may be either phasing or filter, and at any frequency). The output circuit of this balanced modulator can be switched to either the sum frequency, or the difference. This sum or difference frequency, in turn, goes to another balanced modulator together with the SSB output of the exciter. Output of the second balanced modulator is on the VFO's original frequency.

If the difference frequency was chosen from the first mixer, the sideband output will be the same as that from the exciter. If, however, the sum frequency was chosen, the sideband will be inverted so that lower becomes upper and vice versa.

As originally described, the VFO was on 3900 kc while the exciter was on 450 kc; any frequencies will work, however, so long as

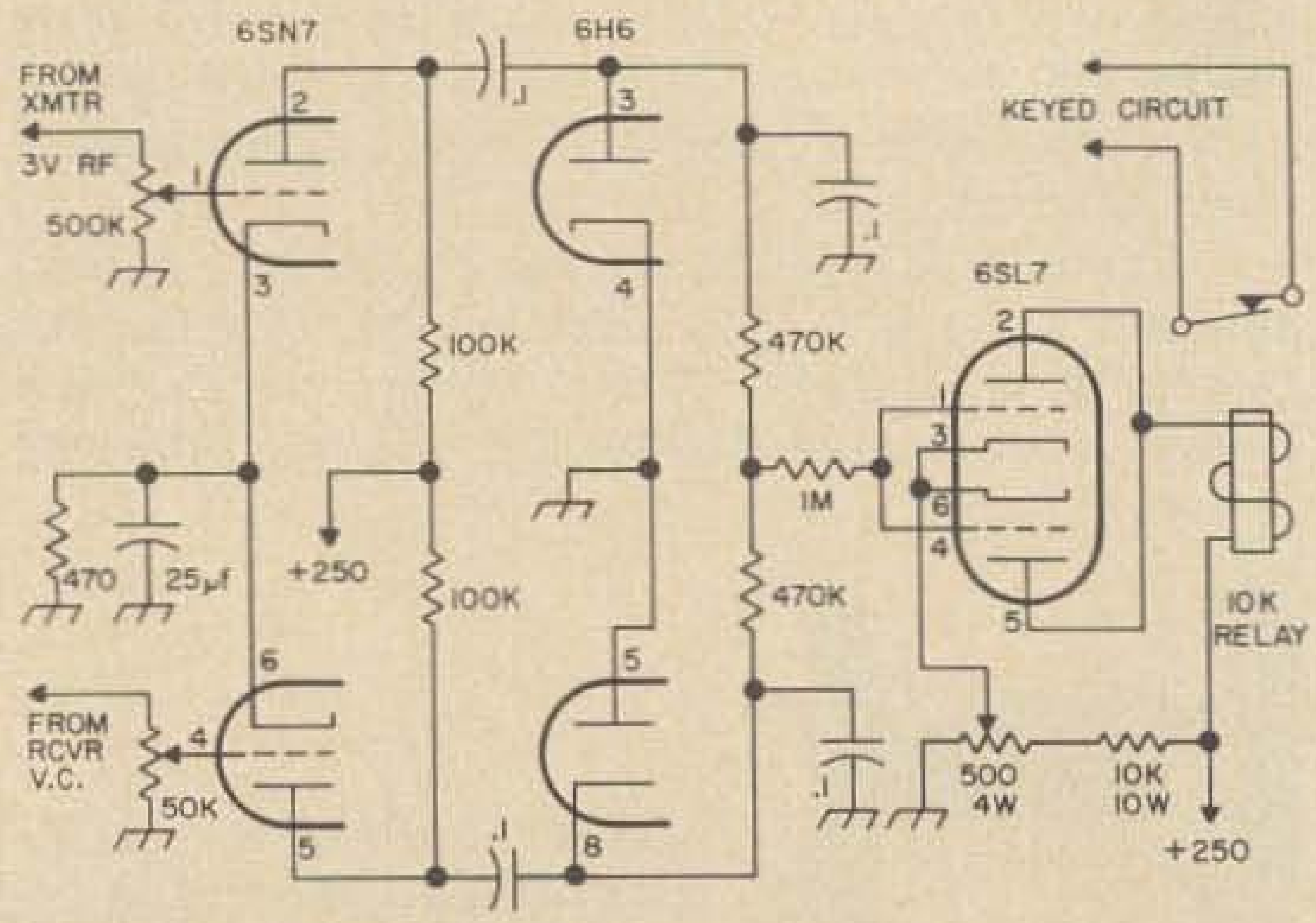

Fig. 7. Simple QT VOX.

they are separated properly to avoid image troubles.

VOX

To many operators, SSB operation and voice control are synonymous. Actually, either can be used separately, but most of the advantages of voice-control or VOX operation can be used to their fullest only with a suppressed-carrier system. On the other hand, AM does not sound so good with VOX.

Many VOX circuits have appeared; basically, all of them consist of a way of using the audio from the microphone to either trip a relay or fire a keying tube, so as to turn the transmitter on and the receiver off whenever the microphone is receiving any sound.

The earlier circuits couldn't be used with a loudspeaker, because the mike had no way of telling where its sound was coming from. Later, however, cancellation or QT circuits were developed to allow VOX and loudspeakers to live together.

One of the simplest such VOX units was developed by W6IBR, and uses only three twin tubes plus a relay. The circuit is shown in **Fig. 7.**

Audio sampled from the transmitter is amplified in half of the 6SN7, while some from the receiver goes to the other half of this tube. Outputs of both tubes go to half-wave rectifiers (the two halves of a 6H6) which are connected to give DC outputs of opposite polarity. The summed outputs of the rectifiers, in turn, fire a keyer tube, the 6SL7. When no output is being received from the transmitter, the keyer tube conducts and holds the relay closed. By proper balancing of input level controls, this condition can be made to hold true even for loud signals from the receiver. But when you talk into the mike, the keyer tube is cut off by negative voltage developed through the "transmit" rectifier, and the relay drops out, putting the transmitter on the air.

A number of other VOX circuits have appeared in the literature from time to time; the ARRL publication mentioned earlier contains a wide selection of them.

T-R switches

With a VOX circuit (as well as for break-in on CW, which is a bit outside our scope here) you must have virtually instantaneous changeover of the antenna from transmitter to receiver. Antenna relays just don't operate fast enough; the situation calls for an *electronic* switch with no moving parts.

Such a switch is called a T-R switch, and like VOX circuits, quite a few have been designed.

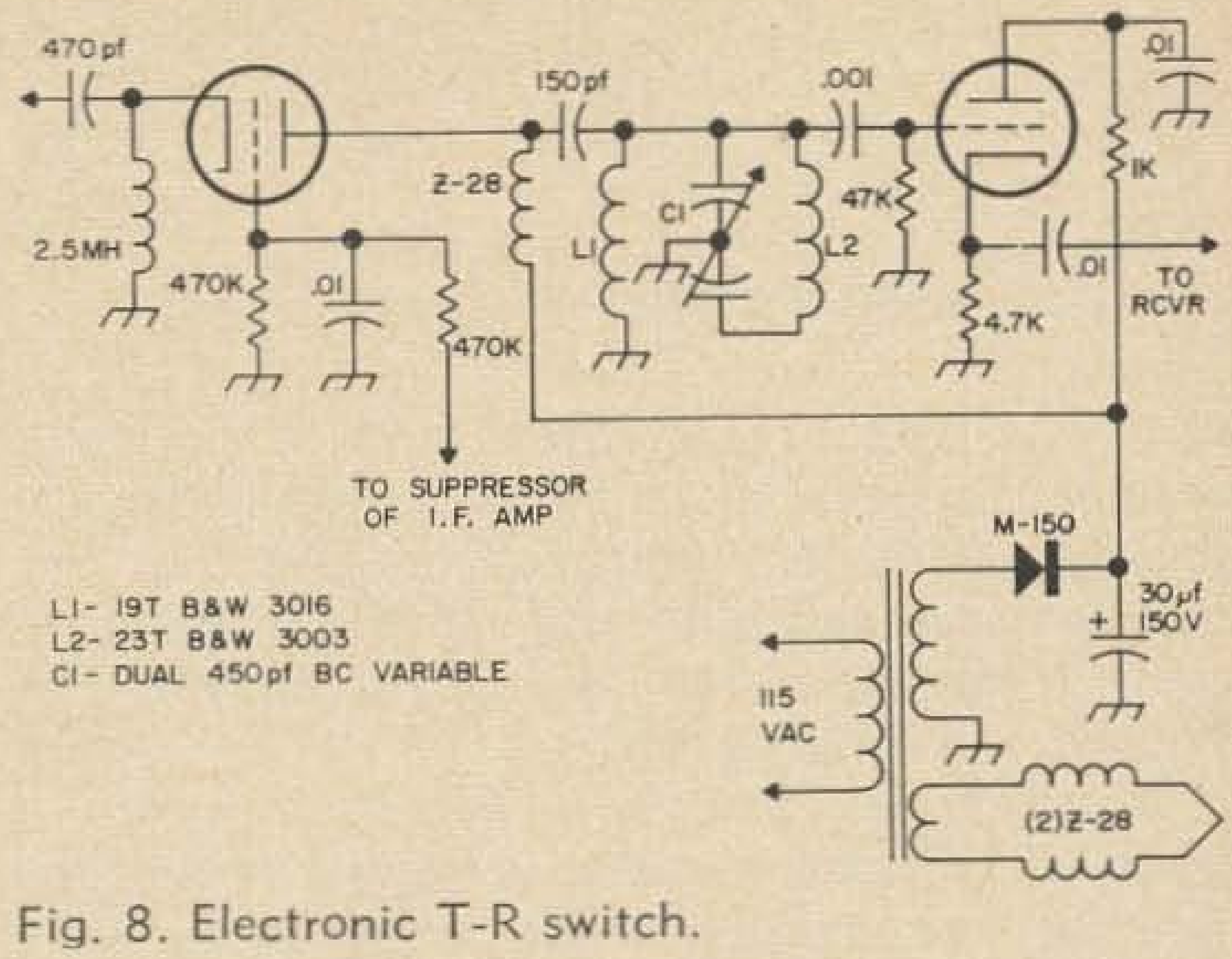

Fig. 8. Electronic T-R switch.

Several of the most popular have been built around grounded-grid triode amplifiers with high-valued grid-leak resistors, bypassed to ground. Under normal received signal conditions, these amplifiers give some gain (with a tuned plate circuit). However, when hit with several volts from the transmitter, the grid draws current and the resulting current flow through the big grid-leak resistor cuts the tube off. You can even pick off a bit of this cut-off voltage through an isolating resistor and use it to mute the audio of the receiver, if you like.

A typical schematic of such a circuit, adapted from a design by W3LYP originally published in *QST* for October, 1957, appears in **Fig. 8.** The original circuit operated up to the kilowatt level with very low SWR, but only with RCA tubes. Other makes were unable to take the high rf voltage between cathode and filament. The modifications included here are intended to make any 6BZ7 usable, as well as to allow for receiver muting at the same time.

All of which brings us around to the final subject on our agenda: instrumentation, adjustment, and testing.

Instrumentation

Any transmitting system requires some instrumentation. FCC regulations require us to log input power used, and most of us want to be able to tune up for maximum output

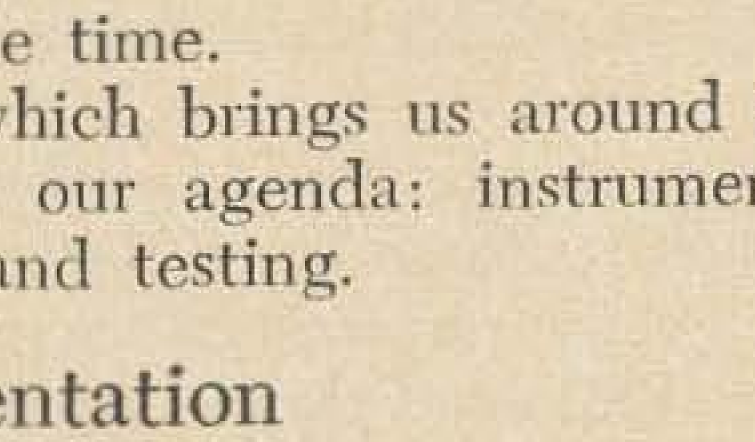

Fig. 9. Crystal diode voltmeter.

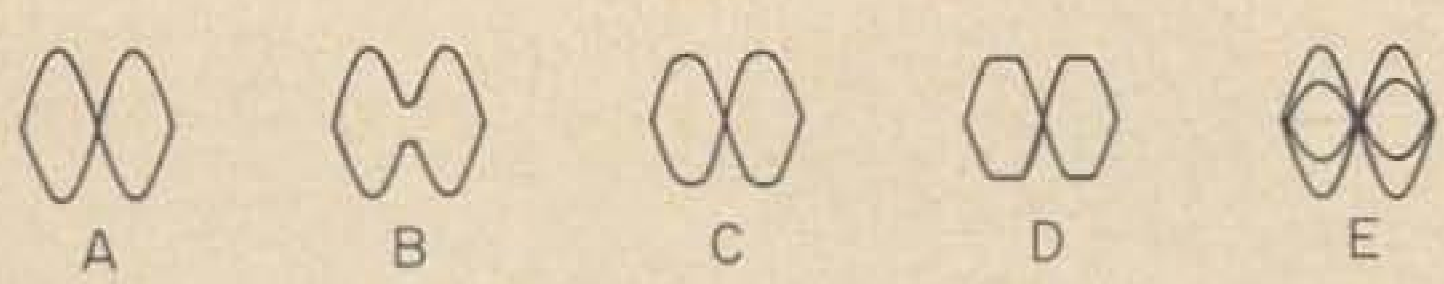

Fig. 10. Typical two tone patterns.

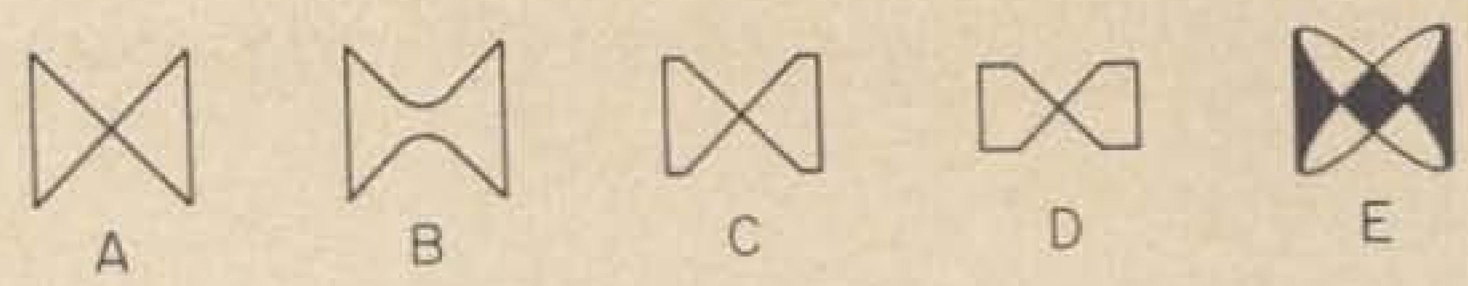

Fig. 11. Twin trapezoid (bow tie) patterns.

power as well. In addition, with a sideband system it's essential to adjust it for maximum linearity (this is important in AM too, but not so well realized). All of these aims require different types of instruments to be hooked into the circuit.

Input power is easy to determine with a plate milliammeter and a voltmeter across the final power supply; with suppressed-carrier systems, the FCC has ruled that the *official* power input is the product of the voltage and the highest current read on the meter during operation, with the further specification that the milliammeter used have a time constant not greater than ¼ second (this is true of almost all common milliammeters). Thus if you run 500 volts to the final and the current meter occasionally kicks up to 250 ma, you're running an official 125 watts input.

Output power is measured most simply by some sort of rf voltmeter connected across the feedline. A reflectometer type of SWR bridge, in the forward-power position, is excellent. So is a crystal-dioxide voltmeter (isolated by a resistor to avoid harmonic troubles) across the rf output jack, as shown in **Fig. 9.** With either of these, tune for maximum meter swing with a steady-tone input signal.

Both of these types of instrumentation are necessary for day-to-day operation, but for initial tuneup of a sideband rig—*and* most helpful also in routine operation—an oscilloscope of some type is a must.

The reason for this is that a meter can tell you only how much power is going in or coming out; it can't tell how distorted the power is or isn't.

The sideband scope need not be elaborate; several simple varieties have been described in the past. Most service-type scopes can be adapted for SSB waveform examination by connecting a length of twinlead to the vertical deflection plates of the CRT, then forming the other end of the twinlead into a two-turn loop (splitting the insulating web down the middle first) and coupling this loop to the final amplifier tank.

For some sideband tests, a pair of linear envelope detectors can be used, and then no rf appears on either scope input. Circuits for these detectors will be discussed a little later.

All sorts of sideband tests can be run with the scope. The most common, often used for checking general adjustment of the linear amplifier, is the "two-tone" test.

Testing with the scope

To perform this test, feed an audio signal of about 1000 cps into the mike input, being careful not to overload the audio section of the rig. Unbalance a modulator slightly to inject some carrier, so that two tones separated by about 1000 cps go through the final.

In a filter rig, this is done by first unbalancing the modulator so that about half-power carrier goes through. Then the audio is fed in, and increased in level until the negative peaks on the scope just meet at the center of the display.

In a phasing exciter, leave the carrier balance alone but disable the audio input to *one* of the two balanced modulators. Feed just enough audio tone in to get a usable pattern.

The "two-tone" test can show you the point of peak limiting of your final, can show the proper bias point, and can reveal parasitics also.

Typical patterns of this test are shown in **Fig. 10.** The first pattern, A, is the ideal. Pattern B shows the effect of too much bias, while pattern C is what you'll get if you're overdriving. Extreme overdrive gives pattern D, while parasitics show up as in pattern E.

For phasing rigs only, a more informative variant of the two-tone test is the "twin trapezoid." This is also very useful with DSB transmitters. The test setup is identical with that of the two-tone test except that the horizontal sweep signal for the scope is taken from the audio oscillator rather than from the scope's internal sweep oscillator.

Patterns to expect with the twin trapezoid (sometimes called bow-tie) test appear in **Fig. 11.** The ideal pattern is shown at A; B shows the effect of too much bias. Pattern C is slight overdrive, while D shows extreme overdrive. If the pattern shown at E appears, you have phase shift in the system and

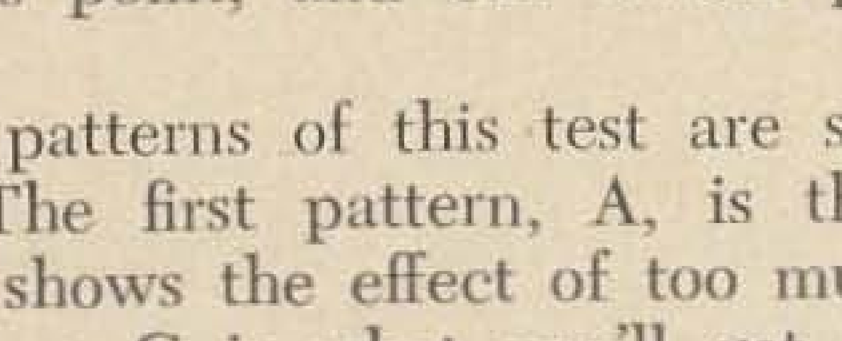

Fig. 12. Phase shift equalizer.

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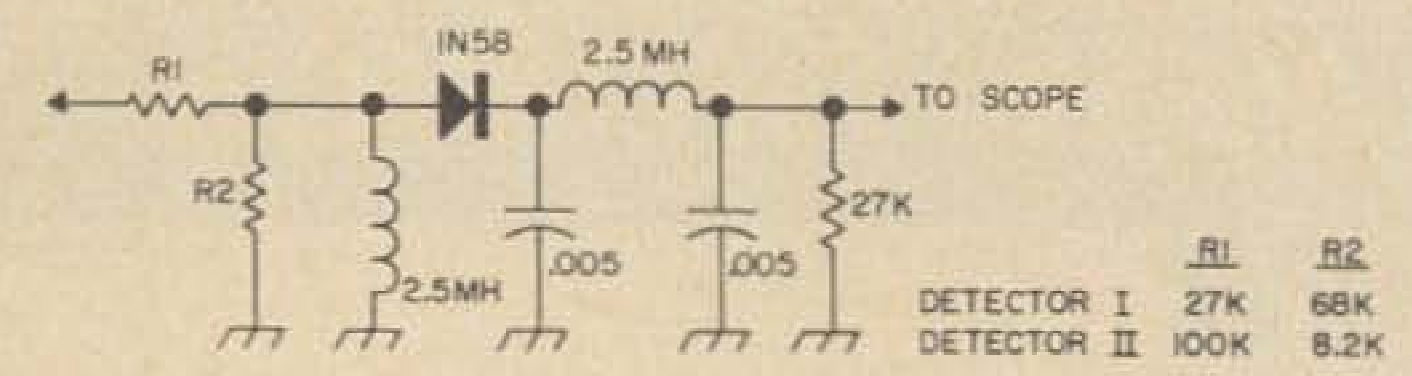

Fig. 13. RF detector. See Fig. 14.

should connect an equalizing circuit such as that of **Fig. 12** betwen the oscillator and the scope; adjust for a clean pattern.

Linearity tests

To check for perfect linearity the most informative technique is to sample a little rf SSB ahead of the amplifier, and a little more after it, then compare the two samples. This is easily done with a scope and two linear detector units.

Fig. 13 shows the circuits of the two detector units, while **Fig. 14** shows the test setup in block-diagram form. Such a setup can be permanently wired into the system, coming out on two sets of leads to tie into the scope.

To start the test, feed some audio into the transmitter and connect the scope into the circuit. Set horizontal input selector to "external," and adjust both vertical and horizontal gain controls on the scope to get a straight line at a 45-degree angle (if possible). If you can't get the line straight, adjust for a 45-degree angle at the straightest part; if the line opens up into a loop, hook up the equalizing circuit of **Fig. 12** and adjust to get a line.

Now you can either use the single-tone sine-wave input, or merely talk into the transmitter. So long as everything is operating perfectly, you'll continue to get the straight line as shown in A of **Fig. 15**, although length of the line will vary as you talk (and it will shrink to a dot when you aren't talking at all).

Improper operation of the amplifier is indicated by the other patterns of **Fig. 15**. Improper tuning of the driver can give the pattern shown at B (which may come out upside down on your scope due to phase reversals). Pattern C indicates non-linear operation due to incorrect bias. Pattern D shows overdriving of the final. This test, incidentally, can be used for talking up to the absolute legal limit with no fear of harming the tubes while testing. It was first described by W8QNW in *CQ* for March, 1958.

So far, we've been talking about operating tests mostly; however, initial tune up is a most important testing step, so let's take a little time to see how it's done on the various types of rigs.

Tuning the filter rig

Simplest of all types to tune initially is the filter rig. We'll assume that all the stages are operating and produce at least some output, approximately of the nature you intended. This is initial tune-up, not de-bugging.

First step is to key the rig and insert a little bit of carrier. This injected carrier is used to tune the final stages for maximum output power just as if it were a CW rig or an AM phone affair.

Now remove the carrier injection and see if the output drops to zero. If not, adjust the balance of the modulator until it does. You should have no detectable output at all in the absence of speech input.

When you have the carrier completely out of the way, you can proceed to test linearity of the final. Adjust bias for best linearity, being certain not to end up with a value of resting plate current which is too high for the tubes. If you do, make the best compromise you can. You'll find the loading to be another important factor; underloaded linear amplifiers are seldom very linear. One quick way to find a starting point is to inject some carrier, tune for maximum output, then load up (redipping for resonance every time) until output drops 10% from maximum. Remove carrier and adjust bias for best linearity, then touch up the loading.

The DSB rig

Next simplest to tune is the DSB rig. Procedure is essentially the same; first inject a little carrier by unbalancing the modulator and tune for maximum output, loading a little heavier than the point of maximum smoke, then re-balance the modulator for minimum carrier.

Then hook up a scope for the twin trapezoid test, and adjust bias for the best crossover characteristic. When you get it, you're ready to go.

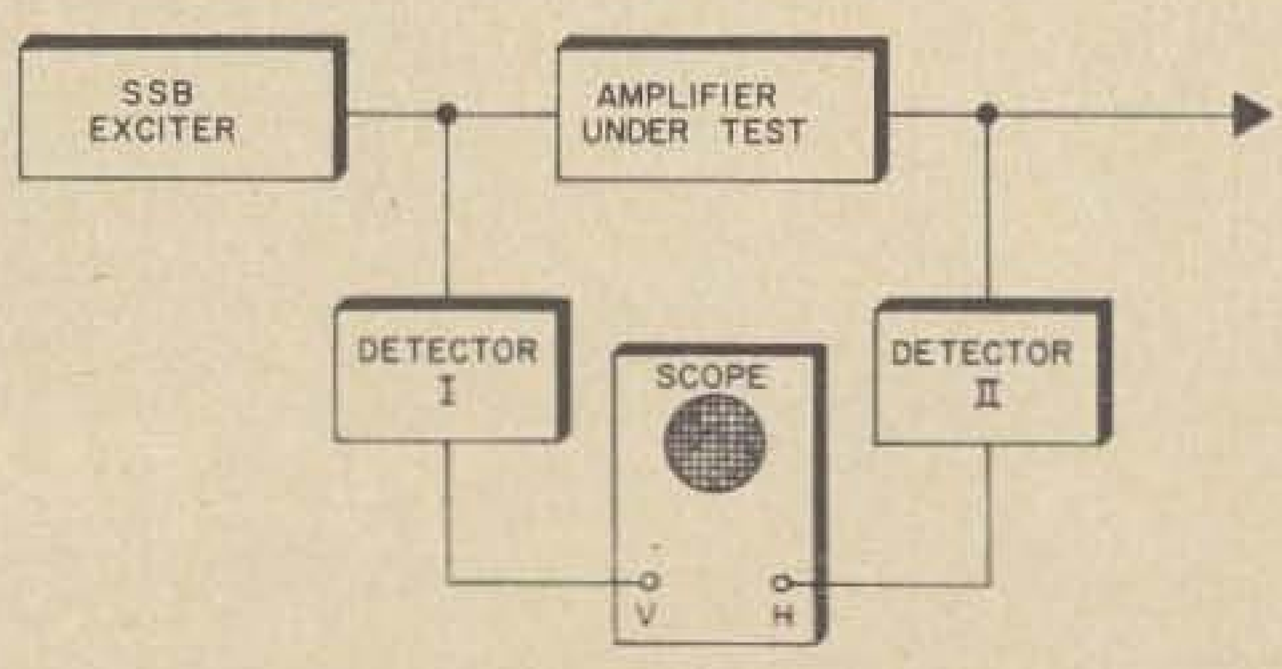

Fig. 14. Linearity test set up.

Fig. 15. Linearity test pattern.

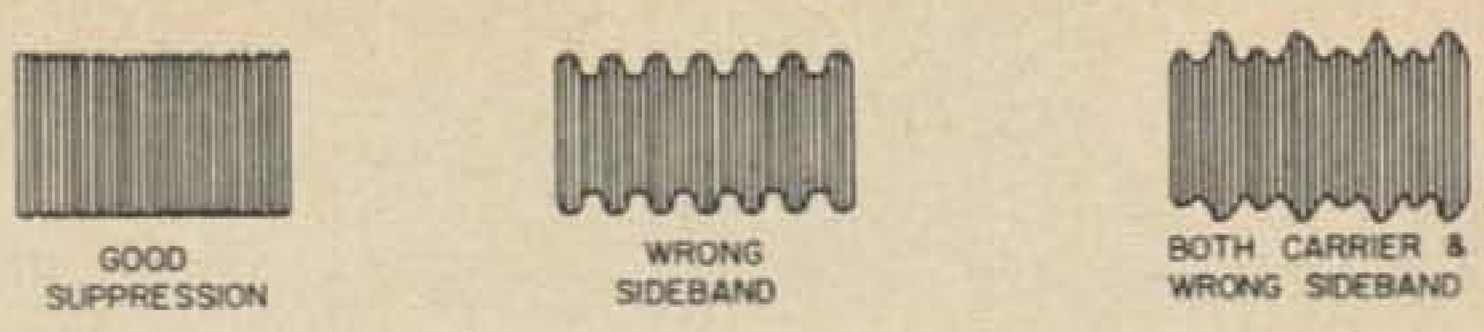

Fig. 16. Carrier and sideband suppression.

The phasing system is harder

Most complicated of all to initially tune is the phasing rig. On it, you have at least four and often more special adjustments, in addition to all the normal rf tuning controls.

Quickest way to tune one of these is to follow the same initial procedure, to the point of having increased final loading for a 10% drop in output, then simply look at the output rf waveshape with a single tone audio input. The waveform of the audio should be free of harmonics, because they will give you troubles.

If everything is working right, you'll see a band of light with perfectly smooth top and bottom edges on the scope. This indicates suppression of both carrier and undesired sideband by more than 30 db. More likely, you'll find ripples on the pattern. If the ripples look like two different frequencies are present, you have both carrier and "wrong sideband" in the output. If they seem to be of only one frequency, the carrier is probably satisfactory but the other sideband is still showing up. Typical patterns for all three cases appear in **Fig. 16.**

Note that ripples due to carrier are twice as wide as those due to "wrong sideband." This tells you which adjustment needs touching up.

The controls and what they do are as follows: the rf phasing control, somewhere in the rf phase-shift network, is one of two (sometimes three) which affect sideband suppression. The other two are the af balance control, usually found in the circuit of the amplifier following the phase shift network, and the af phasing control, ahead of the PSN. The carrier balance controls, in each of the two balanced modulator circuits, control carrier suppression.

When you're looking at the output waveshape, it's easiest to adjust the carrier balance controls with no audio applied, working for zero output from the exciter. Then apply audio, and follow a round-robin technique with the other controls to minimize ripples on the display.

However, even with all ripples gone, there is a chance that you may have adjusted to put some "wrong sideband" into the signal to cancel out unsuspected 3rd-harmonic output! For this reason, it's always wise to check with a sharp receiver after using the scope for tuneup. The receiver *can* be used instead of the scope, but in the early stages of adjustment is sensitive to overload.

To use the receiver, first tune to the wanted-sideband output signal with the receiver set for minimum bandwidth, and adjust coupling from receiver to transmitter to get a convenient S-meter reading. Then tune down to the carrier frequency, and balance the carrier controls for as close to an absolute null as you can get. Finally, tune on to the "wrong sideband" and adjust the suppression controls for the best null possible here also. Then go back to the wanted sideband and check all the adjustments, just to make sure nothing has gone wrong.

If you can't seem to make the rig behave during any of these tune-up procedures, trouble-shooting is indicated. However, it should be little problem if you have put the system together building-block fashion. Usually the type of misbehavior points to the offending circuit. For instance, balanced-modulator trouble usually manifests itself by an inability to get a carrier null. This may be due to a bad diode, or to a tank circuit pulled far out of resonance by diode capacitance.

In a filter rig, troubles in the filter show up as incomplete sideband suppression. The cure depends largely on the type of filter used. The same symptom in a phasing rig usually comes from the audio phasing section.

Lack of linearity may be due to improper adjustment or to faulty parts values in the amplifiers; however, a rough-sounding final signal may not be due to the amplifier at all as the modulators themselves may be a bit non-linear also. This type of distortion is usually cured by keeping the ration of rf to audio voltage high, or, in other words, operating the balanced modulators at extremely low modulation-percentage levels and making up the gain in the linears later.

By this time, you should have enough data to design, build, test, and operate any kind of SSB system. If you need additional data, the books listed at the end of the first article of this series are recommended. See you on sideband!

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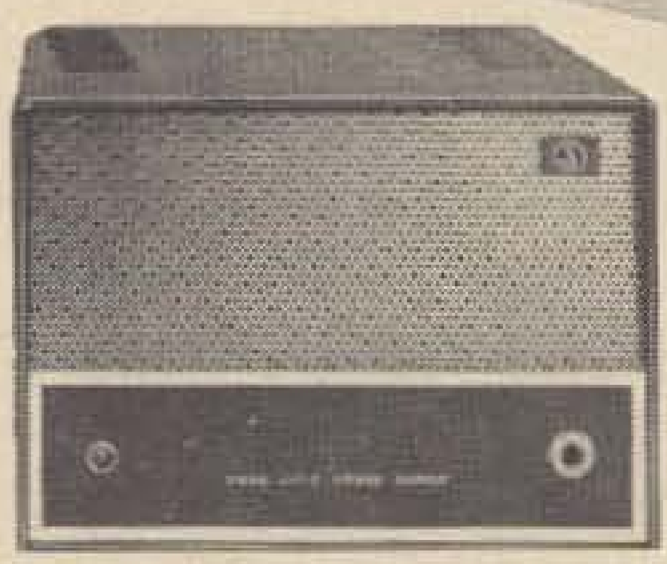

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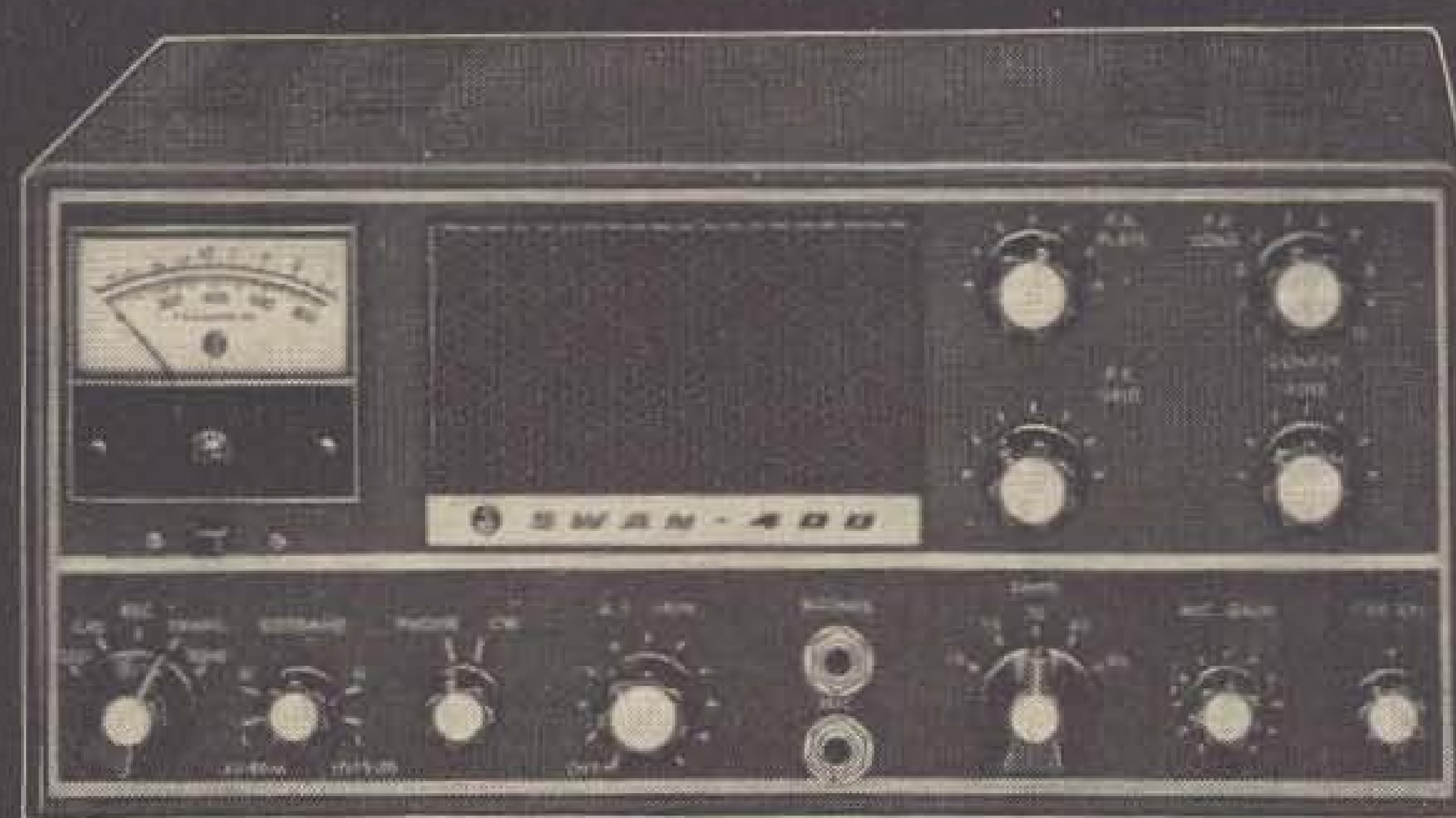

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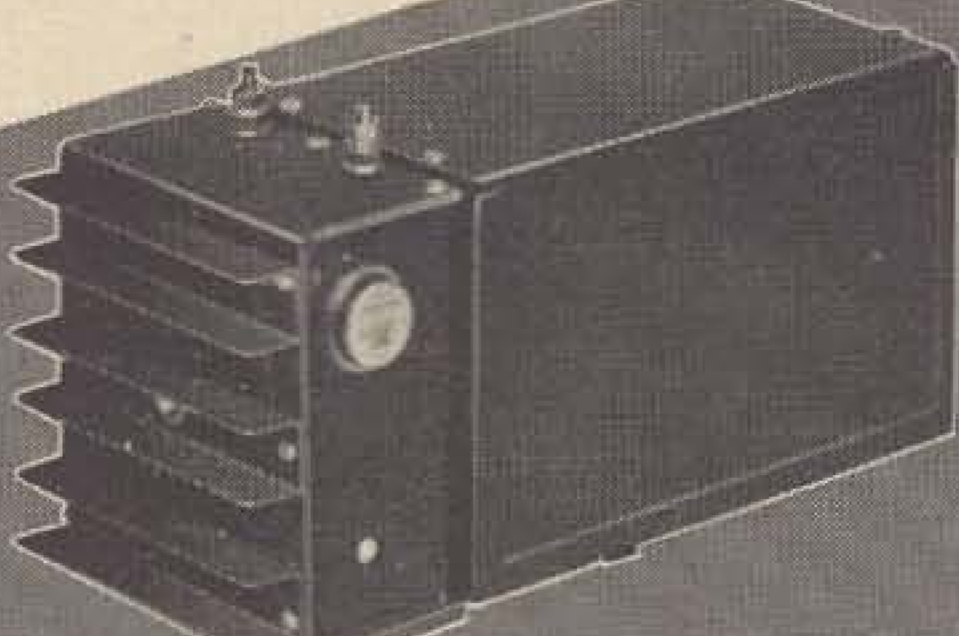

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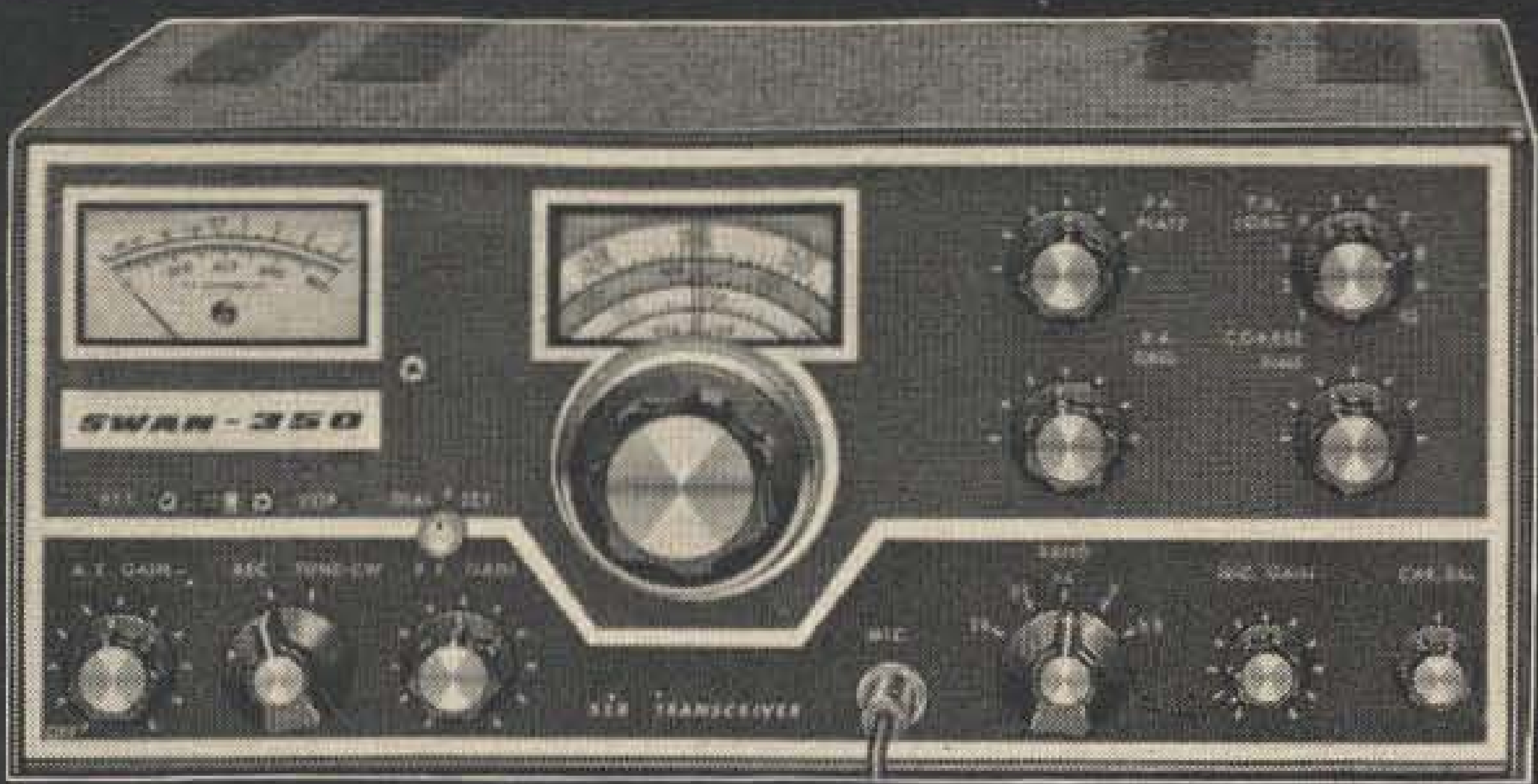

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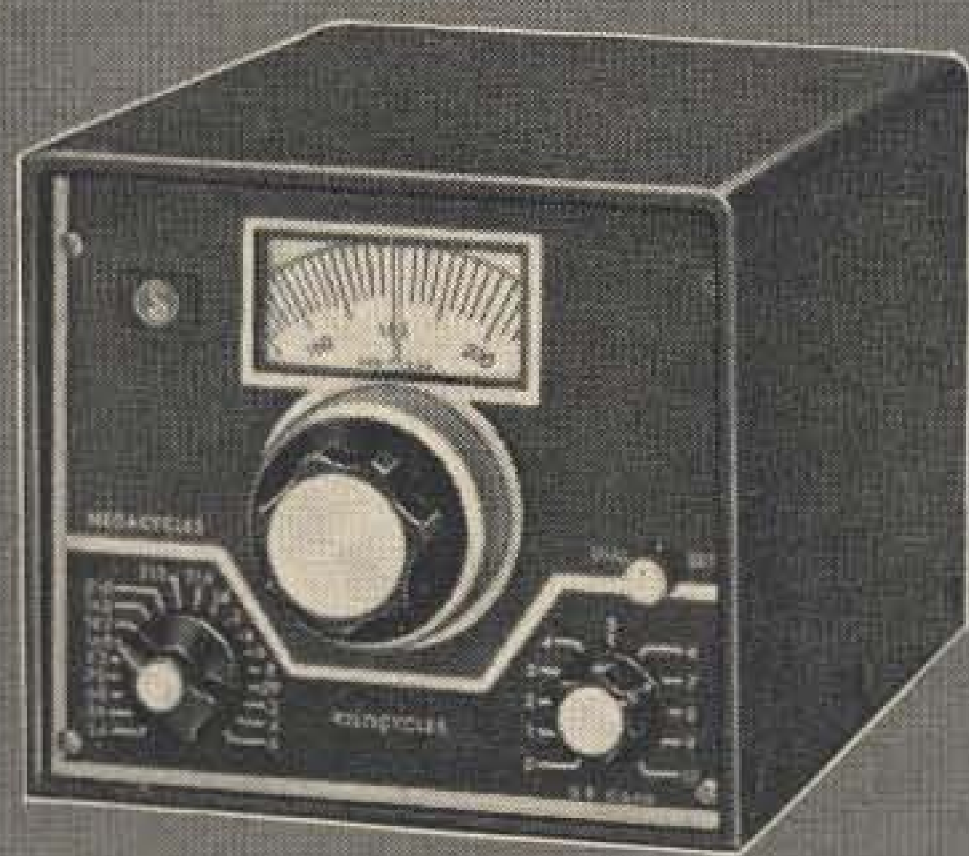

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Gus: Part IX

At the end of Chapter 8 I was on the island of Mahe with WØAIW, WØMAF, WØUQV and Harvey Brain, VQ9HB where we had all gathered for the purpose of going to either Agalega or Aldabra Islands. The boat had been chartered from Harvey. Plans had been made to have the boat ready for us to depart immediately upon our arrival from Mombassa. But the boat was a long way from being ready to leave. Some of us were at the point of wanting to go back to Mombassa because we discovered that it would be almost impossible to get the boat in condition to depart in a day or so. The Ø boys had a rather tight schedule, as they had to return home by a certain day. As for me, I had no definite schedule, my problem being centered around money. After much talking and work we did get the boat in a more or less seaworthy condition. Harvey went to Temolgee's Store and bought the necessary things we would need. We loaded our equipment on board. The transmitter was strapped down in the hold on a small table and the 'putt putt' (generator) was fastened down on the front of the deck. The cook stove was in the center of the deck with the two 50 gallon drums of petrol fastened down very near it! Macan the cook had his big bag of rice, ole Doc had his deep sea fishing equipment, and Harvey had his black cat. We were as ready to go as we would ever be.

Harvey maneuvered the ship very expertly through the maze of buoys and other obstacles between the short pier and the deep water of the channel. Mike got his deep sea rod out and put a spinner on the line and let it out behind the boat some 150 or 200 feet.

Macan got busy with his cooking on the open deck. Now let me tell you about that cook stove thing. Built up on the deck near the center of the deck was a spot covered with sand some 3 or 4 inches deep. In the middle of this box in a pile of sand were four metal rods with metal on top of them on which to set the pots and pans. The fuel used was pieces of wood that burned under the pans. This was what you might call a real open air stove. Of course when the fire was lit there were a lot of sparks and with the wind that was blowing, these sparks would fly everywhere. Now with two 50 gallon drums of petrol not too far away it certainly did make for interesting conversation. I told the fellows that it did not worry me at all. I said that I was just going to let my insurance company worry—there was no need for both of us to worry. I don't think this line of reasoning went too well with them though.

We were headed for Agalega which back then would have been a 'new one.' Port Victoria faded in the distance. The seas were in a very fine mood with nice little swells with a sort of clockwork rhythm to them. The boat would rock from one side to the other and then the bow would go down and then the stern. I called this the Mahe Twist or the Seychelle Swing. It was a real soothing sort of thing, at least to me it was. Not having been to sea before and not having enough sense to know that such carrying on would maybe get the sea sickness bug started, I just sat back and enjoyed it all. For about the first three or so hours we were in the open channel and not too far away from land so we were shielded from the white caps of the open sea. When we approached the end of Mahe Island I could see all those pretty white caps on the deep sea beyond. I could see that things were going to get very interesting when we left the protection of the island and were out in the real ocean.

All this time Macan was busy cooking his rice and fish. You know, down there they let the head stay on the fish when they fry it and they fry it in some sort of oily oil which never cooks the fish to a brown color. In fact when it is completely cooked it is the same color that is was when first put in the frying pan. I noticed that Doc was keeping one eye on the fish and the other on the sparks flying here and there.

Well, there we were four land lubbers about to hit the open sea in a small boat about 50' long and about 12' across. It was basically a sailboat with a small diesel used generally for docking or when there was no wind at all. It was a good sea-worthy ship and Harvey a good captain. There were no conveniences of home on board. You slept down in the hold in swinging hammocks and there is the usual smell that exists in the hold of boats like this. The smell is a little fishy, a little diesel oil, a little kerosene and a little petrol. Then there is the smell of human beings mixed up with all these other smells, and, of course, a little black cat smell thrown in with all the others. But, you are on a DXpedition. When things are not going right and the situation is a little rough I always think of all the boys back home that are watching us and getting their rigs right, locking their front and back doors so they can safely run a good kilowatt without being bothered by the FCC walking in on them. You know the old saying, "the show must go on." A few smells here and there are of small consequence—at least that's my opinion.

We were heading for a good one—Agalega Island—and the quicker we got there the betted it suited me. I had had a sample of the thrills of being chased at Monaco, San Marino and Compione d'Italia and wanted some more of it. Of course we did some /MM work on the boat telling the fellows we were on our way. Along about this time we had arrived at the end of the island of Mahe and were now heading for the open sea. Remember I am writing this little chapter in August 1965 and the trip to Agalega was in the month of August 1959—that's six years ago, so some of the little highlights here and there may be forgotten since I don't have any of my notes with me here in 4X4 land.

I am now operating a 4X5VB at what's called a kibutz. This is one of the community farms of 4X4 land. These farms here are run like a big family. This is a small one, only about 2,000 acres and about 260 adult workers, half male and half female. Everyone eats in the big dining room. There are about 4 families in each house. These houses are built long, like a motel back home and every family has about 3 rooms to use. They have a day nursery for the little ones and also a kindergarten and then grammar school. It is a good deal, but I doubt if they would work out in the States. The people in the kibutz can leave anytime they want to. Most of the people stay here all their lives. They have the security of knowing they have a roof over their heads, clothes to wear, plenty of good food, medical services and retirement when they become too old to work. Most of the people work only 6 hours or so each day. They have a swimming pool and all sorts of sporting facilities. I have heard or read somewhere that life on collective farms in some countries is not quite so pleasant and you cannot leave when you want to. That's not so here. If you are looking for lifetime security this is the place. I understand they have been running these for a long time, so they do work.

So much for the kibutz. Let me ask you if any of you fellows have ever ridden a camel. I don't mean just to get on the back of one and let someone take your picture. No, I mean ride one for a whole day. We, Dick YA4A and I did this while we were up in Afghanistan because that was the only way to get to one of the places where we operated. To me it was not much fun—and we had to ride one back too. I see why they call one of them 'the ship of the desert.' You can get sort of sea sick with that swaying back and forth while they walk across all that sand. In the afternoon and I mean *every* afternoon about 4 pm the sand storms come up and the sand is flying for the next 2 or sometimes 3 hours. At that time you are one of the nomads you have heard about. You can hardly see beyond the nose of your camel. During these sandstorms I suppose the camels go more or less by instinct with their built-in radar systems guiding them. You should have seen Dick and I with our outfits on. We really looked like 2 shieks sitting on our camels. The radio equipment and 'putt putt' were strapped on 4 other camels. This is DXpeditioning the hard way. I think Dick and I have had it as far as this kind of DXpeditioning is concerned! But you know you are trying to put a rare prefix on the air, and this is part of the game. We really did get to see many out of the way places in Afghanistan. Oh yes, we were in sight of UI8, UL7, and UM8. We checked up on the Kyber pass area and you know there is a neutral zone there, so we took this up with the ARRL to see what the chances were for it being a new one. Also we are looking into this Kingdom of Swat business. Now that would be a dandy wouldn't it? When you run out of countries you have to make 'em. Cokes in Afghanistan (12 oz. cans) are 50 cents each! I controlled my desire as much as possible, only one can per day. There is a chance of a return trip to YA land if the ARRL makes either of the above spots a new one. Well, there you are, now back to the trip to Agalega.

Here we were just leaving the island of Mahe behind us and entering the deep blue of the Indian Ocean and the SE Monsoon was just beginning to end. Everything had been going so smoothly and nice until we got a short distance from the shadow of the island —Bang, we were in it all of a sudden. Doc pulled in his trolling line and things were secured very quickly. You should have seen that Hi-Gain model 14 AVS swing. The salt spray was all over the place, Macan was fighting his fire under the cooking thing on the deck and needless to say those sparks were flying everywhere. Everyone was hanging on to something to keep from being blown overboard. Harvey was in his poop deck house and keeping the old tub under good control since this was nothing new to him. This tossing and pitching kept up from then on until we finally came back some 3 or so days later.

Well, finally it got time to eat—after we had been tossing and pitching all this time. Since we are rice eaters in South Carolina, I told Macan to fix me up a plate of rice and fish. I noticed that Doc was keeping his eyes glued to that oily fish on my plate. When I told Macan the rice looked too dry, Macan put more gravy (gravy being oil) on top of my rice. Well, that's when Doc decided it was time for him to count the fish over the rail. Here I was sitting down right smack on the deck eating my fish and rice dinner. Doc came back from his little run to the rail and I said "Join me, Doc, the food is FB." While saying this I picked up the fish by its head and chomped down. A little oil dripped from my hand to the deck—well there went Doc again with his fish survey. Just before he departed he said to me "How can you, Gus?" During all this Lee and Mac (AIW and UQV) were eyeing the happenings and even Mac was starting to get a little pink around the gills. Lee had everything under control pretty well though. As for me, I was hungry and enjoying a delicious fish and rice dinner. I believe the oil on the fish assists it in going down. Mineral oil for assistance is not needed if you eat Macan's fried fish, they have the self-oiling feature built in already. If you want a good picture of one of these fried fish, you take the scales off a regular fish and dip it into some cooking oil, hold it up and take a good look and you will get a rough idea of those fried fish. The WØ boys from Kansas City probably had worked up themselves a good appetite watching me eat that fish, so they sent down to the hold and came up with various cans and can openers. But for some strange reason none of them had much of an appetite. As for me, I cranked up the 'putt putt' and down to the hold and radio I went and called a CQ or two and worked probably W3CRA and W4TO. I even got a message through to the XYL—Peggy—that we were under way to Agalega.

All day long it was solid overcast so Harvey could not take a bearing. I noticed that about one foot of water had accumulated in the bottom of the boat and was swishing around my ankles while I was operating the rig. I mentioned this to Harvey and he said he guessed that the old bilge pump on his diesel was not working again. I also mentioned that the toilet was not flushing either. Things were starting to get interesting you can see. We stopped using the toilet from then on and then we used the rope system where you tie one end of the rope to the bottom of the ship's mast and the other around your waist, and you sort of hang over the side of the ship and hope no snapping sharks happen to pass by.

I asked Harvey what was the ship's position. Harvey got out his charts and maps and said by dead reckoning we would be about here—pointing his finger at a place located not too far north of Platt Island. It was pitch black outside and with all the waves and wind making lots of noise I was sure that if we sneaked up on the island during the night we could not have heard the waves washing the shore. I said "Harvey, what will we do all night?" He said that he was going to let the boat drift. I said, "Harvey, suppose we are closer to the island than your dead reckoning indicates, man, we might wash ashore." He said that this was not possible since the island was surrounded by a coral reef. You know these coral reefs are like a stone wall. It's murder if a boat ploughs on to them, even worse than wrecking ashore on a nice beach. Harvey said he didn't think we would drift to

the island during the night so we had nothing to worry about. We fired up the rig, had a number of QSO's and with wet feet from the bilge water washing up around our ankles, went to bed on the swaying hammocks in the hold. I got up a number of times and went top side and tried to peek into the darkness beyond the boat, but I couldn't see anything.

Well, we did not drift on to the coral reef. Morning came and Harvey got a good shot of the sun when it was rising out of the water, grabbed his charts, and said Platt Island was over that-away and that we would see the island in two and one-half hours. Let me tell you Harvey was exactly right. The island came in view exactly at the moment Harvey had mentioned. At first it looked like a small, flat dark thing way off in the distance. When we arrived at the island Harvey said he would have to search for the one spot where it's possible to slip through the coral reef. It seems as if every one of these islands has just one opening in their coral reefs. Harvey found the spot and by timing the ship's forward motion with the swells, glided through the small and shallow opening. Things were very nice and peaceful inside the reef. No waves and crystal clear water. You could see the bottom of the lagoon and it looked only a few feet deep. Many colors of fish could be seen swimming around. Out came the fishing poles and we selected the ones we wanted to catch. We had fish for breakfast. Some of the crew jumped overboard for a swim. They dove down and brought up some beautiful coral. I asked them how deep it was and was surprised to find that is was something like 30 feet.

Well here we were at Platt Island on our way to Agalega, with the winds and waves getting a little rougher all the time. Finally we had a meeting with everyone present. From a health viewpoint things were not too good, with the toilet not working and the bilge pump not working and a good bit of water settling in the bottom of the hold. It was finally decided that if Harvey could get the toilet in good working order and the bilge pump working, we would continue on our way to Agalega. Upon opening up the toilet we found that we needed a lead ball about one inch in diameter. Well there was no such thing on board, but there was assorted pieces of lead that were sinkers for fishing lines. You should have seen Harvey and the boys melt lead on Macan's cook stove. A lead ball was cast using the sand as a mold that was under the stove. Let me tell you, they did a darn good job with that lead ball. With a little sanding and filing the lead ball was OK, installed in the toilet and boy, we had a toilet again.

Next was the bilge pump. It was torn down and completely repacked with various bits and pieces of cloth, re-assembled and installed. It worked FB also. We spent the rest of the day installing a depth finder that the WØ boys had brought along to give to Harvey. We found that it worked very well and would even locate schools of fish.

By this time the weather had gradually become worse. Getting back through that little opening in the coral reef was real tricky because this time we were inside. We waited until it was high tide and with Harvey at the wheel knowing all the tricks, we just slipped through with only about one foot of clearance between the bottom of his boat and the reef. We were off again to Agalega. But those waves and swells were a lot higher than before and seemed to be getting worse all the time. There was lots of pitching and twisting of the ship and the seasick prone fellows were really catching it now. Well, we continued on towards Agalega Island for about half a day longer. I will admit the wind was a little higher and one or two of the Kansas City boys were getting a little sicker so we had another talk about the prospects of our getting to Agalega. It was decided (against my strong protests) that it would be best for us to turn around and go back to Mahe. Our trip to Agalega was shot. Here we were only a few hundred miles from our island, a heck of a long way from the U.S.A. and we were giving up right when a little bit more 'toughening it out' would have put us on the island. I decided then and there that from then on I would be a lone wolf on any other DXpeditions. I have found that you have to have a great deal of patience, take some risks and be a little careless if you want to get to some of the more remote spots in the world. Things just don't go smoothly, at least for me. There is always something turning up that makes thinks look impossible nearly all the time. It seems like the Indian Ocean never does get really nice and smooth.

We arrived back in Mahe and as far as I was concerned the trip was a complete failure. But I made up my mind that one of these days I was going to return and go to some island in that area and put it on the air. At least the trip, as far as we went, convinced me that I could take the rough seas and not be bothered by seasickness. Ole Gus a sailor! We operated VQ9A for a few days while QRX for the "State of Bombay" to arrive from Bombay to take us back to Mombassa.

The return trip was uneventful. We just sat on deck and watched the flying fish take off when the boat ran into a school of them. You know these flying fish can actually leave the water, take to the air and fly as far as 150 to 200 feet, getting up about 15 to 20 feet in the air. At times one would land on deck. Some seemed to be as large as 10 inches long, but usually they are about 6 inches or so. We saw a whale or two in the distance come to the surface and blow. I had no idea I would ever see a whale doing just that. Each morning we saw a number of porpoises following the ship usually in groups of three or four.

I had some long talks with one of the wireless operators on the boat. We soon started talking about things back in India. His home was Bombay and he had been living there all his life except while away on some ship as the wireless operator. The subject of what happens to those shiploads of wheat that is sent from the USA soon came up. He told me that he understood that this was supposed to be given to people who needed it to keep from starving to death. He said that he had never talked to or met anyone who had actually received any of this free wheat. He said things worked out like this: The wheat is shipped in bags of about 25 pounds each, with the usual handshake of Uncle Sam on each bag and a message saying something like "from the U.S.A." When the ship is unloaded all this wheat is taken to someone in the food business for distribution. At this distribution point the wheat is removed from these 25 pound sacks and put into bags of 2 pounds each—*just plain bags*, no hand shake or any other message is on these bags. Then they distribute them, *but not free*. They are delivered to food stores and as far as he knew they were put on their shelves and *sold* like other things on the dealers' shelves. He said if any of this wheat was ever given to anyone, he had never heard about it. He asked me why we did not do something about it. Here we were practically giving away millions of dollars worth of wheat every month or two with practically no one ever benefiting from it and that the Russians would spend about one tenth the amount we did, but that they would put up a small hospital in some village with the words 'From your friends in the USSR' engraved in stone on the front of the building. He said the people believed what they saw, and this is what they saw! They did not see all this wheat that was sent to them, or at least when they saw it they did not recognize where it came from or who sent it. The above is the opinion of the fellow whom I talked with and not mine. Possibly it's true, possibly not. I suppose it would be interesting if all this was ever checked up on. Someone's eyes might really open if the truth were ever found out. I do know that in VU2 land a lot of manipulating and scheming takes place and it's not beyond possibility that something like this does actually happen.

Well, we were back in Mombassa and as usual we had to spend a whole day there while QRX for the overnight train to Nairobi. Ole Doc handed me a fistful of money and asked me to go and buy a good assortment of weed carvings like I had previously bought—and at the same price I had paid. Before I left Orangeburg, South Carolina I was passing the 5 and 10 cent store and they had a big sale on genuine plastic costume jewelry. Well I decided that being a sort of hoss trader I would buy a little of this junk and take it with me, thinking possibly I could make a deal with some native somewhere along the way. I bought a big bag, spending a total of $15.00. I had completely forgotten that I had this stuff with me until I unpacked over in VQ9 land and found this bag of stuff down in the bottom of my suitcase.

I decided I was going down to have another hassle with those natives over their carvings for Doc and that this was my chance to see if it was possible to do any 'hoss tradin' with them. I removed everything from my briefcase and dumped that genuine plastic jewelry into it and away I went to market clutching my little goldmine. Upon my arrival there I proceeded to turn my pants pockets inside out, saying I have no money to spend (Doc's money was in my coat pocket) but I said that perhaps we could do a little business. I told the young man to get two pieces of everything he had and to make a pile right there on the ground and let me look it all over and to give me his very cheapest price. Well he did just this and there was a pretty good pile of carvings there on the ground. A crowd had gathered to see this big business transaction take place. Well he gave me his price, and I gave him mine. He came down and I came up a little, we haggled and we haggled. Our prices were still a good bit apart so I said I would have to go around the corner and buy from the Indian shop. I walked away about 100 feet when he called me back. We argued and argued some more. Finally he froze and so did I. I said that I was sorry we couldn't do business and that I was going back to my hotel for lunch. I shook hands with him and departed. I actually got into the lobby of the hotel—and there came a fellow running and said that I should come back, that they would sell at my price! I went back and he got three big boxes and carefully wrapped everything. When the boxes were all ready I said to him, "You are a good fellow and I want to do something for you. I opened up my briefcase and slowly pulled out a long plastic necklace and held it up. You should have heard the native YLs! I passed it around to the crowd and eventually put it back in my briefcase. I told the young man I would give him all the genuine plastic jewelry for another stack of carvings. He said he could not give me two of everything but just one of each item. I said no, no, no. I proceeded to explain to him that this was genuine plastic and not the cheap imitation that you could find anywhere at cheap prices.

After more yakking and haggling he said he would do this for me. I started to hand him the money and the jewelry and I said, "Wait a minute, we can't do business." (I had seen a BIG elephant carving under the table—he had only one of these and it was about 3 times as large as anything he had.) I pointed to this and said that if he would throw this in as backsheesh we could close the deal. I said that this was my final offer and that he could take it or leave it. After talking with his father, who had been standing on the sidelines during all this, he agreed and away we went to the hotel with 6 boxes of carvings. Good Ole Doc was completely satisfied and, to tell the truth, so was I.

In a few hours we were on our way to Nairobi on the train, out through lion country. Upon arriving there I stayed with George VQ4AQ this time. I found that, at last, my equipment had arrived from Milan. Why it took a month to get there I never did find out. While attending to things, the Kansas City boys made a quick trip down to VQ1 land (Zanzibar) just as tourists. When they arrived back I had everything done and I took off for VQ1 the hard way, via African Bus through the jungle to Dar-es-Salaam. Now this was some trip. *You* ride an African Bus from Nairobi to Dar-es-Salaam and you will see what I mean. Monkeys, snakes, lions, elephants, zebras, gazelles, vultures, you name it, I saw it by the hundreds. It is a two-day trip, and rugged to say the least.

Next month I will tell you about meeting VQ3PBD, good old Peter Dobs, and about operating in VQ1 land when it was a rare spot. I am still seeing the world and enjoying every minute of it too. This is country number 99 for me! I wonder if I will ever get to number 100—DXCC. Maybe I will, maybe I won't—who knows? . . . GUS

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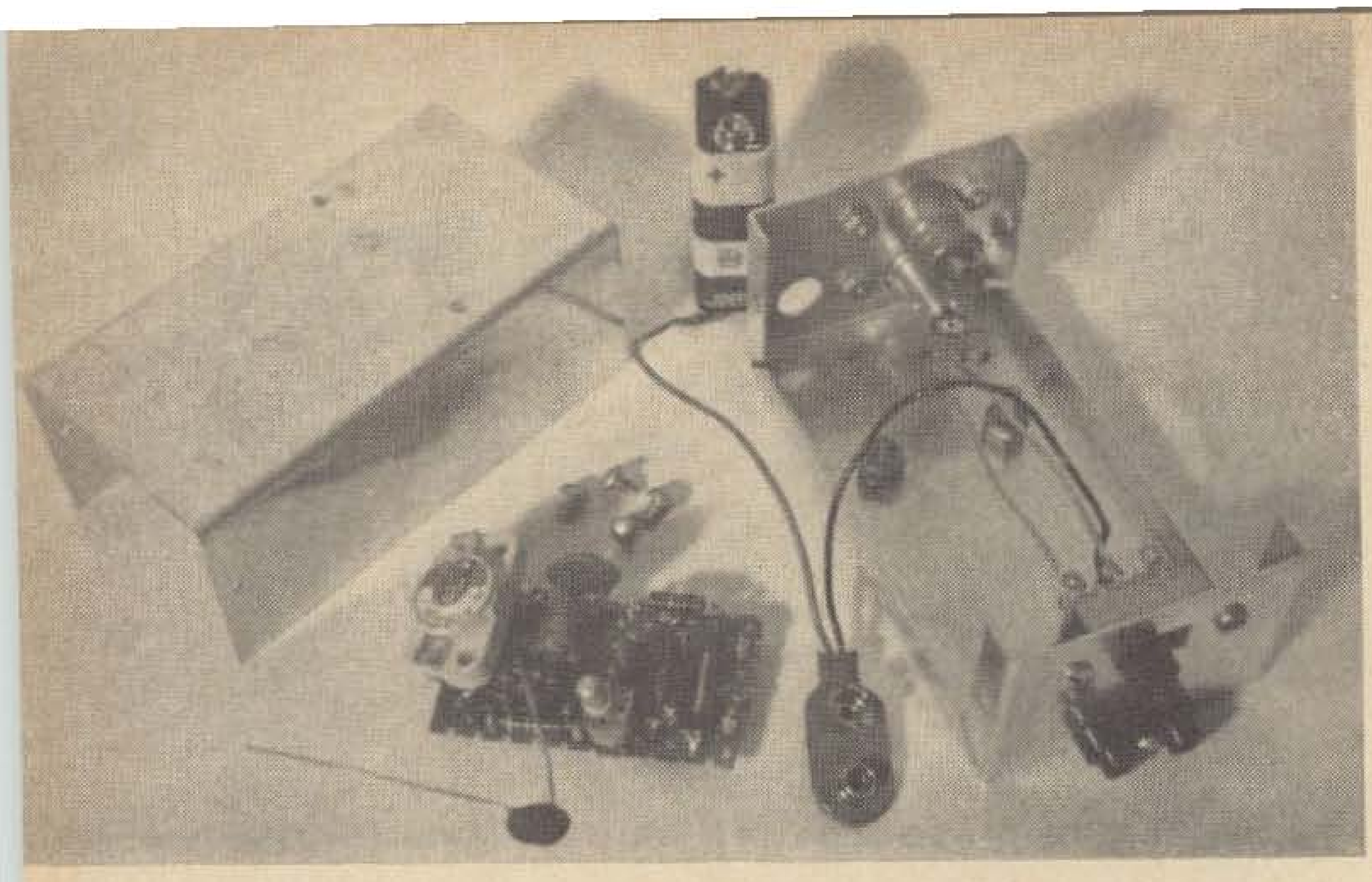

John Crawford WA4SAM
George Webber W1DVG
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West Lynn, Mass.

Build the OTC

A one transistor converter for 28-54 or 108-176 mc

The following converter is your answer to a sensitive and inexpensive receiver for your car. When used with the usual car broadcast radio it will provide excellent monitoring of the two, six, and ten meter bands as well as police and fire frequencies on the low and high bands. Total cost is about three dollars with a well stocked parts box, or a kit can be obtained by writing Webber Labs, 40 Morris Street, West Lynn, Mass. If you choose to build your own you will need a crystal and a special high frequency transistor available as surplus from the above address for a total cost of $4.00.

Two different versions are shown, tuning 28-54 mc and 100-200 mc respectively, the only difference being in Coil L1. If desired, plug-in coils may be used but due to the low cost of the parts it is easier to build two converters.

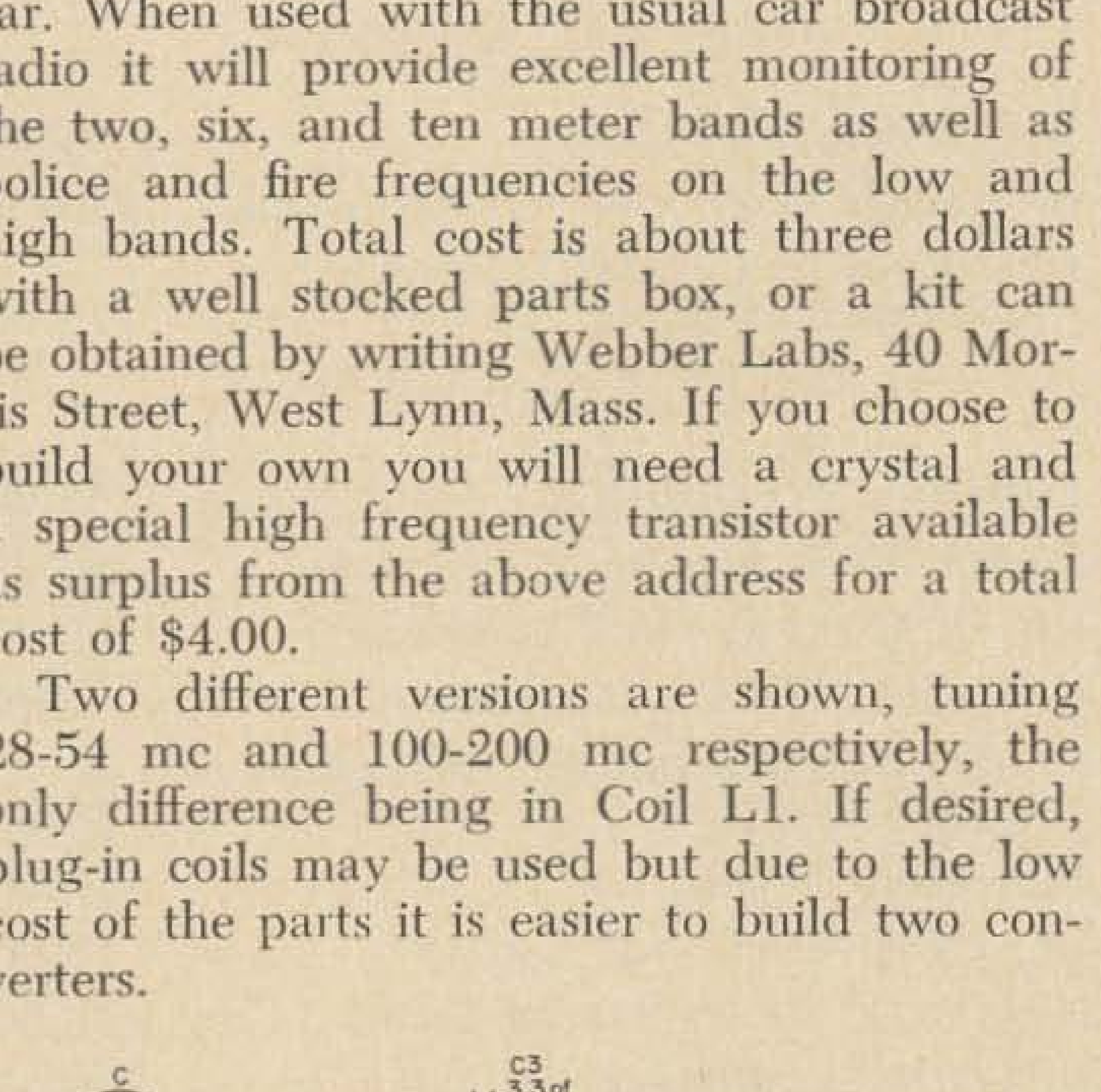

Fig. 1. The OTC. L1 for 100-200 mc is 4 T #16 wire, 1/4" diameter, tap at 1 T from ground. For 30-50 mc L1 is 36 T #30 on 1/4" dia form 1/2" long, tap 11 T from ground. L2 is 36 T #30 on 1/4" diameter form 1/2" long.

The unit is housed in a small 2"W x 4"L x 1½"D Minibox. Parts are mounted by their leads on a 1" x 2" piece of perf board and proper connections made on the underside of the board with the extra lengths of component lead. Because of the high frequencies involved wiring should be kept short and as much point to point as possible. Placement of parts is straight-forward and should cause no trouble if the pictorial is followed. Be sure to leave room at each corner of the board for the mounting holes.

When winding coils L1 and L2 use the specifications shown in the parts list. Because of the small size of the coils it may be easier to solder one end of the wire to a lead on the coil form and then turn the form between your fingers, feeding the wire as you turn. After every few turns or so, apply a small bit of candle wax to the completed part and heat the coil slightly to melt the wax in. This will prevent the wire from slipping off the form. When making the tap on L1 in the 28-54 mc model, be sure to continue the winding in the same direction as before.

Next, drill or punch holes in each end of the minibox and mount the antenna jacks, switch and crystal socket as shown. Drill holes in each corner of the perf board and mount it in the bottom of the box with small grommets or spacers to prevent the leads from shorting against the chassis. Finally, make the connections from the board to the mounted components on the box as shown in the pictorial.

In the authors' model a nine volt battery was used for power and taped to the outside of the OTC. Because of the small amount of

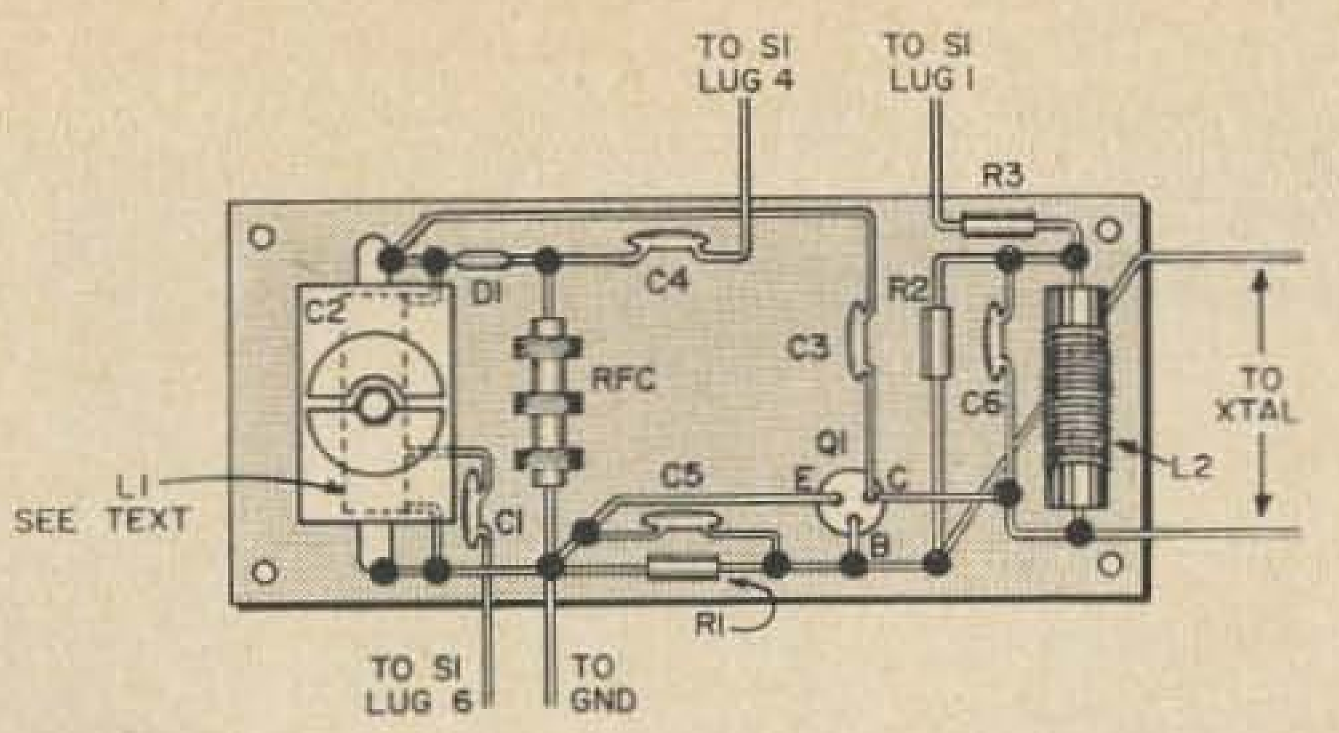

Fig. 2. Layout of the OTC. The converter is built on a 1" x 2" piece of perforated board.

power required by the circuit, the battery will last most of its shelf life. Power may be tapped from the car battery and R3 changed but this will result in more noise through the engine's electrical system.

With a crystal plugged into the socket the converter is ready to go. To determine crystal frequency, use the following formulas:

For the 28-54 mc converter

$F_1 - 1.2 = f_c$

For the 100-200 mc converter

$\frac{1}{3} (F_1 - 1.2) = f_c$

F_1 is the frequency you wish to tune in megacycles

f_c is the oscillator frequency in megacycles. The answer to the above formulas is the frequency of the crystal in megacycles. When ordering from Webber labs it is not necessary to figure the frequency but be sure to specify the frequency of the station you wish to monitor.

Plus in a jumper lead made of about twelve inches of coaxial cable with a male Motorola plug on each end into J2. Plug the other end into the radio and the antenna into J1. With S1 set in the off position turn the radio on and tune the dial. The usual commercial stations will be heard. If not, check the wiring of S1 and the antenna circuits. If all is okay, push S1 to the on position and tune the radio to 1200. A slight hiss will be heard and if the crystal frequency is correct you should hear a signal when the station for which you are listening transmits. It may be necessary to adjust C2 slightly to obtain maximum strength. By tuning the dial a wide range of frequencies may be heard. However, for stations which are far apart in frequency, different crystals will have to be used. The farther away from the crystal frequency the lower the sensitivity.

The OTC may be mounted permanently under the dash or placed in the glove compartment of the car. It's about the easiest way to get good reception of these interesting frequencies for mobile use.

. . . WA4SAM, W1DVG

The EICO 753K

Melvin Leibowitz W3KET
Charles Pappas W3TND
Wilmington, Delaware

The authors recently completed an EICO 753, tri band SSB-AM-CW transceiver kit. The kit sells for $179.95 and in our opinion it is worth every penny. Power input is 200 watts PEP on SSB and CW and 100 watts on AM. Full frequency coverage of the 80, 40 and 20 meter bands is provided. The receiver section has an offset tuning control so that it can be detuned a few kilocycles from the transmitted signal in case the other fellow drifts or is not exactly on frequency. This control is smooth and easy to operate as is the entire transceiver. The transceiver is housed in a heavy gauge perforated steel cabinet with a cast aluminum front panel. Machined aluminum knobs are used and the "feel" is excellent. The main tuning dial is a dual ratio with ratios of 6 to 1 and 30 to 1. This allows rapid band coverage and at the same time gives a good tuning rate for sideband. The receiver is very sensitive on all bands and although we did not measure the rf output; our dummy load light bulb was very bright indicating good efficiency in the transmitter. The set has an effective ALC system on transmit as well as good AVC action on receive.

Construction of the kit was not difficult. The crystal filter is factory assembled. The VFO and if strips are built on printed circuit boards and go together quickly and easily. The audio, VOX, and final rf Section are of conventional construction. All parts are readily accessible and the wiring is "single layer". Alignment was easy and did not require test equipment. The if alignment is accomplished by using the carrier oscillator as a signal generator and the receiver "S" meter as a vacuum tube voltmeter. All other stages are aligned by peaking the tuned circuits for maximum output when transmitting. There were some minor mistakes in the construction manual which is not too surprising for the first run of a kit as sophisticated as this one. They did not cause us any great trouble and conversation with EICO indicates that later manuals will be corrected.

Twenty minutes after the last connection had been soldered in place, we had the unit aligned and on the air. Reports were very flattering in regards to suppression, voice quality and frequency stability. We were impressed by the receiver stability and the general ease of operation and in conclusion we hope that EICO will continue to expand their ham line with other modern, high quality kits such as this one.

. . . W3KET, W3TND

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William Johnson WA2TDR

The Drake R-4 Receiver

Recently I became the owner of a Drake model R-4 receiver. After using it for several months I was impressed enough by its performance to write this review for the benefit of others who may be contemplating the purchase of a new receiver.

The model R-4 receiver is capable of receiving in the SSB, CW, AM and RTTY modes of operation. Its frequency coverage is 3.5 to 4.0 mc, 7.0 to 7.5 mc, 14.0 to 14.5 mc, 21.0 to 21.5 mc, and 28.5 to 29.0 mc, with the crystals supplied. Ten accessory crystal sockets are provided for the coverage of any additional 500 kc ranges between 1.5 and 30 mc with the exception of the 5.0 to 6.0 mc segment. This is one feature that I particularly like as the receiver can never become obsolete if any of the ham band frequencies are shifted. In addition it covers the 160 meter band by using one of the ten accessory crystal positions, or for the VHF enthusiast the accessory crystal selector can be used to provide 5 mc, of continuous coverage for use with VHF converters. Too many equipment manufacturers are omitting the 160 meter band where the Drake Company recognized that the band still belongs to the radio amateurs.

The first if frequency of the R-4 is 5645 kc. The receiver uses a crystal lattice filter at this frequency giving excellent cross modulation and overload characteristics by providing selectivity before the gain producing stages. A tunable passband filter with selectivity switching is used to achieve additional selectivity at the 50 kc intermediate frequency. Four degrees of selectivity are available, without having to purchase additional filters. The passband at the 6 db point on the switchable filters are 0.4 kc for CW, 1.2 for RTTY, 2.4 kc for SSB, and 4.8 kc for AM.

Excellent frequency stability is assured by the use of a permeability tuned oscillator. The specification calls for less than 100 cycles drift after initial warm up. I have found that the stability is in accordance with their specification. The oscillator covers 4955 kc to 5455 kc and is premixed with a switchable crystal controlled oscillator. The output of the premixer is 5645 kc above the frequency of the desired incoming signal. A bandpass coupling transformer between the premixer and the first high frequency mixer attenuates the undesired mixer products.

When the mode switch is in the "SSB/CW" position the output of the 50 kc if amplifier is connected to the input of the product detector. When the mode switch is in the "AM" position the 50 kc local oscillator is disabled and the if signal is detected with a diode, providing AM detection without having to result to zero beating the carrier as required by SSB receivers lacking the additional AM detection system.

The main dial is calibrated in 5 kilocycles divisions and has two scales. The 0 to .500 scale is used for bands 7.000–7.500, 14,000–14.500, 21.000–21.500 etc. and the .500 to 1.000 scale is used for bands 1.500–2.000, 3.500–4.000, 28.500–29.000 etc.

The vernier dial skirt is calibrated in one kilocycle divisions. The scale on the vernier dial is marked 0 to 25. The dial skirt is adjustable by pushing it in slightly and rotating it in the desired direction while holding the main tuning knob stationary. After adjusting the dial skirt the 1 kc divisions track across the main dial so that 5 kc on the vernier dial skirt coincides with the 5 kc divisions on the main dial. When the vernier dial skirt is calibrated using the built in 100 kc crystal calibrator the calibration accuracy is better than 1 kc when the main dial is calibrated at the nearest 100 kc point. The tuning dial turns easily without any backlash. The ease of tuning will be appreciated by the VHF operator that tunes across the complete dial when tuning crystal controlled converters.

The specification lists both the image rejection, and the if rejection in the ham bands as more than 60 db. The internal spurious responses in the ham ranges is less than the equivalent of 1 μv signal on the antenna. I have not found any spurious responses, and have not experienced any image frequency stations in this area appearing in the ham bands.

The specification claims less than 0.5 microvolts for 10 db signal plus noise to noise ratio on all ham bands. I have not measured the sensitivity, but after comparing it with other receivers on the market claiming similar sensitivity it competes with the best money can buy.

Other features contained in the R-4 are: the noise blanker which can be used on CW, and SSB, as well as AM. The permeability tuned "T" notch filter in the 50 kc if strip. This filter is capable of producing a deep notch which can be tuned across the if eliminating interferring carriers in all modes of operation. The automatic volume control has three positions, ie, off, slow, and fast. The receiver has provisions for muting the rf stage off during transmit. The premixed vfo output is brought to a connector so that the receiver can transceive with the T4X transmitter.

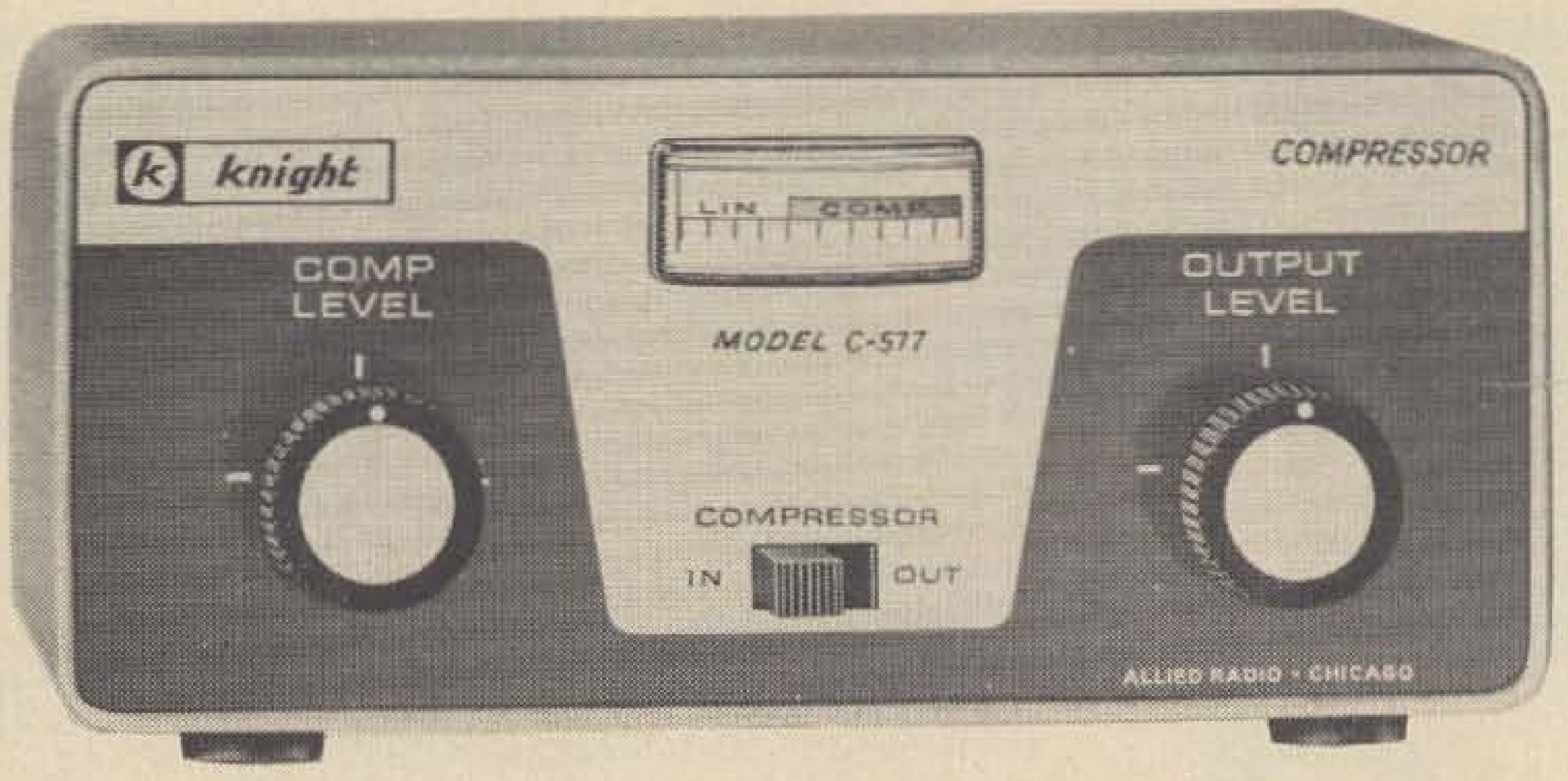
Using the receiver in my two favorite modes of operation, SSB and CW, the R-4 satisfied all my expectations. The features and construction are of the same caliber as the TR3 transceiver and the 2B receiver that earned Drake their present reputation as a manufacturer of amateur products.

The overall dimensions are 5½" high, 10¾" wide, and 12¼" deep.

Incidentally, the new R-4A is identical except for minor production changes including a solid state VFO.

The receiver price is $379.95 with the matching speaker available at $19.95.

. . . WA2TDR



73 Tests the Knight Kit C-577 Compressor

Hams have long known the advantages of compression in the modulation of a transmitter. You can look back at old handbooks and see the very complex and cumbersome equipment that used to be necessary to add compression to a transmitter. Then you can look at the neat, compact Knight C-577 and see how far we've come. This simple, easy-to-build compressor/preamplifier connects between your microphone and transmitter mike input in a few minutes. Then it can be switched in and out of the circuit with adjustable compression and output to provide you with maximum audio for any situation.

The C-577 comes as a kit. The "job" of building it takes about an hour even for butterfingers. Almost all of the parts are on a sturdy printed circuit board and the C-577 uses three modern silicon transistors for reliable operation. The circuit board mounts easily with the controls and common 9 v battery in the attractive 2⅞ x 6¼ x 3" sea blue and silver case. Then it's ready to connect to your transmitter with the double shielded cables that are provided in the kit for use with push to talk switching.

Once the C-577 is connected up, you find that it offers preamplification for low level mikes—up to 26 db at 1 kc. Compression can start as low as 2 mv with full compression limiting output to 50 mv as desired. The input and output impedances are more than 50,000 ohms and frequency response is within two decibels from 300 to 5000 cps. Because of the transistorized-battery operation, hum and noise are more than 50 db down from the maximum output.

The compressor boosts the output of your modulator when you mumble, then limits it when you talk too loudly to give a high average level of modulation. You can easily adjust the unit so that your transmitter will not overmodulate no matter how hard you shout! The big advantage of a compressor such as this over the more common speech clippers is that it introduces very little distortion. All broadcast stations use compressors; I'm sure none use clippers. Of course, hams don't want high fidelity in frequency response, but we do want low harmonic and intermodulation distortion so that our signals are clean and pleasant to listen to. Clippers are notorious for harmonic distortion—that's why they have to be followed by filters. The distortion that a compressor introduces is mostly a matter of phase and amplitude, which is not unpleasant.

I connected the C-577 to a 50 watt 6 meter AM transmitter, got into a contact with a ham just about on the limits of my modulation, and tried the switch test. He said that it made quite a difference. Without the compressor, my voice was weak and partially unreadable. With the compressor in the circuit, it was much stronger and R5 copy. Even with deep compression, the sound wasn't too bad. In fact, my voice is pretty bad without the compression. At any rate, you can always reduce the compression a bit if there are any complaints. The attractive edgewise meter tells you how loudly to talk.

At $19.95, the Knight C-577 is an excellent buy. You'll never know the difference a compressor can make until you try one.

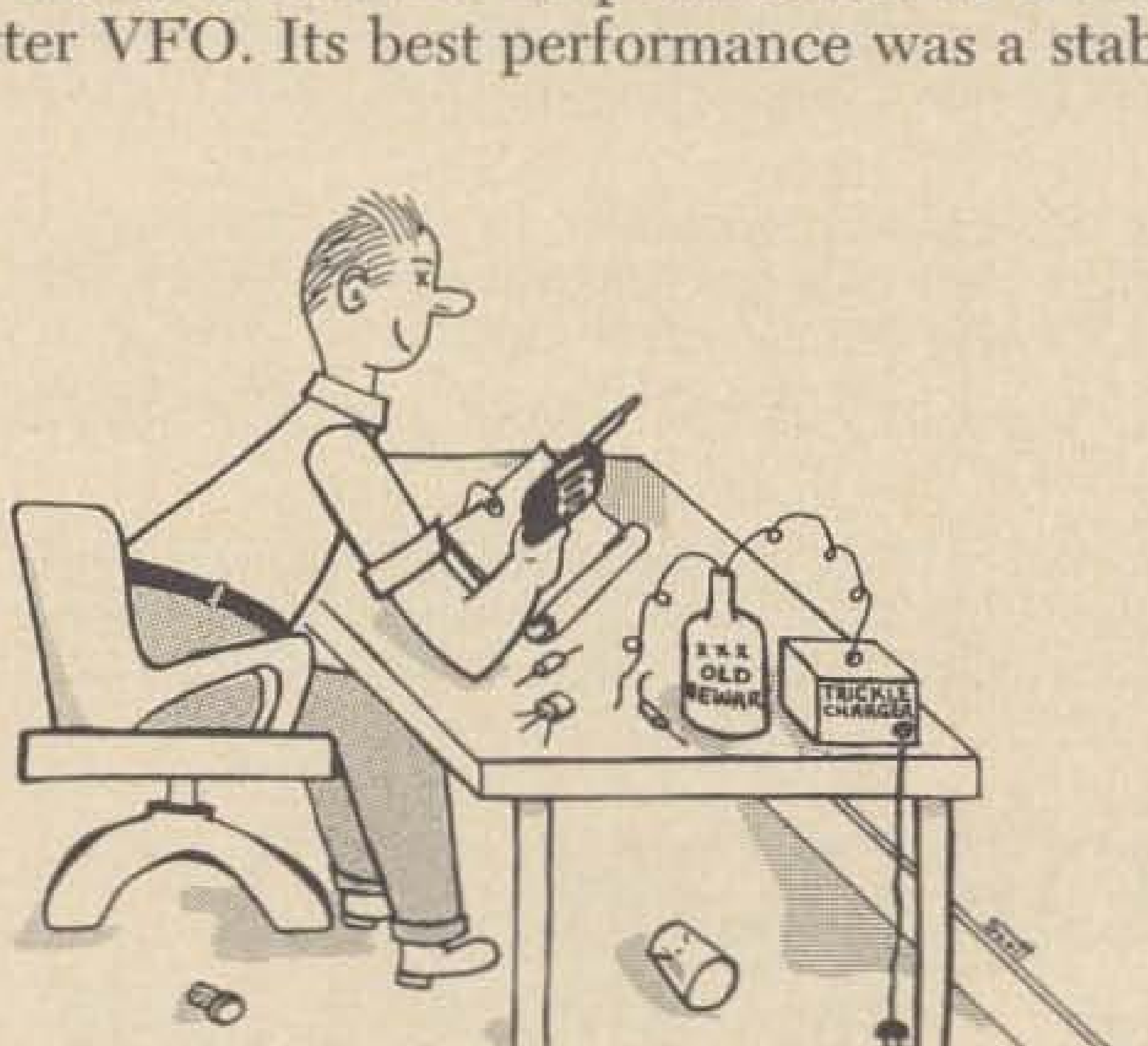
. . . WA1CCH

Kenneth Robbins W1KNI
Sperry Rand Research Center
Sudbury, Massachusetts

VFO Stability: Part II

The article by W6BUV on VFO stability[1] is excellent reading for anyone thinking about exploring this area of ham activity. Having been active in the RF oscillator field for almost 20 years, I wish to add a hearty "Amen." Personal experience with vacuum tube oscillators gives the nod to the Clapp using a Telefunken 6AU6 or the Robberson[2] running at +12v dc on plates and heaters of a 12AU7 (Telefunken) and 12EC8 untuned buffer/cathode follower. Each will hold frequency close to $1x10^{-5}$ with careful construction. With ambient temperature variation held to ±1°C, regulated supply voltages and fixed load they improve by almost an order of magnitude.

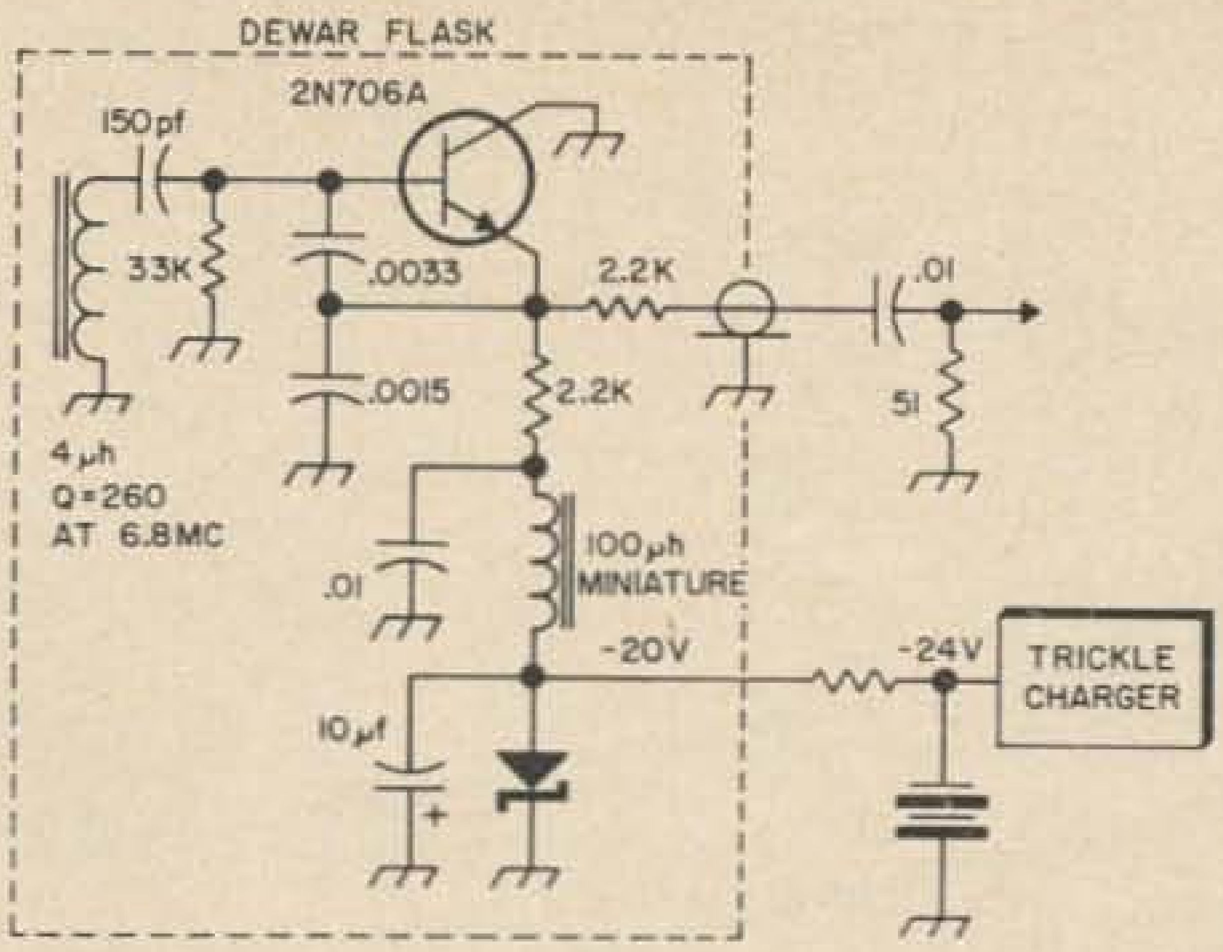
However, transistor oscillators CAN do even better by eliminating cathode interface impedance, microphonics, element heating, power supply problems, etc. Solid state devices are not a cure-all and they do raise questions of junction heating and capacitance effects along with low frequency "burble" (random FM), to name a few. These varied ills are greatly reduced in the Lee[3] oscillator which is one of the best to come along so far. Some lunch-hour and after-five tests were run on this circuit in the lab to determine its possibilities as a transmitter VFO. Its best performance was a stability of $3x10^{-8}$ for about 2 minutes with a long term drift of 280 cps in 8 days. Of course this extreme stability of an LC oscillator required precautions and these are outlined as follows.



A single 2N706A silicon transistor was finally chosen along with a high Q ferrite toroid coil form, dipped silver-mica capacitors in the tuned circuit and deposited carbon resistors. This fixed-tuned oscillator, running at 6.8+ mc, was assembled on a 5x7 cm phenolic board together with a 20 volt zener diode to regulate B+. The assembly was secured to the bottom of a straight sided 667 ml Dewar flask. Fibrous insulating material filled the space between the unit and the open end of the flask. A ½" thick aluminum disc, well fitted to the flask sides, acted as a closure. A heating device in intimate contact with the disc maintained its temperature at 40°C±1°. Microdot coax brought out the RF signal and B+ on a #30 wire came through a dropping resistor from a 24v DC nickel-cadmium battery supply, constantly trickle-charged. A 2.2 k isolating resistor in the oscillator minimized any "outside world" effects on its 50 ohm fixed load. The signal was applied to a HP 524 frequency counter and printer, the counter being driven by an external standard having better than $1x10^{-10}$/day drift. And all this in an air-conditioned lab!

The oscillator was run continuously for one week before meaningful measurements were made. Its best run after this break-in period was a downward drift from 6,889,747.9 cps to 6,889,747.7 cps in 130 seconds. From this and many other earlier experiments useful data has been obtained and is passed on to 73 readers who wish to try their hand on LC transistor oscillators.

Use a well-proven silicon transistor having low capacities, moderate beta, voltage and power dissipation ratings and good high frequency characteristics. The mesa type con-



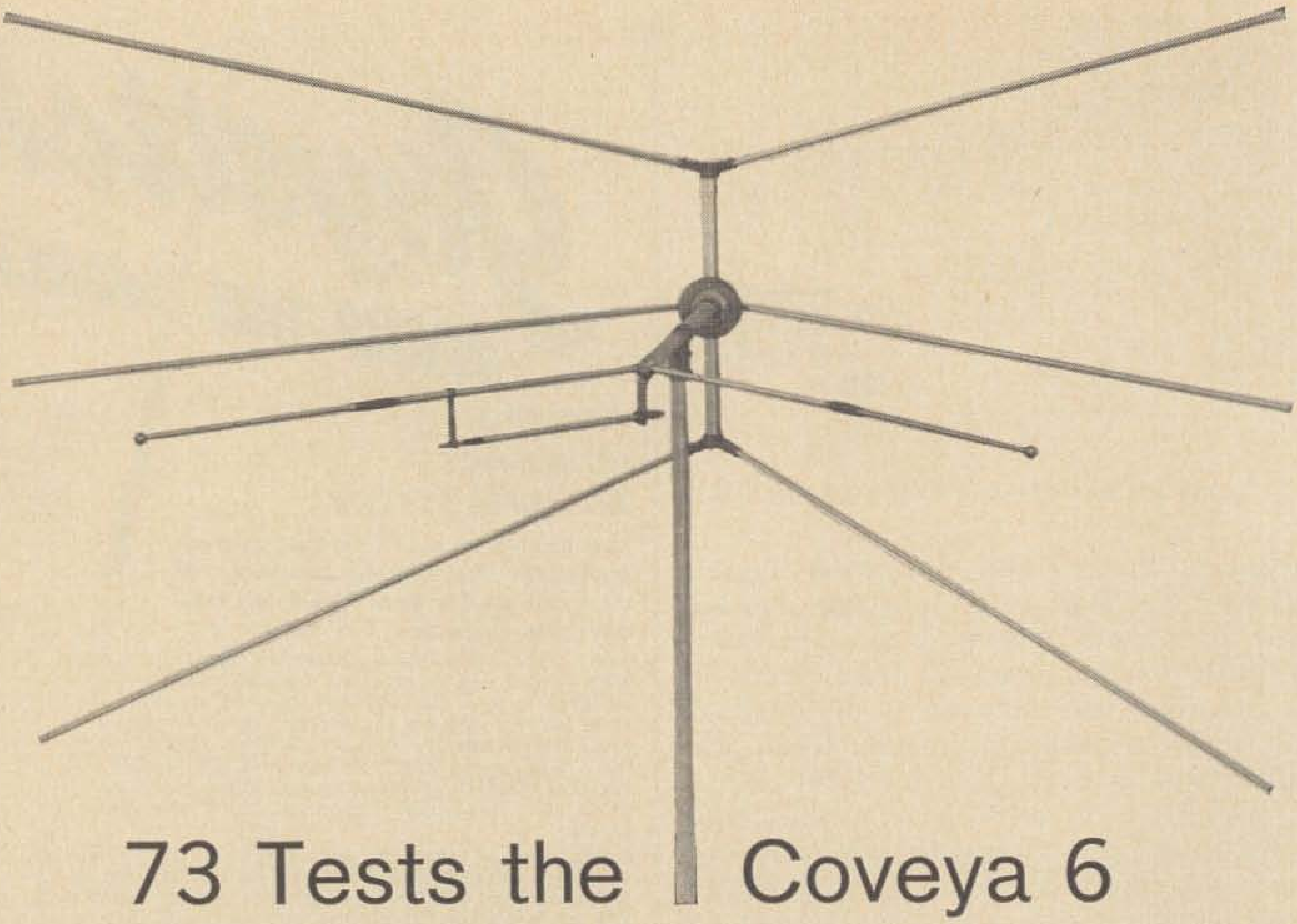
ïg. 1. Suggested circuit for a solid state oscillator.

;truction in the 2N706A fills these require-nents well. Use high collector voltage and low ;urrent to reduce collector-base capacitance vith little junction heating. Solid state de-/ices and iron-cored inductors in the oscillator :ircuit must be temperature stabilized. The nductor must be high Q, at least 200. A coil ;poxy-bonded to a ferrite toroid works quite vell by confining the magnetic field which re-luces coupling effects to adjacent structures. /oltage regulation and/or base bias adjustment vill minimize effects of B+ variations on fre-quency. Reactive feedback from following ;tages can be held down by an isolating re-;istor of as high a value as possible. Small ;apacitance output coupling does not work as vell. Use only passive element phase shifting. 3ypass all zeners with electrolytics to reduce ıoise, especially at audio frequencies. Tap lown as far as possible on the tank circuit to ›btain good impedance matching. The Lee :ircuit is excellent because a very large capac-tance swamps the high capacity of the for-vard biased base-emitter diode which is a najor source of 'burble'. In this oscillator a /alue of .0033 μf is used at 6.8 mc, a reactance of 5.5 ohms. And don't forget to keep Bill Goldsworthy's construction points in mind!

Lest these high-powered lab techniques ;care some hopefuls away, I hasten to add :hat a much less exotic oscillator was con-;tructed at home, operating near 5 mc. Its 10th ıarmonic at 50 mc was used for carrier rein-;ertion on SSB signals in the 6 meter band, ›nabling reception in the regular AM mode. A few were found with incidental FM, not ısually detected with the receiver in its side-›and mode. This is stability of about $5x10^{-7}$, :omparable to quartz oscillators.

. . . W1KNI

(1) "VFO Stability," *73*, September 1965.
(2) "RF Oscillator has Improved Stability," *Electronics*, August 1963.
(3) "Synthetic Rock," Commander Lee, *CQ*, September 1963.



73 Tests the Coveya 6

When a ham sees a Coveya 6, he says, "It looks like a TV antenna."

When a neighbor sees the Coveya 6, he doesn't say anything. It doesn't look like a ham antenna at all to him.

To some hams, the fact that the Newtronics Coveya 6 looks like a TV antenna is unimportant-or even slightly funny. But to those of us who live in areas of bad TV reception, it can be a blessing. As all hams know, antennas cause TVI—not transmitters. No one with a bum TV set accuses his neighbor of causing trouble unless he knows that the neighbor is a ham—or has up a ham antenna.

But it would be ridiculous to think that this is the only advantage of the Coveya. In the first place, it's very compact. The special design makes it narrower than yagis and other antennas. The boom is only 34" long. The Coveya 6 is amazingly strong. It's made of seamless heat treated aluminum tubing. The brackets are solid iridite finished aluminum castings; no cheap stamped parts here. The ends of the elements have aluminum rod plugs for extra strength and to keep out water. It's very light, too.

Electrical specs that Newtronics publishes are 10 db gain over a half wave dipole and a front-to-back ratio of 25 db. The Coveya is gamma matched to 52 ohms and very easy to adjust. The SWR when properly matched is about 1.1 to 1 at resonance, and under 2 to 1 for a megacycle. You can set the center frequency anywhere from 50 to 54 mc, though I set it at 50.2 for SSB. The antenna will handle a KW; I used it with about 150 watts PEP.

The Coveya is a real pleasure to use in round tables. You won't have to keep twisting the rotator knob for each station. The beam gives a cardioid pattern with no side nulls. I live in a very poor spot for hamming, in a valley with a large hill about 50 feet from the antenna between me and Boston. Then there's a mountain behind that. I almost didn't bother going on the air, but decided I'd try the Coveya. I jerry-rigged it about 10 feet above the roof on a one story part of the house pointed right into that hill. Needless to say, I didn't expect very good results. But I had no trouble working into Boston 70 miles way where the beam was pointed and into Connecticut a little off the side. I didn't bother with the rotator since I had little hope, but could hear all sorts of stations around the front of the beam. One of the hams I worked in the Boston area said that he'd never heard of anyone down in Peterborough (as opposed to on the mountain, Pack Monadnock) getting out on six. Looks like the Coveya 6 and SSB make the difference. Maybe I'll get around to putting up that tower with the Coveya on it yet.

. . . WA1CCH

Hank Cross W1OOP

Experimenting with Varactors

If all you want to do is get some output on 432 mc the procedure is simple: buy an MA-4062 and build a tripler to multiply your 144 mc transmitter output.

If the object is to play with or demonstrate the use of variable-reactance diodes in frequency multipliers or other applications, there are cheaper diodes that will do the job very well, at frequencies from one to thirty megacycles.

Hughes, PSI, and other companies make variable-capacitance junction diodes which have Q's of ten to several thousand at one megacycle: PSI makes diodes suitable for use up to several thousand megacycles at fairly high prices, but the V-100 varicap will perform very well in the range below 10 mc, at moderate cost. Another source of low-frequency "varactors" is common silicon power diodes. I have seen experimental circuits working at ten to thirty megacycles using GE 1N1199 and 1N2154 series power diodes, with good efficiency.

Although I have not tried it, it seems that it would be fairly easy to make doublers and triplers from 3.8 megacycles using power diodes and a novice transmitter for a source. To establish that operation is on the proper frequency, output from the transmitter, idler tanks and output tanks can be put on to the deflection plates of any cr scope. No amplifiers need be used; the rf across the tanks should be several hundred volts, and by putting the input tank voltage to the horizontal plates and the output to the vertical deflection plates a lissajous pattern will be obtained that will tell the frequency ratio directly.

. . . W1OOP

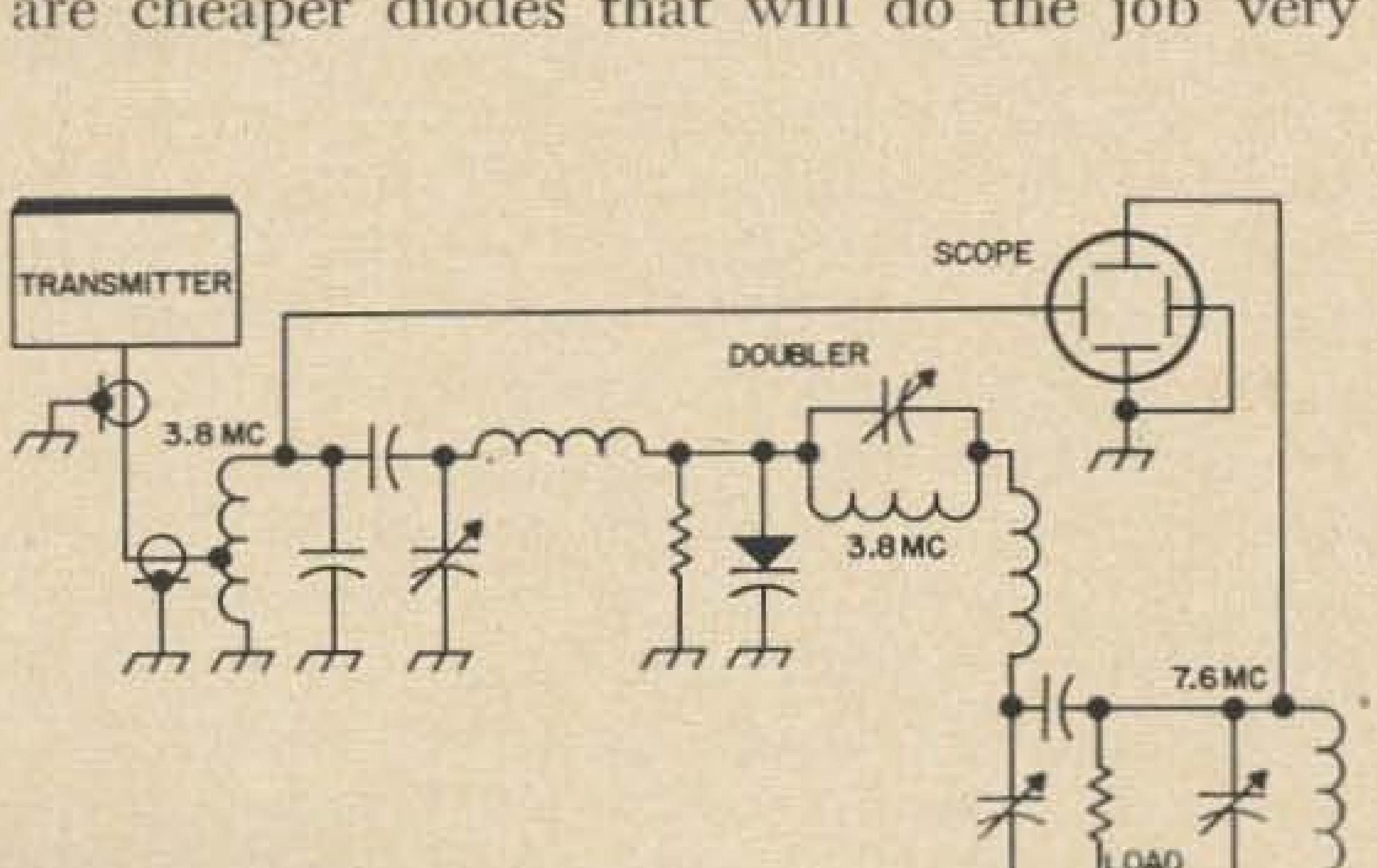
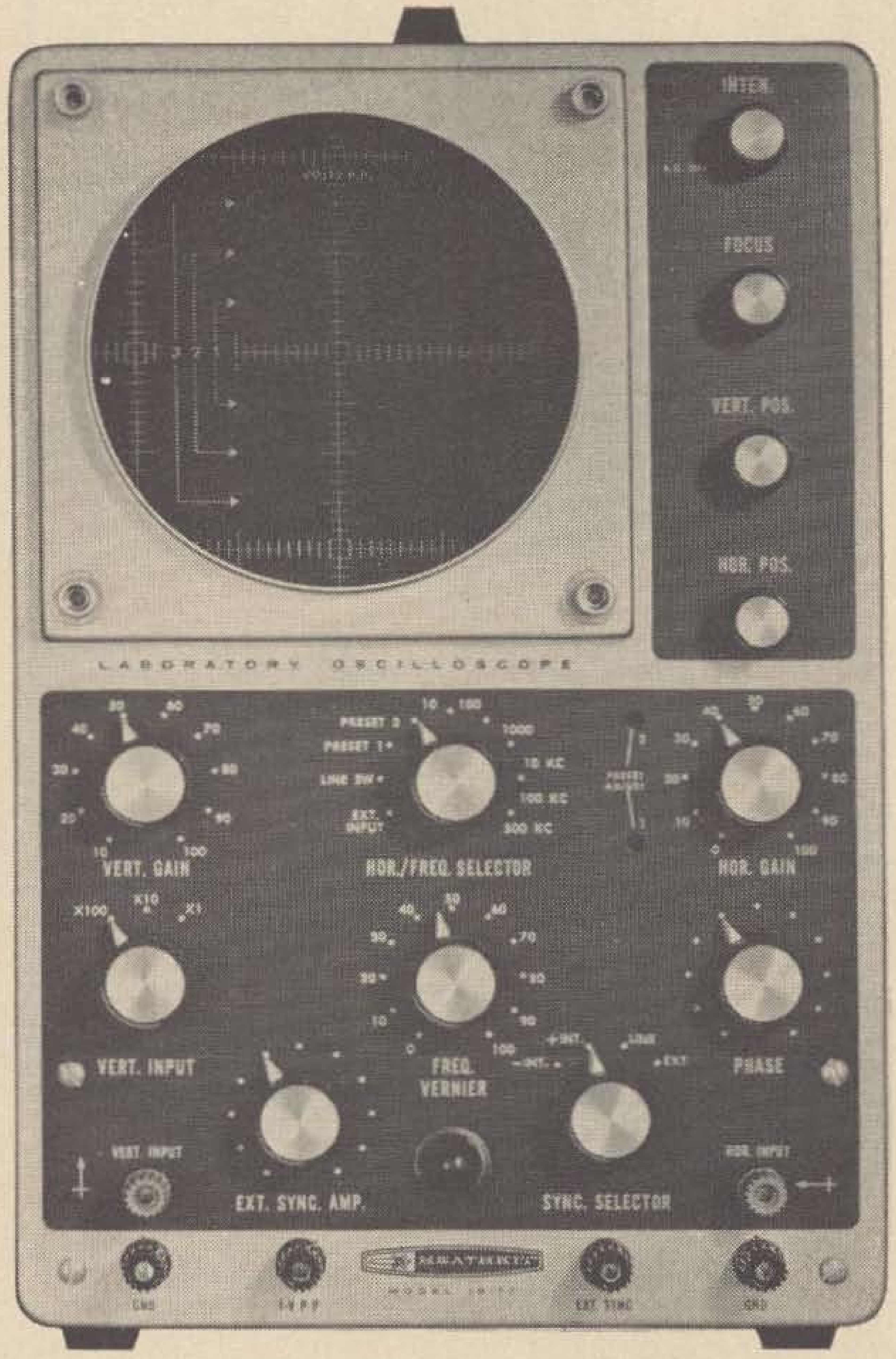


Fig. 1. Experimenting with varactors. This circuit uses a common silicon power diode to double from 80 m to 40 m.



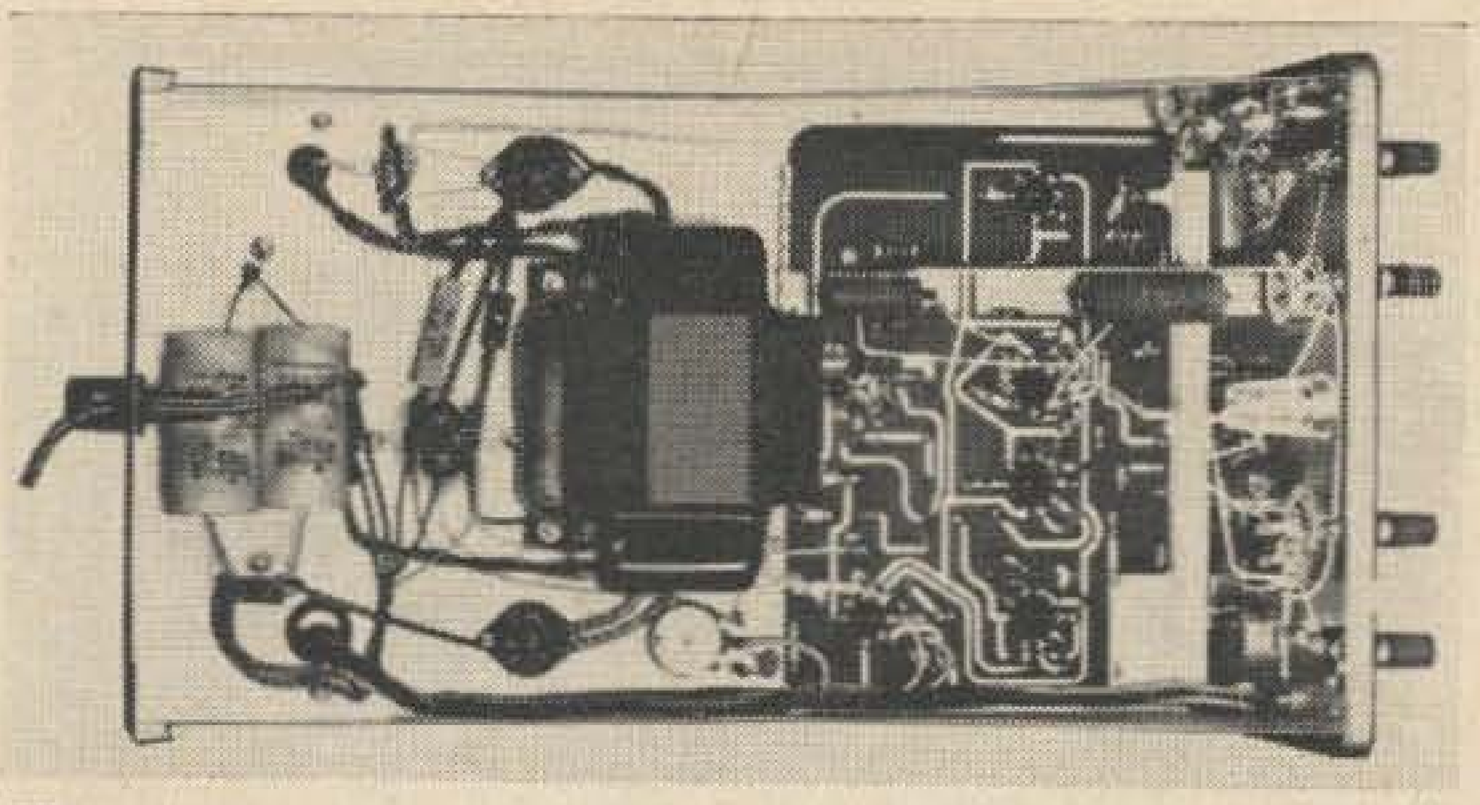
Ken Cole W7IDF
P.O. Box 3
Vashon, Wash.

Twelve Centimeter Heathscope

The Heath Model 10-12 five inch scope is particularly easy to assemble and wire. Accessibility for testing and repair would please the most hot-tempered servicemen. Two circuit boards are used, and should it ever be necessary either of these can be purchased as individual kits which include the sockets and components mounted on the boards.

Two pre-set sweep frequencies (adjustable from the front panel) are provided—vertical and horizontal TV sweeps were what Heath had in mind, but the two frequencies can be set anywhere within the range of the internal sweep generator. An additional feature allows the operator the choice of having the sweep start on either the positive or negative slope of the input signal. Good frequency response for a wide range of input voltages is achieved by a simple compensation adjustment of individual attenuators, after the scope is completed and operating. For measurement of peak-to-peak values a binding post provides a calibrating voltage, and although the source is a simple, unregulated divider network across the filament supply stability is satisfactory.

No problems arose in assembly or wiring, with one minor exception. When I turned the scope on the beam was well off the screen vertically and the trouble turned out to be an open peaking coil. The break was right at the terminal and required only a touch of solder. It might have been caused by excessive tension during the winding process, but more likely it was the result of my own impatient handling. The kits I've put together would fill a Microbus but I can't resist the temptation to accelerate from a crawl to a full gallop at the finish line. When I squeeze those last eight leads through the last solder lug and add a final ounce of 60-40 the feeling of relief and the happy reunion with my family make it all worthwhile. I remember the anticipation that



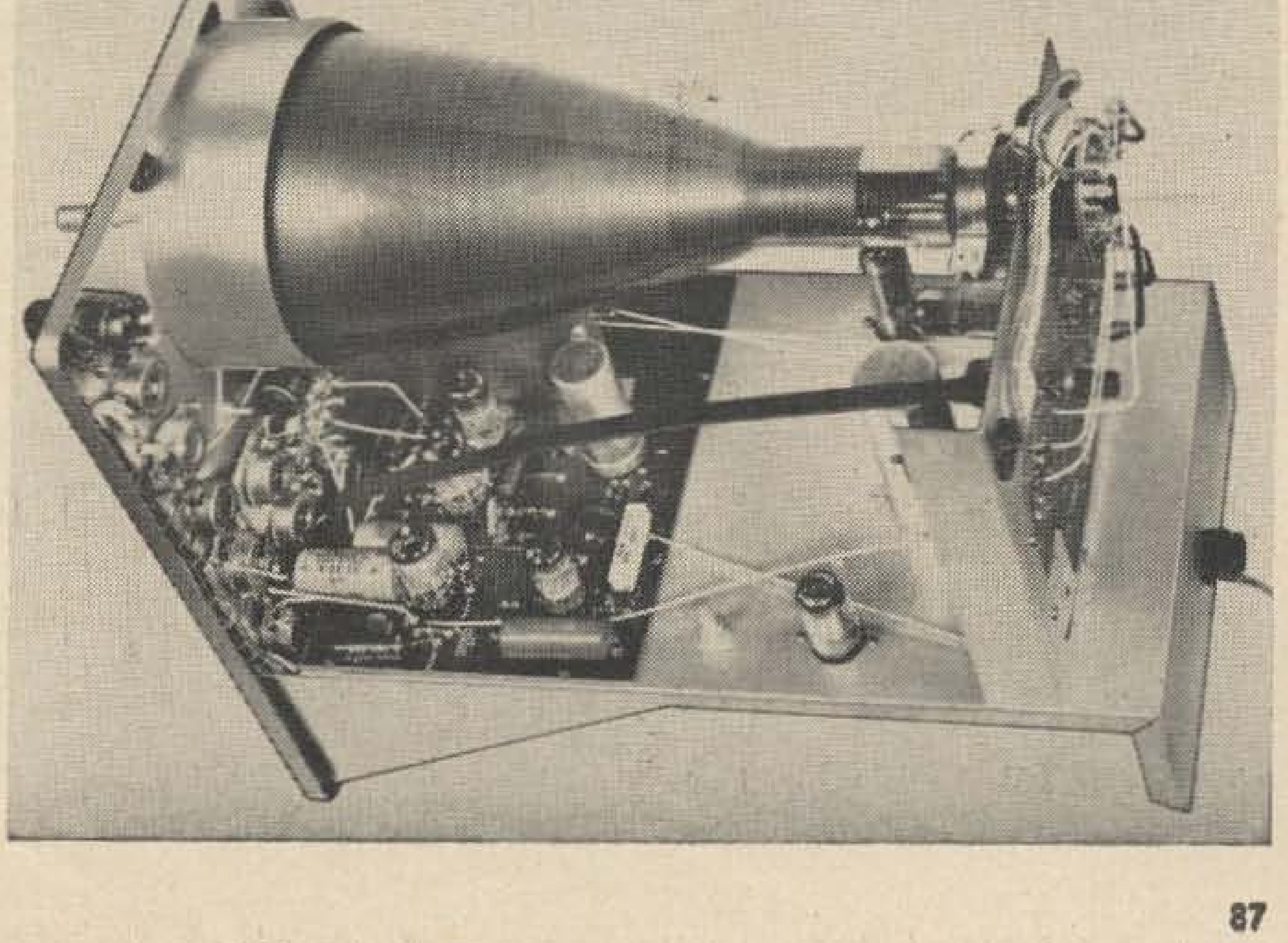
This bottom view of the Heath 10-12 shows you very little. But that's the way I like them; uncluttered and clean.

accompanies the unpacking of a new kit, forget the Solder-No Solder, strip and measure tedium, salute the geniuses who design for Everyman and enjoy my new equipment.

Maybe I've been lucky, but I can't recall a kit that through faulty engineering or overrated components turned out less than satisfactory. Not long ago I was so impressed by the performance of a relatively inexpensive FM receiver that I wrote one of those "unsolicited testimonial" letters to Heath, explaining in some detail why I was pleased with their product—and adding in some detail why I thought they should divert more of their advertising budget to 73. I didn't expect a reply and I forgot about the letter. Some time later I received a wire from Benton Harbor. Mr. Earl Broihier quoted my letter and requested that, if I would allow my remarks to be used in an advertising campaign, I reply using a release form included in the Heath telegram. This I was happy to do, of course, and I even refrained from including in my collect wire more advice about the advantages of large monthly displays in a New Hampshire technical journal. The magazine touting aside, and I harbor no illusions that it made any impression, I think my goodwill was thereby established and perhaps no personal pique will be construed from the following qualified recommendation of an optional accessory to the 10-12 scope.

The EF-2 Educational kit costs $9.95. If purchased with the $76.95 five inch scope the combination price is $84.95. The book supplied, "How to Understand and Use Your Oscilloscope," is worth the price of the kit, and you may find the chassis as useful as it is intended to be. The circuits designed to illustrate the applications of the scope all worked fine, but my feeling was that the unique, convenient approach to solderless assembly was more unique than convenient. For this kind of work the vertical plug-in spring connectors seem to me to be handier, and the parts you attach to them needn't be modified first. The EF-2 board requires that components be soldered to tiny spring clips before they can be used. I may be a minority of one here. See what you think. In any event a generous supply of parts and three transistors are included with the chassis and I'm glad I paid an extra eight bucks to get the EF-2. The book is first class. Finally, there is another text you will find worth having if you are really curious about scopery in detail. This one is *Oscilloscope Circuit Applications*—volume five of an eight volume electronics series set up for the Bureau of Naval Personnel. The Superintendent of Documents, Government Printing Office, Washington, D. C., wants a dollar and a half for this bargain and telling him you saw it in 73 won't make any difference.* . . . W7IDF

*Never Say Die. *Ed.*



The Heath 10-12 is very easy to wire. You can see that almost all the parts are on the circuit boards. It's easy to use, too.

Letters

Dear Wayne:

Your November editorial comment about the code requirement for amateur licensing has certainly hit the nail on the head. I have felt as you do about the code requirement ever since I received my ham license in 1947 and have argued many times with other hams regarding the code requirement.

There is unquestionably much to be gained by stiffening up on the technical written exam for amateurs. A good example of what can be done occurs in another field—the field of general aviation. Prospective instrument pilots are given a written exam which is intended to—and believe me it does—separate the men from the boys. The stringent requirements for instrument pilot make it possible these days for instrument rated pilots to operate on the airways under instrument conditions and not get in the way of all the commercial traffic.

If the amateur written exam were stiffened up, it would stop once and for all the current cry heard in some quarters that "amateurs don't know anything about radio these days."

J. A. Smith Jr.
Newburgh, New York

Dear Wayne:

The best thing that happened to me this year was meeting you at the SSB Dinner at the Waldorf Hotel in London in May. I had a quick look through the 73 Mag you gave me and if you remember immediately gave you the cash for a years subscription. I read the mag from cover to cover. I like your honest, straight-to-the-point editorials and the articles and comments are right on the ball. For me 73 is Top of the Pops. I would like to correspond with any readers using a SBE 33 Transceiver.

Continued success to you and 73 Mag and I hope it will not be too long before we have another eyeball QSO, also another 20m QSO. If you are ever in 'G' land drop in on me.

Roy Reynolds G31DW
Wiltshire, England

Sir:

You speak of bad manners on the air, well you haven't heard anything. I am a Negro and have had a license for seven years. I have a reasonable I.Q. and like to think I am fairly intelligent. I have never attempted to "talk white". I very often hear snide remarks, and sometimes a ham I am in QSO with will lapse into his brand of "Negro dialect". I have heard them throw carriers deliberately on top of mine. I hear hams declaring themselves on issues which have no business in ham radio. I have heard hams using derogatory phonetics, and telling "race jokes". It may be surprising to you that only a small amount of these hams are Southerners. I will continue to ham because I love it. I have met some fine fellows, whose friendships I would not sell or trade. For every crumb in amateur radio there are hundreds of fine fellows. So when you speak of manners, think of me.

Columbus, Ohio

Dear Wayne,

First of all I would like to say that I like 73 magazine. I like the articles, the editorials, and also I like the way you fight for that which you think is right.

I have been licensed since 1936, still holding my original call. I am only a General Class license holder and have no desire to obtain one of the proposed new class of license if the F.C.C. puts the new classes of license in effect. My reason is that I don't believe the proposed rules changes will improve the present condition of the particular bands involved. Any present operator who was licensed prior to WW2 will remember the condition of the 75 and 20 meter bands. They sounded lousy then. Remember we had restricted licenses then? Class A and Class B. Class A permitted operation on all bands. Class B permitted operation on all but 75 and 20 meter phone. Now as I remember it I don't think that the Class A operators were A number one operators and electronic geniuses any-more than the Class B operators were supposed to be lids and dumb-bells. Now forcing a person to take an examination to receive an advanced license to keep that which he already has will not make an operator a better operator, a constructor of equipment, or a technician. Think of all the grown up persons now, who when they were little children their loving mothers forced music lessons on them. How many today are great and accomplished musicians?

You can't force a man to build equipment. This desire has to be born in you. How many persons owning boats build them? In spite of what some operators claim to the contrary, I was always taught by the old timers before me that amateur radio was a hobby and I still like to think of it as such. There are quite a few business and professional men and women who are amateurs and they just don't have time to construct equipment even if some of them would like to. Those of us who do like to build have a hard time of it, let me explain. You can't buy parts, at least not in the Philadelphia area. Even the one surplus house does not have much to offer to the ham. I like to build and have always done so. My receiver is home brewed along with a two meter convertor. I have an ARC 3 transmitter that I am modifying for two meters using W4WKM's article in the June 1963 issue 73 magazine. Now here is something that would discourage many a ham who would like to build. Some time ago I started to build the SSB exciter described by George Bigler W6TEU in the June 1958 issue QST. I have the exciter finished and started the R.F. portion. I need a Centralab P-272 index assembly and three type GGD switch sections, also a P-121 index assembly and one type R and one type RR switch sections. I tried several parts houses. None of them had these parts in stock, only one of them would even order them for me. These parts have been ordered since Good Friday of this year, now here it is six months later and he doesn't have all the parts yet. He has the one index but not the right switch sections. Now you can see even if any one got interested enough to build he would be discouraged before he got started because he would not be able to buy the parts.

The reason most supply houses don't want to handle parts is due to the fact that they must invest too much money in stock, which is slow in being returned to them. Take the case of the above switches. In order to buy direct from Centralab the dealer would have to invest $1500. Now imagine how much money he would have to spend in order to have a good selection of parts such as resistors, condensers, transformers, tubes, etc. So now you can see why we have appliance operators and will continue to have them. The parts houses want them because there is more profit and faster sales with an already manufactured piece of equipment which is usually well constructed, debugged and ready for the power plug. So you can see an appliance operator is one by necessity rather than by choice and this doesn't mean that just because he is one, that he is not technically minded or a good operator.

Well Wayne since our incentive bands are already over crowded, I plan to work 160 meters again this winter where all the gang are all good guys and by the way there are quite a few old timers on the band. Also during December, January, February and maybe March depending on conditions DX can be worked on this band. Also I plan to work two meters and I will work any one no matter what class of license he may have. Ten meters is also a good band at night for local contacts. I don't hear too much activity here. Those fellows on 75 meter phone at night are mostly having local contacts and usually with very heavy QRM, heavy QRN, and need considerable power to get through. They should use ten meters thereby keeping it occupied so we don't lose it to other services.

Well, Wayne keep in there fighting. We need more like you.

Russ Lee W3GGY
Royersford, Penna.

Dear Wayne:

The stories in the November issues of CQ and QST seem to give slightly conflicting information as to just who gets the credit for the work done by Dr. Sam Rosen (WA2RAU) in winning the tower case against the city of New Rochelle. It doesn't seem right for both the ARRL and the Communications Club of New Rochelle to hold off for a year and a half and then step in—especially galling was the part about the fine job done by the ARRL. Maybe a fine job was done by Dr. Rosen, but no credit should go to the ARRL.

C. E. Monson WA2RWP
Geneva, New York

Dear Wayne,

At our local radio club meeting recently an effort was made to raise our dues for forced membership in the ARRL. I strongly objected to being forced to join the ARRL to stay a member in good standing of the local club, which hasn't been affiliated with the League for a score of years. The whole mess was instigated by the Area Emergency Coordinator who attempted to awe the uninitiated as to the works of the Great White Father of Amateur Radio. It was stated that they maintain a lobby in Washington and a big battery of lawyers who rush forth and rescue anyone that may be legally challenged by neighbors who object to antennas, interference, etc. Also, most locals believe that they cannot operate outside AREC during an emergency and have on this basis dropped out of well organized independent nets so they won't be off the air come the next hurricane. This lie has caused one net to fold and kept others from developing. We need help and advice.

Harold Lami K4GGV
Mobile, Alabama

No wonder your club members are confused. Apparently many ARRL officials have been spreading the lies and distortions you have run against. They have even been printed in club bulletins and semi-official League mouthpieces such as the Washington Amateur Radio News and Autocall. Much of this confusion can be cleared up by the expenditure of 10¢, half of it for a little government pamphlet entitled, "Federal Regulation of Lobbying Act." This costs a nickle from the Government Printing Office . . . the other nickle is your postage. Publication 78418 O-62. This Act is most specific. It sets forth heavy fines and imprisonment for any persons, societies, companies, etc., who in any way attempt to influence the passage or defeat of any legislation of Congress without being registered with both the House and Senate. The ARRL is not now and never has registered with either body and therefore is forbidden by law from any attempts whatever to influence Congress. The Institute of Amateur Radio registered with the House and Senate, starting in 1964, and is the only amateur radio organization that is so registered. So much for the League trying in any way to influence Congress. You can bet that their counsel in Washington sticks to his business of dealing with the FCC and nothing else. As proof of this, when the League was threatened with a libel suit recently as a result of an incredible blunder by the General Manager, outside counsel had to be hired for the case. Now, regarding the big battery of lawyers that rush forth to help beleaguered amateurs . . . those of you who know someone still getting CQ can ask them to read you the trials and tribulations of WA2RAU on page 59 of the November issue wherein he exposes the myth of ARRL legal help once and for all. All you get is a mimeo list of cases for the lawyer you have hired with your own money to use to look up past court actions. From there you are on your own. The Institute of Amateur Radio is the ONLY organization that provides funds for amateurs fighting legal battles that could affect us all if lost. We think that it is a crime that the League refuses to help amateurs in legal difficulties and the Institute is trying to fill this desperate need. During official emergencies amateurs are asked to keep off the emergency channels unless they are handling emergency traffic. This certainly does not mean that they cannot operate as much as they like outside of these designated channels. I hope not all EC's are as completely misinformed as yours. The Institute of Amateur Radio is the ONLY organization representing amateur radio in Congress and the ONLY organization lobbying for amateur radio.

Dear Wayne,

Can't you do anything to stop all these DXpeditions? There are now four fellows who are working full time at the DXpedition business and hardly a day goes by that from one to three of them are not on the air from some minor protuberance of the earth. The result is that twenty meters (and the other bands) are in a constant uproar, often with over half of the phone band taken up by thousands of stations calling by the hour. I heard one serious DXer brag that it took him 16 solid hours of calling to finally work 1S9WNV. Serious means qualified for the nut hatch, by the way.

Yes, I know that this is all the result of that abomination, the DXCC, but when I write to the ARRL I get nauseous at the pious cliches I get back from that bunch of idiots. Isn't there one single active ham on the ARRL staff? *Do* something, Wayne. Get these DXpeditions off our backs.

An Old Timer

Dear Wayne:

The question you have raised relating to the identification of the operator, as opposed to the station from which the signal originates appears to present no insurmountable obstacle. A simple change to para's 12.28 and 12.82 of the rules would provide a solution to the problem.

When an amateur radio station is operated by a licensed radio amateur, transmission of the station call alone merely identifies the station. It must be assumed that the station is being operated by the station licensee. No provision is made in the existing rules for identifying a licensed radio operator other than the licensee of a station being operated.

It is desirable to identify both the operator and the station when the call sign of the operator is not the same as the transmitting station. This applies specifically to club stations, but also to any station where a guest operator is using the equipment. I think the IOAR should approach the FCC with a suggestion based on the following:

When an amateur radio station is operated by a licensed radio amateur whose call sign is not the same as that of the station being operated, the call sign of the station should be transmitted followed by the fraction bar character DN and the call sign of the radio mamteur making the transmission, as for example:

Amateur operator with call sign W1ABC is operating Club station W1XYZ and calls W3DEF:

"W3DEF W3DEF W3DEF DE W1XYZ DN W1ABC W1XYZ DN W1ABC W1XYZ DN W1ABC AR"

Eric Young
Kent, Washington

Dear Wayne:

This will acknowledge receipt of your check for $40.00 for the Twoer Talk manuscript. I am proud to have my material appear in 73 Mag. It's still the best journal for my money (even if I don't agree with some of the editor's viewpoints, Hi!).

Doug DeMaw W8HHS (W1CER)

Part II: The Local Oscillator

Bill Hoisington K1CLL
Peterborough, N.H.

The 1215 Transistor Superhet

This article also describes a number of other transistor oscillators for test use from 28 to 1300 mc

Last month I discussed the mixer for a solid state 1215 mc superheterodyne receiver. You ought to have that mixer about ready to go now, so you can start on the local oscillator. This article is devoted to transistor oscillators for all the ham bands from 30 to 1300 mc, as the information gained in building these oscillators leads up to the last one described, the tunable local oscillator for the 1215 mc receiver. Next month's article, the last in this series, will be devoted to the *if* strip, the audio and the assembly of the solid state receiver.

This article will describe the following tunable oscillators:

1. A 28 mc signal generator for aligning the 28 mc *if* amplifier.
2. A 50 mc oscillator that lights a bulb with a low cost transistor.
3. A strap line oscillator for 140 to 300 mc.
4. A boxed-in oscillator for 250 to 500 mc.
5. A half wave unit for 800 to 1100 mc.
6. Two 1200 to 1300 mc oscillators. One is the receiver local oscillator.

An untuned UHF detector and a phase shift audio oscillator for modulating the oscillators is also described.

28 mc oscillator

This circuit (**Fig. 1**) is good from 1 to 50 mc. Note that no ground is shown. As you go up in frequency in VHF and UHF, remember that the only possible definition of ground is a place where there is no RF. A ground—such as battery case, metal panel, Minibox or the outside sheath of coax—can be connected to either A or B, but not both! This is very useful for mobile, of course.

L3 is a low impedance link for taking some of the power developed and putting it to use. You can tune the unit either with the iron core or with a variable capacitor across it. An impregnated paper coil with internal 6/32 threads and a powdered iron core with similar threads make a handy and very small assembly. Insert the core from the cold end for

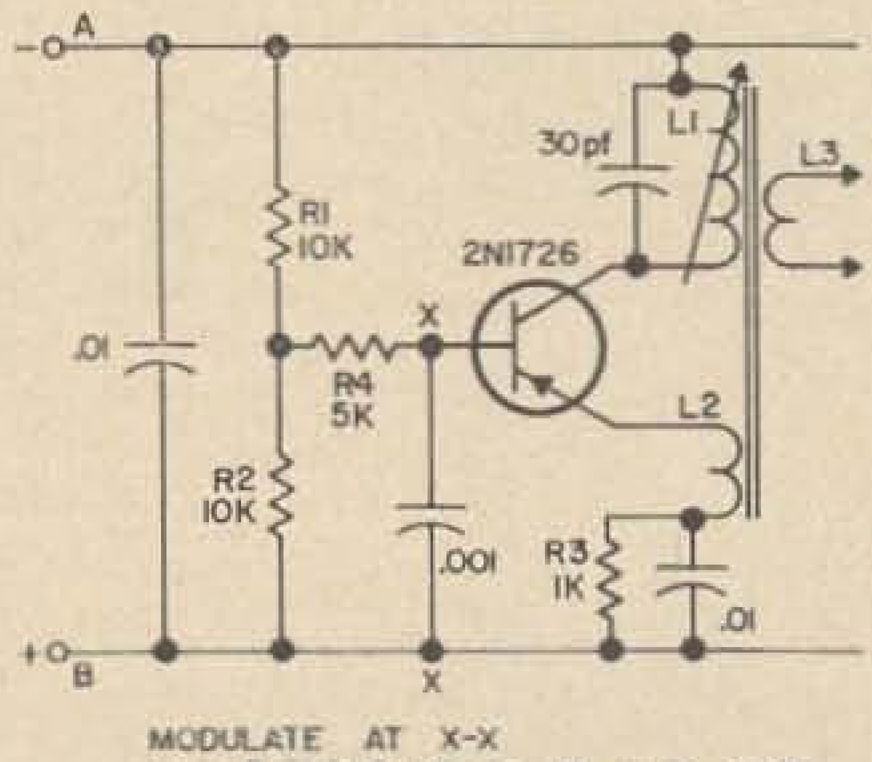
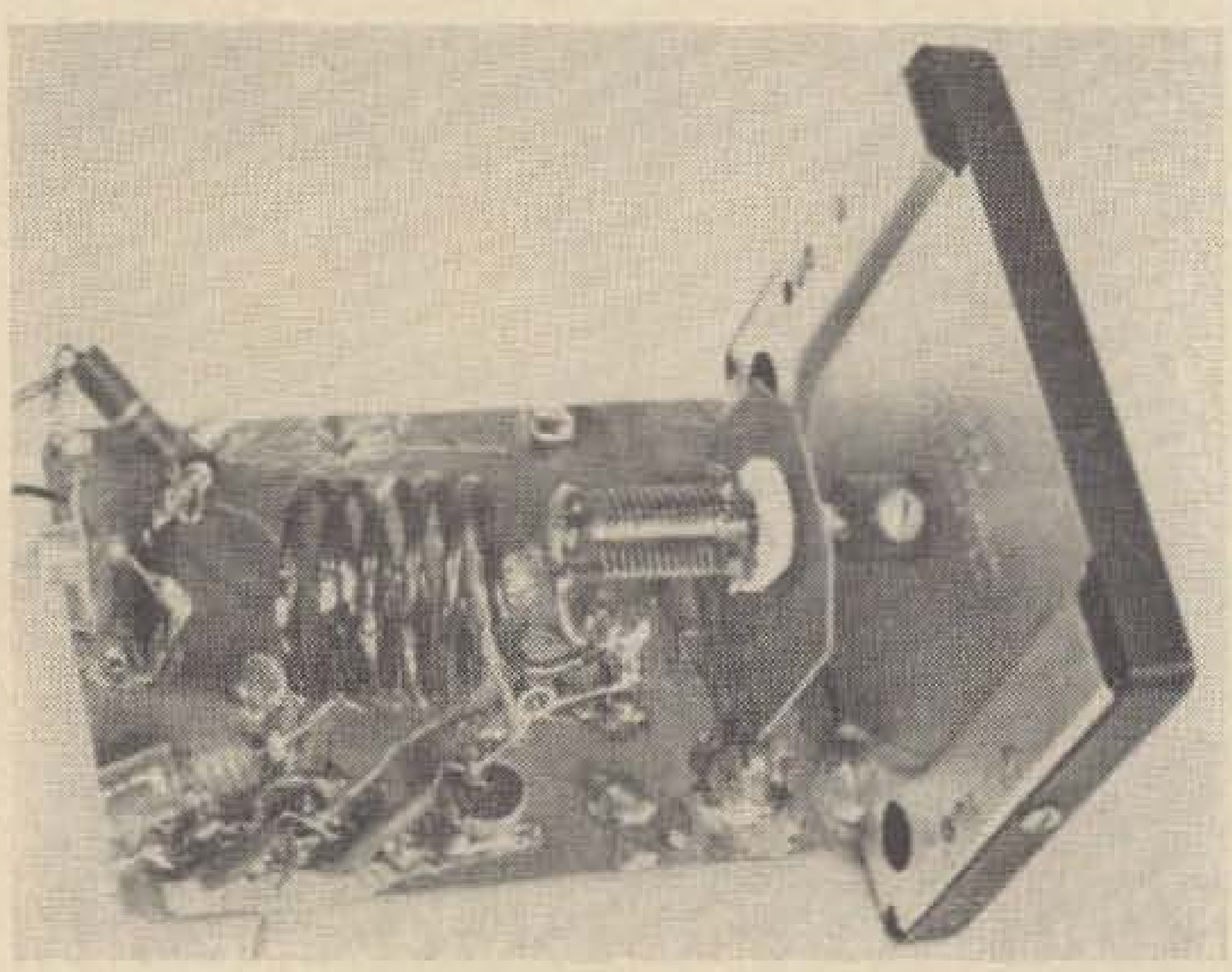
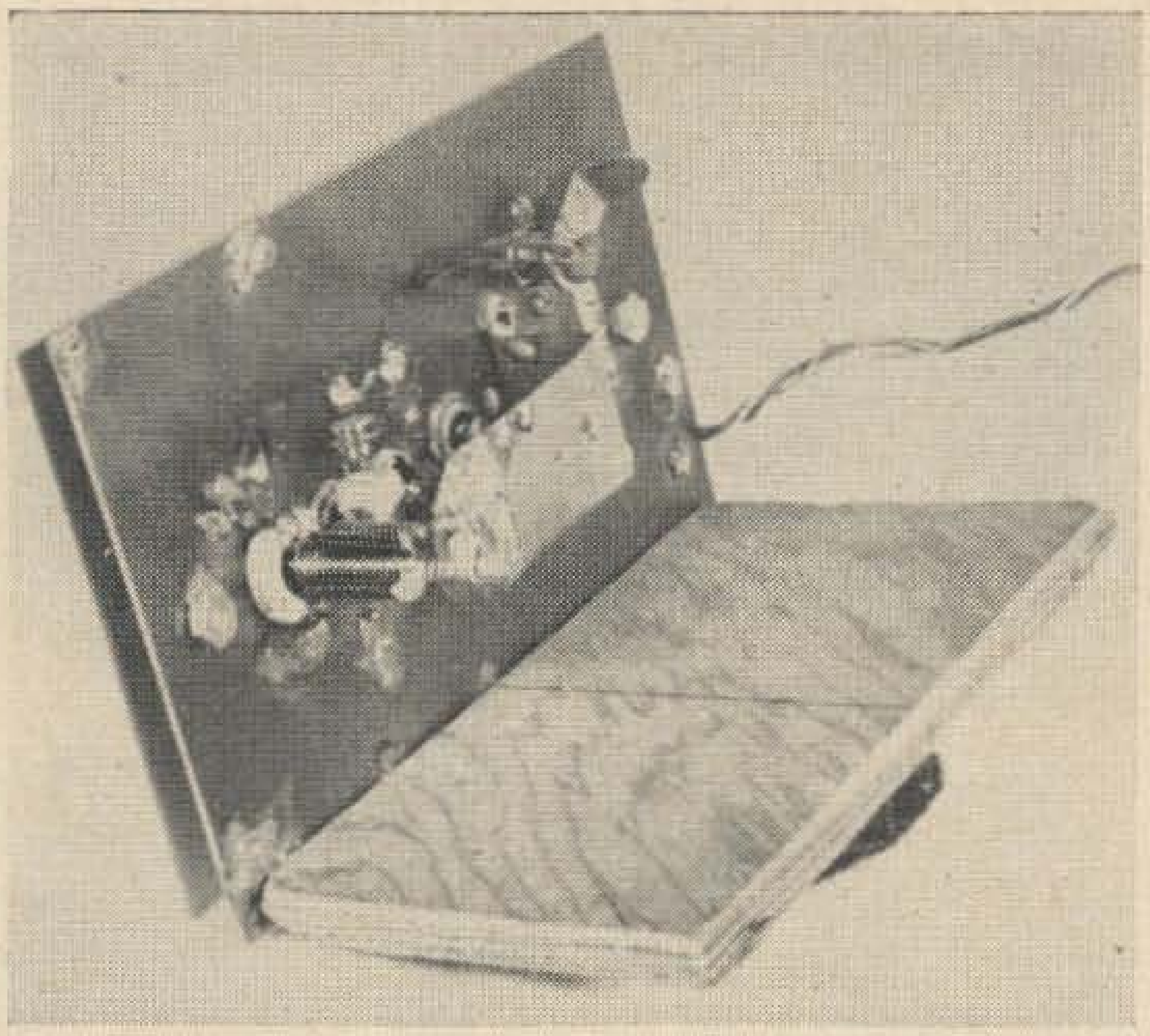


Fig. 1. 28 mc transistor oscillator.



Back view of the 50 mc oscillator shown in Fig. 2.



140-300 mc strap line oscillator.

best results. Use a 1 k emitter resistor (R3) and you are pretty sure not to burn out the transistor. You can reduce R3 for more power, but don't go too far. R1 controls the bias on the transistor base, so I often use a pot there and adjust for best results. Watch the collector current while you do that, though! The $1.15 Sprague 2N1726 does fine here and up to several hundred megacycles. Many other inexpensive transistors will also do.

50 mc oscillator

The circuit of **Fig. 2** works very well with a Sprague 2N1726 on six meters. It's recommended for local oscillator service with a collector current of about 2 ma for a total input of about 18 to 24 mw. Both base and emitter feedback were tried. Both work well, but the base feedback circuit shown seems to give more power. But some makes and types of transistors show greater or lesser variations between the two feedback methods.

Since this is a test oscillator, a front panel with dial was used. Place the one or two turn feedback coil L2 within the first turn at the collector end of L1. A very small capacitance

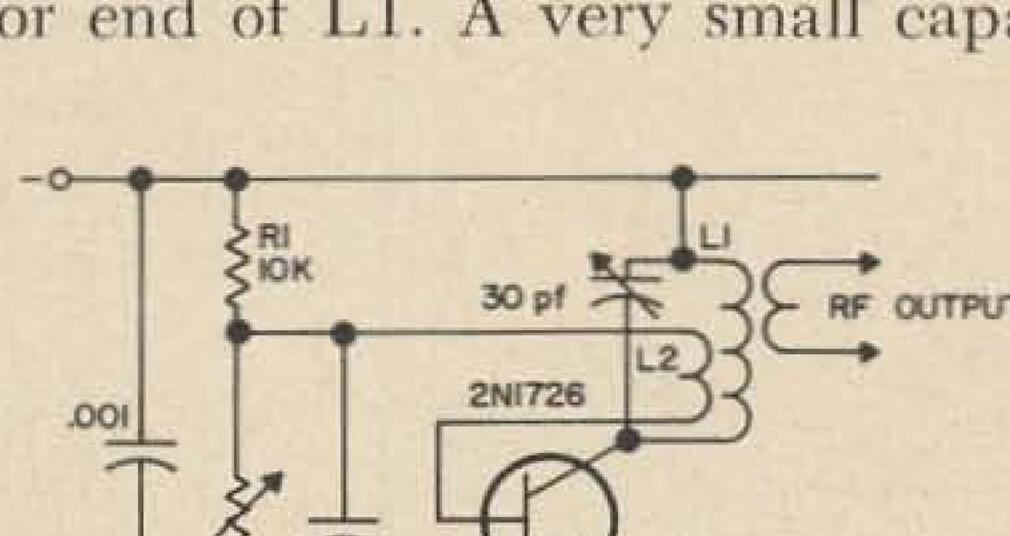


Fig. 2. 40-75 mc oscillator.

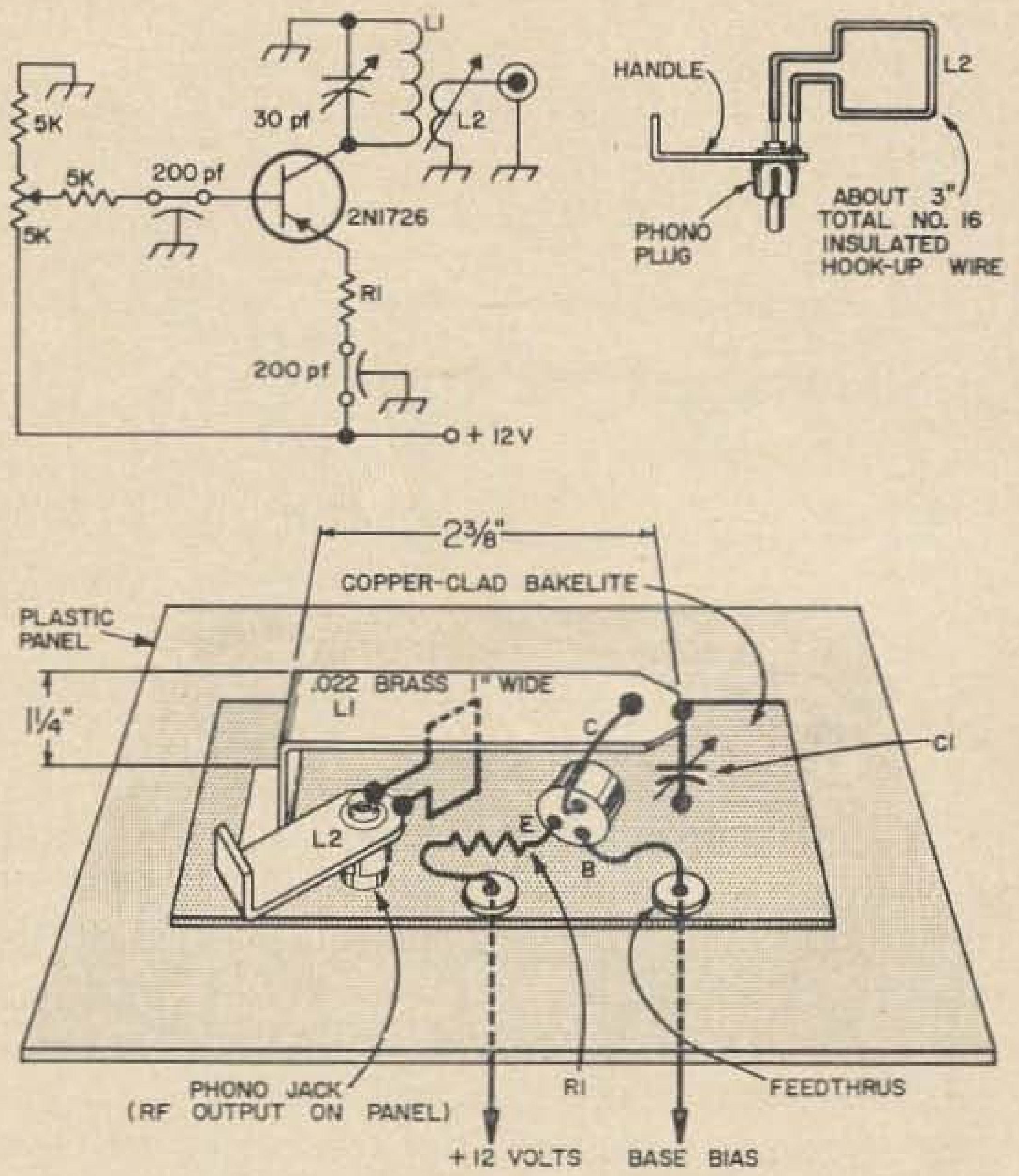


Fig. 3. 140-300 mc strap line oscillator. R1 is 1 k.

(a short length of hook up wire) between base and collector helped with some transistors, even though not needed by theory.

This is a very strong oscillator. I was unable to cut it off fully by pressing my fingers around L1. It also oscillates with less than 2 volts at 50 mc. Just for fun, I paralleled the 2N1726 with another 2N1726. Then I connected a #48 pilot bulb across a turn of L1. Collector current doubled nicely and the bulb was lit with a very faint glow. A third was added for an even brighter glow (maybe 70 to 100 mw) with no complications. I also tried a Motorola 2N3266. It lit the bulb with one transistor and two gave more power. Not bad for low power receiving transistors!

140 to 300 mc oscillators

Now we start using strap line circuits. You can use strap wound coils, but strap lines work so well, why bother? **Fig. 3** gives the circuit and layout. What could be simpler or neater? A quarter wave line with the collector across the hot end, base bypassed right through the ground plane, 1 k resistor in the emitter and output jack variable to your heart's desires. A 2N1726 works fine, but a 2N2360 is a little livelier at 300 mc. Note that you can put the base bias pot on the panel or in a separate box. This unit was left in the open, but could be put in a box like the next oscillator.

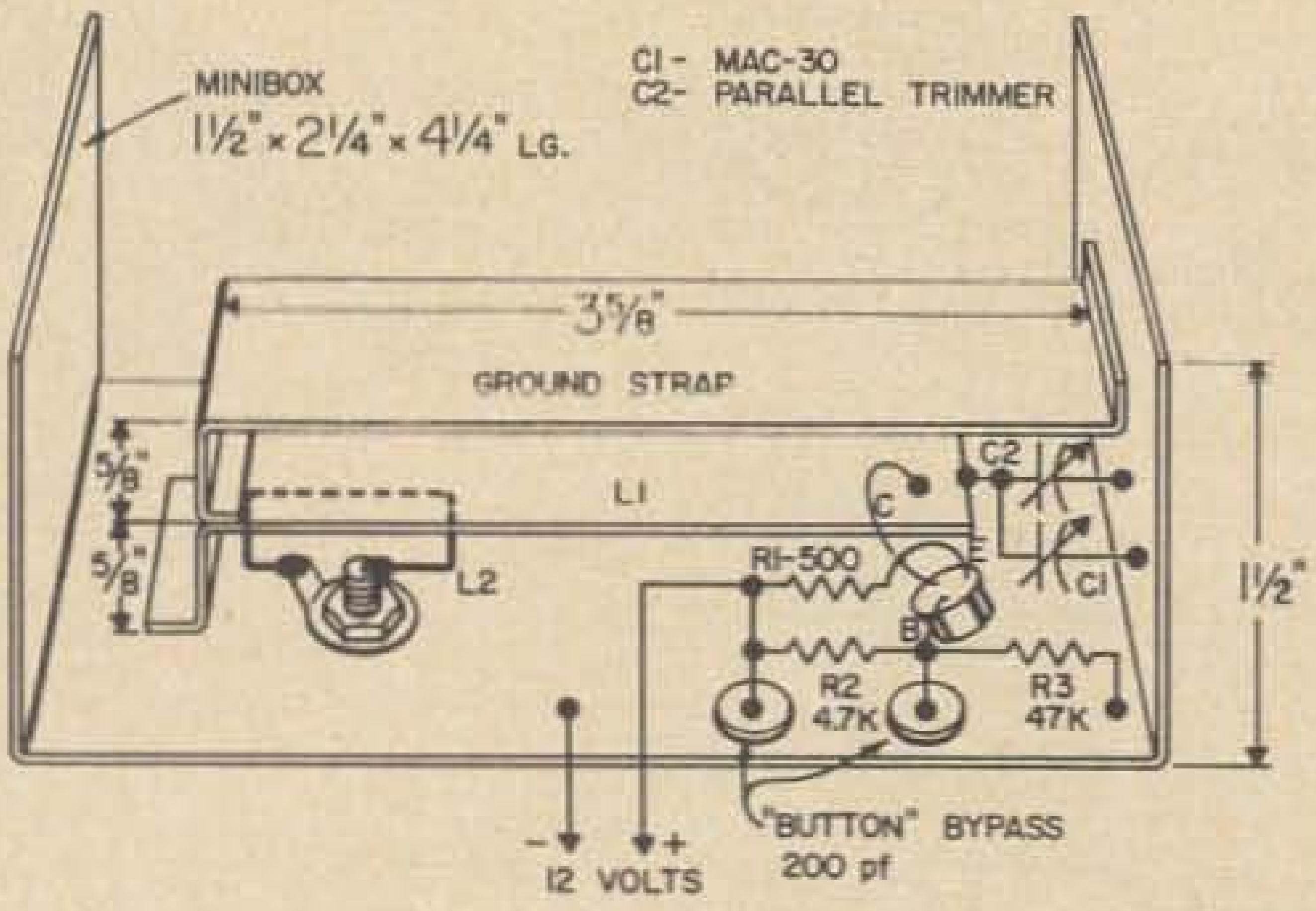
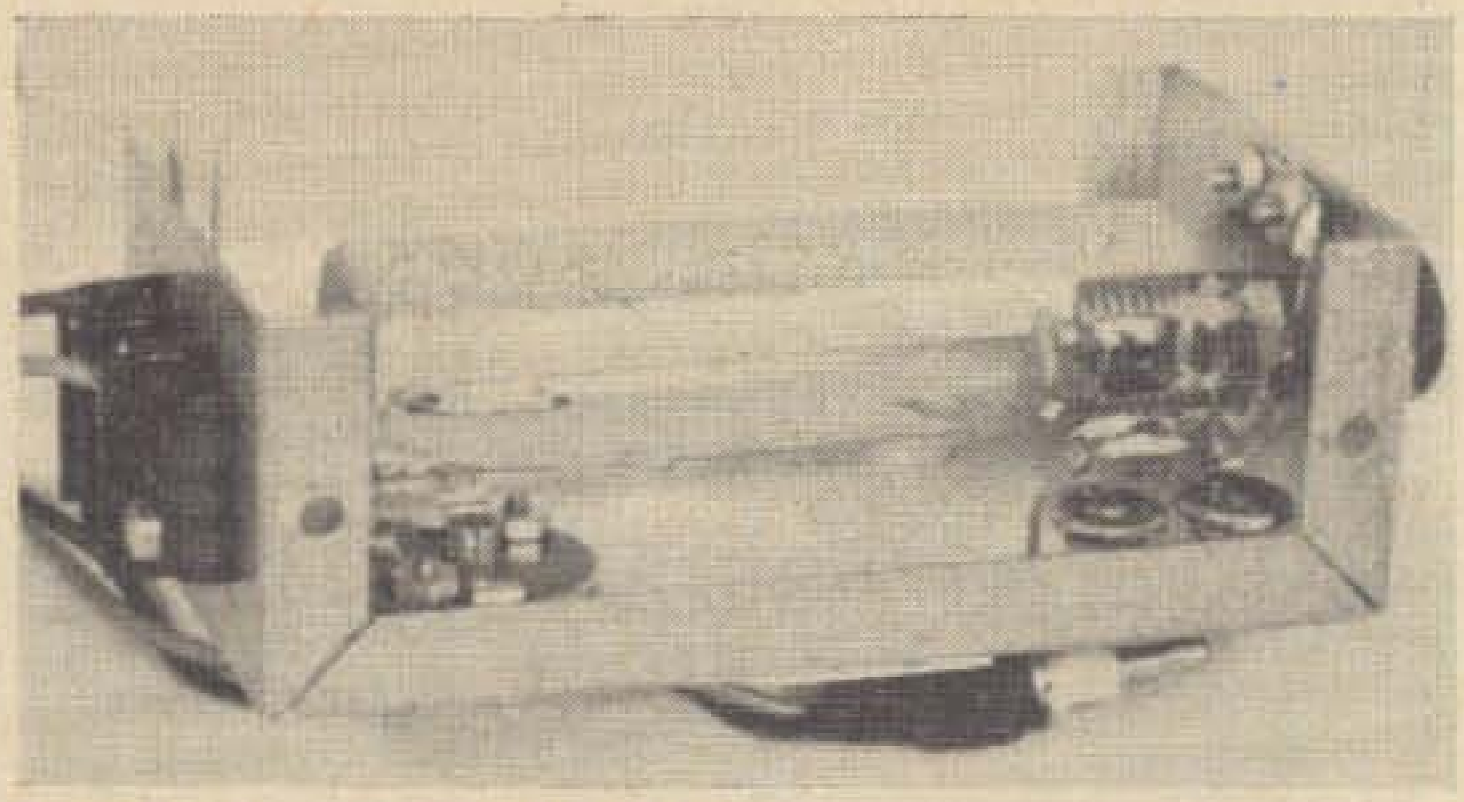


Fig. 4. 250 to 500 mc boxed oscillator. C2 is about 5 pf.



250-500 mc boxed oscillator.

A real simple gimmick for variable output is shown as a detail in **Fig. 3.** It's the output link L2. You can use a panel in front of the copper clad bakelite and mount a phono jack on it for removing RF. Stability of the oscillator is quite good. You can even get a clean beat with a communications receiver BFO as tuned in with a two meter converter. Just don't bang the table!

250 to 500 mc oscillator

Fig. 4 shows an oscillator tuning 250 to 500 mc. The same type of circuit will go up to around 700 mc with a little fussing. You can bandspread it anywhere in the region with the use of C2, about 5 pf, by dropping the value of C1. The emitter resistor is reduced to 500 ohms for a little more gain to overcome increased losses at UHF. The circuit is similar to the one in **Fig. 3,** except for the added encircling ground strap, which was discussed in last month's article. At these frequencies, the 2N2360 works very well. You can put this oscillator in a Minibox if you wish, with the battery in another box. Don't ground either side of the battery, though, or you may run into problems with PNP and NPN transistors. The 2N2360 runs at about 2 ma collector current.

850 to 1100 mc half wave oscillators

Just like in the 6AF4 tube oscillators in the 1215'er (May 73, page 72), at a certain frequency you have to abandon quarter wave lines and go to half wave straps, two of them: one for base and one for collector. This oscillator is shown in **Fig. 5.** It tunes 860 to 1120 mc as shown. Attach the collector and base resistors (R2 and R1) to the lowest points of rf. You can find them by placing an untuned detector near the tuned circuit with temporary connections and touching the lines with a pencil point. Attach the resistors where the pencil has least effect on output. The construction of this oscillator is quite experimental. I didn't use a ground plane but just a plastic base and capacitor support.

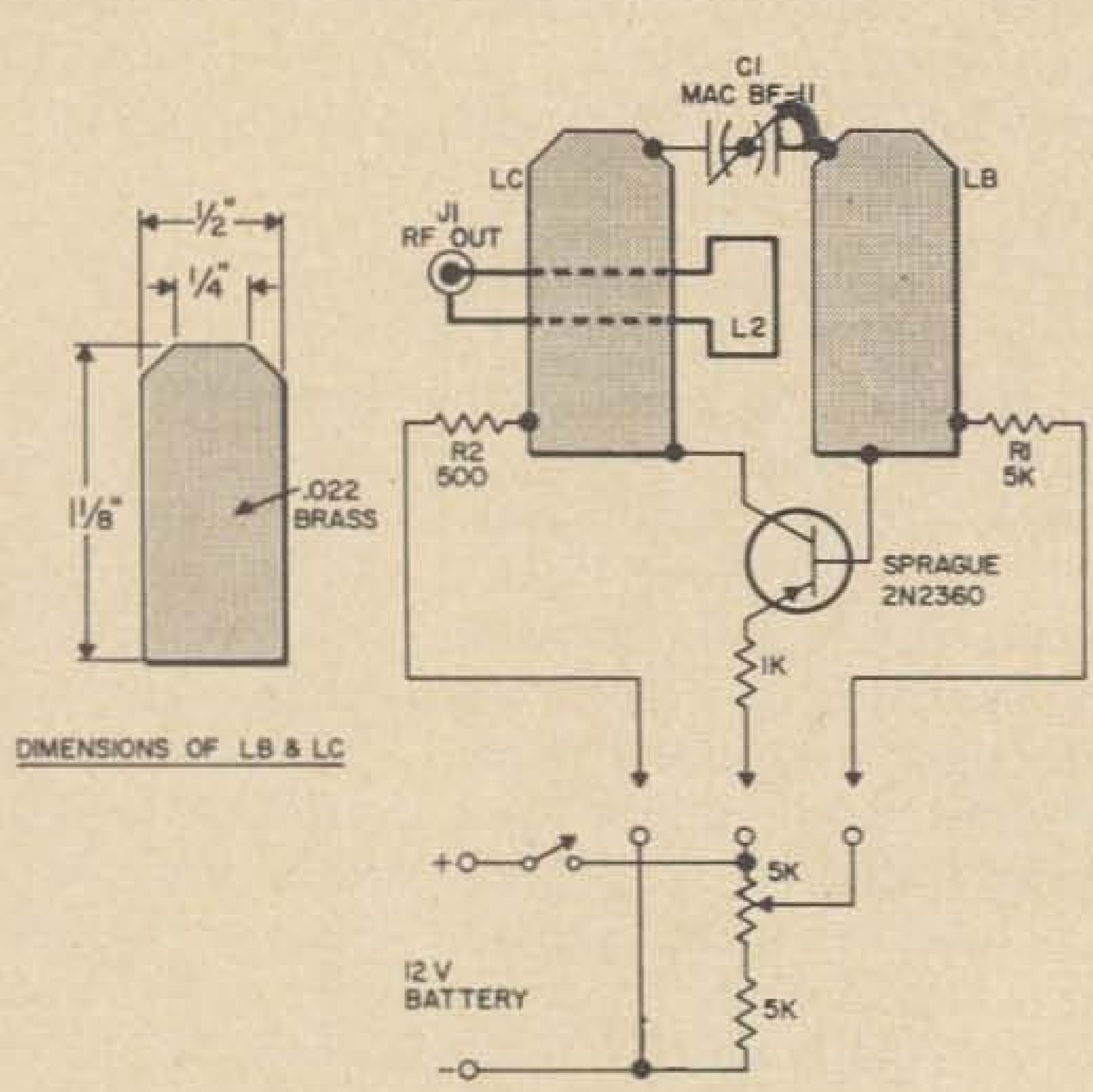


Fig. 5. Experimental 850 to 1100 mc half wave oscillator.

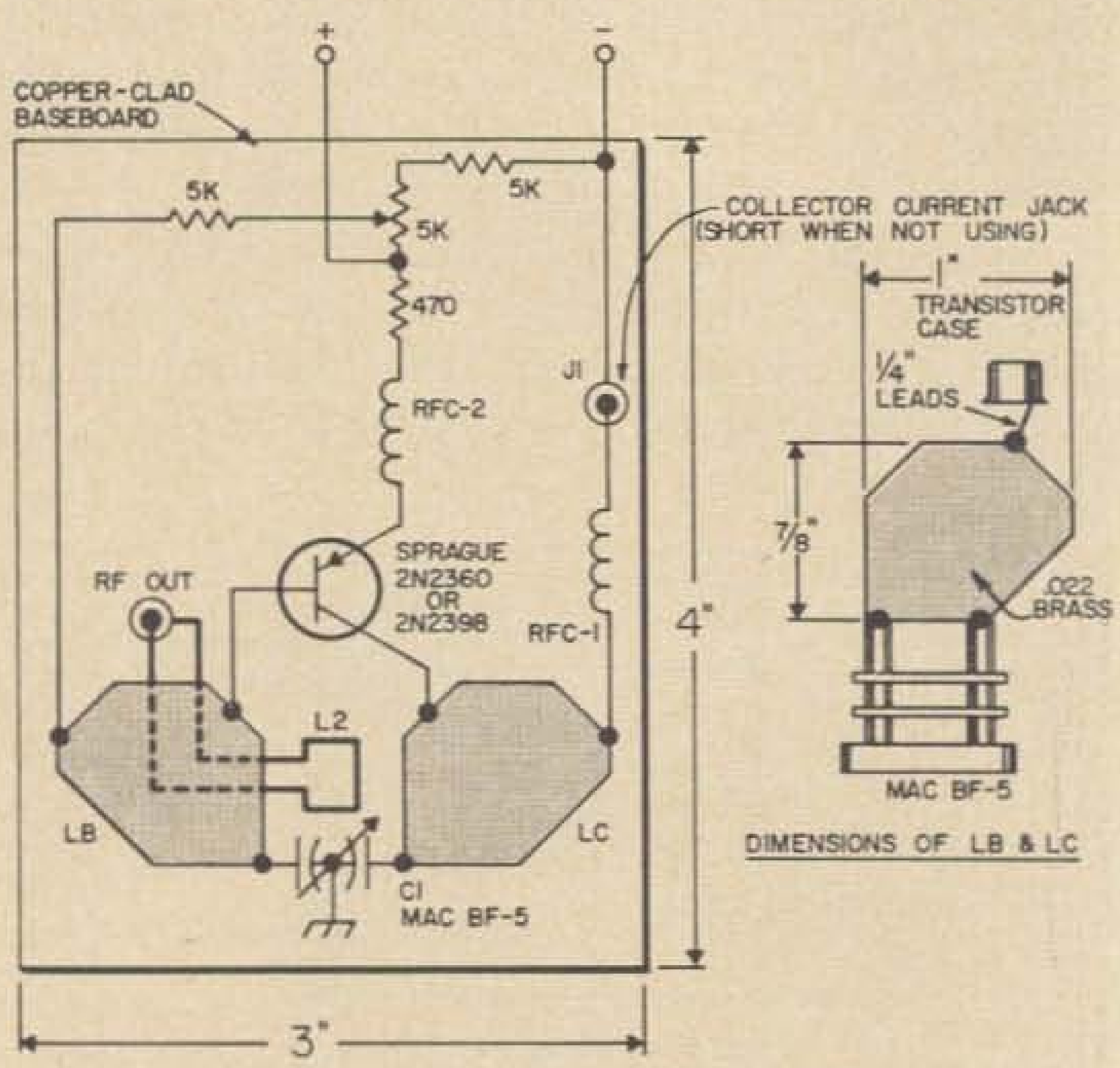
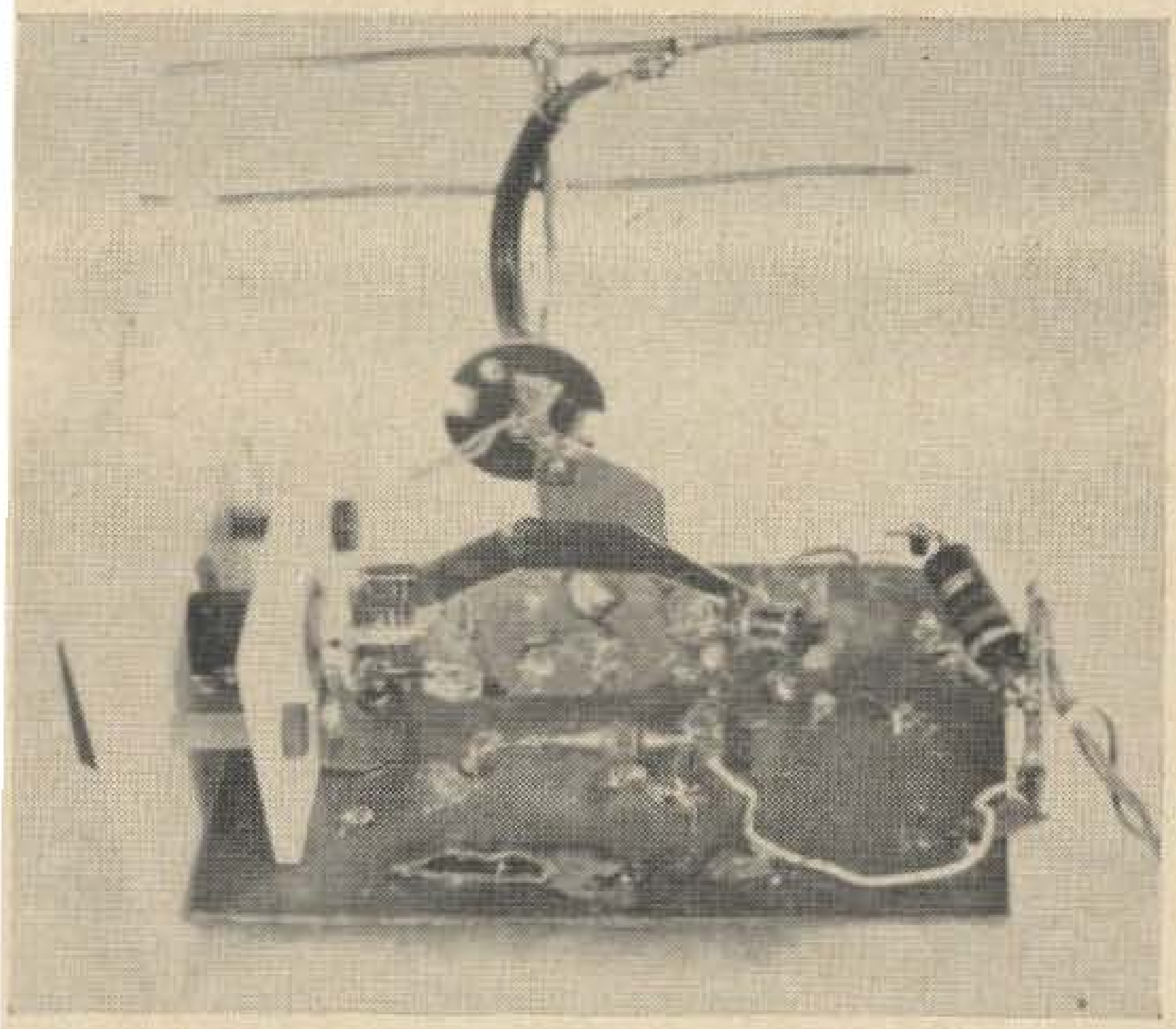


Fig. 6. Open 1200-1300 test oscillator. See text for RFC1 and RFC2.



Open 1200 to 1300 mc oscillator. The antenna is for test use.

1200 to 1300 mc oscillator

This oscillator, shown in **Fig. 6**, is an open type which is used here for generating signals, antenna testing, etc. It is similar to the one shown in **Fig. 5**, with changes to bring it up the 1200 to 1300 mc region. RFC1 brings the DC to the collector with less loss than the previously used resistor. RFC2 is a little touchy. I have used bare wire, strap, chokes, etc. Use a small coil or what you want. You'll probably have to adjust it for best results. I ended up with 1¼ inch insulated wire. You can tune it for best output by mov-

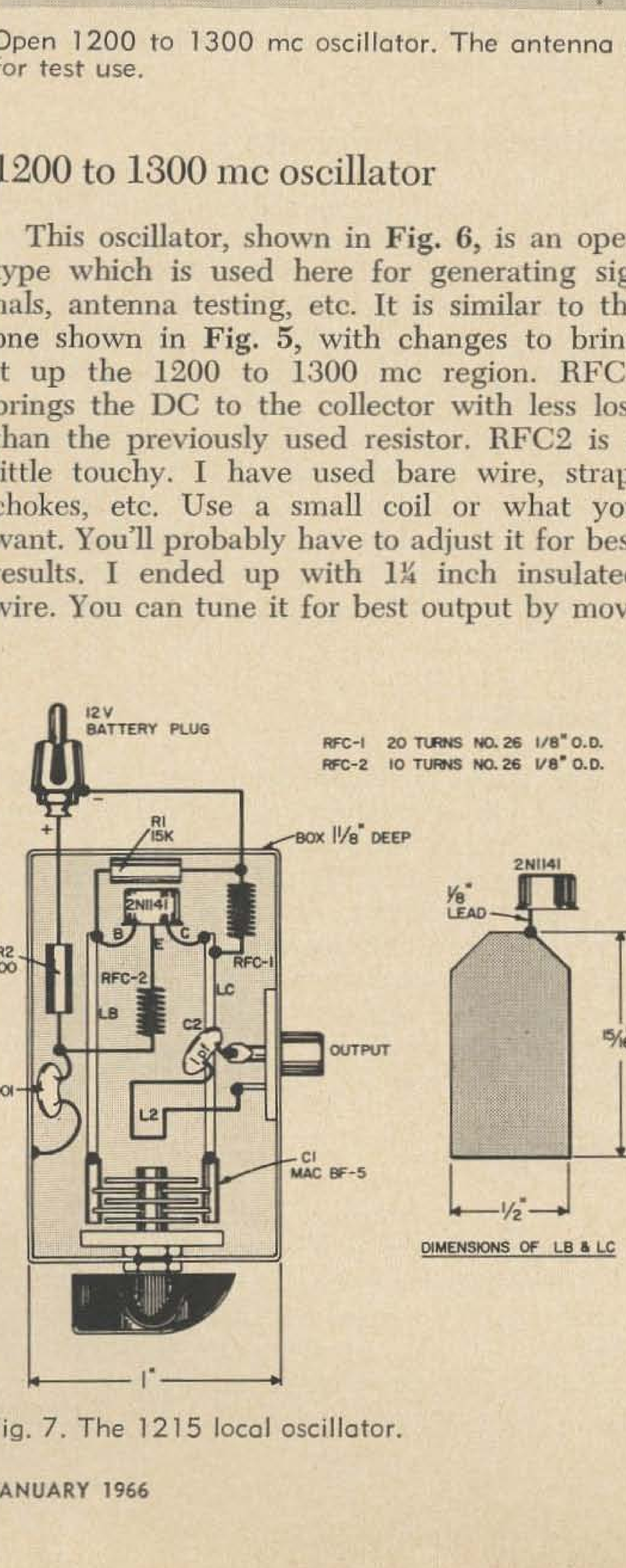


Fig. 7. The 1215 local oscillator.

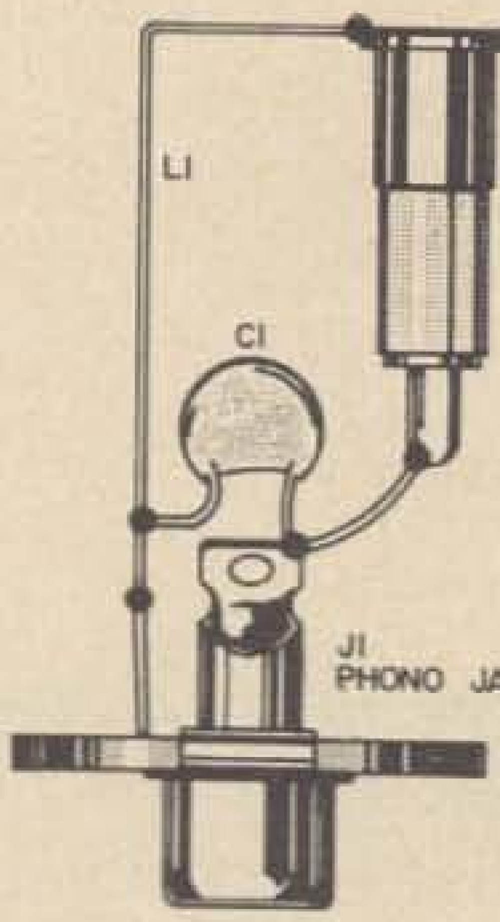
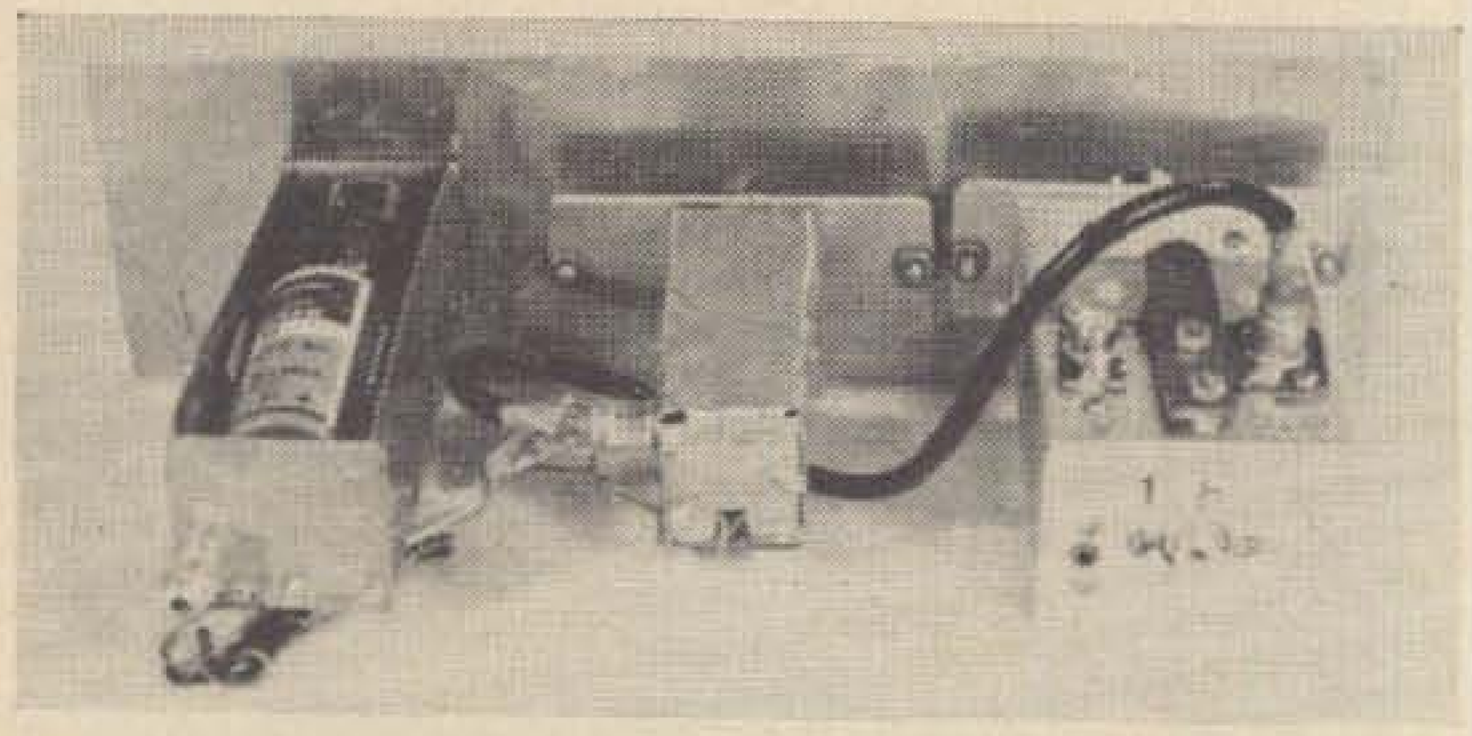


Fig. 8. UHF untuned detector. C1 can be 100 to 1000 pf.



Back view of the battery case, local oscillator and mixer of the 1215 superhet.

ing a small square of copper foil near and up it. Do this while watching an RF meter, such as the one described later in the article. LC and LB are spaced half an inch from the base plate and 5/16 inch from each other. C1's ground connection is a half inch wide copper strap about ⅜ inch long. The shortest possible leads were used on the transistor. I use very small pliers to hold the leads close to the case and have had no trouble so far.

The RF output jack should be mounted on a piece of insulating material, as this circuit is quite touchy about any metal connected to the base board near the lines. You can see that 2¼ inch wire is a quarter wave vertical antenna at 1300 mc and pieces of metal will absorb power like a sponge. Don't go over about 2 ma. Remember that the total dissipation of the 2N2360 is 60 mw.

Solid state local oscillator

This is the main feature of the article and will be concerned with the physical details of packaging the oscillator of **Fig. 6** in a small box. A 2N1141 was used in the local oscillator shown in **Fig. 7**. It has a higher capacitance than the 2N2398 or 2N2360, so LB and LC get real short. You could also use a 2N2398 and longer lines.

I built it in a .022 brass box. I didn't bend the brass, just soldered it together. The operation is similar to the last two oscillators, but collector current can be as high as 4 or 5 ma. You can adjust R1, but make sure that you keep at least 5 or 10 k in series with the battery. Don't want to blow out more good transistors.

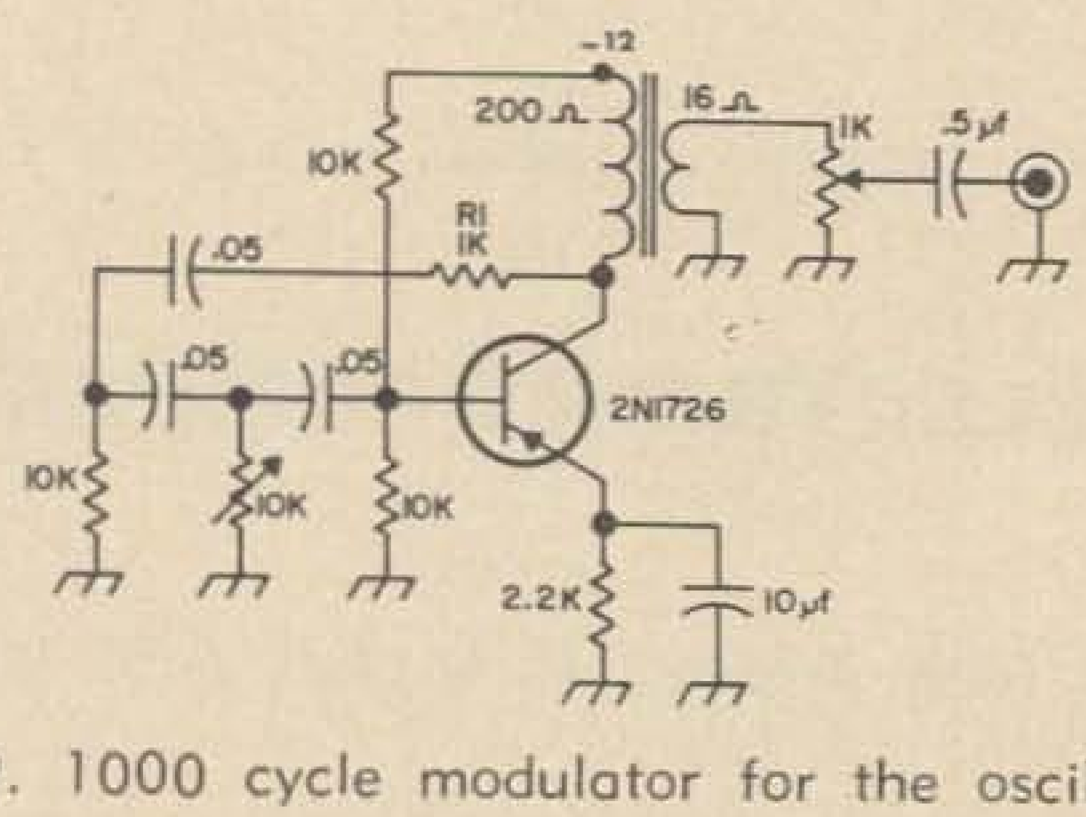


Fig. 9. 1000 cycle modulator for the oscillators.

Untuned UHF detector

Here's a useful gimmick shown in **Fig. 8**. It's an untuned detector that consists mainly of a 1N23 type crystal diode detector. C1 is a tiny Lafayette capacitor. Measures just over ⅜ inch square. It can be any value from 100 to 1000 pf. It does a fine job from 420 to higher than I've been yet. L1 has a total of less than one inch. I soldered right onto the crystal case—though I'm sure that the engineers who designed it will turn over in their graves! I generally use it with a large dial 0-500 µa meter with the detector about half an inch from the oscillator lines. It's quite sensitive.

Modulator

The audio oscillator shown in **Fig. 9** does a good job of modulating the RF oscillators shown. It has an adjustable frequency trim for centering on 1000 cycles, which is used by some test equipment. It also has a volume control on the amount of modulation. The .5 µf coupling capacitor will drive the base of the transistor without modifying the base voltage. This oscillator seems to work better than any other one I found.

Conclusion

This article has described a number of useful transistor test oscillators. One is used as the local oscillator for the 1215 superhet receiver that I've been describing. The final installment of the receiver, the *if*, audio and assembly, will be covered next month.

. . . K1CLL

Paul Franson WA1CCH
Peterborough, N.H.

Vibrator Checker

Most hams would like to have a spectrum analyzer, twelve gigacycle wavemeter, and 5 kw dummy load for 420 mc. Then they could build their own gear instead of making Collins rich. But cost, complexity, and infrequent use keep them from owning the above, as well as some more exotic test gear. Here's a piece of test equipment that you won't use much, but it's so simple and cheap that it's silly not to build it. It checks vibrators (as you know if you read the title).

Parts List:

- 1 vibrator (4 pin) socket.
- 2 # 51 or similar pilot lamps.
- 2 grommets.
- 1 case (use your imagination!)

Obviously, if you use another type of vibrator, you have enough sense to use another socket. You don't need lamp sockets, mount them in grommets and solder to the terminal and shell. A built in voltage source (a 12 volt center tapped transformer) is ideal, but hardly necessary. You can steal the voltage for the short time you'll need it. **Fig. 1** gives the circuit.

Interpretation of results and Testing procedure: Attach the proper voltage source (6 volts for a 6 volt vibrator, *etc.*) Plug in vibrator.

1. If the two lights are of equal brilliance, it's good.

2. Uneven brilliance. Questionable. Hit on table a few times or use twice normal voltage for a minute or two.

3. One or both lamps dark. Try procedures under *2*. If no luck, put in power supply you're about to trade. If you can't unload it, open carefully with pliers or teeth. If the reed is stuck, unstick. Try again in tester. If contacts are dirty, clean carefully with suitable abrasive (wife's nail file, emery board, a two dollar bill, *etc.*) Try again. If still no luck, you've got a 4 prong male plug, a puller for miniature tubes, a shield can or ashtray, plus! some ceramic or other insulators and some fine wire. If there are three insulators and enough wire, you've got a dipole that is excellent if your transmitter causes TVI and you want to hide the antenna.

Finally, if you've had to play around to get the vibrator to work, you shouldn't use it in critical equipment. All vibrator manufacturers advise you not to try to fix or adjust vibrators (After all, they want you to buy a new one!) But they're fine for most ham use. And even a bad vibrator is good for generating hash to adjust noise limiters and ratio detectors. So build it up, get some vibrators (perhaps from a local repair shop) and then you can brag about your interest in building and the technical side of the hobby.

. . . WA1CCH

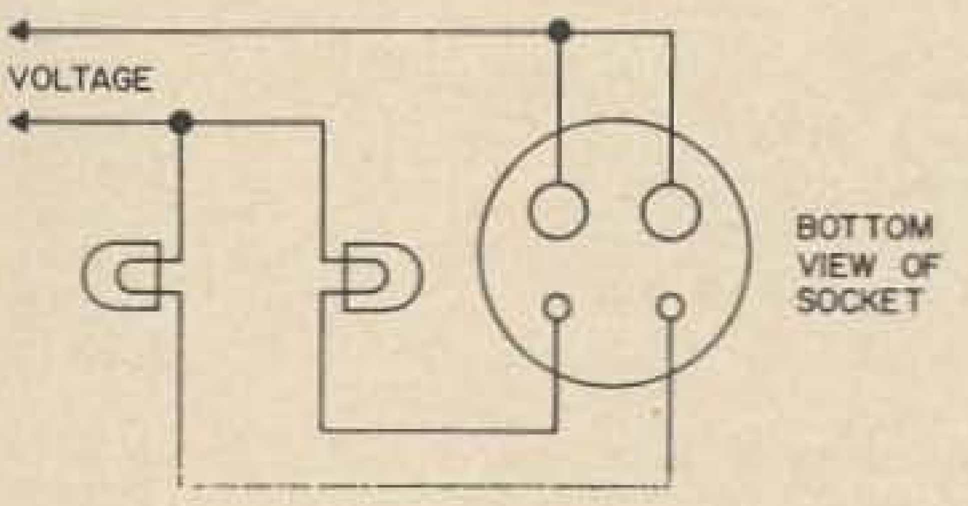


Fig. 1. Schematic of the vibrator checker.

HOT SCOOP: The Texas Instruments TI-XMO5 germanium PNP mesa transistor selling for 52¢ apiece in single quantity is consistently the quietest 432 rf stage we have seen in transistors selling for under $15. See an upcoming article in the VHF'er for details.

. . . W1OOP

Henry Cross W1OOP

Low Noise UHF Transistors

Here is a list and graph I have compiled of all the UHF RF stages that I have been able to get data on. The high priced items seem to me to give us a taste of what we'll be getting for a couple of bucks by 1968.

So far, we can say:

1. Transistors are quieter than tubes above 150 mc.

2. Transistors are quieter than crystal mixers below about 800 mc (unless you are very rich, in which case read 1200 mc.)

3. Germanium or silicon—it's a toss-up in practice.

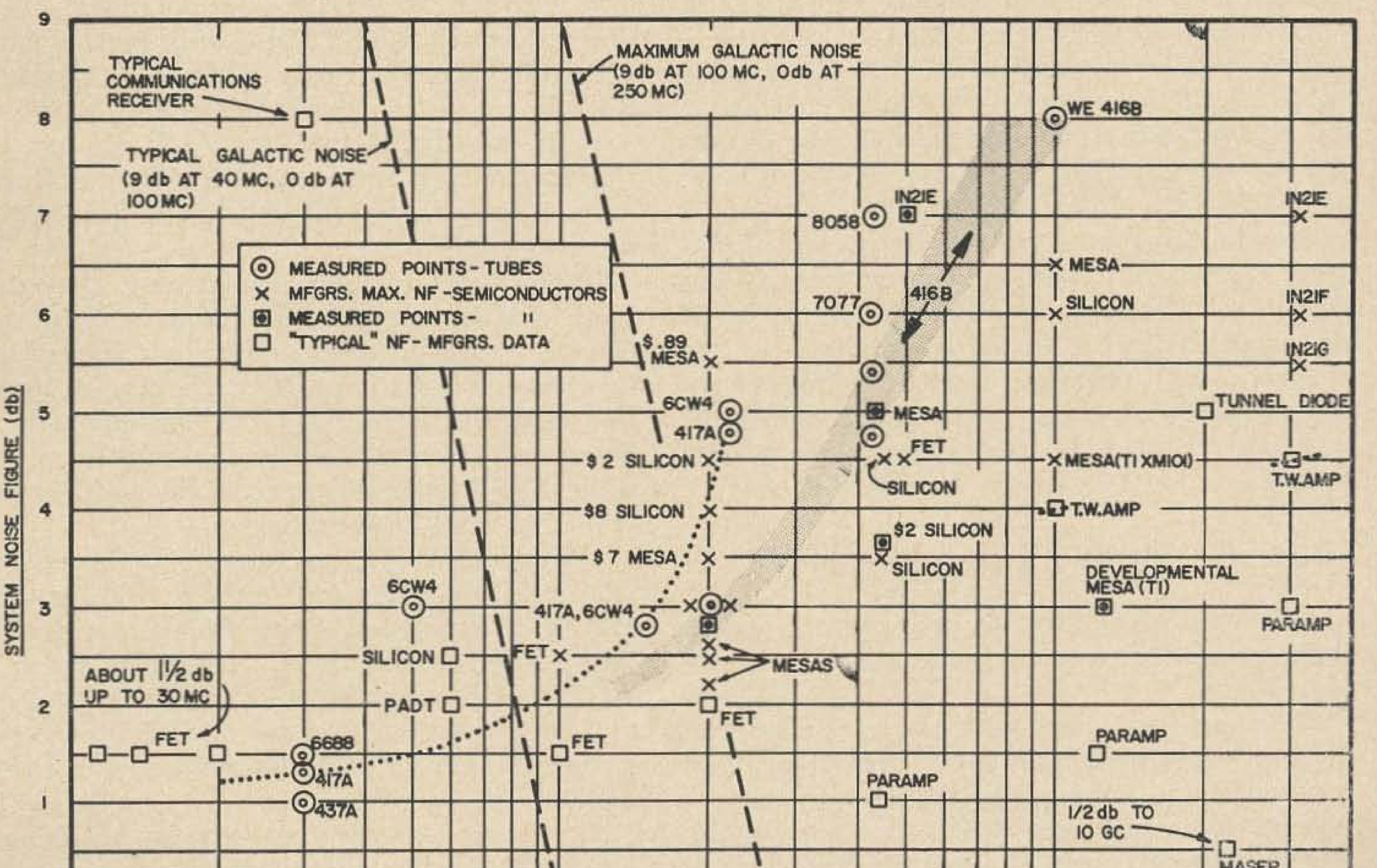
. . . W1OOP

Current UHF Low Noise Transistors

Mfg.	Type	Wrk Col Volts	Max NF 200 mc	Other info	Price
A. PNP Germanium (mesa)					
TI	XM101	9	2.6	4.5 db max NF 1 Gc	19.00
MOT	2N3783	10	2.2	6.5 db max 1 Gc	45.00
MOT	2N3784	10	2.5	7.0 db typ 1 Gc	30.00
MOT	2N3785	8	2.9	7.5 db typ 1 Gc	15.00
MOT	MM2503	6	3.0	2.4 db typ 200 mc	26.25
MOT-TI	2N2415	6	3.0	2.4 db max 200 mc	26.25
TI	2N2999	6		7 db max 1 Gc	75.00
TI	2N2998	6		8 db max 1 Gc	52.50
TI	2N2997	10	4.5		3.38
TI	2N2996	6	5.0		1.48
MOT	2N3279	10	3.5	2.9 typ	7.50
MOT	2N3280	10	3.5	2.9 typ	6.75
MOT	2N3281-2-3	10	5.0	4.0 typ	4.50-4.05-2.10
MOT	2N3307	10	4.5	Silicon PNP. OK to 25 v CE & 100°C	10.50
Philco-Sprague	2N2398-9	10	4.5	Different packages	3.45-3.35
TI	TI-400	6	5.5	4.5 db typ 200 mc	89¢
Amperex	2N3399	10		5 db typ 400 mc	2.55
B. NPN Silicon. Mostly diffused planar.					
KMC-RCA	2N2857	10		4.5 db max 450 mc	18.00
KMC	2N3683	10	4.0		8.00
KMC	2N3880	10		3.5 db max 450 mc	
RCA	2N3478	10	4.5	2.5 db typ 60 mc 5 db typ 450 mc	1.90
TI	TIX3015	10	—	2.4 typ 200 mc 6 typ, 7 max 1 Gc	high
Fairchild	2N3339	10	5.5	—	18.00
Fairchild	SE3001	6	—	—	75¢
C. FET's					
KMC	K-1001	10	4.5	4 db typ. Source stepped up to 200 ohms	30.00
KMC	K-1201	9	—	4.5 db max 450 mc	63.50
KMC	K-1501	15	5	—	—
TI	2N3823	15		2.5 db 100 mc 4.5 max 500 mc	12.90

FET's are high input impedance low transconductance devices. The K-1001 could be used in place of a vacuum tube in some circuits, though its gain is about 6 db lower than a 6CW4.

Mfg.	Type	Wrk Col Volts	Max NF 200 mc	Other info	Price
D. Tubes					
	6CW4	70		5 db typ 200 mc	2.23
	416B	250		5 db typ 450 mc	54.00
	7077	150		6 db typ 450 mc	33.75


TYPICAL COMMUNICATIONS RECEIVER
TYPICAL GALACTIC NOISE (9 db AT 40 MC, 0 db AT 100 MC)
MAXIMUM GALACTIC NOISE (9 db AT 100 MC, 0 db AT 250 MC)
MEASURED POINTS - TUBES
MFGRS. MAX. NF - SEMICONDUCTORS
MEASURED POINTS - "
"TYPICAL" NF - MFGRS. DATA
WE 416B
IN21E
8058
MESA
7077
416B
SILICON
IN21F
IN21G
$.89 MESA
6CW4
417A
MESA
TUNNEL DIODE
$2 SILICON
FET
SILICON
MESA(TI XMI01)
T.W.AMP
$8 SILICON
T.W.AMP
$2 SILICON
$7 MESA
SILICON
DEVELOPMENTAL MESA (TI)
6CW4
417A, 6CW4
PARAMP
SILICON
FET
MESAS
ABOUT 1½ db UP TO 30 MC
PADT
FET
FET
6688
417A
437A
FET
PARAMP
PARAMP
1/2 db TO 10 GC
MASER
SYSTEM NOISE FIGURE (db)
FREQUENCY (MEGACYCLES)
0
1
2
3
4
5
6
7
8
9
30
100
144
220
432
800
1000
2000
3000
4000

NEWS FROM THE INSTITUTE OF AMATEUR RADIO

Compiled by A. David Middelton W7ZC, Secretary

Institute Of Amateur Radio

The big news of the month . . . no, of the year, for the Institute is the appointment by the Directors of David Middelton W7ZC/W5CA as Secretary of the Institute. One of the major problems suffered by the Institute was the dependence on me for getting letters to Congress, letters to members, and all the other important work of the Institute done. Now, with Mid at the helm, ably directed by our Directors, the Institute will enter 1966 in a very strong position.

Mid has an interesting background that he brings to the position of Secretary. He is a senior member of IRE, the First Vice President of AREA, a member of the OOTC, the Morse Telegraphy Club, and ARRL since 1923. He is a past Director of the League and an ex-editor of QST. The list of his activities could go on for several pages for he is interested in many things and has taken an active interest in many projects and clubs. He has been licensed since 1921 and held the Extra Class license since 1928.

Mid will be preparing the letters to Congress about Amateur Radio and coordinate the representation of amateur radio in Washington with our Directors there. Mid will keep in touch with Institute members through a series of confidential letters giving the inside dope on what is really going on behind the scenes and through a more general series in the monthly report in 73 Magazine.

Most well informed amateurs throughout the world are looking anxiously to the Institute and to Mid for the preservation of our hobby.

Open Letter to all Readers of 73

It is with great joy and pride that I accept the post of Secretary of the Institute of Amateur Radio.

It is my hope that with the guidance and help of the IoAR Directors, combined with assistance and suggestions from every one of you vitally concerned with Amateur Radio, that I may carry out the complicated task of implementing the work of IoAR.

Those of us charged with the administration and organization of the Institute can only lay the ground work and set the stage for its full operation and the utilization of the Institute's potential capabilities. The actual "performance" must be given by IoAR members and supporters. And, that is where YOU, the readers of 73 may assist.

Institute Members will regularly receive, thru direct mail, detailed reports of the IoAR, and space in 73 will be devoted to generalized information on the overall workings of the IoAR that effect the whole body of Amateur Radio.

If you are not now a member of the Institute, and if you are thoughtful about the present and future status of your chosen hobby—Amateur Radio—then we heartily welcome you to our ranks. If for any reason you choose not to become a member of IoAR, please study the contents of these official IoAR columns in 73. Rely upon such information as being factual—regardless of what you may hear or read otherwise. It is our intention to present FACTS and only facts regarding IoAR and its relationship with Amateur Radio.

It is our hope that you will do us the courtesy of *non-prejudicial* thinking until you have digested the official IoAR information presented.

Correspondence concerning any phase of IoAR activity or Amateur Radio will be welcomed. Crack-pot and anonymous letters will receive the treatment they deserve—a quick toss into the Round File. All others will be answered as completely and promptly as possible. SASE will be appreciated, as they will save time and IoAR money.

Visitors at W7ZC are always welcomed by my wife Charlet and myself. Living only 1000 feet from State Road 15 leading directly into beautiful Zion Park (2.5 miles north of W7ZC) we are fortunate to have many hams and their families stop by. Zion Park is open all year round and is fabulously scenic at any season.

If you get out this way—stop by W7ZC and we'll talk about at least two things of mutual interest—The IoAR and Amateur Radio!

IoAR—Totally Dedicated to the Betterment and Preservationof Amateur Radio.

Meanwhile, watch for W7ZC on the bands, on both CW and SSB as I will continue to be as active as possible along with my duties as Secretary of the Institute.

. . . W7ZC/W5CA

Progress Report–the IoAR to Date

A brief history of the Institute is in order.

The IoAR was founded on August 28, 1963 by a group headed by Wayne Green, who believed that Amateur Radio needed to be better represented and that only by providing direct public relations information to those who rule over our destiny, (the governmental agencies and public officials) could we hope to preserve Amateur Radio.

International friendship and technical achievement thru the medium of Amateur Radio was also in the thoughts of those starting IoAR.

The State of New Hampshire, on April 6, 1964, granted the Institute its approval and charter. The articles of agreement were signed by Mr. and Mrs. Wayne Green W2NSD/1, (he is owner and editor of 73 Magazine) Val Barnes W1ALU; Dan Lester W1AER; and Ted Shapas K9YOE.

The Institute is chartered as a *non-profit organization*, no capital stock is issued, and the official object of the IoAR, as stated in Article 2, is "To further technical achievement and world friendship through the medium of Amateur Radio."

The Institute started in a small way, without fanfare and sans much publicity, even in 73. It grew slowly and gained strength through its activities, mainly that of establishing public relations contact with the entire FCC, Senate and Congressional personnel by direct mail reports on the GOOD side of Amateur Radio. Some ten thousand pieces of such literature have been distributed *where it helps*, by the IoAR.

Response has been gratifying! Many communications have been received from the recipients of this IoAR-originated publicity. Many of these persons had never had any direct information from an Amateur Radio organization and had only received their news second-hand and often distorted.

The Institute established its "Man in Washington," and publicized his availability to answer questions and to supply further accurate information. The IoAR applied for and received *official* recognition as a lobbyist for Amateur Radio, and continues to file the required reports to maintain its legal lobbyist standing.

Important IoAR Addresses

For all correspondence except that regarding membership and supplies:
Institute of Amateur Radio
Springfield, Utah 84767

For membership correspondence and IoAR supplies:
Institute of Amateur Radio
Peterborough, N.H. 03458

No other Amateur Radio organization is officially recorded as a lobbyist, and therefore none other than IoAR can legitimately REPRESENT Amateur Radio in Washington circles, nor can they legally expend money to lobby for Amateur Radio in *any form!*

The Institute so far has been busy with activities that have not had much direct effect on individual members. This is acknowledged and deeply regretted, but was unavoidable due to lack of personnel, finances and pressure of other duties on Mr. Green, and on many of his associates.

A group of nine INTERIM DIRECTORS was chosen for the IoAR. They are–Bill Ashby K2TKN; Wells Chapin W2DUD; Lloyd Haslam W3AYA; Maurice Hinden W6EUV; Harry Longerich W2GQY/4; Edwin Schaad WA4PDX; Foy Guin W4RLS and Howard Pyle W7OE. The IoAR Secretary is A. Davide Middelton W7ZC/W5CA.

It should be noted that none of the original signers of the Articles of Agreement (with the State of New Hampshire) are Officers of the IoAR. These signers of the Articles were the *originators* of an idea and some ideals which later became The Institute of Amateur Radio.

The Interim Directors have given council, furnished guidance and advice on every phase and every step of the progress of the Institute.

At the present time, a Constitut.on and By Laws has been hammered out, is being revised for final presentation to the IoAR Members for ratification. It is expected that the C & BL format may be in the mails to the IoAR Members by the time this appears in 73. Following approval by a majority of the members or after any further changes as are made as deemed necessary, it will become effective.

In the meantime, work at IoAR continues apace. Among the first tasks assigned to the new full-time Secretary is the preparation of a descriptive booklet—"IoAR—WHAT, WHY, WHO"—that will contain detailed information on the basic structure, aims, goals, plans and work of the IoAR, both for the present, the immediate and the far-reaching future.

Another task, and one of vital concern, involves the coordination of the activity of the individual IoAR member into the entire IoAR community to better utilize his or her effort to BUILD IoAR and to assist those who have carried the load so far along the way. Another task is the evolvement of ideas along the lines of technological achievement awards; and club and Chapter affiliation with IoAR.

Still other tasks include the never-ending Public Relations releases with a broadened approach and presentation of this vital work; plus the Institute's constant effort to assist in the fight against unjust persecution of Amateurs through local nuisance and ordinance suits!

These are only a few of the things being worked upon at IoAR Headquarters and by individual Directors and members.

The IoAR is doing this work for Amateur Radio and ALL of us will benefit, in one way or another, from these coordinated IoAR efforts on behalf of Amateur Radio. Will you help us?

A Statement of IoAR Policy

This issue of 73 brings to its readers the first in a new and continuing series of official IoAR columns. Wayne Green has generously donated, free of charge, two full 73 pages monthly for the use of the Institute. This space will be used for information of general interest to 73 readers who are potential members of IoAR. Institute Members will regularly receive IoAR reports directly, by mail.

It must be made clear that there is no connection between the policies of 73 Magazine and those of the Institute except that *both* are dedicated to the betterment and preservation of Amateur Radio. There are no officers of the IoAR on 73 and no 73 Staffer is an officer of the Institute. The IoAR policies are completely determined and controlled by its Board of Directors and Members.

The Institute is indeed grateful to 73 Magazine for this welcome space and we hope that the readers of 73 will find the IoAR news stimulating and informative.

Be assured that the content of the IoAR News is completely accurate and that it reflects IoAR views and those of its members. It is suggested that 73 readers review and examine with considerable caution *any* references to IoAR in other publications and check their authenticity and purpose before accepting them as fact!

If you are desirous of reading previous 73 material about IoAR, please refer to the following issues, by date and page: January '63, page 2; Febr. '64, page 4; March '64, page 64; May '64, page 85; June '64, page 92; August '64, page 5; October '64, page 87; Febr. '65, page 2; April '65, page 32; June '65, page 15; August '65, page 88.

For additional information read this and subsequent "News from IoAR" in 73.

IoAR and "Two-Party" Ham Radio

The Institute of Amateur Radio is NOT anti-anything! It is FOR Amateur Radio and has not been created to fight any other group, activity, individual or collection of personalities in Amateur Radio. IoAR plans to establish, to implement and to carry out its OWN programs. It is not a "ME TOO" setup!

If other organizations have programs that are, in the opinion of IoAR, *good* for Amateur Radio—we will strive, to the best of our abilities, to further those programs. However, IoAR intends to establish and maintain its own position—regardless of the action taken by any other group.

IoAR will not knowingly enter into or publicize any assaults upon or comparison with, the *basic* fundamentals of other Amateur groups. IoAR may, naturally and deliberately, take exception to deviations from those *basic* concepts, editorially or politically!

These United States of America have survived and thrived on a multi-party political system. The founders and Founding Members of IoAR believe that such a system is ıg *overdue* in the matter of national Amaır Radio policy-making, leadership and idance.

IoAR upholds the full right of FREE EECH and a FREE PRESS. IoAR deıres its privilege to challenge, at any ıe, any programs or views presented that ɜ inimicable to the underlying principles the Amateur Radio fraternity—those of endship, service and advancement of technological skills!

IoAR will not withhold its support and couragement from any bonafide intra-mural ɔup of Amateurs who are endeavoring to ıke our endeavor more exciting, challengʒ and rewarding through their specialized :erests and efforts such as CHC, countynting, DX, SSB, VHF, nets, and awards.

IoAR does not intend to publicize the ɑtings and ravings of radicals, ignorant, lfish-minded individuals or groups who put eir personal operating desires or habits ove the common good. There is no place IoAR or in Amateur Radio for "sharpooting" or a political King Fish! Let's leave at to the professionals.

IoAR most definitely has no plan or proam to

—Become a GIANT in the Amateur Radio blishing field.

—Control the Amateur Radio advertising ırket.

—Permit usurpance of Amateur Radio freıencies by non-Amateur groups or interests.

—Foster complacency on the part of Amaurs, when our very existence is at stake ru lack of operational and technological ills.

IoAR *does* have definite plans for a proessive program for action at the operational ıd technical levels, designed to *upgrade* the nateur (through educational and explanary measures), which will bring new Amaurs into focus on the proper procedures hereby they too can enjoy and participate the Amateur service in the most efficient ıd proficient manner.

The Institute has a definite plan for recogtion of INDIVIDUAL effort and achieveent along in the Technological phase of nateur Radio.

IoAR is FOR any action and FOR any dividual or any group who is *doing someing* in a POSITIVE manner and direction ıat will enhance and preserve Amateur adio. IoAR welcomes fraternization with oups and programs designed to enhance the chnical or operational aspects of Ham Radio!

. . . W7ZC

Don Miller W9NTP
Waldron, Indiana

What's the Strength of Your Mobile?

There was one time in the ham life of W9NTP when I had $100 per contact invested in mobile transmitters. After years of experimenting, which included a 500 watt mobile AM station, two or three factors became evident which contributed greatly to successful mobile operation. Over this period, mobile contacts became commonplace and many countries of the world were worked. Most of these contacts were made on the crowded 20 meter band where QRM is bad. The three most significant factors contributing to successful mobile operation in order of merit are:

1. VFO operation
2. Field strength indicator in the car working continuously
3. At least 50 watts of power. AM operation was used in most of these contacts, but it goes without saying that SSB or DSB has much advantage.

VFO operation: There is something psychologically in favor of the mobile station who is able to zero beat a CQ from another station. After making hundreds of contacts, I have found that less than 10% are worked by calling CQ from the mobile. Perhaps the fixed station is flattered when the little mobile running along 50 mph hears his signal. If you have any doubts about this, keep track of your contacts for a month and see for yourself. It goes without saying that a stable vfo source is necessary. This is a sizable project for the average ham and apparently for the commercial manufacturers too, since very few commercial vfo's are stable enough to allow use in mobile DSB and SSB operation.

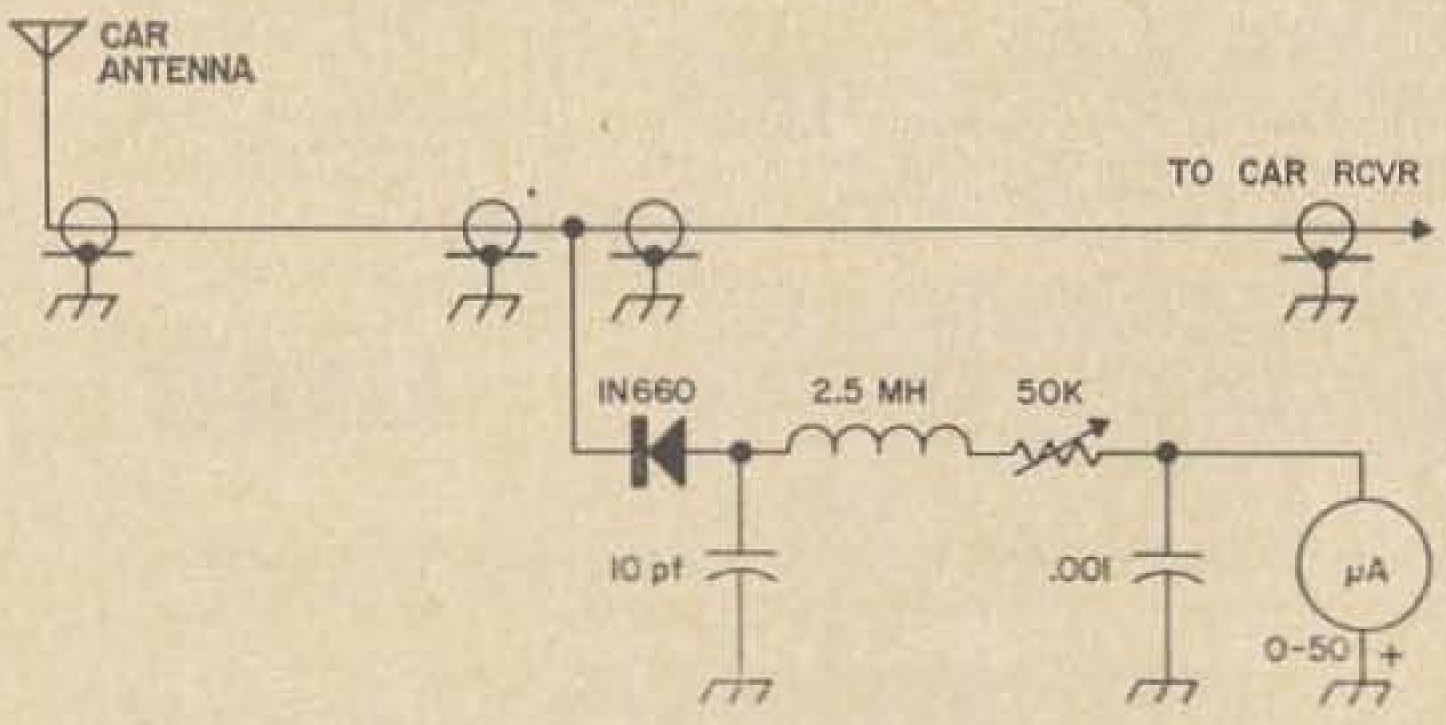


Fig. 1. Schematic of the mobile FSM.

The second factor is field strength measurement. Years ago, I built a combination field strength meter and S-meter for my 1949 Chevrolet. Immediately it became evident why I had failed to get out on some frequencies and it also pointed up the fact that the dip in plate current, so commonly used for tuning, was a poor indicator for maximum output. With a continuously operating field strength meter it is possible to tune for maximum output even if the antenna is near large detuning objects or leaning at a forty-five degree angle due to the forward velocity of the car. On the lower frequencies, seventy-five and forty meters, it will give an indication of how far you can operate from the resonant frequency of your antenna. I have even used the meter indication to tell me the charge state of my battery.

Naturally the obvious antenna to use on the automobile is the broadcast antenna. This is sometimes unused in a mobile installation when a converter is used. Many of us mobilers used the long amateur transmitting whip for broadcast reception when we wanted our injection of Rock and Roll, while the broadcast antenna was used for the field strentgh indicator. Anyone who has tried this with the new hybrid or transistor receivers is due for a shock. My broadcast receiver received a weather station near the *if* frequency so well that it blanked out broadcast stations. I finally decided to use the broadcast receiver with the antenna for which it was intended. If a continuously operating field strength meter is to be installed, it means that a separate antenna will be necessary or a circuit designed to work wtih one of the existing antennas. Since I have three antennas on the car now, the broadcast antenna was chosen to be the combination broadcast and field strength indicator antenna.

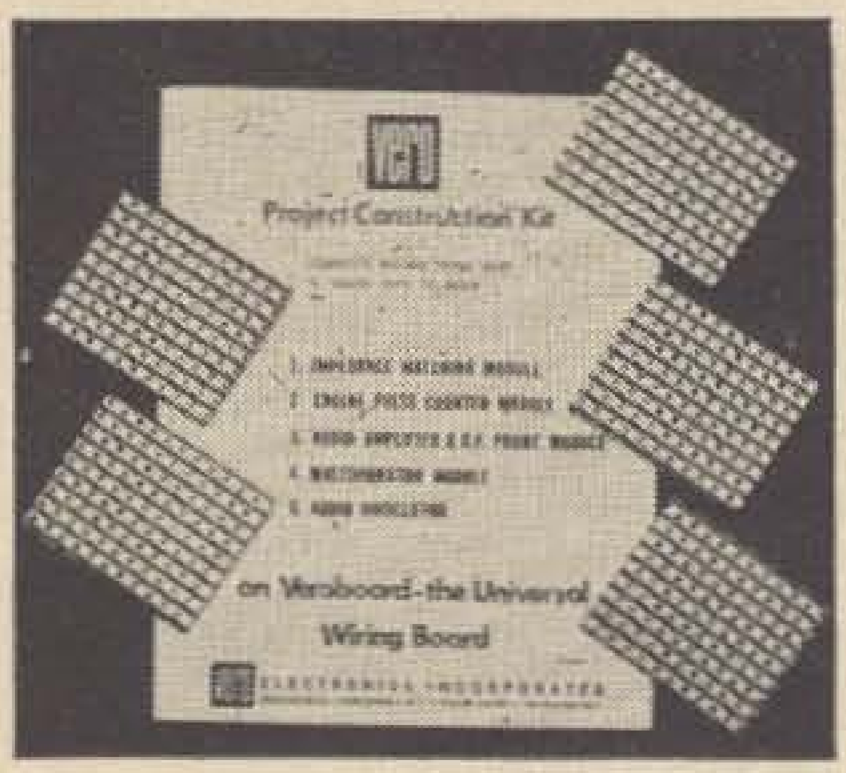
The circuit is mounted in a small 3x4x4 Minibox and secured behind the dashboard. A 1N660 silicon diode is used, because at the low microvolt levels at broadcast operation, the diode will not conduct due to its high threshold voltage. A 50 micro-ammeter was used for the indicator and with my particular installation I was able to mount the meter in the dash of my 1960 Chevrolet in the dummy hole which should have contained a clock. The addition of this meter actually improves the appearance of the dashboard. Although this installation was to be mainly used in the tune up of my 20-15-10 meter transmitter, I find that it reads extremely well on the 2 meter FM transmitter that I have installed for local communication. In addition, it draws out the radiation pattern of the local brodacast stations as I drive by. The normal reception of the broadcast receiver was not affected in any way. I did cut out as much of the low capacity antenna lead-in as I could in order to compensate for the addition of any capacitance from the diode and other circuitry.

I had been suffering along with the final plate current indication for maximum power output in the 1960 car installation, but when I installed the field strength meter, I immediately saw the fruits of my labor as I tuned up my transmitter on 20 meters during a Sunday afternoon and heard a bunch of California kilowatts complain of a strong heterodyne on their frequency. I immeditely identified myself and apologized for interrupting their local QSO. Before you desert mobile operation, try a continuously operating field strength meter and see the difference. I forgot to mention that a field strength meter in the home QTH will do as much for the fixed station as it does for the mobile. I just had a horrible thought; please don't all of you fellows build these meters or I'll have to put a second 6146 in the car.

Last of all, on the subject of power, I have found that 50 watts is the minimum power that true DX can be worked from the car. My 500 watt mobile installation was much better but not enough to make it worth the great effort involved. Fifty watts comes easy in a car because it is about the power range that can be handled without special power supplies. Let's all work WAC mobile!

. . . W9NTP

NEW PRODUCTS



Veroboard Kit—$1.95

Been curious about Veroboards? Want to try a little project or two with them to see how they work? Here's a very inexpensive way to do it. The Vero Model PK-5 project construction kit comes with five Veroboards and a detailed instruction book that tells you how to build an impedance matching module, an engine pulse counter, an audio amplifier and rf probe, a multivibrator and an audio oscillator. The projects don't require etching, wiring or terminals. The instruction book contains diagrams, schematics, illustrations and parts list. Theory and applications are also explained in detail. It's only $1.95. Write Walt O'Donnell, Vero Electronics, 48 Allen Blvd., Farmingdale, N.Y.

1966 Heathkit Catalog

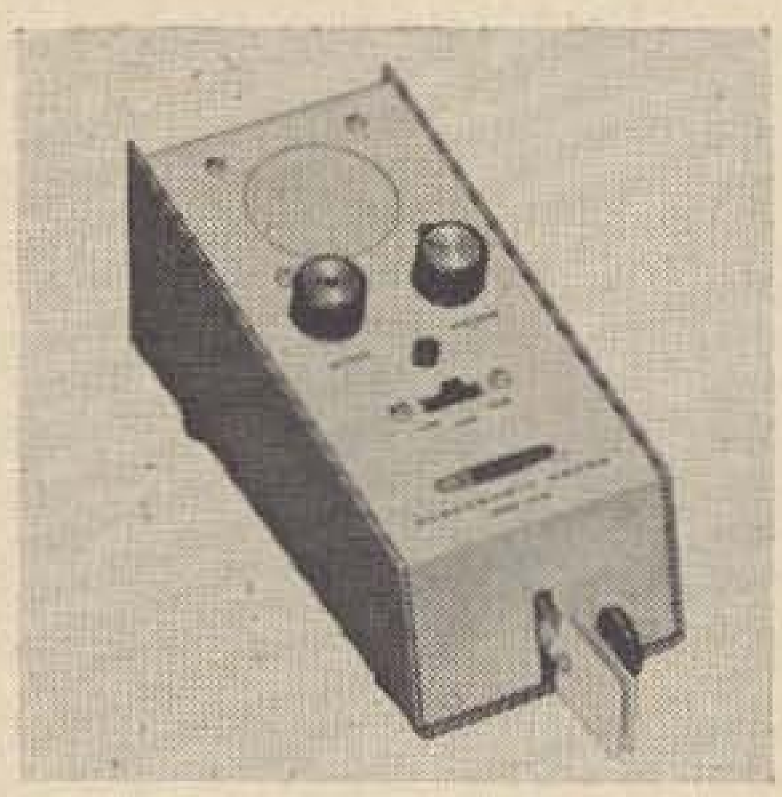
We don't need to tell you much about the Heath catalog. All hams know about the excellent Heath amateur (and other) electronics equipment. The latest one is 108 pages with many of the pages in color and prices on many of the kits have been reduced, too. Among the new products listed in the catalog are the SB-110 6 meter SSB transceiver, the HA-14 SSB KW amplifier, the power supplies for this amplifier and lots of non-ham ones. Send for your copy today. Write the Heath Company, Benton Harbor, Michigan 49023. Please mention 73.

Hallicrafters SX-146

Hallicrafters new SX-146 receiver makes use of modern techniques to provide excellent amateur reception. It uses a single conversion signal path for minimum spurious responses and a 2.1 kc six section crystal lattice filter for optimum selectivity for SSB. There's also provision for AM and CW filters. It's designed for transceive operation with the HT=46 SSB transmitter, too. Sensitivity is less than .5 μv for 20 db S/N, drift is tiny, and the receiver is very attractive. The price is $269.95 and you can get complete specs from Bernard Golbus, Dept. 73, The Hallicrafters Co., 5th and Kostner Ave., Chicago, Ill. 60624.

Ami-Tron Fan Top Heat Sinks

Ami-Tron's newest product is a little fan top transistor heat sink for the popular TO-5 case transistors. It's black anodized for best heat dissipation. You can get a bag of three for only $1 from your local distributor or from WRL. Ami-Tron Associates, 12033 Otsego Street, North Hollywood, California.

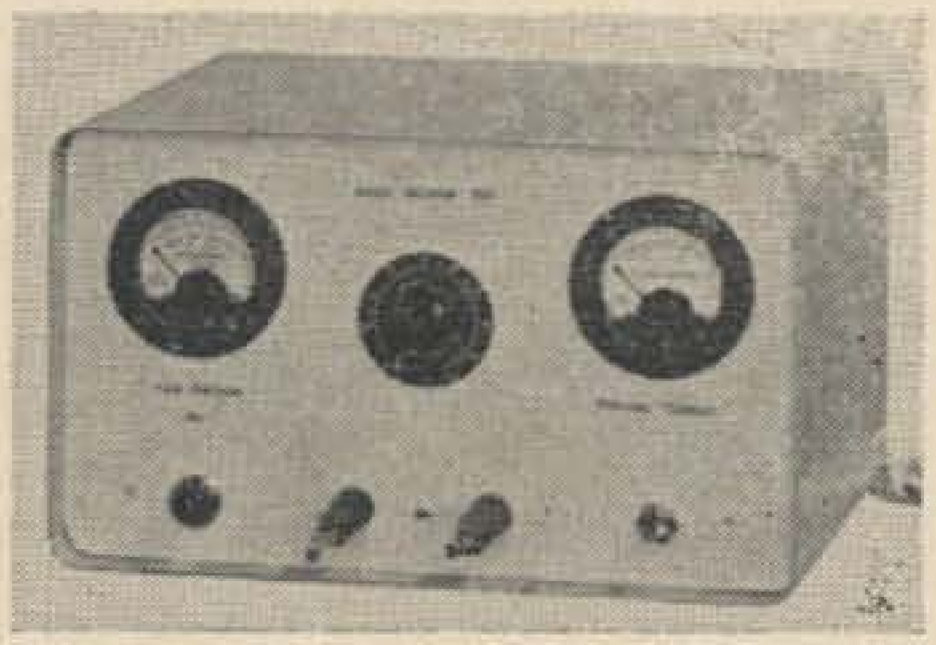


Heath HD-10 Electronic Keyer

Heath's new HD-10 all transistor electronic keyer offers about everything you could want in a keyer. It has no relays to stick since all the switching is solid state. The built-in paddle has sealed contacts. The dashes are the proper three dots long and the spaces one dot apart. The built-in oscillator and speaker with volume control lets you monitor on or off the air. It provides many other features too. Price is $39.95. For complete specs, write Heath Company, Benton Harbor, Michigan 49023.

TUCO Catalog

One of the best places to get transistors, ther semiconductors and subminiature parts Transistors Unlimited. They feature new, randed parts, pack them carefully, and ship iem fast. Their new large 16 page catalog in-ludes many pages of tremendous bargains iat will fascinate any ham. They also make number of power supplies, test equipment, nd interesting kits. You need this catalog. Vrite Elias Furst at TUCO, 462 Jericho 'urnpike, Mineola, L.I., N.Y. 11501.

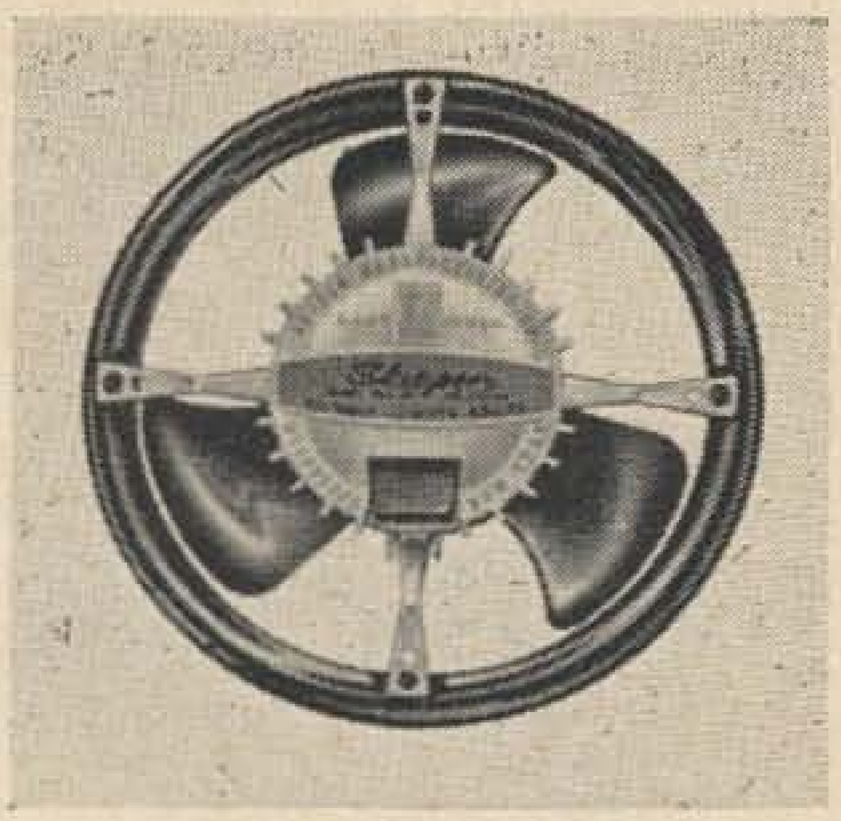


Quaker Diode Tester

The new Quaker solid state diode tester ccurately tests PIV up to 1000 PIV and leak-ge current up to 5 ma. You can quickly heck unmarked and odd lots of diodes, make ure that diodes for series strings are up to pecs, etc. The unit is completely self con-ained with power supply, metering and con-rols in one attractively styled instrument ackage. It works on 115 vac. Price is $79.95. or custom models, or more information, write Quaker Electronics, P.O. Box 215, Hunlock Creek, Pa. 18621.

Amateur Radio Mobile Handbook

The new Sams Amateur Radio Mobile Handbook (AMH-1), by Charles Caringella V6NJV will be of interest to all hams who perate or are considering operating mobile. hapters are on converters and receivers, ansmitters, modulators, transceivers, trans-itters, receivers, microphones, antennas, ower supplies, control circuits and the sup-ression of transmission noise. Both commer-ial and home-brew equipment are discussed n detail. On top of that, W6NJV is an ex-ellent author and the book is very easy to ead and understand. It's well illustrated, too. ou can buy a copy from your local distribu-or if he's on the ball, or from Howard W. ams, 4300 W. 62nd Street, Indianapolis, ndiana 46206.

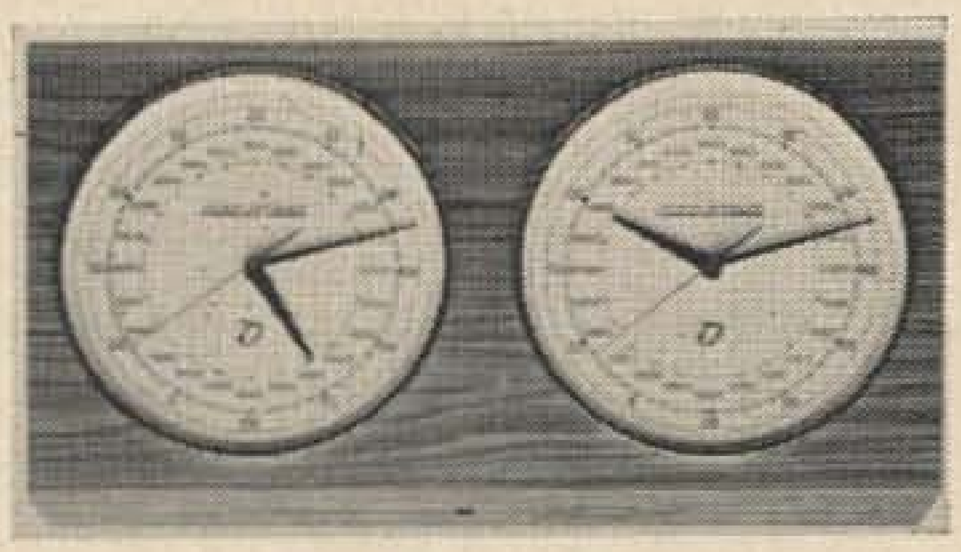


Rotron Skipper Fan

Rotron, a large manufacturer of fans and blowers for all electronic uses, has recently introduced an inexpensive fan, the Skipper, that delivers 100 cubic feet of air per minute. It mounts in a 4½" hole with no screws; a retaining ring holds it in place. It's quiet, too, yet usable up to 140°Fd. There are a number of accessories available, so get full information from Rotron, Woodstock, N.Y. 12498.

International Crystal Catalog

The new 60 page catalog from International Crystal Company is full of all sorts of equipment for the ham (and others). It lists all of the fine International crystals with complete operating data and suggested circuits, but that's just the start. They also have crystal ovens, plug-in transistor oscillators and cases, accessories, frequency meters, transistor and tube multivibrators, SSB filters, AOC transmitters and exciters, transistor subassemblies, converters, CB equipment, etc. Why procrastinate; send for one today. International Crystal Co., 18 North Lee Oklahoma City, Oklahoma 73102.



Quement Dual 24 Hour Clocks

You undoubtedly noticed page 73 in the December 73. You may have even noticed the beautiful set of two ten inch synchronous electric 24 hour clocks. They're mounted in a rich 12" x 24" x 2" wood cabinet and would enhance any room. Set one on your local time and one on universal time so you can both fill out your log and know when to eat. The set is only $24.95 FOB Quement Electronics, 1000 South Bascom, San Jose, California.

Howard S. Pyle
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Why Instruction Books?

Here's a subject which should be of pretty vital interest to you who are 'home-brew artists'; even more so if your projects result in building something which you, yourself have designed from scratch. Or, perhaps what you build has been taken from plans and specifications set down in a magazine or handbook article. We will wager that a few modifications and/or changes of your own will take place as you go, nevertheless. How are *you* going to know exactly what is what in a piece of gear which you build and which may give trouble (and often does) a few months later, unless you have an accurate black and white record on paper?

Suppose you are not a 'home-brew' artisan; you buy a piece of ham gear which has been designed, assembled and wired by a commercial factory. Invariably, if you buy it 'first hand,' a complete instruction book including schematics, voltage reading charts etc., is included. Unfortunately, when purchasing second hand or used gear, such instruction manuals are often missing. If your choice of a piece of equipment is in this category, stand pat on your refusal to purchase it unless the initial instruction manual accompanies it. Don't let the seller push you off with a casual statement such as ". . . oh, the dope and schematic is all in one of the surplus manuals . . ." or words to that effect. If the gear does happen to be a piece of surplus military equipment, make the seller show you in what surplus manual, even to the page, where the information exists.

Next, take the popular 'kit' type of equipment. Regardless of whether the item is but a simple transistor code practice oscillator or a more elaborate piece of gear such as a transmitter or a communication receiver, the factory always supplies a manual which, in addition to schematic wiring, mechanical assembly, adjustment and operation details, gives you every hint and tip essential to satisfactory operation of the equipment if you follow the printed instructions and illustrations.

Unfortunately the average ham designer-builder discounts the necessity for keeping a record of his home-built gear, simulating a factory handbook. This is just as true of the more experienced ham as with the novice. Probably this is due to the naturally human instinct to 'try it out' and right now, once it is built. If it works satisfactorily the normal procedure is to continue to use it as long as it holds together. Just let it 'blow up' once however and the long, tedious search for the trouble begins. ". . . Let's see; what size capacitors did I use here; what resistor there? What magazine or handbook did I take the parts list from? . . ." How much simpler, quicker and easier does such trouble shooting occur if you can refer to one simply bound or stapled set of instruction sheets and find all of the answers?

"So what?" you say. If you have actually constructed something, satisfy yourself that it really does work the way you had hoped that it would. Then, don't spend every minute of your leisure hours working it to death hoping that it will hold together. Give a few of those hours to a methodical recording of performance characteristics which will prove invaluable when a case of trouble, major or minor, develops (and it often does!).

Put together an instruction manual of your own to cover every complete piece of equipment which you build. Such a manual can even be written in pencil on ruled note paper of the school type; better if it can be typed and bound, either by stapling or in a ring binder of suitable size. While neatness is a virtue, the main element of any recording manual of this type is the information which it imparts. Suppose now that we examine what actually should constitute the essential information to cover a particular piece of 'home-brew' gear.

(1) An accurate schematic diagram of the item with appropriately labelled components which can be readily identified from an ac-

companying key nomenclature. For example, "VT-1" on the schematic to identify the oscillator tube in a transmitter; the key will show this as "VT-1; oscillator tube, 6V6 (or equivalent)." "R-1" on the schematic will appear as "R-1—7500 ohm carbon resistor" in the key list. Carry this through all of the components appearing in the schematic. In addition, show the *positive* (or in a few cases, the negative) potential which should normally appear at various terminals throughout the schematic. For example, where the positive plate voltage on "VT-2" may normally be 250 volts, designate it on the schematic as "VT-2: 250 v +."

(2) Actually, as in factory-prepared manuals for completely assembled and wired equipment, the schematic should appear as the last item in your book. The pages preceding the schematic should include brief paragraphs descriptive of the equipment as a whole, plus such tabulated tables as may be required to show the voltage readings to grounds (chassis in most cases) such as above mentioned as "VT-2: 250 V +." Any voltages which should read 'negative' normally, should be mentioned as well, otherwise it can be assumed that a positive voltage reading is applied against negative (chassis or 'ground').

(3) Last, but by no means least, particularly if the equipment which you have designed, assembled and built from scratch or from a magazine or handbook article, undergoes any modifications or changes while in usage, so indicate these changes on the schematic or by reference to the magazine or handbook article by month and page.

"Why" you say, "go to all this trouble to record such data; I built the thing, I know what makes it tick!" But suppose that you have ambitions for more elaborate equipment in the future? What you have already constructed and which has proven entirely satisfactory to you within its limitations, may constitute somewhat of a puzzling maze to a prospective purchaser on whom you hope to unload your 'brain child' in hopes of sufficient financial return to help out with the cost of the more elaborate gear which you contemplate building. If you can show such a prospective purchaser what your piece of gear is all about, by a methodical, written record, your chances of sale and of greater profit will be greatly enhanced. In addition, you will gain the respect of any such prospective purchaser who will naturally assume that anyone who goes to the extent of preparing a complete instruction and operating manual, has been just as conscientious in its construction; it will pay off, any way you look at it. . . . W7OE

Joseph Marshall WA4EP
Ozone, Tenn.

Improving the Noise Figure of Old Receivers

There are a number of commercial ham band or general coverage receivers and military surplus receivers which cover the 6 meter band. While some are hotter than others, practically none of these yield performance barefoot as good as that obtainable with a preamplifier or converter using a low noise rf tube. While a preamp is not too expensive, it is a nuisance when changing bands, and in many locations the additional gain is an embarrassment rather than an improvement because it intensifies the problem of overloading on strong signals. Actually, most of these receivers can provide close to optimum 6 meter performance with no changes other than a change in rf tubes.

The fact is that the cosmic noise level in the 6 meter band is high enough not to require an extravagantly low noise figure. The average equivalent noise figure of cosmic noise ranges from about 5 db to a high of about 8 db. This is achievable only in an extremely quiet location where no man-made noise is added to the cosmic noise. A receiver noise figure equal to the equivalent noise figure of the cosmic noise provides a practical optimum sensitivity. At this point, the maximum possible improvement in S/N ratio with a perfect receiver with no noise whatever, would be just 3 db; anything less than this total improvement yields an insignificant improvement in effective sensitivity. Thus a noise figure somewhere in the 4 to 8 db range yields practically optimum sensitivity in the 6 meter band. Most of the 6 meter receivers, however, have noise figures in the 12 db region, or higher. Fortunately, it is possible to lower the noise figure to the required optimum in most of them simply by changing the rf tube.

The old reliable 6AK5 is a still nearly ide 6 meter tube. It is capable of yielding nois figures as low as 3 db which is so far belo the cosmic noise that the difference betwee it and a receiver with no noise whatever woul provide an improvement of scarcely 1 db i S/N ratio. While it is not likely that a 3 d noise figure can be attained merely by sub stituting the 6AK5, it is possible with mo of these receivers to get the NF into the 4 t 8 db range.

In some cases, the 6AK5 can be substitute for the 6BA6, 6CB6, 6BZ6 or a similar remot cut-off rf pentode with no changes whateve In most cases it will be necessary to mak one small change at the socket terminals. I the 6AK5 the cathode is connected to bot pin 2 and pin 7, and the supressor is internall connected to pin 7. The other tubes men tioned have the suppressor to pin 2 and th cathode to pin 7. Take a look at the wirin diagram of your receiver or, if you don't hav one, at the wiring at the socket of the rf tub If the suppressor is connected to the cathod by a wire from pin 2 to pin 7 no changes ar necessary. If both the supressor (pin 2) an the cathode (pin 7) are grounded (as in th SP600) you can also just plug in the 6AK with no changes.

In most cases, however, you will find th supressor (pin 2) grounded and the cathod (pin 7) with a cathode resistor. In this even you will have to unground pin 2. Usually snip of the wire with wire cutting pliers fro pin 2 to ground will do the job. In some case the socket lug is soldered to a ground tab o to the center shield on the socket. In this even you need to unsolder it so it hangs free. That' all.

Up in the air over RTTY?

If you want to go all out you can also remove the avc from the rf stage. The 6AK5 is a sharp cut-off tube and cuts-off very quickly with a small amount of avc. However, this is not necessary. It will provide peak performance on weak signals when you need it and the lower gain on strong signals is not necessarily a disadvantage. Now repeak the rf stage trimmers for peak noise with the antenna connected. Receivers having an antenna trimmer control make this very simple, though it would be well also to peak the tuned circuit in the plate circuit.

The improvement in noise figure and performance will depend on the tube line-up. In receivers using a single rf stage working into a 6BE6 mixer, the optimum noise figure cannot be obtained because the mixer noise makes too high a contribution to the overall noise. However, substituting a 6AK5 in an HQ170 or 110, for example, will lower the noise figure from more than 12 db to the 6 to 8 db region. If the receiver has two rf stages the improvement can be much greater. In my SP600-JX, for example, with a 6AK5 in the first rf stage and a 6BZ6 in the second, the measured (with a Marconi Noise Generator) noise figure is less than 3.5 db in the 6 meter band and less than 2 db in all the lower bands, and provides an effective sensitivity barefoot which cannot be improved with preselectors with noise figures as good as 1.5 db. For all practical purposes, it yields the best possible sensitivity attainable on the 6 meter band today.

An even greater improvement can be obtained with a 6AJ5. This tube is not well known and is expensive ($4 wholesale) when bought new. It was designed primarily for operation with 28 volts on the plate and screen in aircraft radar equipment, but with normal voltages it has a higher transconductance and draws more current than the 6AK5 and hence has an even lower noise figure. If you run into any surplus equipment using this little bottle, cannibalize it of these little gems. The procedure is the same as with the 6AK5, though undoubtedly better performance would be possible by juggling the parameters slightly.

Obsolete receivers using metal tubes can also be improved—and even more strikingly—but substituting the 717 for 6SK7's. The base situation is comparable to that involved with the miniatures. In the 717A the cathode is connected to pins 3 and 5 and the supressor is internally connected to pin 3. In the 6SK7 the supressor goes to pin 3 and the cathode to pin 5. Again if the supressor is grounded and resistor, it is necessary to unground pin 3 when substituting the 717A. Receivers having two rf stages with 6SK7's will usually deliver optimum performance with a 717A in the first rf stage and a 6AB7 in the second rf stage. The 717A is an octal based version of the 6AK5 and is available surplus for as little as 25c.

Still older receivers using top-cap type tubes present a problem. If you can find an 1851 you can use it in place of the original rf tube with minor changes at the socket.

There are several military versions of the 6AK5, namely: the 5591, 5608, 5654, 6096 and WE403B. Some are hotter than the regular 6AK5, but all are interchangeable. The 6AJ5 also occurs as the 7755.

In most cases this change of tubes will provide effective sensitivity as good as that possible with a nuvistor preamp at a fraction of the cost and with less danger of overloading effects. Your S-meter readings may be lower than originally and, of course, they will not be exaggerated as they are with a preamp. However, the ability to read weak signals, which is what counts, should be considerably improved. You can make a simple test to check the improvement or to see how close to optimum you are. With the avc off, listen to the noise with the antenna disconnected and then with it connected. The noise should increase markedly when the antenna is connected. The greater the difference the better the noise figure and therefore the better the effective sensitivity—up to a point. After you reach a 3 to 5 db increase in noise, the improvement in actual receiving ability becomes very slight, if any.

. . . WA4EPY

(W2NSD from page 4)

worrying about how radio waves were being sent out. He puzzled over it. If you transmit a hundred watts from a beam antenna, shouldn't there be some sort of reaction in the opposite direction? That's a good fraction of a horsepower and something should happen. Right? Wrong . . . he hung a beam from a string and it didn't move a hundredth of an inch. End of digression.

Now, back to those UFO's for a moment, One of the great puzzles about them has been how they can go several thousand miles per minute and then stop on a dime without squashing anyone inside. The Biefeld-Brown experiments have shown that everything within the field is acted on equally, so anyone inside a UFO would not experience the inertia of changes of speed or direction. This explains the right angle turns that have been witnessed many times.

The high voltages required to run the UFO's explain the bright violet light that they emit and the paralyzing effect they seem to have on nearby electrical systems . . . also the ozone smell they leave. Brown, after trying many shapes to find the most efficient for using the electro-gravitic force, ended up with one almost exactly the same as the bulk of the reported UFO's . . . and this was several years before UFO's became a common newspaper item.

It would seem to me that we radio amateurs are in a beautiful position to break the barriers into this new field, just as the amateurs of the past broke into radio. Many of us have a technical enough background to start experimenting and we don't have the pressure of having to succeed, as do the commercial boys. Thousands of us can devote years to something like this . . . and eventually one of us is going to hit. And what a jackpot that will be! It is beyond the imagination. The chap who gets the first patent on an electro-gravitic receiver could possibly parlay that into something bigger than RCA. Who knows, the solution to our spectrum problems may be just ahead, waiting for some hams to get to work on them.

A parting hint for those of you who might like to try . . . the electro-gravitic force varies according to the dielectric constant (K) of the condenser, the distance between the plates, the area of the plates, the voltage used, and the mass of the dielectric used.

Many will ask, if the UFO's are real, how come the government is not admitting it? Simple, really. We have intruders in our skies and landing in our country and our military doesn't know what to do about it. We are darned sure that they are trying to learn everything they can about the UFO's in the hope that they will eventually come up with some sort of answer to them . . . some way to protect ourselves from them. Until that time they feel that the best policy is to keep quiet about what they do know on the basis that the beings in the UFO's can monitor our radio and television and that whatever is broadcast about UFO's will be picked up, letting them know what we know or don't know. This makes sense.

Our Air Force has the unhappy job of trying to cover up things as best they can. They try to keep people quiet, keep things out of the news, discredit sightings, etc.

Needless to say, this is something that you should not discuss over the air. While I expect that the UFOites are probably not listening to our ham bands . . . I have trouble listening to them for any length of time now and then, still, why take chances.

OK, so I'm a nut . . . this year. Let's see how nutty this all sounds five years from now.

American Morse

Morse telegraphers may be interested in the Morse Telegraphy Club and should drop a note to Ralph Graham W4RJX, 6443 Dryden Drive, McLean, Virginia 22101. They have a bi-monthly publication of interest.

Books

We're starting preparation for a series of small books to run as inserts in future issues of 73, books of 15 to 30 pages in length covering special aspects of amateur radio. Perhaps you have some ideas for a book that we might be able to publish. If you are interested in preparing something like this then drop us a note telling us what you propose. We'll pay up to $500 for a 15 pager and up to $1000 for a 30 page book, depending on the interest and the quality of the manuscript. Would you prefer that in 10's or 20's?

Help wanted

We're still looking for the right man for advertising manager of 73. This calls for someone with a good background in selling, someone who is already doing well. We'll pay a basic salary of $7500 plus 10% on any increase in our advertising income. This means that if you bring our sales up to those of QST you'll be making about $27,500! You can live like an earl up here on half of that. If you *know* you can step in and handle the job and it sounds attractive, all you have to do is tackle your first big selling job: sell me.

We're also looking for two sincere and experienced hams to spend the summer with us. The work will primarily consist of improving the VHF installation on 73 Mountain and installing a remote control system so it can be operated from home base during the winter. We'd like to put in FM, TV, RTTY, and stuff like that too. Pay will depend somewhat on experience, but will be scanty. You will have a ball though and get in a lot of hamming (on your own time, please). See if you can convince me that I really need you for this. I'm looking for doers, not talkers. Tell me what you have done, not what you'd like to do.

Need Vermont?

The Vermont QSO party is Feb. 19-21. Full info can be had from K1MPN, 3 Hillcrest Drive, Montpelier, Vt. 05601, but look for those rare ones on 3685, 3855, 3909, 7030, 7240, 7290, 14040, 14225, 14290, 21050, 21300, etc.

Scoundrel

The other night, while eavesdropping on the low end of 75 (as the cliché goes), I didn't hear any good of myself. One fellow mentioned how great 73 is and how he thinks it is better than QST. . . . I liked that. Then another said that he wouldn't read that filthy rag for anything, why that Green was one of the lowest opportunists in the country . . . look what happened to him, he printed an attack on the Navy in CQ and had to print a retraction the next month and was fired, and it is well known that he doesn't pay for articles for 73. There was this poor fellow who came all the way from Germany to work for 73 and was fired after just one week and thrown out penniless and they kept half of his belongings which arrived later. Besides that he takes advantage of every little thing that goes on to work up amateurs against the ARRL, usually lying and exaggerating to do it. The fellow sounded like a combination of the hate rantings put out by the Anti-Communist Amateur Radio Network and the Washington Amateur Radio News.

Never one to keep my peace when provoked, I called in and asked if they were interested in a little clarification. They were.

I explained that the Navy article was published in the February 1957 issue of CQ. I was out at the Fresno DX Convention when I received my airmail copy of the issue and it was there that I discovered that my assistant had "beefed up" the article, as he explained it later, so it would have more impact. Well it certainly had impact. I flew to Washington and explained to Admiral Bruton what had happened and we printed an apology the next month. In 1958 the Admiral (then F7FA) and I had a good laugh over the incident when he came to a party thrown for me in Paris. The article did create quite a disturbance and many believe it had something to do with the complete change in Navy policy on ham radio which followed shortly. Until the article only one Naval ship had ever been permitted to use amateur radio . . . afterwards hundreds were authorized. Now you hear them in all parts of the world boosting the morale of the operators and their shipmates.

I left CQ three years later and non-payment of authors was an important contributing factor. When I decided to start 73 I made it a firm policy that all articles in 73 would be paid for and promptly. They have been. I pay for all articles in 73 when I accept them and this can be up to a year before they get into print. At CQ the published policy was to pay for the articles when they were published, but I found that it often took from one to three years for an author to get paid for his article and there seemed no excuse for this when we were making a profit in six figures and the publisher was able to retire and loaf on an enormous yacht. I got so furious at that and other things like it that I got fired. My policy of paying fast and well for articles has resulted in 73 getting first choice on almost everything written in our field, which explains why 73 has the new developments months before they reach the other magazines . . . and why all of the top writers in our field write for 73.

Now, about that chap from Germany. Yep, we had one. He was getting discharged from the Army and wanted to work for 73. I told him we would give him a chance to show what he could do. Apparently the Army taught him a lot of interesting things on how to avoid work and he sure didn't get on with our small hard working staff. After a couple of months he left one night with no notice, leaving behind only a TV set with more payments due on it than it was worth. Pierre, F2BO, who roomed with him, kept up the payments for him for a few weeks until it was obvious that we were not going to hear from him and the set was turned back to the store.

Every now and then I hear that I've been lying about the ARRL, but no one is ever explicit about what I've said that is a lie. Just recently John Huntoon wrote a letter to the chairman of the National Convention Committee demanding that 73 not be permitted to exhibit. He threatened removal of ARRL support if 73 was permitted to exhibit. In this letter he lists 28 instances where he claims that I have lied in my editorials. At long last I had something definite to work with. I read over the list of my lies with growing wonder. I read them all a second time. This was incredible! Not one single one of those 28 instances was in any way other than completely false. I sat down to my typewriter and wrote an answer to each and every one of Huntoon's charges of lies and sent this formidable document to the National Committee Chairman, asking that 73 be permitted to exhibit since the basis for demanding that we not exhibit was entirely false. Then, figuring that others might be interested in this whole thing, I put it together into a booklet . . . 24 pages. You can see why I don't try to print it all here. Imagine taking 24 pages of the magazine for something like this? Anyone who is interested in the real facts and an expose of stupidity, ARRL lying, and distortion is welcome to send a stamped envelope for a copy of this reprint. Put 8¢ on the envelope, it is heavy.

As far as me being an opportunist . . . hmmm. I try to call 'em as I see 'em and I refuse to sit here and shut up when someone or some group is doing something lousy for ham radio.

$5 Reward

While most of the radio parts distributors around the country do carry 73 on their counters, there are a few that have either not gotten the word or else have resisted our not too energetic approaches. Now, if you'd like a little extra money in the mail all you have to do is scout around and find a parts distributor who should have 73 on his counter (but doesn't), talk him into making out a purchase order for ten or more copies a month, and send us the order. We'll send you a check for $5.

If the distributor gives you any static about handling 73 just point out that 73 is the fastest growing ham magazine in the world, that it runs 25-35 feature articles every month, and that the cover price is 50¢ and all he has to pay for copies sold is 30¢, and nothing whatever for copies not sold. Can there be a better deal than that? Nothing to lose in any case, and 73 is an excellent drawing card for his store. For some reason I am completely at a loss to explain fellows will drive miles looking for a copy of 73 every month, but they somehow don't get around to subscribing. It's weird, but it does bring traffic into radio stores, so why fight ham nature?

W2NSD joins ARRL's SS troops

I've been trying to remember back to just how this whole harrowing thing started and I don't remember. I get such laughing fits when I read QST that I know it couldn't have been anything in there that did it . . . but somehow, for the first time in several years, I found myself sitting there operating in the Sweepstakes Contest.

Along about Thursday I got to brooding over it and on some subconscious level must have thought that I would give it a try. I think I expected to give up after meeting with frustration as I have in the last few VHF contests. I remember the last CQ VHF contest I tried. By the end of about three hours I found only about three chaps making any effort to have a go at it. What possible fun is it to beat three fellows?

On Friday I galvanized into action and spent a good deal of the day bumbling about the yard trying to put up a simple stupid dipole for 80 meters so I would at least be on two bands for the damned contest. I figured my twenty meter three element beam would handle that band OK, but I had to have some place to operate when 20 closed for the evenings.

I used to throw dipoles up in the trees and work out all over the world. This time I decided to put up a sagging dipole . . . known as an inverted vee, with the center tied to the 70 foot tower. Several hours later I dragged myself back in the house to rest my weary legs (I had to climb the bottom 30 foot section several times), my weary arms (have you ever cranked one of those towers down and back up again?), and nursed the big gash in my head which I sustained at the 50 foot level when I climbed into a tower lock without looking. I cranked the tower down because I was afraid to climb that skinny little top section which was flapping around up there.

What was left of me collapsed into the chair by the rig and I eagerly tuned up on 80 to see what my new antenna would do. What it did was not tune up. Oi. After a bit of checking I found that it resonated nicely about 4500 kc. I should have cut a new one instead of digging out that mess coiled up in the barn and spending all day getting it up. It didn't take long, once I managed to get back on my feet again, to dangle some extra wires from the ends and bring it down to the band.

Saturday morning I made up some log sheets, laid in a stock of hamburger and Metrical, unplugged the phone, and took a quick look at the rules. After taking care of my days' mail and chatting about an hour on twenty with friends in Europe I grabbed for a couple hours sleep so I would be fresh for the contest. I think I spent most of the sleeping time thinking about the contest.

It seems that we can operate for any 24 hours of the 30 hour contest period. I decided to get some sleep Sunday morning from 4-8, which is usually the slackest period of a contest, plus a half hour Saturday night so I could watch "Get Smart" on tv and an hour Sunday night to watch Perry Mason. No use missing those shows if I don't have to. I don't watch anything else except Dick Van Dyke, so missing them would louse up two thirds of my weekly watching. On the other hand I have managed to miss all of them many times with no noticeable ill effects other than a slight increase in the sourness of my disposition.

Let's see, twenty-four hours at sixty minutes per hour is 1440 minutes for the contest. If I can make one contact per minute I can make almost 1500 QSO's. Then I got to brooding over that incredibly ridiculous message that ARRL says we have to exchange. This includes such important information as the year of my first amateur license and my birthday and month. Good grief! I timed a transmission of the whole message . . . hmmm, twenty seconds if I give it fast, and chances are that many ops will ask for a repeat of parts if it doesn't come rather slowly. Allowing time for establishing a contact, I could see that one per minute would only be possible with expert ops.

More of my resting time was spent in grumbling to myself over this crumby situation. The object of the contest seems to be to make as many contacts in as many ARRL sections in a given period of time as possible. So why the molasses? Why not exchange calls and sections and let it go at that? The SS used to be simpler. I remember the first one I tried back in 1941. The little bronze medal I won that year is still around. The next contest wasn't until after the war, in 1946. I won this one for my section also. The contest was rugged then, running for 66 hours over two weekends with 40 hours of operating permitted.

My mind went back to 1951 when I operated the first weekend at W2NSD/8 out in Ohio, where I was working. During the next few days my new call came and, while visiting New York the next weekend, I operated from there as W8NSD/2. The scores for both weekends were formidable, but not enough to win in those hotly contested sections.

The flag dropped at 4 pm and I charged into the QRM on twenty. Friend, you have never heard anything like that in your life. I tuned from one end of twenty to the other looking for the slightest crack in the barrage of signals to slip myself into. There wasn't any place at all. The signals were every hundred cycles right on through the band and who knows how deep? They were all very loud. It was even worse than the mess 1S9WNV made out of the band when he turned up on Spratly Island for a couple days and the DX boys knew they had to work him or forever lose their position on the DX lists.

Sam, W1FZJ, has always said that the way to do well in the SS contest is to have such a strong signal that everyone comes to you. In the past I had always had to fight for every contact, jumping around the band and waiting for other fellows to finish their contacts so I could exchange with them. This time, once I got started, I found that my signal was commanding enough so that I never had to move . . . for hours at a time and that indeed everyone did come to me. Many times when I finished with one station there would be five or ten calling me at once on the frequency. Boy, could I have worked a lot of stations if I hadn't had to go through those long complicated exchanges.

Though I knew that I had a fair signal on twenty, I wasn't sure it was good enough to stand out the way it apparently did. And I had no idea of how I would do on 75. I had figured that I would get my sections on 20 and my contacts on 75. It worked out the other way around. Alaska, Hawaii and Canal Zone all called me on 75! Plus I worked most of the sections down there, with very few exclusively on twenty. My contacts were split about 50/50 though.

A study of last year's results showed that the top man had made 733 contacts. Perhaps you can understand my enthusiasm when I passed that figure with three hours left to go. As the end neared I reached 850 contacts and decided to stop there even though I had some time left and there were still stations calling me. Though I didn't hear anyone with a score anywhere near that high, I suppose there are some chaps that will beat me out for the top honors. As I say, I didn't tune much. It is quite possible that the other top men did as I did and we may never have even worked each other.

In retrospect I don't think I could do a lot better than I did. I did waste some of those 1440 minutes, I admit. Things like going to the bathroom, frying a quick hamburger, letting the dog in and out a dozen times or so, short stretches, shooing away visitors, changing bands, new fuses, etc.

Though I never sought sections, letting them come to me, I did end up with 73 of them. Only VE6 and VE8 never came to me . . . drat. It would have been nice to have worked all sections too.

Does it help to be well known? Not really, for though every now and then someone would say hello Wayne to me, it frequently was followed by several precious seconds of compliments on the magazine . . . which I hastily agree are not at all unwelcome under normal circumstances . . . and requests that I keep up my fight for what I believe is right.

The factor that will probably put many stations ahead of me is the power multiplier. We all used to laugh every year when the SS results were published and there were all those pp-100TH rigs being run at 90 watts input. This wasn't so funny back in 1947 when I made a determined effort to do well and ended up with one of the top scores, only to find myself down to about fourth place in the country after application of the low power multiplier. The chap that won was putting in a signal that was stronger than a well known ham near him who runs 5 kw and a rhombic. I shudder to think what he was using for an amplifier. The power multiplier makes embarrassed liars out of most winners . . . but if they don't lie about the power they don't win and it is that simple. I do not believe that there is any way to run up a high score without using high power.

Except for a monumental case of writers' cramp (34 pages of logs) and a loss of ability to focus my eyes which was probably brought on by a slight stroke when someone tried to get my frequency away from me . . . an affliction which has since cleared up, as did my frequency when I called CQ contest for three minutes. . . . I managed to survive the ordeal fairly well. I'm not sure, I may even have had fun.

. . . Wayne

Why slave for that wallpaper?

Buy these certificates to dress up your shack. Be proud of the effort it took to earn the money to be able to afford them.

The CHC Certificate

The Certificate Haters Certificate is available to any ham with $1 who submits a signed statement that he has never been awarded any other certificates and that he will hate any that he happens to get in the future.

The WAAS Certificate

The Worked Almost All States Certificate is available to hams who have proof of contact with 49 states. It takes almost as much effort to work 49 as 50. Why should this work go unrewarded? Send the 49 QSL's in statabetical order or a statement signed by two responsible radio club officials that they've seen the 49, along with a note of the missing state. Mode stickers for CW, AM, SSB, RTTY, band stickers and stickers for all contacts made within one year are available for $1 extra for each sticker.

The DXDC Certificate

Everyone knows that this matter of "countries" is ridiculous. The DX Decade Certificate requires contacts with ten countries (defined as members of the UN; too bad, Switzerland, Communist China, etc.). Same regulations and endorsements as the WAAS Certificate above. There are no stickers for more than ten countries.

Countries for DXDC. Members of UN.

Afghanistan
Albania
Algeria
Argentina
Australia
Austria
Belgium
Bolivia
Brazil
Bulgaria
Burma
Burundi
Byelorussian S.S.R.
Cambodia
Cameroon
Canada
Central African Rep.
Ceylon
Chad
Chile
China
Colombia
Congo (Brazzaville)
Congo (Leopoldville)
Costa Rica
Cuba
Cyprus
Czechoslovakia
Dahomey
Denmark
Dominican Rep.
Ecuador
El Salvador
Ethiopia
Finland
France
Gabon
Ghana
Greece
Guatemala
Guinea
Haiti
Honduras
Hungary
Iceland
India
Indonesia
Iran
Iraq
Iceland
Israel
Italy
Ivory Coast
Jamaica
Japan
Jordan
Kenya
Kuwait
Laos
Lebanon
Liberia
Libya
Luxembourg
Malagasy Rep.
Malaysia
Mali
Mauritania
Mexico
Mongolia
Morocco
Nepal
Netherlands
New Zealand
Nicaragua
Niger
Nigeria
Norway
Pakistan
Panama
Paraguay
Peru
Philippines
Poland
Portugal
Rumania
Rwanda
Saudi Arabia
Senegal
Sierra Leone
Somalia
South Africa
Spain
Sudan
Sweden
Syria
Tanganyika and Zanzibar, United Republic of
Thailand
Togo
Trinidad and Tobago
Tunisia
Turkey
Uganda
Ukrainian S.S.R.
U.S.S.R.
United Arab Republic
United Kingdom
United States
Upper Volta
Uruguay
Venezuela
Yemen
Yugoslavia

The RRCC Certificate

If you're a Real Rag Chewer, you can keep it going for at least six hours. This certificate is for hams who have had a single two station contact going for six hours with no interruptions. Include signed statement to that effect.

Each certificate application must include $1 to help cover the costs of administering the program, etc.

73 Magazine Peterborough, N.H. 03458

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TOOOOBES, TRANSMITTING-SPECIAL PURPOSE. New boxed, guaranteed . . . 6CW4-$1.40, 6146-$2.55, 417A-$3.95, 826-$6.00, 6360-$3.45 . . . Free catalog . . . Vanbar dist, Box 444X, Stirling, N.J. 07980.

PRINTED CIRCUIT materials. Three sample pieces and details. One dollar. Betty Lou Nolin, 35 Arbor Drive, New Hartford, N.Y. 13413.

ART'S QSL'S Samples 10¢. Art Bliss, 1829 N. Catalina St., Burbank, California.

CONVERTERS $10 and up. World's largest selection of frequencies. Ham TV vidicon cameras and parts at low factory-direct prices. See them all now in our full page ad in this issue. Vanguard Labs, 196-23 Jamaica Ave., Hollis, N.Y. 11423.

GIANT 20th ANNIVERSARY CATALOG. Increase your product category. TV cameras, electronic equipment, kits, Hi-Fi, components. Free copy. Denson Electronics, Rockville, Conn.

TELETYPE TEST SET I-193C. Government rebuilt, still crated. Tests RTTY transmitters, converters, relays. $14.95 each, two for $27.40. F. O. B. Harrisburg, Pa. Satisfaction guaranteed. Telemethods International, 3075 E. 123rd Street, Cleveland, Ohio

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IT'S SUPERCALIFRAGILISTICEXPIALIDOCIOUS! Free new catalog of etched circuit boards, radio books and information on Kit-of-the Month Club. Leader Enterprises, Box 44718-KH, Los Angeles, Calif. 90044.

WE WILL PAY CASH: Wanted, popular, late model unmodified amateur equipment. Highest prices paid for clean, good operating gear. Write Graham Radio, Dept. 10, Reading, Massachusetts.

CLOSEOUT discontinued full size beam, new ⅞" and 1" aluminum. Three element 20 meter, $22, Two element, $16. Three elements on 15 meters, $16, two elements, $12. Express collect shipment. Gotham, 1805 Purdy, Dept. 73, Miami Beach, Fla.

ARE YOU SINCERE? Are you *really* looking for the best deal on a new or fully guaranteed used unit? Let us convince you with a specific quote that will *really* save you money. Graham Radio, Dept. 10, Reading, Massachusetts.

ːLOBAL WRIST WATCHES. Feature 24 hour world ime conversion. Free brochure. Mention 73. Nordlund. 635 West Irving Park, Chicago, Illinois 60634.

'UNAVERTERS! Transistor 6-1 tuning calibrated conerters for AM-CW-SSB! Half a mobile station $19.95-24.95! Sensitive, selective, tunable BFO! Marine, amaeur, SW bands! Herbert Salch and Co., Woodsboro, 'exas.

IEATH MARAUDER, Hallicrafters SX-111. Both for 450 or will sell separately. J. Michlin WA2WPN, 2282 ironx Park East, New York, N.Y. 10467.

ıLTERNATOR UNITS Leece Neville 100 amp, 14 v nd 7 v. $55 each. K6PDR, 26107 Delos Drive, Torance, California. Phone day 679-8711 ex 22716, night 26-2711.

IODEL 15 complete with table. Alltronics TU model I, Kleinschmidt typing reperforator model AN/GGC-3. ːlCPX, 617-862-2448, Lexington, Mass.

'ICTORIAL STUDY in electrical theory and basic adio communication for the amateur. Understanding hrough visualization. Free details. Dwight Cross, 212A Lynch Street, St. Louis, Mo. 63118.

ːOUTHERN COUNTIES ARA (N.J.) will hold its anıual installation dinner on Friday evening, January 4 at Copsey's Restaurant on the White Horse Pike, ıbsecon, N.J. All hams, wives and those interested in mateur radio are welcome to attend. Details from ː2SOX, 2217 Cornwall Ave., Northfield, N.J.

ːSTATE SALE: Reasonable offers. SX-100, HT-40, ːX-140, Twoer and AC/DC supply, HB 2 m transmitter nd receiver, precise model 300 scope, Eico model 66 tube tester, BC-221T frequency meter and RT-8/ARC-1. Contact Mrs. R. L. (Sue) McDougal, 1690 ːountry Club Drive, Marion, Iowa 52302.

00 2C39's and 3CX100A5's. Pull outs and unchecked. 'rade all or part for hamgear. You name it. Jack D. ımes, Box 5325, Dallas, Texas.

ːALAXY V, DC power, VOX, calibrator, 20 and 40 vhips and bumper mount, 2 quickoffs, mic, cables and peaker. Cost me $599. Best reasonable offer. G. Slaw, 4 Meigs Ct., Bensenville, Illinois.

ıIRSTREAM 18' Globetrotter. Perfect self-cont. No ents. $2500. Nathan D. Vance K8TMX, 823 Cory St., 'ostoria, Ohio.

ːOLLINS 75A3-32V3 both $325.00. AF-67 and PMR6A eceiver and power supplies. All for $65.00. Plate ransformers, 1 ampere, 3200 volts center tap. $40.00. Iaury Blog W2RBZ, 25 Peru Street, Metuchen, N.J.

ːLEGG ZEUS and 11 element 6 meter beam. Contact VB2CUD, 201-756-8340.

'ECHNICAL MANUALS. Signal Corp. Some of the vailable manuals R-390,A, SP-600, BC-610, I-177, 'V-7, teletype manuals, test equipment. World's largst list 10¢. Quaker Electronics, Hunlock Creek, Pa.

ıWAN 350 and 117C supply. Less than six months old, ıew condition. $385.00. Stu Kelly K3MAK, Fox Hill ːoad, Perry Hall, Md. 21128.

FM for 2, 6 and 432

GE 12 volt 40-50 mc 30 watts output, receiver transmitter 4ER6-4ET5. Transmitters are fully narrow-banded. These rigs were removed from service this year and are very clean and in excellent operating condition. Complete with all tubes, xtals, control heads, speakers, etc. Less antenna $39.95

Same rig with tubes, crystals, but less cables, head, spkr, mike $29.95

Receivers only, with tubes, crystals $24.95

Alignment info with order only .... $ 1.00

Transmitters only, w/tubes, xtals $13.95

12 v dynamotors, 640 v, 265 ma .... $ 9.95

Transmitters less dynamotor .... $ 9.95

FOLLOWING ITEMS AS IS:

Bendix 150 mc base station. 50 watt, 2 freq, clean, less xtals, some small tubes, mike $52.95

GE 150 mc base station (6146). Converted mobile. Clean, complete with all accessories $52.95

Link or Dumont 450 mc transceivers 5894 final, all tubes, dirty, less mike, speaker $28.85

WANTED: Bird Thru-line any condition, Measurements 65B Signal generator, Collins receiver 51J3-4, etc, hi-band FM equipment, freq. meters and other types of surplus equipment and components.

All items FOB

Ray Newsome K8TJP, 2670 Pinetree, Trenton, Michigan.
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Attention Aeron. Radio Shops: We now modify our Hewl-Pack #608B Signal Generators so has same or less incidental FM as #608D, and sell w/money-back grty of complete satisfaction and that it will pass any FAA test!

10-400 mc	$ 475.00
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TIME PAY PLAN: Any purchase totalling $160.00 or more, down payment only	10%
All-Band SSB Rcvr Bargain: Hallicrafters R-45 ARR-7, 550 mc to 43 mc continuous: Voice, CW, MCW, aligned, qrtd, w/book; 2-RF, 2-IF's. S-meter; noise lmtr; 3 xtl, 3 non-xtl select. choices. Less pwr sply	149.50
60 cy pwr sply: $30. SSB product detector	20.00
Panadapter 455 kc for above, 60 cy	89.50
RBS-2 Rcvr: 2-20 mc, ready to use on 115 v 60 cy, aligned, qrtd OK, w/tech. data	69.50
ARR-15 Rcvr: 1½-18½ mc, 10-channel Auto-tune; exc. cond. visual inspection only. You make pwr sply; with much tech. data	69.50
AN/URR-13 Rcvr: 225-400 mc cont. tunable, has 115v 60 cy sply; good used, w/data	149.50
R-23/ARC-5 Command rcvr 190-550 kc	14.95
A.R.C. 12 #22 Command rcvr 540-1600 kc	17.95
ARR-5 rcvr, 60 cy, am/fm, 27-140 mc	179.50
APR-4Y AM/FM rcvr mod. to 115 v 50/60 cy, with pwr plug, book, tuners 38-1000 mc	250.00
P.U.R. for tuners 975-2200 and 2175-4000 mc.	
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LM-14 freq. meter, .01% 125 kc-20 mc	57.50
TS-323/UR freq. meter 20-480 mc, .001%	199.50
Gertsch FM-3 freq. meter factory certified	395.00
Berkeley Counter/Timer counts to 1 mc	495.00
Hewl-Pack 524B w/525A,B counts to 220 mc	1650.00
Tektronix 541 W/B or K plug-in	795.00
Tektronix 514AD scope dc to 10 mc	395.00
Tektronix 513D scope dc to 15 mc	495.00
G. R. #1001A sig. gen. 5 kc to 50 mc	595.00
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Hewlett-Pack. #616A Sig. Gen. 1.8-4.0 gc	795.00
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73 Books

RECEIVERS. K5JKX.—If you want to build a receiver or to really understand your receiver, this is the book for you. It covers every aspect of receiving in author Kyles usual thorough manner. **$2.00**

SIMPLIFIED MATH FOR THE HAMSHACK —K8LFI.—This is the simplest and easiest to fathom explanation of Ohm's Law, squares, roots, powers, frequency/meters, logs, slide rules, etc. If our schools ever got wind of this amazing method of understanding basic math our kids would have a lot less trouble. **50¢**

CW—W6SFM.—Anyone can learn the code. This book, by an expert, lays in a good foundation for later high speed CW ability. **50¢**

FREQUENCY MEASURING—WØHKF—Ever want to set yourself up to measure frequency right down to the gnat's eyebrow? An expert lets you in on all the secrets. Join Bob high up on the list of Frequency Measuring Test winners. **$1.00**

CARE AND FEEDING OF HAM CLUBS—K9AMD.—Carole did a thorough research job on over a hundred ham clubs to find out what aspects went to make them successful and what seemed to lead to their demise. This book tells all and will be invaluable to all club officers or anyone interested in forming a successful ham club. **$1.00**

ATV ANTHOLOGY. WØKYQ and WA4HWH.—A collection of the construction and technical articles from the ATV Experimenter. Includes a complete, easy to build vidicon camera and 50 other projects. The only book available about ham TV. **$3.00**

REVISED INDEX TO SURPLUS—W4WKM.—This is a complete list of every article ever published on the conversion of surplus equipment. Gives a brief rundown on the article and source. Complete to date. **$1.50**

TEST EQUIPMENT HANDBOOK. W6VAT.—Every ham needs to have and know how to use test equipment. This book tells you how to make valuable ham test gear easily and cheaply. It also covers the use of test equipment. **50¢**

73 Magazine
Peterborough, N.H. 03458

HALLICRAFTERS HT-30 sideband transmitter like HT-32 only smaller. Excellent stability and suppression. Manual. $145. C. MacDowell W7UB, 2455 SW Montgomery, Portland, Oregon.

SWAN 240 and HP-10 dc supply, real good shape; best offer over $225. Les Grinspoon W3BDE, 12317 Village Square Terrace, Rockville Terrace, Rockville, Maryland 20852. 949-3159.

PAIR 4CX250B tubes and Eimac special sockets, all brand new $50. VE6AKU Glenn Christopherson, Innisfail, Alberta, Canada.

ART-13, good shape $25.95 without two 811's and one 813, or $35.95 with all tubes. You pay shipping. WN5MBU, Box 381, Hobbs, New Mexico.

QSLS BROWNIE-W3CJI, Highest quality since 1939. Samples 10¢, with cut catalog 25¢. 3111R Lehigh Street, Allentown, Pa. 18103.

KNIGHT STAR ROAMER. Factory aligned/calibrated. Excellent for beginner, SWL. Like new. $25 ppd. continental USA. David Brender, 300 Bronx Park East, Bronx, N.Y. 10467.

SELL OR SWAP: Ameco CN50, used Cleveland electronics course. Want ham transmitter, mint BC-312, SSB mike. Make offer. W8FWB, Box 242, Dover, Ohio.

NEW RG-8 COAX. 100 feet with PL259 each end, $8.25. 750 ma diodes: 600 piv 30¢, 900 piv 55¢. Send for flyer. Don Marquardt K9SOA, RR7, Box 436, Crown Point, Indiana 46307.

DRAKE TR-3, RV-3 and AC power supply, $550. Hallicrafters HA-2, HA-6 and AC power supply, $250. Absolute finest mint condition. K4TCK, 689 Beth Lane, Lexington, Kentucky.

TRADE YAMAHA 80 cc cycle for RTTY gear or cash. I had a back operation and cannot ride. 1963 model with helmet, extra sturdy baskets. Excellent condition, only 1700 miles. I need printer, keyboard, tape punch/reader. Will transport 200 miles. Carl Dudey K9WWQ, 45 N. Orchard, Madison, Wisconsin.

QRM FILTER-3 kc bandpass filter works with any 500 ohm receiver audio output. Unused surplus 25 watt UTC, 2 for $5. Tone filters for TTY or signalling: 595 cy, 765 cy, 2635 cy-2 for $5.

Generator noise filters, aircraft grade 25 amp, 50 amp $1 each. Lock City Electronics, Box O, Freeland, Michigan.

75A1, mechanical filter, matching speaker—$175. Classy 80-20 meter 100 watt phasing rig, $75. 10% off for pick-up. Fred Nichols, 1119 Howard, Niles, Michigan 49120.

HEATH SIXER, usual modifications. Good condition. Two six meter crystals included. $40 or best offer ppd. WB2QJA, 116-02 221 St., Cambria Hts., N.Y. 11411.

GOT BIGGER RIG, sell Knight T-60 for $35. Bill Herrmann, Oakcrest Acres, Rte. 1, Springfield, Illinois.

LAFAYETTE HE45B, 6m-Xcvr, VFO-HE6la, unused-mint, $102. Ameco TX-86 factory wired, 80-6m, AS-3 power supply, V.G., $105, WB2JJX, 36 Brompton Rd., Garden City, N.Y.

POWERFUL NEW 572B's—2000 hour guarantee—never unboxed—$39.50 matched set of 4 postpaid. Need Drake DC-3 Len Malone, WA5DAJ Box 1222 Garland, Texas.

CHANGE CRYSTAL FREQUENCY—even plated type. Deluxe Kit includes ammonium bi-fluoride, holders, storage and etching vials, complete instructions. Only $2.00, Postpaid.—Ham-Kits, 16 West End Court, Long Branch, N.J.

SELL DRAKE TR-3 $449 SW-240 with matching PS/Spkr. $275. Both excellent, look new, used very little. Bill Porter, W5FAH, Kenedy, Texas 512-FR52505

TH3MK2 BEAM—Hy-gain's finest, most popular 3 element tribander—can't use—never unpacked—Prepaid U. S. A. $69.95—WE6KEH, 781 California, San Luis Obispo, Calif. 93401

QUITTING will sell one: oscilloscope EICO 430, $45; dynamic conductance tube tester EICO 667-k $65; deluxe signal generator EICO 315, $40; audio generator Heathkit AG-8 $15; resistance capacitance bridge EICO 950B $15; capacitor tester EICO 955K $13; VTVM Conar 211 $18; decade condensor Heathkit IN-21 $10; decade resistor $4; Coyne radio and TV encyclopedia set $15. Francis Jacobs, 1111 Vattier, Manhattan, Kansas

NEED RESISTORS? Brand new, FAMOUS NAME, ½ watt 10% standard carbon. Any regular 10% value from 10 ohms to 2.7 megohms $.05 each postpaid. Any quantity assorted. Pick your own values. Rapid shipment. Minimum order $1.00 TEPCO, Box 508, Tullahoma, Tenn. 37388

EL 37 BRITISH DX transmitter wanted in good condition. Write 3 Vendue Range, Charleston, S.C.

WANTED: Pre-1934 QSTs. Also binders for both new and old volumes. Also 73 from first issue to Dec. 1964. Also CQ from first issue to Dec. 1964. Any good run acceptable. Will pay cash. Must be in good condition! R. Kampf 9 Black Birch Lane, Scarsdale, N.Y. 914-723-1467.

COUPON BOOK—Special offers from various firms for members of electronic Experimenters' Club. Dues $2.00 or write for further particulars. Box 5332-EA, Inglewood, Calif., 90310.

600 PIV @ 750 MA Tophats—10 for $2.50. Tubes—pullouts—4CX1000 $37.50, 6146 or 6883 $1.25. 4CX250B—$6.50, 4-125—$5.00, 5894A—$5.00, 813—$5.00, 5763 or 6CL6—$1.00, 4X150—$4.50, 12AX7-12AT7-12AU7-6AK5-6BH6-6C4-6CB6-6AK6-6S4-6AQ5-6BJ6-6AL5 — 4 for $1.00. FRR rec. (4—8MC drawer) $75.00. All material guaranteed. East Coast Electronics 123 St. Boniface Rd. Buffalo, N. Y. 14225. Min. order $2.50. Include sufficient postage. Canadian money accepted at par.

SPECIAL!! $50.00 credit on the purchase of station accessories when you order a NEW Galaxy V or SB-34. Cash or time payment. RECONDITIONED SPECIALS: DX-40 $29.95, HQ-100C w/m Speaker $89.95, Galaxy 300 $188.00. Order To-Day. ELECTRONICS SALES, EXECUTIVE HOUSE #15, LEWISBURG, TENNESSEE

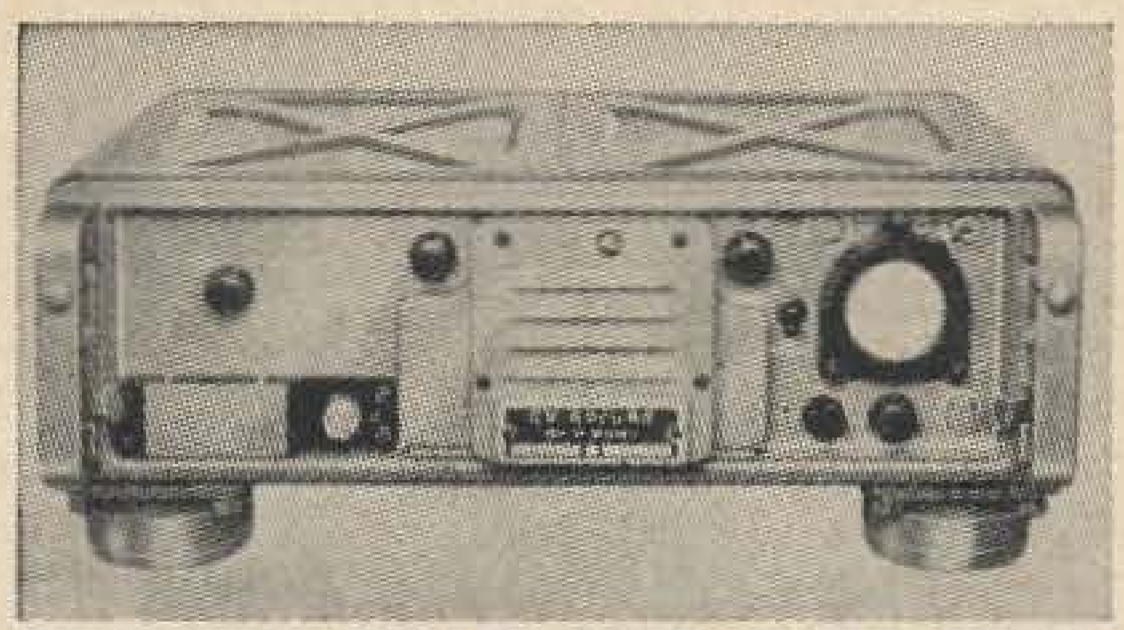
ART-13 fully converted 10-80, cool 300-w FONE-CW, w/110v ac pwr sup-all over-rated components; 75A-2 gud condx-$250 complete station. Xfrmr 3000/1700-0-1700/3000 vac about 1 amp $15.00 cash/carry. Clean-as-a-pin 15-type printer w/converter & 3-inch scope in 1 unit $175.00. W5ENH, 2608 S. Taylor, Little Rock, Ark.

TAPE RECORDING: Need someone with facilities to reproduce prepared 3¾ ips tapes in limited quantities. Good speech quality required. Original tape and supplies furnished. Write IoAR, Springdale, Utah 84767.

R U REALLY interested in Ham Radio? Send SASE for IoAR information and help fight Amateur Radio Apathy. W7ZC, Springdale, Utah 84767.

75A4 Collins Rec. excellent cond. serial #085—2 filters, 3 & 6Kc, speaker & vernier dial $350.00. WA9DFH 5631 W. Morris St., Indianapolis, Indiana

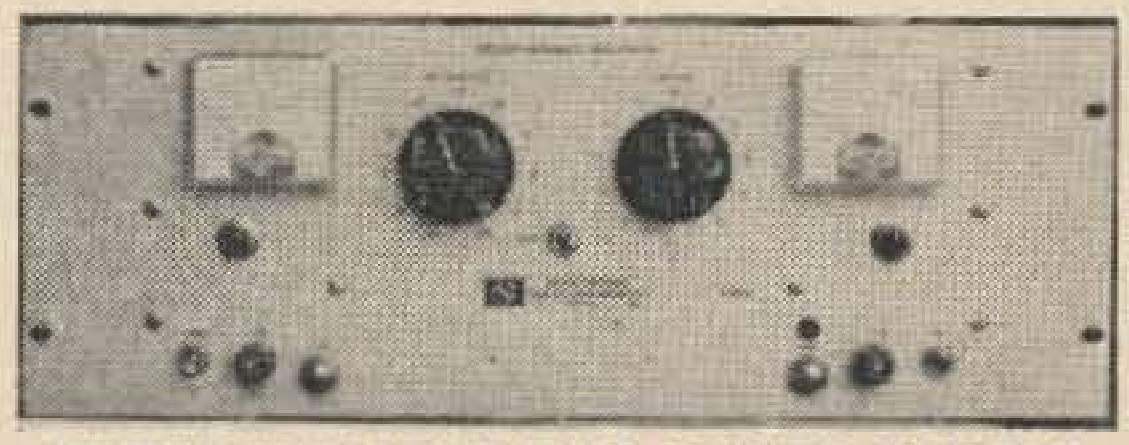
DAYTON HAMVENTION April 16, 1966—Everyone welcome at the Dayton Amateur Radio Association's 15th annual Hamvention, Wampler's Ballarena, Dayton, Ohio. Watch Caveat Emptor for information.



CV-60/URR (URA-8) FREQ. SHIFT CONV.

The model everyone is looking for. We have half a dozen, made by RCA in new condition. Audio type feeds from 600 ohm output of your receiver.

$150.00



PROGRAMMABLE E/M POWER SUPPLY

Regulated Electronic Measurements Power Supplies. In excellent condition.

#231AM	0-300 volt 100 ma	**40.00**
#232AM	0-300 volt 200 ma	**45.00**
#233AM	0-300 volt 300 ma	**50.00**
#234AM	0-300 volt 500 ma	**55.00**

CV-253/ALR 30-1000 mc CONVERTER

Written up in "73" mag. for June. A rare and valuable item. 4 units available. Like new of course. **$135.00.**

COLLINS ARR-15 RCVR 1.5-18.5 mc

Written up "73" June. Tuneable with Collins PTO and calibrator. 45.00

FREQUENCY METER LR-3 85.00

SILICON DIODES SPECIAL

800 PIV 400 ma	**$3.00/12**	**30¢ each**
1000 PIV Studs 2 amp	**$10.00/12**	**$1.00 each**

Above is a small selection of choice surplus from our large 72 page illustrated catalog. Send 20¢ production & handling cost for catalog.

JOHN MESHNA JR.

19 Allerton St., Lynn, Mass.

Index to 1965

INDEX TO ADVERTISERS

Propagation Chart

January 1966

J. H. Nelson

Note: Through a printer's error, the propagation chart that ran in the December issue was the September one.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	7	7	7	7	7	7#	14	14*	14
ARGENTINA	14	7#	7	7	7	7	14	14	14	21	21*	14
AUSTRALIA	14	7#	7#	7#	7	7	7	14	14	14	14	14*
CANAL ZONE	7*	7	7	7	7	7	14	14	21	21	14*	14
ENGLAND	7	7	7	3	7	7#	14	14	21	14	7#	7
HAWAII	14	7#	7	7	7	7	7	7#	7#	14	21	14
INDIA	7	7	7#	3#	7#	7#	14	14	7#	7#	7#	7
JAPAN	14	7#	7#	7	7	7	7	7	7#	7#	7#	14
MEXICO	7*	7	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	7#	7#	7#	7#	7	7	7	7#	7#	7#	7#
PUERTO RICO	7	7	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7	7#	7#	7#	14	21	21	14*	14	14
U. S. S. R.	7	3	3	3	7	7#	14	14	14	7#	7#	7
WEST COAST	14	7	7	7	7	7	7	14	14	21	21	14

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	7	7	7	7	7	7	14	14	14*
ARGENTINA	14	7#	7	7	7	7	7*	14	14	21	21*	14
AUSTRALIA	14	14	7#	7#	7	7	7	7#	14	14	14	14*
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	14
ENGLAND	7	7	7	3	7	7	7#	14	14*	14	7#	7#
HAWAII	14	14	7#	7	7	7	7	7	7#	14	21	21
INDIA	7	7	7#	7#	7#	7#	7#	7*	7#	7#	7#	7
JAPAN	14	7#	7#	7	7	7	7	7	7#	7#	7#	14
MEXICO	7*	7	3	3	7	7	3	7	14	14	14	14
PHILIPPINES	14	7#	7#	7#	7#	7	7	7	7	7#	7#	7#
PUERTO RICO	7*	7	7	7	7	7	7	14	14	14*	14	14
SOUTH AFRICA	7	7	7	7#	7#	7#	14	14	21	14	14	14
U. S. S. R.	7	3	3	3	7	7#	7#	14	7*	7#	7#	7

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	7	14	14	21
ARGENTINA	14	14	7#	7	7	7	7#	14	14	21	21*	21*
AUSTRALIA	21*	21	14	7#	7	7	7	7#	14	14	14	14*
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21*	21
ENGLAND	7#	7	7	7	7	7	7#	7#	14	14	7#	7#
HAWAII	21	14	14	7	7	7	7	7	14	21	21	21*
INDIA	7#	14	7#	7#	3#	7#	7	7	7	7#	7#	7#
JAPAN	14*	14	7#	7	7	7	7	7	7	7#	7#	14
MEXICO	14	7	3	3	7	7	3	7	14	14	14	14
PHILIPPINES	14*	14	7#	7#	7#	7	7	7	7	7#	7#	14
PUERTO RICO	14	7	7	7	7	7	7	14	14	21	21	14
SOUTH AFRICA	7#	7	7	7#	7#	7#	7#	14	14	14*	14	14
U. S. S. R.	7#	7	3	3	7	7#	7#	7*	7*	7#	7#	7#
EAST COAST	14	7	7	7	7	7	7	14	14	21	21	14

Very difficult circuit this hour.
* Next higher frequency may be useful this hour.

Good: 3-6, 8-16, 18-20, 24, 25, 28-31

Fair: 7, 17, 21, 23, 27

Poor: 1, 2, 22, 26

VHF DX: 4-10, 15, 16

"TAB" • TRANSISTORS • DIODES!!

GTD! FACTORY TESTED — FULL LEADS.

PNP 100Watt/15 Amp HiPower TO36 Case! 2N441, 442, 277, 278, DS501 up to 50 Volts/VCBO $1.25 @, 5 for $5. 2N278, 443, 174 up to 80V $3 @, 2 for $5.

PNP 30 Watt, 2N155, 156, 235, 242, 254, 255, 256, 257, 301, 392, @ 35c, 4 for $1
PNP 2N670/300Mw 35c @, 4 for $1
PNP 2N671/1Watt 50c @, 3 for $1

PNP 25W/TO 2N538, 539, 540, 2 for $1
2N1038 6/$1, 1039 4/$1, 1040 $1
PNP/TO5 SIGNAL 350Mw 25c @, 5/$1
NPN/TO5 SIGNAL IF, RF, OSC 25c @, 6 for $1

Silicon PNP/TO5 & TO18 25c @, 5 for $1
2N1046/$1.40 @, 3/$4. 2N1907/$2@, 4/$6
Power Heat Sink Finned Equal to 100 Sq" Surface $1 @, 6 for $5
TO36, TO3, TO10 Mica Mtg 30c @, 4/$1
Diode Power Stud Mica Mtg 30c @, 4/$1

ZENERS 1Watt 6 to 200v 70c @, 3/$2
ZENERS 10Watt 6 to 150v $1.45 @, 4/$5
ZENER Kit Asstd up to 10w 3 for $1
STABISTORS up to 1watt 5 for $1

TRANSISTORS—TOO MANY! U-TEST

Untested Pwr Diamonds/TO3 10 for $1
Untested TO36 up to 100Watts 3 for $1
Untested TO5/SIGNAL/sistors, 20 for $1
Untested Power Diodes 35 Amp 4 for $1
Untested Pwr Studs up to 12Amp 12 for $1

D.C. Power Supply 115v/60 to 800 Cys. Output 330 : Tap 165V up to 150Ma. Cased $5@, 2 for $9

SILICON POWER DIODES • STUDS

DC AMP	50Piv 35Rms	100Piv 70Rms	150Piv 105Rms	200Piv 140Rms
3	.08	.14	.17	.24
12	.30	.55	.70	.85
18*	.20	.30	.50	.75
35	.70	1.00	1.50	2.00
100	1.65	2.05	2.50	3.15
240	3.75	4.75	5.75	8.75

DC AMP	300Piv 210Rms	400Piv 280Rms	500Piv 350Rms	600Piv 420Rms
3	.29	.30	.40	.48
12	1.00	1.35	1.45	1.70
18*	1.00	1.50	Query	Query
35	2.15	2.45	2.75	3.33
100	3.75	4.60	5.50	8.00
240	11.70	17.10	23.94	29.70

*P.F. PRESS-FIT AUTOMOTIVE TYPE!

18 Amp Press Fit up to 200Piv 4/$1
2 to 3 Amp Studs up to 600Piv 6/$1
35 Amp Studs 150 to 200Piv 5 for $5

"TAB" • SILICON 750MA DIODES

NEWEST TYPE! LOW LEAKAGE

Piv/Rms 50/35 .05	Piv/Rms 100/70 .09	Piv/Rms 200/140 .12	Piv/Rms 300/210 .14
Piv/Rms 400/280 .15	Piv/Rms 500/350 .19	Piv/Rms 600/420 .23	Piv/Rms 700/490 .27
Piv/Rms 800/560 .35	Piv/Rms 900/630 .45	Piv/Rms 1000/700 .65	Piv/Rms 1100/770 .75

GTD ALL TESTS AC/DC & LOAD!

:700 Piv/1200 Rms/750 Ma/$1.20 @, 10/$10
Same 1100 Piv/770 Rms 75c @, 16/$11
3 Kv/2100 Rms/200 Ma/$1.80 @, 6/$10
6 Kv/4200 Rms/200 Ma/$4 @, 3/$9
12 KV/8400 Rms/200 Ma $8 @, 2/$14

SCR—SILICON CONTROL RECTIFIERS!

PRV	7A	16A	PRV	7A	16A
25	.60	1.00	260	2.70	3.00
50	1.00	1.35	300	3.00	3.45
100	1.60	2.15	400	3.75	3.90
150	1.95	2.45	500	4.75	4.80
200	2.20	2.80	600	5.45	5.65

UNTESTED "SCR" Up to 25 Amps, 6/$2
Glass Diodes IN34, 48, 60, 64, 20 for $1

Two RCA 2N408 & Two Regulators RCA IN2326 on prtd ckt. 30c @, 4/$1

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"TAB" Tubes Factory Tested, Inspctd. Six Months Guaranteed! No Rejects! Boxed! GOVT & MFGRS Surplus! new & Used

Low Prices! New XMTTG Tubes!

4-65A	$7.00	4X150A	$6.75	OB2	.55
4-125A	15.00	826	Query	5R4WGA	3.50
4-400A	25.00	829B	7.20	24G	Query
4-1000A	75.00	872A	3.50		
		OA2	.65		

We Swap Tubes! What Do/U Have?

OA3	.80	5R4	1.00	6F7	.99
OC3	.70	5T4	.90	6F8	1.39
OD3	.59	5V4	.89	6H6	.59
OZ4	.79	5Z3	.89	6J5	.59
IL4	.82	6A7	1.00	6J6	.59
IR4	5/$1	6A8	.99	6K6	.59
IS4	.78	6AB4	.59	6L6	1.19
IS5	.68	6AC7	.72	6SN7	.72

Send 25c for Catalog!

IT4	.85	6AG5	.65	6V6GT	.90
IT5	.95	6AG7	.75	12AU7	.69
IU4	6/$1	6AK5	.69	12A6	.45
IU5	.75	6AL5	.55	25L6	.72
2C39A	Q	6AQ5	.66	25T	4.00
2C40	5.50	6AR6	1.95	28D7	.89
2C43	6.50	6AS7	3.49	50L6	.59
2C51	2.00	6AT6	2/$1	83V	.95

We Buy!		We Sell!		We Trade!	
2D21	.65	6BA6	.59	250TL	19.45
2K25	9.75	6BE6	.59	VR92	5/$1
2K28	30.00	6BK7	.99	388A	3/$1
2V3	2/$1	6BQ6	1.19	416B	16.00
2X2	.48	6BY5	1.19	450TL	43.00
4X250B	30.00	6BZ6	.91	813	9.95
5BP4	7.95	6C4	.45	815	1.75

Top $$$ Paid for All Tubes!

"VOLT-TAB" 600Watt Speed Control 115VAC $4.50 @, 2 for $8

866A Xfmr 2.5V/10A/10Kv/Insl $3 @
Ballentine #300 AC/Lab Mtr. $54
(Sd) Choke 4Hy/0.5A 27Ω $40 @, 2/$6
"VARIACS" L/N 0-135v/7.5A ... $15
"VARIACS" L/N 0-135v/3A $10
TWO 866A's & Fil. Xfmr. $6

SILICON TUBE REPLACEMENTS
OZ4 UNIVERSAL $1.75 @, 2/$3
5U4 1120Rms/1600Inv $2 @, 3/$5
5R4 1900Rms/2800Inv $9 @, 2/$15
866 5Kv/Rms - 10.4Kv Inv $11 @, 2/$20

Mica Condsr .006 @ 2500V 4/$1
Snooperscope Tube 2" $5 @, 2/$9
Mini-Fan 6 or 12Vac/60Cys $2 @, 3/$5
4X150 Ceramic Loktal $1.25 @, 2/$2
Line Filter
Line Filter 50Amp/250VAC $10 @, 2/$16

DC 3½"/Meter/RD/800Ma $4 @, 2/$7
DC 2½" Meter/RD/100Ma $3 @
DC 2½" Meter/RD/30VDC $3 @, 2/$5
AC 3½" Meter/RD/130VOC $5 @, 2/$9
DC 4" Meter/RD/1Ma/$5 @, 2/$9

Battery Charger 6&12V Charges up to 5Amp "Approved" Heavy Duty Design with Klixon Circuit Breaker. Operates 220 or 110VAC @ 50 or 60 Cys $8, 2 for $15, 7/$49

Transformers—All Input 115v/60Cys VCT @ 250Ma, 6V/8A/5A/3A $6, 2/$10
400VDC Supply @ 200MA & Silicon Rect & Filters $10
20VAC & TAPS/,8,12,16, 20V @ 4A, $3
32VCT/1A or 2X16V @ 1A, $8 @, $2/$5

Line Filter 4.5A @ 115VAC 4 for $1
Line Filter 5A @ 125VAC 2 for $1
Converter Filter 400 Ma @ 28VDC 4 for $1
Converter Filter Input/3A @ 30VDC 4/$1
2.5MH PiWound Choke/National 5 for $1

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Kit 75 Resistors 1/2/1&2W
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Kit 500 Lugs & Eyelets
Kit 10 Bathtub Oil Cond's.
Kit 5 lbs. Surprise Package
Kit 10 Transmit Mica Cond's.
Kit 8 Phone/Patch Xfmrs
Kit 10 Insltd Tuning Tools
Kit 6 "SunCells" Battys
Kit 10 Sub-Min Tubes
Kit 12 Alligator Clips Asstd
Kit (6) Tube Clamps Asstd
Kit (32) Transistors PNP & NPN
Kit (12) 2Amp Stud Rectifiers
Kit 75 Mica Condensers
Kit 10 Crystal Diodes
Kit 200ft Hook Up Wire
Kit 4 Rolls, 500ft/ea. Assorted Color
Kit 5 FT243 Xtal Holders
Kit 10 Xtal Osc. Blanks
Kit 4 Asstd Rectifiers
Kit 100 Self/Tap Screws
Kit Adj Wire Striper & Cut
Kit Hi Gain Xtal Mike
Kit 2 pair SO239 & PL59
Kit 12 Binding Posts Asstd
Kit (3) TO36/50Watt Untested
Kit (50) TOPHAT 3/4A/Diodes Untested
Kit (12) TO3/3A Transistors Untested
Kit (4) PF/PressFit 18Amp Studs

Order Ten (10) Kits—We Ship Eleven

One Each Above Kit Only. Each Kit 99c

W.E. Polar Relay #255A/$5 @, 2 for $9
W.E. Socket for #255A Relay, $2.50
Toroids 88Mhy New Pckg $1 @, 6/$5
6.3VCT @ 15.5A & 6.3VCT @ 2A $4 @, 2/$6
200KC Freq Std Xtals $2 @, 2/$3
Printed Ckt Bd New Blank 9x12" $1 @, 6/$5
Klixon 5A Reset Ckt Breaker $1 @, 8/$5
2K to 8K Headsets Good Used $3 @, 2/$5
Xtal Blanks Asst Types 12 for $1

WANTED TEST SETS & EQUIPMENT

Bandswitch Ceramic 500W 2P/6Pos $3 @, 2 for $5
6Hy-305Ma Choke Cased $3 @, 2/$5
7-½Hy-400Ma Choke Cased $7 @, 2/$12
250Mfd @ 450 Wv Lectlytic 4/SSB $3 @, 4/$10
Cndsr Oil 10Mfd x 600-2x2.5 & 5Mfd $1 @, 15/$10
Cndsr Oil 6Mfd @ 1500V $4 @, 4/$10
880Vct @ 735Ma for SSB $9 @, 2/$16
480Vct @ 40Ma & 6.3 @ 1.5A CSD $1.50 @, 4/$5
10Vct @ 5A & 7.5Vct @ 3A CSD $6 @, 2 for $10

WANTED LAB METERS! BRIDGES! K-POTS!

Pwr Sup Kit 900VDC @ 500Ma & 4/Silicon Diodes 1700Piv FWB $12
Pwr Sup Kit 1200VDC @ 200Ma/Xfmr & FWB Silicon Rect $10 @, 2 for $18
Modulation Xfmr 60W/15K to 5.7K $5
Headset Rubber Bunyon Pads pair $1
Socket Ceramic 1625 Tube 4/$1
Socket Ceramic 866 Tube 4/$1
Socket Ceramic 4X150/Loktal 4/$2

WANTED YOUR - ORDER - TODAY!

6MTR Ground-Plane Ant (R Exp) $4
Knob Spin-Crank BC348 Type $1
MiniFan 6 or 12 VAC $1.50 @, 4 for $5
Beam Indicator Selsyns 24VAC 2 for $10
Precision TL147 Feeler Relay Gage $1
8 foot Elec. Cord #16ga & Plug 39c @, 3/$1
Fuse 250Ma/3AG 5 for 30c, 100 for $3

DON'T C-WRITE & SEND ORDER!

XMTTG Mica Condsr .006 @ 2.5Kv 39c @, 5/$1
XMTTG Mica Cndsr .00025 @ 8Kv 75c @, 4/$2
Mini-Rectifier FWB 25Ma @ 115VDC 3 for $1
Micro-Switch Rated 40Amp AC & DC 4 for $1
BandPass Filters 60 or 90 or 150Cys 3 for $5
T30 Throat Mikes $1 @, 4 for $3
"Bruning" 6" Parallel Rule #1 @ 3 for $2
Linear SawTooth Pot KS15138/W. E. 3 for $1

RUSH YOUR ORDER TODAY. QTYS LIMITED!

- AM, CW or SSB
- Wave envelope or trapezoid patterns
- No tuning required
- Up to 60 Mc
- Will handle 5W to 1 KW
- Uses standard connectors
- Internal sweep
- Size: 9½" deep, x 5½" high, x 3½" wide
  Weight: approx. 5 lbs.

$29.95

NEW AMECO VFO FOR 6, 2 & 1¼ METERS

The new Ameco VFO-621 is a companion unit designed to operate with the Ameco TX-62. It can also be used with any other commercial 6, 2, or 1¼ meter transmitter.

Because it uses the heterodyne principle and transistorized oscillator circuits, it is extremely stable. An amplifier stage provides high output at 24-26 MC. The VFO includes a built-in solid state Zener diode regulated AC power supply.

This new VFO is truly an exceptional performer at a very low price **Model VFO-621 $59.95 net.**

SUPEREX HAM HEADPHONES

Full comfort even after many enjoyable hours of continuous use. Superb comfort even for eyeglass wearers. Crisp, distortionless reproduction and high sensitivity allows you to single out that weak signal and hard to reach station. 600 ohms impedance, completely adjustable head harness.

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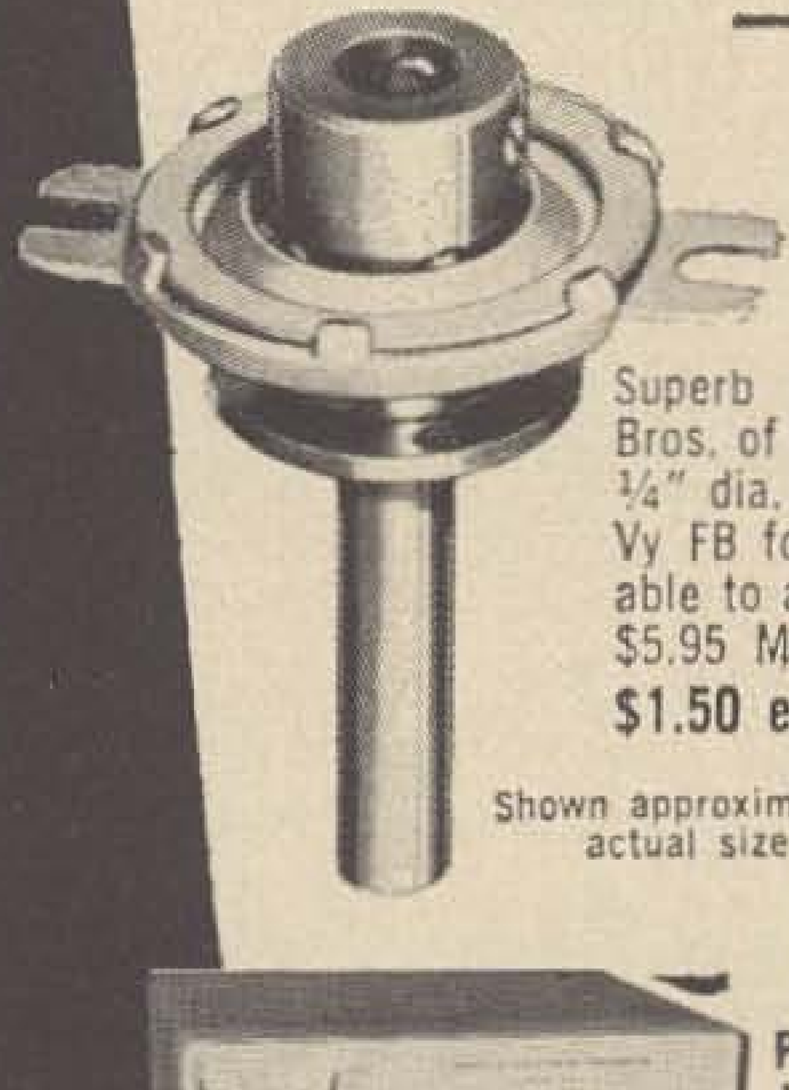
PRECISION PLANETARY-VERNIER for exceptionally fine tuning



Superb craftsmanship by Jackson Bros. of England. Ball bearing drive. ¼" dia. Shaft 1⅛" long; 6:1 ratio. Vy FB for fine tuning. Easily adaptable to any shaft. Comparable value $5.95 Model 4511 DAF.

$1.50 ea. 10 for $13.50

Shown approximately actual size

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AMECO 2 & 6 METER CW/PHONE XMTR WITH POWER SUPPLY

Model TX-62 complete 75 W. phone & CW transmitter has built-in power supply and modulator. Tunes easily by adjusting final plate and loading caps. 50-54 Mc. & 144-148 Mc. Xtal (8 Mc) controlled or can take VFO. Meter reads final grid or cathode current or RF out. Built-in, solid state power supply, fused. Mike/Key jack & xtal socket on front panel. Size: 11½x9½—6" high, shipping weight approx. 20 lbs.

TX-62, wired and tested **$149.95**

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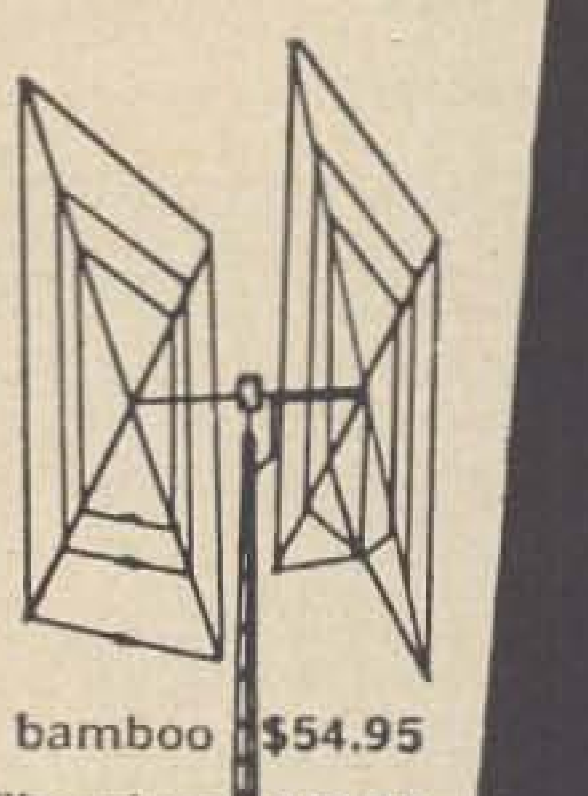

pre-tuned • rated 2KW PEP • low Q • low angle radiation • high gain • broad band • low wind load • simplified assembly • rugged construction • single line or 3 line feed • ship. wt.-40 lbs.

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Definitely not. It's a cold fact that no competitive linear amplifier compares with National's NCL-2000—regardless of price. Take the time to look at the chart below and plug in the specs of *any* amplifier next to those of the '2000 — not a single competitive unit in the maximum power classification offers even half the features of the NCL-2000:

FEATURE	NCL-2000	COMPETITION
POWER	Entire equipment I.C.A.S. rated for full 1000 watt average, 2000 watt peak input; output tubes and all RF components rated for C.C.S. operation. Power input and efficiency identical on all bands — 80 through 10 meters.	
SIZE	Completely self-contained, including power supply, in desk-top cabinet (dimensions only 7⅝" H, 16¼" W, 12¾" D).	
DRIVE REQUIREMENTS	Adjustable passive grid input and use of high power ceramic tetrodes in final permits drive to full output with exciters delivering as little as 20 watts or as much as 200 watts.	
METERING	Separate rear-illuminated precision D'Arsonval plate and multi-meters for simultaneous measurements.	
ALC	ALC output to exciter for maximum talk-power with greatest linearity.	
SAFETY AND PROTECTIVE DEVICES	Fuses, time delay and plate current overload relays, plate power lid interlock and automatic HV mechanical shorting bar.	
CLASS OF OPERATION	Grid-regulated AB_2 permits easiest tune-up, low drive power for maximum exciter linearity, and protection from destructive peak currents.	
EASE OF TUNE-UP	Internal dummy load in grid circuit makes adjustment of exciter into amplifier possible without turning on NCL-2000 and without radiating a signal.	
STYLING	Award-winning design matches NCX-5 transceiver and complements any equipment.	
GUARANTEE	National's exclusive One-Year Warranty.	
PRICE	Only $685.00.	

The NCL-2000 is a rock-crusher of a rig built to *commercial* standards. That's why you get I.C.A.S.-rated maximum legal power in a one-piece desk-top package, and why you get ALC and drive power compatibility with high quality exciters. It's why you get two precision meters, and sensible protection afforded by proper safety devices. Match the NCL-2000 with all the others before you buy — then see your National dealer for easy terms and trade-in deals.

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