73 AMATEUR RADIO

DECEMBER 1967

60¢

73 Magazine

December 1967

Vol. XLVI No. 12

Jim Fisk WIDTY
Editor

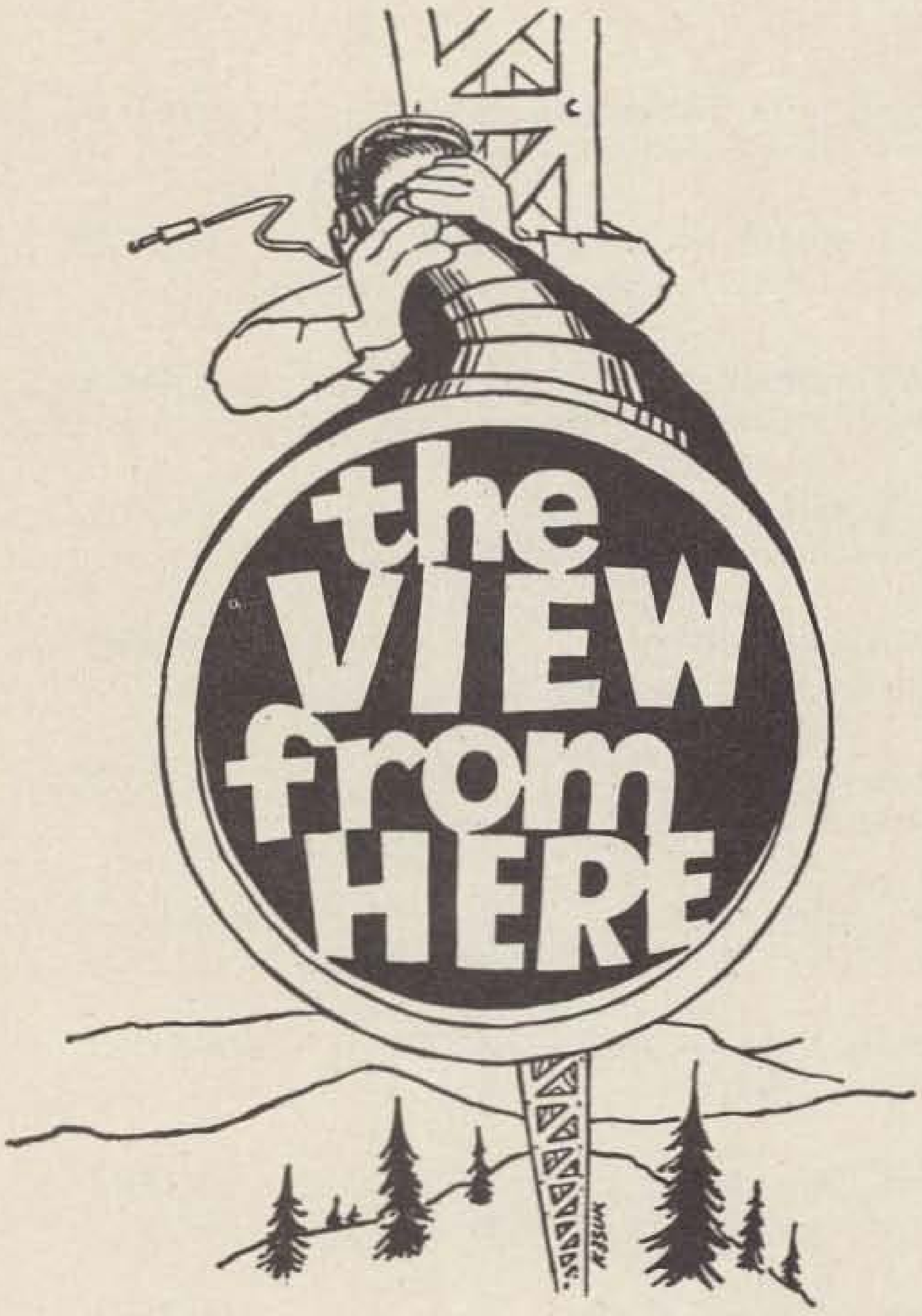
Kayla Bloom WØHJL
Assistant Editor

Published by
Wayne Green, W2NSD/1

Cover by Bob Rogers

73 Magazine is published monthly by 73, Inc., Peterborough, N.H. 03458. The phone is 603-924-3873. Subscription rate: $5.00 per year, $9.00 for two years, $12.00 for three years. Second class postage is paid at Peterborough, New Hampshire, and at additional mailing offices. Printed in Pontiac, Illinois, U.S.A.

Postmasters, please send form 3579 to 73 Magazine, Peterborough, New Hampshire 03458.



I have talked to several hundred amateurs since the new Incentive Licensing Law was announced in late August, and except for one very vociferous individual whom I met in Los Angeles, there has been a noticeable absence of complaints. In general the amateurs have accepted the new rules in good grace and are setting to work on their code speed and theory.

That is not to say that they're all that happy with it. But then, whenever you add requirements to any task, there is bound to be a certain amount of rebellion. That's just natural. However, most individuals will take it all in stride and get on with the task at hand.

Still, there are those hams who ask why. Perhaps the biggest reason is PICON, "public interest, convenience or necessity", which is spelled out in the Communications Act of 1934. This is covered in paragraph 97.1 (c) of the amateur regulations: "Encouragement and improvement of the amateur radio service through rules which provide for advancing skills in both the communications and technical phases of the art."

In fact, I am a perfect example of the need for incentive licensing. If you check the latest edition of the *Radio Amateur Callbook*, you'll find a great big "C" beside my name, indicating a Conditional class license. I never needed anything else, so I never went to the trouble to try for a higher class. Why in fact should I even take the General exam? I already had all the privileges that are available.

However, since I was going to lose a good deal of my operating privileges under the new regulations unless I took the Extra exam, I had to stop procrastinating. And, since I held a Conditional license, I had a pretty good row to hoe. I'm happy to say I made the grade on October 27th. If I was primarily a phone operator, I would probably have waited for the Advanced test, but since I spend about 80% of my operating on CW, the Extra class is a must. Not that it's all that difficult.

Admittedly, there are a few individuals who have trouble with the code. However, and you may not believe this, if you can take 13 words per minute, the odds that you can't take 20 wpm are pretty remote. Tests indicate that up to about ten words per minute, you don't actually "copy" code, you write it. At 13 wpm you actually have to copy it letter by letter because there isn't sufficient time to count the individual dots and dashes in each character. Below 10 wpm you can get away with counting the dots and dashes.

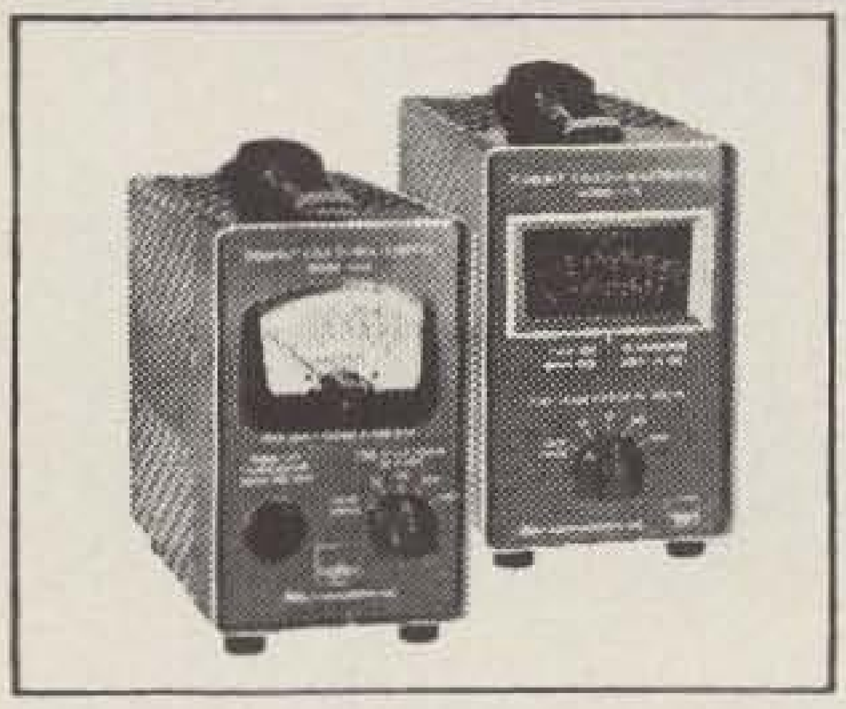
This is borne out by records in the various military radio operator schools. The majority of the fellows who don't make it drop out at the jump from 10 to 13 wpm. And, if they can make 13, they inevitably can increase their speed. It takes some longer than others, but with practice nearly all of them can get up to 20 words per minute.

I'm afraid that I can't offer the same amount of encouragement to the Technicians. In many cases they will never get over the five word-per-minute hurdle. There are a lot of factors involved, but if you can copy five, you can't necessarily get to 13. And I have yet to see someone who could not be taught to take five words per minute. There is even one case on record where a chimpanzee was taught how!

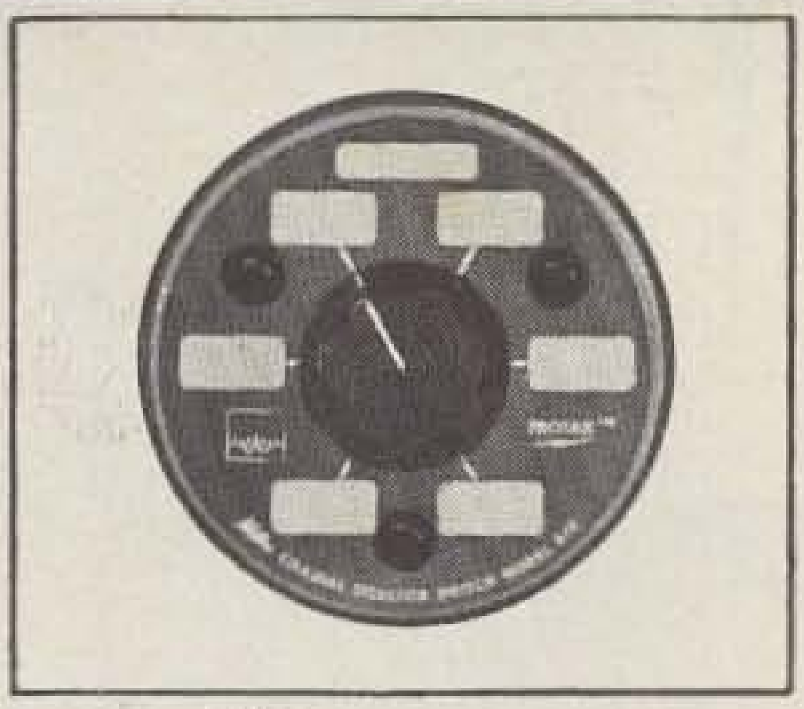
Incidentally, for my unknown friends from San Antonio who want to know how I qualified for the "box-top" license, it's very simple: I was a radio operator with the 7th Division in Korea when I applied.

. . . Jim Fisk W1DTY
Extra Class

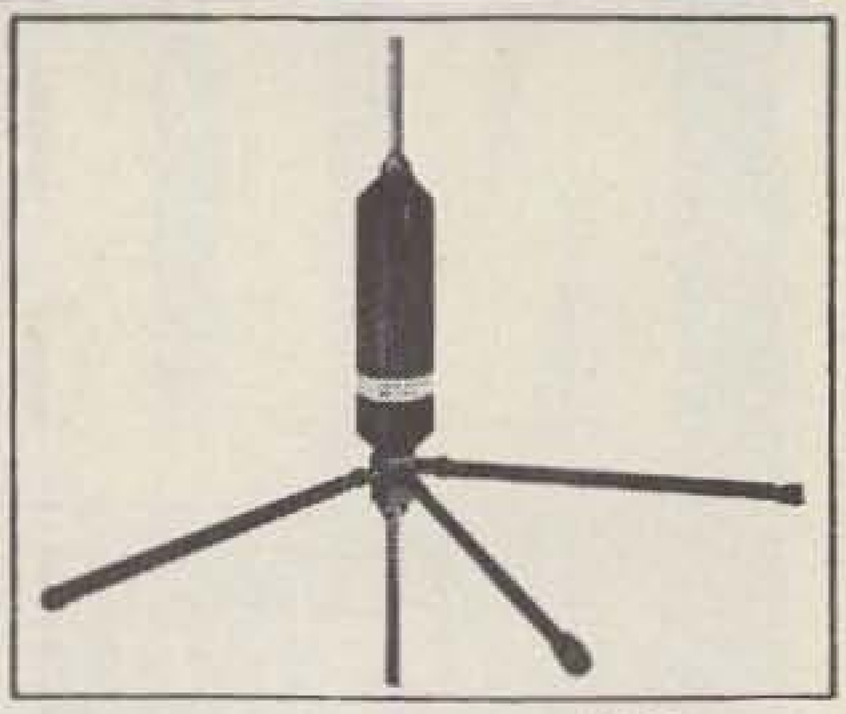
Order Waters fine ham gear *direct*



DUMMY LOAD/WATTMETERS
An effective means of measuring and peaking RF power into a dummy load. Four calibrated scales permit accurate readings of RF watts. Protective warning light.
MODEL 334A
1000 watts.
2 to 230 MHz ...... $135.
MODEL 374
1500 watts.
2 to 30 MHz ...... $135.



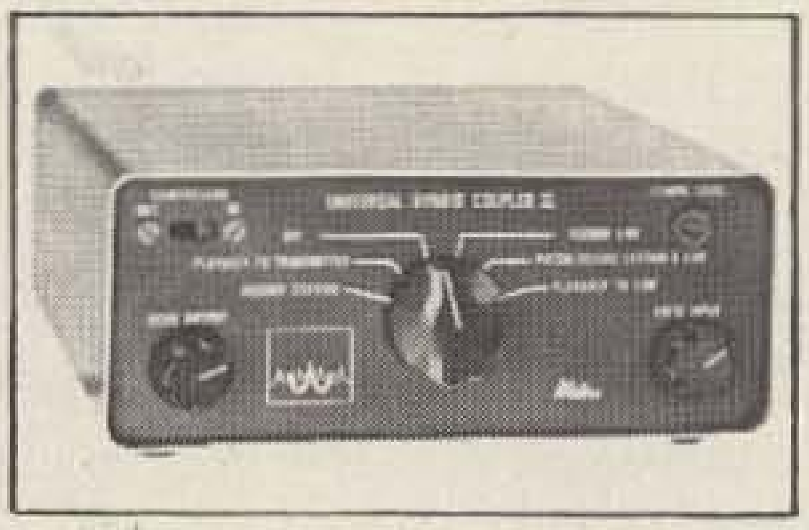
PROTAX™ ANTENNA SWITCHES
Unique coaxial selector switches that automatically ground entire antenna system when station is not in use. Handle 1000 watts; complete with hardware.
MODEL 375 SP6T
Rear Axial Connectors $13.95
MODEL 376 SP5T
Side Radial Connectors $12.50
MODEL 380 SPDT
Rear Axial Connectors $12.45



MOBILE BAND-ADDER ™
Add 10, 15 and 20 meters to any standard mobile antenna with 40 or 75 meter coil. Pre-tuned for full coverage on each band. Will carry 500 watts PEP . . . lightweight and installs in seconds.
MODEL 370-3 ...... **$19.95**

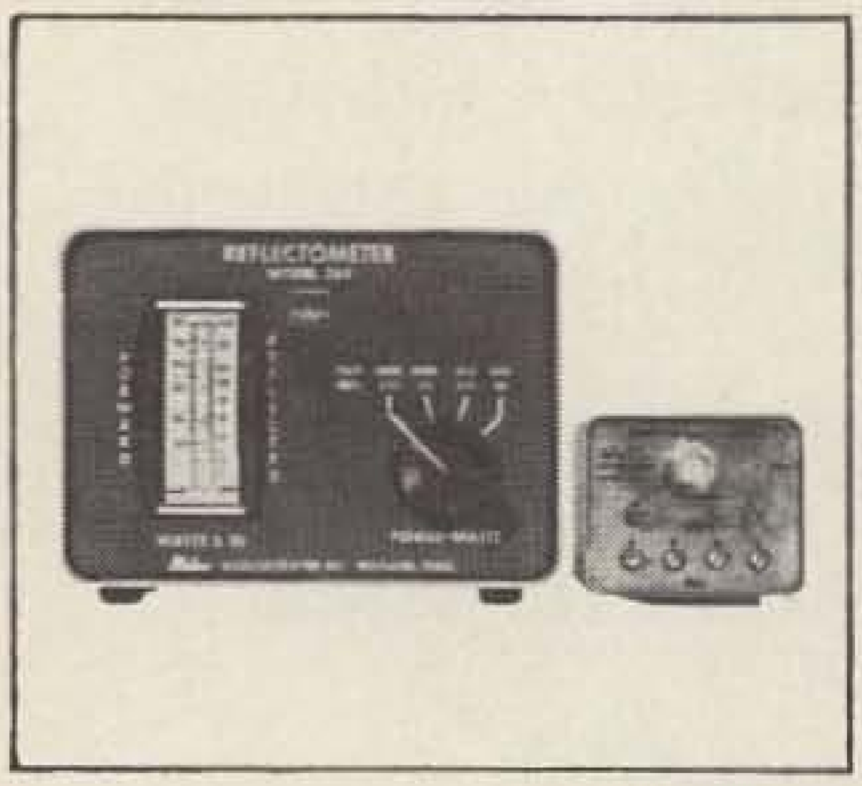
AUTOMATCH ANTENNA . $42.85
Rugged — efficient. (Mast, stainless steel tip and 75 meter coil. Complete)

CODAX KEYER
Automatic spacing and timing from 5 to 50 WPM . . . built-in double-paddle key adjusts to any fist. Solid state with sealed "Reed" relay . . . keyed audio output at microphone level allows use of VOX circuit on either sideband. Self-powered — operates with any rig.
MODEL 361 .... **$92.50**
(Less 1.35 volt batteries)



COUPLER/PHONE PATCH
The ultimate in phone patches providing effortless, positive VOX operation. Also connects tape recorder for both IN and OUT. Available with or without built-in Compreamp which may be used independent of patch.
MODEL 3001
(Without Compreamp) . $53.00
MODEL 3002
(With Compreamp) $72.50

COMPREAMP
Add definite "talk power" to your signal with Compreamp! Self-powered and solid state, it is easily installed in the mike line of either fixed or mobile station. Great for the added punch when QRM and band conditions are tough.
MODEL 359 .... **$27.95**



REFLECTOMETER
Measures both forward and reflected power simultaneously on unique double meter. Covers 3 to 30 MHz at 52 ohms on two separately set forward scales of 200 and 1000 RF watts (20 and 200 watts reflected) to insure accurate readings. Complete with directional coupler.
MODEL 369 .... **$120.00**

ATTENUATOR
Gives stepped attenuation to 225 MHz from 0 to 61 DB in 1 DB steps. 50 ohms.
MODEL 371-1
(UHF Connectors) ... $29.95
MODEL 371-2
(BNC Connectors) ... $32.50
MODEL 371-3
(N Connectors) $38.95

USE THIS CONVENIENT ORDER FORM

...from Waters

or...

SPECIAL BONUS OFFER!

Model 372

CLIPREAMP

for only...$11.00

ALMOST 50% OFF — REG. $21.95

(With the purchase of any other Waters product)

This is Waters way of saying 'thank you' to our many old customers . . . and 'welcome' to new friends!

The solid-state Clipreamp is both speech amplifier and clipper designed to increase and maintain the talk-power of your signal up to four times normal levels. Self-contained and self-powered (9-volt battery gives 500 hours operating time) Clipreamp is readily installed in the mike line of any transmitter. It is best appreciated when QRM and band conditions are tough . . . extremely effective with any form of patch.

For a very limited time you can save $10.95 on the Clipreamp with the purchase of any other piece of Waters ham gear. BETTER HURRY!

order from the exclusive Waters Distributor nearest your QTH

The complete Waters line is always in stock at all of these exclusive Waters distributors.

AMATEUR ELECTRONIC SUPPLY
Milwaukee, Wisconsin 53216

AMRAD SUPPLY, Inc.
San Francisco, California 94121

ARROW ELECTRONICS, Inc.
Farmingdale, Long Island, N.Y. 11735
Norwalk, Connecticut 06850
Totowa, New Jersey 07512
Mineola, New York 11501
New York, N. Y. 10007

ELECTRONICS CENTER, Inc.
Dallas, Texas 75204

ELECTRONIC DISTRIBUTORS, Inc.
Wheaton, Maryland 20902

HARRISON RADIO CORPORATION
Jamaica, Long Island, N.Y. 11435
New York, N.Y. 10007

HENRY RADIO, Inc.
Butler, Missouri 64730
Anaheim, California 92801
Phoenix, Arizona 85017
Los Angeles, Calif. 90064

STERLING ELECTRONIC SUPPLY
New Orleans, Louisiana 70112

WORLD RADIO LABS, INC.
Council Bluffs, Iowa 51501

PAYETTE RADIO Limited
Montreal 3, Canada

This order form may be sent direct to the factory or to your nearest Waters Distributor.

WATERS MANUFACTURING, Inc., Wayland, Mass. 01778 Dept. S-2

Send .... Model .... @ .... each .... $ ....

PLUS — Send 1 Model 372 Clipreamp @ .... $ 11.00

Total Order (Check/Money Order Enclosed) .... $ ....

NAME .... CALL ....

CITY .... STATE .... ZIP....................

A. E. McGee, Jr. K5LLI
2815 Materhorn Drive
Dallas, Texas 75228

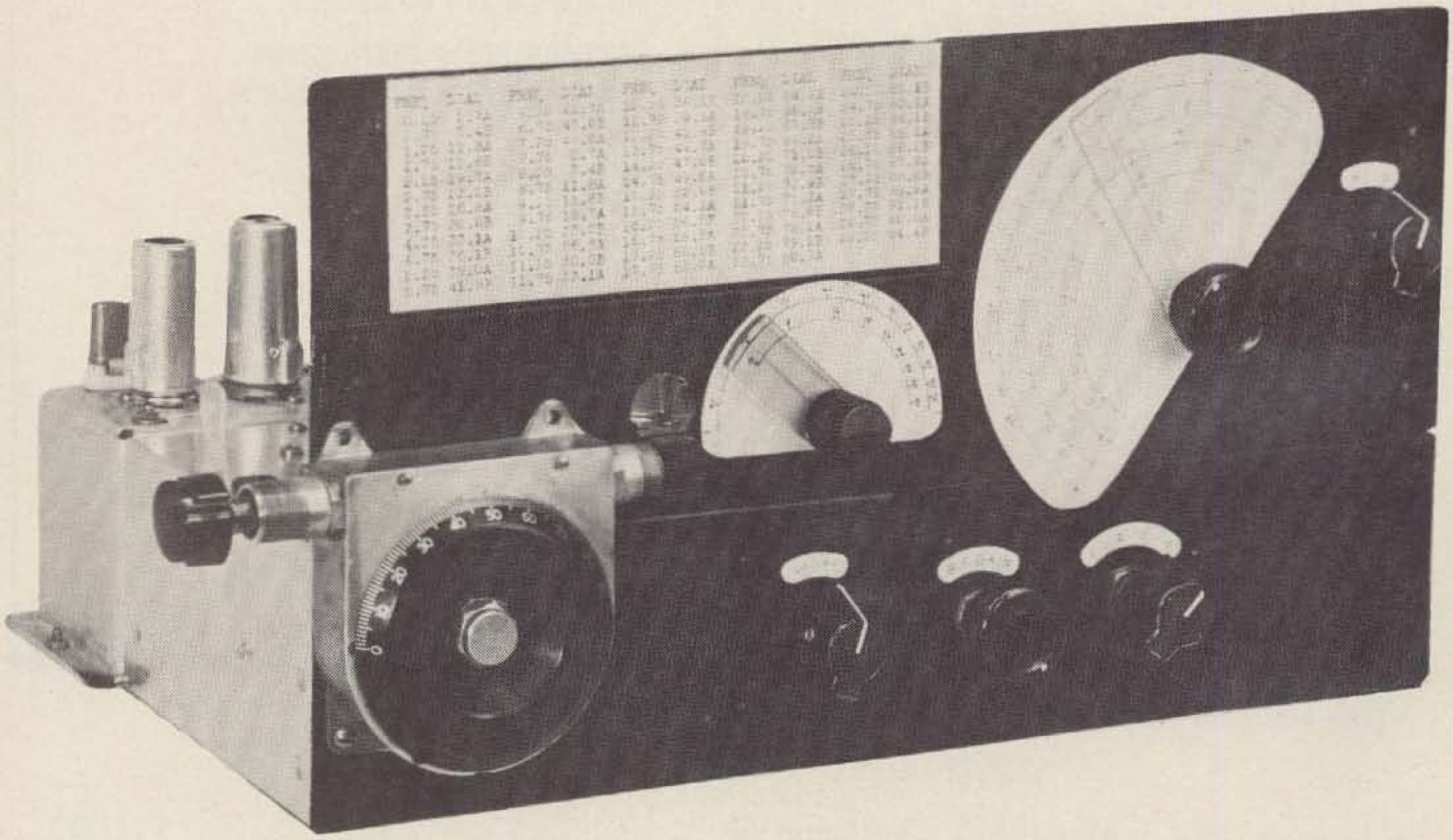
A .25 MHz to 29.75 MHz Stabilized Converter

There are many advantages to the ham-bands only receiver. Good stability, a slow tuning rate, and accurate calibration are common in these receivers. Their greatest disadvantage is that they tune only a small portion of the spectrum below 30 MHz. This converter was designed to eliminate this disadvantage by converting all frequencies from .25 MHz to 29.75 MHz to the output frequency of 3.5 MHz to 4.0 MHz. This is done with little loss of stability or calibration accuracy.

The 29.5 MHz range is covered in 59 bands, each 500 kHz wide. Forty-four local oscillator frequencies are used. The local oscillator is above the signal from .25 MHz to 7.75 MHz, and below the signal from 7.75 MHz to 29.75 MHz. The local oscillator is a vfo which is stabilized at the proper output frequencies with an afc circuit. The main frequency-determining parts of this circuit are a 1 MHz crystal oscillator and a 1.75 MHz phase-shift discriminator, both of which are quite stable.

The afc loop doesn't have enough gain to lock exactly on frequency, but with reasonable care in tuning, the error will be no more than a kilohertz or so. The warm-up drift is about 2.4 kHz at 28 MHz and about 1.3 kHz at 2 MHz. Most of the drift takes place in the first 10 minutes after turn on, and after about 20 minutes the drift is too slight for me to measure.

With an output frequency of 3.5 MHz to 4.0 MHz, all of the bands begin and end at the .25 MHz and .75 MHz points. This is a minor inconvenience when tuning some bands. The bands would begin and end at the .5 MHz and 1 MHz points if the output frequency were changed to 3.75 MHz to 4.25 MHz, but this wasn't convenient with the receiver I use.



Front view of the stabilized converter which covers from 500 kHz to 29.75 MHz. The dial on the left is the tuning dial, the one in the middle is set according to the chart and the dial on the far right is the preselector.

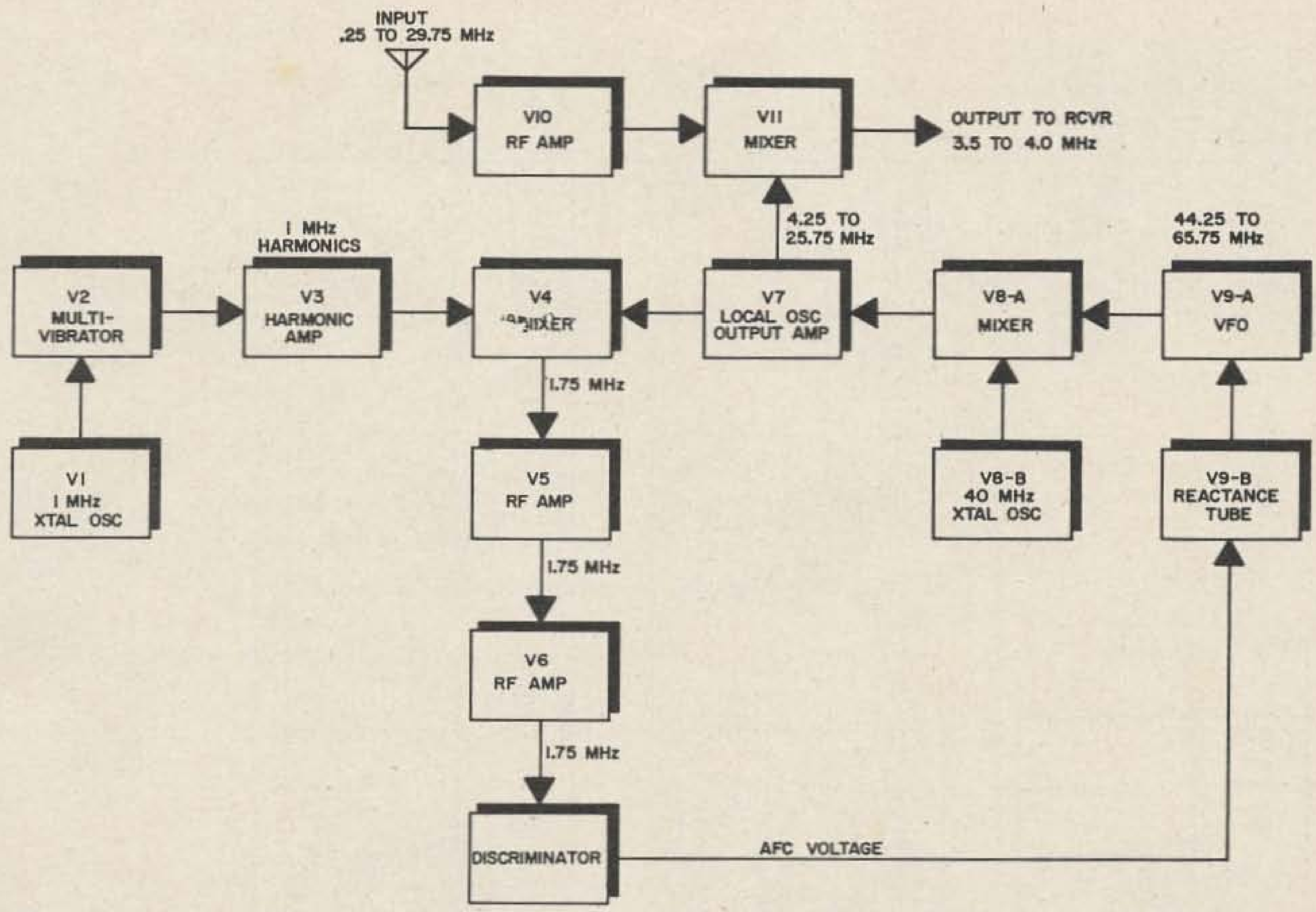


Fig. 1. Block diagram of the wideband converter which covers from 500 kHz to 29.5 MHz. A complete description of its operation is given in the text.

Theory of operation

The local oscillator operates in the following manner. Refer to the block diagram, *Fig.* 1. V1 is a crystal oscillator operating at 1 MHz and is capable of being zeroed with WWV. This 1 MHz signal is fed into a multivibrator, V2, to increase its harmonic content. The output of V2 is fed into a wideband amplifier, V3, to increase the level of the higher harmonics. These 1 MHz harmonics then go to one input of V4, a pentagrid mixer. The vfo, V9a, is continuously tunable from 44.25 MHz to 65.75 MHz. The vfo output goes to a triode mixer, V8a, where it is mixed with the 40 MHz output of V8b, which is an overtone crystal oscillator.

The difference frequency is selected and amplified by V7 to get an output of 4.25 MHz to 25.75 MHz, which goes to the other input of the pentagrid mixer, V4, and is also the local oscillator output to the converter. The output of the mixer, V4, is tuned to 1.75 MHz and is amplified by V5 and V6. The output of V6 goes to a Foster-Seely type discriminator with a center frequency of 1.75 MHz. The diodes in this circuit are reversible by means of a switch to give the proper output polarity.

When the incoming frequency is exactly 1.75 MHz the output of the discriminator is zero. When the frequency is greater than 1.75 MHz there will be a dc output voltage from the discriminator, and when the frequency is less than 1.75 MHz there will be a dc output voltage of the opposite polarity. This is the control voltage which goes to V9b, a reactance tube which has the effect of shunting a capacitance across the vfo tuned circuit. The amount of capacitance is determined by the discriminator output voltage, so it follows that the vfo frequency can be controlled in some extent by the frequency of the signal input to the discriminator.

As the vfo is tuned through its range, the 4.25 MHz to 25.75 MHz output of V7 beats with the 1 MHz harmonics in V4 to produce the 1.75 MHz output at .5 MHz intervals. For example, when the vfo output is 4.25 MHz it beats with the sixth 1 MHz harmonic at 6 MHz to give a difference frequency of 1.75 MHz. When the vfo is moved up .5 MHz to 4.75 MHz it beats with the 3 MHz harmonic to give the difference frequency of 1.75 MHz, and so on throughout the tuning range. As the vfo is moved up through its range, at each consecutive .5 MHz interval it mixes alternately with a 1 MHz harmonic which is either 1.75 MHz above or 1.75 MHz below the vfo output frequency. This alternate use of 1 MHz harmonics above and below the vfo frequency is the reason for the diode switching in the

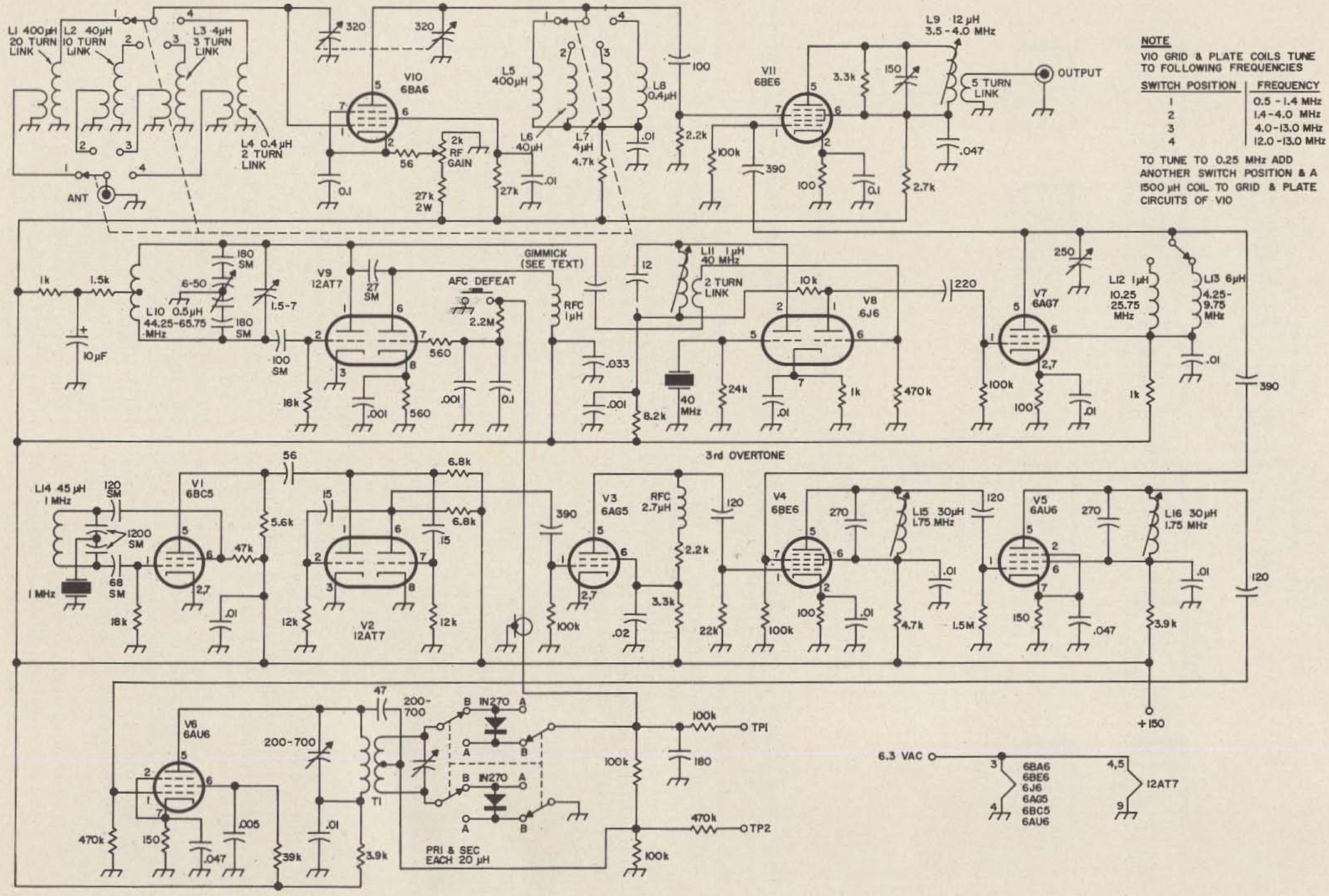


Fig. 2. Circuit diagram of the stabilized converter. Coil values are given in Table 1.

discriminator output. This maintains the proper polarity of afc voltage needed to lock the vfo on frequency.

When the vfo is tuned to within 25 kHz or so of the right frequency the afc action of the discriminator and reactance tube will tend to pull the oscillator to an exact 0.5 MHz interval and correct for any drift or slight mistuning. This afc action is not perfect but with average care in tuning, the error can be kept to less than 2 kHz. If a meter is used to monitor the discriminator output voltage and is kept zeroed, the only error will be caused by drift in the 1 MHz oscillator or drift in the 1.75 MHz discriminator circuit, both of which can be made very slight.

A vfo in the VHF region is used so that the reactance tube will have a considerable effect on the frequency of oscillation. It also enables you to cover the entire range without any switching in the oscillator circuit.

Construction

This unit was built almost entirely from the junkbox. The circuits are simple and nothing seems to be critical. The vfo, high-frequency mixer, and local oscillator output amplifier are built on a 5 x 7 x 3 inch aluminum chassis, and the converter is built on another the same size. The locking circuit is built into four small surplus aluminum boxes. Using a separate chassis is a simple way of providing good shielding, which helps to reduce spurious signals.

The vfo is tuned with a Bud No. LC1662 dual capacitor with 6-50 pF per section. It works well enough but the straight-line capacity causes crowding at the high frequency end of the dial. The dial is from a BC-429 receiver. It has a nice slow 120 to 1 ratio, but the 0 to 100 calibration leaves something to be desired. The coil is wound on a ½ inch diameter ceramic form. A 1.5-7 pF ceramic trimmer and two 180 pF silver mica padders were used to spread the tuning range over most of the dial. This circuit should be built for maximum mechanical stability.

In the reactance tube circuit, the 1 μH RFC and the 560 ohm grid resistor were found experimentally to give the greatest frequency swing.

The high frequency mixer, V8a, is coupled to the vfo by wrapping several turns of insulated wire around the vfo plate lead, and is coupled to the 40 MHz oscillator with a two turn link around the oscillator coil.

The local oscillator output amplifier, V7, is tuned with one section of a two gang variable, the other section not being used. It is from surplus and has a maximum capacity of 250 pF. The coils are wound on ¾ inch diameter plastic tubing. Two coils are needed to cover the tuning range of 4.25 MHz to 25.75 MHz.

The 1 MHz oscillator uses a series resonant CR-19/U crystal. This requires a tuned circuit in the oscillator. The coil is wound on a ⅞" diameter ceramic form. I tuned the circuit to resonance by pruning the coil. A trimmer capacitor could be used for easier adjustment.

The multivibrator, V2, synchronizes easily with the crystal oscillator using the parts values given. If you change some of the values be sure the free-running frequency is close enough to 1 MHz to sync properly.

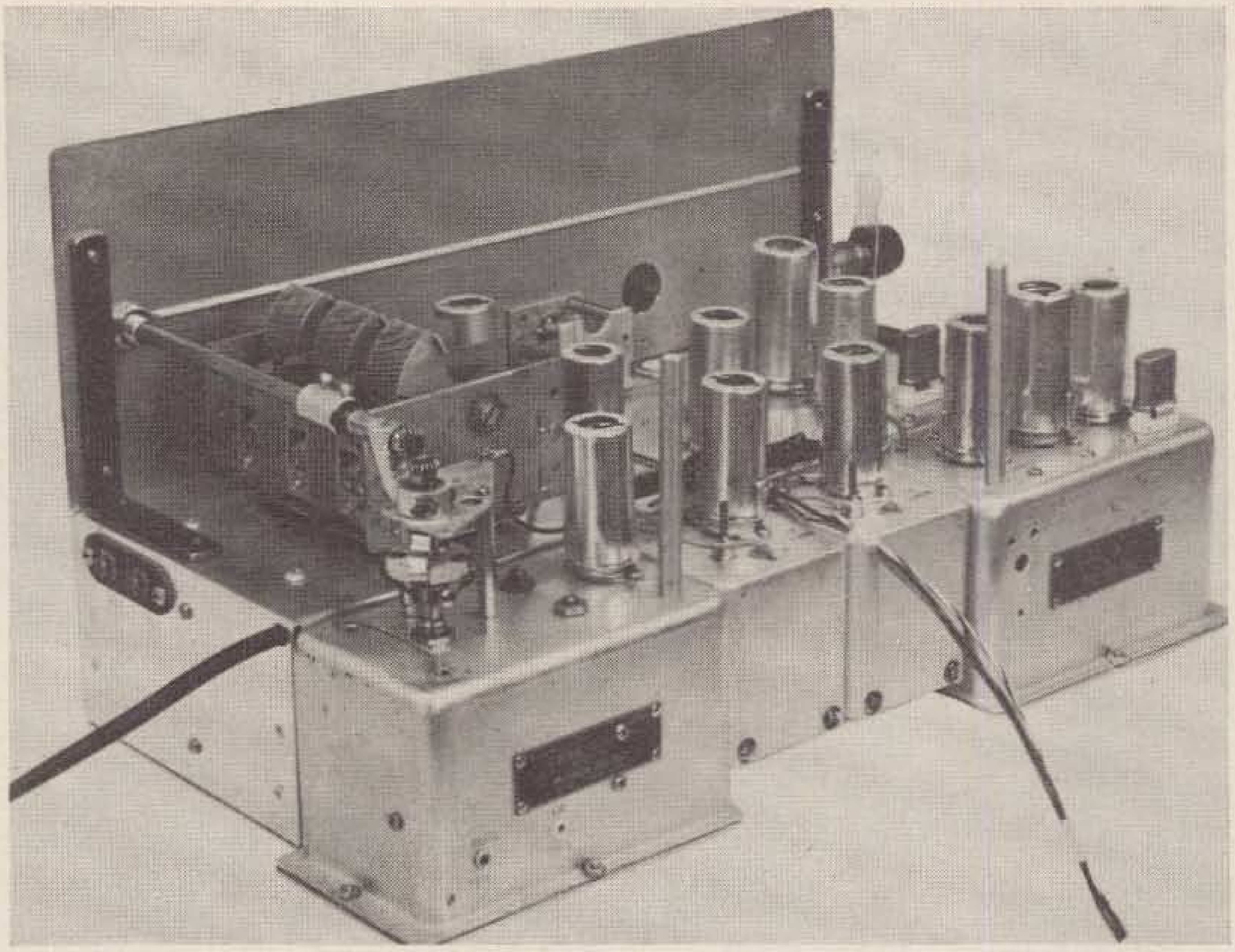
The harmonic amplifier, V3, is a crude type of wide band amplifier. The 2.7 μH RFC and the 2200 ohm resistor in the plate circuit were chosen by trial and error to give some amplification of the higher 1 MHz harmonics without attenuating the lower frequencies.

In the low frequency mixer, V4, the plate coil is wound on a ¼ inch diameter iron slug tuned form taken from an old TV set, as is the plate coil in the 1.75 MHz amplifier, V5. There should be no regeneration in the 1.75 MHz amplifiers or the bandwidth may become too narrow for easy locking of the afc

Table 1. Coil data for the stabilized converter.

L1, L5	—175 turns no. 30, 1-1/16" diameter, close wound.
L2, L6	—50 turns no. 30, ¾" diameter, close wound.
L3, L7	—15 turns no. 26, ¾" diameter, ½" long.
L4, L8	—5 turns, no. 20, ¾" diameter, ½" long.
L9	—50 turns no. 30, ¼" diameter, ½" long, scramble wound.
L10,	—8 turns, no. 18, ½" diameter, ¾" long, center tapped.
L11	—20 turns no. 26, ¼" diameter, close wound.
L12	—6 turns no. 26, ¾" diameter, ⅜" long.
L13	—22 turns no. 26, ¾" diameter, ¾" long.
L14	—52 turns no. 30, ⅞" diameter, close wound.
L15, L16	—75 turns no. 30, ¼" diameter, ½" long, scramble wound.
T1	—Primary 45 turns no. 30, ½" diameter, close wound. Secondary 45 turns no. 30, center tapped, close wound. ½" space between windings.

Rear view of the wide-band converter. The chassis is made up from six smaller chassis—this provides modular construction and shielding between stages. The coaxial cable to the left connects into the station receiver; the wires from the rear furnish power.



loop.

The discriminator coil is wound on a ½ inch diameter plastic form taken from an old TV set. The tuning capacitors are mica compression type trimmers. The capacity required is about 450 pF. This probably should be made up of a fixed silver mica in parallel with an air trimmer for tuning, as this is one of the main frequency-determining circuits. However, in the original circuit frequency drift is negligible. 1N270 diodes were used because they were on hand. Any of the small signal germanium diodes should work well.

The diode reversing switch is a ceramic rotary from surplus. It is actuated through a right angle gear drive taken from a surplus tuning drive. The dc output should be run through a shielded wire to the reactance tube to avoid hum pickup. TP1 and TP2 are phone tip jacks used as test points for aligning the 1.75 MHz stages.

The converter, consisting of the rf amplifier, V10, and the mixer, V11, is conventional. The grid and plate circuits of the rf amplifier are tuned with 2 sections of a 3 gang variable capacitor taken from an old car radio. The shielding between the two tuned circuits is inadequate in this unit, which made it necessary to load the output circuit with a 2200 ohm mixer grid resistor to prevent oscillation. The lowest frequency tuned is 500 kHz, but this can be extended to 250 kHz, if desired, by adding another switch position and two more coils. The mixer output coil is wound on a ¼ inch diameter iron slug tuned form from an old TV set. It is loaded with a 3300 ohm resistor to broaden the bandwidth and gives a reasonably flat response across the band.

Alignment and calibration

The equipment required for alignment and calibration is a grid dip meter, a receiver covering from 3.5 MHz to 30 MHz, a 100 kHz crystal calibrator, and a 50 μA meter or a vtvm. The most difficult job is calibrating the vfo. Start by checking the tuning range with the grid dip meter and adjust the trimmer and padders or prune the coil until the range of 44.25 MHz to 65.75 MHz covers most of the dial. Apply filament and plate voltage to V8 and V9 and adjust the 40 MHz oscillator coil slug for maximum output consistent with good starting. Check for output and proper frequency with the grid dip meter in the diode position. Ground the grid of the reactance tube temporarily, or close the afc defeat switch.

With the vfo and the 40 MHz oscillator working properly, lightly couple the plate of the high frequency mixer (pin 1 of V8) to the receiver by bringing a short antenna wire nearby. Calibrate the vfo (vfo frequency minus 40 MHz) as accurately as possible to the .25 MHz and .75 MHz points from 4.25 MHz to 25.75 MHz. I calibrated by 0 to 100 dial to the nearest tenth of a division and made a chart listing the frequency and dial reading.

Apply filament and plate voltage to the

local oscillator output amplifier, V7, and filament voltage to V4 and V11. For a resonance indicator measure the grid voltage of V4 (pin 7) through an isolating resistor. Calibrate the tuning of V7 at enough spots so that it may be set close to the mixer output frequencies (4.25 MHz to 25.75 MHz) without use of the meter.

With all voltages removed, pre-tune the 1.75 MHz output circuits of V4 and V5 with the grid dip meter. Pre-tune the discriminator transformer by shorting out the secondary with a short jumper and dipping the primary to resonance. Remove the jumper from the secondary and place it across the primary and dip the secondary to resonance. Remove the jumper from the circuit and apply filament and plate voltage to V5 and V6. Connect a 50 μA meter or vtvm between test point 2 and ground. Inject a small amount of 1.75 MHz rf into the output coil of V4 with the grid dip oscillator.

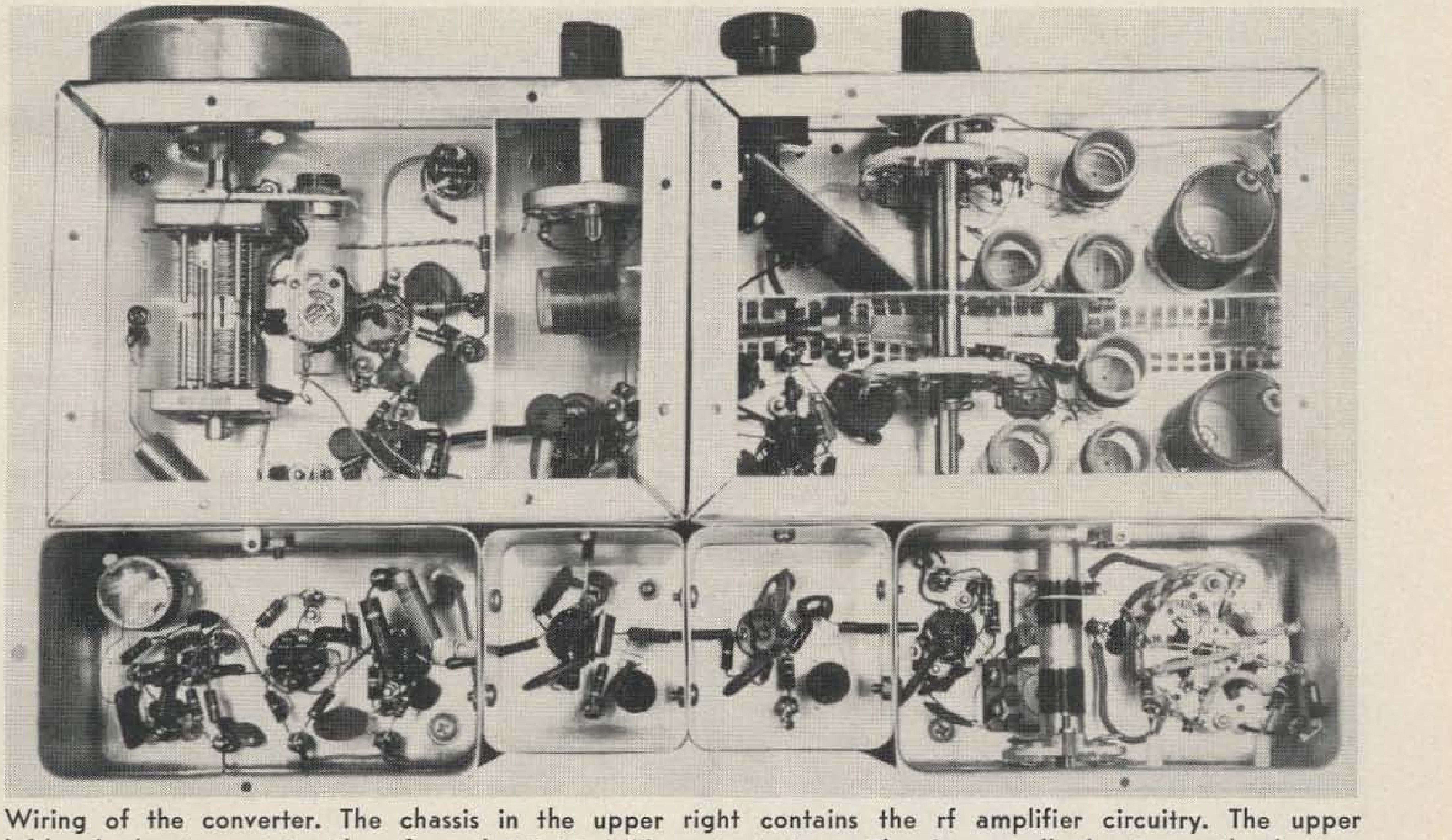
To insure accuracy tune the receiver to 3.5 MHz and zero beat the second harmonic of the grid dip oscillator with the crystal calibrator. Tune the output coils of V4 and V5 and the primary of the discriminator transformer for maximum voltage at test point 2. Connect the meter to test point 1 and adjust the secondary of the discriminator transformer for zero output at exactly 1.75 MHz. Moving the grid dip oscillator frequency above and below 1.75 MHz should swing the output voltage above and below zero. The output polarity should reverse when the diode reversing switch is thrown.

Check the 1 MHz crystal oscillator for proper operation and adjust it for zero beat with WWV. Check the free-running frequency of the multivibrator by listening to it or its harmonics on the receiver. It should be within 100 kHz or so of 1 MHz to insure proper synchronization. The operation of the harmonic amplifier can be checked by listening to the 1 MHz harmonics above 20 MHz with the amplifier in and out of the circuit.

The plate coil of the mixer, V11, can be tuned to resonance at about 3.75 MHz with the grid dip meter.

I calibrated the rf amplifier, V10, after everything else was working properly. I started with the lowest frequency band and went through the entire range, first setting the local oscillator and the receiver to the desired frequency and then tuning the rf amplifier for maximum noise. A signal generator or the grid dip oscillator could also be used.

Some kind of charts or graphs are necessary to convert the receiver dial reading to



Wiring of the converter. The chassis in the upper right contains the rf amplifier circuitry. The upper lefthand chassis contains the vfo and 3.5-4.0 MHz output stage. The four small chassis on the bottom are, from the left, 1 MHz crystal-controlled reference and harmonic generator, two amplifier stages and the 1.75 MHz frequency discriminator.

the actual received frequency. Four conversions are needed: below 7.75 MHz (reverse tuning) in "A" diode switch position; below 7.75 MHz in "B" diode switch position; above 7.75 MHz (forward tuning) in "A" diode switch position; and above 7.75 MHz in "B" diode switch position. I use a slide rule type scale drawn on graph paper with the receiver dial reading above the line and the corrected reading below the line. The tuning charts are not necessary for most general listening. It is usually enough just to know the center frequency and whether the tuning is forward or backward.

Operation

Operation of the completed converter is simple. The vfo is first tuned carefully to the proper frequency. Then the local oscillator output tuning and the rf amplifier tuning dials are set and the diode reversing switch is set to the proper position. With the discriminator diodes and the reversing switch wired as shown, the "A" position is used for properly locking to the .25 MHz local oscillator frequency points, and the "B" position for the .75 MHz points. The afc defeat switch is then momentarily closed to let the vfo return to its natural frequency. When the afc defeat switch is opened the converter will lock on frequency and be ready for use. The rf amplifier is sharp tuning and will have to be peaked up several times when tuning across a band. The converter should not be used from 3.5 MHz to 4.0 MHz because of direct feed through of signals to the receiver. To tune 3.5 MHz to 4.0 MHz without disconnecting the converter, the local oscillator can be set to some other band with the rf amplifier tuned to 3.5 MHz to 4.0 MHz, thereby using the converter as a preselector.

There are three strong spurious signals in the output of the converter. These are at exactly 3.5 MHz, 3.75 MHz, and 4.0 MHz. They are seldom bothersome and provide useful marker signals. Any incoming signal that is zero beat with these signals, such as WWV, is easily heard.

The power required is 150 Vdc at 85 mA, and 6.3 Vac at 3.5 A. The plate voltage to the vfo and the reactance tube should be regulated.

The idea for using a VHF vfo came from the British Racal receiver. The afc circuit is similar to that used for stabilizing some types of FM transmitters.

... K5LLI

NEW Drake R4B Receiver

Amateur Net **$430.00**

Same specifications as R4A*

PLUS

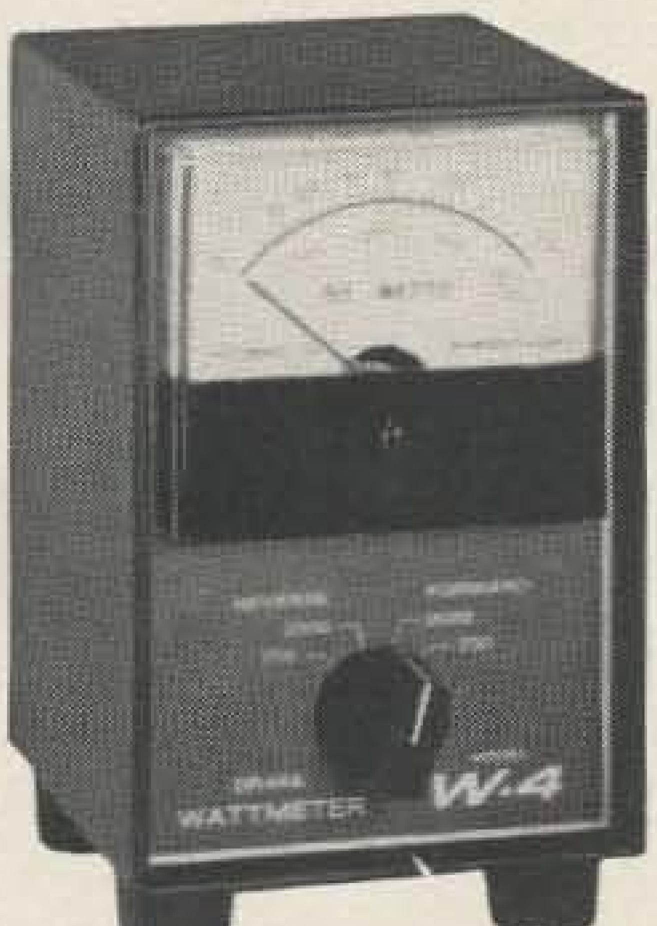
- New tuning knob and skirt
- PTO indicator light
- Side-mounted head phone jack
- New scratch-proof epoxy finish
- New eye-ease front panel
- Improved audio (low distortion, high output)
- SOLID STATE circuitry used in PTO, Crystal Oscillator, Product Detector, AVC Circuit, BFO, Audio Amplifier, Crystal Calibrator.

25KC Calibrator has a sophisticated design, using integrated circuits and FET's; permits working closer to band edges.

The R-4B RECEIVER is a model of design, using the best combination of transistors and tubes, printed circuits and hand wiring to give maximum performance and minimum maintenance, at the lowest cost.

***Linear permeability tuned VFO** with 1 kc dial divisions. VFO and crystal frequencies pre-mixed for all-band stability • **Covers ham bands** 80, 40, 20, 15 meters completely and 28.5 to 29.0 Mc of 10 meters with crystals furnished • **Any ten 500 kc ranges between 1.5 and 30 Mc** can be covered with accessory crystals for 160 meters, MARS, etc. **(5.0-6.0 Mc** not recommended) • **Four bandwidths of selectivity,** 0.4 kc, 1.2 kc, 2.4 kc and 4.8 kc • **Passband tuning** gives sideband selection, without retuning • **Noise blanker that works on CW, SSB, and AM** is built-in • **Notch filter and crystal calibrator** are built-in • **Product detector** for SSB/CW, **diode detector** for AM • **Crystal Lattice Filter** gives superior cross modulation and overload characteristics • **AVC** for SSB or high-speed break-in CW • **Dimensions:** 5½"H, 10¾"W, 12¼"D. **Wt.:** 16 lbs.

NEW DRAKE ACCESSORIES



WATTMETER W-4 $49.50

Reads forward and reflected power directly in watts (VSWR from nomogram). Two scales in each direction, 200 and 2000 watts full scale. Calibration accuracy ± (5% of reading + 2 watts) on 200 watt scale; ± (5% of reading + 20 watts) on 2000 watt scale. **Size:** 5½" H x 3¾" W x 4" D.

MN-4 . . . $90.00
200 watts

MN-2000 . . . $160.00
2000 watts **PEP**

MATCHING NETWORKS

General: With integral VSWR meter and RF wattmeter. Matches 50 ohm resistive transmitter output to coax antenna feedline with VSWR of up to at least 5:1 whether resistive, capacitive or inductive. Covers ham bands 80 thru 10 meters. Has alternate output for tuning up into external dummy load. Meter reads forward power directly and VSWR directly, or can be calibrated to read reflected power directly in watts. Size: 5½" H x 10¾" W x 8" D. Matching network can be switched in or out with front panel switch.

Continuous Duty Output: MN-4, 200 watts; MN-2000, 1000 watts (2000 watts PEP).

Meter reads forward power directly: MN-4, 300 watts full scale with accuracy ± (5% of reading + 3 watts); MN-2000, 2000 watts full scale with accuracy ± (5% of reading + 20 watts), and 200 watts full scale with accuracy ± (5% of reading + 2 watts).

MN-2000 only: Up to 3 antenna connectors can be selected by front panel switch.

Prices and specifications subject to change without notice.

See your distributor. For more information write to:

R. L. DRAKE COMPANY • MIAMISBURG, OHIO 45342

Attn: Dept. 3127

George Cousins VE1TG
Lower Sackville
Nova Scotia, Canada

Some Experiments with Stacked Beams

For the amateur interested in DX, both the power output of the transmitter and the type of antenna used will be of prime importance in getting a signal to the desired location. Neglecting for the time being the general characteristics of the receiver itself, the antenna becomes equally important in reception of long-distant communications. In the pursuit of a rare DX contact, the frequency will, more often than not be jammed with stations who are running the legal limit—which is not difficult or even particularly expensive for a great many hams—so it becomes a matter of operating skill and antenna efficiency if one is to break through to the rare one. For the antenna to be most useful for DX work, it should have as much gain as possible. It should also have as low an angle of radiation as possible. Of the two factors, the angle of radiation is probably most important. This will be especially noticeable when the band is just starting to open, and the antenna with a low angle will get through just a little before the competition. But, to achieve this low angle, careful consideration must be given to the type of antenna and its construction. Cost is also of importance of course.

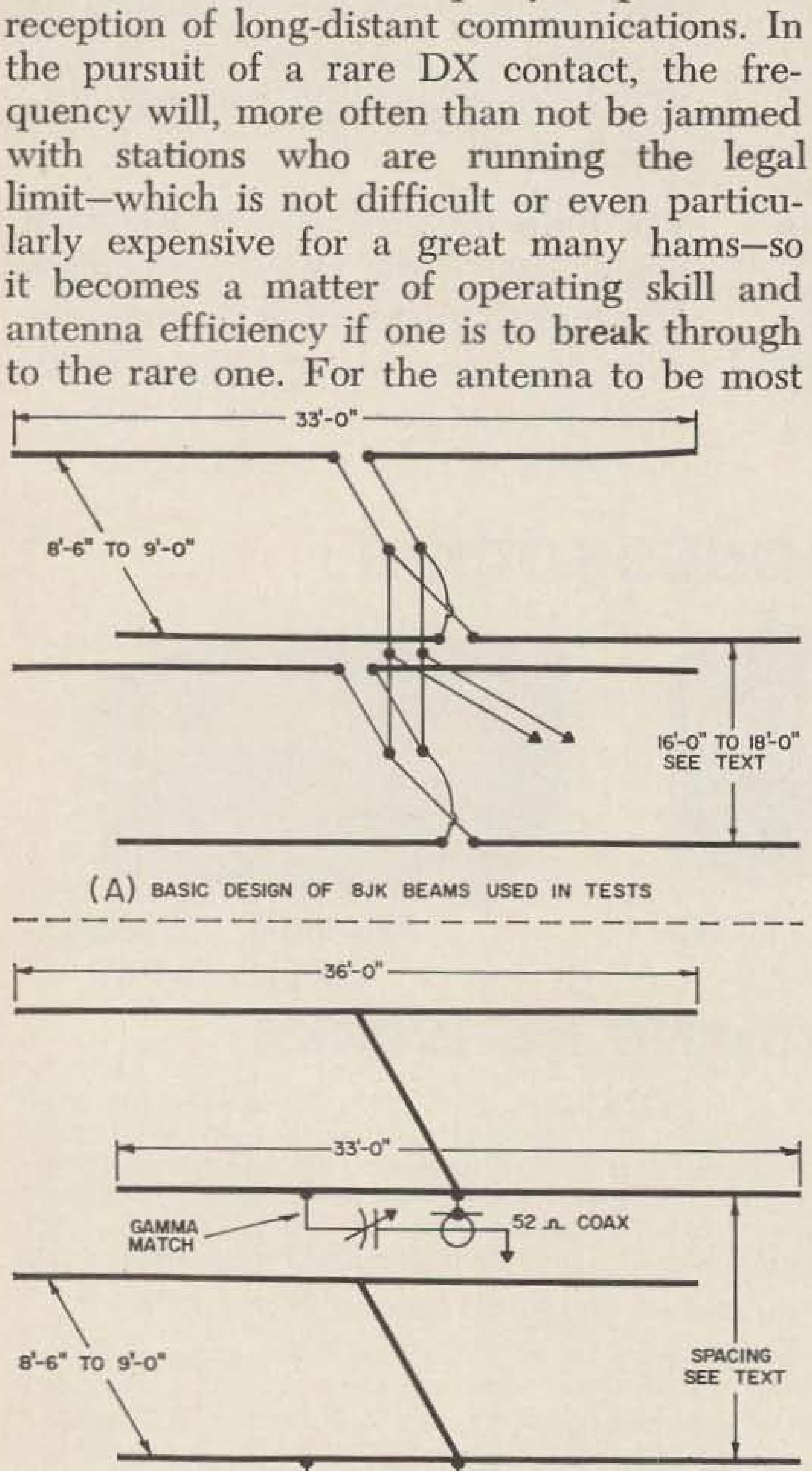


Fig. 1. The basic designs of the beam antennas used in the tests; in A is the 8JK array and in B, two 2-element beams.

It has been well established that a vertical antenna with a good ground radial system will achieve a low angle, and the ground plane is very popular as a result of this and of its low cost and simple construction. Half-wave and five-eighths wave verticals worked against ground are equally good and in many instances will not only hold their own against conventional yagis but will actually out-perform them.

The drawback of the vertical, from my point of view at least, is the omni-directional pattern, with no attenuation of unwanted signals from the sides or rear. There is also the lack of gain to consider. Although both signal discrimination and gain can be achieved by using several verticals and phasing them, few hams have the space to do this and usually look toward the yagi or cubical quad as being the best solution to the antenna situation.

There is a never-ending argument about the benefits of quad vs. yagi and the more one reads on the subject, the more he is inclined to believe that both antennas are excellent. It becomes more a matter of personal taste than anything else. However, there seems to be a fair amount of proof that the quad will perform better than the yagi for long DX if the antenna is not very high. If the antenna is mounted about one full wave above ground—approximately 70 feet in the case of 20 meters—there is apparently little to choose between yagi and

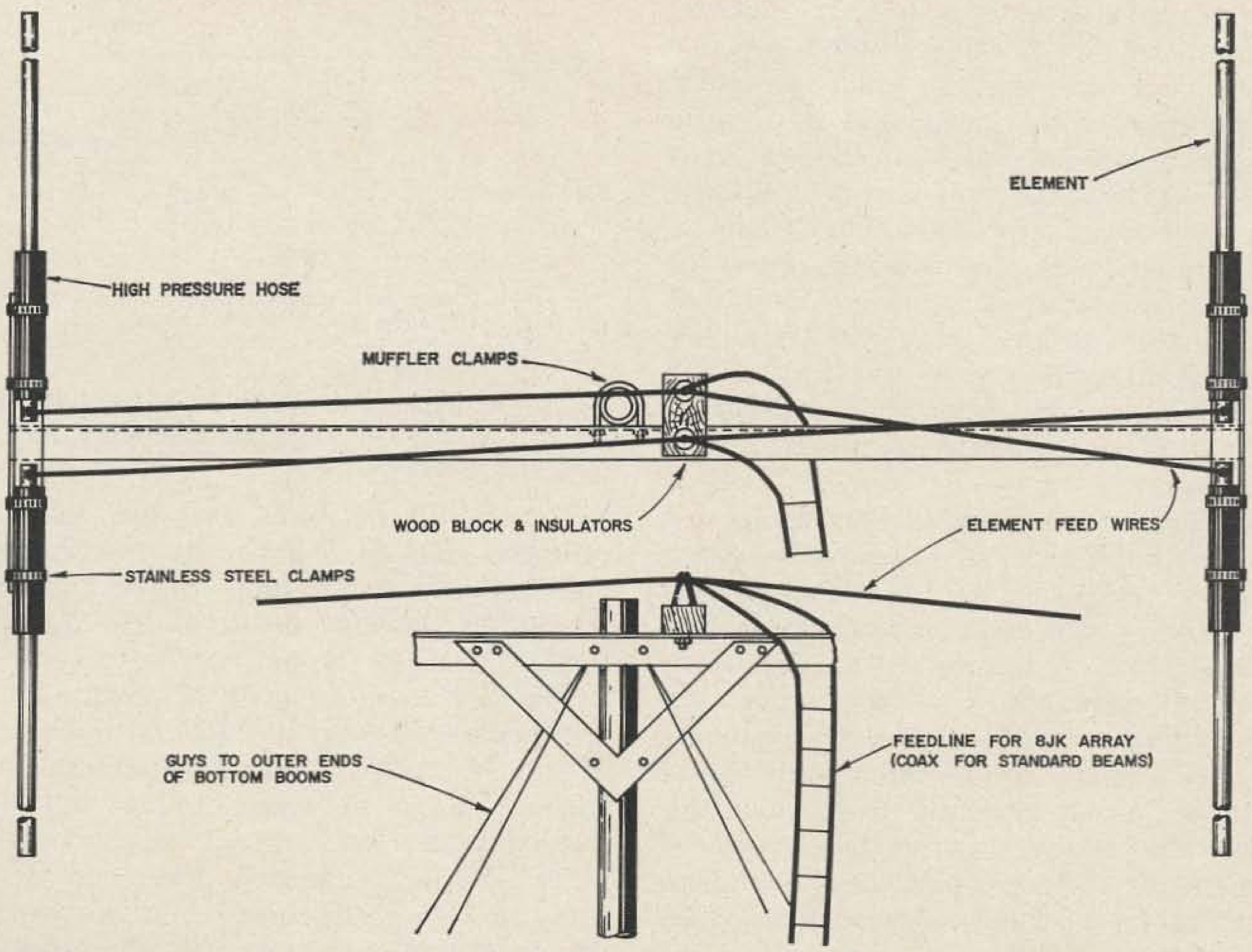


Fig. 2. Boom and element construction of the 8JK beam antennas used in the stacked-antenna experiments.

quad (assuming we are comparing antennas of the same general size, such as two-element quad and three element yagi).

Even at optimum antenna heights, the angle of radiation is not as low as may be desired and the most logical way to bring it down is to "stack" a second antenna over the first one, feeding the two in phase. Here we can probably relegate the quad to the sidelines, as the construction problems of stacking quads would be considerable to say the least. In the case of the yagi, however, it is quite possible to stack, and a number of amateurs do this with great success. Not only does this lower the radiation angle, but it also increases the overall gain of the system. Constructional problems are not too bad on 10 meters or even 15, but on 20 they can be rather formidable. Stacking also means using single-band beams, not too popular in this day of tribanders and multi-band operating.

About two years ago, I had been operating in a temporary QTH with a ground plane and had the urge to put up something with some gain, reasonable directivity, low angle radiation, multi-band operation and low cost construction. The first effort along this line was a wire array, consisting of two 8JK arrays stacked ¼ wave apart (at 20 meters) and driven through an antenna tuner. This proved to be a most effective antenna. Having the ground plane right beside it for comparison, it was quite easy to make alternative checks on a great many stations. For fairly short hops, such as from the East coast to Europe, there appeared to be little difference although the 8JK array seemed to get through a little earlier. Actual signal reports were not too much different, but on long haul paths to South Africa or Australia the array proved a definite superiority. This was evidenced more by the consistency of contacts rather than actual signal reports, the difference being only a matter of an S unit or two at the average DX location. Received signals were better on the array by about the same amount but a certain part of this was due to the front-to-side discrimination of the array. As with any 8JK, this array was bi-directional so front-to-back ratio was nil and of course there was no rotation system.

Results on 10 and 15 meters with the same array were not as clearly defined as on 20 because of the very poor band conditions at that time. However, the array did load very satisfactorily on 40 meters, and proved to work extremely well. An inverted Vee was used for checking results, with it's apex fifty feet high, and the 8JK consistently provided QSOs with Europe and the Pacific which were not possible with the inverted Vee. The QTH at the time was on a hillside which overlooked the ocean and was extremely quiet, with no close neighbors or other sources of man-made noise. One rather strange feature of this array was its ability to put a good signal into West Africa which was off to the side somewhat and which could not be contacted at all using the inverted Vee.

The biggest drawback of this array was its size and the fact that two fairly sturdy masts were necessary to hold it up in the high winds which were a notable feature of this location. A transfer to another town meant the dismantling of the array and space at the new QTH limited new antenna efforts to a single tower. Along the way I had picked up a crank-up tower and this became the centre of the next projects. Having had such good success with the wire array, I proceeded to plan another one, but this time building it of metal in the form of two similar beams of 2-elements each. Because of the close spacing and the need for all elements to be insulated from the boom and tower, the construction was a little more difficult than for a normal plumber's delight type of beam. It was not, by any means, either expensive or requiring any special tools, and the final result was very neat and clean-cut in appearance. For those who may be interested in this array, some constructional hints are given in **Fig. 2**. **Fig. 1** shows the basic diagram of the antenna and its feed line system. It is simply the standard 8JK array using two stacked sections. The obvious advantages of construction are the short booms required, and the comparatively small stacking distance. Although the open-wire feedline requires some careful planning, the advantage to be gained is multi-band operation. Looking at the photograph of the array, it will be seen that no rotator was used, simply because the tower was quite small in diameter and my operating hours permitted the use of only one or two possible paths—however, a rotator could be included and would not have to be elaborate. Since the array is bi-directional it only has to be turned half-way round the circle to cover all directions. This might be a good moment to point out that one

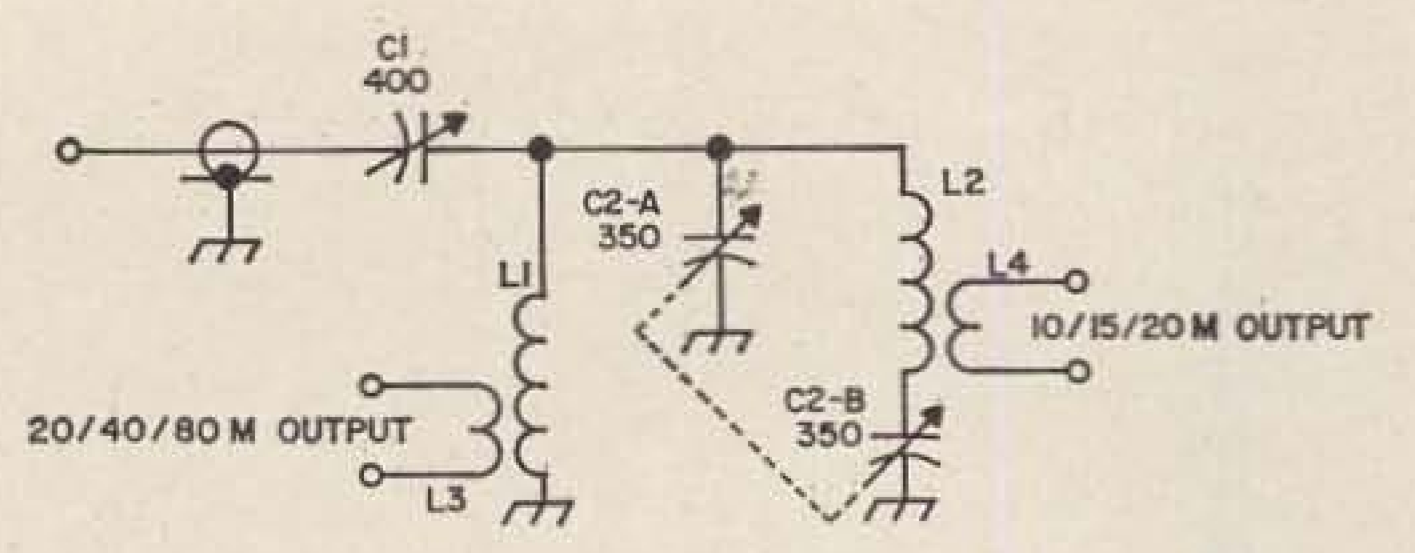


Fig. 3. The antenna tuner which was used to obtain 80, 40, 20, 15 and 10 meter operation from the stacked 8JK beams.

section could be built and the same advantages enjoyed, but the two sections produce somewhat more gain and what is mo[illegible] important, lowers the angle of radiation for DX work.

Fig. 2 shows the general construction of the boom assembly, which is made from 2" or 2½" angle iron or aluminum, with similar pieces of angle either bolted or welded to the ends to act as element supports. The old standby-muffler clamps were used to clamp the boom in place, and of course liberally coated with zinc chromate and aluminum paint to preserve them from the salt air. The elements were made from 65ST6 aluminum tubing with an .035 wall. Diameters of 1 inch and ⅞ inch allowed the usual telescoping method of construction. The necessity for insulating the elements can be solved by the use of insulators, but I visited the maintenance shop of a local fish processing plant and obtained some lengths of high pressure steam hose. This has various diameters, depending upon the pressure it is designed for, but even the lowest pressure stuff will have a wall thick enough for adequate insulation. It is, of course, unaffected by water and I selected pieces which had a 1" inside diameter. By dusting the inside of the hose with talcum powder, the tubing will slide into the hose fairly easily. Allow an inch or so of the tubing to protrude from the far end of the hose for the feedline to attach. The whole affair is held to the boom by simply laying the hose and element in the "trough" of the angle iron and using two stainless steel hose clamps around both the iron and the element. The actual length of the elements can be from about 33 to 40 feet with no ill effects, but they must all be the same length. **Fig. 2** also shows the method of mounting the feedline.

A small wooden block is mounted on the boom, and two insulators of different height are mounted on the block. By using the difference in height, the wires of the element feeder will not touch each other as they transpose. It is also a good idea to use insulated wires for this part of the feed system, and make sure the feeders between the elements are actually transposed or the system will not feed properly.

Both booms are identical, and are mounted on the mast about 16 feet apart. By making a simple stand-off insulator of wood dipped in paraffin and clamped to the mast, the feedline is held off from the mast and the insulator also forms a convenient point at which to attach the feeder from the transmitter. The feeder is easily made from any wire from size 10 to 14 or thereabouts, spaced by wooden dowel cut into short pieces. If the transmitter is medium power the feeder can be made from TV ladder line. If the line enters the house low enough to be reached by children, it should be enclosed in a protective cover. I found a very simple method was to use two lengths of plastic water pipe, which is very tough and rigid as well as being a good insulator. An antenna tuner is of course a "must" for this array. The all band tuner in **Fig. 3** is the one I have used on this array in both the wire and all-metal configurations. It has the advantage of being continuously tuneable across all bands from 80 to 10 meters. As usual, an SWR bridge is almost a necessity for the initial tune-up and a pair of calibrated dials should be used on the tuning capacitors. Once the proper settings are found, a simple chart should be made to allow rapid QSY and band change.

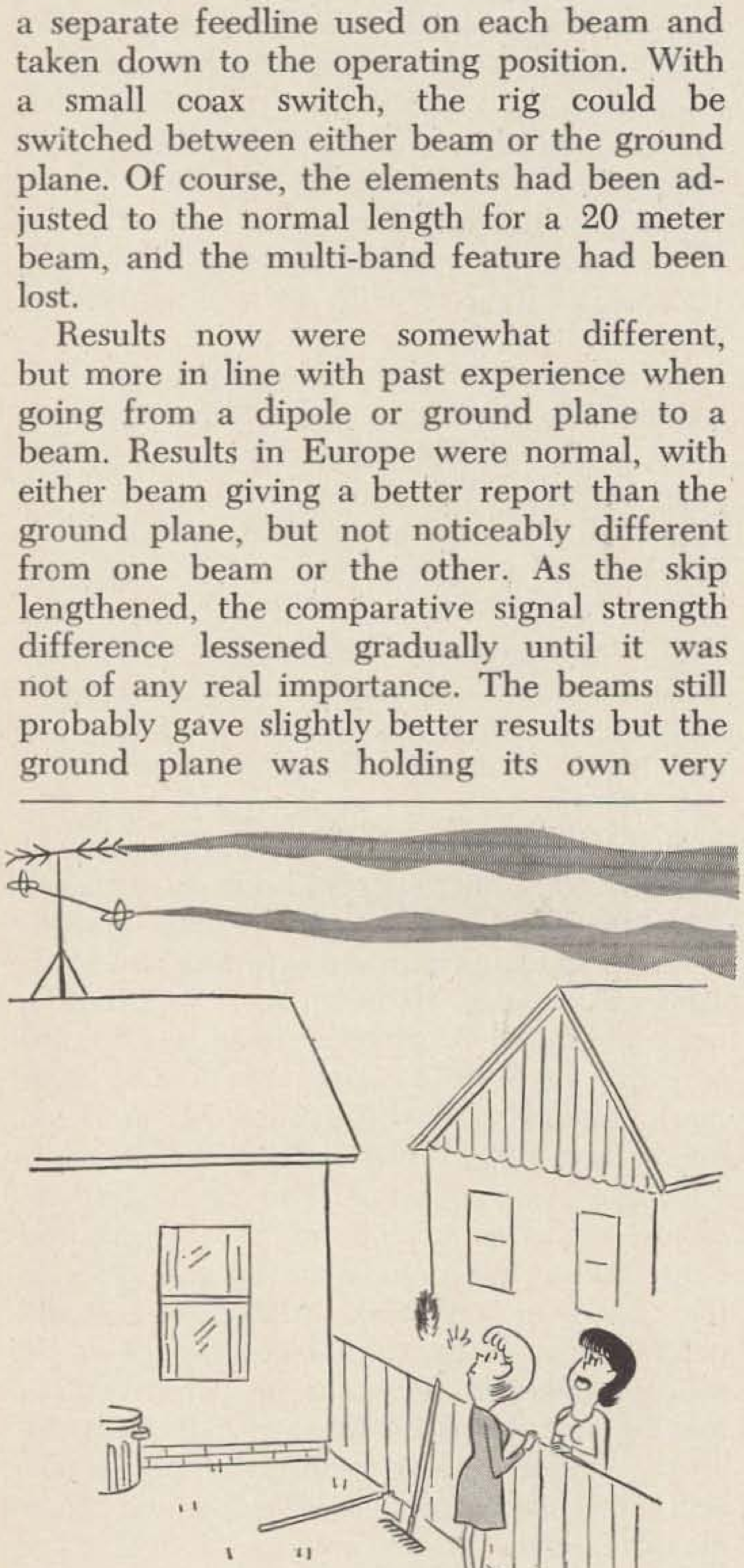
During the time this antenna was under construction the trusty ground plane had already been installed for 20 meters, and a second one constructed for 15. There was also the 40-meter inverted Vee again up on a separate pole. No attempt was made to run checks on 10 as the band was almost completely dead all the time I was at that QTH. Daily QSOs on 20 were providing good information on general conditions, but when the array was first tried one evening with a friend in VE4 land, his comment was that the beam "wasn't doing a thing for me"—quite frustrating to say the least! Next morning a contact in England came out the same way, neither better nor worse than the ground plane. Throughout most of Europe the results were the same and disappointment was growing by the minute. Operations had to cease to go to work, and for the next several mornings the same results were obtained and the array very nearly was torn down. Finally however after running a check with a DL station I was called by a UAØ and his report gave the array an edge of two S units over the ground plane. Subsequent QSOs over the next few weeks proved that the array was behaving very much the same as the wire one had in good but not spectacular reports from Europe or across North America, but gradually better results from longer distances. Rather than glowing reports, the best thing that came of all this was the noticeably higher ratio of calls answered to calls made, particularly with long-path calls to the Pacific. The directivity pattern appeared to be a very broad figure 8 with quite good attenuation off the sides.

Results on 15 meters were somewhat different. The long-haul capabilities were as good as on 20, but signal reports from Europe and the West Coast were quite a bit better than with the ground plane, often being 3 or 4 S-units higher. The spacing of the beams was wider of course on this band (as related to wavelength) and after some misgivings the array was taken down and an extension mast installed so that the top beam could be about 28 feet above the bottom one. It would have probably been better to use a full wave separation of about 32 feet but this could not be managed with this light duty tower. However, the increased spacing improved results considerably. European stations now reported a noticeable gain in signal strength on 20 and a couple of S-units higher on 15. On long-haul contacts the difference was not too much, and results were about the same as with the closer spacing. This seemed to indicate that the spacing of the beams had considerably more effect on the gain than on the angle of radiation. Although I made careful note of the signal reports given by stations overseas, I would be careful about making any claims for unusual gain from the array. Unless one is equipped, and qualified, to make proper instrumented gain measurements on an antenna I feel it is better to simply claim no definite figures but merely give the results in general terms.

After using the array for about four months, it was again taken down, and the

8JK beams converted to normal 2-element 20-meter beams with all-metal construction. This was simply done by removing the insulating hose from the elements, coupling them together at their center and fastening them directly to their supports with plated machine bolts. The boom length of 8 feet was comparable to element spacing in some commercial beams. The stacking distance was again limited to 28 feet maximum, and each beam operated as a driven element and reflector combination. Gamma matches were used with RG-8/U 52-ohm coax and a separate feedline used on each beam and taken down to the operating position. With a small coax switch, the rig could be switched between either beam or the ground plane. Of course, the elements had been adjusted to the normal length for a 20 meter beam, and the multi-band feature had been lost.

Results now were somewhat different, but more in line with past experience when going from a dipole or ground plane to a beam. Results in Europe were normal, with either beam giving a better report than the ground plane, but not noticeably different from one beam or the other. As the skip lengthened, the comparative signal strength difference lessened gradually until it was not of any real importance. The beams still probably gave slightly better results but the ground plane was holding its own very well, and in VK/ZL land there was apparently very little to choose between the antennas. I might mention I adopted a practice of switching back and forth between the three antennas, either on alternate transmissions or between words on a single transmission. Sometimes I would tell the other station what I was doing and sometimes not, the idea being to try to average out reports from stations who knew what was going on along with those who didn't.



"I see your ol' man is lousing up the air waves again!"

After a couple of months of this sort of thing, I made up a couple of pieces of RG-8/U cable about one electrical wavelength long (approximately ⅝ wavelength physically) and used one piece to feed each beam. Then using a T connector I fed both beams from a single feedline. In other words, taking **Fig. 4** as a reference, substitute the open wire line with coax. I still used the gamma matches on the beams and there was quite an interesting time getting both matches adjusted quite right. Whether it was worth worrying too much about is problematical and I rather think results would have been just as good if I had merely connected the coax directly to the center of the driven elements. However, this would have meant opening the element again and insulating it from the boom and this was too much of a chore. The eventual SWR reading on the bridge was about 1.8:1 which was considered good enough.

Operation was now found to be considerably improved. Stacking the beams is supposed to give a 3 dB gain both on sending and receiving and it did appear that this was happening or at least a good part of it. Again, only the ground plane was used for reference since several days usually elapsed between tests, but there was considerable increase in received signal strength. Reports received from the other end were also quite complimentary. European and North American contacts were not made at the same time because of the good front-to-back ratio of the beams and the necessity of turning them by hand power. Eventually a rotator was constructed from a prop pitch motor and the small light-weight tower was rotated as a whole unit, with a bearing ring fabricated and installed to allow the guy wires to remain stationary. This was a major project in itself and, when completed, it allowed much more facility in tests. The morning path to the Pacific gave some very pleasing results with the two beams fed together and this finally appeared to be the best configuration. Stations called on the ground plane could usually be contacted, though at times with some difficulty. Switching to the beams part way through the QSO generally brought comments such as "the band is improving" or "the skip is changing," etc., accompanied by a better signal report. I feel it is very difficult to attribute this merely to the extra gain of the array or the different angle of radiation. It seems definite that both factors would enter into the picture, though which would be dominant is hard to say. Several times were noted in which stations could be heard on the beams and contacted but which could not be worked on the ground plane; this would seem to point to a lower angle rather than just the gain feature.

The logical extension to these tests would be to increase the beam stacking distance to a full wavelength and/or add a third element (director) to each beam. Both ideas would have required a considerably heavier tower than I had available. It is also a very expensive undertaking. However, the experience of amateurs who are already using such arrays should be sufficient evidence of their value. The arrays tried at my QTH were all made in the basement, of common materials and using simple tools. They are well within the ability and pocketbook of the average ham.

To recapitulate then, the stacked 8JK array should be very satisfactory if one requires a good DX antenna with multi-band capabilities, but whose bi-directional characteristics mean no front-to-back ratio at all. It has the advantage of giving good coverage over two most used signal paths (providing they are in opposite directions) without a rotator, but the construction of the feedline and elements is more complicated. A tuner is also required. The stacked 2-element beams give the best overall results but should have stacking distance as close as possible to a wavelength for best operation, and a rotator will be necessary for best operation. On 20 meters this presents formidable construction problems, but on 10 meters it would be much simpler. The tests were brought to a halt in my case by another transfer-probably to the neighbors' immense relief—and the story is presented for the benefit of any who might be thinking along similar lines. . . . VE1TG

Carl Ebhardt W4HJZ
22 E. Rowan Street
Raleigh, North Carolina

A Simple Antenna Mount for Satellite Work

This elevation-azimuth mount is a rather straightforward approach to satellite tracking and moonbounce work. Many of the construction principles used by W4HJZ are equally applicable to polar mounts.

Over the past few years the author has constructed numerous temporary antenna setups for moonbounce via KP4BPZ and for the Oscar series of satellites. All arrays were hand operated and of the azimuth-elevation type. When the time came to construct Oscar IV antennas, it was decided that too much time was being wasted on these temporary mounts and a more permanent rotor driven system was in order.

The polar mount is best for tracking the moon because the elevation angle above the southern horizon is constant for a given pass of the moon, and only one direction of rotation is necessary to follow the moon across the sky. The azimuth-elevation mount is more flexible and can aim an array in any direction. Its disadvantage is that two rotor controls must be simultaneously manipulated to follow an object across the sky. The advantages of both mounts can be had in an elevation-azimuth system. With the EL-AZ mount, by aiming the array south and elevating it to the proper angle above the southern horizon, the azimuth rotor becomes the "hour angle" and the elevation rotor need not be touched for an entire pass of the moon, or any other equatorial orbit satellite. By aiming the array east to west and fixing it in place, the elevation rotor aims the array at the desired angle above the eastern or western horizons and the azimuth rotor makes the array follow a polar orbiting satellite.

To set up the array for polar or equatorial orbits, the mast must be rotated 90° and this done by hand. At the base of the mast the U-bolts are loosened, the mast rotated, and then the U-bolts tightened.

For elevation and azimuth controls Cornell-Dubilier TR-44 rotors were chosen for their good torque and indicator accuracy. However, these rotators have a brake mechansim that works via gravity on the motor shaft. When employed in a horizontal position, the brakes do not operate properly. The rotors must be modified. A small spring must be installed which will press against the end of the motor shaft and hold the brake clutch engaged, center the armature in the field, and release the brake clutch. The spring is fashioned from flat spring copper about ¼ x 1 inches and can be held in place under an existing screw which holds the indicator pot to the end of the motor. Spring tension should be adjusted for best clutch pressure consistent with good motor starting and armature pull-in.

Notes on the mechanics

The mast is approximately 2" diameter and 10 feet high. It turns freely in a slightly larger piece of pipe which is imbedded in concrete. Guy wires attach via a slip ring at a point just below the rotor box.

The rotor box is fabricated from ⅛ inch aluminum (old rack panels) using ¼ inch diameter bolts. Its bottom is approximately

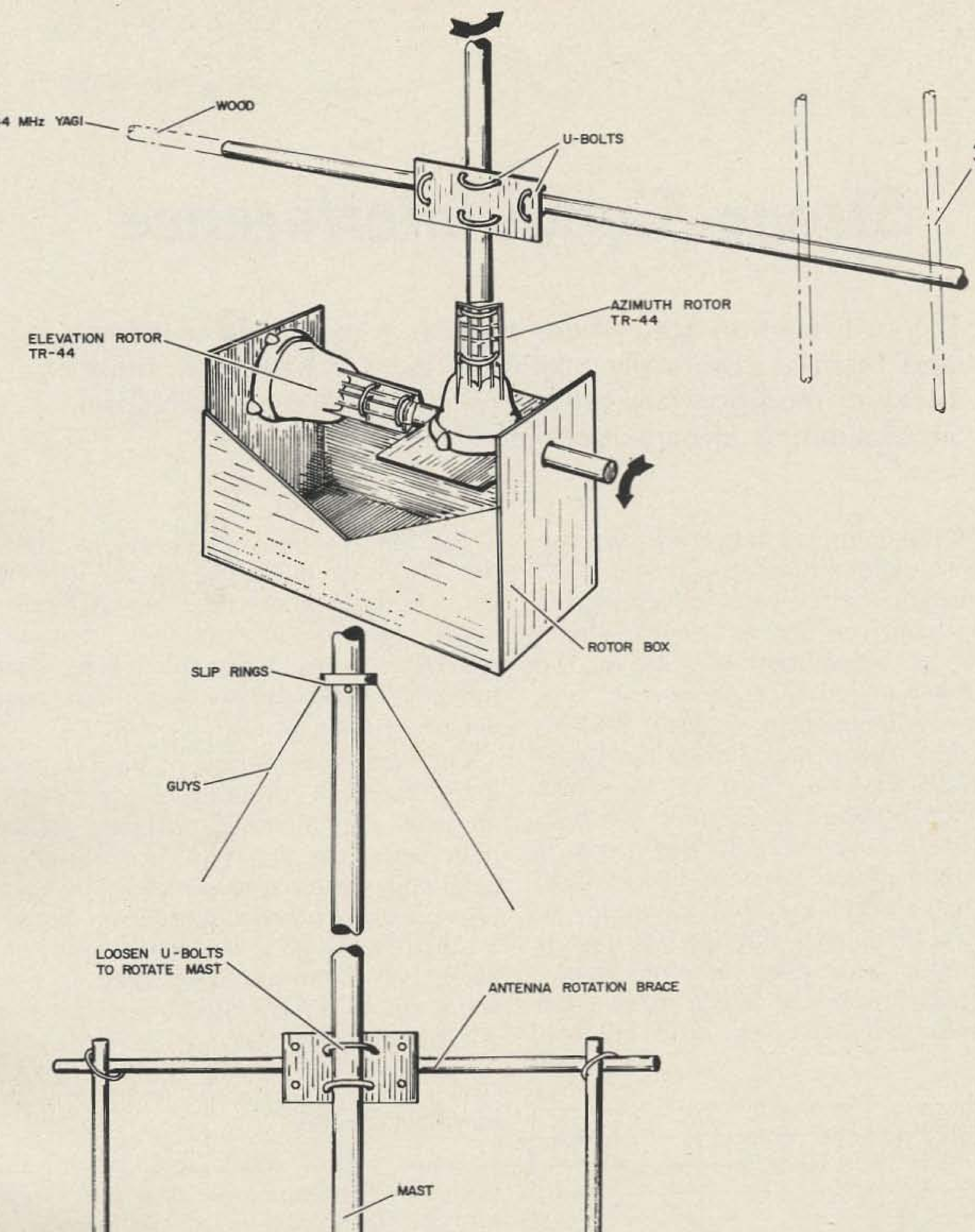


Fig. 1. Construction of the simple antenna mount used by W4HJZ for moonbounce and satellite tracking.

12 x 24. The end plates are approximately 12 x 12. A four inch skirt extends below the bottom for torsional strength. All corners are held firm with angle brackets. The rotor box mounts to the mast with the rotor to mast adapter plate which is supplied as part of the TR44 rotors.

. . . W4HJZ

E. H. Conklin K6KA
Box I
La Canada, California 91011

Strong-Signal Interference

If you live in an area where there is a multitude of hams, and there is practically a kilowatt in your backyard, these receiver modifications suggested by K6KA may be helpful in eliminating strong-signal interference.

These are the days of widespread purchase of expensive amateur radio equipment. One wonders whether the receivers were designed in a screen-room, or out on some isolated island with no DXpedition present. In the homes of amateurs, they experience a very different environment. Don Wallace, W6AM, estimates that there are 10,000 amateurs within ground-wave distance of his Palos Verdes hilltop station. Thousands are line-of-sight. This means not only that there is usually a strong station almost in every block, but also that several hundred kilocycles in and out of a band pass through the first *if* of the receiver. This may represent megawatts of transmitter power which reaches the second mixer grid after too little attenuation.

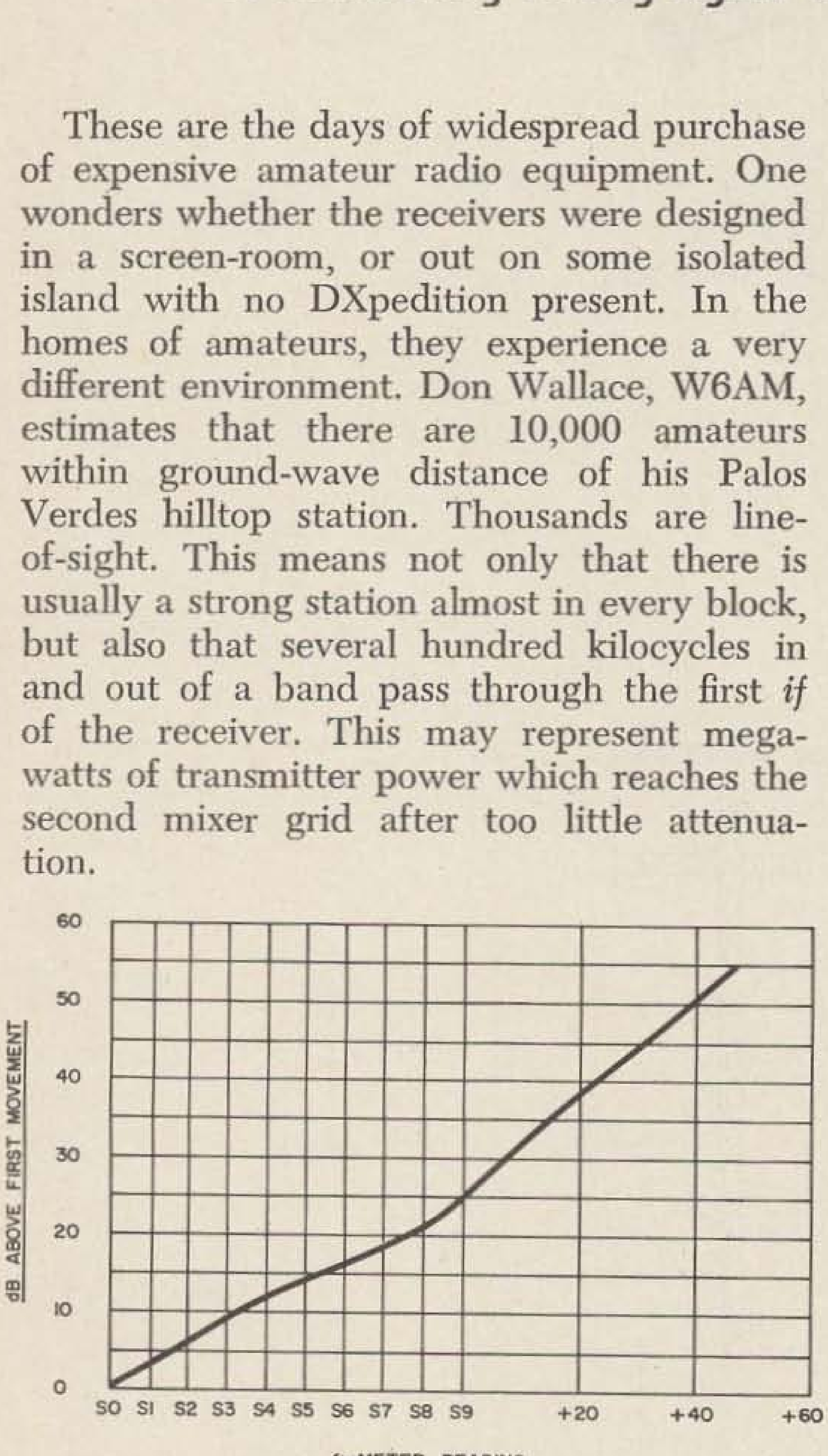


Fig. 1. S-meter calibration for SB-300. The unmodified curve is satisfactory. Without agc on the rf tube, the curve is too flat. Adding the parallel 100-ohm resistor produces a good calibration, even between the 20-db points above S-9. The bend in the curves around S-9 is due principally to the scale markings; a flatter curve can be produced by using wider spacing on the graph.

No longer can we operate as the Navy did 25 years ago using Model RBC receivers. There were several kilowatt transmitters going in the same ship, without mutual interference between circuits. Things have improved. Under similar conditions now, we cannot operate at all.

One receiver—not made in this country—gives excellent promise of operating in a crowded neighborhood without modification both here and at W6YY. An inquiry to an independent source has brought this response: "Any decent receiver, of course, should have a tuned front end if it is going to reject some of the crud, but no front end is going to stand up to a kilowatt in your back yard." Ah, but not all is lost!

Heathkit SB-300

Upon getting back into active amateur radio, my first experience was with the Heathkit SB-300. Occasionally, the S-meter would hit the pin, and nothing would come out of the audio. As stated by Stuart Meyer, W2GHK, in a paper delivered to IARC, "Very often, these strong off-channel signals will completely block the receiver, and the operator is not able to identify the offender!"

With the help of the one piece of equipment needed to check out the SB-line, the vacuum-tube voltmeter found that the *if* tube grids were being driven negative by almost 50 volts, even with the agc switch off. This turned out to be a problem frequently experienced by amateurs using various types of equipment, although not always to the same extent. A local amateur's radiation put several volts on the grid of the rf tube. This

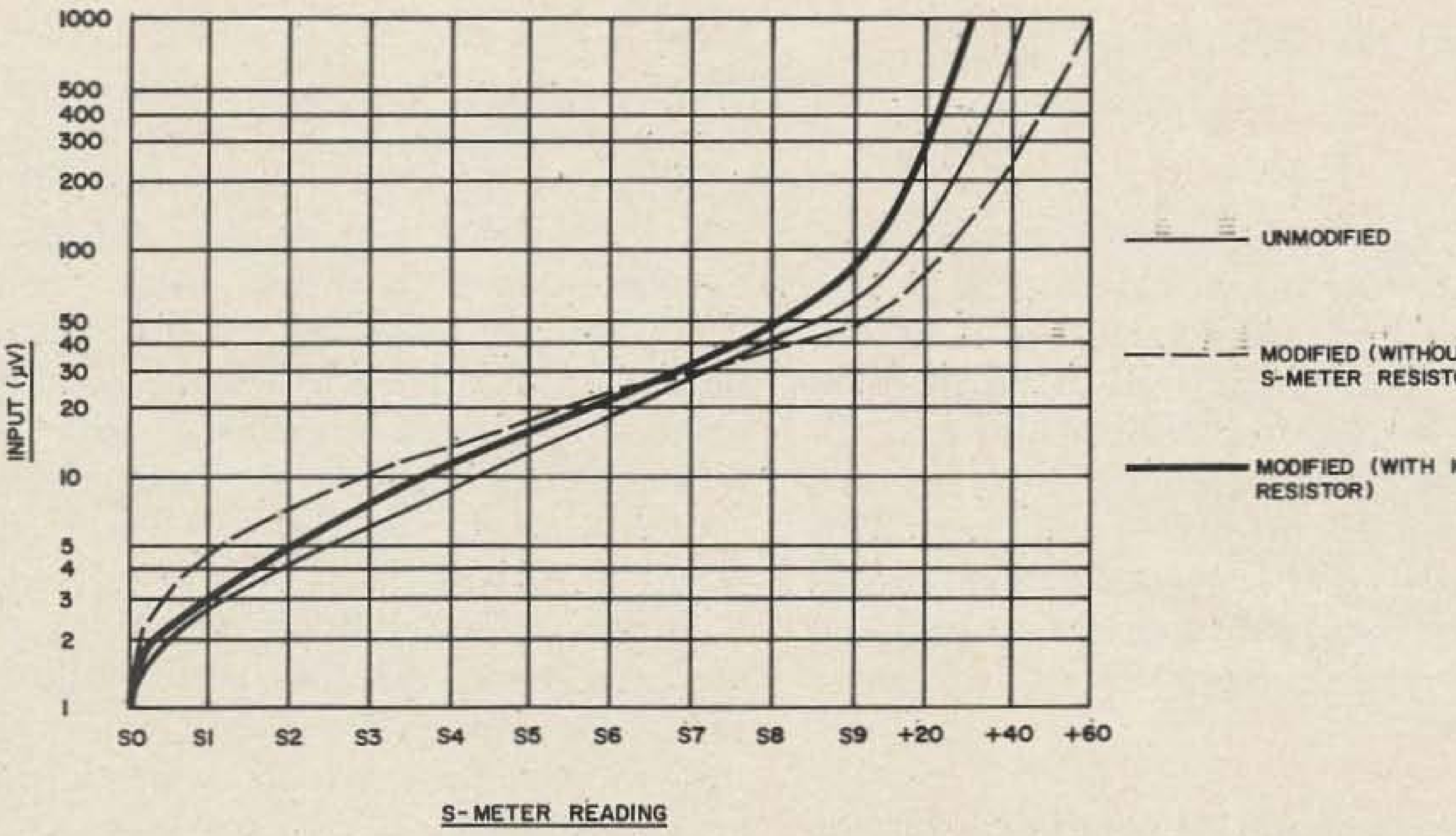


Fig 2. S-meter calibration for modified Collins 75S-3A, with the 100-ohm resistor in parallel with the meter. The slight bend in the surve at S-8 appears to be typical. Each 20 dB segment of the meter actually requires from 13 to 15 dB increase in receiver input, thus making antennas and linear amplifiers look somewhat better than they are.

was rectified. It charged up the grid capacitor, which could discharge only by leaking down the agc buss to the *if* tube grids. Someone suggested putting an attenuator in the antenna lead—which worked just about as well as using the on-off switch.

Once the cause was isolated, the yellow agc buss to the rf circuit board was disconnected and taped up. The grid capacitor was shorted. No longer was there reaction on the *if* stages nor on the S-meter. The only remaining interference was a buck-shot background that did not completely disrupt operation on the opposite end of the band. This is the type of "modification" that I like—one that can be restored in a few moments, leaving no trace.

Modified performance

Such changes are not without their effects. Obviously, the total agc action would be reduced. Measurements indicated that a one-dB change in audio on an output meter resulted from each five-dB change in signal from an rf signal generator. This represented some reduction in agc action from the unmodified condition, but it was not noticeable on CW and single-sideband signals. It was not considered to be a disadvantage.

Another change was in the activity of the S-meter. It was necessary to put a 100-ohm resistor directly across the S-meter terminals. The result was slightly better than the original S-meter performance, as shown in **Fig. 1.**

The receiver sensitivity (signal-plus-noise-to-noise) ratio did not deteriorate. It was just slightly better with the modification.

Collins S-Line

A similar change was made in Collins S-Line receivers, with equally effective results. The voice quality might have deteriorated slightly on very loud signals, but this presented no problem. The same S-meter shunt was required. The *if* gain was set at a middle position where loud CW signals in zero beat did not tend to block the bfo operation slightly when listening through zero beat to weak signals. The final S-meter calibration is given in **Fig. 2.** S-zero was taken as "first movement" which was at 1.3 μV. The input for S-9 was 24 μV.

The rf tube in the 75S-line obtains its bias from the agc line. There is no cathode bias. Therefore, this modification requires a cathode resistor, carefully by-passed with a *good* high-frequency ceramic or mica capacitor with very short leads to cathode and ground. The small 0.001 μF Sprague was fine. The resistor value is 180 ohms for the 6DC6 tube, which requires its bias between pin 2 and ground. If the 6FV6 is used for more gain, the cathode resistor can be about 140 ohms, but it goes between pin 7 and ground.

With a poor by-pass, the 6FV6 will be regenerative on 28 MHz without the antenna connected to the receiver. Shorting the grid capacitor can be avoided by using a choke from grid to ground, both of which are more accessible than the coil end of the grid capacitor.

Swan 350

The circuit for the Swan 350 was studied. In this transceiver, it would appear to be better to disconnect the agc buss and to substitute an rf choke from grid to ground on the rf stage, because of the need for a direct-current blocking capacitor between the transmitter and the grid of the rf tube. The change probably will be made in one of the Swan transceivers that operate a hundred yards from my location.

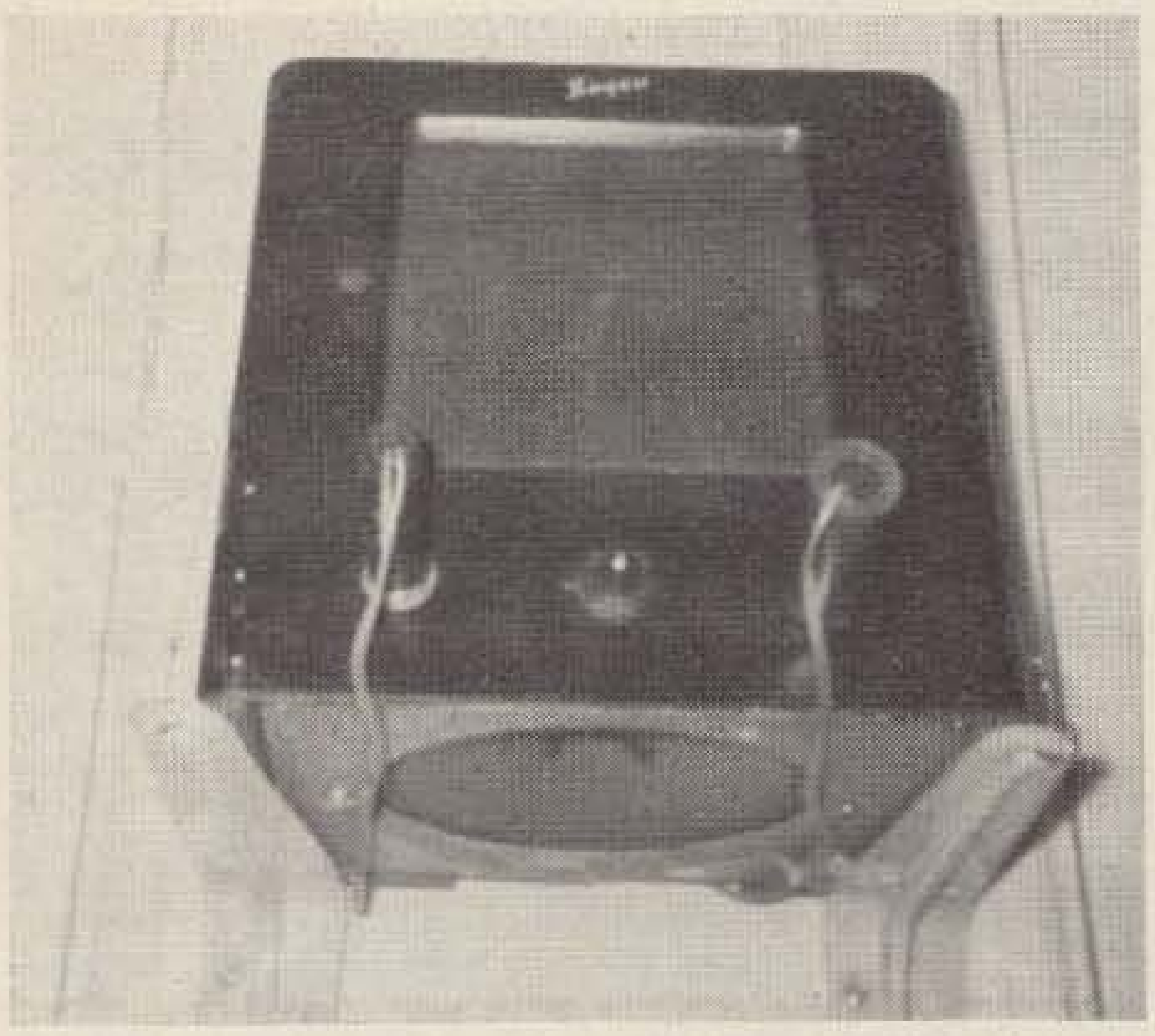
Results

The proposals made above have proven helpful to a number of local amateurs. Refinements may be made in the future, particularly by using a grid-to-ground rf choke, terminating in a low-resistance cathode potentiometer that will increase the bias on the rf tube. This is desirable under strong-signal conditions in which the signal-plus-noise-to-noise ratio is adequate. In the meantime, detuning the preselection away from an interfering signal is possible. Also, an rf attenuator such as the Waters 371 can be inserted in the antenna lead.

Other potential solutions to the problems of strong-signal interference, spurious responses, cross-modulation and intermodulation distortion, will be presented in an early issue.

K6KA

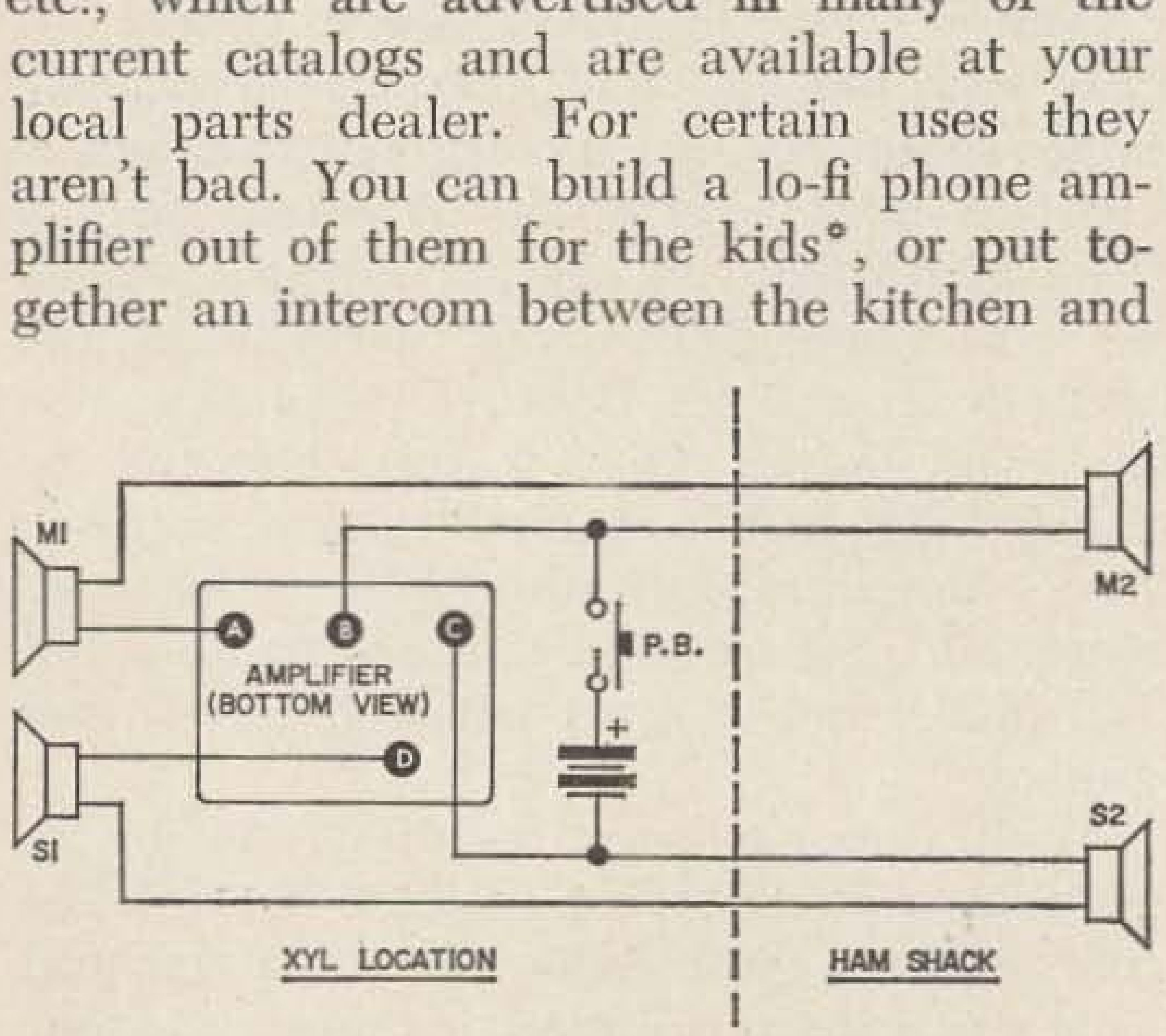
A Molded-Mud Intercom



By this time, everybody has seen the assortment of epoxy transistor modules for phono amplifiers, PA amplifiers, intercoms, etc., which are advertised in many of the current catalogs and are available at your local parts dealer. For certain uses they aren't bad. You can build a lo-fi phone amplifier out of them for the kids*, or put together an intercom between the kitchen and the ham shack is just about nothing flat. We have done both.

All is not gold that glitters, however. It seems that in addition to the "molded mud module" you need a couple of speakers, a volume control with switch, and a four-pole double-throw switch. Most hams have cannibalized a few TV sets, and the neighbors have given them a radio that junior dropped on the basement floor, so there are usually several speakers in the junk box. Even a volume control with a switch might be expected. But four-pole double-throw switches are not exactly a stock item. Nor are they cheap.

Well, I went down to the local electronics emporium and invested $3.50 in the molded-mud module because my wife got tired of hollering up the stairs when chow was on, or when a call came in on the telephone, or for some other reason. We experimented around to see what the thing would do, and came up with the following:



MI, M2 = MICROPHONE (SMALL SPEAKER)
SI, S2 = SPEAKER

Not having a four-pole double-throw switch, and not feeling in need of a volume control, and having a drawer full of small speakers, I decided to have all circuits hot at all times. As the circuit indicates, both listening speakers and "mike" speakers are on whenever the switch is on. Strangely enough, there is no feed back and it is just like talking on the telephone.

. . . Bob Baird W7CSD

*Using 40 ohm 6" x 8" speakers and 2 modules you get reasonable quality stereo.

Jim Lomasney WA6NIL
2501 Waverly Street
Palo Alto, California 94301

Charging Dry Batteries

A secondary cell is defined as a cell which can be recharged while a primary cell can not. An ordinary dry cell is a primary cell, right? On the other hand, you can buy clever little devices which are claimed to be able to recharge dry cells. Who is kidding who. Or whom?

It is possible, under proper conditions, to recharge dry cells. If you are a steady and frequent user of them, it may even be economical. But, if you buy two cells for a flashlight once a year and they go shelf dead, forget it.

Scientific information on the subject is hard to find, but there is a little (References 1, 2, 3, 4). This lack of information does not represent a conspiracy on the part of the manufacturers to sell more batteries; as we will see, recharging is apt to be more trouble than it is worth to the occasional user.

I first learned about the recharging bit in World War II, from a British magazine which I have long since lost. At the airbase where I was stationed, we used flashlight batteries by the hundred while servicing planes at night. That usage happened to be ideal for recharging, and we had dozens of cells on charge every night. Nowadays, with toys and transistor gadgets using up scads of batteries, I have revived the scheme.

The recharging procedure is quite simple; you pass a reverse current back into the cell to replace what has been taken out. Since carbon-zinc cells, like any other type, are not 100% efficient, more must be put in than comes back out again.

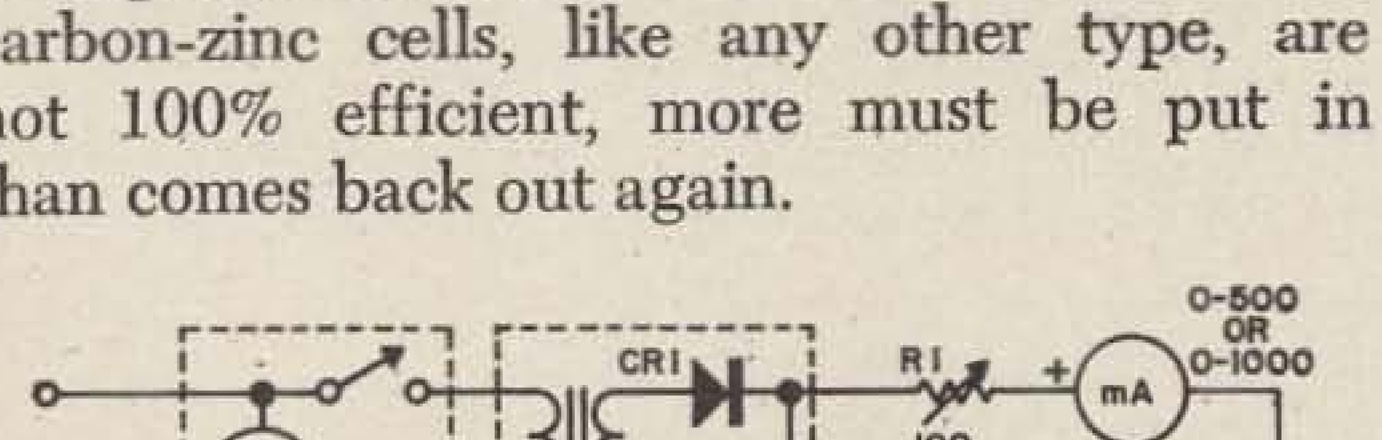


Fig. 1. Typical dry cell charging circuit. See text for discussion of circuit values.

The charging circuit

Any low voltage dc supply can be made to do; it must have more voltage available than that of the largest number of cells you expect to charge in series. A quarter or half an ampere is enough current for most uses. I use an HO-model railroad supply delivering 12 volts at 1 ampere, so I can charge up to 7 of the 1.5 volt cells in series. A variable resistor, a milliammeter and a string of cell holders are connected in series with the supply; **Fig. 1** shows the arrangement. The clock timer on the primary side, I find, is very useful as I am the forgetful type. It allows me to set up a predetermined amount of charge to a string of cells, and to take them out some time later. For the same reason, the rectifiers in the dc supply should have low reverse leakage so that the charged cells will not discharge back through the supply when it shuts off. Measure your rectifiers with a good high-range ohmmeter and, if they show measurable reverse leakage, replace them with good low leakage silicon ones of sufficient current rating.

The variable resistor R1 adjusts the charging current to the desired value; it must be able to carry the maximum current you will use, and have enough resistance to hold the current down for the smallest cell you will charge. I put a 25-watt 100 ohm rheostat in my supply, which will carry 500 milliamps easily, but I have to add extra resistance in series when charging the smallest cells.

500 milliamps or 1 ampere is a convenient range for the meter. I used an 800 mA meter because it was on hand. If you want an extra visual indicator, connect a flashlight bulb in series also. It will serve as a fuse, too. Pick one with plenty of current rating, as they don't last too long at full current.

Mount all the above on a board or chassis, with enough battery holders to accommodate all the cells you want to charge at one time, and all the sizes. My board will hold 7 of the D (large flashlight) size, or 7 of the C (small flashlight) or 7 of the AA size (standard penlite), or 3 of the AAA (thin penlite) cells. A clip lead selects which bank of holders is used, and jumpers across the unused holders when less than a full load of cells is being charged.

Suitable holders are made by Keystone, their number 175 (D size), number 173 (C size), or number 139 (AA size), and by several other manufacturers. Multiple cell holders are also available. If you are handy with spring brass, you could make your own. Being a bit fumble-fingered, after trying a couple, I decided the "boughten" ones were a bargain. (They vanish off the market at Christmas time, so get them early).

How to use the charger

We now have a suitable charging circuit, but it must be properly used. Follow these rules carefully:

We now have a suitable charging circuit, but it must be properly used. Follow these rules carefully:

1 - New, quality cells, on moderate drain and used up fairly quickly, say within a couple of weeks, will charge up best. Cells used very slowly or "shelf dead" will not charge well, due to loss of internal moisture.

2 - For good results, remove the cells from service before they are completely dead. One volt under load is a good end point.

3 - Determine the condition of the cells from **Table 1** (the tester shown in **Fig. 2** is convenient) and put them on charge right away. A dead cell deteriorates fairly rapidly.

4 - Any bulged, leaking or corroded cells should be thrown out immediately.

5 - Charge according to **Table 2.** From the condition of the cells found in step 3, pick the proper column in **Table 2.** Find the number of milliampere hours for the size of cell being charged. The product of charging rate in milliamperes times charging time in hours is the charge in milliampere-hours. Do not exceed the maximum charging rate called for by **Table 2,** but there is no harm in charging at a lower rate for a longer time.

6 - After charging, stabilize the cells by waiting 6 hours before testing them for condition or putting them into service. Just after charging, the voltage of the cells may be abnormally high and might cause damage to equipment.

7 - Do not overcharge, as this quickly ruins the cell. When in doubt, it is better to give less than the recommended charge, stabilize, test again for condition and give the remaining charge as called for by the cell condition and **Table 2.** Stop when the cell reads 1.4 to 1.5 volts after stabilizing; do not push the charge to the point where cell voltage begins to go down again.

8 - Put the recharged cells back in service soon, as their shelf life is not too good. Avoid charging up a large batch and letting them sit around; it is better to use a few cells over and over until they will no longer take a charge.

9 -An average of four charge-discharge cycles can be expected from good quality cells treated as above. Large cells tend to

Table 1. Condition of cells using tester of Fig. 2.

Voltage	Charge Condition
1.5	New
1.4	Full
1.3	¾
1.2	Half
1.1	¼
1.0	Dead

Note: While carbon-zinc cells can be discharged below 1.0 volt, it is not recommended if the cells are to be recharged.

Table 2. Charging data for standard carbon-zinc dry cells.

Cell Size	Cell Diam. Inches	Rated Capacity mA/Hour*	Maximum Charge Rate, mA	Recommended mA/Hr. Charge*** Dead	¼	Half	¾
D	1-5/16	4250	400	5000	3750	2500	1250
C	1	2150	200	2600	1950	1300	650
AA	½	750	75	900	675	450	225
AAA	⅜	410	40	490	367	245	122
N	7/16	460	40	550	412	275	137
Tran.	**	410	40	490	367	245	122

* Service life when discharged to 1.0 volt in 50 hours at 4 hours per day. (Data taken from reference 5)

** 9 volt transistor battery, 1 inch wide by 0.6 inch thick.

*** Approximate, see text.

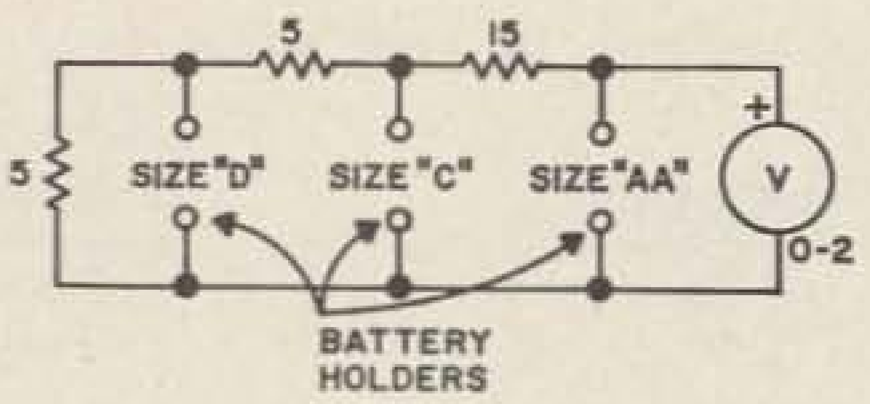


Fig. 2. Tester for dry cells. This tester puts a load on a standard carbon-zinc cell approximately equal to its 10-hour intermittent discharge rated load. A 40-ohm load should be used when testing AAA or N size cells. A 9-volt transistor battery should be tested with a 250-ohm load and will give six times the voltage listed in Table 1.

recharge better than small ones.

Other hints

Especially when charging a full stack of cells, so that there is very little voltage drop across R1, recheck the charging rate after the first hour or so. The voltage of the cells may change quite a bit in the first few minutes, so that the charging rate may need readjustment.

If no charging current at all can be obtained, you may have poor contact at a battery holder, or a completely open cell, which happens once in a while. Take a voltmeter and go looking for the cell holder with too much voltage across it. (Or, you may be trying to charge too many cells for the available charging voltage.)

Dry cells will not charge well in parallel, since they will usually not divide the current properly between them. If you must charge more than one string of cells at a time, use a separate R1 for each string. The milliammeter could be connected in series with each string in turn, by a plug and closed-circuit jacks or a suitable switch.

The amount of milliampere-hours charging time given in **Table 2** is an educated guess, as the milliampere-hour capacity of cells varies somewhat with the make, the age and previous condition of servitude. Also, as a browse through references 4 and 5 will show, cells of the same size are made for several different uses such as transistor devices, flashlight, heavy duty, photoflash, etc., and their capacities are not all the same. The capacity given in **Table 2** is that of a standard flashlight cell discharged to 1.0 volt end point in 50 hours at 4 hours a day, and the charging milliampere hours given are 120% of that capacity. These figures will do as a general guide; when in doubt charge up in steps as described in step 7 above. Where possible, stick with one make and type of cell and keep records on it until you find out its charging requirements. The maximum charging rate given in the table is 10 percent of the cell capacity; this should be quite safe.

Charging other types of cells

Do not attempt to recharge mercury cells. Their large capacity and rather high cost may make this a tempting idea, but the manufacturers warn that it may cause the cells to explode (I have not verified this from personal experience). A couple of years ago there were some rumors of a rechargeable mercury cell being developed, but nothing seems to have come of it.

Heavy duty carbon-zinc cells may have up to 50 percent more capacity than listed in **Table 2**, and take correspondingly more charge.

Alkaline cells have about twice the capacity of standard carbon-zinc cells (see **Table 3**). One manufacturer recommends that they not be recharged. On the basis of limited experience I find that they seem to charge up and hold a charge better then carbon-zinc types; I have had a set of four recharged penlite cells in a little transistor tester for over a year. As a first guess, you might try charging to 120 percent of the capacity given in **Table 3**, for fully discharged alkaline cells (to 1 volt end point).

A rechargeable type of alkaline cell is now being made; I have no experience with it. If you should run across any, follow the manufacturer's recommended recharging procedure.

Table 3. Capacity of alkaline cells

Cell Size	Rated Capacity Ma.-Hour*	Maximum Charge Rate, Ma.	Approximate** Charge for a Dead Cell. Ma. Hr.
D	8500	850	10200
C	3500	350	4200
AA	1400	140	1680
AAA	750	75	900
N	600	60	720

* Estimated service life to 1.0 volt (from ref. 5)

** Very approximate due to limited experience

Nickel-cadmium and other secondary cells may, of course, be charged by the circuit of **Fig. 1.** The condition of most true secondary cells (possibly excepting the alkaline cells just mentioned) cannot be determined by a tester such as that of **Fig. 2**, since the cell voltage does not drop steadily with use. Again, the manufacturer's recommended charging time and rate should be used.

Constant voltage charging

The charging method described so far is a constant current method, where the current charges very little over the whole time. A constant voltage method is often recommended for secondary cells and claimed to give superior performance. It is possible that such a method would work well with dry cells also; here is a good field for investigation for someone who has the time and curiosity. Briefly, the charging voltage is adjusted to be exactly equal to the voltage of the fully charged cell, and only a small series resistor is used. Thus the charging current is high at first, when the cell can stand it, and falls to a low trickle charge at the end. The charging time becomes non-critical.

Summary

As you can see, recharging of ordinary dry cells is quite possible, but not especially simple. If you use fairly large quantities of them, you may find it worth the trouble. If this is so, you also may be close to the point where nickel-cadmium or other secondary cells will work out better because of the large number of times they can be recharged, and this should be considered. There remains a range of applications where dry cell charging is worth while, and you may want to try it anyway just to find out how it works.

. . . WA6NIL

References

1. "Reclaiming Used Flashlight Batteries," Kennedy, *Electronics*, October 1943, page 148.
2. "The Effect of Applying A Counter EMF to a Leclanche' Cell," Kobe and Graham, *Transactions Electrochemical Society*, Vol. 73, 1938, page 587.
3. "Electrical Characteristics of Dry Cells and Batteries (Leclanche' Type),'" Letter Circular LC965, U. S. Department of Commerce, National Bureau of Standards, November 15, 1949, page 8.
4. "Eveready Battery Applications and Engineering Data," 1965, Union Carbide Corporation, New York, New York.
5. "Burgess Engineering Manual," 1964 Edition, Burgess Battery Company, Freeport, Illinois.

Frederick N. Davis K8DOC
RD #2 Creek Road
Jefferson, Ohio

A Forty Meter Vertical Array

With the increase in foreign broadcast activity in the forty-meter band, night-time operation has become difficult, if not impossible, in the eastern part of the country. The installation of a parasitic beam is one solution but it is expensive and presents many structural and support problems and was ruled out for this location. The three-element vertical all-driven array was the final result of several months experimentation.

In the time it has been in use, it has been found to consistently outperform the extended double-zepp 90 feet in the air used as a reference antenna. Although no means of measuring the gain was available, a figure of 5 to 8 dB would seem reasonable.

The front-to-back ratio is comparable to, or perhaps slightly better than, that of the three-element parasitic beam, apparently running from 15 to 40 dB on skywave and well in excess of 60 dB on ground-wave signals.

When erected on a northeast-southwest line, the unidirectional pattern is excellent for DX work into both Europe and the South Pacific areas. When working west, a substantial decrease in broadcast interference will be noted.

The array consists of three driven one-quarter wave elements phased progressively in 90-degree steps, resulting in a unidirectional pattern in the direction of the lagging elements.

In a three-element array of this type, it is necessary to employ binomial current distribution to obtain the best front-to-back ratio. In effect, half the current in the end elements as in the center one. This is accomplished by coil L2. The inductance of this coil is not particularly critical but the reactance should be enough higher than the impedance of the elements to prevent serious power losses. Excessive reactance is tuned out by the C1-L1 combination after final tuning of the array.

The pattern is reversed by a DPDT relay which is controlled from inside the shack. A second control switch is installed at the divider box for ease of tune up, but it may be removed after initial tune up.

Phasing is accomplished by means of proper length feedlines and a 180-degree coax phasing line which is switched into

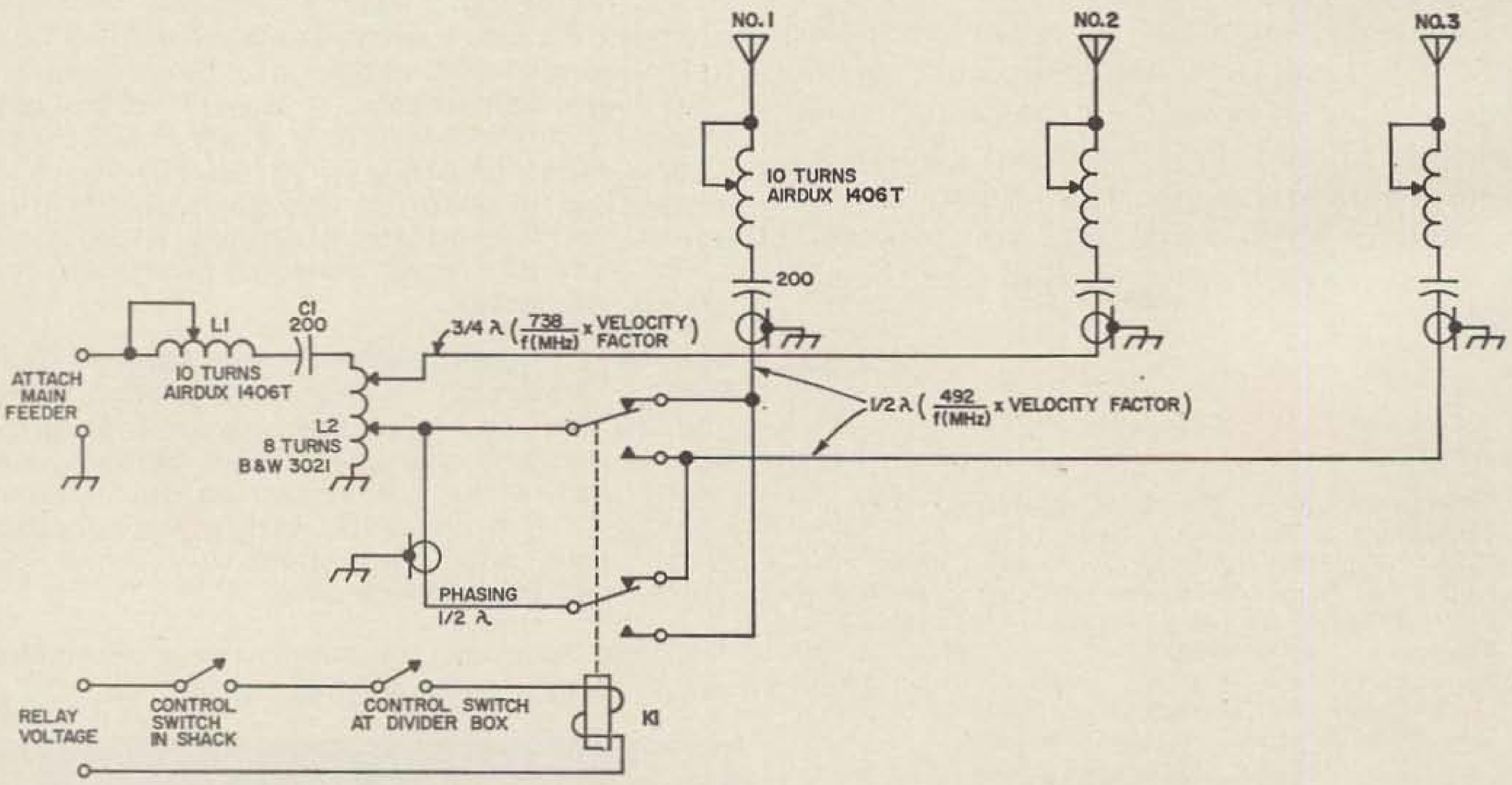


Fig. 1. Diagram of the 40-meter vertical array. The spacing between elements is 34 feet, 3 inches. The ½-wave phasing line using RG-8/U coax is 45 feet long (54 feet, 7 inches for foam coax). The ¾ wave phasing line is 67 feet, 6 inches long (81 feet, 9 inches for foam).

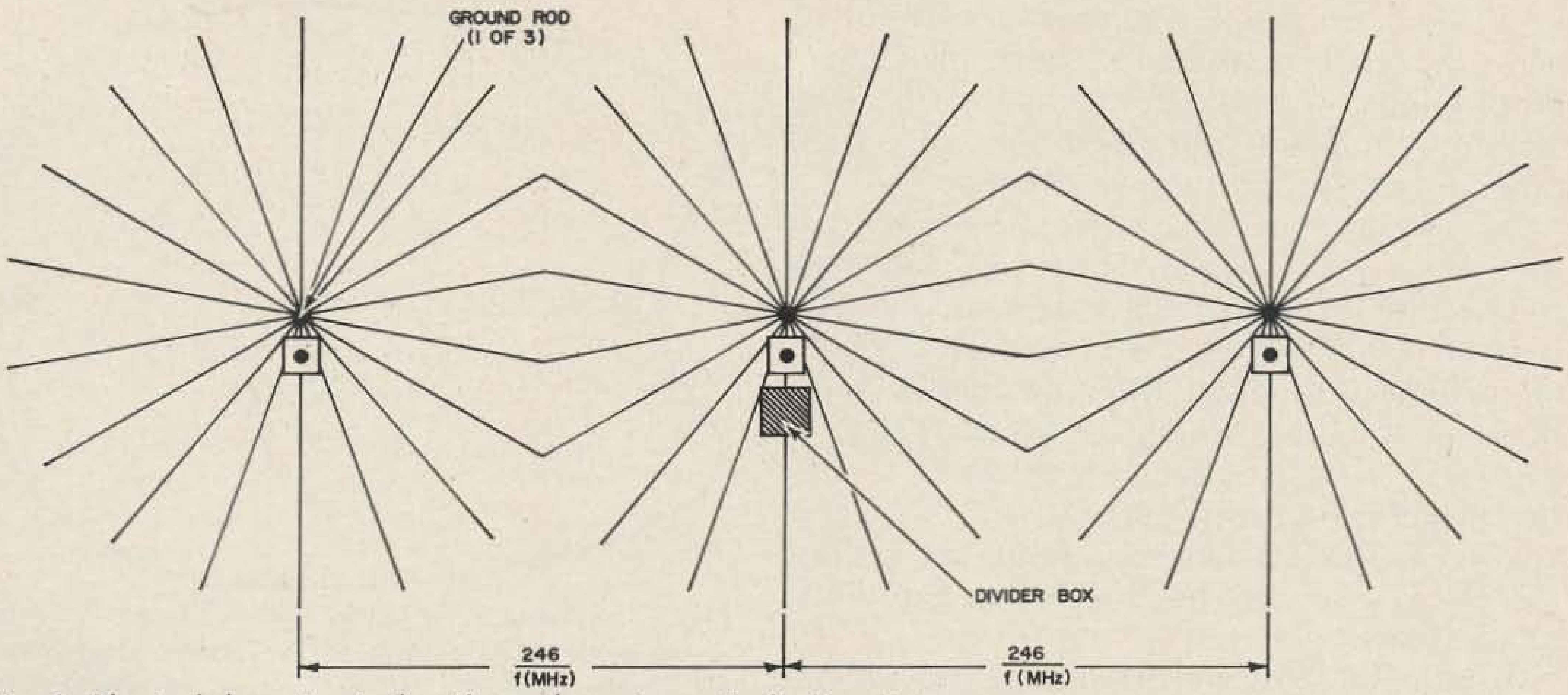


Fig. 2. Physical layout of the three-element vertical 40-meter array.

the feedline of either element one or three. Element two is always 90 degrees out of phase with the other two elements. No switching is done in this line.

Element construction

The elements are constructed from 3-inch round galvanized downspout available for about $1.25 a length. Three ten-foot lengths are driven together and the joints secured with sheet metal screws. Each joint should then be soldered using a torch and acid solder. At a point 22 feet from one end, drill pairs of ¼-inch holes at 120-degree intervals and attach three one-foot lengths of guy wire. Place a strain insulator on the free end of each and attach the regular guy wires.

Base platforms

The base platforms are 2½-feet high with a square top of three-quarter inch plywood 18 inches square. The corner posts are 2x2 lumber which is braced with 1x2 furring strips. After painting the bottom, 6 inches is coated with roof coating and set in the ground. A smaller square of plywood is cut and a round hole is cut in it the size of the base of the quart pop bottle used as an insulator. These squares are nailed to the center of the platform top. Without the ring, the bottle has a tendency to kick out from under the element in high winds. In areas where deep snow is not a problem, the antenna bases may be installed at ground level.

Three-foot lengths of pipe should be driven into the ground at 120-degree intervals around the base and about ten feet out to serve as guy anchors. When attaching the guys, a second strain insulator should be installed in each guy about two feet above the ground. The elements may be walked up by two people and lifted into place atop the insulator. One person can hold the element while the guy wires are tied down.

Ground System

The array was originally used with only a driven ground rod at the base of each element and performed quite well. However, a ground system of 20 radials was installed around each element and a worthwhile improvement was noted. The wire was laid on top of the ground. The radials should be tied together at all points where they intersect and also tied to the guy anchors. If only the rods are used, they should be tied together with heavy copper wire.

Base tuning networks

The tuning network at the base of each element consists of a 10-turn length of Airdux miniductor 1406T in series with a 200 pF mica transmitting capacitor. Since the elements are slightly short, this system permits tuning the element to any desired frequency in the band while keeping the self impedance close to 50 ohms. This avoids the necessity of raising and lowering the elements to trim them to the exact physical length.

Power divider and phasing

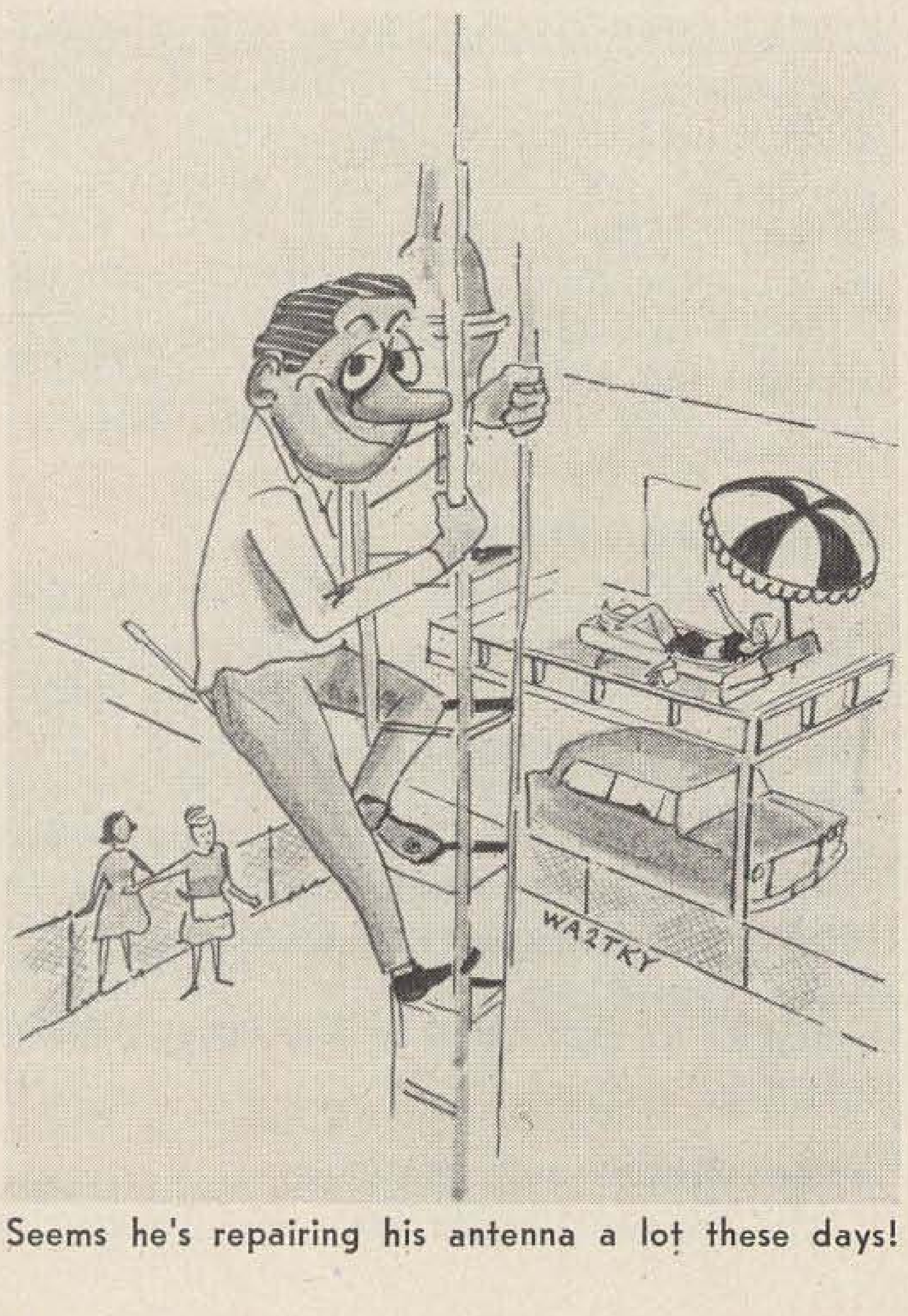
The power divider may be constructed

in a wood or metal box of any convenient size. If wood is used, a sheet of copper or aluminum should be attached to the bottom for grounding purposes. This should in turn be tied into the ground system.

An electrical half wavelength of 50-ohm coax should be brought from the elements to the divider box which is mounted at the base of the center element. A similiar length of feedline is brought from number 3. Both these lines attach to the switching relay as shown in the diagram. These lines should be cut according to length (ft) = (492/f) x velocity factor. At the same time, cut a third half-wave line to be used for the 180° phasing line.

Run a line ¾ wavelength long (electrically) from element number 2 to the tuning box and connect it to the top of the divider coil as shown. Excess line may be coiled up and hung on the base platform. The phasing line should also be coiled out of the way and a copper clip installed on the input end to allow for moving the divider tap on the lines.

All shields should be grounded at both ends. RG-58/U is suitable for all element feedlines and the phasing line, however, if high power is used, the main feedline should be RG-8/U.



Seems he's repairing his antenna a lot these days!

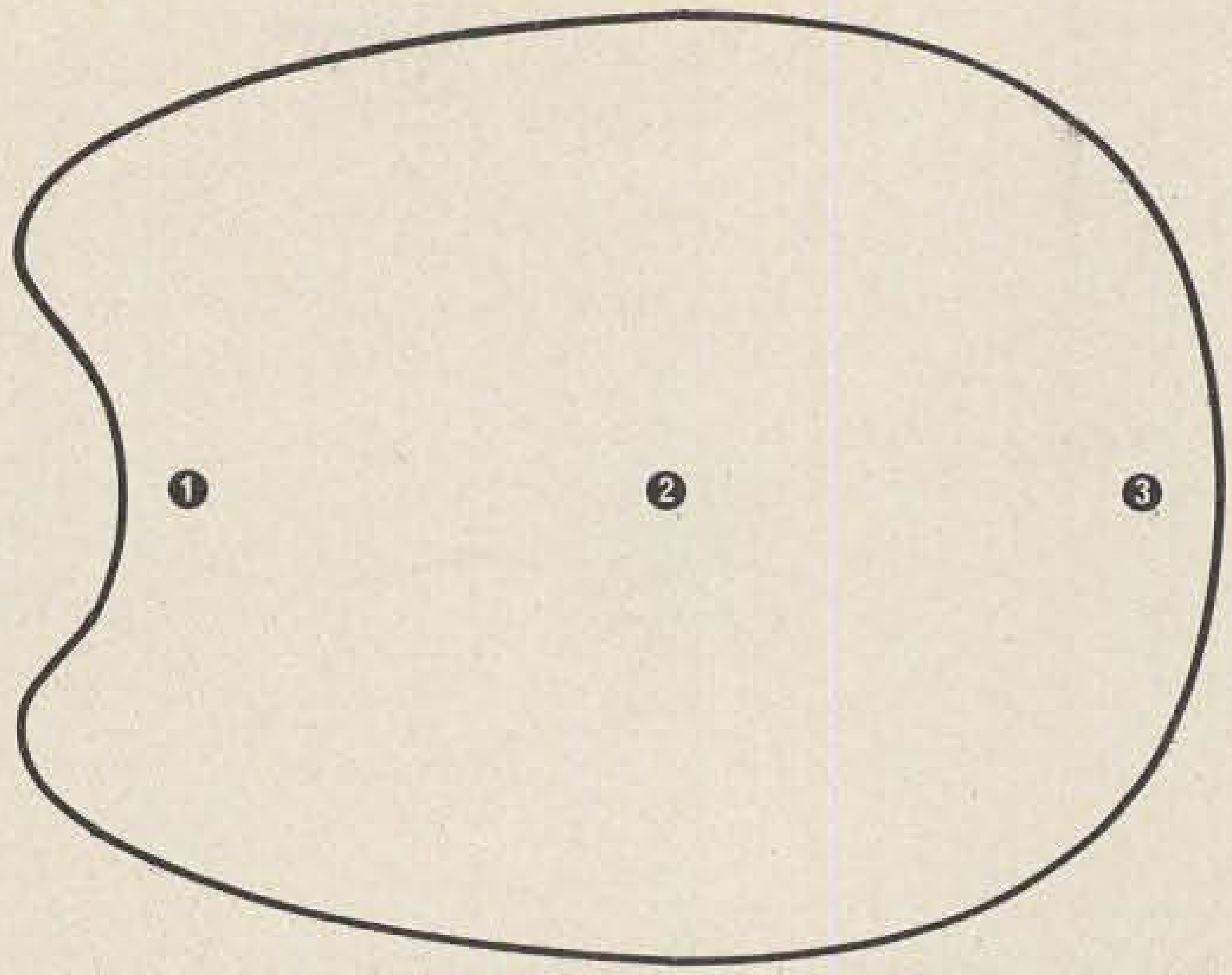


Fig. 3. Pattern of the array with 25% of the power at element 1 (0°); 50% of the power at element 2 at −90°; and 25% of the power at element 3 at −180°.

Element matching

All feedlines should be disconnected from the elements and the main feeder temporarily attached to one element. The element should be tuned for lowest SWR with an SWR bridge or a complete null with an impedance bridge. The process is repeated for each element.

This is a compromise match, as the impedance changes somewhat with all elements driven and each time direction is changed. As long as feedlines are multiples of ¼ wavelength, the reactance introduced is not sufficient to cause serious distortion of the pattern. Do not use lines of lengths other than those given unless they are multiples of ¼ wavelength.

The array was originally built with equal length feedlines of random length, however, the null was shifted 30° to one side. When the element 1 and 3 lines were increased to ½ wave and element 2 line to ¾ wave, the null moved to the rear where it should be.

Additional relays were then installed at each element to change matching coil taps when the direction was switched. However, they did not result in any noticeable improvement and have since been removed.

Power divider adjustment

To tune the divider, all feedlines should be attached to the elements and the feeder taps connected at the top of the divider coil. A small amount of power is applied to the array and L1-C1 adjusted for lowest SWR by moving the shorting clip. If an impedance bridge is used, the measured impedance will be quite low.

Adjustment for the best front-to-back ratio is accomplished by tapping the clip for elements 1 and 3 down the coil until the best front-to-back is observed on received signals or by checking with a field-strength meter. A tap about two turns from the top of the coil is a good starting point.

A much more accurate adjustment may be made if a mobile rig is available. A switch is installed at the power divider for direction change and a remote S-meter brought out from the receiver in the shack. If the receiver has an S-meter circuit which does not allow the meter to work at less than full rf gain, a T-pad will be needed to reduce the reading to around S-9 with the antenna toward the signal source. The array is then switched away from the mobile rig which should be at least ¼ mile away and in line with the array. With careful adjustment of the taps on the divider, it should be possible to null out the signal entirely if the array is not being influenced by other objects in the area. The receiver gain should then be increased until no further improvement can be made. Front-to-back ratio should be well over 60 dB when properly adjusted. On a Hallicrafters SX-111, the signal dropped from 40 over 9 to S-3 after careful adjustment.

While most S-meters may tend to exaggerate, this is a substantial difference. Unfortunately, the front-to-back ratio will not be nearly as good on skywave signals. It is worst on extremely close signals (under 300 miles) and on strong broadcast stations whose signal apparently arrive from several directions at once.

After final adjustment, touch up L1-C1 for lowest SWR. If the SWR is still too high, the input may be matched with an additional network, however, the SWR of the installation shown was 1.3:1 and this was not felt necessary.

As described, the array only allows two primary directions. Although not tried, a second relay could be installed to short out the 180° phasing line which would give a bi-directional pattern broadside to the array. If an additional set of contacts were used to disconnect element 2, slightly more gain would probably be obtained (4 dB or so), but the effect of the floating element on the side nulls is not known.

The array has been in use for over three months and the results have been very satisfactory. A similar array is planned for 75 meters in the near future. . . . K8DOC

Robert C. Green, W3RZD
3304 Collier Road
Adelphi, Maryland 20783

Hamateur Acoustics

Have you ever noticed, when copying another station, some types of signals seem to bounce around the operating room? And have you ever noticd in the background of a phone station you can hear kids yelling, doors slamming, telephones ringing and other miscellaneous noises? Sure you have, and naturally all of this makes for harder copying. It also stands to reason that if you can hear background noises in other stations they can hear background noises on your signal. To eliminate some of these headache factors, why not sound condition your shack? This can be done even if the station is in the living room, den or family room. But if you have your own little cubby-hole away from the cares of the world, such as the basement or attic, so much the better.

Even though the term sound-conditioning was used, why can't we say noise conditioning? Isn't it one and the same? Well, yes and no. Sound is usually defined as being a wavetrain or series of periodic pulses having a definite pitch, such as good copy from a CW station. Noise is usually defined as a series of non-periodic pulses having no definite pitch, such as QRN behind that CW or phone station. Some acoustic engineers break it down even a little further as, "Whats one man's sound is another man's noise." So sound and noise are and are not the same.

Assume that you are copying a nice clean phone station, with no background noise, atmospheric or otherwise, when all of a sudden a plane flies overhead, or a heavy truck goes down the street. All at once you have noise that is both distracting and annoying. Just how does this noise get into the building anyway? Simply stated, the air is set into motion by the object, the air in turn is pulsed against the sides of the building, and the walls, acting as a diaphragm, cause the air inside the building to vibrate. What makes the noise so disturbing is that it does not die out instantly but is reflected from one object to another. For example, if the wave hits a plaster wall, 97% of it is reflected. The reflection of noise or sound is known as reverberation. Every room or auditorium therefore has a reverberation time, which is the time necessary for the sound level to drop 60 dB from the original sound level. This time is also dependent on the frequency of the signal, or sound. That's why some of the signals you are trying to copy seem to bounce around the room. If the reverberation time is too long, new sounds and noises will be added to the old, causing a discordance. Hence, when a room is sound conditioned, it means that two basic things are being done. The reverberation time is being reduced to a predetermined value, and the reverberations are being absorbed as much as possible. Even a small room, 10 feet by 12 feet, 8 feet high, has a maximum acceptable reverberation time. The optimum reverberation time for the same room will be different for speech and music. For a room of approximately 1,000 cubic feet the maximum reverberation time is 0.835 seconds. The optimum reverberation time for speech for the same room is 0.76 seconds. See **Table 1.**

It was stated that a plaster wall reflects 97% of the sound hitting it. This figure is the percent of acoustic reflectivity of this surface. So the opposite would be the acoustic absorptivity of the surface, and is known as the coefficient of sound absorption, and written as a decimal. In the case of the

*The sabine is a measure of the sound absorption of a surface. It is equivalent to a perfectly absorptive surface one-foot square.

Table 1. Various room sizes and their optimum reverberation times for speech and music. The reverberation times are given in seconds; room size in cubic feet.

Room Size	Max. acceptable reverberation	Optimum music	Optimum speech & music	Optimum speech
1,000	.835	.835	.817	.76
2,000	.905	.88	.84	.769
5,000	1.02	.976	.89	.775
10,000	1.12	1.07	.93	.78

plaster wall the coefficient would be .03 sabines.* **Table 2** gives the coefficients of some of the more commonly found objects in the home. The figures given are for 512 Hz and are considered the average, since the coefficient will vary with frequency. The lower the frequency, the lower the coefficient. The total number of sabines of a surface is the number of square feet times the coefficient. For items such as chairs and people it is not necessary to find the area, just multiply the number of units present by the coefficient. But if the chair is occupied, then subtract the coefficient of the chair from the coefficient of the person. The reason being, that the time will be different for unoccupied and occupied rooms. The formula for finding the reverberation time is:

$$\text{Time} = \frac{.05 \text{ X Volume of room in cubic feet}}{\text{Sabines.}}$$

Let's assume we want to sound condition the room mentioned above; 10′ x 12′ by 8′ high. This gives 960 cubic feet (1,000 cubic feet for our purposes) in this example. Also we want the room designed for the optimum reverberation time for speech. First we have to find the basic reverberation time. Again let's assume that the walls and ceiling are plaster board and the floor is varnished oak. There are two windows, closed, each 3′ x 5′ and a closed door, painted pine, 3′ X 6½′. Using Table B for the coefficients we have:

One 10′ x 8′ wall	= 80 sq ft x .03 =	2.40 sabines
Second 10′ x 8′ wall		2.40 sabines
One 12′ x 8′ wall	= 96 sq ft x .03 =	2.88 sabines
Second 12′ x 8′ wall		2.88 sabines
Ceiling 12′ x 10′	= 120 sq ft x .03 =	3.60 sabines
Floor 12′ x 10′	= 120 sq ft x .03 =	3.60 sabines
		17.6 sabines

Because the glass in the closed windows, and the wood in the closed door, have for all practical purposes the same coefficient as the plaster board walls, they will not have to be considered separately. If the windows or the door were open, their area would have to be figured and subtracted from the wall area and the number of sabines in this area would have to be added to the total of the wall. So in our problem, the reverberation time of the bare room is:

$$T = .05 \text{ X } 1{,}000/17.76 = 2.81 \text{ seconds}$$

This value as can be seen is far above the optimum value of .76 seconds.

The next step then is to consider what is going to be placed in the room when it is furnished. Of course there will be the person operating the station, the transmitter, receiver, and other gear, an operating desk, a chair, framed certificates, a rug, and curtains at the windows. By refering to **Table 2** again we can compute the additional absorption of these items.

One average male adult	= 4.2 sabines
8′ by 10′ lined rug (80 sq ft x .2)	= 16.0 sabines

Table 2. Absorption coefficients at 512 Hz of materials commonly found in the home.

18" brick wall, unpainted	.032
18" brick wall, painted	.017
Carpets, unlined	.1-.2
Carpets, lined	.2-.3
Celotex, unperforated, ½" thick	.31
Concrete	.015
Cork flooring slabs, glued down	.08
Cork tile	.06
Cretton cloth	.15
Drapes	.5-1.0
Glass, single thickness	.027
Battleship linoleum	.03
Marble	.01
Open window	1.0
Plaster on wood lathe	.034
Plaster on wire lathe	.033
Plaster board	.03
Wood, white pine, unpainted	.06
Wood, white pine, painted	.03
Oak flooring, varnished	.03
Human, average male adult	4.2-4.7
High school student	3.5-3.8
Average female adult	2.3-2.5
Upholstered seats, thick plush	1.0-4.5
Wooden chairs	.1-.2
Masonite, on 2" x 4" studs 16" o.c.	.32

Operating desk, painted pine 6'x3'x3' (consider it a box)		
= 54 sq ft x .03	=	1.62 sabines
One wooden chair, painted	=	.2 sabines
One upholstered chair, average size seat	=	3.0 sabines
Radio gear, assume 12 sq ft of surface 12 sq ft x .01	=	.12 sabines
Two curtains, cretton, 6'x4' draped and folded to cover entire window 48 sq ft x .15	=	7.20 sabines
		32.34 sabines

As with the glass in the windows, we can disregard the framed certificates because of the coefficients. Now the room will have 32.34 plus 17.76 sabines or a total of 50.10 sabines. The reverberation time will now be:

T = .05 X 1,000/50.10 = 0.99 seconds

This is still too long by .23 seconds from the optimum time of .76 seconds and still too high for the maximum reverbration time.

For all practical purposes though, we could stop here and say that the room is now correct. The reason is that the total area of the room is small and in the future things will be brought into the room, such as books, paper, and maybe an additional chair. But for the purpose of our example, let's continue as if nothing more will be added to the room in the future. Then the additional sound absorbing material needed

Bah—wireless! ! !

can be found by transposing the formula to give:

Absorption needed = 0.5 V/T = .05 X 1,000/0.76 = 65.78 sabines

65.78 minus 50.10 equals 15.68 sabines needed in additional material. Let's say we decided to use a wall covering to get the needed absorption, so to find the number of square feet to be covered:

15.68/coeffiicient of material to be used.

By using the table of coefficients and doing a little figuring we can see that it might become difficult. Suppose that plain celotex is decided upon then 15.68/.031 would give 50.5 square feet that has to be covered. This is less than the square foot area of any of the walls or ceiling. We could cover just part of a wall, but the appearance would look odd. However, and again assuming, suppose that both windows are in one of the 10' walls, then 80 square feet minus 30 square feet, both windows, give a remainder of 50 square feet. This wall could be covered, disregarding the remaining half-foot of material needed.

Another solution would be to change something already in the room, such as the curtains. Instead of using cretton curtains, why not use drapes. By using material which is not too heavy, something that might have a coefficient of 0.3, we get the following: 48 square feet of curtains times .3 equals 14.4 sabines. The room would now have:

17.76 sabines in basic room
39.54 sabines from the furnishings
57.30 sabines

The reverberation time would now be:

T = .05 X 1,000/57.30 = 0.87 seconds

Then this gives a difference of only .11 seconds above the optimum time. This is assuming that the drapes are closed, covering the entire windows. If the drapes were made longer, from ceiling to floor, then this would correct the time. By opening the drapes we now have a method of varying the amount of absorption and time, if it has to be done. The greater absorbency of the drapes will mask the absorbency of the walls and windows they cover to some extent. However, if the drapes are not tight against the walls and windows, some sound will get behind them and be absorbed. So it is not necessary to subtract the area of the walls covered by the drapes.

If you decide to sound condition the room as if it were a radio studio, then the optimum time changes. For a radio studio the most satisfactory time has been found to be about two-thirds the optimum time for speech. For a music recording studio the time is about two-thirds of the optimum time for music. These figures only hold if the residual noise in the room does not exceed 5 to 10 dB.

If the shack is in the living room or den most of the needed absorption can be made up in drapes and upholstered furniture. The XYL will be more than glad to pick these items out for you. When the station is in the attic it would be wise to remove the floor and install rock wool or fiber glass mats between the joists. When reinstalling the floor get the joints butted together as tight as possible, or use tongue and groove flooring. It is surprising how much sound can get through cracks. If it is impractical to remove the old flooring, install a false floor about two inches high with the mats beneath it. This will not effect the coefficient of the floor, but it will help dampen any vibrations that the floor, acting as a diaphragm, would transmit to the ceiling below. As for the basement, the ceiling should be treated in a similar manner, installing fiber glass mats between the joists before covering with any acoustic tile.

Any noise carried through heating ducts between rooms, can be attenuated to a great degree by lining the inside of the ducts with a sound absorbing material. Use either fireproof tile or fiberglass, held in place by glue or some form of staple.

When buying any acoustic tile, make sure you get the coefficient number from the manufacturer's literature. Also, try to get material which will not have to be painted later as this will reduce the coefficient by 15%. This should have been taken into account with the plaster-board walls mentioned in our example because the walls would have been painted at the time of construction, but it was not figured for ease of computing. The 15% would not reach full value until about three coats of light weight water base paint has been applied, or two coats of heavy oil paint.

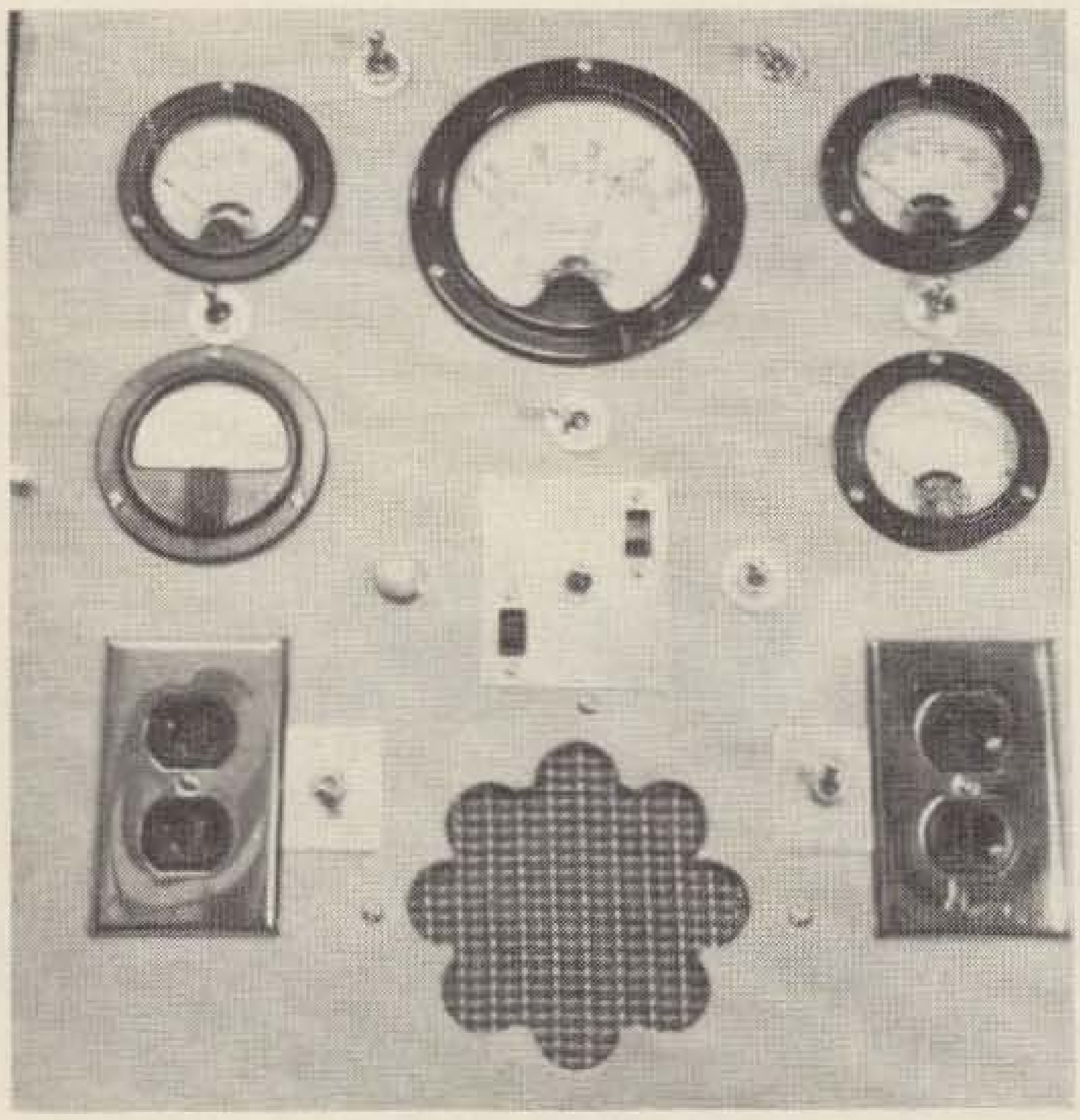
. . . W3RZD

Jack Bruce WA6UVS
Box 259, Route 3
Carmel, California

A Workbench Clutter Filter

Cluttered work bench? Try this surefire bench clutter filter designed by WA6UVS.

Anyone who has ever breadboarded an electronic circuit knows well what a prodigious mess this endeavor can spawn on the home workbench. Commonly this same brambly mess can become not only unsightly in appearance but also physically dangerous, as I am sure a good many people can testify. Described here is a simple device which will assist measurably in preventing a good part of the unpleasantness from ever developing.



Note that the individual input receptacle to each of the four ammeters is not shown on the photograph. The reason for this is that I did not recognize the desirability of this feature until after the photograph was taken. All 'on'—'off' switches are turned 'on' by pushing the switches 'up'. All meter selector switches position by actuating toward the desired meter.

Drawn on a sheet of paper as a schematic, a simple one-stage amplifier will appear beguilingly simple, but once this schematic has been fleshed out into electronic bone and tissue on the breadboard, one begins to wonder where the simplicity went.

The gadget outlined here represents an attempt to clean up a lot of loose odds and ends about the workbench and confine them to a handy panel assembly on the premises. Its development was promoted by various unpleasant encounters with almost every breadboard assembly I have ever built.

The proverbial final straw was loaded aboard about a month ago. On that day I had an errand to perform, one of those itchy things dreamed up by the XYL. However, since "H" hour was some 45 minutes away I figured this gave me just enough time, if I hurried, to run some tests on a group of 1619's that happened to wash up on my personal beach. Out came the power supply, the filament transformer, the voltmeter, 2 ammeters, an output transformer and a speaker. These were all hurriedly arranged, each in its respective place and all nicely tied together with a bird's nest of hook-up wire. The last item of the array was the speaker which I intended to hook into the circuit with alligator clips. With a glance at the clock to see how much time was left, I leaned over the workbench like a bullfighter over a bull and plunged home the two alligator clips, all the while keeping half an eye on the clock.

As it developed, half an eye was all I could muster some seconds later as I pushed a good part of the scrambled equipment

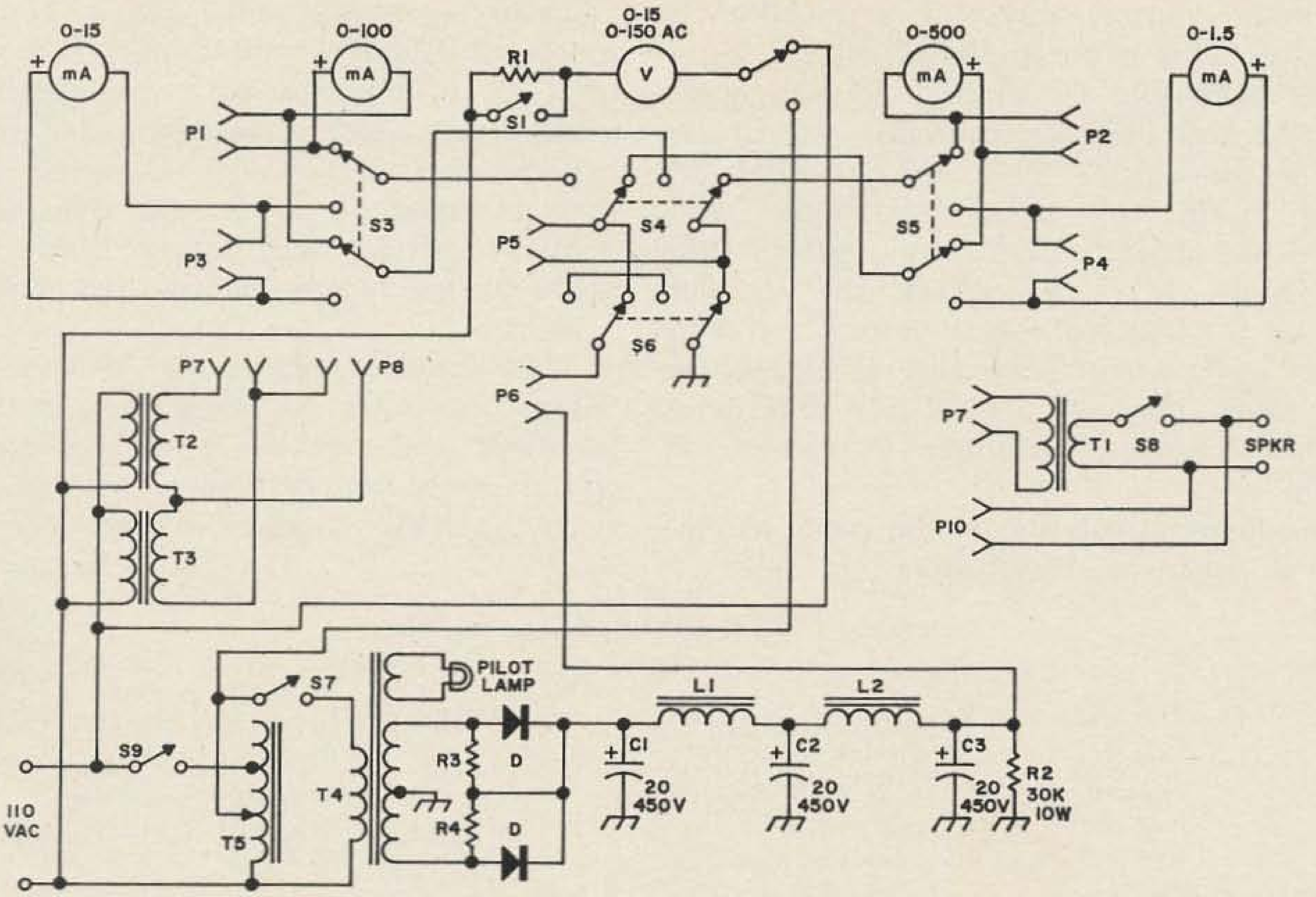


Fig. 1. Wiring diagram of the workbench clutter filter. This gadget is handy and guaranteed to clean up your workbench!

off my chest, struggled to my feet, cut all line switches, and thankfully staggered off about that errand. I don't know into what part of that seemingly innocuous plethora of wire my alligator clips were slipped, but, certainly, it was not the voice coil of the output transformer.

Later, having performed the errand for the XYL and in the process recovered a portion of my shaken nerve, the tests were continued toward a result which included not only tube curves but also a couple of charred filament wires, an abused ammeter and a throbbing elbow. The latter got that way from having richocheted from a B plus off the workbench shelf.

These, then, were the conditions under which the *Workbench Clutter Filter* was conceived and built.

The assembly consists of three separate parts. The first of these is the power supply which is variable from approximately 0 volts to 400 volts and is controlled by a small *Variac.* Note that in order for this type of voltage control to be successful, either solid state rectifiers must be employed, as is done here, or a separate rectifier filament transformer must be used. The second part of the assembly is made up of five meters, four of which are dc types measuring from 1.5 mA to 500 mA; the fifth meter is an ac type covering two ranges, 0-15 Vac and 0-150 Vac. The latter range is used to monitor the ac line voltage or ac input voltage to the power supply. The third part of the assembly is made up of an audio output transformer and a speaker. These latter components can be used separately or together as a unit depending on switching arrangements used. Three or more sets of leads should be fabricated for use with the assembly. These can be made from new material or from television cheater cords with the chassis ends hacked off and a pair of alligator clips soldered onto each set. These leads should all be marked for polarity, as should all meter and power plugs on the panel. (Use your XYL's best crimson nail polish for this purpose and be assured of not forgetting.)

Operation of the assembly is quite simple. To illustrate, let us return to the 'shocking' experiments which led to the conception of the assembly; the 1619 tube experiments. Plug a set of leads into the power supply, being careful to observe polarity. Connect one clip to the plate of the 1619 and the other to ground. Read plate current with the 0-100 mA meter. Plug another set of leads into the 0-15 mA meter. With a second power supply feeding through these leads screen current will be metered.

The output transformer-speaker combination can be used whenever trouble in the final audio output stage of a receiver is suspected. This is accomplished by plugging a set of leads into P9, closing (pushing up) switch S8 and attaching the clips, one to the plate of the output tube and the other to B plus. If this test clears the trouble, next remove the leads from P9 and reinsert into P10. Open switch S8. Break the speaker leads on the receiver being tested and clip the test leads on the secondary of the output transformer. These two tests will determine if either output transformer or speaker is at fault.

The remaining portion of the panel assembly, the filament transformer, is self explanatory, serving only as a convenient source of filament voltage for tubes under test. As a precautionary measure, always remove test leads from the panel after an experiment has been run. It would be most easy to overlook a shorted pair of leads (clips together) and either burn out the main power supply or the filament transformer.

This about wraps it up. If your clutter filter contributes as much toward the contentment and well-being of your shack as it has mine, you may have to start a fight with the XYL to generate some excitement.

. . . WA6UVS

Table 1. Parts list for the clutter filter.

C1, C2, C3	20 μF/450V electrolytics
D	For 800 Vct transformer use sufficient number of diodes to produce a value of 1200 PIV in each leg plus one diode as a fudge factor. I used Sarkes-Tarzian F-6 diodes in each leg.
L1, L2	Whatever is available; I used 1 Henry units from old TV power supplies.
P1 thru P4	Single 110-volt female receptables used as individual inputs to each of the meters.
P5	Same as P1 used as input to any of the four ammeters.
P6	Same as P1 as B-plus receptable.
P7, P8	Double 110-volt female receptable; P7 is 12-volt outlet and P8 is 6-volt outlet.
P9, P10	Double 110 volt female receptable; P9 is input into output transformer. P10 is input into speaker.
R1	Meter multiplier resistor; select for particular meter used.
R2	30k ohm, 10 watts.
R3, R4, etc.	About 400 to 500K ohms across **each** rectifier diode.
S1	SPST toggle switch. Meter multiplier.
S2	SPDT toggle switch. ACV meter selector, line voltage or auto-transformer output voltage.
S3, S5	DPDT toggle switch. Meter selector switch.
S4	DPDT toggle switch. Meter branch selector switch.
S6	DPDT toggle switch. Inserts selected meter into B-plus circuit.
S7	SPST toggle switch. B-plus control.
S8	SPST toggle switch, Permits use of speaker without input transformer.
T1	Audio output transformer. 4.5k ohms to 3.2 ohms primary to secondary will probably prove most useful.
T2, T3	Filament transformers, 6.3 volt, current rating as desired.
T4	800 VCT, 200 mA power transformer with at least one filament winding to power pilot light.
T5	Variable Auto-transformer. I use a 500-watt unit.
Pilot Light	6.3-volt or 12.6-volt to match the winding on T4.

Hy-Gain 14AVQ

HY-GAIN ANTENNAS, FOR THE MOST POWERFUL SIGNAL UNDER THE SUN

Thomas R. Yocom WAØOBJ
1875 Country Club Drive
Marion, Iowa 52302

General Information About Amateur RTTY

The number of radio amateurs using teleprinters on the air is increasing at a great rate. Each of these new amateurs is faced with many technical problems which must be solved. Some are fortunate enough to live near an already established amateur teleprinter station. For those not so fortunate, there has been a great need for down-to-earth information on the manner in which one goes about entering the ranks of the current operators. The comments here recorded have been assembled to assist those amateurs who are in need of fundamental information and instructions.

The information which follows is not intended to answer all of the questions that may arise. There are several publications available which go into the details of the teleprinter machines and how they operate. Interested amateurs should acquire these sources of information and read them carefully. It is hoped that the information presented herein will enable those who are interested to make better use of the existing publications.

Types of machines

There are many different types of teleprinter machines, manufactured by different companies. Many of the ones available to hams have been manufactured by the Teletype Corporation. For example, the models 12, 15, and 19 are frequently found in amateur circles. Many people who enter into RTTY select the model 19 because it offers flexibility at a reasonable cost. The flexibility results from the tape equipment which is an integral part of the model 19 while the cost is moderate because of the machine's age. (One can purchase a model 19, pre-tested and shipped to the door, for approximately $150.00). Other models, such as the model 15, which does not include tape equipment, can be acquired for considerably less. On the other hand, for those who can afford the very finest, model 28 machines are available.

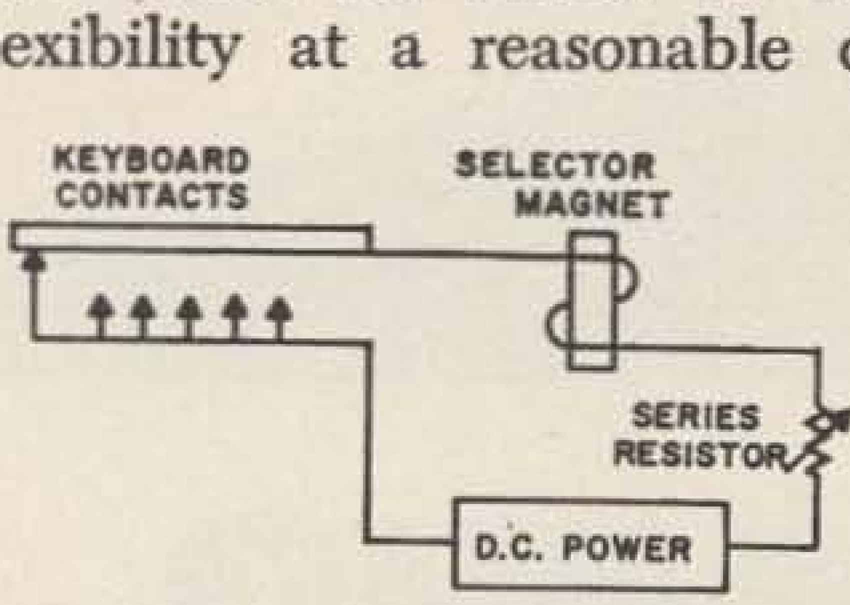


Fig. 1. With the local loop shown here, the teletype operator can type on the keyboard and activate the printer for printing.

Tape equipment

When we speak of "tape" we are referring to the 5-channel paper tape that can be used to store information for later use. Information can be placed into paper tape using a paper tape punch. The information is then saved until it is later read by a paper tape reader. The information contained on the tape can be alphabetic, numeric, and/or control. By control information, we mean information capable of performing such functions as ringing a signal bell, advancing the paper in the typer, or returning the typing unit to begin a new line. All of this information is stored on the tape in the form of punched holes which by their position and number indicate the particular character of interest.

Tape equipment is popular in the RTTY field, because it enables one to prepare messages ahead of time and to send them automatically when desired. This is accomplished by punching the messages into paper tape and then later reading them with a paper tape reader at a high speed (approximately 60 wpm). Many amateurs enjoy calling "CQ" by using tape equipment to send out the signals which, when received, generate the normal type of CQ format, i.e., CQ CQ CQ DE WAØOBJ K K K. The tape equipment thus represents a way of transmitting from a teleprinter machine without actually doing the typing at the time of transmission.

The model 19

The model 19 can be thought of as having 6 essential parts:

1—a model 15 page printer
2—a keyboard capable of transmission to an outside circuit, a paper tape punch, or both simultaneously
3—a paper tape punch
4—a paper tape reader and transmitter
5—a sturdy table containing power distribution connectors
6—a suitable dc power supply

The above six parts, when properly connected, enable the operator to perform the following functions:

1—receive incoming messages on the page printer
2—prepare paper tapes while receiving incoming messages
3—prepare paper tapes while simultaneously transmitting directly from the keyboard
4—transmit from the keyboard to external circuits (while transmitting, the information can be printed on the printer or can be transmitted "blind")
5—transmit from the paper tape reader (see #4)
6—receive on the printer while transmitting with either the keyboard or tape transmitter.

Function 6 is especially interesting for it enables one to operate in a simulcast mode. The discussion which follows will not be concerned with this mode of operation. Persons interested in exploring this type of operation should consult the more advanced publications covering RTTY configurations.

How the machines work

The teleprinter is activated by releasing the printing mechanism. This is accomplished by de-energizing the selector magnets. In the model 19, the selector magnets are located on the left-hand side of the machine. With the printer motor running, the printer unit is maintained inactive as long as the printer magnets are energized. When current ceases to flow, the magnets release. If the current is interrupted according to the "teletype code", the printer will be activated and the appropriate character will be printed. The more detailed publications explain the manner in which this is accomplished.

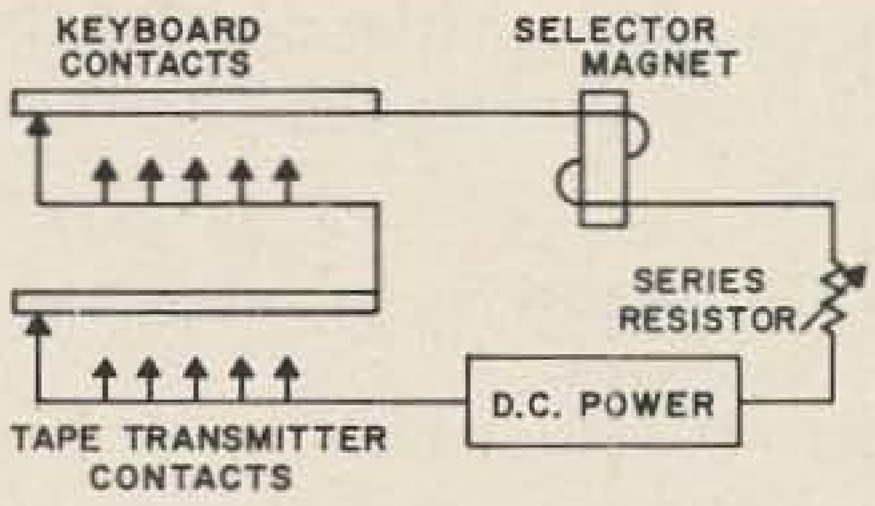


Fig. 2. With this local loop arrangement, the printer will print from either the keyboard or the tape reader.

The selector magnets can be wired in series or parallel. In general, they are wired in parallel. The magnets are energized with direct current—60 mA being required for proper operation when wired in parallel. The model 19 is generally supplied with an appropriate power supply which will furnish the current necessary for the selector magnets and also the tape punch and tape reader. The supply is in general capable of supplying 120 volts at 800 mA (1200 mA intermittent) and may carry a Western Electric identification of KS-5928. The resistance of the selector magnets is low and a series current limiting resistor is required when using the 120 volt supply. Do not attemp to operate the unit without the series resistor. The magnets will overheat in a few minutes time and will burn out shortly thereafter! A variable resistor is desirable so that the current can be adjusted when the unit is periodically serviced. A suitable resistor would be a 2500 ohm unit rated at 20 watts.

The selector magnets do not have to be operated with a high voltage dc supply. Low voltage supplies will work quite well and reduce the danger associated with the higher voltages. The main advantage of using high voltage is the self-cleaning of contacts which takes place due to the slight arcing.

A local loop

In teleprinter installations, a closed circuit is referred to as a loop. Thus a "local loop" is a closed circuit which encompasses equipment in your local area, i.e., only your machine. A local loop could consist of a printer and a keyboard or a printer and a paper tape reader. To set up a local loop with your model 19, you will have to locate the leads connecting to the selector magnets, the keyboard, and the paper tape reader-transmitter. Details on how to locate these leads will be presented later in our discussion.

The inter-wiring required for successful operation can be greatly simplified by thinking of the units performing like the following components:

Printer—an electromagnet which is normally energized
Keyboard—a SPST switch which is normally closed
Tape Reader-Transmitter—a SPST switch which is normally closed

With the above understanding of the units, we can immediately wire a local loop containing the keyboard and printer. The loop would be a series circuit containing the following elements:

1—the keyboard SPST "switch"
2—the printer's electromagnet
3—a current control resistor
4—a source of direct current

Such a circuit is shown in **Fig.1.** Since the keyboard "switch" is normally closed, a current will flow through the selector magnets keeping them energized with an amount of current governed by the setting of the current control resistor. When a key on the keyboard is depressed, the normally closed contacts will be interrupted momentarily. This will cause the selector magnet to de-energize and thus activate the printing mechanism. Note that the circuit is not simply opened and then closed again. The actual interruption may consist of several openings and closings—the number and spacing depending upon the character being sent by the keyboard. A complete discussion of the "teletype code" is presented in several of the detailed publications.

With this simple local loop, one can type on the keyboard and have the characters displayed on the printed page by the printer. Now observe that the tape transmitter is simply another normally closed switch. If the above loop is opened and the tape transmitter inserted, we would have a new loop in which the printer could receive from either the keyboard or the tape transmitter. Just as depressing a key on the keyboard causes the circuit to be interrupted momentarily, so passing tape through the tape reader causes the same thing to happen. Such a loop is shown in **Fig. 2.**

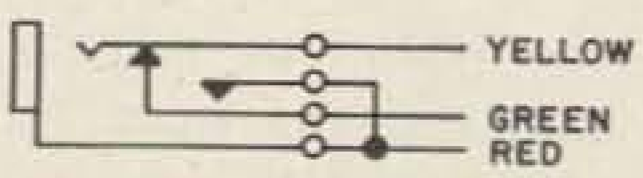


Fig. 3. Color coding of the switching jacks found in the Model 19. With the plug inserted, connections are made to red and yellow.

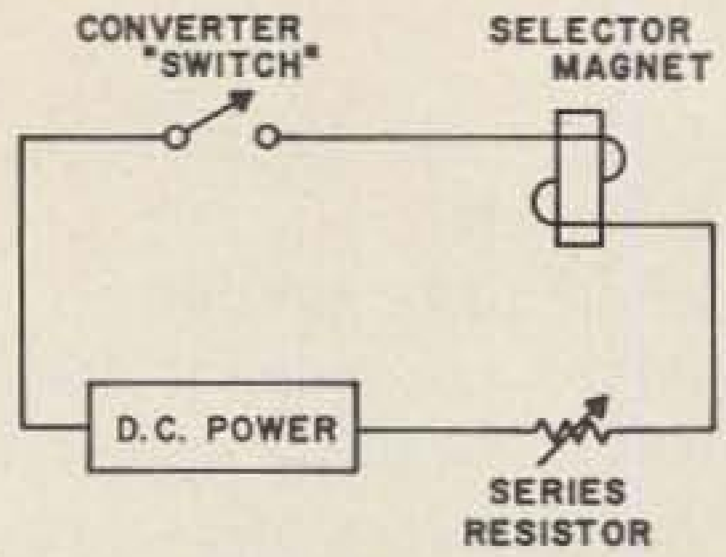


Fig. 4. Installation of the RTTY converter in the local loop to energize the printer from received RTTY signals.

Comments on unit wiring

Although you will find several publications showing a wiring diagram for the model 19, this does not imply that your model 19 will be wired exactly as shown in the diagram. At first this sounds as though it would pose great problems. However, a few minutes spent exploring the machine with an ohmmeter will pretty well identify the necessary wires.

In general, you will find two wires coming from the printer which are terminated with phone plugs. One will be red and the other will be black. It is these wires which you will want to examine with an ohmmeter. Sometimes one is the keyboard while the other is the selector magnet. Other times, the two centers of the plugs are the one unit while the two outsides are the other. You will have to study your machine to determine exactly how it is connected.

Switching jacks are provided for the phone plugs. These jacks are mounted in the model 19's table along with the various power connectors. **Fig. 3** shows how the jacks are wired and color-coded.

Assuming that you are using the standard Western Electric KS-5928 power supply, the power connections are straight-forward. On the back of the table, you will find various sockets that will accept only special keyed plugs. These plugs are contained on either the power supply unit or the printer.

The power from the incoming line is supplied to the power supply by the toggle switch located under the table top (left hand side). This switch represents the main power switch for the entire teleprinter machine. The printer's motor is controlled by the "on-off" switch located on the front of the printer. Some units also have a switch to control the ac to the tape reader's motor. If your machine does not have such a switch one should be installed.

Provision is made for mounting a switch in the box containing the general power switch mentioned above. If your model 19 does not have the switch for controlling the tape reader's motor, you will find that one wire comes into the switch box, loops around, and then goes back out. The new switch should be inserted in this loop.

The "on-off" switch mounted on the front of the tape reader-transmitter is not a power switch controlling the ac drive motor. The switch is connected in series with a solenoid used to maintain the transmitter inactive. If you lift off the cover of the transmitter, you will find a large solenoid located near the front, on the left hand side of the unit. If this solenoid is energized, the motor will turn the vertical shaft and "read and transmit" the information contained on paper tape. Thus to send from tape, two sources of power must be connected to the tape reader—the ac power to the motor and the dc to the control solenoid. The dc for this solenoid is distributed via the printer's inter-unit switches (see next section).

Inter-unit operation

There are several modes of inter-unit operation possible with the model 19. We indicated before that one must identify the leads coming from the keyboard and selector magnet. We implied that they were directly connected. Actually, there are switches installed in these lines. You will find three switches on the front of the printer. The one on the far right is the "on-off" switch for the printer motor. The motor must be turned on to either receive with the printer or to transmit with the keyboard. It does not have to be on to punch tape (blind punching). Now observe the switch on the left hand side of the printer. This switch is connected in series and in parallel with the keyboard. In the "send" position the keyboard is connected to the out-going wires. In the receive position, the keyboard is shorted (bypassed). In the "break" position the keyboard circuit is opened. The remaining switch, located slightly left of the printer motor power switch, selects the mode of transmission that will take place from the keyboard. Thus, if in the "keyboard" position, transmission will take place from the keyboard to the outgoing lines. In the "keyboard and tape" position, transmission goes to the outgoing line and the information being typed is simultaneously punched into paper tape. When placed in the "tape" position, the keyboard will punch tape but will not transmit to the out-going line. It is in this mode of operation that the printer motor need not be running.

We should now note some interactions which take place between the paper tape reader-transmitter and the above mentioned switches. If you want to send something, whether it be from tape or the keyboard, the "send-rec-break" switch must be in the "send" position. Furthermore, if you want to send from paper tape, the "keyboard-kbd/tape-tape" switch must be in the "kbd/-tape" or "tape" position. Also, when transmitting tape, remember to turn the "solenoid switch" to "on". Note: Some tape transmitters have other switches connected in series with the solenoid switch. These include switches to stop transmission if there is no tape in the reader, etc.

Radio teletype

Up until now, we have concerned ourselves with the machines used to send and receive teletype. But we have not talked about applications involving anything other than a local loop. Certainly the fascination of typing on an over-sized typewriter will wear off quickly. Let us then pursue the reception of teletype signals and the manner in which they can be used to activate a teleprinter machine.

You will recall that we said the printer was activated by interrupting the flow of current through the selector magnets. It then follows that if we could get the receiver to interrupt the flow of loop current in step with the intelligence being received, we

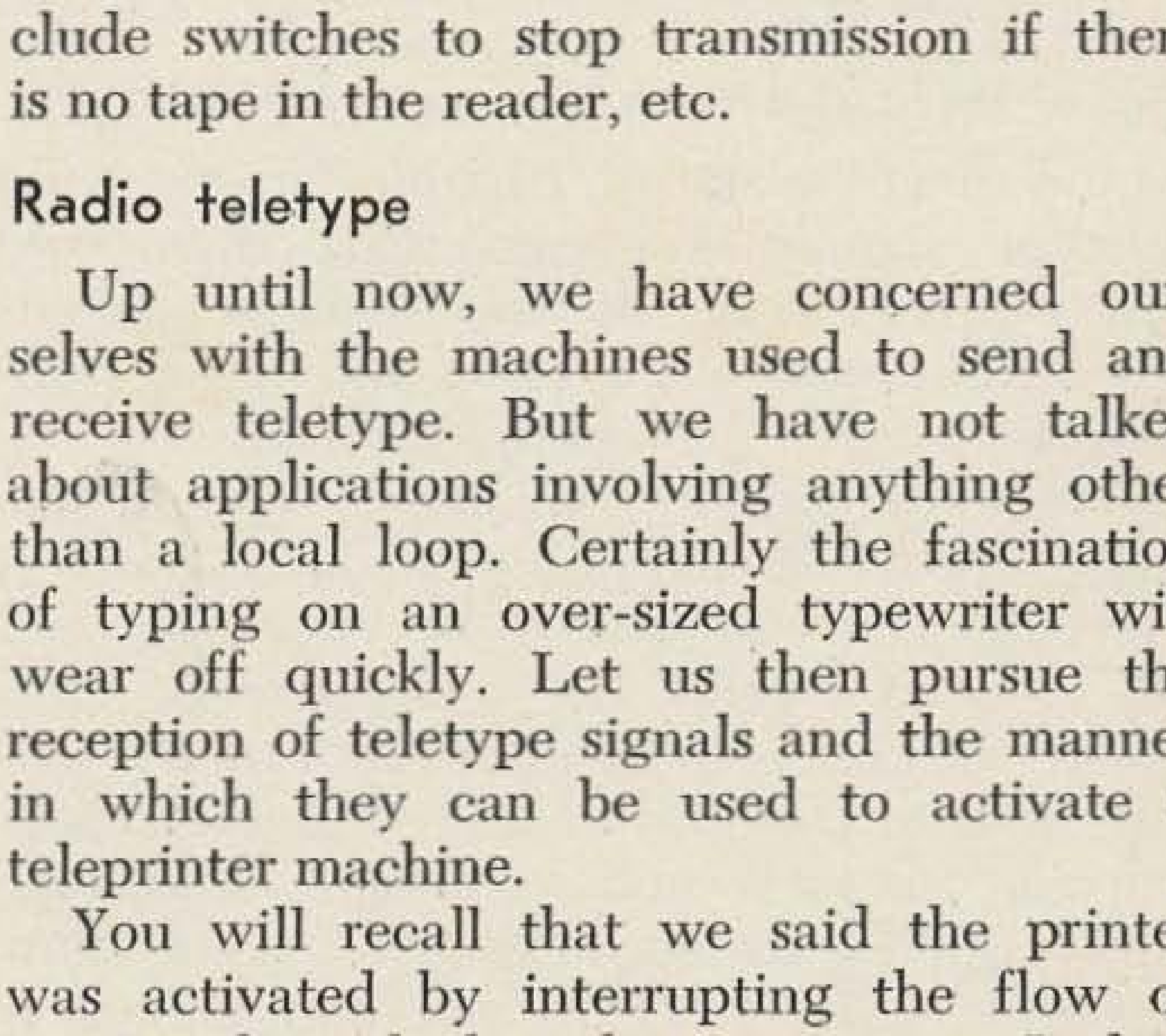


Fig. 5. The "Mainliner" frequency-shift keying circuit described by K8DKC in the May 1965 issue of *QST*. The resistor R_s is adjusted for 60 mA through the selector magnets.

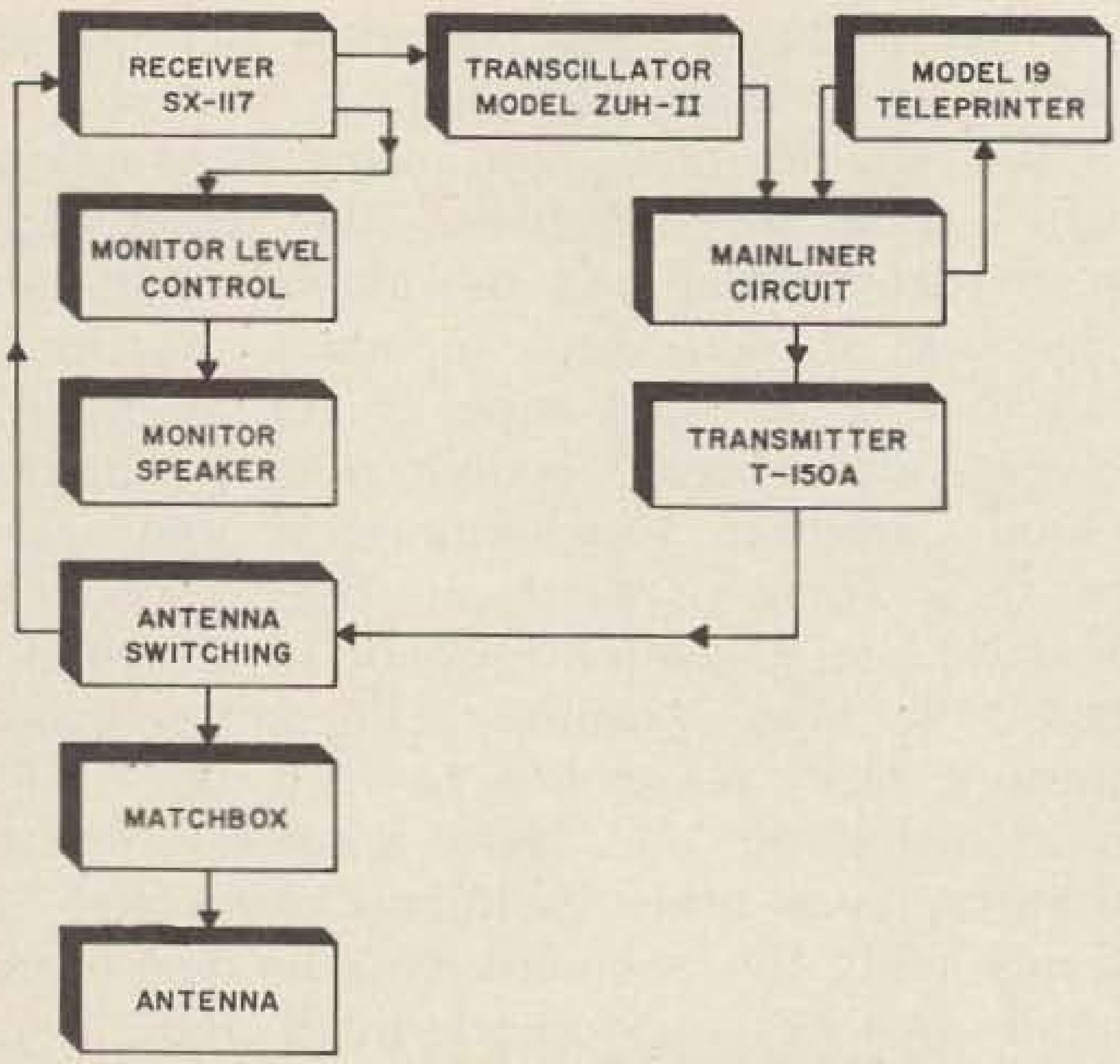


Fig. 6. The station setup used at WAØOBJ.

would have a set-up capable of receiving teletype signals and converting them into the printed word. If the teletype signals were transmitted in a make-and-break fashion, we could, for example, rectify the receiver audio output and apply it to a normally open relay (So long as the signal was present, the relay would be energized and the contact would be kept closed). Thus when the audio ceased, the relay would open the loop to the printer and de-energize the selector magnets and printing would take place. Such a circuit, although lacking many desirable characteristics, can and indeed is used by some amateurs.

In general two types of teletype transmission are employed by amateurs: frequency shift keying (fsk) and audio frequency shift keying (afsk). Frequency shift keying is accomplished by adding and subtracting a small amount of capacitance at the cathode of the transmitter's vfo. The addition and subtraction are done in step with the conditions existing in the local loop. The addition or subtraction of capacitance to the cathode of the vfo causes it to shift its frequency of oscillation. Thus, if current is flowing through the selector magnets, one frequency is transmitted. If current is not flowing, the alternate frequency is transmitted. Thus the condition existing in the loop is constantly indicated by the frequency being transmitted. In audio shift keying, the same theory applies except two audio notes are transmitted to indicate the conditions existing in the loop. This is accomplished by switching the transmitter's audio input from one audio oscillator's output to that of another.

The devices used to convert the received teletype signal into pulses capable of operating the printer magnets are called converters or terminal units. There are many different unit circuits available and the literature abounds with information about them. Some converters process the audio output of the receiver while others process the signal existing in the *if* section of the receiver. The output of the converter amounts to a switch which is either open or closed. As soon as you recognize this fact, you should realize that the converter is very similar to the keyboard or tape transmitter so far as its function as a circuit element. Since the converter output is just another SPST switch, we can set up another series loop containing the converter's "switch", the selector magnets, the series limiting resistor, and a source of direct current. See **Fig. 4.** As the receiver's output changes in step with the intelligence being transmitted, the converter's "switch" will open and close and thus set up current changes in the receiving loop identical to those existing at the transmitting station.

To keep the converter from responding to signals other than the one desired, it is equipped with various filters which are designed to reject the unwanted frequencies. A full discussion of converters and filters can be found in the existing detailed publications.

To summarize, transmitting involves converting the make-and-break in the local loop into either a shift in transmitter carrier frequency or a change in the audio note transmitted. Receiving involves converting the change in the audio frequency received (audio type converters) into a make-and-break signal for the receiving loop. (Note that in receiving fsk the receiver's bfo is turned on and beat with the incoming signal just as in receiving CW signals.)

Shift circuits for FSK operation

Various shift circuits are available and have been presented in the literature. One very flexible circuit is that called the "Mainliner" which was presented in the May 1965 issue of QST in the article by Irvin Hoff. This circuit uses a small diode in a diode switching circuit to add or subtract the capacitance to the vfo cathode. The circuit is shown in **Fig. 5.** The model 19's power supply can be used to power the circuit.

The circuit's operation centers around the voltage drops appearing across the various resistors. With the loop closed, a voltage of a given polarity exists across the diode. Opening the loop (sending a character with the keyboard or tape) causes the polarity across the diode to reverse. As the polarity changes, the diode either conducts or does not conduct. Thus the diode either shorts the capacitance applied to the cathode to ground (thus connecting it into the circuit) or "disconnects" the capacitance by allowing the one lead to "float".

Station setups

No doubt every amateur teletype station is set up differently. A typical set up is shown in **Fig. 6.** The author has used a similar arrangement and has found it quite satisfactory. Once the basic principles are understood, one can design any configuration desired.

Conclusion

Although teleprinter machines may vary in detail, the basic principles are all the same. A basic understanding of the manner in which the machines operate, coupled with the electrical competence required for the general class license, should enable the interested amateur to install and successfully operate an amateur radio teletype station.

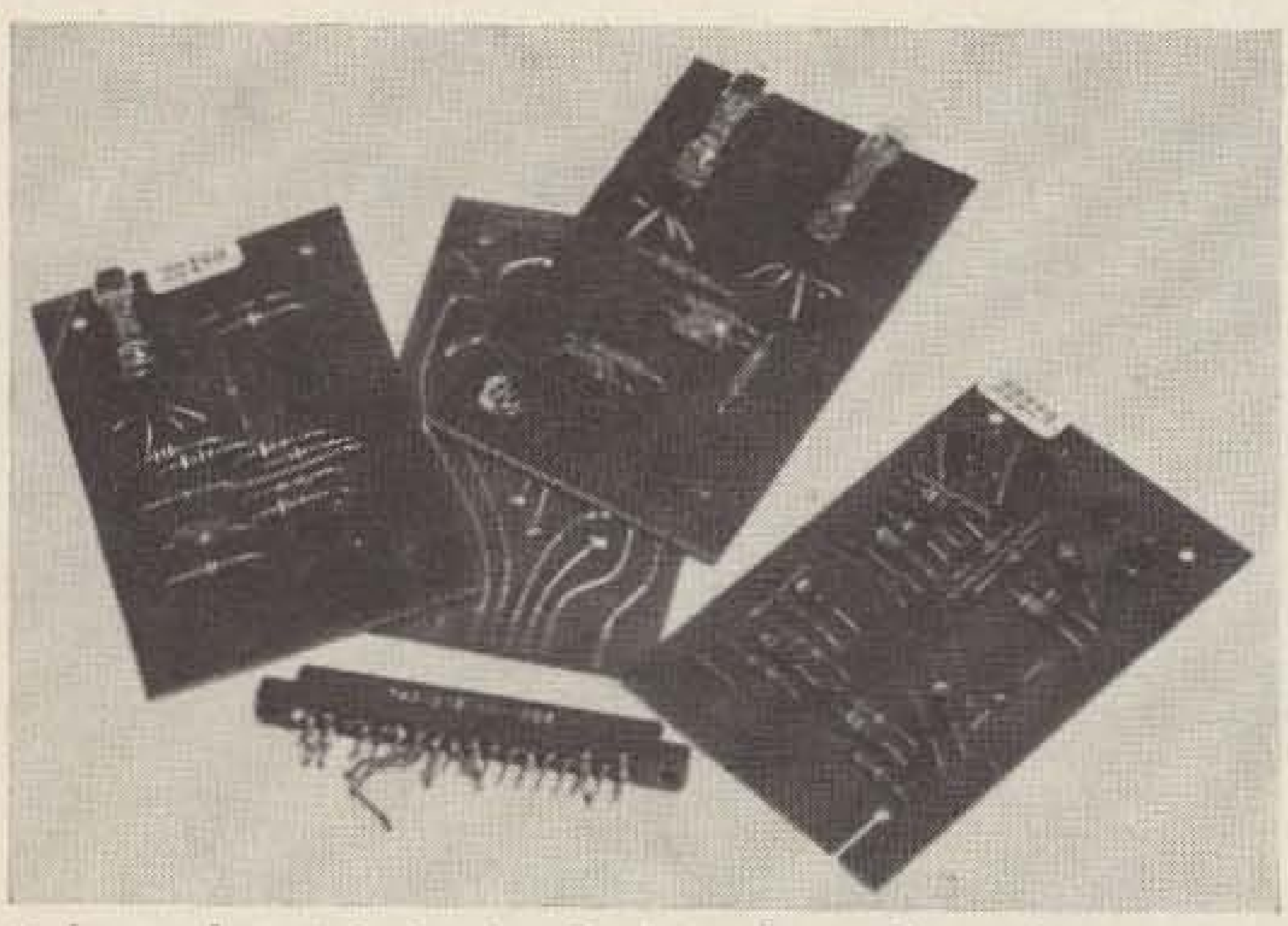
WAØOBJ

G. R. Allen K1EUJ
74 Wells St.
Westerly, Rhode Island 02891

Computer Card Construction

Using surplus computer boards and sockets in homebrew construction.

Printed circuits and miniature construction techniques have been used for ham projects for quite some time now; however, most hams who use these techniques fail to make full use of them by building their circuits on plug-in type computer cards. By utilizing these cards, the ham has at his finger tips instant inter-changeability, instant access for repair or replacement, and a means of including a temporary circuit in a piece of gear today for replacement tomorrow with a newer version. In addition, surplus computer cards are readily available and inexpensive. They provide cheap, convenient, and even disposable bases on which transistorized and miniaturized gear may be constructed.



Salvaged printed circuit boards and socket.

Obtaining the cards and sockets

If you are fortunate enough to be able to get to an electronic junkyard, such as those found in New York, Providence, and Boston, then you should have little trouble obtaining computer cards with sockets; in most cases sockets will have to be dissected from some small piece of computerized gear which might otherwise be unuseable. Virtually any type card and socket pair will do as long as they are mating. Most cards obtainable will be printed circuit boards with small components mounted on them. Some boards may be quite large and may contain octal type vacuum tubes. Again, the type of card isn't too important as long as mating sockets are obtainable. However, it is advisable to choose one type card and its mating socket as a standard so that full advantage may be taken of inter-changeability. If you are unable to obtain cards and sockets from a surplus supplier, than you may purchase them new from an industrial supplier at increased cost. One type of card is called a *Vector Plugboard*. This board and its mating socket are available from most electronic supply houses.

Building a Card Frame

After obtaining the cards and sockets, the first step is to build a card frame. The

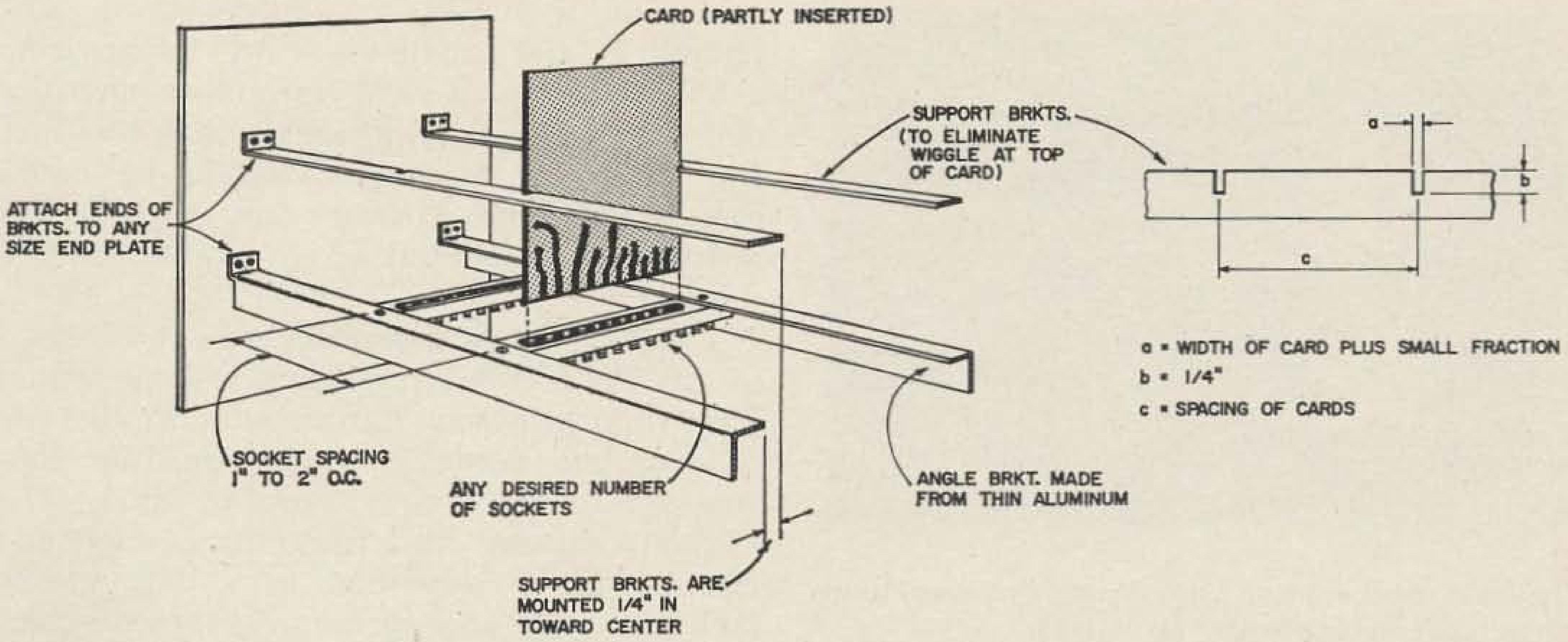


Fig. 1. Construction of a card frame to hold surplus computer cards and connectors. Although provision for only two cards is shown in this drawing, almost any practical number of cards may be held in one frame.

card frame consists of a series of sockets mounted on two metal strips. The computer cards when finished are plugged into the sockets in this frame. It is difficult to specifically describe how to construct the card frame since you may wish to use one of a variety of cards and sockets. However, **Fig. 1** shows a unit which can be used as a general pattern.

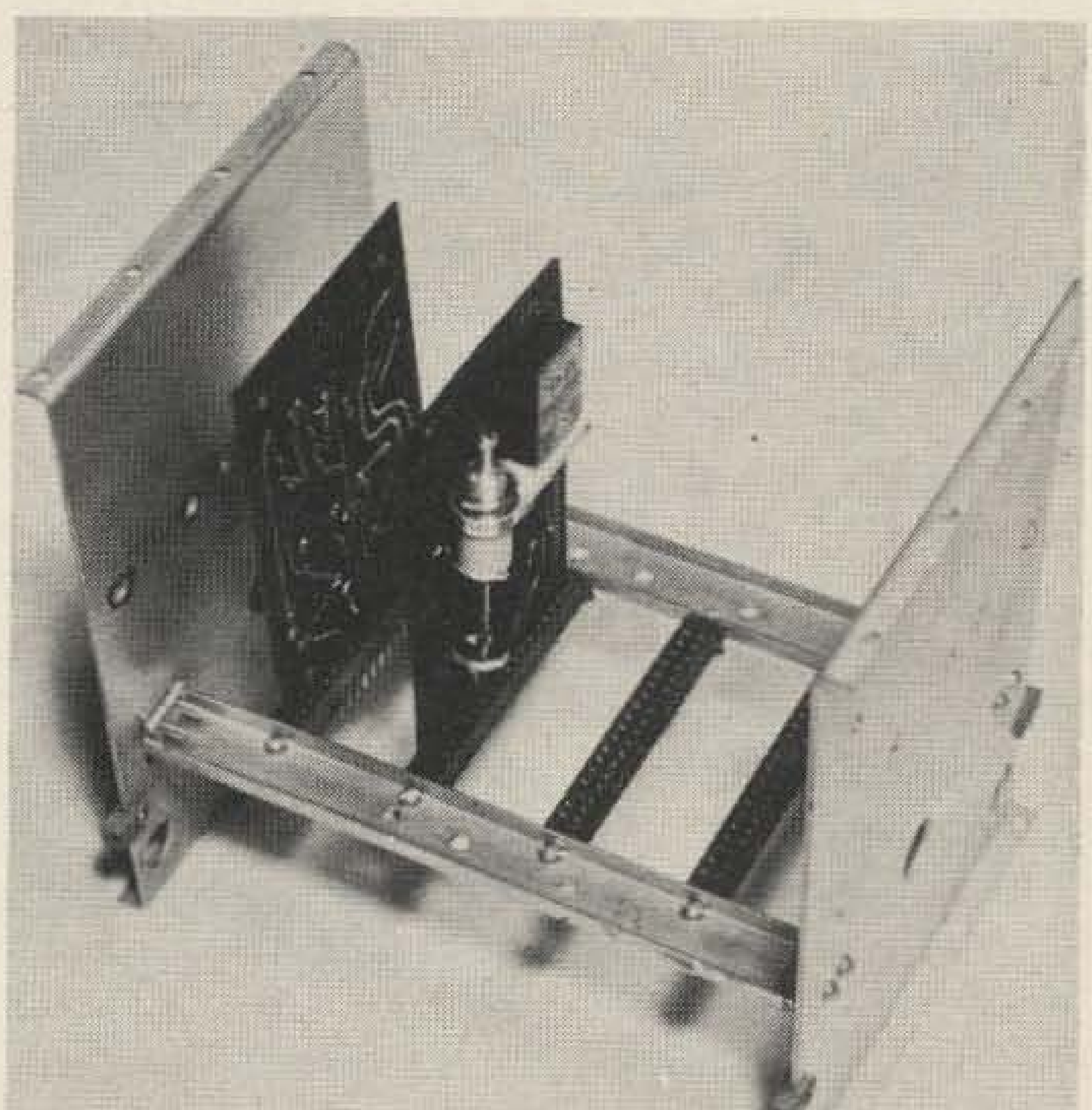
The photograph shows the particular card frame which I built using sockets with 17 connections and cards measuring 3" by 4½". Spacing between sockets was 1½ inches to allow room for bulky cards. Although the photograph shows a card frame with room for two cards, a frame may be constructed which may hold any number of cards. In some instances, the cards may wiggle noticeably in the sockets. If this occurs, a pair of support brackets should be installed as shown in **Fig. 1.** Materials for my particular card frame were obtained from surplus tuning units.

Wiring the cards

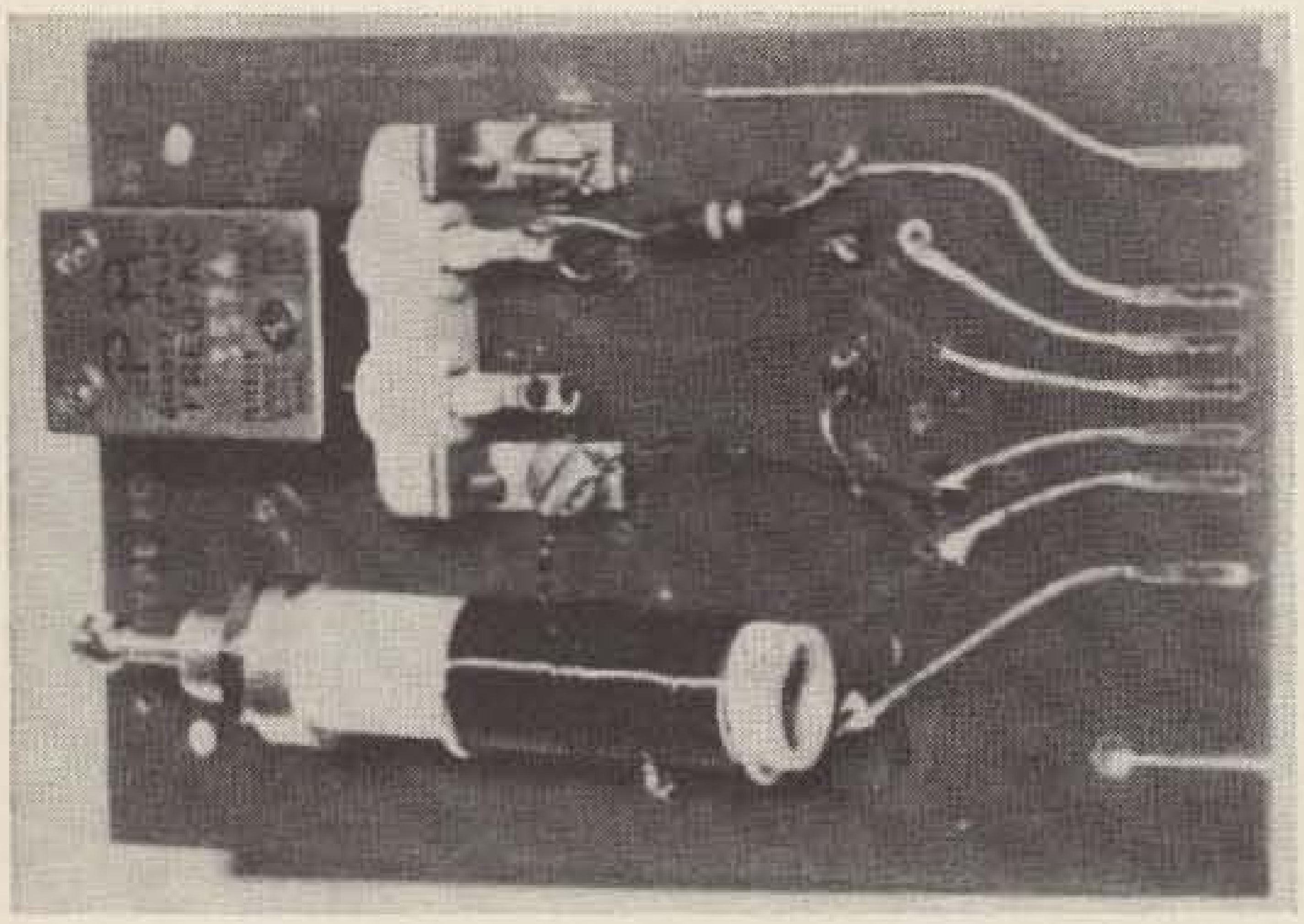
The first step before actually building a circuit on one of the cards is to unsolder and remove all components from the cards. After this is done, the card will be blank except for several metallic connecting strips. With a little forethought, it may be possible to utilize some of these strips, so before removing any strips, take some time and map out your project to best utilize existing wiring. Undoubtably, some of the metallic strips will have to be removed before the cards can be used. To do this, carefully cut the foil strips to be removed about 1" above the printed connector. After cutting, the strips may be removed by using a knife and carefully peeling away the unwanted foil.

To wire the cards, several precautions should be observed. First, when drilling use a drill with a slightly dulled point to avoid cracking the card. Second, avoid using too much heat when soldering the foil to prevent possible peeling. Lastly, leave quarter inch margins on the sides of the cards in case a support bracket is used.

It is a good idea when using these techniques to make a trial sketch of the tentative



The computer card frame used by K1EUJ. If trouble is experienced with loose and wiggling cards, use the support brackets shown in Fig. 1.



Oscillator card from a hybrid computer card transmitter under construction by K1EUJ.

parts placement before actually wiring the boards. By doing this, optimum parts placement can be obtained and a neat appearance will be the outcome.

The photograph shows a sample circuit wired on a surplus computer board. The circuit is the oscillator card taken from a hybrid computer card transmitter now under construction. If it seems like some of the parts are missing, it should be noted that the transistor, heat sink, and a few resistors are mounted on the other side of the card.

The techniques described are not intended to be final techniques, but are presented only to provide an introduction to the use of computer cards as a base for the construction of most any type of gear. The hybrid computer card transmitter mentioned above will be described in a later article and will show how to mount tubes on computer cards. In addition, an article is being prepared which will describe a simple 10 meter walkie talkie using computer card construction techniques.

. . . K1EUJ

Golden Bear QSL Party

During the time from 0500 GMT, December 3 through 0200 GMT December 4, 1967, each person checking into the Golden Bear Amateur Radio Net will receive a certificate. In order to be eligible for the Golden Bear Net QSL Certificate, an operator must, during his check in contact period, provide the Net Control Station, the correct call, name, and mailing address of his station. The Net frequency is 3975 kHz, and check-ins will be accepted, with or without traffic, on LSB, AM, or CW.

QSLs cards from stations who receive the confirmation certificate will be accepted with pleasure and will be placed in the hands of the Net Historian to be preserved with other records of this program.

Baton Rouge, Louisiana QSO Party

The first week in December—December 3 through December 9—has been set aside by the Baton Rouge Amateur Radio Club to celebrate Baton Rouge's 150th year. The club will award a certificate to anyone making contact with a Baton Rouge Club member during this week. You may use any mode and any frequency. To receive your Sesquicentennial Certificate, send a large, stamped, self-addressed envelope to Baton Rouge Amateur Radio Club, P. O. Box 53194, Baton Rouge, Louisiana 70805. But remember, it must be a *Club member* only.

Data Net

There seems to be an above average amount of interest in the subject of Unidentified Flying Objects among radio amateurs. Data-Net grew out of just such an interest. The net members have a serious interest in UFOs and a desire to communicate with others on the subject. It is presumed that there are a number of 73 readers who are similarly interested, but who are unaware of any organized activity, such as Data-Net. Of course, increased participation would multiply the effectiveness of Data-Net. The group initially convened about ten months ago.

Data-Net is still quite small, with something over 50 who contribute in one way or another with enough regularity to be considered full members. The net meets weekly at 0300 GMT on Thursdays (8 PM Wed. PDT) at 14.315 MHz, either USB or CW. Other frequencies are monitored at selected times. Net Control is WB6RPL and anyone interested should write him for up-to-date operating information. Address letters to Michael M. Jaffe, 624 Farley St., Mountain View, California 94040.

Data-Net operates with no dues of any kind. Contributions are entirely voluntary, and they go mainly to cover mailing costs. A report is published monthly and mailed to net members. It covers operating activities, news and views on UFOs, contributions by members, etc.

. . . William H. Hunkins WAØKOM

W. H. Paxton K6ZHO
720 Glenandale Terrace
Glendale, California 91206

Station Accessory Control Unit

Have you ever just leaned back and looked at your shack and then realized what a conglomeration of stuff you have amassed and what a mess of wires are running all over the place? Or, has the wife mentioned it to you? Well, at this QTH the rig is stashed away in a bedroom and, as is the case with many of you I'm sure, it behooves us to keep things as shipshape as possible. After due consideration it appeared that the following items could be combined into a single cabinet and I'm sure you can do the same with yours:

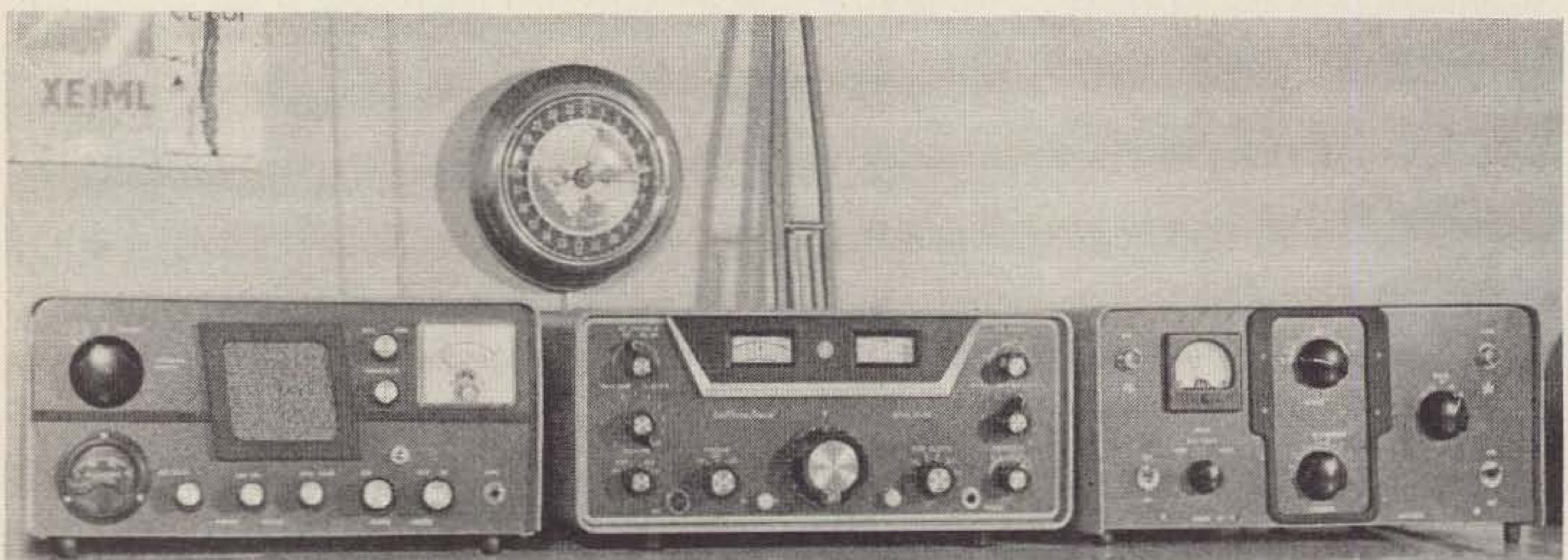
SWR bridge
Antenna switch and low-pass filter
Phone patch
Audio compressor
Speaker
Plate or rf meter

Now this will not be an electronic construction type article and we will assume you have equivalent type units that could be assembled, or disassembled as the case may be, and put into a cabinet similar to this one. What we will try to do is to present some tricks of the trade, resulting from umpteen years of building everything from model airplanes, model railroads, magic illusions, photo equipment and numerous pieces of radio gear. So, before you give up and think that this is too hard a job for you, just read through and you will see that by taking things one at a time it is really not a very tough job at all.

Chassis

Cabinet and chassis size were determined first by a desire to match my transceiver and linear and secondly by just how much space would be required. Things worked out great with an inexpensive 3 x 10 x 14 aluminum chassis box from LMB. Now obviously, your components are not going to be exactly like mine, so the first thing to do is to gather them together, disassemble as necessary, and position them on the chassis taking into consideration best locations for incoming/outgoing signals and front and rear panel accessibility. Study the basic wiring diagram (**Fig. 1**) and modify it to suit your particular needs. Basic arrangement of components is shown in **Fig. 2.**

Now a word about some inexpensive special tools that make the difference between a cussed job and a simple job. If you don't



Author's setup has station acessory control unit on the left which matches SR-150 and homebrew copy of 30L-1 linear. Antenna switch is at top left and SWR meter is at top right. SR-150 plate meter is at lower left and lower knobs are for phone patch and audio compressor controls.

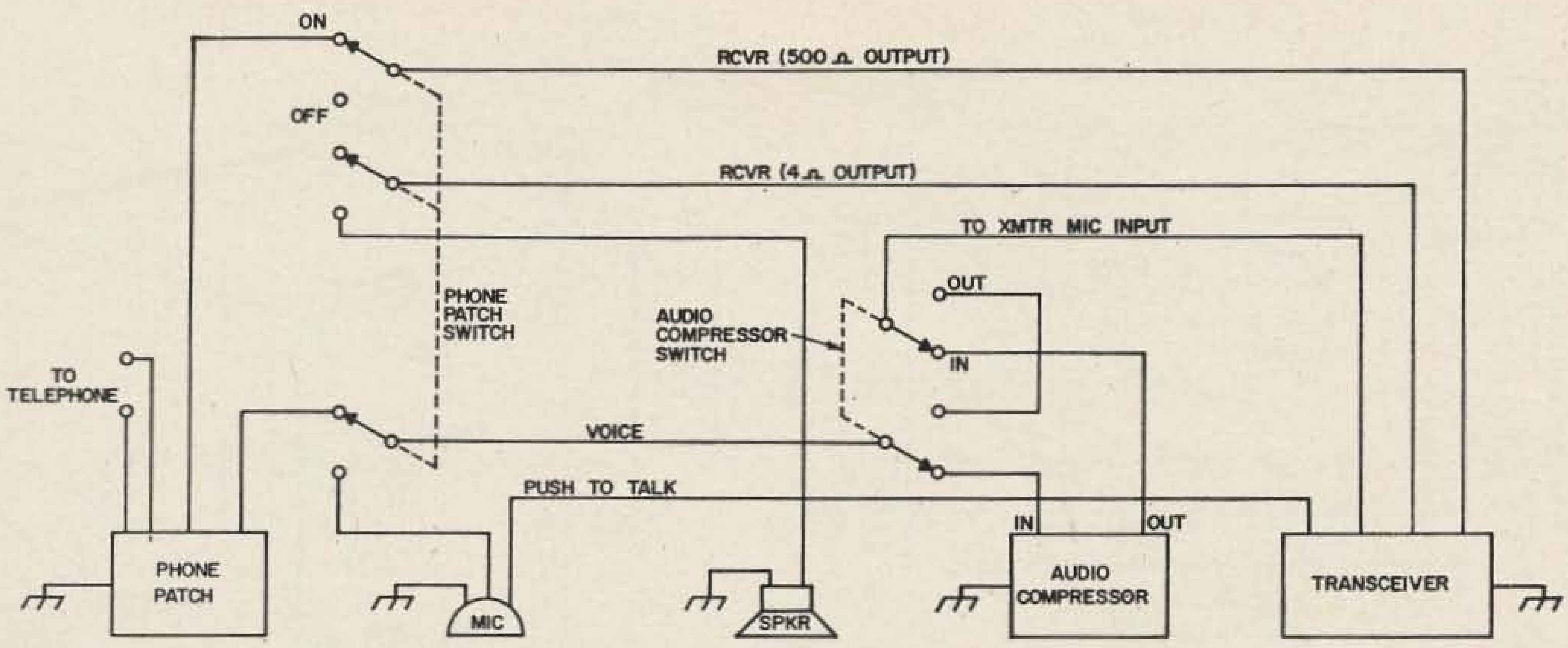


Fig. 1. Basic wiring diagram of the station control unit at K6ZHO.

have a chassis punch set and one of the Adel nibbler tools, borrow, or better yet, buy 'em now and save yourself much grief in the future. Also, a small ⅛-inch diameter rattail file and a larger ¼-inch diameter wood rasp make repositioning holes in aluminum a cinch. A medium-weight flat file, an adjustable flycutter, and an assortment of drills will just about do the trick.

SWR bridge

Disassembly or assembly of the Heathkit SWR bridge is extremely simple and installation in the new chassis only requires fabrication of an rf shield which is constructed from .032 aluminum. If you've never tried this before the following will make the job easy for you while referring to **Fig. 2**:

1. Mark dimensions and bend-lines on aluminum sheet.
2. Drill ¼-inch holes at intersection of bend lines and cut metal to shape.
3. Use files to smooth edges and then steel wool both sides.
4. Cut two wooden blocks ¾ x 2⅞ x 11½ inches to match bend lines.
5. Place blocks on each side of metal and clamp together tightly, being careful to hold alignment with bend lines.
6. Use rubber mallet to bend flanges.
7. Position shield inside chassis and mark its outline on chassis.
8. Drill screw holes in chassis and deburr holes with file or next larger size drill.
9. Mark and drill holes in shield to match holes in chassis.
10. Cut holes for coax fittings in chassis using ⅝-inch punch.
11. After drilling first 3/32 screw hole for coax fitting, insert the same diameter nail into that hole before drilling remaining three holes to retain alignment of screw holes. Use coax fittings as drill jig.
12. Attach shield with 6-32 nuts and screws.

Antenna switching unit and low-pass filter

My antenna switch was assembled in a 3 x 4 x 5 inch LMB box using SO-239 coax fittings and a heavy-duty surplus 5-position rotary switch. In retrospect, the commercial Waters or Pic Polyswitches will do a better job and can be easily installed with a simple bracket. A ¼-inch shaft, a coupling and a feedthrough bushing on the front panel are all that are required. A Johnson low-pass filter is connected to the SWR bridge with a 90-degree coax elbow and a Dow double-female coax fitting, and to the antenna switch with an elbow and a short piece of RG-8/U cable.

Phone patch

Adequate space is available for almost any of the commercial makes and if a meter is required it may be installed in lieu of the plate meter shown.

Audio compressor

This unit, homebrewed from the February, 1963 *QST*, feeds through the phone patch to smooth down some of the excited voices and has an added in-out switch used for demonstration purposes. This sometimes provokes caustic comments from fellow hams who don't dig compressors.

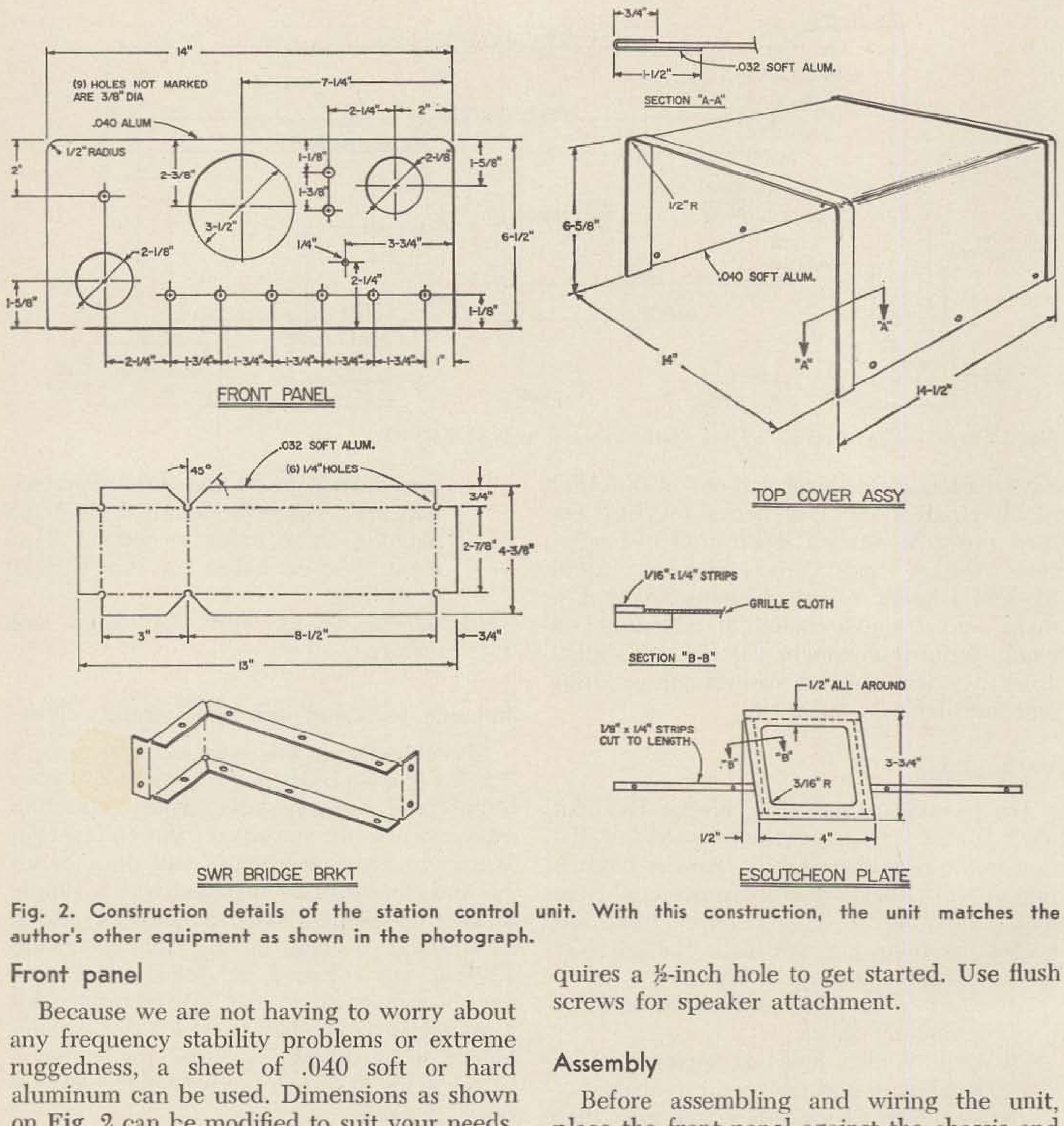


Fig. 2. Construction details of the station control unit. With this construction, the unit matches the author's other equipment as shown in the photograph.

Front panel

Because we are not having to worry about any frequency stability problems or extreme ruggedness, a sheet of .040 soft or hard aluminum can be used. Dimensions as shown on **Fig. 2** can be modified to suit your needs. Using safety glasses, the meter and speaker holes were cut on a drill press using a fly-cutter. A tip here is to go slowly and when half-way through, stop, remove the panel, clean it off carefully, and then finish the cutting from the opposite side.

Speaker system

It may not be hi-fidelity, but it is possible to get acceptable audio from a four inch speaker if a good quality unit is purchased. For clearance, it will be necessary to provide a cutout in the chassis. This is easily done with the Adel nibbler which only requires a ½-inch hole to get started. Use flush screws for speaker attachment.

Assembly

Before assembling and wiring the unit, place the front panel against the chassis and mark location of meter, switch, etc. holes on the chassis. The meter hole is cut out using the Adel nibbler. The other holes may have to be enlarged using the ¼-inch wood rasp. Panel will be finally attached to the chassis with the switch and potentiometer nuts.

Escutcheon plate and trim strip

The escutcheon plate for the speaker was cut on a jig saw from a piece of ⅛-inch basswood plywood purchased from a local hobby shop. Edges and front surface were sanded with decreasing grades of sandpaper between three coats of lacquer sanding sealer. This may also be purchased in small quantities at hobby shops. Several coats of glossy black lacquer were applied and the finished article looks just like metal or plastic. Trim strips were cut to length from ⅛ x ¼ x 36-inch pine (hobby shop again) and finished in the same manner. The speaker grill cloth was cut to shape and glued to the back of the escutcheon plate. Chrome plated ½-inch 2-56 Phillips head screws and nuts were used to hold the plate and trim strips to the panel.

Finishing front panel

After the unit has been assembled and wired, the front panel is removed, gone over with steel wool or fine sandpaper and cleaned with a strong detergent before spray painting. I used a dark grey spray enamel, applying several coats. Let it dry overnight and then gently rub the surface with light weight steel wool. Clean with a soft dry cloth.

Lettering is very simple nowadays thanks to the new dry transfer processes such as the Ami-Tron associates system which is advertised in *73 Magazine*. A set of printed sheets containing common ham words is supplied and if an exact word is not found it is no trick to use individual letters to make up your own words. Several tips are in order here: (a) keep back-up tissue between transfer sheet and panel except for letter or word being transferred: (b) after transfer, use lighter fluid on cotton or Kleenex and lightly wipe over words or letters to sharpen up edges: (c) letters are soluble in acetone or lacquer thinner so be careful what you use.

Top cover

Here you will find it most helpful if you can get access to a sheet metal shop and have them shear and bend the front and rear strips. In the interests of economy don't overlook the high school or college metal shops where sometimes the instructors will be glad to let you do a simple job like this when you explain that it is a do-it-yourself project.

The front and rear strips should be first folded over into U-shaped channels and then slipped onto the flat top piece. Use a rubber mallet to fasten the strips firmly to the top. Then the top is bent around a wooden form 14-inches wide with a ½-inch radius. Here again, the secret to a good bend is a good back-up block firmly fastened in place.

The cover was carefully checked for fit, trimmed to length at the bottom and then given several coats of a light-grey spray enamel followed by two coats of clear spray varnish. A bottom cover plate was cut from .032 aluminum and rubber feet were added as a final touch.

PK metal screws, ⅜-inch long were used to fasten the top cover to the sides of the chassis and to fasten the bottom plate. Now, by gosh, you have done it and are ready for a good housekeeping award from the wife.

. . . K6ZHO

Earl Spencer K4FQU
1413 Davis Drive
Fort Myers, Florida 33901

A True Parasitic Monitor

A small simple transistorized CW Monitor which steals its operating power from the transmitter's radiated signal with perfect reproduction.

Are you an old timer who is so adept at CW that it is second nature to you If you are, then read no further since this article is not for you. If, however, you cannot work CW without listening to a side-tone monitor, then read on my friend. Perhaps this gadget will help to alleviate the situation a little.

I have tried just about every conceivable type of CW Monitor which has been written up (and a lot which haven't), and they all leave a lot to be desired. Either the tone was not a good reproduction of the generated signal or the oscillator was unstable, or the blocking diode was too small to prevent the accidental keying of the transmitter, or the battery was weak, if not dead, or, or and or. Something was always wrong.

Thus, after six years of experimenting, I think that a rather simple and practical approach has been found; at least for a while. I don't pretend to be the first to think of this particular method since oscillators are oscillators and everyone uses them. As for stealing rf power, I'm not the first to do that either, so here goes.

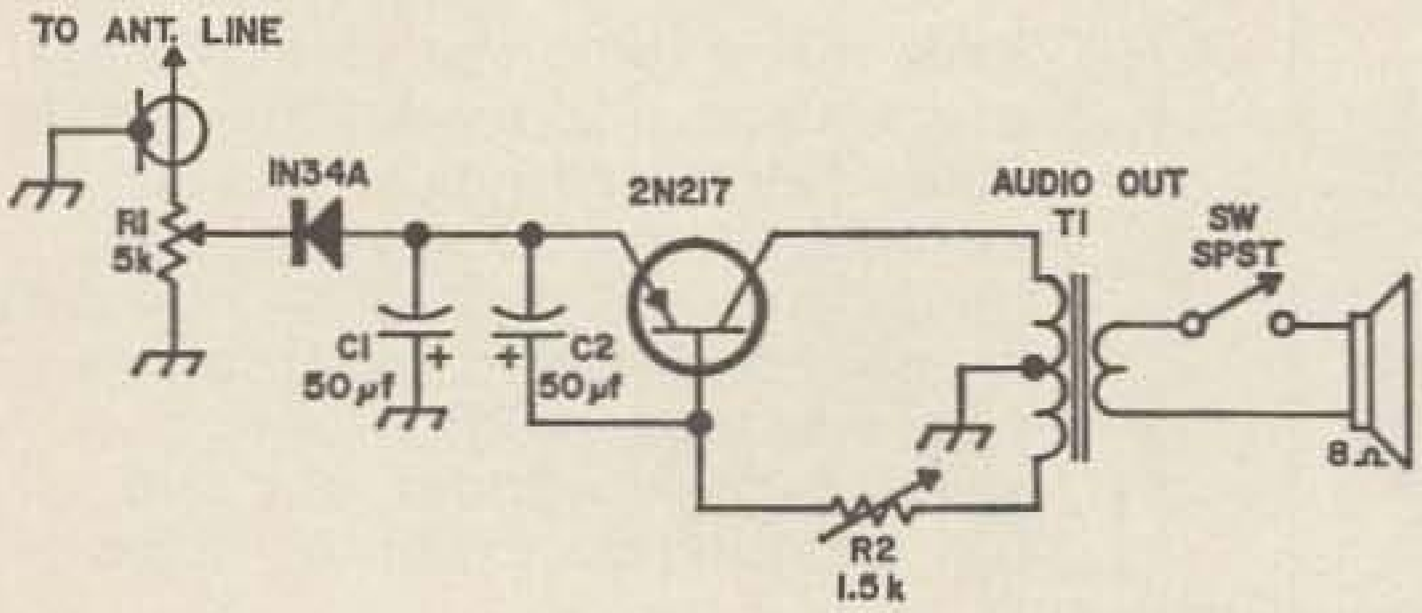


Fig. 1. Circuit diagram of the true parasitic monitor. The rf input is tapped directly onto the coaxial output connector of your SWR bridge. For power inputs over 250 watts, a small pickup probe may be used.

This monitor, I believe, could be an ideal solution. It will monitor any mode of transmission. It will reproduce the character of your fist perfectly (including the flaws). It uses no batteries, and has no power supply. It is simple, tiny, easy to build, and shouldn't cost over five dollars even without the aid of the junk box. However, if you have an old junked transistor radio around you are in business.

The monitor steals its power from the radiated signal via the feed line, and, by rectifying the rf, produces its own dc to run the oscillator. Under these circumstances it only operates when a signal is present on the feed line; one reason for the accurate reproduction of your fist. The other reason being that it actually receives your transmitted signal. I know few amateurs today who don't use an SWR bridge in the transmission line and the monitor gets its power supply, as well as its shelter, from this bridge.

The input lead is tapped directly to the output connector on the SWR bridge. This method of direct tapping will work well with all power inputs up to about 250 watts. If higher power is contemplated, the pick-up will either have to be swamped, or a different manner of pickup must be used. For high power a small loop in the vicinity of the sampler would probably suffice.

The pick-up is applied directly to the output connection of the sampler through a 5k-ohm resistor (pot) which draws enough of a load, when rectified, to produce up to 18 volts of dc. This is more than enough to operate the oscillator. All leads in the vicinity of the pick-up should be kept as short as possible and/or shielded (with the shield grounded) as this lashup can be a beautiful TVI generator.

The circuit is small enough to be housed in the average bridge cabinet, and could even include the speaker if you wish. I chose to run a lead to the station speaker cabinet where I nested a small 2-inch speaker to prevent cluttering up the bridge cabinet.

Potentiometer R1 is used to regulate the voltages and should be set with a VTVM prior to installing the transistor. Set the voltage at about 8 volts from the diode with the transmitter under full load. Fine adjustments for best signal can be made later but this may prevent blowing a good transistor during construction. Eight to twelve volts will produce a good solid signal. However, anything from three to eighteen volts will operate the oscillator. Any rf and most af NPN transistors will work in the circuit and PNP's may be used by observing voltage polarities. The 2N217 was used because I had one available.

Resistor R2 is used to control the pitch and also has some affect on the volume. A control for volume could be inserted in the speaker lead, if desired, but the audio level can simply be pre-set with R1 and R2 and forgotten. Both pots interact so adjustment of one necessitates the adjustment of the other. A headphone jack could also be inserted if you are an ear-muff man.

The switch is used simply to shut off the monitor during voice transmissions as it can result in feedback if it is left on near the mike. The monitor will do a pretty fair job on voice; however, the fidelity leaves a lot to be desired as the monitor was designed mainly for CW and is a very modest circuit which will not lend itself well to speech reproduction.

To use the monitor, simply fire up the transmitter and start keying. It is automatic, and once it has been tuned up will need no further attention. The monitor is dead without the presence of rf at the pickup. When used for CW, it will quickly show up the errors in your sending ability. Remember that what you are hearing is the same signal that the other fellow is trying to copy. The monitor will operate at all frequencies and will not affect the SWR.

Now sit back and enjoy working CW with no more battery problems and no more accidental keying of the rig.

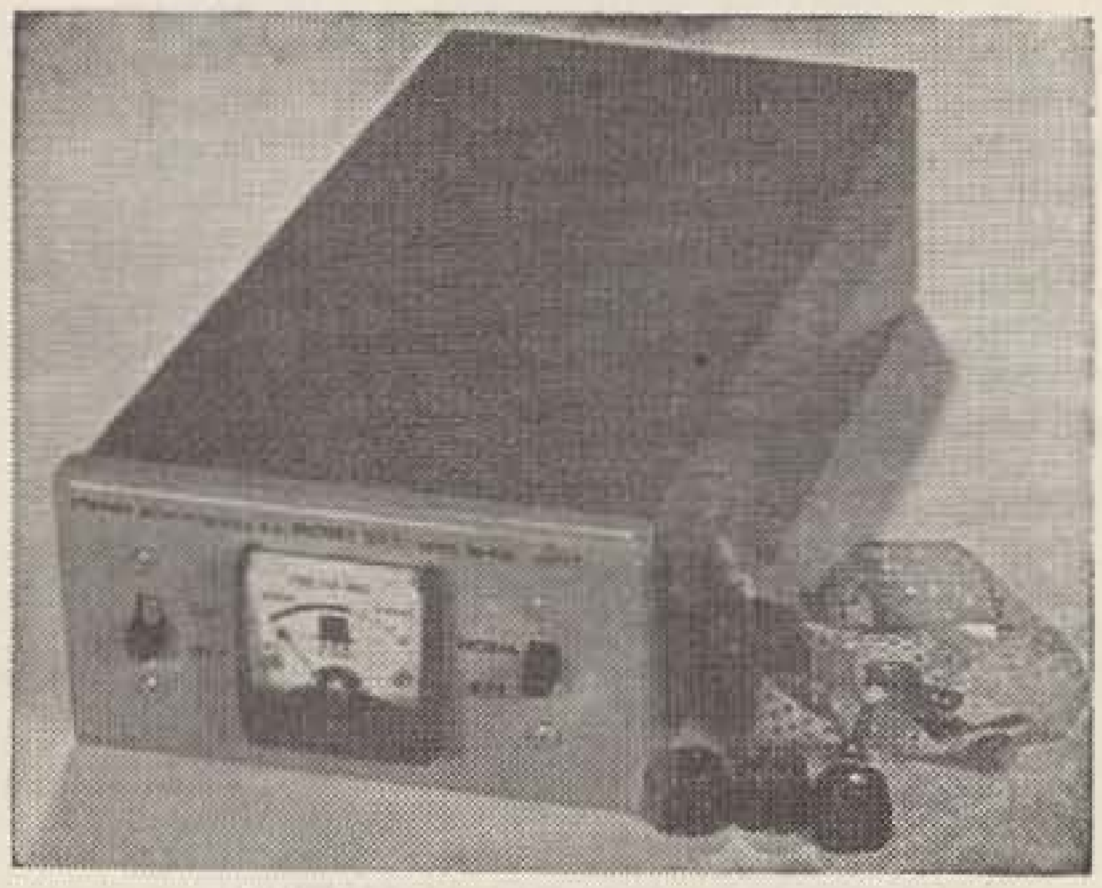
. . . K4FQU

Go RTTY

WITH THE AMAZING

"Beatle Box"

TELETYPE CONVERTER !



CHECK THESE FEATURES:

- ★ ALL TRANSISTORIZED, SELF POWERED.
- ★ 13 SEMICONDUCTOR CIRCUIT.
- ★ MILITARY GRADE EPOXY CIRCUIT BOARD.
- ★ RUGGED CONSTRUCTION.
- ★ REVOLUTIONARY TUNING INDICATOR, AS ACCURATE AS A SCOPE.
- ★ SINGLE CHANNEL AND NARROW SHIFT COPY.
- ★ ANTI-FADE AND DECISION CIRCUITRY.
- ★ SELECTIVE FILTERS TO MINIMIZE GARBLE DUE TO INTERFERENCE.
- ★ TWO CASCADE LIMITERS EMPLOYING DIODES AND TRANSISTORS.

RT-WIRED AND TESTED **$99.50**

I will ship in the 48 states freight free! Write to me for top trade-in allowance!

Bill Hullquist K6LOS

MISSION HAM ELECTRONICS

3316 Main Street
Riverside 3, California 92501
Phone 683-0523 (area code 714)

Buy Yourself A New Toy For Christmas!

COLLINS

KWM-2 transceiver	$1150.00
516F2 AC Pow/Sup	153.00
MP-1 DC Pow/Sup	235.00
351D-2 Mobile Mount	120.00
32S3 transmitter	795.00
75S3-B Receiver	725.00
312B-4 SWR, Patch, Spkr Watt meter	195.00
30L-1 Linear	520.00

DRAKE

TR-4 Transceiver	$ 599.95
AC-4 AC Pow/Sup	99.95
DC-3 DC Pow/Sup	149.95
MS-4 Speaker Cabinet	19.95
MMK-3 Mobile Bracket	6.95
R4B Receiver	430.00
T4X Transmitter	399.95
L-4 Linear w/tubes & P/S	695.00
T-4 Receiter	299.95
SW-4 Short Wave Receiver	289.00
2-C Receiver	229.00
2-NT CW Transmitter	129.00
RV-4 Remote VFO	99.95

SWAN

250 6 meter Transceiver	325.00
350 5 Band Transceiver	420.00
500 5 Band Transceiver	495.00
410 VFO	95.00
406B Mobile VFO	75.00
RC-2 TRUNK Remote Control Kit	25.00
22 Dual VFO adapter	25.00
405 Mars Oscillator	45.00
117XC AC Pow/Sup	95.00
14X DC Module Supply	65.00
MARK II Linear w/tubes	630.00

MISSION HAM SUPPLIES ORDER TODAY

3316 Main Street, Riverside, Calif. 92501

- ☐ SHIP ONE "STONER" RT-1 CONVERTER:
- ☐ Send spec sheet on BTI Linear.
- ☐ QUOTE Trade allowance for my ....
- ☐ Please send latest HAM flyer.
- ☐ Put me on your mailing list.

Name .... Call ....
(please print)
Address ....
City .... State .... Zip ....
(Calif. orders add 4% tax)

John J. Schultz W2EEY
40 Rossie Street
Mystic, Conecticut 06355

Mini-SWR Bridge

A no-holes, no-chassis construction for a simple SWR bridge that is useful for a number of tune-up applications.

Most SWR meters today are of the coupled variety which can be left in a transmission line while a transmitter is operated at full power. However, for a number of prolonged tune-up operations, involving antenna matching systems, for instance, such couplers have several disadvantages.

On 160 and 80 meters, especially, a reasonable amount of power is necessary to produce full deflection—up to 100 watts with some configurations. With a very low-powered transmitter, making adjustments at this power level certainly may damage the output tube or tank-circuit components with a high SWR. This will not be the case with higher-powered circuits but, in any case, a signal strong enough to cause needless QRM will be radiated.

Another disadvantage of the coupled SWR meter, if it is home constructed, is that it must be carefully calibrated since its response is very dependent upon the mechanical configuration of the coupling circuit. This is unlike the bridge-type SWR meter (described in this article) where a standard SWR curve may be used with a good degree of accuracy.

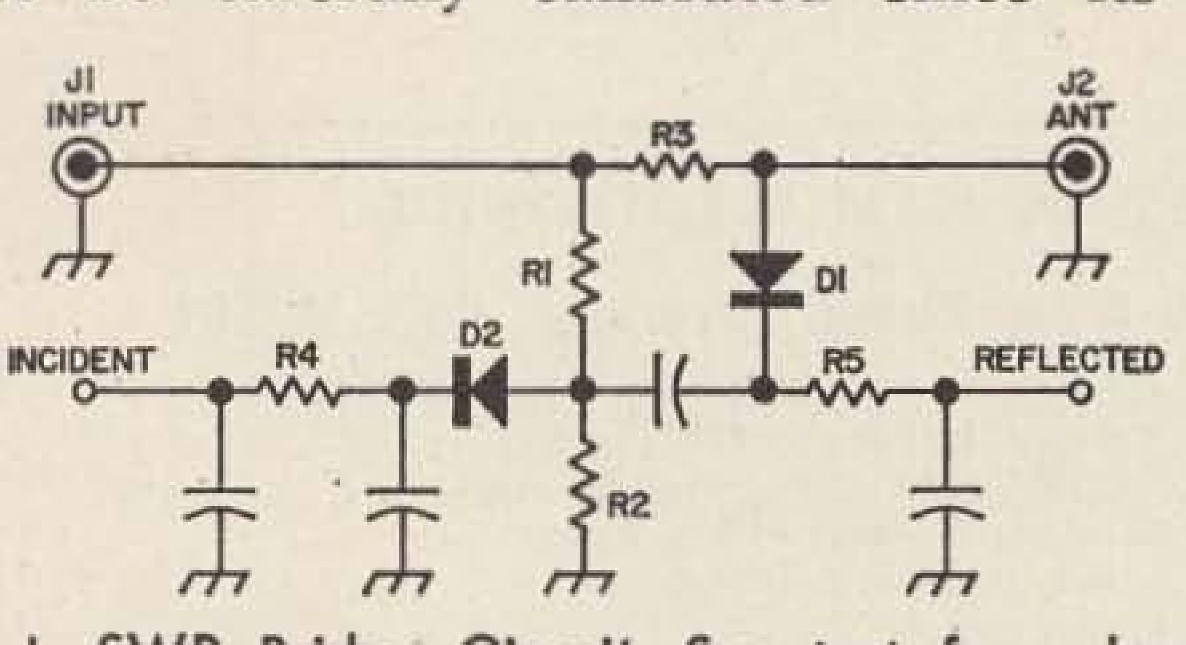


Fig. 1. SWR Bridge Circuit. See text for values of R_1, R_2 and R_3. R_4 and R_5 may be any matched value from 10 k to 47 k. D_1 and D_2 are IN34, IN54, or similar types. All capacitors are disc ceramic, .005 MF, 100V.

The above factors, plus the fact that I didn't need an SWR meter continuously in the transmission line, led me to construct the little resistance type SWR bridge shown in the photograph. It is just about as simple and inexpensive a unit as can possible be built.

Construction

Two SO-239 coax chassis connectors are joined back to back by two 1¼ inch threaded hex spacers. The two four-lug terminal strips are mounted at the ends of one of the spacers. The wiring of diodes D_1 and D_2 as shown in **Fig. 1**, should be such that the incidental voltage-measuring point appears on the terminal strip mounted on the "input" SO-239 connector, in order to avoid confusion in measurement. Short leads, of course, should be used but hardly anything else is possible with only 1¼ inches between connectors.

Some attention must be paid to the components used if accurate readings are to be obtained. Resistor R_3 must closely match the impedance of the coaxial line used (52 or 75 ohms). For 52-ohm lines, a suitable resistor (within ½ to 1 ohm) can usually be found from a group of standard 10% tolerance, 47-ohm resistors; and for 75-ohm lines, from a group of 68-ohm resistors. Resistors R_1 and R_2 can have any value from about 30 to 100 ohms, but it is important that they are as closely matched as possible. One trick which may be used to affect very small resistance changes is to file "V" notches in a composition resistor to raise its resistance. Two-watt units are suggested for these resistors because of their longer-term stability and endurance in case too much input power is applied.

Resistors R_4 and R_5 serve as linearizing resistors so that almost any meter with a basic movement of 1 mA or less can be used as an indicator. The lower dc voltage ranges on almost any VOM will work fine. These resistors as well as diodes D_1 and D_2 should be checked to see that they match reasonably well (the resistors within a few precent and the diodes within a few percent for their forward and reverse resistance readings).

Calibration

There are really no adjustments that can be made to the bridge, and calibration really consists of checking the balance. **Fig. 2** is the dc circuit of the bridge (a simple

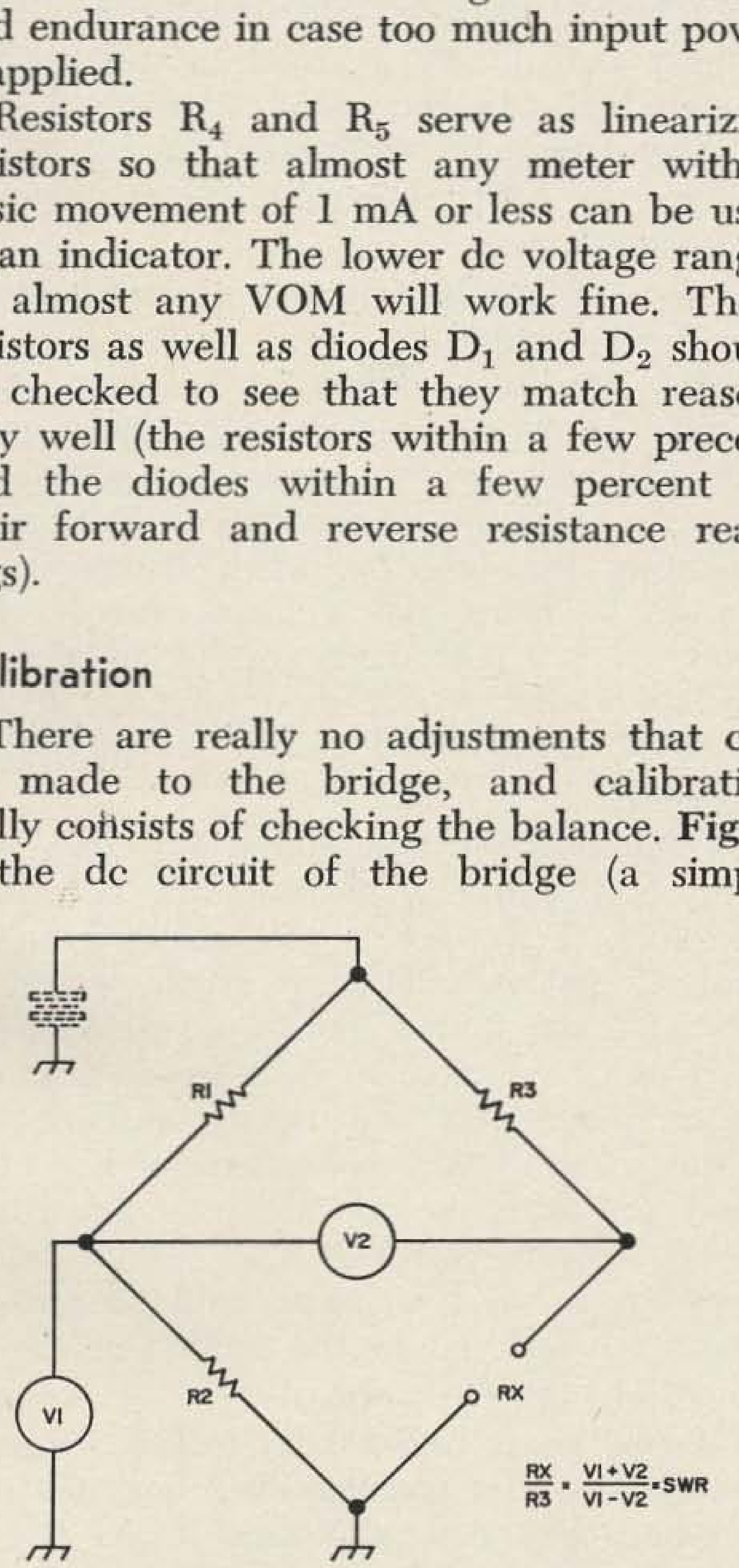


Fig. 2. Simplified diagram of SWR Bridge. V_1 represents incident voltage and V_2 the reflected voltage.

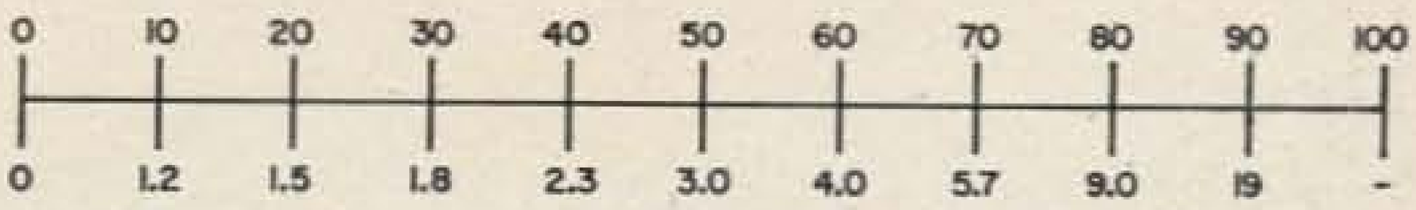


Fig. 3. SWR values for selected reflected voltage readings taken as % of incident voltage reading.

Wheatstone bridge with resistance arms). If the balance of the bridge is good, V_2 should be the same when points R_X are opened or shorted so long as V_1 is held constant. This can be checked on the actual bridge by applying an input at the highest frequency of interest (6 or 10 meters), shorting J_2, and checking that incident and reflecting voltages are the same. The same is done with J_2 open. If the voltages are not equal, the difference can be taken as an indication of how accurate the SWR readings will be. If the difference is too great, R_1 or R_2 will have to be changed for a better match or the mounting of the components changed to reduce stray couplings.

A further check is to connect a known 52 or 75 ohm resistor across J_2. The reflected voltage should, of course, read zero.

Operation

As noted in **Fig. 2** the actual SWR is a simple function of the incident and reflected voltage readings. **Fig. 3** presents this function in graphical form. The incident voltage is simply adjusted for some convenient value, say 10 volts reading **on** the dc scale of a VOM (possible with most SSB transmitters by adjusting the carrier balance control with no audio input). The reflected voltage is then read as a percentage of the incident voltage and the SWR found from **Fig. 3.** The input power required to operate the bridge is essentially independent of frequency, being about 1-2 watts maximum.

It should be remembered that such a bridge can measure only the resistive portion of an impedance. When using it to adjust a circuit, if a SWR minimum null but not a zero reading for reflected voltage can be obtained, it indicates some reactive component must still be present.

. . . W2EEY

Kayla Bloom WØHJL
Dublin, New Hampshire 03444

Yes, Old Timer, There is a Santa Claus

'Twas the night before Christmas, and all through the house . . . you've all heard that one before. Well, on this particular Christmas Eve, the old timer walked into his ham shack and looked around. The shack was a reasonably large room, but it was filled with old racks of home-brew equipment. All of vintage years, which really didn't make it any better. An accumulation of parts was scattered about, and half-built projects were on every available work space. He heaved a great, weary sigh, and cleared away a space on the old desk which was scarred from years of use. He sat down, pulled out a sheet of paper and began to write.

"Dear Santa," he began,

"I'm an old man. I've been a ham for almost sixty years. I was one of the first to be licensed when the government took over, but I was busy experimenting long before that. I have always been proud that I built everything in the shack and it worked fine. All the young hams used to come to me to learn how to make things, and they all thought I was something pretty special.

"But, you know, Santa, I'm old and I'm tired. My hands aren't as steady as they used to be, so I can't hold a soldering iron very well any more. And, since my eyes began to fail, I don't read much and haven't kept up with all the new-fangled technical ideas like I used to. All the magazines keep writing about the new SSB rigs and how you can build them, but they all use the new transistor circuits, and I just haven't kept up and I don't know what they're talking about.

"Like I said, I'm getting old. All my old friends are on sideband and won't talk to me on AM. Well, let me tell you, this gets kinda lonely. I'd sure like to be able to join them on the air again, but I just don't have the money to buy one of those fancy rigs.

"What I'm getting at, Santa, is this. If you could see your way clear to bring me a SSB rig, you would make my last days real happy.

"Now, I don't want you to get the idea that I'm asking for anything special, but I hear that the Gollings X-line is about the best SSB equipment you can get. So, if you could manage that, I'd sure be a happy man. I really need something which won't break down on me in no time. They have a real pretty console model with a desk and all. As you can see, this old desk is about ready for retirement and it would be nice to have something nice and new for a change.

"There is another thing you could do for me, if you could. As I may have mentioned before, I'm an old man. It is pretty hard for me to work on antennas these days. Antennas are pretty important and all I have are some old dipoles which have taken a beating through the years. If you could arrange to bring me a good, sturdy, tall, tower . . . . with separate beams for the HF bands, and maybe something for 40 and 80, well, that would really set me up in fine shape.

"I don't know how much influence you have, Santa, but if it wouldn't be asking too much, I wonder if you could do something to get rid of some of the QRM. It sure isn't like it was in the old days. Heck, years ago, we used to be able to find big empty places on the bands and not be bothered with QRM. Now it seems like every place you want to operate, you don't have a clear spot to call CQ. They began letting everyone in on ham radio and all the old timers are left out in the cold. Let me tell you what I mean.

"A few years back, they decided to make some changes in the licensing laws and put in what they call a Novice Class license. Now, I figure anybody who hasn't got the brains to get a 'real' license, has no business taking up space on the bands. 'Course I haven't worked much CW in a long time (I said my hands weren't too steady now) but they really make a lot of QRM and don't say anything. There isn't a one who can send with a good fist that I can copy. Why should all those kids take up space on the band? I'd sure be a happy man if you could arrange to get the Novices off the air.

"Then there are the nets. All kinds of nets. Nuts is a better word for them. They take up valuable space on the bands sending out such trash as 'having a good time at the fair. Be home Friday' and stuff like that. They give the excuse that this gives them practice so they can be ready in the case of an emergency. Now, you know as well as I do that you don't need practice to be ready in an emergency. All they do is cause more QRM. If you could do something to free all those traffic nets, it would be the greatest thing ever to happen to ham radio.

"Oh, yes, I nearly forgot. All this nonsense with working DX! That is the most ridiculous thing I ever heard of. If you could just listen in to one of those DX pile-ups, it would make you wonder what was going on. Give me a good old fashioned rag chew every time. But these days it is hard to find anyone to rag-chew with who can talk about the old days. Anyhow, how about stopping all the DXpeditions and getting things back to normal?

"So long as I'm going to go on SSB, and since everyone says AM is obsolete, you might as well clear out all the AM operation too. And, while you are about it, I don't see too much point in keeping CW, either. Seems as if with all the new ideas in radio, there isn't much need to keep up with CW. Just look at all the space they take up that could be used for SSB.

"Well, I guess that about wraps it up . . . . . no, there is another thing that gets me. How about all this certificate thing? Some hams just spend all day on the air looking for new pieces of wall paper. They don't contribute anything to ham radio. If you could just get rid of them things would be fine. And the whole idea of weekends being taken up with contests is another sore point with me. Why, a fellow gets on the air on a weekend and every contact he makes hands him a number. I just can't figure why all that was started in the first place. Just a bunch of darned fools staying up all night trying to compete. Those weekends are terrible. A man can't find a good contact anymore.

"I guess that is all, Santa. Nope, there is one thing I nearly forgot. Women! The day they gave a ham license to a woman was the worst thing they could have done. All those YLs sould like a bunch of chipmunks and you can't understand a thing they say. Seems to me they ought to all be in the kitchen tending to business. The best thing you can do for ham radio is to get all those women off the air.

"Well, Santa, I guess this is a pretty big order, but it sure would make an old man happy if you could fix this all up for me.

73,
An Old Timer"

The old timer put down his pen, left his letter in a prominent place and headed out of the shack to his bedroom. Soon he was asleep, dreaming of his new rig and the new world of ham radio. Others may have had visions of sugar plums, but he had visions of QRM-free contacts on his new rig.

Christmas day dawned clear and cold. The old timer awakened slowly. The bed was warm and the room was cold, so he stayed beneath the blanket for a while. Suddenly he remembered his letter of the night before, and, like a child, he sprang out of bed and ran for the ham shack. There his eyes greeted the new world of ham radio. All the racks were gone. The old desk had been replaced by a lovely console with the Gollings X-line. He dashed forward and threw on the filament switches. Wait, . . . how about the antennas? He ran to the window and looked out onto the snowy ground. Sure enough, there was his new tower reaching to the sky. Looking up, he saw beautiful stacked 10-15- and 20-meter beams, along with a rotatable 40 meter dipole and an inverted vee for 80.

In nearly uncontrolled joy, he dashed back to the rig and began tuning 20 meters. From one end of the band to the other, he heard only atmospheric noise at S 1. Switching from 20 to 15 then 10, he found the same conditions. "Must have been a good blackout", he thought, "But, I'll find the old gang on 40". A check on 40 brought the same results. "Well, there will always be the gang on 3999" he muttered as he quickly switched to the other antenna. 3999 had a bit of interference from NSS, but the ham band was silent.

There on the desk was the last page of his letter to Santa. There was a note at the bottom saying, "Dear old timer, I have brought you everything you asked for. I hope you have a Merry Christmas with your new rig". It was signed, "Santa Claus".

. . . WØHJL

MERRY CHRISTMAS WITH 73

The perfect Christmas present for a ham is the gift he'd pick for himself—a subscription to his favorite ham magazine, **73**. This is the gift that will bring pleasure all year and even longer. You'll like the special price, too, of only $5 for 14 months for the first subscription and $4.00 for additional 14-month subscriptions. The newsstand price for 14 copies of 73 is $8.40, so you can save up to $4.40. That also means that the copies of 73 cost only 32c apiece instead of 60c. Don't forget:

$5 for 14 months of 73

(for the first subscription)

$4 for 14 months of 73

(for each additional subscription)

We'll send an attractive individually-signed gift card to arrive just before Christmas for each gift subscription.

OFFER EXPIRES DECEMBER 24, 1967. ORDER TODAY.

Please send 73 for 14 months to:

Name...Call.......................... New.......... Renewal..........

Address.. Sign the gift card:

City.............................State.........................Zip.................. ....

Please send 73 for 14 months to:

Name...Call.......................... New.......... Renewal..........

Address.. Sign the gift card:

City.............................State.........................Zip.................. ....

Please send 73 for 14 months to:

Name...Call.......................... New.......... Renewal..........

Address.. Sign the gift card:

City.............................State.........................Zip.................. ....

I enclose $.............................. Please send me 73 for 14 months, too..............................

Name...Call..........................

Address.. New.......... Renewal..........

City.............................State.........................Zip..................

Use another sheet for additional subscriptions or if you don't want to tear up this 73. Please print legibly. Allow 6 to 8 weeks for delivery of the first magazine.

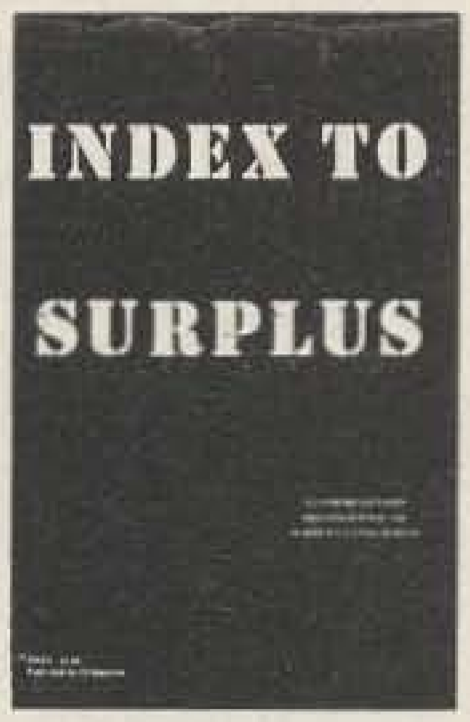
73 MAGAZINE, PETERBOROUGH, N. H. 03458

73 BOOKS FOR CHRISTMAS

73 USEFUL TRANSISTOR CIRCUITS

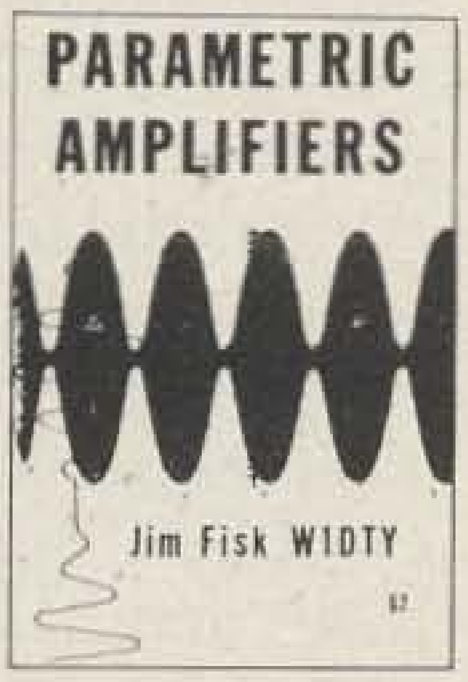
If you've been looking for a transistor circuit to do a special job, chances are there is a circuit in this book that will give you a head start. It covers circuits for audio, receivers, transmitters and test equipment. **$1**

INDEX TO SURPLUS



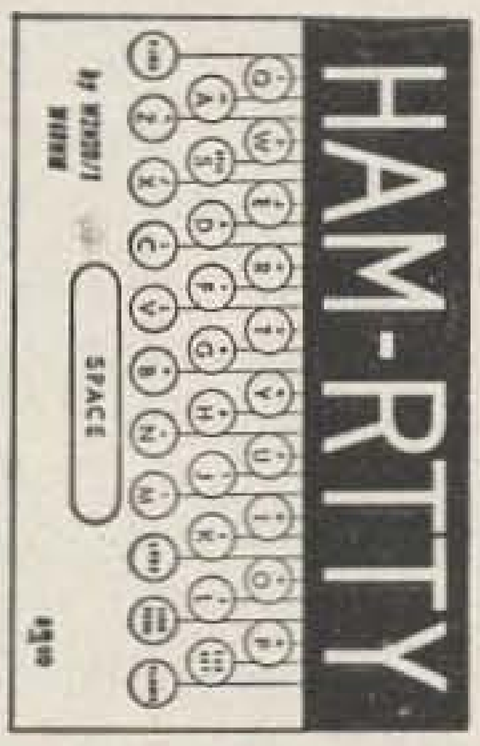
Do you have a piece of surplus equipment that you want to convert but can't find an article? If so, this is the book you need. It lists all of the surplus articles and conversions in popular electronic and amateur magazines from 1945 to 1966. **$1.50**

PARAMETRIC AMPLIFIERS



For the ham who wants to work DX on the bands above 432 MHz, there is nothing that can beat the gain and noise figure of a paramp. This book shows you how they work and how to build and use them. Lavishly illustrated with photographs and drawings. **$2**

HAM RTTY

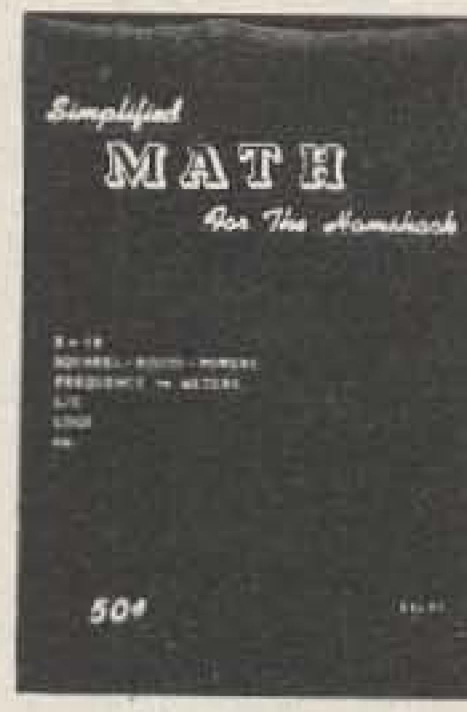


More and more hams are joining the RTTY crowd every day. This 112-page book gives you all the basics and tells you what you need to know to get started and get on the air. Written by W2NSD and W4RWM. **$2**

VHF ANTENNAS

This handbook by K5JKX is a complete collection of information about VHF and UHF antennas, with design hints, construction and theory. If you've been wondering what array you need, this book will give you enough background to make the right decision. **$2**

SIMPLIFIED MATH



Does math scare you? It shouldn't in this easy-to-understand book K8LFI explains the simple exponential system of arithmetic, simple formulas, logarithms, and their application to the ham shack. **50c**

HAM TELEVISION

The Amateur Television Anthology is a collection of the technical and construction articles from the **ATV Experimenter**, edited by WØKYQ. If you're interested in ATV, this is the book for you. It covers the gamut from the simple to the complex in amateur television equipment. **$3**

HAM CLUBS by K9AMD tells you how to start one and keep it going. **$1**

CW by W6SFM explains code and how to learn it. **50c**

MILITARY SURPLUS TV EQUIPMENT by W4WKM is a necessity to the surplus-scrounging ATV addict. **$1**

CUMULATIVE INDEX lists all the articles in **73** up through December 1966. **25c**

—Transistor Circuits $1.00
—Index to Surplus $1.50
—Parametric Amplifiers $2.00
—Ham RTTY $2.00
—VHF Antennas $2.00
—Simplified Math .... $ .50
—ATV Anthology $3.00
—Ham Clubs $1.00
—CW .... $ .50
—Military TV $1.00
—Cumulative Index .... $ .25

Please send me the books checked at left:

Name ______________________ **Call** ________

Address ______________________

City ______________ **State** ________ **Zip** ______

Books shipped prepaid in US and Canada.

73 Magazine

Peterborough, N. H. 03458

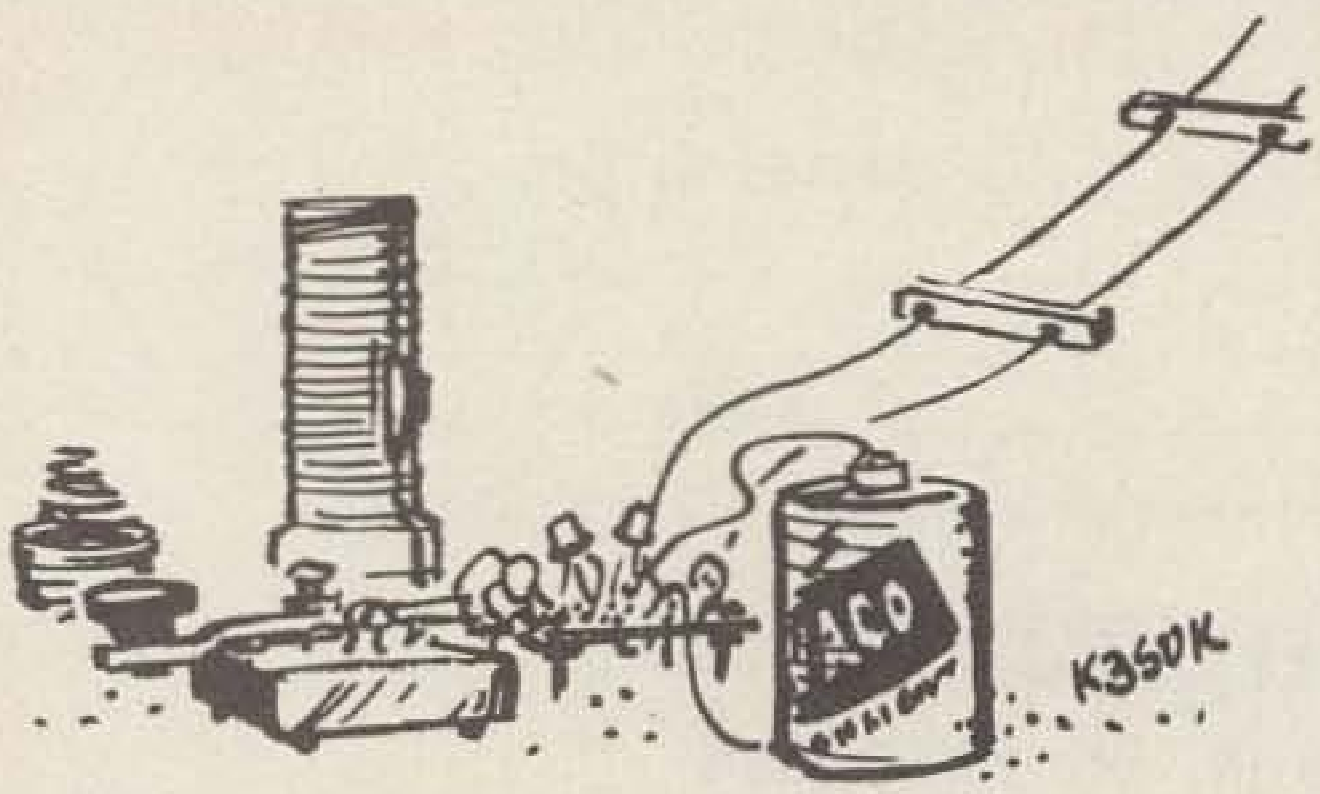
Al Nowakowski, Jr. K8KFP
4047 Lyman Ave.
Toledo, Ohio 43612

The Contest Caper

Sooner or later, the urge to take a crack at a contest hits everyone. Unfortunately, most operators become discouraged and quit seriously contending when they find their final score is substantially lower than the top operator's. The intent of this article is to explore some reasons behind the score difference and to point out some items which hopefully will allow you to make a significant increase in your score or even put you on top.

The big DX contests and the sweepstakes require special preparation and strategies, so while much of the material covered here is applicable, it is not in itself sufficient. Also such contests are rather infrequent. We will confine our attention to the various QSO parties and the special interest contests such as the QCWA and YL-OM parties which occur almost weekly. Besides, the chances of winning these are much greater as the participation is rather limited.

When you start seriously thinking about winning a contest, you must take a critical look at your shack. Contrary to popular opinion, the high power station doesn't always win, even when there is no special multiplier for low power. On the other hand, you aren't going to win many contests with ten watts. Power levels of 75 to 300 watts are usually quite adequate. If a low-power multiplier is given, say for running under 150 watts, by all means use it. With any kind of decent antenna, the points you might lose due to missed QSO's will be more than offset by the additional multiplier.



The high-power station doesn't always win . . . on the other hand . . .

Transceive operation is nice, but it can turn into a headache unless you have the offset tuning feature. If you have a choice of antenna orientation, aim at the high population density areas. So far nothing has been said about the type of equipment, and with good reason. The type of contest you enter is usually determined by your normal operating habits, that is, if you usually operate SSB, you will probably operate the phone section of a contest. One thing must be mentioned at this point, if you are a phone-only man, forget the contests that don't distinguish between the CW and phone sections. The CW ops will take you to the cleaners just about every time out.

Perhaps the key words on equipment are flexibility and dependability. Flexibility in this context refers to the ability to rapidly switch bands and modes. Dependability rules out haywire setups because a malfunction or blown component usually means defeat. No one can be prepared for every eventuality, but it's always comforting to know you have a spare set of tubes just in case one should quit.

Control systems should also be checked. VOX and break-in are almost mandatory, although many ops get by with one-switch operation, especially if the switch is foot operated. Foot switches are also great for zero beating. If used, they should be movable since you can get mighty tired of sitting in one position.

Keyers cut the CW work to practically nothing and have the added advantage of making your fist smoother and easier to copy. Don't wait until the contest to learn how to use one though.

Needless to say, TVI should be cleared up if nothing more than for your own peace of mind. Your mental attitude plays a large

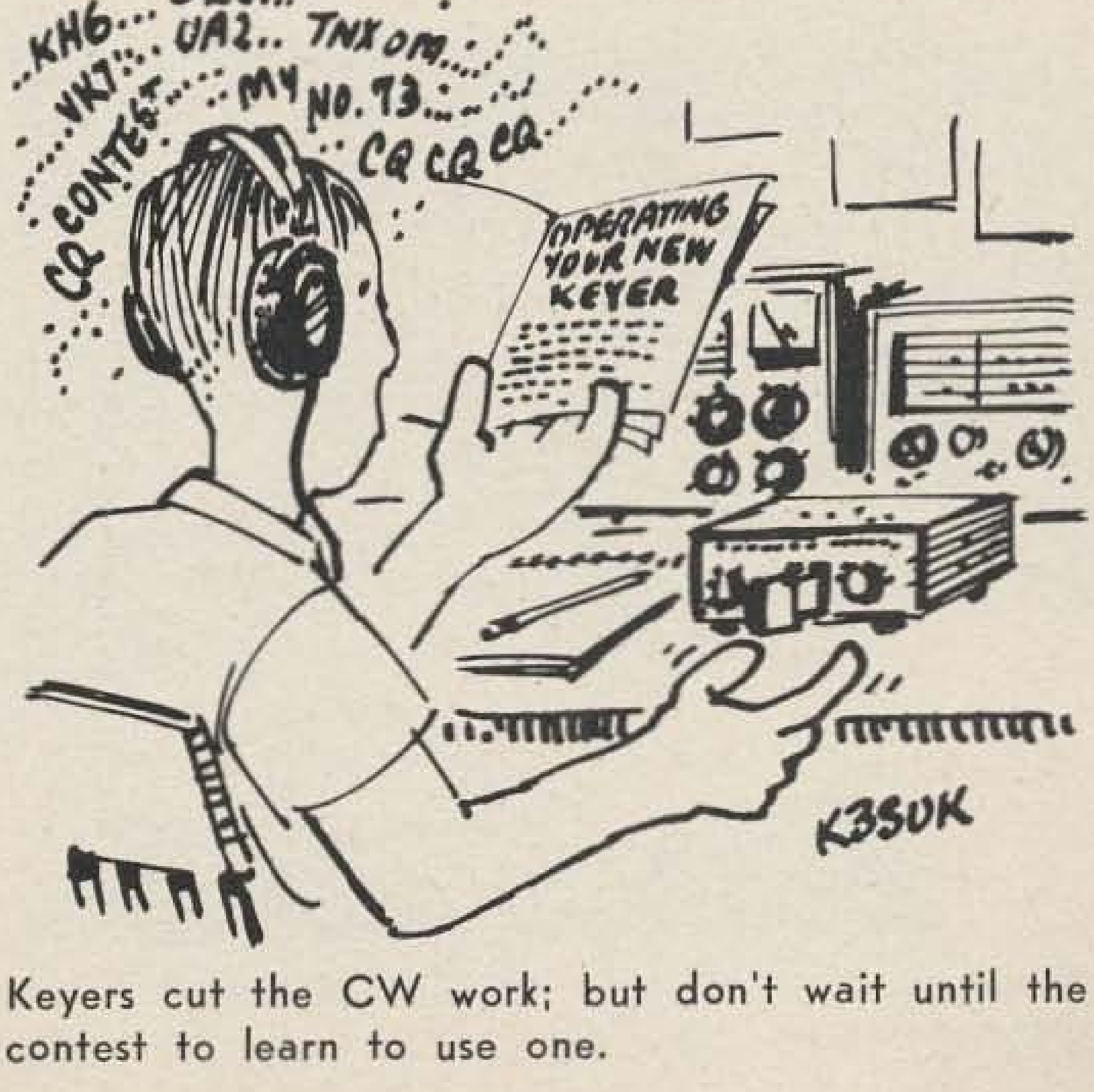
If you have a choice of antenna orientation, aim at the high population density areas.

role in determining how well you do in a contest. Along this same line, you should try to eliminate those little annoyances that just never seem to get fixed. Such things as knobs that come loose or chattering relays may seem minor, but after a few hours of operation, they tend to wear your nerves a bit thin.

While you are in the shack, it's also a good idea to take a look at the creature comforts. Vital controls should be within easy reach, especially the receiver tuning knob. You may have to prop the receiver up to get the tuning knob at a comfortable height. Ventilation and lighting are also important. You should be able to operate your station for several hours at a time without becoming unduly tired. Also developing little knacks like holding a pencil while using your key save time and effort and eliminate scrambling around on the floor for a pencil that rolled off the table.

So far no big secrets, and in fact, if you are fairly active, your station probably already meets the above criteria. Now we get into some specifics of contest operating. First of all it is necessary to decide if you are really trying to win or just run up a good score. If you are out to win, you have to do some homework. First get the complete rules for the contest. Don't trust what you read in only one magazine in this regard. Sometimes editors reword rules or leave out what they consider unimportant data, thus giving a misleading impression. Check several sources, preferably the sponsor of the contest if time allows. Some contests allow the same station to be contacted on different bands or modes for additional points, others don't, thus it is vital to know exactly what the situation is. Become familiar with the rules and the required exchange information. If suggested congregating frequencies are given, don't assume everyone will be within a few kHz of the frequencies. Some fellows still use crystals! If possible, find out the winning scores from previous contests. This will clue you in on how well you have to do to win, and also give you an idea of who your chief competition is likely to be. The results will also indicate what stations you can expect to be active from rare multipliers.

There is no substitute for experience, and this is especially true in contest operating. After operating a particular contest for several years, you develop a mental file of what stations you can expect to work, and on what band at what time. Also you become familiar to them. W9IOP stressed this last point in regard to the sweepstakes and it is just as true in the smaller contests. If the station you are calling recognizes your call, he is more likely to answer you even though several other stations are also calling. Experience also helps you develop the uncanny ability commonly called savvy. It's this ability that allows you to confidently answer a 10 wpm CQ at 25 wpm with the almost definite certainty that the fellow at the other end can copy it perfectly. It also allows you to tune across a band full of stations calling CQ contest, and even though



Keyers cut the CW work; but don't wait until the contest to learn to use one.

you may not have heard a single call, you know which of the stations you have already worked.

Some operators develop complex systems for logging and cross checking, but usually the simplest method is the best. Regular log forms are not too suitable for contests. Notebook filler or a steno pad can be ruled as necessary so that the exchange information can be entered across the page as it is received without a lot of skipping around. Carbon paper can save you recopying the log, but if you aren't careful it can get messy in a hurry. Check-off lists of county or section multipliers are handy in keeping track of how well you are doing. Use of duplicate sheets depends on the contest and your memory. When multiple contacts with the same station are permitted, they are almost vital to prevent passing up a station because you think you have already worked him on that particular band or mode. An atlas and a recent callbook are also extremely useful.

Working stations not actively in the contest can mean the difference between top money and also ran, thus it is necessary to be able to rapidly identify such stations, and especially to determine if they are new multipliers. In this regard most stations will oblige you with a QSO if approached politely. Don't go breaking into nets or QSO's though. It's better to wait a few minutes than risk losing the multiplier. Courtesy is a key factor in contest operating. It doesn't hurt to QRS for the slow op, or to explain what the contest is all about to a newcomer, and if you do it, you just might find you picked up a few extra points along

Some operators develop complex systems for logging and cross checking.

Breaks for chow and sleep are necessary if you are to be in top form.

the way.

If a general strategy could be formulated, it might best be described as: run up a good contact total and then concentrate on multipliers. For instance, if you have 75 QSO's in 30 sections, each additional section is worth more than twice as many points as an additional contact. It gets to be a bit touchy when you have to decide whether to spend a considerable amount of time chasing a new section or pass it by in the hope you can work him when the pileup has thinned out. I prefer to stick with it since conditions may change for the worse or he may QRT. Flipping a coin may help. Most of the time you will be on the chasing end, that is, you will have to find the stations you want to work whether they be stations in Illinois, YL's, or members of QCWA. Thus your time is better spent in tuning the receiver than sitting on one frequency calling CQ contest. CQ wheels and tapes are fine, but don't really help much unless you are the one being chased.

Before sending your log in, double check it to see that it is in the proper form and the score is correctly, and honestly, computed. Duplicated contacts should be left in the log although no points should be claimed for them. If a signed statement of rule observation is required, be sure to include it with the log. Needless to say, the log should be neat and readable. Also make sure it is postmarked before the contest deadline.

Most operators find it impossible to operate a contest straight through. Breaks for chow and sleep are necessary if you are to be in top form. Sleep is a personal matter, but in any event, the period between midnight and seven AM tends to be the slowest. If you have worked most of the active stations, you are fairly safe in knocking off during this period. I won't make any guarantees though.

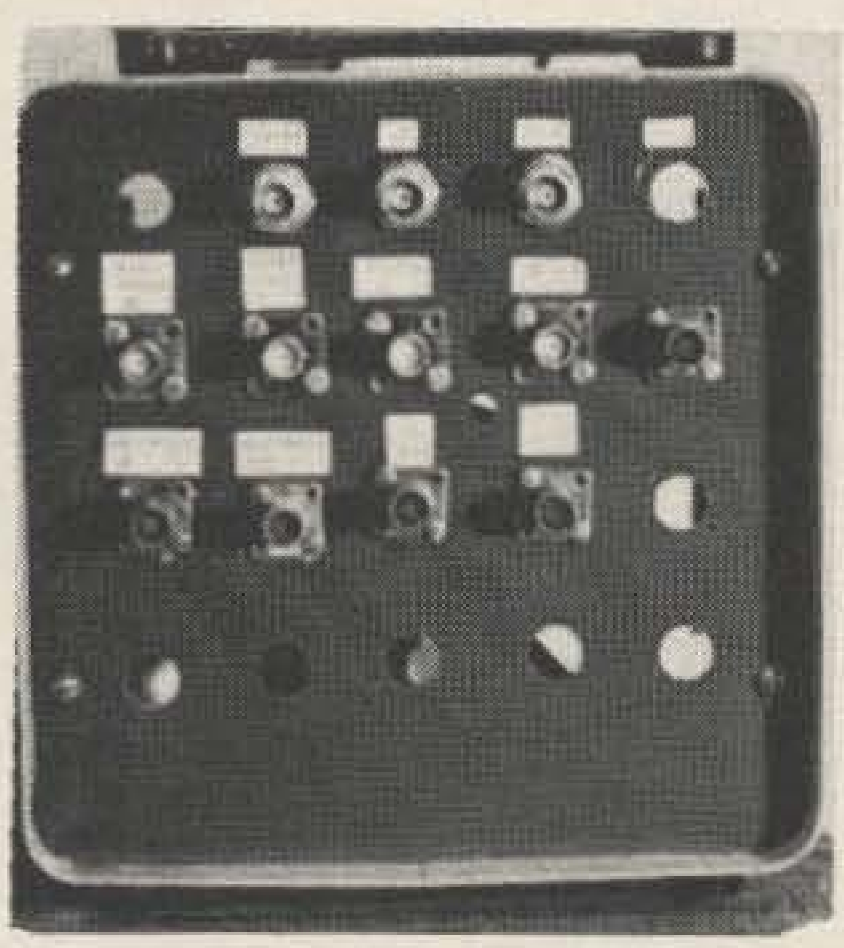
One habit to develop is that of periodically checking the other bands even though the band you are on is producing contacts. A brief skip opening can produce a wealth of points your opponents never even know exist, and once the band changes, such points are almost impossible to make up. Also many stations tend to operate only one band and they may only be on for short periods, thus to work them you have to meet them on their own ground. A quick check of the novice bands now and then might prove fruitful.

Many operators just don't have the patience it takes to win. Often you will find yourself waiting in line for a QSO, especially if a new multiplier suddenly shows up. But again it's much wiser to wait than risk losing the multiplier. This is probably the best argument for running high power. One of the greatest frustrations of contest operating is waiting in line while a station passes out S-six and seven reports only to receive an S-nine plus when it finally comes your turn. Perhaps the most discouraging aspect of a contest is hearing a station across the state giving a higher number than yours in the final hours of a test. But remember, he may not submit a log, he may not have as good a multiplier, and finally, he may be lying.

Some operators continually gripe about the number of contests taking place on the bands. Actually most contests are confined to a ten or twenty kHz of the band, and thus don't usually disrupt normal operating in the band to a large extent. But they do provide an effective way for the fellow with limited time to earn awards or just get a good dose of operating. They are also the best way to truly test new equipment and to gain operating proficiency. Contests are more fun if you do well or win. Almost any reasonably equipped station is capable of winning, especially if the operator is on the ball. The points listed in this article are taken for granted by most steady contest operators, but the newcomer has to develop the techniques by trial and error. I hope some of the hints prove useful to you. C U in the next contest.

. . . K8KFP

Patch-All



WØPEM's Patch-All

How easy do you change bands? Coax all over the place? Build this simple, cheap *Patch-All*. I started with a small cabinet which was obtained surplus—the front panel is a scrap piece of aluminum.

I have four rows of five coax fittings as shown in the picture. It is not full yet, so I have room to add more at a later time. I used the one hole BNC coax fittings because they are reasonable to buy and are easy to use. You need to drill only one hole.

The antennas are hooked across the top row. On the second row are antenna relay in, receiver relay in, receiver direct in and transceiver out. The third row has transceiver matchbox in and out and SWR bridge in and out. I have several patch cords about 15-1/2 inches long made up from RG-58/U with male connectors on each end. I also have one that has a regular male coax connector on one end.

There are a lot of different patching possibilities for a person with a little ingenuity. No schematic is shown because every station is different. If you want a very easy and convenient method of changing coax, get out the soldering iron and build one of these handy *Patch-All's*.

. . . WØPEM

GIVE YOURSELF A CHRISTMAS GIFT THAT YOU WILL NEVER FORGET

the 2K-2 linear amplifier

The inspired simplicity of the 2K-2 design, its rugged reliable mechanical construction and the use of only the finest components promises a long, long life of dependable performance. The 2K-2's enormous power output, its exceptionally low distortion figure and attendant signal sharpness promises complete satisfaction with its quality of performance. You have probably heard the strong clear signals of the 2K-2 by now . . . why not put that BIG signal on the air with your own 2K-2. After all, you deserve the best. The 2K-2 console or desk model $675.00. Let us send you a descriptive brochure.

6% Finance Charge • 10% Down or trade-in down • No finance charge if paid in 90 days

Christmas Greetings from Ted (W6UOU), Bob (WØARA) & Walt Henry (W6NRV)

Henry Radio Stores

CALL DIRECT . . . USE AREA CODE

Butler, Missouri, 64730	816 679-3127
11240 W. Olympic, Los Angeles, Calif., 90064	213 477-6701
931 N. Euclid, Anaheim, Calif., 92801	714 772-9200

East Coast Rep.: Howard Laughrey, 2 Elizabeth St., Chappaqua, N.Y. 10514, (914) CE 8-3683

"World's Largest Distributor of Amateur Radio Equipment"

WTW Report

Another month rolls around, the fall of the year is upon us again and it's DX time on the bands. Conditions are very FB I am glad to say. You had better get in there, fellows, and work some of the fine DX that's on the bands every day and night. Don't overlook the chance to get some very small serial numbers yet available, especially on 40. Number 1 is still being held for 75/80 meters as well as 160 meters. Also number 1 certificate is still not issued for 40-meter Phone. Small numbers are still on hand for almost all the bands. Certificate #35 has been issued for 14 MHz phone now so we can really say that small serial numbers are on hand for every band and every mode—when we get up to certificate #100, I will not be able to say small numbers are on hand.

In earning these certificates remember you are, at the same time, "having yourself a ball" working lots of good DX. Remember that WTW has a few more countries than DXCC. Next month we will try to print up a new list of our countries—so pass the word around that all the DX'ers should grab a copy of that issue especially if they are interested in our WTW. It's one issue which everyone should hang on to for reference when working one that you are not sure of.

Remember fellows you can send in your score as per the instructions given in last month's issue of 73 magazine—*except* it's not necessary for you to send in any cards. Use the multiples we said were acceptable though. We don't want to get one *claimed* country at a time, and only send in your score for QSO's that *you have confirmed. But* when you have qualified for the WTW-certificate then *you have to submit the cards* to your QSL check point. We may ask you to submit QSL's at any time. Remember this in sending in your *claimed* score for Honor Roll listings. Everytime any check point sends me the information that so and so has submitted his cards please send me the list of stations that he has confirmed with the dates each one was confirmed. This will help me keep my records better here. We still have plenty of our Country Lists available, either from me (Gus Browning, Rt. #1,

David E. L'Heureux, a Foreign Service Officer of the United States, has recently been licensed to operate in the Central African Republic as TL8DL. He is the only station QRV from TL8 land at present and plans to spend his limited leisure hours at the rig working DX. David still has more than a year left of his tour in the C.A.R. He formerly operated from Libya as 5A4TQ. The TR-3 feeds a TH3-MK2 three element beam about 50 feet above the ground. David operates SSB, usually on the American phone band, and is usually found between 2000 and 2200 hours GMT on either 15 or 20 meters, depending on conditions. He also checks into the YL Net on 14.330 MHz from time to time as #4027.

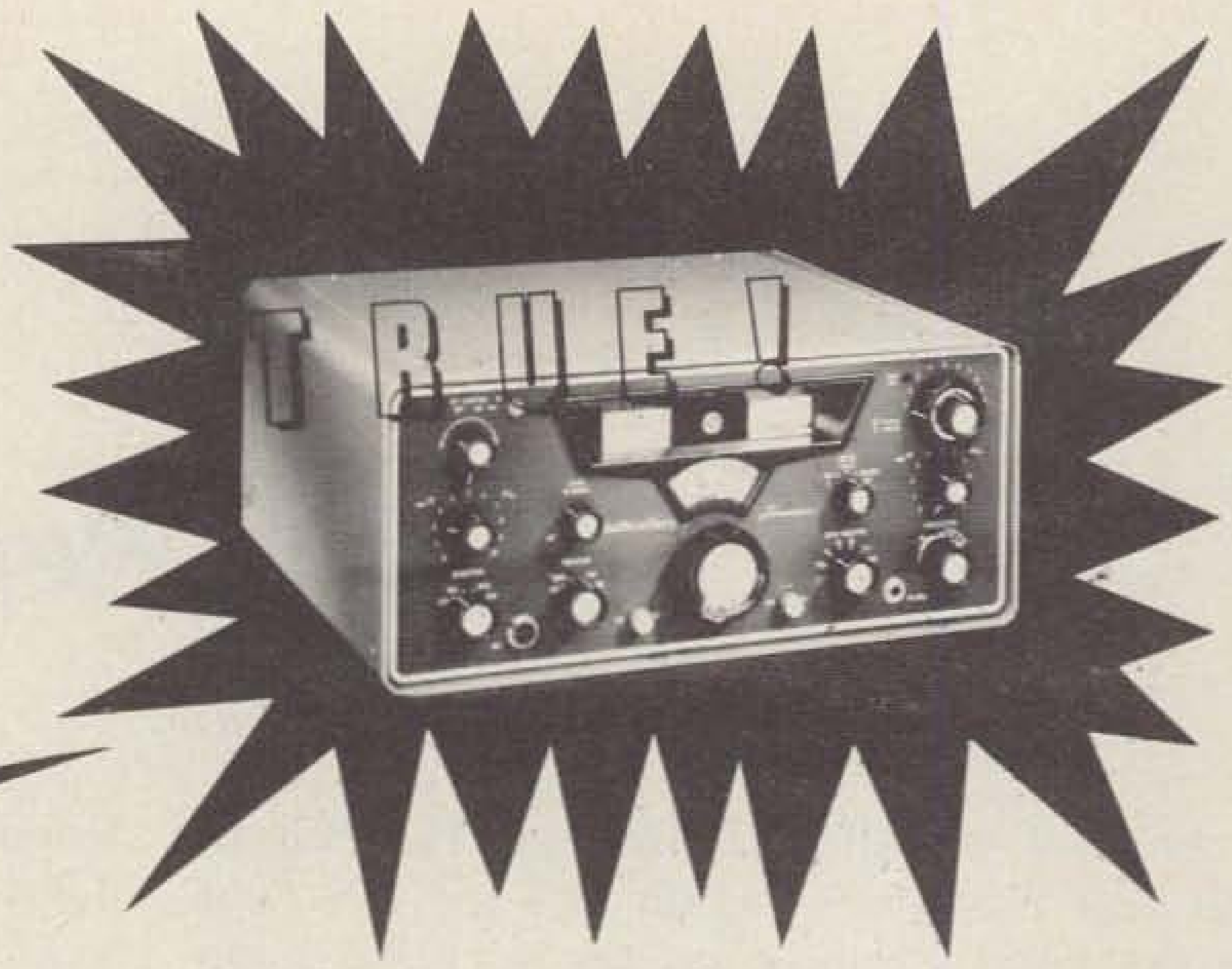
David prefers to receive QSL's direct addressed to TL8DL, American Embassy, B. P. 924, Bangui, Central African Republic. Stamps not required for his collection will be turned over to missionaries in the country. For direct replies include a S.A.E. and 2 IRC's. Other cards will be distributed via bureaus in Europe and the United States.

would YOU believe ?

MORE

than you PAID

IN TRADE ?



Your clean late model SSB equipment is **actually worth more** than **you** paid for it in trade ON THE NEW HALLICRAFTER SR-2000 HURRICANE MAXIMUM LEGAL POWER TRANCEIVER AND P-2000 A.C. POWER SUPPLY

LOOK! AT YOUR VALUE PACKED TRADE-IN ALLOWANCE

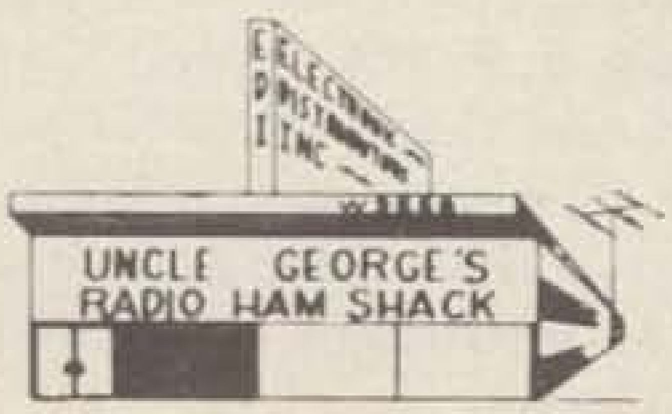
	Original List price	Your Trade-in Allowance	SR-2000 P-2000 List Price	Your Cach Difference
SWAN 350 with 117XC AC Supply (late serial #)	$515	$620	$1545	$925
SWAN 350 with 117XC AC Supply (old serial #)	$490	$600	$1545	$945
SWAN 500 with 117XC AC Supply	$590	$700	$1545	$845
SWAN 250 with 117XC AC Supply	$420	$500	$1545	$1045
DRAKE TR4, AC4, MS-4	$720	$800	$1545	$745
DRAKE R4, T4A, AC4, MS-4	$919	$975	$1545	$570
NATIONAL NCX-5, MK-II, NCXA (old serial #)	$795	$800	$1545	$745
NATIONAL NCX-5, MK-II, NCXA (late serial #)	$659	$750	$1545	$795
COLLINS KWM-2, 516F-2 (above 9000 serial #)	$1265	$1300	$1545	$245
COLLINS KWM-2, PM-2 (above 9000 serial #)	$1345	$1400	$1545	$145
GALAXY V, AC Supply	$500	$600	$1545	$945
HALLICRAFTERS HT-46, SX-146	$639	$700	$1545	$845

YOU CAN MAKE MONEY ON YOUR PRESENT EQUIPMENT AND RUN THE LEGAL LIMIT AS YOUR BONUS!

Carefully pack and insure and ship your gear to us prepaid with check or money order for the cash difference and we will ship your fabulous HURRICANE "Living End" station via surface freight prepaid anywhere in the continental U.S.A. ACT NOW! This offer good for a limited time only.

The new HA-20 DX Adapter is now available. Remote VFO/VSWR Consol companion to the SR-2000 (gives you the most versatile station combination available) ONLY $199.95.

Remember, your own bank financing plans ALWAYS cost you less. We feel it is to your best interest to take advantage of them.



Uncle George's Radio Ham Shack

A division of Electronic Distributors, Inc.

11324 Fern Street, Wheaton, Maryland, 20902

Box 161-A, Cordova, S. C. 29039) or you may obtain some from your QSL card check point. If they have none, send me a line and I will send them to you pronto. Remember, send along 25c either in cash or stamps for postage allowance and costs of the large envelope the country lists will be sent in. There are a number of blank spaces for new countries or ones I forgot to include in the list. These country lists are very FB for keeping your country tally and are good for a number of years. I am also using this same country list for my *DXers Magazine* (weekly deal) Honor Roll so they do you double duty. I talked with Wayne over the phone and he said, "Gus, it's impossible to print up a list without forgetting a few countries." I told him that the list I was about to print up (used here for my own record keeping purposes only) was 100% complete—I checked it three times, Peggy checked it a few times and two local hams checked it twice each I think—and when it was printed and I started transferring my records to the new list I found that KG6-Guam, and VS6-Hong Kong are missing. Seems as though Wayne knew what he was talking about doesn't it? But one of these days I will print another and not miss any at all *except* probably W/K for the USA and VE—for Canada. Sometimes the harder you try to be perfect the more mistakes you make!

. . . W4BPD

Worked the World

14 MHz SSB WTW-200

1. Gay Milius W4NJF
2. "Hop" Hopple W3DJZ
3. Dick Leavitt K3YGJ
4. Joe Butler K6CAZ

14 MHz SSB WTW-100

1. Gay Milius W4NF
2. Bob Wagner W5KUC
3. "Hop" Hopple W3DJZ
4. Bob Gibson W4CCB
5. Jim Lawson WA2SFP
6. Joe Butler K6CAZ
7. Warren Johnson WØNGF
8. Lew Papp W3MAC
9. George Banta K1SHN
10. Dan Redman K8IKB
11. Paul Friebertshauser W6YMV
12. Jay Chesler W1SEB
13. James Edwards W5LOB
14. Bill Galloway W4TRG
15. Olgierd Weiss WB2NYM
16. Jose Toro KP4RK
17. Gerald Cunningham W1MMV
18. Edward Bauer WA9KQS
19. Dick Tesar WA4WIP
20. G. "Gus" Brewer W4FPW
21. Jack McNutt K9OTB
22. Charles R. Sledge W4JVU
23. Ira C. Crowder DL5HH
24. James Leonard W4FPS
25. Richard Leavitt K3YGJ
26. Gordon Read VE6AKP
27. Paul Haczela K2BQO
28. Don B. Search W3AZD
29. Len Malone WA5DAJ
30. Egon Gadeberg OZ3SK
31. G. Coull ZL3OY
32. John F. Berryman K4RZK
33. William T. Broder CN8FC
34. George C. Blunck WAØOAI
35. Bob Parlin WØSFU

14 MHz CW WTW-100

1. Vic Ulrich WA2DIG
2. James Resler W8EVZ
3. Dan Redman K8IKB
4. Robert C. Sommer W4CRW
5. John Scanlon WB6SHL
6. Newton K. Gephart W9HFB
7. Fred A. Fisher W5ODJ

21 MHz SSB WTW-100

1. Ted Marks WA2FQC
2. James Lawson WA2SFP
3. Joe Hiller W4OPM
4. Scott C. Millick K9PPX
5. Paul Friebertshauser W6YMV

21 MHz CW WTW-100

1. Joe Hiller W4OPM

28 MHz SSB WTW-100

1. James L. Lawson WA2SFP
2. Ansel E. Gridley W4GJO
3. J. B. Jenkins W5YPX

7 MHz CW WTW-100

1. Rex G. Trobridge W4BYB
2. R. Sigismonti W3WD

Tricky Soldering Job

Now and then, when building a project or wiring a circuit on an aluminum chassis, it becomes necessary to ground a copper wire "at the nearest point". At that point you drill a hole and insert a screw, nut and solder lug to attach the copper wire. Often, due to the presence of a transformer, capacitor or other part on the underside of the chassis, it is not convenient or practical to drill a hole through the chassis. In such a case, *why not solder the copper wire to the aluminum chassis?*

Most experienced wiremen, proficient with a soldering iron, will tell you that this is impossible. However, if you know why it is impossible, a way can be found to do just that. The author has used the following method on many occasions to make a solid bond between copper and aluminum, using an ordinary soldering iron and ordinary solder (*not* aluminum solder). And you need no "special tools", just your soldering iron, regular wire solder and a sharp-pointed tool such as an awl, scriber, or other sharp-pointed instrument. The reason why it is "impossible" to solder on aluminum is that aluminum oxidizes immediately on contact with air. Sandpaper a clean spot on aluminum and before you have lifted the sandpaper the aluminum has already oxidized or "rusted". Therefore, soldering aluminum in a perfect vacuum is as simple as soldering any other metal, but since this is impossible we must find another method of cleaning a spot on aluminum "out of contact with air". Take a piece of scrap aluminum and a few short lengths of copper wire and in a few practice tries you will get the "knack" of it.

It is not necessary to sandpaper or scrape the aluminum to clean it—just wipe the spot with alcohol or any other grease-cutting solvent to remove all traces of oil or grease. If the aluminum feels dry and not oily, the alcohol or solvent is not needed. Place the tip of a hot soldering iron on the spot to be soldered and feed in a few inches of wire-solder to make a puddle of liquid solder.

Keep the tip of the iron in the puddle of solder to keep the puddle liquid and flowing. Using an awl or scriber, scratch deeply in the middle of the puddle of liquid solder. Continue to scratch back and forth and around in the puddle of liquid solder. Each scratchmark exposes more clean aluminum to which the ordinary solder will bond, because *no air* is present under the puddle of hot, liquid solder. The more you scratch in the puddle, the tighter the bond between solder and aluminum. Remove the soldering iron, and wipe away any excess solder with a rag or old brush. Tin the copper wire to be soldered, and solder it to the "tinned" aluminum just as in any ordinary soldering job, using a fresh piece of solder.

Two or three scratches in the puddle of liquid solder are not sufficient for a good bond. Ten or fifteen scratches in all directions will assure exposure of enough clean aluminum to make a solid, permanent connection between copper wire and an aluminum chassis. A copper-to-aluminum solder joint made in this manner will not corrode or rust, as sometimes happens with the screw-solder-lug-and-nut type of connecting two different metals, because no matter how tight the connection, air is always present and rusting or corrosion can eventually occur.

When the job is finished, test the connection with a strong pull on the copper wire. If the lump of solder pulls loose from the aluminum, the soldering iron was not hot enough to keep the puddle liquid and flowing. The puddle of solder must be kept sufficiently hot and liquid to flow into the scratches on the aluminum, just as solder must be liquid and flowing when soldering any other metal. Slightly more heat is required to keep the puddle liquid, because of the presence of the awl or scriber in the puddle of solder while scratching the aluminum. Scratch deeply into the aluminum surface, since the more aluminum that is exposed in scratching, the tighter the bond. Sufficient heat for the job is a must and a solder connection properly made in this manner is premanent and oxidation-proof.

. . . W2FFR

More 5Z4's and less VU's

The news from East Africa is good. Amateur licenses are being given out for the first time since Kenya came into its own. Look for a goodly group of 5Z4's around the bands. Quite a need has built up in the last four years.

India reports no new licenses issued for the last ten months. That country has enough trouble without further discouraging the development of electronics trained people .

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION
(Act of October 23, 1962; Section 4369, Title 39, United States Code)

Publisher: File two copies of this form with your postmaster.

1. DATE OF FILING: 14 October 1967
2. TITLE OF PUBLICATION: 73 Magazine
3. FREQUENCY OF ISSUE: Monthly
4. LOCATION OF KNOWN OFFICE OF PUBLICATION: Peterborough, N.H. 03458
5. LOCATION OF THE HEADQUARTERS OR GENERAL BUSINESS OFFICES OF THE PUBLISHERS (Not printers): Peterborough, N.H. 03458
6. NAMES AND ADDRESSES OF PUBLISHER, EDITOR, AND MANAGING EDITOR
PUBLISHER (Name and address): Wayne Green, Peterborough, N.H. 03458
EDITOR (Name and address): Jim Fisk, Rindge, N.H.
MANAGING EDITOR (Name and address):

7. OWNER (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given.)

NAME	ADDRESS
73 Inc	Peterborough, N.H. 03458
Stockholder: Wayne Green	Peterborough, N.H. 03458

8. KNOWN BONDHOLDERS, MORTGAGEES, AND OTHER SECURITY HOLDERS OWNING OR HOLDING 1 PERCENT OR MORE OF TOTAL AMOUNT OF BONDS, MORTGAGES OR OTHER SECURITIES (If there are none, so state)

NAME	ADDRESS
none	

9. Paragraphs 7 and 8 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner. Names and addresses of individuals who are stockholders of a corporation which itself is a stockholder or holder of bonds, mortgages or other securities of the publishing corporation have been included in paragraphs 7 and 8 when the interests of such individuals are equivalent to 1 percent or more of the total amount of the stock or securities of the publishing corporation.

10. EXTENT AND NATURE OF CIRCULATION	AVERAGE NO. COPIES EACH ISSUE DURING PRECEDING 12 MONTHS	SINGLE ISSUE NEAREST TO FILING DATE
A. TOTAL NO. COPIES PRINTED (Net Press Run)	53,725	55,300
B. PAID CIRCULATION 1. SALES THROUGH DEALERS AND CARRIERS, STREET VENDORS AND COUNTER SALES		
2. MAIL SUBSCRIPTIONS	52,024	53,561
C. TOTAL PAID CIRCULATION	52,024	53,561
D. FREE DISTRIBUTION (including samples) BY MAIL, CARRIER OR OTHER MEANS	241	219
E. TOTAL DISTRIBUTION (Sum of C and D)	52,265	53,780
F. OFFICE USE, LEFT-OVER, UNACCOUNTED, SPOILED AFTER PRINTING	1,460	1,520
G. TOTAL (Sum of E & F—should equal net press run shown in A)	53,725	55,300

I certify that the statements made by me above are correct and complete. (Signature of editor, publisher, business manager, or owner) Wayne Green

POD Form 3526 Jan. 1967

Solid-State Chopper

To properly adjust the depth of modulation of a TV transmitter, it is necessary to establish a point of zero carrier (see October 1966 *73* Magazine). This is usually done by shorting the video input to the scope with a relay pulsed at a 60 Hz rate. Relays used in this way are plagued with point bounce, and changing contact resistance. This results in erratic and jittery scope presentations. Most of these problems can be solved by using relays with mercury wetted contacts, but it's even easier to replace the relay with a cheap transistor. This solid-state chopper will give you a stable presentation with a definite trace for a reference line.

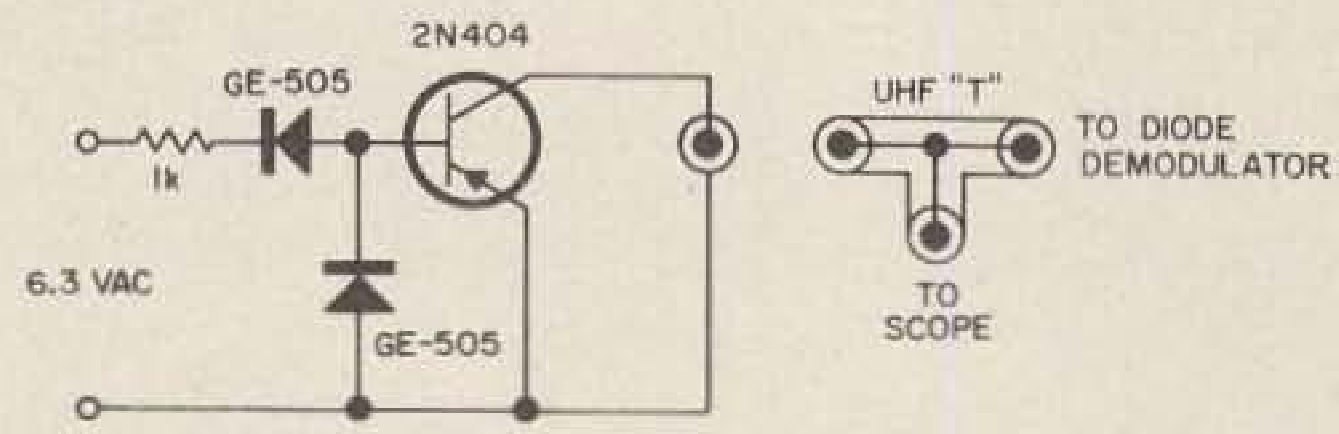
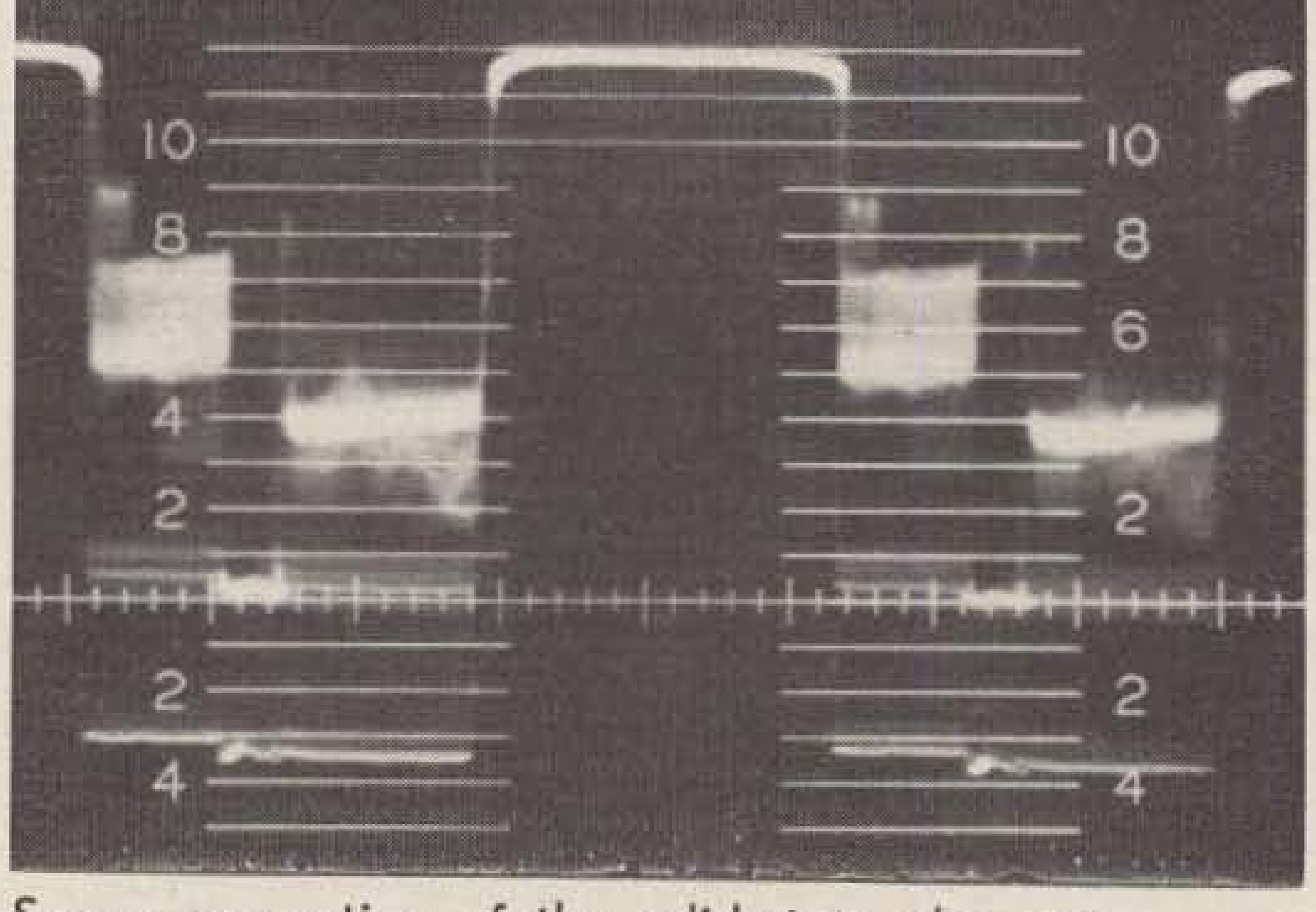


Fig. 1. Schematic of the solid-state chopper.

Any 6.3 Vac source can be used for triggering. I use the calibration voltage from the scope. From this, the diodes form a negative pulse, which drives the transistor into saturation, shorting the scope input, and giving a zero carrier trace for one third of each video frame. Collector to emitter impedance is high, compared to the 75-ohm source, so the chopper will not disturb your video monitor when the 6.3 V is disconnected.

All components were mounted on a piece of perforated phenolic, 1" in diameter. This board is then fastened to a 6/32 x 1¾" bolt which has been soldered in the UHF connector to serve as the inner conductor.

. . . John Howard KØMHZ



Scope presention of the solid-state chopper.

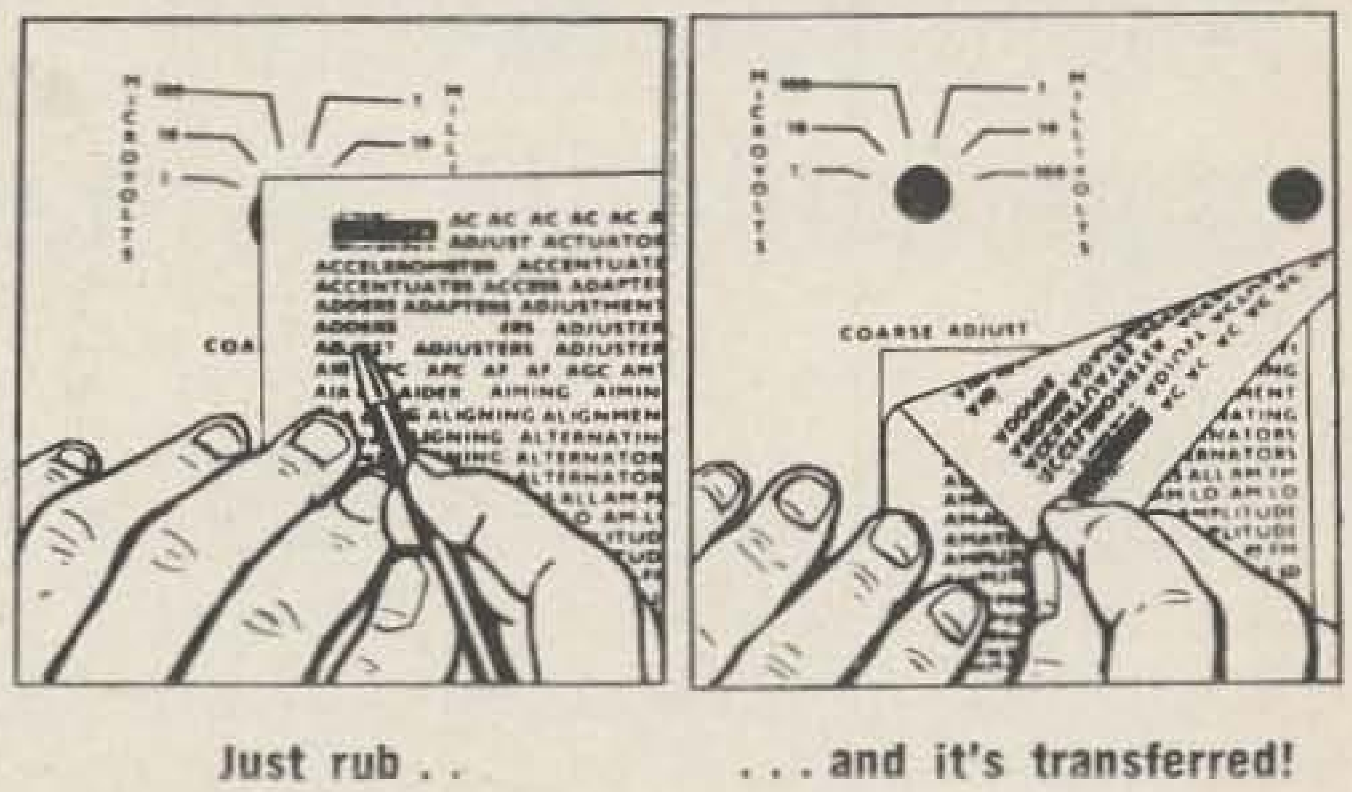
GET PROFESSIONAL RESULTS

. . . when marking your electronic equipment or making schematics or logic diagrams. INSTANT LETTERING® dry transfers let you achieve the look of fine printing, quickly and with a minimum of effort.

instant lettering® dry transfer MARKING and DRAFTING KITS for ELECTRONICS

With INSTANT LETTERING® marking kits you can completely mark equipment from component parts to the finished control panel. Dry transfer meter and dial markings, preset words, component identification letters, etc. are printed on a special transparent carrier sheet. Rubbing over one of these elements with a ball-point pen transfers it to your working surface. What could be easier . . . and you get professional looking results every time.

You get the same ease and speed with INSTANT LETTERING® dry transfer drafting symbols for schematics and logic diagrams. They let you make reproduction quality drawings in just minutes.



Just rub . .   . . . and it's transferred!

TITLES for ELECTRONIC EQUIPMENT

Completely revised and expanded to give over 10% more words in a more readable type face. Contains hundreds of preprinted titles for marking control panels, drawings, parts, prototypes, etc.

No. 9581—Complete set in black $4.95
No. 9591—Complete set in white $4.95

TERMINAL & CHASSIS MARKING KIT

Includes all the standard component identification letters used in marking chassis printed circuit and terminal boards, prototypes, etc.

No. 966—Complete set in black $4.95
No. 967—Complete set in white $4.95

METER & DIAL MARKING KIT

Mark your own standard or special rotary tap switches, potentiometers, prototype and specially calibrated meter dials, etc. with these dry transfer switch patterns, arcs, graduation lines, letters and numerals, etc. Sheets are in 3 colors to simplify usage of complex equipment.

No. 968—Compete set $4.95

DATAKOAT PROTECTIVE COATINGS

Designed specifically for INSTANT LETTERING® products, Datakoat affords maximum protection by covering transferred elements with a heavy weatherproof acrylic film. Available in a brush-on kit (for use on small areas) and in spray cans (in matte or glossy).

No. 04176 — Brush-On-Kit $1.00
No. 04177 — Spray Can (glossy) $2.95
No. 04178 — Spray Can (matte) $2.95

DATAMARK KITS

Handy, economical marking kits for the home experimenter, student, hobbyist, etc. as well as the regular electronics applications. You'll find hundreds of uses for these inexpensive sets.

K58B — Audio, TV & Hi-Fi (black) $1.25
K58W — Audio, TV & Hi-Fi (white) $1.25
K59B — Amateur Radio & CB (black) $1.25
K59W — Amateur Radio & CB (white) $1.25
K60B — Experimenter, Home & Intercom (black) $1.25
K60W — Experimenter, Home & Intercom (white) $1.25
K61B — Test & Industrial Equipment (black) $1.25
K61W — Test & Industrial Equipment (white) $1.25
K62 — Marks & Switch Patterns (black & white) $1.25
K63 — Alphabets & Numerals, 1/8" (black, white & gold) $1.25
K64 — Alphabets & Numerals, 1/4" (black, white & gold) $1.25
K65 — Alphabets & Numerals, 1/2" (black, white & gold) $1.25

ELECTRONIC SYMBOL DRAFTING SET

Heat resistant dry transfer drafting symbols that are uniform and correct in every detail according to MIL-STD-15-1A and ASA-STD-Y32.2. All you do is draw in the connecting leads. Included is a booklet on drawing with dry transfers, offering useful hints and suggestions on how to get perfect results every time.

No. 970 .... $15.95

LOGIC DIAGRAM SYMBOL SET

Dry transfer symbols for making logic diagrams. These heat resistant symbols conform fully to MIL-STD-806B and ASA-STD-Y32.14. All you do is add connecting leads and you have a reproduction quality drawing.

No. 971 .... $3.50

For more information on these and many other fine INSTANT LETTERING® products, contact your local parts distributor or write direct.

THE DATAK CORPORATION • 85 HIGHLAND AVE. • PASSAIC, N. J. 07055

Frank M. Roberts
421 Woodland Drive
Jacksonville, North Carolina 28540

WB4DOH: The Piano Prodigy

In writing about Jean Shepard, it's difficult to figure out whether the story should refer to her as one of the youngest female ham radio operators—or as one of North Carolina's most talented, award-winning pianists. The 17 year-old Jacksonville High School senior is both.

Since readers of 73 would be most interested in the young lady's interest in ham radio—let's start there. Her fascination for amateur radio began when she was all of 13 years old. "I used to read books about it. In school at that time, my science project involved electronic equipment."

Shortly afterwards, she built her own set, enough of an accomplishment for an older man, but for a girl just in her teens, it is even more amazing. She put all of the electronic equipment together from scratch and strictly on her own. She constructed her transmitter, the matching circuits, antenna—plus all of the etcetera's.

After she got her novice license, she went on the air (operating with the call letters WN4DOH) and began operating from her now-crowded bedroom. To back up just a bit though—it must be said that she does admit to failure. "The first set I constructed didn't work, so I tore it down and built another."

Since that time, she has been operating with a power of 30 watts, but will shortly be increasing her output to 75 or 90. "I'd also like to go on phone," she said. Right now all of her transmission is via code. Most of her current conversation of course, is with people in the immediate area, but she is looking forward to the power increase, introducing her to new friends.

In her home town of Jacksonville, she is secretary of the Onslow Country Radio Club (youngest and only female member). They meet twice a month at the local Red Cross headquarters, "And talk about equipment." Other club members have found out that Jean knows as much about the technical aspects of their rigs as they do. "Sometimes more," one of the men admitted, while talking in admiration of the young piano prodigy.

She became interested in music at the age of ten. Now she is one of the few serious students who has been selected for individual study with Dr. Robert Carter, Professor of Music at East Carolina College in Greenville, North Carolina. He gives private tuition to only three or four students from across the Tarheel State.

Jean not only studies classical piano with Dr. Carter, but devotes about four or five hours a day to practice at home. It has enabled her to become so accomplished that she has received a mark of Superior Plus, at National Guild auditions—involving hundreds of high school and college students from all over North and South Carolina. She was one of very, very few ever to have achieved such a remarkably high rating.

When not playing at home or for special audiences, Jean travels around the state to perform. She was recently featured at an event sponsored by the Federation of Music Clubs. She has also appeared with the North Carolina Symphony and has given numerous recitals. The young lady would like to be a concert pianist and hopes to enter a conservatory after high school.

Right now, high school almost seems a breeze. Her favorite subjects are physics and math and she maintains a 96.4 average, is a member of the National Honor Society and a Marshall.

While outstanding in such a variety of endeavors as schoolwork, amateur radio and piano—she also enjoys outdoor sports and plays a good game of tennis. "For relaxation, I like to do jigsaw puzzles."

Talent with the unusual seems to be a Shepard family trait. Dad is a research bacteriologist at the Naval Research Laboratory at Camp Lejeune; Julie, a 19 year-old sister, is now studying zoology at North Carolina State University in Raleigh, under a research grant from the National Science Foundation. She is doing research on the Baltimore Oriole (bird not baseball); a 14 year-old sister, Evelyn, is studying dance at the School of Arts in Winston-Salem, having won top honors in a competitive audition.

The family though is not in competition, one with another. It's just a good, healthy case of each of the youngsters becoming interested in a variety of subjects—encouraged by their parents—and wanting to do their very best.

Jean Shepard has proven that parental concern and a youth's own abilities, can combine to create an outstanding young person. ■

Increasing Resistor Heat Dissipation

To help dissipate the heat in large wire-wound resistors in transmitters and power supplies, use the fins from old selenium rectifiers. Break the fins loose from the old selenium units, enlarge the center holes and position them along the body of the resistor. Heat dissipation can be increased slightly by blackening the fins over a flame. Small adjustable cable clamps will hold the fins in their proper positions.

. . . Richard Mollentine WAØKKC

"THE HAM'S HEAVEN"

CRABTREE'S ELECTRONICS

PRESENTS

GALAXY V *MARK 2*

5 BAND TRANSCEIVER

NEW

400 Watts Power

—

6 WAYS BETTER

STILL ONLY **$420**

WE WANT YOUR BUSINESS

And we are prepared to offer King-Size trade-in allowances on your present gear. Also, we will give you a quote on any package combination you are looking for. The package price in this ad applies to both cash and charge orders.

Bob Baker

Crabtree's Electronics
Phone 214—748-5361

WRITE or CALL For Quotes or Trade-in Allowances

● MONEY SAVING PACKAGE

(DELUXE MOBILE)	Reg. Price
Galaxy V Mark 2	$420.00
DC35 12V DC Supply	99.95
CAL35 Calibrator	19.95
MMB Mobil Mount	7.95
DELUXE Ball Mount and Spring with 25' RG58 and connector	16.20
WEBSTER WMWD Mast and Top Section plus KW Coils 75 thru 10	49.45
TURNER 350C Mike and Connect	8.25
Mobil Log Book	.50
REG. TOTAL	$622.25

ALL THIS ONLY $549 COMPLETE

CRABTREE'S ELECTRONICS
2608 Ross Ave., Dallas, Texas 75201

Please ship me the following:

- ☐ Mobile Package — $549
- ☐ Galaxy V Mark 2 — $420
- ☐ Free 1967 Catalog with credit form
- ☐ Check or Money Order attached

NAME ______________________ CALL __________

ADDRESS ______________________________

CITY ______________________ STATE __________

ZIP __________

D. Byrne G3KPO
Peterborough, England

psst! Go pffft with your Bmmfft!

Do you chuck it all in the garbage-bin after you've read it, or hoard the lot—like most hams—until the shack door refuses to close?

I'm referring to old technical magazines, and W2DXH's article in the May 1966 issue.* His is a very good idea, but to my mind it has two major snags. The first is that one is still left with stacks and stacks of "mag-centres," and the second is the difficulty in tracing articles on any one special subject in a hurry, without the time to wade through stacks and stacks of unwanted material.

Ninety percent of all magazine material is pure bmmfft (excepting *73*, of course, where 90% is real meat, and only 10% the other stuff). So cut out the genuine gold—neatly, with a single-sided razor-blade—and ditch the rest.

Now, my suggestion is that you file them away under *separate headings* for each subject—using large cardboard folders. These can be kept in an old cabinet, or even a few hefty boxes.

I started with this system long before WWII, and all was quite simple—to begin with, that is, but like Topsy, it just growed and growed! At first, clippings went under such headings as "Antenna, modulators, transmitters, receivers, etc."

However, as the years went by, these individual files became so over-filled that most had to be sub-divided. For instance, "Antenna" would grow into "Beams, HF, inverted-V, long-wire, VHF, all-band, Quad, towers, rotators, feeders, etc."

The great beauty of this "cutting-up" and "sub-dividing" is that one can lay one's hands on the articles dealing with a specific subject—literally, within seconds! Several times, my phone has rung, and a fellow amateur has asked if I could help him regarding say "Q-fivers" or perhaps "Q-multipliers." Whilst he was hanging on the line, I would open the filing cabinet, and produce a card-board folder containing practically *every* article on "Q-fivers" written during the past quarter-century . . .

Can anyone suggest a quicker way of finding information?

It is rather interesting to go carefully through a file and note how the same particular subject is written up every decade as being "something new," when all the time it is an old idea in new guise. Pre-war, it was first of all battery-operated tubes, and then mains tubes. After 1946 came miniature tubes, and of late, transistors. Then we've had printed circuits and encapsulated unit construction . . . but basically, the same circuitry! Mutton dressed up as lamb, and served as the plat-du-jour.

But I digress. Back to practicalities. One of the greatest difficulties in filing under the "KPO system" is what to do with the kind of magazine which finishes one article on reverse page of another—*73* is exemplary in this respect!

It is, of course, possible to type out (or photo-copy) the meat in the last page—it's funny how much "padding" goes in the last few paragraphs of most articles! But perhaps the easiest way is to file away all "opening" pages of articles, and then make a note on the bottom of the page, giving the title of the article on the reverse of which the first article is concluded. Phew—hope that explains itself.

One final word of warning. Never, never lend any of your precious files—you'll never see 'em again. I know, having suffered bitterly. It's bad enough when they keep the whole file, but even worse when they return it minus the very pages you wanted most.

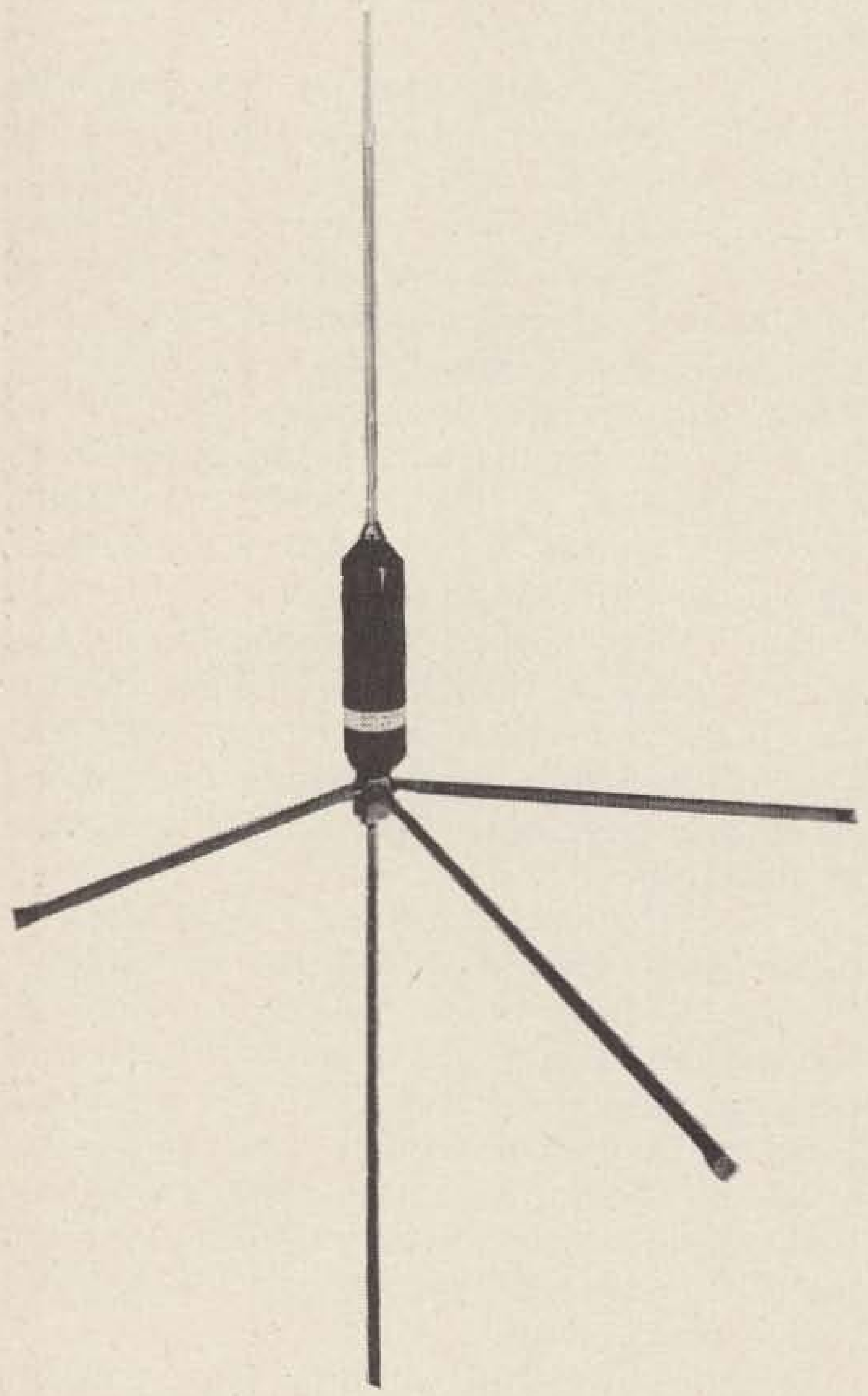
. . . G3KPO

*James Ashe, "Dealing with the Information Explosion," *73*, May 1966, page 42.

Kayla Bloom WØHJL
P.O. Box 224
Dublin, New Hampshire 03444

Waters Band-Adder 370-3

Mobiling with Fingers



Waters Manufacturing, Inc. of Wayland Massachusetts, has finally solved the problems of multiband mobile operation at low cost; and it works. Furthermore, it works remarkable well.

The *Band-Adder* consists of an assembly of three helically wound resonator "sticks" in a metal bushing which mounts on the top of the mobile mast, just below either a 40 or 75 meter coil and tip, adding 10, 15, and 20 meter operation to the original antenna.

Having used several makes of center-loaded mobile antennas, I find there is always the problem of stopping the car, getting out the wrenches, and changing the coil and tip. Therefore, I was reluctant to change bands even when conditions on one band would deteriorate. Not so when the *Band-Adder* was installed. I can now change bands without touching the antenna.

Since resonance is controlled for each band primarily by the inductance of the helix for each band, the *Band-Adder* is self selecting without the use of any type of switching device. The *Band-Adder* coils are pre-tuned for full coverage of the 10, 15, and 20 meter bands and will handle 500 watts PEP on SSB and 100 watts on AM.

When the *Band-Adder* is first installed, it will be necessary to retune the 40 or 75 meter tip to resonance due to the added capacitance. This is a slight change, usually shorter.

I must admit to a certain amount of skepticism when the idea was first presented to me. This doubt rapidly disappeared when I began running it through some tests.

I tested the *Band-Adder* with the *Waters Auto-Match* and with two other popular center-loaded mobile antennas with much the same results. The conclusion is that it works equally well with any center-loaded whip which has ⅜ - 24 studs.

Using the 75-meter coil and tip, I first adjusted for resonance on 75. This required

Specifications

Frequency Ranges:	28.5 MHz—29.80 MHz 21.2 MHz—21.45 MHz 14.2 MHz—14.35 MHz
Mounting:	Female ⅜-24 thread to attach to standard mast and male ⅜-24 stud to accept standard 40 or 75 meter coil.
Transmission Line:	When used with 75 meter coil tip we recommend your using RG 58/U 50 ohm cable. When used with the **Waters 40 meter coil** use 35 ohm cable (Waters 370-48). NOTE: When 35 ohm cable is used the VSWR on 15 meters will be about 2:1.

about a ⅜ inch shorting of the tip. This adjustment was at my normal operating frequency which had previously had an SWR of 1:1. I was still able to get the SWR down to 1:1 and, oddly enough, when I got on the air, I was told I had an outstanding signal. This led me to run some field strength tests (with and without the *Band-Adder*) and discovered a 2 dB gain over the original antenna. This began to look better and better. In field strength tests on the other three bands as compared to the separate coils and tips, I found virtually no difference. On 10 meters, it was equal to the separate coil and tip, on 15, it was down 1 dB, and on 20, it was up 1 dB.

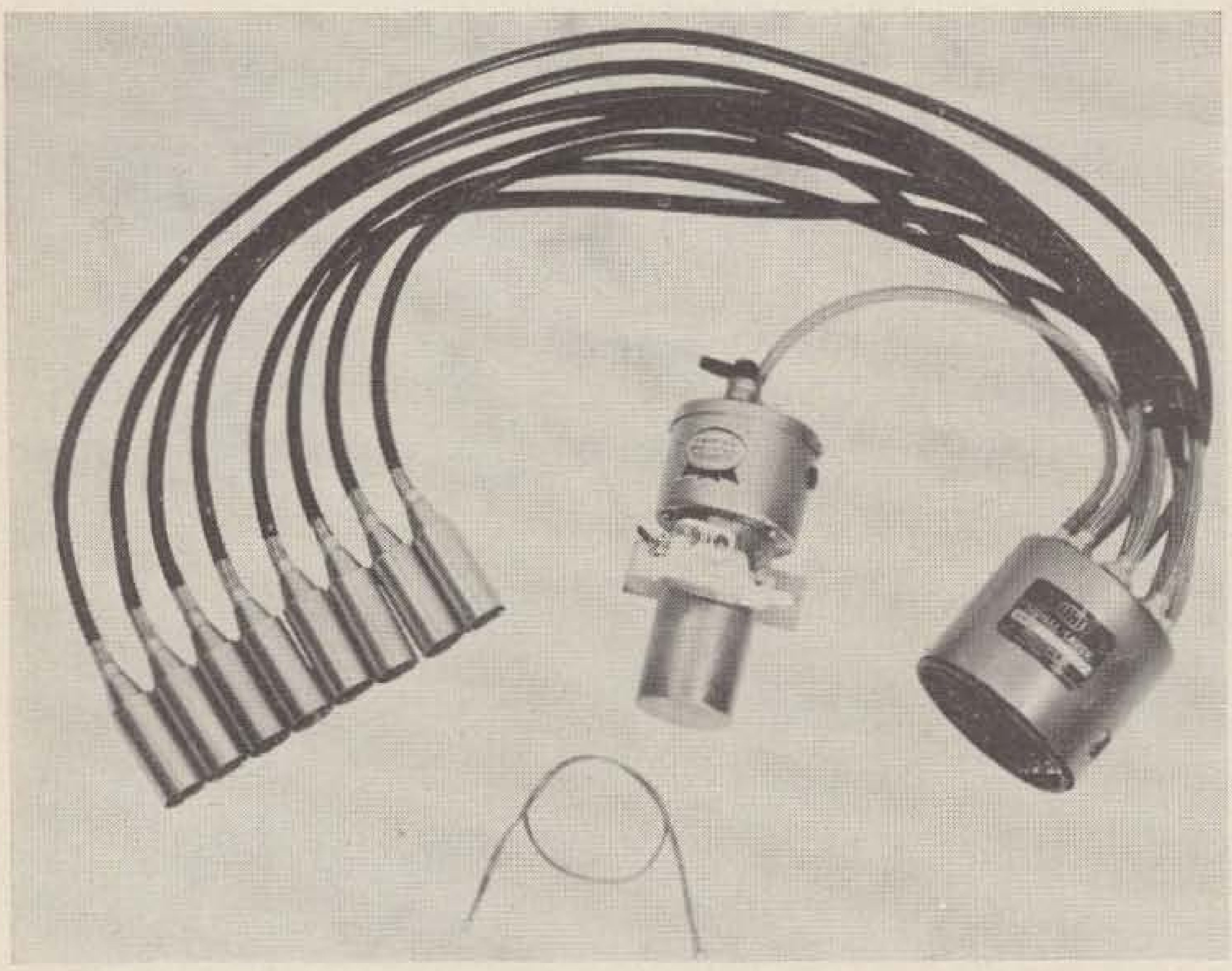
Looking at SWR readings, from 28.1 to 29 MHz (the range of my transceiver) I found the highest SWR to be 2:1, with a much more broadband operation possible than with the 10 meter coil and tip. On 15 the maximum SWR was 2.5:1 at the extreme ends of the phone band with a good 1:1 match in the center. On 20, the maximum SWR was 2:1 with a more limited range which was flat.

The one disadvantage I found was in added wind resistance with high speed driving. This may mean the addition of a nylon cord to support the mast at high speeds. Certainly this is a minor obstacle and a small price to pay for the advantages of band switching.

One other point. If you, for instance, only want to operate 20 and 75, simply remove the 10 and 15 meter "fingers" and it makes no difference. There is no inter-dependency between the three "sticks". You may use one, two, or all three as you wish.

I'm not sure what magic was performed at the Waters factory, but they have provided a new facet to mobile operation with the *Band-Adder*.

. . . WØHJL



A. A. Wicks WB6KFI
1208 Levin Avenue
Mountain View, California 94040

The Hallet Signal Saver®

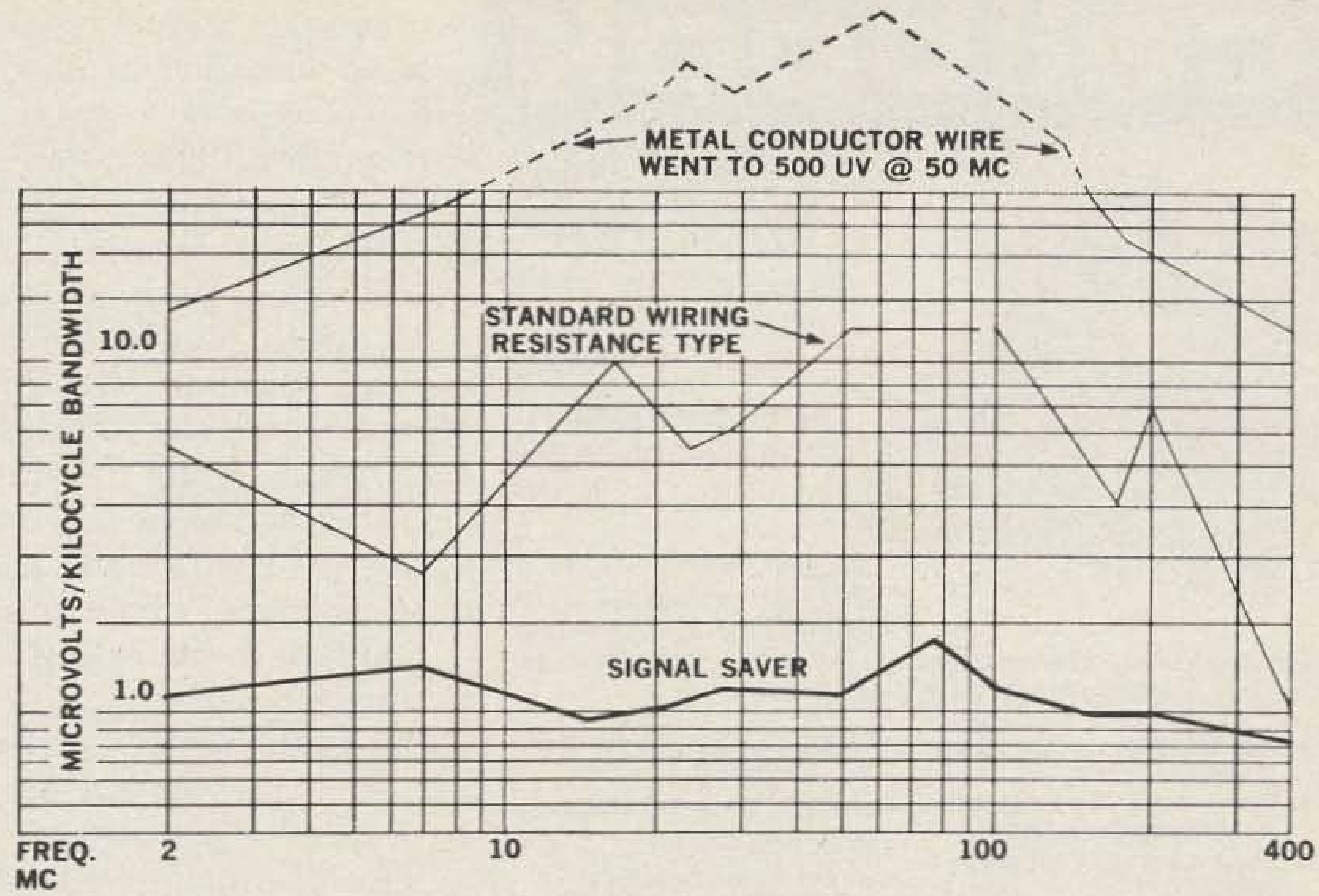
In the past few years, the number of amateur mobile installations has increased at a tremendous rate. This has been accelerated by the availability of transceiver equipment, which is usually compact, presentable, and easily removed for a dual-purpose role of fixed or mobile. If statistics were available, and CB and boat installations were added, the total figure would no doubt be amazing.

It would probably also be astonishing to know how many users were suffering to a lesser or greater degree from self-created ignition interference. Until recently, I was one of these sufferers, when the Hallett Signal Saver was installed on a new car and tested. Before this, a National NCX-3 had been used in a 1960 Chevrolet, and with no special corrective measures being taken other than the usual capacitors on generator, etc., the ignition (and possible other) noise level of S2 was tolerated as being "the best that could be done".

Upon acquiring a 1966 Ford Galaxie, and reinstalling all of the equipment, including the antenna, in an identical configuration, it was very disconcerting to note that there was now a steady, solid S7 noise level. This appeared to be all ignition noise, but there was a distinct possibility that this noise was masking alternator and possibly other noise sources.

An inspection of the Ford, carried out with the engineering specifications for noise suppression as supplied by the Ford Motor Company, showed that, with the exception of a "radio resistance" primary lead and one copper hood-bonding spring, no suppressive measures had been taken with this car. The Ford looked like a classical case for the

Measurement of radiation interference (noise level), compares the Hallett Signal Saver and original equipment on an automobile using resistive wiring.



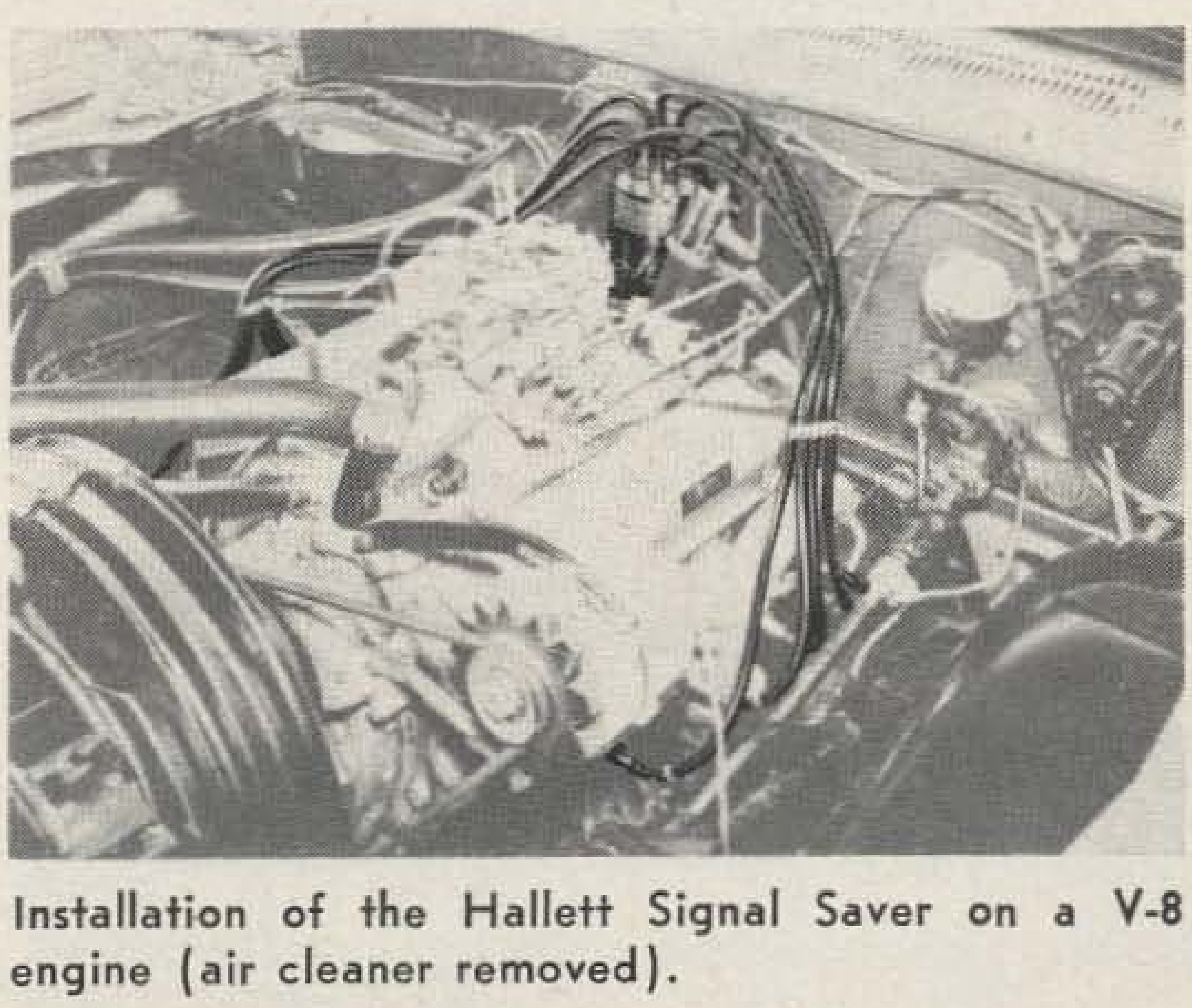
Signal Saver, which was receiving strong promotion at the radio parts suppliers.

Before making the installation, a test was made under existing conditions. An open area, two miles from the nearest power line or other man-made structure, was chosen as a test site. Antenna resonant frequencies of 3900, 7260, and 14,260 kHz were selected, and noise levels checked with engine running and engine off. The latter condition showed an S-meter reading of zero, and with the engine running, the aforementioned noise level of S7 was noted on all frequencies. The noise was so severe that no signal-free check frequency was selected—only the strongest local signals were received anyway. The equipment in all tests consisted of a NCX-3, a Webster Topsider antenna and a Linear Systems 350-12 dc power supply. RF gain was set at maximum in this and all subsequent tests. Following this initial test, I proceeded to install the Signal Saver.

The general appearance and sturdy construction of the Signal Saver equipment is excellent. Heavy steel is used throughout, and it is attractively and heavily coated with a gold finish. A chrome finish, if it were available, would probably attract the hot-rod set.

The equipment, as received, was complete for the specified installation. Two systems are available, one for conventional distributor caps, where the original will continue to be used, and one for those caps that are equipped with a timing window. The installation shown in the photo consists of a distributor cap shield, a coil shield, and spark-plug shields with shielded wire securely soldered to the shield, and terminated at the distributor end by a very secure snap-locking cap. The coil shield contains an integral feed-through capacitor to the "hot" ignition switch lead. The shielded cables are made up of aircraft type ignition cable and the braid is protected with a stainless steel conductor. The cable itself has a temperature rating from −65F up to 250F. The complete installation is certified to be dust-proof, spark-proof, and moisture-proof.

Installation was relatively simple. However, California automobile owners may have some "squeeze" problems due to the large amount of smog-control equipment spread over the engines of their cars. This was particularly difficult for the coil installation. This portion of the installation took four hours, of which one hour was spent in removing paint thoroughly from the coil case



Installation of the Hallett Signal Saver on a V-8 engine (air cleaner removed).

to provide a good bonding contact. About one hour was used in making a "dry run" to see if we were even going to be able to make it through all the hoses and pumps. Normally, two hours should suffice for this portion, and about another hour for the distributor and spark plug wiring. With one exception all spark plug cable lengths were adequate —the number five plug cable had to be routed in a slightly different manner in order to reach from the distributor to the plug. Once the shields are installed, a metal clamp groups each bank of plug wires together so that the whole installation looks neat, in addition to providing further bonding. Spark-plug shields may be quickly removed without tools for any plug work required.

The instructions are very explicit and appeared to be written with this car in mind. This is probably not the case, but is a compliment to their preparation. Only two very minor inconsistencies were noted. Many clear photographs are used (twelve on two pages, for example), and the line drawings are excellent.

Results of the installation exceeded all expectations. Somehow, we anticipated hearing *some* noise. Instead, S1 and S2 signals were coming through, and, they were readable! It was somewhat shocking to hear ignition noise from passing cars, but very pleasant to drive along in a rural area away from all power lines, and hear nothing but signals. Actually, the reception appeared to be better than at the fixed location. The same test frequencies were used after the shielded installation was made, but due to signals coming through at levels from S9+ to S1, an additional check was made at 4100, 7350, and 14,533 kHz. Nothing was heard at these particular frequencies, either signals or noise.

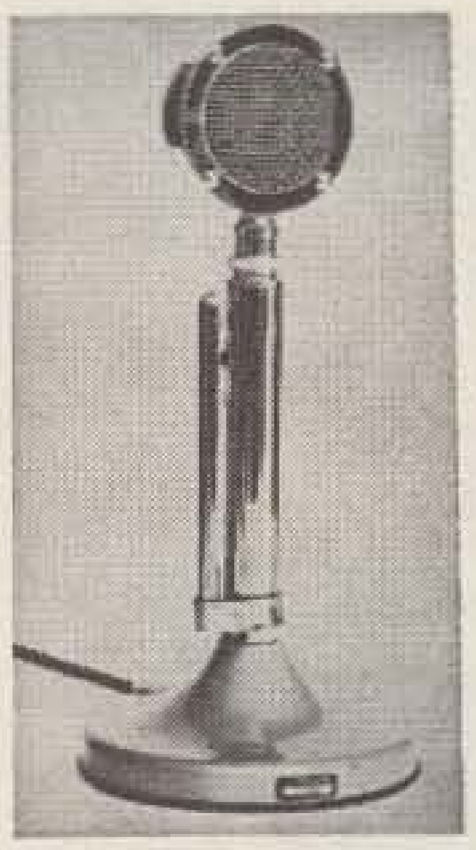
The Signal Saver components are available as individual items, or a complete system may be purchased. All parts are ready to install without modification. For unusual situations, such as large marine engines, the company will provide special materials. Radio parts suppliers carry a listing showing the system to be used for any particular car.

The installation of this system can be a boon to amateur, citizen-bander and marine operator alike. The old saying "you can't work them if you can't hear them", is most appropriate in mobile work. With the Signal Saver, you *will* hear them.

. . . WB6KFI

Quement
ELECTRONICS
"YOUR COLLINS HEADQUARTERS"
HAMMARLUND
HALLICRAFTER
SWAN
MOSLEY
DRAKE
HY-GAIN
SBE
ANOTHER QUEMENT FIRST!
QUEMENT MODEL
QEC-2
VERY EXCLUSIVE
$24.95
SHIPPED EXPRESS ONLY
TWO BEAUTIFUL SYNCHRONOUS 24 HOUR ELECTRIC CLOCKS
ONE FOR LOCAL AND ONE FOR ZULU OR ??? TIME
VERY RICH LOOKING 12"X24"X2" WOOD CABINET CONTAINS TWO TEN INCH MATCHED CLOCKS WITH CHROME TRIM RINGS AND STYLING TO ENHANCE ANY ROOM. RED SWEEP SECOND HANDS. SHIPPING WT. 20 LBS.
• Compact
• Accurate
• Self-contained
• Highest Stability
• Heavy Dip
ALL-TRANSISTORIZED
GRID DIP METER
$29.95
Allow $1.00 for packing and shipping. California residents include 4% sales tax.
Assembled & tested, complete with six coils, ear phone and battery.
TUNES 500 Kc THRU 150 Mc
DOZENS OF USES
GDM-3
NEVER BEFORE HAS A PRECISION INSTRUMENT LIKE THIS BEEN OFFERED AT SUCH A LOW PRICE.
OUR FAMOUS MT-2 VOM
20,000 OHMS per VOLT DC
$12.95
1% Precision Resistors
POST-PAID USA
NINE TRANSISTOR SUPERHETERODYNE
WOW!
METAL CASES
100 MW
HOT!
Allow $1.00 for packing and shipping
Supplied with batteries
$31.95 PAIR
LOOK!
PROFESSIONAL
stereo or monaural listening
20-20,000 CPS 8-16 OHMS
HI-FI
HAM
ORGAN
Allow $1.00 for packing and shipping. California residents include 4% sales tax.
QUEMENT QPH-1
$12.95
S.W.R. BRIDGE and FIELD STRENGTH METER
9.95
Allow 50c for packing and shipping. California residents include 4% sales tax.
MAY BE LEFT IN LINE, UP TO 2000 WATTS.
GOOD THROUGH 2 METERS
THE BEST VALUE WE HAVE EVER OFFERED!
POPULAR MT-1 VOM
Allow 50c for packing & shipping. Calif. residents add 4% sales tax
Test Leads
$5.95
QUEMENT
FLEXIBLE NECK FLASHLIGHTS
HANDIEST TOOL IN YOUR SHOP
$1.95 EA.
"Q LITE"
PPD IN USA
SINCE 1933 • FAST SERVICE • Phone CY 4-0464
QUEMENT ELECTRONICS
1000 SOUTH BASCOM AVENUE
SAN JOSE, CALIFORNIA
"Northern California's Most Complete Ham Store"

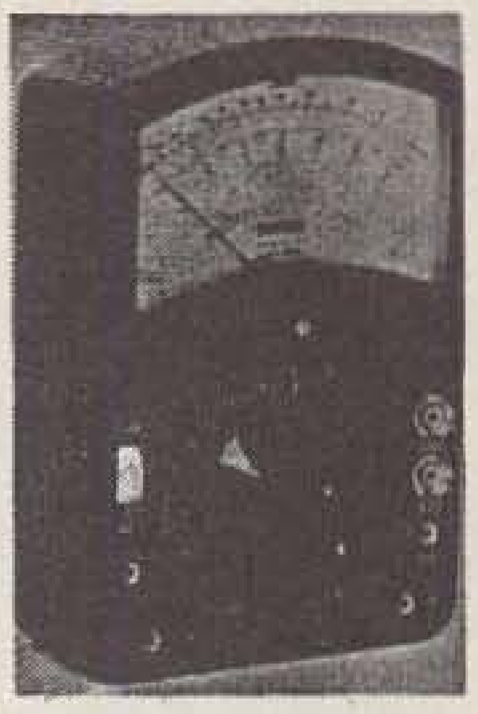
"HAM" BUERGER'S
October Specials . . .



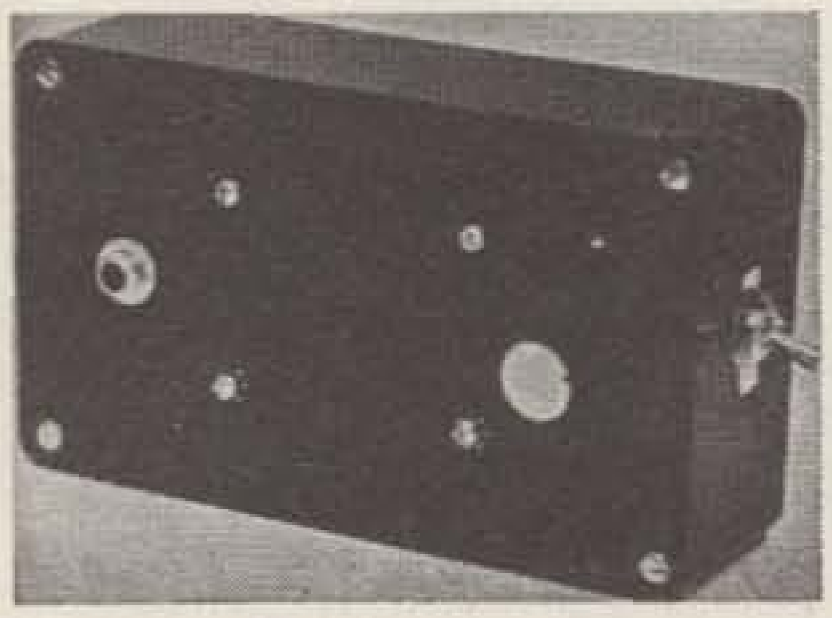
Astatic GD-104 desk type push-to-talk microphone and stand. Regular price **$51.20.**

Special price $25.00

Volt - Ohm - Milliammeter. 20,000 ohms per volt DC, 10,000 ohms per volt AC. DC voltages: 0-0.6-6-30-120-600-1200-3000-6000 V. AC voltages: 0-6-30-120-600-1200 V. Resistance: 0-6K-600K-6 meg-60 megohms (30-3K-30K-300K at center scale); plus DC current, dB and capacity. With leads and batteries. 6" H x 4" W x 1¾" D. Regular price **$19.95.**



Special price $12.95

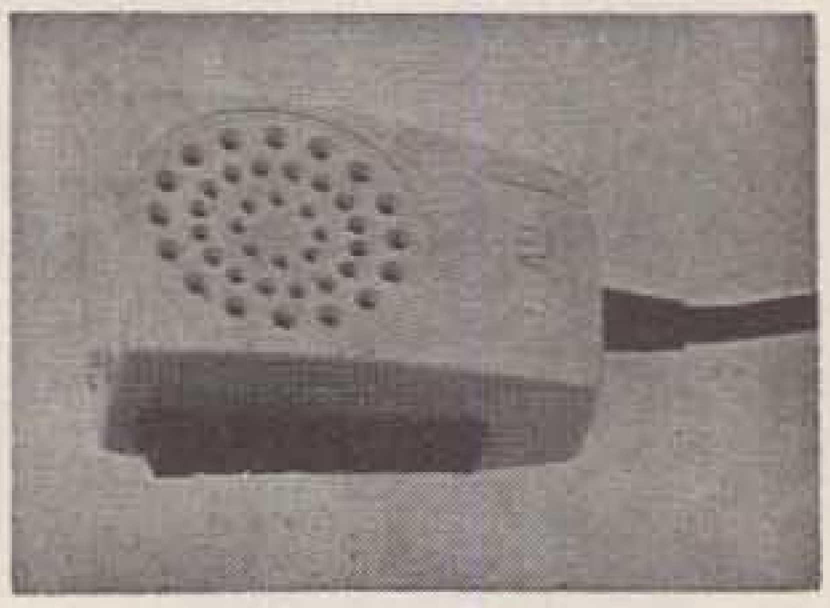


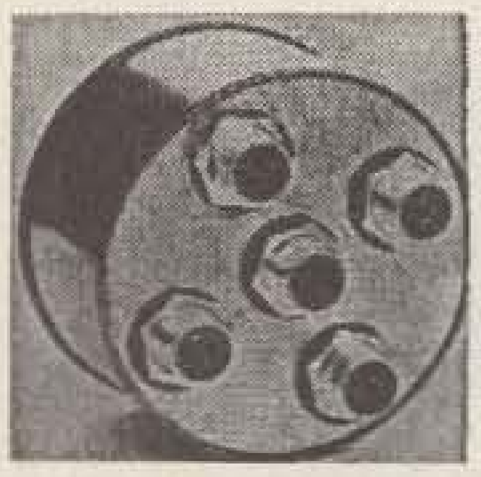
AJ-1 Audio Filter. Ideal for CW and SSB transceivers. Variable audio range. 28 dB down at 100 cps —peaks 200 cps. 4 ohm input and output impedance, built-in in and out switch. 6¼" L x 3¾" W x 2" D.

Special $7.95

Astatic mobile ceramic microphone. Super talk power. Regular price **$12.75.**
Special price

$6.50

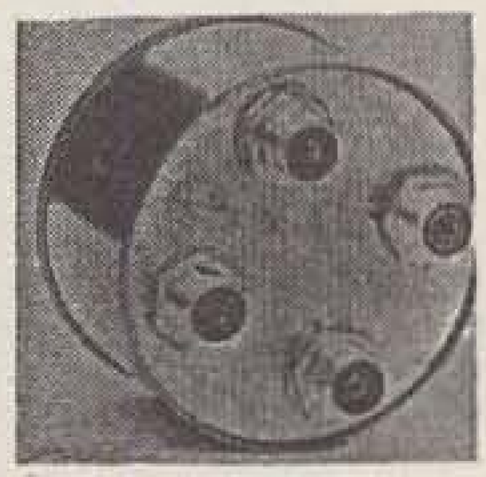




CO-4 4 Position Coaxial Antenna Switch. Uses low loss connectors and a ceramic switch. Complete with knob. Regular price **$9.95.**

Special price $6.95

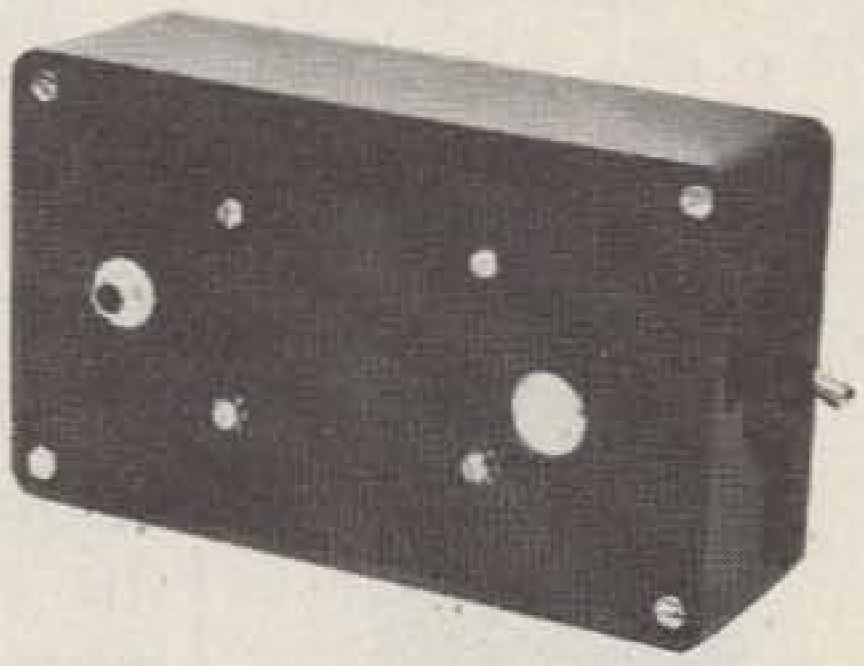
CO-2 2 Position Coaxial Antenna Switch. Same construction as the CO-4 switch to the left. Used for switching linear amplifier in and out of the antenna line. Regular price **$8.95.**



Special price $6.95

CW MONITOR and CODE PRACTICE OSCILLATOR

Solid state, 9.V battery, 2¼" speaker, variable tone, easy to connect. Complete with key jack and plug. A "MUST" FOR GOOD SENDING.



Specify cathode or grid block keying, or give model of your transmitter. Model CMO-K (cathode) and CMO-G (grid), each $7.95 PP.

HERE IS THE IDEAL WAY TO ACHIEVE GOOD, SNAPPY BREAK-IN OPERATION

All prices plus postage • Pa. residents add 5% state tax.

Open evenings — Monday, Wednesday, Friday; 9 AM to 9 PM.
Saturday, 9 AM through 5 PM.

"HAM" Buerger
Amateur Radio W3BAH

424 York Road • Jenkintown, Pa. 19046 • Phone 215-887-7350

Gus Browning W4BPD
RFD 1
Cordova, South Carolina

Gus: Part 30

Back to South Africa

After a brief visit in Capetown with my good friends Jack and Marge (ZS1OU and ZS1RM), I departed for Kroonstad, a fairly good sized city which is between Capetown and Johannesburg.

I was met at the station by my good friend Syd ZS4RM. I had mentioned to Syd on my first stop at his home some months previously, that I wanted him to put *my name* on one of those fine peach trees he had in his back yard. Luckily I did, because he had sold all the peaches on all the other trees except this one big, fine one that was loaded with the finest peaches I have ever seen anywhere. Syd and his wife took me out in his backyard and pointing at the tree, said, "they are yours, Gus". I spent some four or five days with them and I think I ate most of the peaches from that tree before I left. They made some very fine peach ice cream with some, made peach cobbler pies with some, many were used by just slicing them, covering them with sugar and then with fresh whipped cream—*man thats eating* high on the hog. I definitely say in all the world with the fine eating I have sampled here and there *nothing can touch fresh peaches and fresh cream* when they are put together.

One day Sid drove me over to the town of Welcome in his little car (I think it was a Volkswagon). Syd and the other ZS4 fellows I met while down in Welcome told me about this town. Just a few years before I visited the town, it was just a big, flat field, with very few trees in it, and the land where the town was built was a few very large farms. In some way they found that gold was down below the place and very deep mines were sunk. It turned out that the place was loaded with gold bearing rock at a very deep depth. I took a trip down one of these mines. I forget the exact depth but it was something like 7,500 foot straight down and I had a look see at how things were down there. Even with all the tremendous blowers and even air-conditioning in some, it was very warm down at that depth. They hauled the rock up after it was loosened by various means. At the surface, it was crushed and by some chemical process the gold was removed from the rock. Sitting on a small table, they had one of the gold bricks with a sign that said, "Its yours if you can pick it up with one hand, no sliding to the edge of the table permitted". Of course like many others I grabbed at it and let me tell you, I don't know what it's weight was, but I could not budge it from that table! Its size was somewhat smaller than a usual brick but it must have weighed 50 or so pounds. I sure could have used that "chunk" of gold.

The town of Welcome was laid out absolutely perfectly. Every street was a straight line, and all city blocks were perfectly square. The houses there were all brand new; each one air conditioned, beautiful lawns, and every house had a car in its front yard. The entire place had the smell of real prosperity. Everyone was very well dressed and had a very happy look on their face—it looked like a very fine place to work and live. It was one place that, if I was a young man looking for a place to settle down and live the rest of my life, I would have stayed. Sid and I drove all around the town and visited quite a few houses and hams, many of them real DXers. They all had some very fine rigs and most of them had either quads or yagis for antennas. These fellows all seemed to be making very good money on their jobs.

After spending a full day there, we drove back to Kroonstaad and had a real ball on the air with all the "Gus Watchers," telling them the date I expected to arrive at the next DX QTH. I even connected up my own rig and used it. Sid said it sure was great to be able to operate a real rig! He sure did love the feel of that rig I had and he thought the electronic key was great. It was made especially for me by my friend-W3KVQ/2—good old Ed. I have it in use at my home station now and it's still as good as it ever was. In fact it seems to improve with age!—but back to the story—

Time arrived for me to depart from Sid and those FB peaches. Sid was one of those fellows who went all out to make my stay at his home a highlight, and it was with regrets that I departed for Johannesburg.

I was met at the railway station by Lamberth, ZS6LM, who is just about one of the sharpest operators in ZS land, and a technician of the first magnitude. Lamberth had made all the arrangements for us to drive down to Basutoland (now its called Lesoto) and he had the license in order and all necessary permits fixed up for both of us. Now this fellow Lamberth was one of these thorough Dutchmen (used to be a PAØ, some years before moving to ZS land) and he had the check list all made out of what we were to take with us on this camp out DXpedition into Basutoland. Absolutely nothing was overlooked either, and we were prepared for any eventuality. Plenty of spare parts, plenty of food, a cook stove, canned goods, fresh fruit, plenty of spare Petrol & oil for the putt-putt (power plant) which I had brought back with me from my island stops at ZD9 and LH4 lands. The plant I had used all this time was a 1 KW Onin with shielded spark plug wire and to eliminate the last bit of spark noise, I had installed a 10,000 ohm, ½ watt resistor. This one was a 115 volt job and I could get up to 4 hours from a gallon of gasoline with it. It used about 1 quart of #20 motor oil to every 30 gallons of gas. I would take the same plant again, I think. I had tried my very best to buy one of these new very small, light weight plants that has magnets and uses no brushes, but I could never get them to, lets call it "play ball" and sell it to me at what I thought a good price. Maybe if there is another trip I will have better luck with them. It would have been very nice to have used a smaller plant and saved lots on "surplus baggage" charges all along the way. Don't ever think, fellows, it's easy traveling all over the world with 3 suit cases full of radio gear and a wooden box with a power plant in it with a *very thin pocketbook* and not in a good financial position to pass out large tips to the various red caps you need at every stop. And then there were those Customs boys to deal with. This along with sometimes as much as 100 rolls of color 35mm film and two cameras to "explain" to them. After months and months of this, you get to the point where you don't even worry about it any more. I had many different stories to tell the Custom boys usually no two of them were ever the same; and you must remember at some stops, the Custom fellows could not even speak English.

Like I said quite a few lines back, here I was at the home of ZS6LM getting ready to go along with him over into Basutoland (ZS8). We had a small trailer attached to the rear of Lamberth's car. This was a small one and every single item was packed in it. I don't think there was enough room left for a flea to get in. That fellow Lamberth really knew how to pack a trailer. Then a large canvas cover was wrapped around it so that if it rained nothing could get wet.

Lamberth spoke fairly good English and just a little of the South African tongue called Africaans. The further we got away from Johannesburg, the less and less the local people could understand English—but Lamberth said they were just putting this act on, that they could understand and speak English OK but were just hard headed and did not want to use that tongue because their feelings at that time were not too good towards England. The trip from Johannesburg to ZS8 land took us from about 4 AM in the morning to about 5 PM that afternoon. There were good roads all the way up to the border of ZS8, a very rocky, mountainous looking sort of country, strictly run by their natives, policeman, customs officials and all. At least they spoke and understood English. The last hundred or so miles, no one at any of our stops along the way could understand or speak English, or thats what they indicated to us. This did not make either Lamberth or me very happy. It was very difficult to convey to them that we even wanted a cup of coffee and gasoline for the car.

The customs and immigration stop at the border of ZS8 was very brief and we were treated very nicely. They did not try to cause us any delay at all. We drove thru Maseru some 10 or 15 miles into the country, around a few small hills and mountains, turned off on a side road and found a small lake with a beautiful grassy spot under some high trees, an ideal spot for our operating position. We stopped and got out the car and walked all over the place looking up at the tall FB trees to support our antennas, etc. Then we drove back to Masuru, to hunt up the Government Officials, police dept., security dept, army, etc., to tell them why we were down there and what we wanted to do. In a few hours we were cleared to operate. We explained to them where we wanted to operate from, telling them exactly where the nice little lakefront was. We found that this was Government property and after locating the right officials we were given permission to stay and operate from that spot. We stopped at a sort of grocery store/bakery and bought a few loaves of bread (hard as a rock and just as heavy too!). Back to our little DXpedition QTH we drove, and by doing a lot of rushing we managed to get our tent erected before nightfall. After nightfall, it was us and the mosquitoes, but when we got our netting over the beds in place the QRM from them ceased. We were dead tired so had no trouble getting to sleep that night. In the distance we could hear a few lions roaring and many other strange sounds eminating from the jungle which was some few miles away from us.

We were up early the next morning and I was raring to get an antenna up and to get on the air! We found the trees impossible to climb, the first limbs on them being out of our reach. But, while we were trying to figure a way to get our antennas up in the tops of the higher ones, two natives came past, an old man and probably his young son. The old man looked as if he was about 60 and the younger one about 20 years old. Lamberth hailed them and asked them if they could climb these trees. Neither of them could understand. He then tried in his beat-up Africaans language and the old man could sort of halfway understand this, but the youngest one could *not*! After a little explaining the younger man agreed to climb the trees for us. This was a very interesting antenna installation fellows. I would tell Lamberth, he would translate what I said into Africaan, and give it to the old man, the old man would then translate this into the Basuto tongue. To this day I am quite sure the final message to the fellow up the tree installing the antennas was never the message I gave to Lamberth! Something was lost along the way I am sure. After about 6 or 7 hours of yelling back and forth we finally ended up with my Hy-Gain model 14AVQ vertical up in the very top of the tallest tree some 75 to 80 feet from the ground—a very FB antenna we had there, fellers. Then we put up our 80 meter halfwave dipole between the next two tallest trees, some 70 feet or so above the ground. We were all set for a very fine DXpedition operation. The power plant was set up 500 ft. away at the end of two 250 foot extension cords attached together. These two #12 wire extension cords saw me all around the world and came in very handy many times so as to be able to get the power plant a good distance away from the operating position. This was about 3PM in the afternoon, I let Lamberth have the first go at the rig, while I sacked up (I wanted to be well rested for my turn!). Lamberth stayed with it for about 3 hours, turning the rig over to me just about sundown—which we all know is a good time to be on the air from anywhere in the world. With our all band capability some band was open all the time except from about 4 to 5 AM, which I had found was a bad time to try operating from almost any point on the globe. But, right now, I would think many bands would be open all night long with the FB sunspots we now have with us. The sunspots were very close to their minimum 11 year count when I was on this one trip, so I could not depend on much help from ole Sol. But even with the Sun spots against us we had a very fine DXpedition operation from ZS8 land. At that time Basutoland was on the rare country list and many fellows needed it for a new one. Specially on the lower frequencies. To be honest, fellows—"we had a ball there". Being on a DXpedition with a specialist like Lamberth was a real treat to me. We never had any trouble with both of us wanting to do the operating at the same time. Lamberth was more than fair in our operating schedules—a fine fellow to be with on a DXpedition. It doesn't always work out like this when more than one operator is on a DXpedition, I am sorry to say. The 5 or so days we stayed there passed all too swiftly, but the day to depart always arrives. We had to find the same two fellows who had installed the antennas to take them down. This was no trouble since they lived nearby and like many others around there they were not working anywhere so they were at home and gladly assisted us in the antenna removal. This was a lot easier than erecting them, I am glad to say. Every day while we were down there, we drove to town to pick up something to eat and to get our watertank filled with fresh water. There were plenty of nice oranges, mangos, apauas, grapes, melons there as well as very fine bananas at very cheap prices.

Canned sardines could be found at the local store at a very *high price,* I hate to say. We ate plenty of these but not because I liked them, only because that was all to be found in the eating line. Sometimes you try eating just oil sardines and very hard, dry, brittle, stale bread three times a day! Then you will be glad to fill your stomach up with fresh fruit and this is exactly what I did each day. I would estimate I ate about 35 oranges and 25 bananas each day and maybe 3 small sardines and 3 slices of that doggoned bread. I did not look forward to our mealtime I am sorry to say.

We of course drank plenty of coffee, and Lamberth liked it very strong which did not please me at all and there was no instant coffee on this DXpedition. We departed from Basutoland after what I called a very fine operation, I at the moment have forgotten how many stations we actually worked, seems like about 4,700 QSO's as near as I can remember which is not too bad considering the rotten sun-spot activity—BOY it sure would have been great to be there with the bands like they are now—its hard to say how many QSO's a fellow could have if he could stick with it all night long, every night for 5 or 6 nights solid. Maybe one of these days I might get to find out how this would work out—a feller can't ever tell what will happen in the future you know!

We drove back to Johannesburg, arriving there late that night. The next few days was spent in and around the town visiting the various DXers thereabouts and finding that they all were very well equipped with nice rigs and FB beams mostly. I even got to visit a few gold mines there too, quite interesting these gold mines BUT you can be sure they don't give you any samples of their product. That earth down under Johannesburg must be loaded with gold, I have no idea as to how many Gold mines there are in and around that town. All too soon, time arrived to depart for the east coast city of Durban where the fellows were QRX to have an eye-ball QSO with me. Again it was via train—those fine luxurous trains of South Africa will spoil a fellow. They are as smooth as silk, very quiet, with delicious food at very reasonable prices, too. Much different from the trains in the USA, I hate to say.—more next month fellers.

. . . W4BPD

de W2NSD

never say die

Satellites

When you live almost totally immersed in ham radio, as I do, there is a tendency to keep a crystal ball at hand for occasional checking for portents of the future.

The other day I swung around from a nice chat on 20M with a movie photographer out in Hollywood and looked into the ball. Actually, since those real crystal balls are so expensive, I've made do with the world globe we advertise. I just throw my eyes out of focus a little. I'm thrifty. Well, anyway, there, staring back at me, was another ball. I threw my eyes a little further out of focus, which I find is a lot easier to do these days than it was ten years or so ago. Actually, it is getting harder to keep them in focus now days.

As George Floyd W2RYT/4 would say, "Holy Sacramento!" There was a satellite.

The more I find out about the satellites, the more I am convinced that these are the best thing to come along for amateur radio. Not that we will be using them ourselves in any future that I can see, other than an occasional little Oscar attempt. This would take a national effort and, as far as I know, we have no national society capable of anything creative like that.

When you consider that one single satellite could replace all of the long-lines in our country you can see that it can't be very long before we step into this possible future. The FCC is embroiled in this right now and it is going to get nothing but worse for them. This probably has a lot to do with the almost complete lack of their attention that we got on the ARRL incentive licensing proposition. Obviously they took the easy way out and went along with the pressure from the League. If we don't learn to try to control our own future we are going to be on the dirty end of a lot more sticks.

The FCC is wrestling with the problems posed by CATV. A couple satellites broadcasting television on all channels would put every CATV right out of business. It would also probably put every land-based television station out of business too. There are a lot of commercial interests that can get hurt unless they move now to meet the future and find some solution to the coming era. The public has everything to gain. If we have a choice of fifty or one hundred different television channels instead of the present two or three that are available in a great many areas of the country we may get a little more from the slavery to ratings and developed programs for special interest groups. I imagine that we will have a good supply of educational shows. I hope so.

Ma Bell will be able to get all that copper back that she is now using for outside wires to our homes and offices. A small transceiver and a little dish on the roof will enable all phones to be connected via satellite to ground equipment for switching and back to satellite to be relayed. We should be able to have a telephone in our car and even in our shirt pocket, if we want. A unit the size of a pack of cigarettes should enable us to keep in touch with the world. What a thing to have in case of an accident anywhere . . . or even getting lost.

Radio channels would bring us instant news. There might even be different channels for different types of news. Another channel for time and weather announcements, etc. It could do away with watches.

Our great mail problem could be solved via satellite communications. Suppose that a small teleprinter type device were available which would type out the letter and also put it on tape. The tape "letter" could then be sent by satellite and automatically routed to the delivery printer. This should cost even less than our present postage. It would be almost instantaneous and letter exchanges could take place rapidly when desired.

Global television will probably do more to bring the world together than any other influence. The backward peoples will be able to be in contact with what is happening right at the moment all over the world. If the U. S. is first in global television we may well get a head start on teaching English to everyone in the world.

Satellites certainly will be far more efficient for all communications than any system we are using at present. As they come into use we will see those short-wave teleprinter signals disappearing. And they will be followed by the disappearance of short-wave broadcasting. It may not be very many years before we have the short waves all to ourselves again and can expand our bands back to where they were many years ago. Twenty meters used to run from 14,000 to 15,000 Hz, you know.

Calcutta

Within minutes of my arrival at the hotel in Calcutta VU2RF had located me. This took a bit of doing for I was a day late due to the changed airline schedules from Nepal. I had just time for a quick shower before RF, AJ and HK (VU2's) arrived to take me to dinner. We talked ham talk over the usual Indian curries. They had curried everything, meat, vegetables and potatoes. I think even the peach melba was curried, though it may have been residual. I like curry. Actually, I love curry, but this meal brought on a three day attack of super heartburn that you wouldn't believe. My digestive tract was almost completely destroyed.

My plane to Rangoon was supposed to leave about noon the next day but, having found most of my original reservations on the trip were flights that no longer existed, I checked into the situation upon arrival. Sure enough, my noon flight had been changed to 7:20 AM. And would I please be at the airline office at 5:40 tomorrow morning. I tried to explain to the lady that first of all this was a terrible time to run a flight. And second I wanted to know if the flight out of Rangoon had been changed too so I would be able to stop there. You see Burma is not at all anxious to have any visitors and the very best you can manage is a 24-hour visa. If you arrive in Burma more than 24 hours before your confirmed reservation out of the country they will not let you get off the plane. My flight just flew to Rangoon and then back to Calcutta, so if Royal Thai airlines hadn't changed the schedule out of Rangoon then I couldn't fly in the morning. She knew nothing about this. Royal Thai airlines has no offices in Calcutta so she told me to call SAS airlines, who handle Royal Thai.

SAS informed me that their office was closed and that if I would call after nine in the morning they would let me know about my reservations and the Royal Thai flights. Lady, I'll be on my way to Rangoon by nine. Sorry sir. Oh well, nothing lost but a night's sleep and about two millimeters of ground off teeth.

At five in the morning I groggily checked out of the hotel . . . $4 for the room with air conditioning and shower . . . and stepped carefully over the people sleeping on the

VU2RF, VU2HK and VU2AJ in Calcutta, three nice fellows who made my visit particularly memorable.

sidewalk into a cab. The taxi fare to the airline office was 10¢, including tip. I reported in to Indian Airlines and found that my plane had been delayed until noon. Well that was good news. Back on the original schedule. I checked and found that my Royal Thai flight was still on schedule and that I would be able to visit Burma.

I went back to the hotel and slept a couple more hours before venturing out for some pictures and sightseeing. By then the thousands of people that I had seen sleeping on the streets were all up and away. A shoeshine man started following me, ignoring the obvious fact that my shoes had been perfectly shined by the hotel boy a few minutes earlier. He kept after me, whining, for several blocks, making my life miserable.

Calcutta is one of the few places in the world left where there are still large numbers of gin rickshaws in use. People . . . people . . . by the tens of thousands. What can I describe? The dried leaves they use instead of small paper bags for candy or cakes . . . the cobbler shops that are just a few square feet of the sidewalk . . . people washing at sidewalk pumps . . .the piece of rope tied to a lamp pole in front of a tobacco shop, lit on one end for customers to light their cigarettes . . . the little booths of the betel nut venders sitting at waist height with the leaves and evil-looking makings spread around them, the booths only about two feet deep.

In checking out of the hotel the second time the manager apologized for the airline letting me get up at five like that. He explained that the flight crew was stopping at the hotel too and that they had been told the night before that the flight was delayed and thus didn't have to get up at the crack of doom. That little bit of news would have saved me a sleepless night of worry.

There was another American on the bus to the airport with me. He was also going to Rangoon. Good deal, it was a lot more fun to have someone to talk things over with. At the airport Indian Airlines checked my visa carefully and rechecked the Royal Thai flight to make sure that they wouldn't get me down to Rangoon and then have to bring me back again. All ok. They explained that this was very unusual for normally, when their flight is on time, there are no flights out of Rangoon within 24 hours, so no one is able to go there to visit. It is only when a plane is very late that a connection can be made. They checked the visa of the other American and had some doubts about it. He tried to get the Burmese Consul on the phone, but coudn't manage it. He finally gave up and went back to Calcutta.

My plane left with just three passengers in the 60 seat plane, and two of us were Burmese. Lunch was served . . . small cardboard box with little waxed paper packages in it. There was a chicken leg, a curried croquet . . . I needed some curry about now . . . carrots and beans, fried potato, roll and butter, and for dessert a macaroon cake and banana. Orange squash to drink. I ate sparingly, remembering the interesting dinner I had had last night with RF, AJ, and HK. I'd give you their names, but Indians seem to go by their last names instead of their first names and it is easier to say RF than Rengarajan. You know, ham talk is ham talk anywhere . . . beams, rigs, DX, new circuits, expeditions, all that stuff. Put me with hams and I'll go on for days telling about the rare ones I used to work with my little Twin-Three beam . . . how many kilowatts some of the louder of the U. S. DX'ers are using, and such.

I did want to tell you about my fascinating visit to Burma this month, but I want to tell you all about that in detail, so I'll hold off and let you have the news next month. Perhaps you've noticed that you have heard absolutely nothing about what is going on in Burma in any magazine or newspaper. The fact of it is that Americans find it almost impossible to get into the country. I doubt if a newsman has been there in years. I read a lot . . . a very lot . . . and I've seen absolutely nothing about the situation there.

. . . W2NSD

WHY A NEW QUAD?

There are many desirable commercial quad designs available today. If you have ever considered a new antenna and debated the beam versus quad theory, you are undoubtedly aware of advantages of quads and their disadvantages as well. Our Reginair 321 Quad (3 bands, 2 elements, 1 feed line), announced in September, brings to Quad owners several new advantages. Before describing these, let me point out that a good quad should be quickly assembled and erected, without the tedious problem of adjusting stubs, traps, or baluns, and that when completed it should be mechanically rugged and stable for years of trouble free operation. Up to now the beam always led this argument. But no longer.

Imagine, if you will, a quad that will go together in one hour, that requires no tuning or adjustment of any kind, and that will present a flat response of less than 1:5 to 1 over the entire 10, 15, and 20 meter bands with one 52 ohm feed line! Remember too that there is positively no interaction between bands. When you operate on 20 there is no harmonic suck out from the 10 meter element.

Imagine a boomless quad—much less wind resistant, yet mechanically more reliable!

And now for the Reginair's philosophy. To achieve single feed line this Quad is designed so that the *electrical spacing* between driven element and reflector is the same on each band; a reality because of the unique boomless hub. The actual feed impedance of each element is 100 ohms. This is transformed to 50 ohms by a Q section of RG11/U cut for 21 mc. When matching only 2 to 1 the section works well over the octave from 14 to 28.

The problem of harmonic radiation from the 20 meter element was resolved by inserting a ¼ wave, 10 meter, shorted decoupling stub within the 20 meter driven element at the point of feed. The stub is made of RG8/U, the center conductor of which becomes part of the antenna loop.

The boomless hub is actually a 3½" thick wall aluminum tube, 8" long, machined in such a way as to serve as the anchorage for both the masting and the aluminum tubing which in turn holds the hardwood dowels in place.

The major specifications are:

1. Full band coverage on 10, 15, and 20 with less than 1:5 VSWR
2. Maximum of 4.5 square feet wind resistance
3. Turning radius is 9½ feet
4. Front to back ratio, 25 db across each band
5. Forward gain, 8½ db
6. Net weight, 35 lbs; gross shipping weight, 60 lbs.
7. Feed impedance, 52 ohms (RG8)
8. Power limitation, 2 kw PEP
9. Net price F.O.B. Harvard, Mass., $69.95

Here is a unique new Quad, pre-eminent in design, that not only works well, but will last and last, and yet can be installed in minimum time and with no tune up. Remember, there is nothing you can spend money on that will produce such dynamic change as a good antenna. Put up your Quad now while DX is so good!

HERBERT W. GORDON COMPANY

Woodchuck Hill Road

Harvard, Massachusetts 01451

"Helping Hams to Help Themselves"

AN UNUSUAL OFFER

Hams visiting me are invariably impressed when I demonstrate my station. It consists of a National NCX-5 with a BTI Linear. The results are pure pleasure. Just about every station called is worked—no matter where they are located. Obviously my antenna system has a great deal to do with my results, but whereas I have a choice of all transceivers, why do I use the National NCX-5?

In a few words—because I like its performance, and its conveniently thought-out controls. Greater flexibility and ease of operation, especially in contents or when the going gets rough.

When your signal is the dominant one, and when the DX is vying with each other to try to work you, they haven't the time and sometimes the means to exactly zero beat you. Maybe they are only 100 cycles away or perhaps its 2 Kc from where you are transmitting. With most transceivers you would be lost as far as these contacts are concerned, for you wouldn't want to constantly change your transmitted frequency. The NCX-5 has incremental tuning which permits up to plus or minus 5 KC of vernier tuning.

Next in importance to me is the ability to read frequency precisely and to an order of 100 cycles. In most products you only guess at up to ±3 KC.

Did you ever handle traffic? Notice how often it is necessary to go on the opposite sideband for copy while the Net continues along. The NCX-5 provides opposite sideband operation.

For Round-table SSB work Vox is most useful. Does your transceiver offer Vox? The National NCX-5 does—and it is a darned good one, too.

Suppose you want to operate CW. Do you have to switch your transceiver every time you listen or every time you send. The National NCX-5 offers automatic break-in CW. To my knowledge, it is the only set that does this.

I could go on and on. Suffice for me to say that this model set has been debugged, is very, very practical for me to use—and should therefore be for you, too.

Now, here is the deal. I will sell you the latest Mark II version—factory fresh NCX-5, at $549.00. Its matching console speaker and supply is $110.00. A companion VFO with the same digital read-out sells for $250.00. Add these up—they total 909 bucks. My special price for the three pieces—all with a 1 year guarantee—is but $750.00, delivered free to the 48 states. The bargain applies to all three pieces; in effect, you are saving $150.00 on the companion VFO.

Here is the height of deluxe ham radio operation, at a price you can afford. Terms to those deserving them—trade-ins, too.

HERBERT W. GORDON COMPANY

Woodchuck Hill Road

Harvard, Massachusetts 01451

"Helping Hams to Help Themselves"

MEAT AND POTATOES AND SOMETHING CALLED VALUE

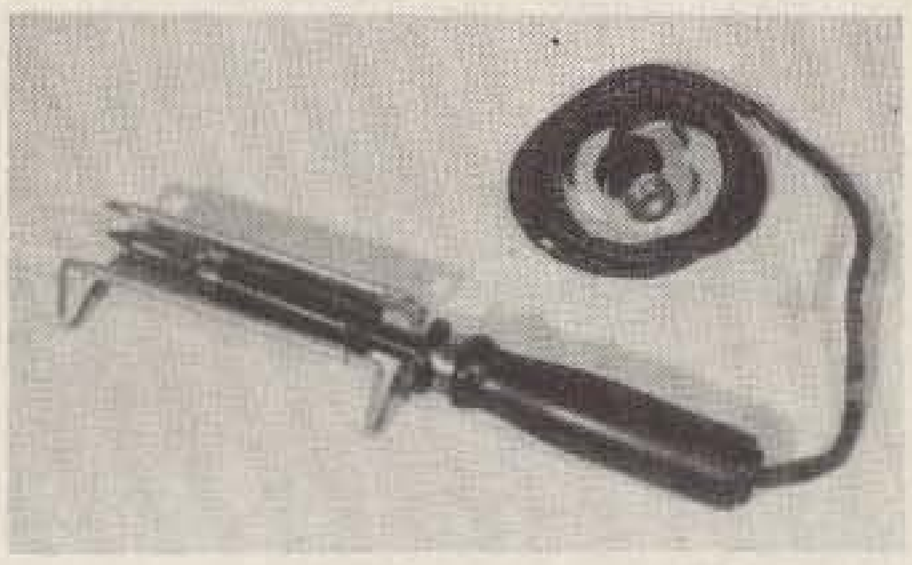
I am always on the lookout for electronic components or assemblies which possess potential ham value. I have also been interested in any item which makes it possible for more hams to enjoy sideband. You can, therefore, understand how happy I was when on a recent western trip I found one lot of 225 watt core power transformers and in another area a batch of computer grade electrolytic condensers. Immediately, I felt that we could put out a darned good universal transceiver power supply and when I got back, the boys in the shop confirmed this.

I say universal because with two of these power transformers and two 500 mil chokes, 12 diodes, assorted resistors and other components, we were able to make up a supply which met the requirements of the latest Swan, Collins, Drake, Hallicrafters, Heath, and National transceivers. Talk about value! We can offer this complete assortment of parts including a 16 gauge steel chassis and bottom plate, a good PM speaker and mating plugs for your particular transceiver for just \$50. The transformers in this set weigh 17 lbs. and altogether the completed supply will weigh close to 40 lbs. This is what I call meat and potatoes. The filtering is excellent; the regulation is extremely good, and we have schematics and a printed story to be supplied with each kit, giving detailed information as to how to make the connections for your own rig. You will have to tell us what model you own.

This is what the power supply will do:
800-1000 V at up to 400 mils on peak
285-320 V at up to 300 mils
bias of up to 125V at 100 mils
12V DC at 1 ampere
12.6V AC at 6.5 amps

Remember, this is an assembly of parts. We do not furnish a drilled chassis; we do not furnish the hardware; we do not furnish the solder and the wire but literally everything else is supplied.

Please allow for 45 lbs. shipping weight or otherwise be prepared to accept Railway Express or motor truck shipment.



AMERICAN BEAUTY 3138 100 watt SOLDERING IRON — \$4.95

This famous iron has been standard in our trade for over 25 years. It will operate year in and year out without failure for it is built like the proverbial battleship. Especially well balanced for heavy use. Heavy enough to solder a chassis and light enough for all general work. The soldering tip is iron plated which greatly reduces pitting and redressing and saves you time if you work with an iron all day long. The casing and body are of one-piece seamless steel. The shatter-proof wooden handle is coated with a durable rubberoid for personal handling comfort. Has a cooling baffle; uses an extra-flexible cord which withstands repeated kinking, and bending. Supplied with tip and stand. One of the most useful and best values I have ever offered. Absolutely new. \$12.50 value—my net is \$4.95. Allow postage for 2½ lbs. Only 275 available.

DON'T RUN OUT OF NUTS AND BOLTS

We have 500 boxes of ⅝" 6-32 thread nuts and bolts for \$1.95 a box. These are heavily plated steel oval head bolts with square nuts to match. Used all the time in ham construction projects. Each box weighs 3 lbs. Please allow for postage.

HERBERT W. GORDON COMPANY

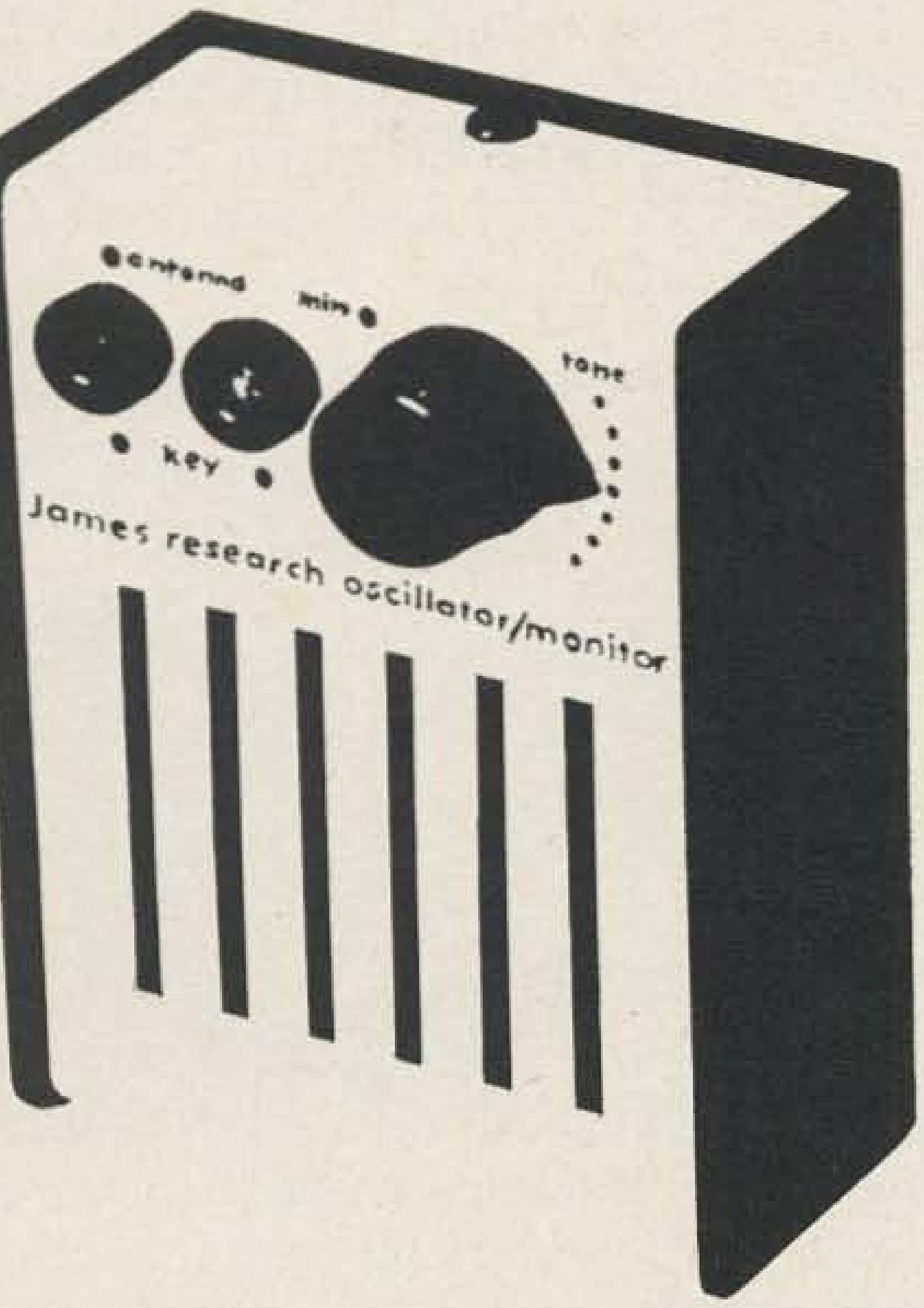
Woodchuck Hill Road

Harvard, Massachusetts 01451

"Helping Hams to Help Themselves"

NEW PRODUCTS

James Research Oscillator/Monitor



This unit can be used for many purposes. It is a broadband detector, coupled to a dc amplifier which triggers an audible tone oscillator and speaker for use as a DC oscillator/monitor. It will detect any rf power source of as little as 10 milliwatts without direct connection to the unit. The input detector will respond to any frequency between 100 kHz and 1000 MHz and a stiff wire pickup antenna of 8 inches in length is all that is required for most rf detection uses.

As a CW monitor the unit will work with any amateur transmitter and will provide a clean clear CW sidetone. As a code practice oscillator, the unit is self contained, has adjustable tone, and will work with any key, bug, or automatic keyer unit. As a general purpose rf detector, the unit will trigger either by direct connection to low level sources, or by proximity to higher level rf (10 milliwatts or higher).

As a circuit continuity or component tester, the unit will trigger from circuit resistances as high as 100 K with no damage to delicate components. As a semiconductor tester the unit will indicate polarity, type (germanium or silicon) and indicate whether good or bad.

Available from the factory for $12.95 including battery, postage and insurance. Write The James Research Company, 1111 Schermerhorn Street, Brooklyn, New York 11201.

Injectorall Alignment Tool Kit

Not only the presence of metal, but even nearness of fingers to high-frequency transformers can add enough body capacitance to make alignment inaccurate. The use of poorly designed alignment tools can make sweep response curves on a scope misleading. The Injectorall kit contains six alignment tools, all made of nylon which will flex without breaking.

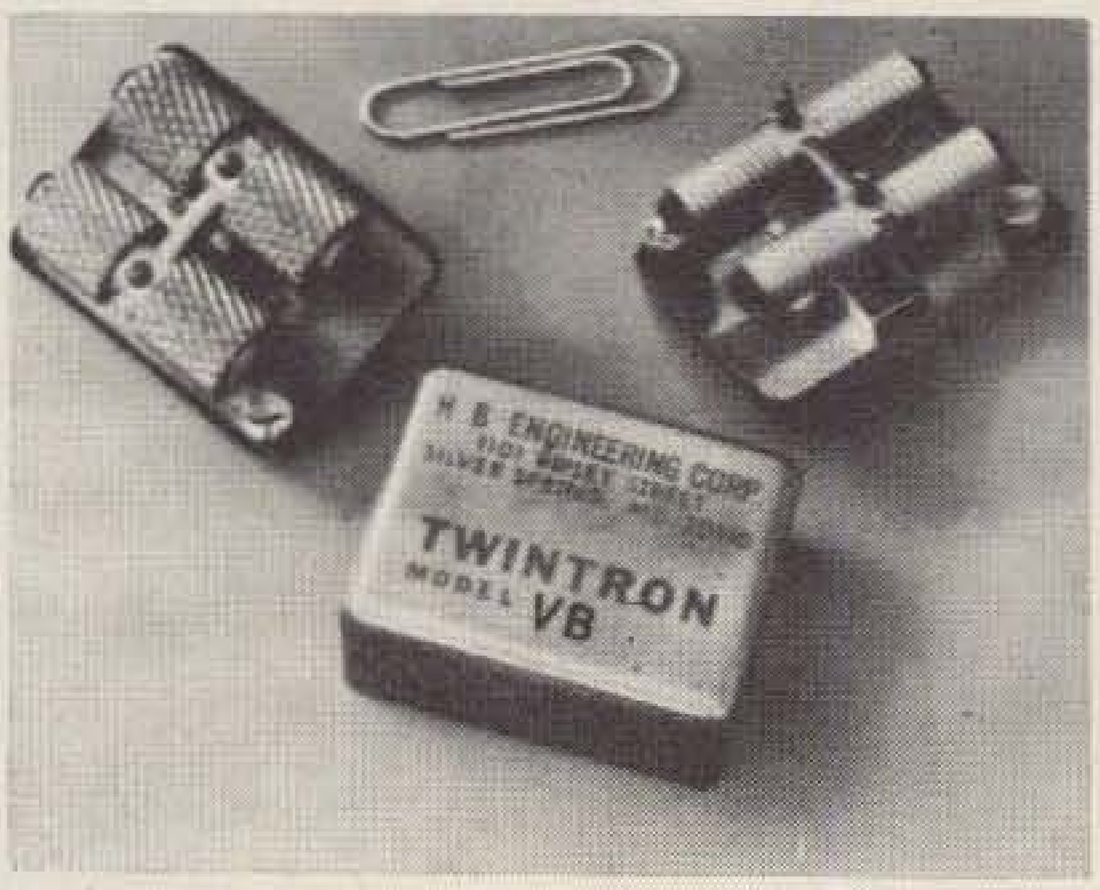
It contains two double ended .100" hex wrenches, 5 and 11 inches long for standard *if* transformers and coils; a 5 inch long alignment tool with both hex and screwdriver tips; a pair of tuner alignment tools, 7 and 12 inches long; and a double ended .075" hex wrench, 5 inches long for miniature transformers and coils. The kit costs $1.95 and should be an invaluable addition to any ham shack.

Get them at your local electronics parts distributor or write to the manufacturer, Injectorall Electronics Corporation, Great Neck, New York, 11024.

Pioneer 900

The Pioneer 900 is a tunable frequency shift converter which will accommodate any shift from 100 to 900 Hz. It has continuous tuning of shift range, permitting reception of stations using non-standard shift. The unit is completely solid state with 20 semiconductors and one integrated circuit. This unit uses a high-voltage keyer stage which will switch up to 300 volts. This high-voltage feature allows a full printing range to be obtained. The Pioneer 900 has a built-in bandpass filter, 250 Hz @ 6 dB selectivity per channel, complete metering, and consumes less than 10 watts. The input impedance is 4 ohms (others on request). The converter is normally packaged in a 5¾ inch high, 11¾ inch wide, 6¾ inch deep cabinet which is perforated. It is also available for rack mounting at a small additional cost. Price for the Amateur model is $189.50. For further information write Pioneer Electronics, 738 Pacific Street, San Luis Obispo, California 93401.

Twintron AF Resonator

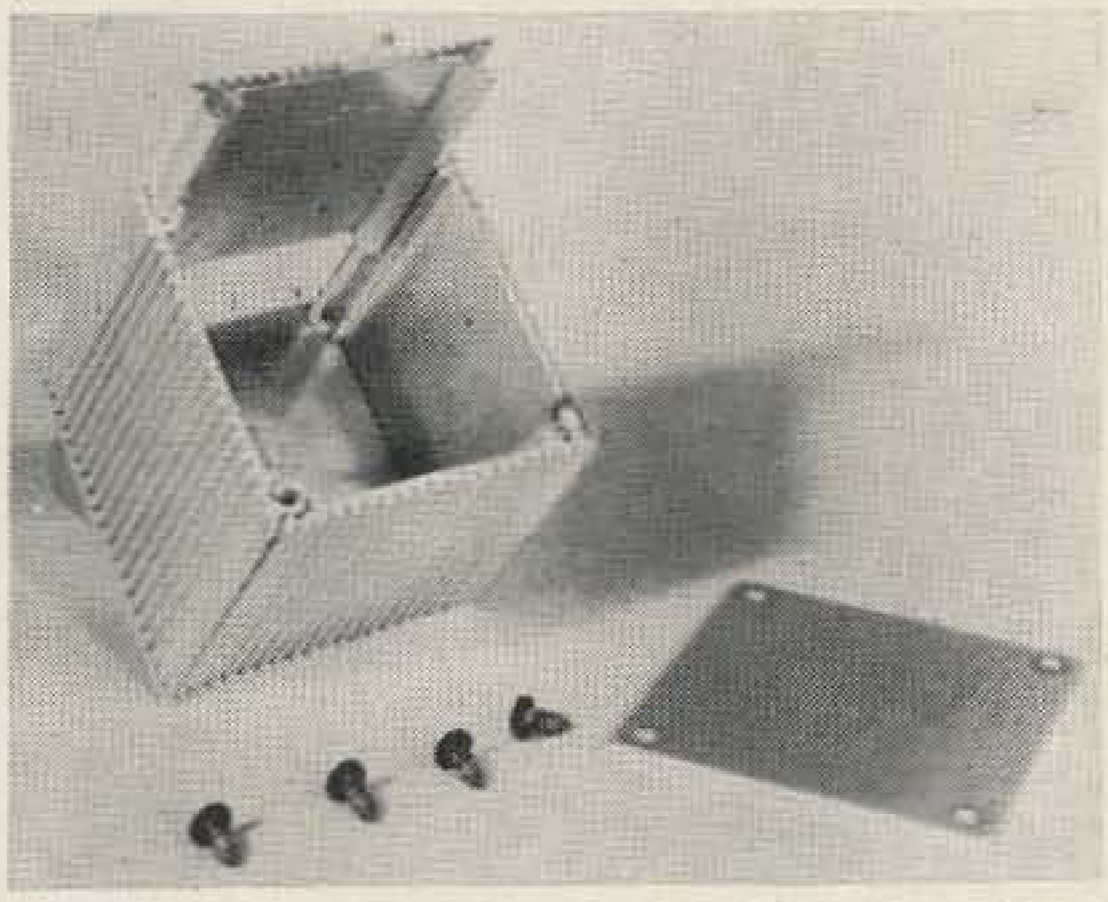


Here's a new device for electronics experimenters and builders of radio controls for model aircrafts and boats. It is a tunable, low-cost, electromechanical resonator, called the Twintron. The Twintron can be used in audio oscillator circuits, as a narrow band reject or pass filter and as a tone echo reflector.

This tiny resonator is inherently immune to shock, vibration and mounting position, and is insensitive to harmonics. It is available in three types for the following frequency ranges: 100-700 Hz, 300-3000 Hz, and 700-800 Hz. Each type is tunable to any frequency within it's range, where it will stay until retuned.

Experimenters can use these tunable Twintron resonators in electronic organ oscillator circuits, frequency-sensing devices, CB tone squelch encoders and decoders, fixed-frequency audio oscillators, as extremely selective band-stop and band-pass filters and in radio or wire remote controls. Specifications, application information and prices may be obtained by writing to HB Engineering Corporation, 1101 Ripley Street, Silver Spring, Maryland 20910.

Sarex Mini-Cool Enclosures



The Mini-Cool has literally hundreds of uses for radio amateurs, or anyone who wants to install or mount precision instruments with maximum protection and flexibility. These minature units are constructed to contain cable junction plug boxes, control modules, transformers, circuitry, solid-state devices, meters, and amateur radio gear. Easy drilling, testing, and assembly of components and servicing of circuitry is made possible by the six flat sides of the Mini-Cool, made of lightweight extruded aircraft aluminum alloy. A special feature is a clever lock joint at each corner, which tightens when the screw fasteners are installed.

At present twenty-one sizes are available ranging from 2 x 2 x 1½ to 2.6 x 2.6 x 10 inches and are available from your local electronics distributors.

Prosser Constant Output Alternator

A portable alternator capable of delivering a constant power output of 2500 watts @ 115 volts, with a frequency variation of only ±2.5 Hz has been announced by Prosser Industries, Inc. The model 2511A features an automatic transmission which compensates for input speed changes through 1800-3600 rpm to maintain a constant output of

3600 rpm when the alternator is under load. This feature makes it ideal for CW, RTTY, facsimile, and SSB. Since the clutch functions only when power is required, belt and bearing wear is minimized.

Dimensions of the constant output alternator, including the clutch housing, is only 17 x 17 x 8 inches; weight is 80 pounds. Excitation requirement is either 12 or 24 volts, making the alternator ideal for mobile use, or as a portable power plant when driven by an external engine. For additional information about the Model 2511A, write Prosser Industries, Inc., 900 East Bell Road, Anaheim, California.

Vector D. I. P. Plugbord

These plug-in circuit boards are 4½ Q 6½ inches, with an overall pre-punched grid of .041 holes on 0.1 inch centers, and have copper etched lines .070 inches wide running vertically on one side of the boards and horizontally on the other side.

These new D.I.P. Plugbords provide an easy, fast method of mounting integrated circuits for experimental, prototype, or ham equipment. To speed circuit construction, a line of accessories are available which include line-cutter tools which interrupt the copper lines, printed transparent layout sheets for planning circuit connections, and miniature push-in terminal pins for connection points.

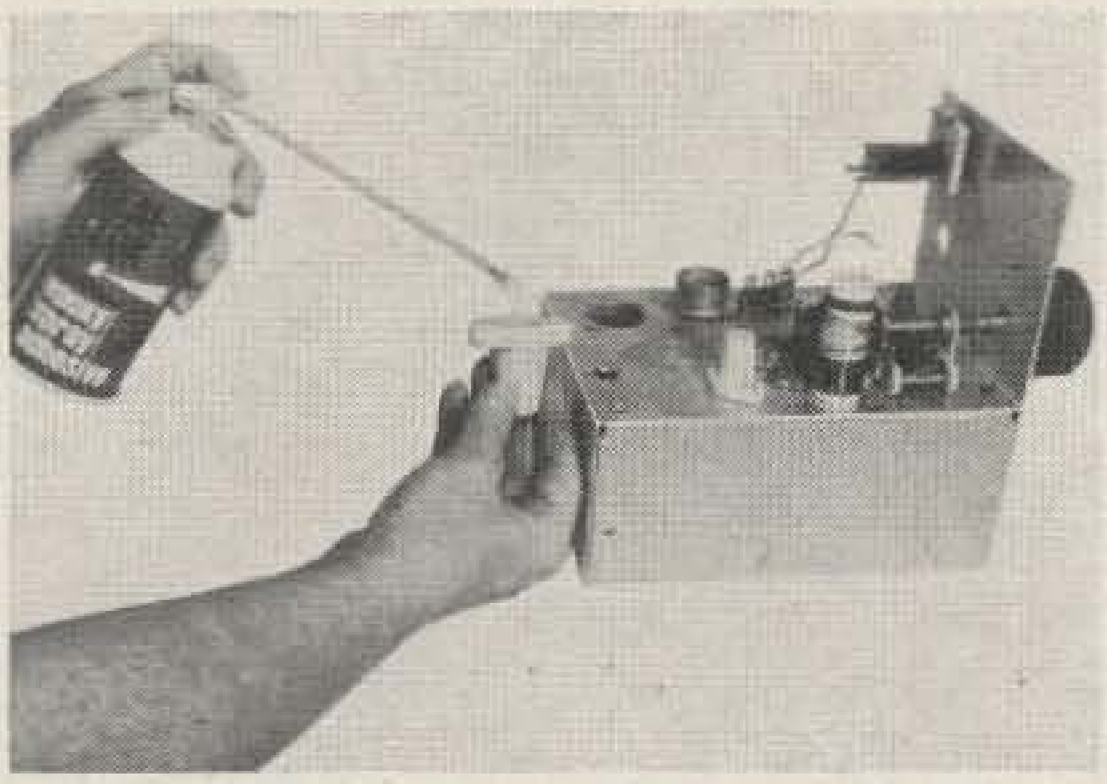
The board material is epoxy paper with two ounce copper etched patterns. Vector also supplies mating receptacles. Other accessories are available such as dual-in-line 14-pin sockets, with or without wire wrap contacts, for direct installation in board and terminals.

Boards may be ordered direct from the factory or through the firm's authorized distributors. Vector Electronic Co., Inc., 1100 Flower St., Glendale, California 91201.

Transceiver Auto-Mount

A simple, inexpensive auto-mount allows you to carry your transceiver in your car, safely belted in with operating controls within easy reach at knee height. It utilizes waste floor space over the drive shaft hump and is easy to install or remove. The Transceiver Auto-Mount retails for $7.95 postpaid. Satisfaction guaranteed or your money back. If you have any further questions, write to Arco Mfg. Co., Box 817, Grand Forks, North Dakota 58201.

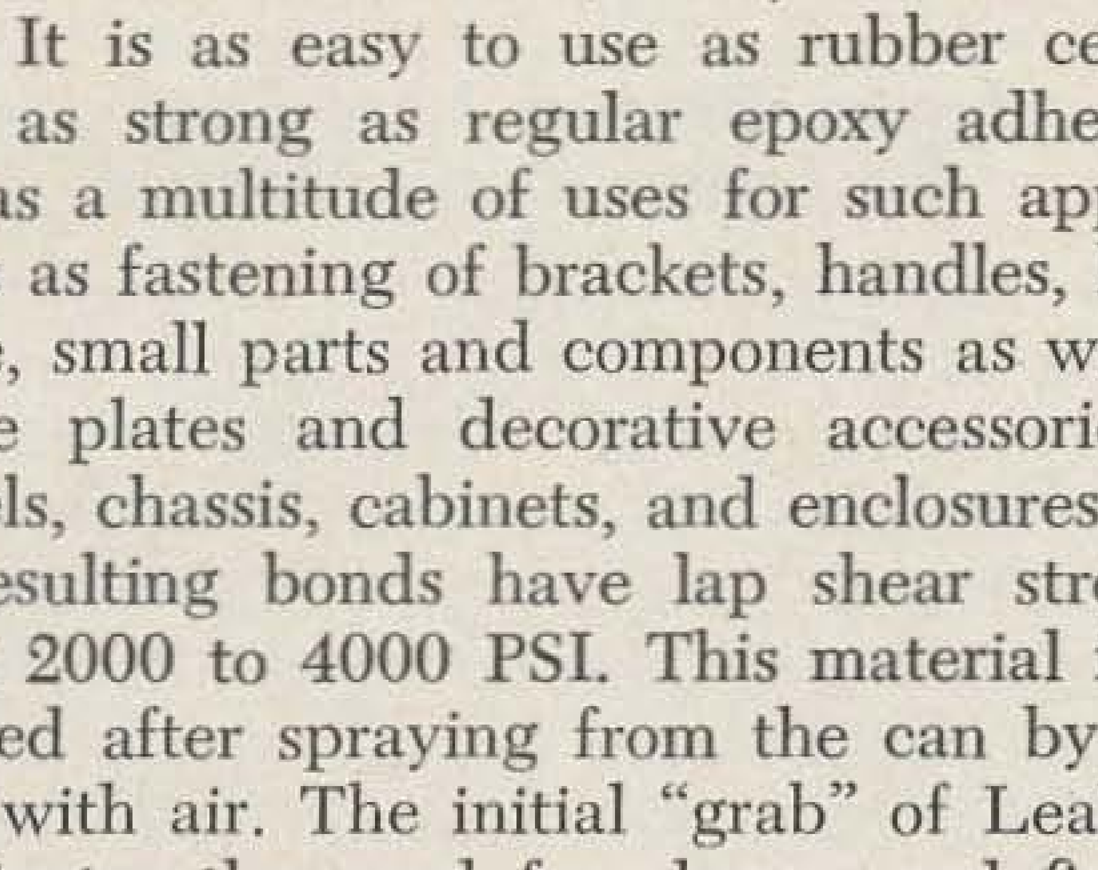
Leal-Lok Epoxy Spray



Leal-Lok is a one part material, supplied in 6-ounce aerosol cans, ready for immediate use. It is as easy to use as rubber cement and as strong as regular epoxy adhesives. It has a multitude of uses for such applications as fastening of brackets, handles, hardware, small parts and components as well as name plates and decorative accessories to panels, chassis, cabinets, and enclosures.

Resulting bonds have lap shear strength from 2000 to 4000 PSI. This material is activated after spraying from the can by contact with air. The initial "grab" of Leal-Lok eliminates the need for clamps and fixtures for most applications. Curing takes 8 to 16 hours to develop full joint strength. Literature and prices on this product are available from Leal Company, Box 53, Oaklyn, New Jersey 08107.

Cornell-Dubilier TMD5 and TMD6



A smaller ceramic capacitor, with high stability, closer tolerance, and a higher capacitance per unit volume., than any previously designed is now available from Cornell-Dubilier Electronics.

Types TMD5 and TMD6, phenolic coated with radial lead construction were designed to meet the requirements of rugged handling experienced under conventional assembly methods. These stable units are ideally suited for conventional or printed wiring assemblies in tuned circuits, delay lines, and filter circuits.

Standard ratings are available from 10 pF to a new high of 100,000 pF. Type TMD5 and TMD6 dipped ceramic capacitors are manufactured at the CDE "clean-room" facility at Norwood, Massachusetts, under carefully monitored and exacting quality control standards for highest reliability.

For more information contact Marketing Services Department Cornell-Dubilier Electronics, 50 Paris Street, Newark, New Jersey 07101.

Epoxy-Dipped Low-Cost Tantalum Capacitors

JFD Electronics Company Components Division is now offering a broad line of epoxy protected solid tantalum capacitors at a price below that of metal-cased types. These miniature, bead-type units, offer better performance, take up much less space and give considerable overall savings in circuit size relative to aluminum foil electrolytics.

The JFD "Stangard" capacitor series is made of sintered tantalum with a tantalum pentoxide dielectric. Capacitance values are available in ranges from 0.1 to 50 mfd with a tolerance of −20% to 50%. Physically, these units range from 0.2 to 0.28 inches in diameter by 0.3 to 0.38 inches in length.

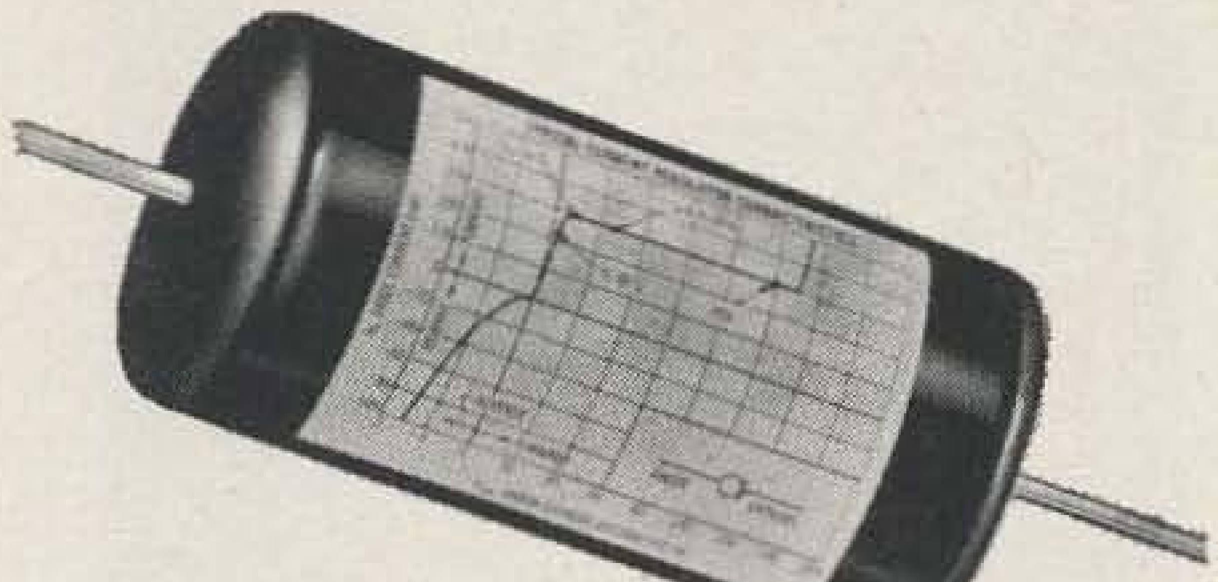
Write to JFD Electronics Company, Components Division, 15th Avenue at 62nd Street, Brooklyn, New York 11219, for the name of your nearest distributor.

Caslon Digital Clock Movement

The ROPAT company wishes to announce the availability of the Caslon Digital Clock Movement. The Caslon utilizes a unique split card read-out feature, combined with a silent, completely enclosed gear box designed for many years of trouble free operation. The movement is available with pilot light and for operation on either 110 or 220 Vac; 50 and 60 Hz operation is provided and all electrical parts are U.L. approved.

This movement makes an excellent addition to TV, radio, transmitters, and any equipment utilizing a built-in clock. For further information contact ROPAT Company, 5557 Centinella Blvd., Los Angeles 66, California.

Motorola Field-Effect Current Regulating Diodes



A new series of current regulating diodes covering the current range from 0.22 to 4.7 mA with 32 devices is now available from Motorola Semiconductor Products, Inc.

The 1N5283 through 1N5314 current regulators are field-effect diodes which establish a constant current flow independent of voltage—the analog of a zener diode which provides a voltage independent of current.

These diodes are well adapted for use as a constant current source in differential amplifier circuits, ramp generators, transistor biasing, or as an active, high impedance load for high voltage-gain amplifiers.

The device current specifications have a ±10% tolerance, a peak operating voltage of 100 volts, 600 mW power dissipation, and is in an hermetically sealed DO-7 glass package.

Further information and complete specifications are available from the Technical Information Center, Motorola Semiconductor Products Inc., Box 13408, Phoenix, Arizona 85002.

World's Smallest Cup Core

The world's smallest ferrite cup core has been developed by Indiana General Corp., Electronics Div., Keasbey, N. J. Its O.D. is 0.125 inches, ground to a 0.035 inch thickness. The main application will be in portable and vehicular communications where size reduction is a prime concern. Its small size allows the cup core to be used in integrated circuits of frequency synthesizers and *if* sections as radio frequency chokes and transformers.

Core material is IGC's Ferramic® Q2 ferrite which was chosen because of its good frequency response in the 10-65 MHz range and its relatively flat temperature coefficient range from −55°C to +125°C. In addition, Q2 has one of the highest Curie tempera-

Allied Radio 1968 Catalog

Allied's 1968 catalog lists thousands of products produced by hundreds of manufacturers. Listings include a wide variety of amateur equipment, kits, hi-fi components, CB equipment and accessories, public address and intercom equipment, test instruments, electronic test units and accessories for automobiles and motorcycles, small-screen television sets, radios and phonographs, weather instruments, semiconductors, antennas and accessorie, resistor, capacitors, transformers, relays and timers, switches, plugs and jacks, connectors, sockets, lamps, wire and cable, hardware and technical books.

The 1968 catalog 270 is available free on request from Allied Radio Corp., 100 N. Western Ave., Chicago, Illinois 60680.

101 More Ways to Use Your VOM and VTVM

Almost every amateur has a VOM or VTVM on his bench and this new book by Robert Middleton describes 101 ways to use them. These applications include many special uses that haven't previously appeared in print. There are chapters on testing household devices, test-equipment checks, circuit tests, component tests and special uses. Some of the more interesting tests described are determining input capacitance, checking oscillator calibration, measuring impedances of L- and T-pads, checking grid drive, measuring feedthrough in a neutralized rf amplifier, measuring the negative resistance of a semiconductor diode, ohmmeter tests for transistors and checking zener diodes. If you have a measurement that you can't find a way to make, it might be in this book. $2.95 from your electronic distributor, or write to Howard W. Sams & Co., Inc., 4300 West 62nd Street, Indianapolis, Indiana 46206.

Mahlon Loomis
Inventor of Radio

This biography, written by Thomas Appleby, is the delightful story of one of the forgotten men of radio. Loomis, a dentist in Washington, D. C., actually communicated by radio over a distance of about 18 miles in 1866! He duplicated his feat several times, and even formed a corporation, the Loomis Wireless Telegraph Company, in 1873. But, he was years ahead of his time. This, coupled with many financial reverses, prevented the company from getting on its feet.

The author has gone through a lot of research and the book reflects his work; it is well written and full of illustrations, many by Dr. Loomis himself. Limited edition $3.25 postpaid from Loomis Publications, P. O. Box 6318, Washington, D. C. 20015.

Ham's Spanish-English Manual

If you work many Latin-speaking countries in the course of your operating, here is a book that is a real aid. Written jointly by August Gabriel K4BZY and Juan Johannessen LU7FAG, it covers all phases of Spanish conversation used in amateur radio communication. It covers the normal types of conversation used in the course of a QSO plus Spanish phonetics, numbers, and alphabet. It also covers names and nicknames, nouns, verbs and a general vocabulary. According to the authors, with this manual and an additional study of the Spanish language, you can become proficient in speaking Spanish. All in all, a very useful manual for the DXer. Order from August Gabriel K4BZY, 1329 N. E. 4th Avenue, Fort Lauderdale, Florida 33304.

MF/HF Communications Antennas

The price of this excellent antenna book, reviewed in the September 1967 issue of 73 has been increased to $3.75. For your copy, order DCAG 330-175-1, Addendum No. 1, DCS Engineering Installation Standards Manual, MF/HF Communications Antennas from the Superintendent of Documents, Government Printing Office, Washington, D. C., 20402.

Letters

Incentive Licensing

Dear 73,

. . . All the incentive tripe in the world will not change human nature, especially ham nature. I could write a book on violations, bum signals, bad manners, and appliance operators, but why bother you

Now that FCC agrees with incentive, and has assigned frequencies for advance and extra operators, we will see how these 4710 extras stick to their places. And, we will see how many are caught with a foot switch.

Martin Hellman K2TAJ
Staten Island, New York

Dear 73,

I have been a General Class ham for more than ten years, and have worked all bands from 160 to 2 meters. Now after all that time, it seems very unfair to me to have almost one half of my operating frequencies taken away. I cannot see how the new licensing proposals will benefit me or anyone else. It will not take any more skill to tune up on 14.205 next year than it does now.

John V. Smith W4ACG
St. Petersburg, Florida

Dear 73,

I'm too new to know much about the pros and cons of Incentive licensing, but it looks like it is not all bad. It seems to me that it is going to give Novice ops an opportunity to perform a public service.

A lot of "Old Timers" have turned up in the Novice bands in the last week or so. Looks like they are looking to us "kids" for some practice in CW that they haven't used in ten years or more. I had one ask me to QRS. What a boost for my morale! You see, I've blown the CW test at FCC three times.

Robert W. Malmquist
Morris, Illinois

Dear 73,

As a Canadian studying like mad for my own ham ticket, I feel that our system is still better. It means a lot of hard work before we even get on the air, but the feeling of accomplishment is much greater and it is this, I'm sure, that carries you through to the advanced classification.

With your Novice License so easy, it is not much of an accomplishment to get one, no great feeling of doing something can only lead to boredom with the whole affair. Anticipation is still half the fun of getting anything, so don't rob your youngsters of this personal pride and great feeling.

F. B. Houghton
Vancouver, B. C., Canada

Poor Judy!

Dear 73,

Re J. D. Weaver's correction to Judy's antenna p. 109 October issue:

Where may I obtain one of those magical, mystifying, free floating, gravity defying pulleys that J. D. Weaver uses on his antenna? Seems to me that the pulley at the end of the antenna would permanently station itself on the bucket handle which would, I assume, not be the desired effect. Why not tie one end of a safety line to the bucket handle and the other end to a tree limb (using the antenna arrangement as originally shown). If the antenna should break the safety rope would suspend the bucket well above ground until repairs could be made.

John Stroup K7KBH
Cornwallis, Oregon

Dear 73,

Some of the letters which appear in your wonderful magazine can be downright interesting. I have in mind two letters which appear in the Ooctober 1967 issue; one from VK7RG in Australia mentions interest in anti-gravity projects, and the other from W7AAF/W8BGP who appears to have solved the problem of keeping an antenna up in the air with no visible means of support. These two old boys should get together. Take a look at that illustration on page 109 and see that there is nothing in evidence to keep the pulley from sliding down the rope which supports the bucket.

In order to make this set up practical, simply drop another line from a point in the tree 5 or more feet above the pulley and attach it to the pulley.

George H. Gabus WB2IJF
Downsville, New York

I agree that the antenna support certainly appears to be anti-gravity, but if you ran a test with the bucket rope tied off at an angle of about 30° from the vertical as shown in sketch, the antenna will not slip down to the bucket handle. It will stop at the point where it makes a 120° angle from the vertical—it's a simple matter of vectors. If you doubt it, try it!

Bouquets or otherwise

Dear 73,

One of the issues of your journal *73 magazine* came to my hand and I was really delighted by its contents. The articles about amateur technique are excellent as well as their illustrations and it is just a pity that your journal is, owing to lack of currency, not distributed in our country.

Zdenek Kvitek
Brno, Czechoslovakia

Dear 73,

I must congratulate you on the fine series of articles in *73* and the general upgrading of the magazine in the past months. The transistor and solid-state articles have been an eyeopener and speaking for many hams, I must say that you have done hamdom a world of good by opening the world of solid state.

Keep up the lucid series of articles you have been running in the magazine.

K. Nose KH6IJ
Honolulu, Hawaii

Dear 73,

Maybe you will tell me something. Why . . . . can't *CQ* or *QST* come up with as many good technical articles for the "poor" and "inexperienced" hams as you can? Until they do, I'll be subscribing to *73*.

Ray L. Mote, Jr. K5FKT/KP4
APO New York 09845

Dear 73,

I wouldn't have given 2¢ for your magazine until I talked to your rep at the Los Angeles Ambassador Hotel ARRL Convention . . . I was given a free September issue and read it. What an improvement! I am now awaiting the next issue.

R. E. Peebles, Jr. WB6VPY
Los Angeles, California

Dear 73,

After seeing a notice in a rival magazine noting it was the cheapest, I thought someone ought to note that a VW is cheaper than a Rolls-Royce.

Scott McCann W3MEO
Arnold, Maryland

Dear 73,

I refer to your writings in the June and September issues of 73, and in particular to the last paragraph of the article in the September issue.

From a trend which started in the late '50s, I know that it has grown more in vogue for the staff of amateur radio publications to launch into campaigns advocating the addition of this, or the elimination of that. The pattern is pretty obvious; good technical articles are, and will continue to be, more avidly sought for by the readers than the politics of the ham magazine. It seems that more and more, your readers are being tossed bones of contention rather than gems of wisdom.

I cannot seriously believe you, yourself, are convinced of the total validity of your arguments . . . If your goal has been to create dissention in one of the finest fraternities in the world, you have certainly succeeded.

F. A. Rodd K2BVS
Bayville, New Jersey

Dear 73,

. . . I am greatly pleased to see more and more technically oriented articles appearing in your magazine. I hope they will encourage amateurs to do more reading and building.

Robert L. Magill WA6MUG
Garden Grove, California

Dear 73,

I just finished reading your August issue of *73*. Very good.

I just passed my General in July, and as yet haven't received my ticked. After reading all of the letters written in, I was very pleased to see that you have a column in which we may express our feelings. But I hope that we hams don't sit around thinking about which is better; SSB or AM. We should have better things to do than sit around and gripe. Let's get in there on the frequencies and do some *good* for amateur radio itself.

Lee Hays WA5PPF
Abilene, Texas

Dear 73,

I would like to congratulate you on a presentation of excellent material in your August 1967 issue. I was especially happy to read the articles on transistor oscillators and toroids as I am currently engaged in building a very small FET-ized receiver.

A. R. Werback
China Lake, California

Dear 73,

Well, I never thought you guys would do it. I expected to hear from someone from New Hampshire skipping down to Rio with a hunk of cash. I'm talking about that back issue deal for a dollar a year. The last bundle came today amid quite a few grumbles from Sam, my postman, and his sore back. It's a good thing that all 57 issues didn't come at once. I've been up 'till 1:30 AM each night for the past five days reading the back goodies.

Tony Russomanno WB2YVU
Whippany, New Jersey

We lost money on every bundle, Tony, but we are making it up in volume!

Dear 73,

After having complained about late delivery and poor wrapping of *73*, I feel you deserve a good report when you have earned it. The September issue (1967 hi) arrived on August 24th, and the wrapper was so tough it was not even mussed! The circulation department has earned a commendation for their success in remedying the old problem.

Charles M. Cross WB6SWJ
Palo Alto, California

Dear 73,

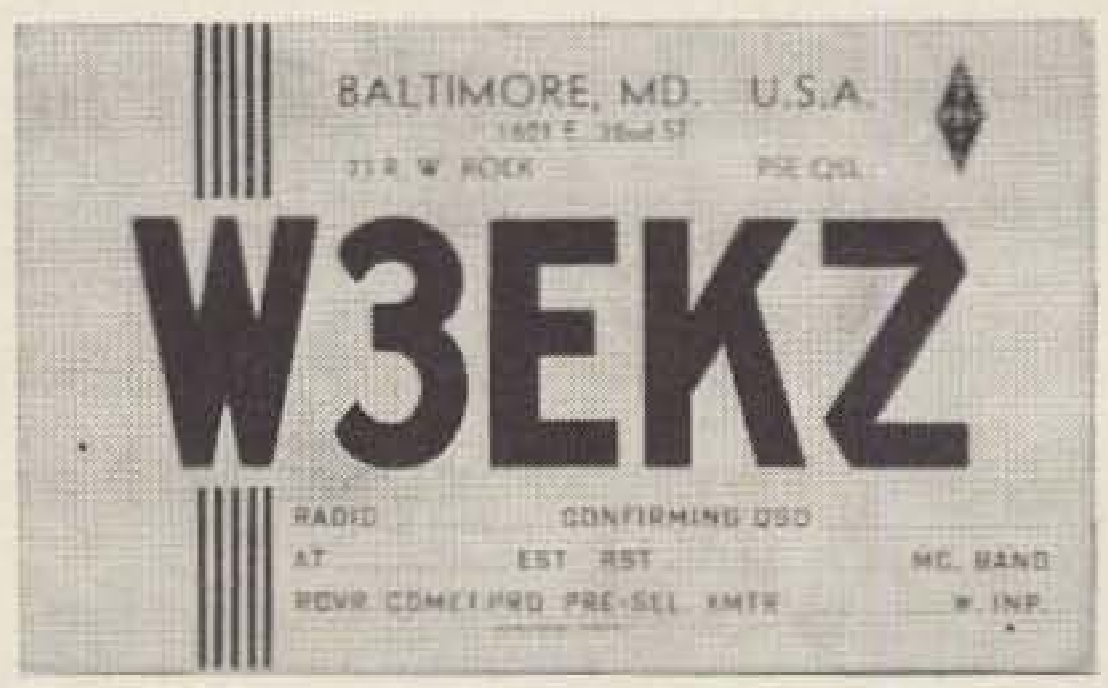
Last night I assembled the globe which came to me as a gift for two year subscription to 73. The assembly of the globe was easy, but what amazed me was that it was lighted and really up-to-date in all details . . . In my estimation, *73* magazine is hard to beat in the amateur radio world, and now your illustrated globe becomes a part of my Collins radio outfit. I hear the world, and now I "see" the world.

Syd Tymeson W3FL
Takoma Park, Maryland

Dear 73,

I just finished reading by September issue of 73 Magazine. I found all the articles very good and enjoyed one article, especially, because it couldn't have been more true. It was entitled "How to Be a Ham, By Really Trying". The author points out that most potential hams are too lazy to try to master the code. This is true . . . I went through the same thing when I started out, but once accomplished, it makes you feel good. For once in your life you have really done something. It sure helps if there is a ham in your neighborhood. Most every ham would walk a mile to help another fellow get started. If it wasn't for a local ham, I probably wouldn't be in the position that I am in now. I am grateful now, this hobby is really terrific . . . educationally and socially.

Werner G. Vavken WB6RAW
Pacifica, California



Dear 73,

Your article "World's Fair 1939" in the July issue of 73 brought back pleasant memories. Enclosed is my QSL, a duplicate of the one seen in picture on page 33, 5th from the top in the 7th row from the right. It is a little shop worn after 29 years.

I also have a W2USA Radio Operators Card signed by W2KU Oscar Oehmen and Walter Smith Jr. which I received to operate W2USA.

Raymond W. Rock W3EKZ
Whitemarsh, Maryland

Dear 73,

How your article, entitled "Torticollis and All that Jazz" will be received by the gentlemen of hamdom is debatable, yet I was thoroughly amused by its delightful similiarity to my own experiences.

As a novice, working only CW, I too find the OMs coming at me left and right, except for those regular friends I've made with repeated contacts . . . Since I have recently had that nail-biting experience of passing the general exam, as I await that big ticket. I wonder how closely my newly earned phone privileges will parallel those of Cheryl. I'm not a YL, but an XYL with three children, the youngest being about the age of Cheryl.

One additional frustrating thought to add to those of Cheryl's; when traveling, how nice it would be to stop and say "hi" to one of those particularly interesting contacts you've worked repeatedly, yet still be one of the "fellas on the air" in the eyes of his XYL. Conclusion . . . stay frustrated . . . don't!

Thank you for this entertaining article, so paralleling my own and possibly other YL and XYL experiences.

Penny Bonnema WN2ZNN
Towaco, New Jersey

Dear 73,

What goes with the YLs? As there are two articles in the same issue by "the weaker ? sex". It seems we now have no place to hide from your domination as we have been doing since the beginning of time. Hi. More power to you and let's have more articles.

Sam Moskowitz K3RTR
Upper Darby, Pennsylvania

Dear 73,

I thought you might like to know that we radio amateurs are still getting publicity via AM/FM radio. During the Fairbanks, Alaska flood recently, KTNT AM/FM carried taped communications between Dave Moran, a radio amateur who works for KTNT and two KL7 stations in Fairbanks during the two or three days the flood was at its worst. I monitored other stations in the area, but didn't hear radio amateurs mentioned at all.

Ralph Westgrund W7IJJ
Tacoma, Washington

Dear 73,

Last week I had the pleasure of having my antenna base installed by WA1DRO. Everything went FB. The best part was when the cement truck came along with the number 73. What luck! I immediately got my camera and snapped this picture. To add to my delight, his name was Jim.

Nat Cohen WN1HBX
Milton, Massachusetts

Dear 73,

This may be a first. I constructed an FET transmitter. It consisted of a Crystalonics CP651 in a Pierce crystal oscillator and a CP 650 amplifier. I worked WB2JKL on 40 meters. Field Effect transmitter supplied about 1 watt to the antenna. Is this the first FET transmitter contact? The distance was about 180 miles.

Ed Noll W3FQJ
Chalfont, Pennsylvania

Propagation Chart

DECEMBER 1967

ISSUED OCTOBER 8

J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7B	14	21	28	21
ARGENTINA	14	14	14	7A	7	7	14A	21	21	28	28	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14	21	21	21	21A
CANAL ZONE	14	7	7	7	7	7	14A	21	28	28	21	21
ENGLAND	7	7	7	7	7	7	14	21A	28	21	14	7
HAWAII	21	14	7	7	7	7	7	7B	14	21A	28	21A
INDIA	7	7	7B	7B	7B	7B	14	21	14	14	7B	7
JAPAN	14	7A	7B	7B	7	7	7	7	7B	7B	7B	14
MEXICO	14	7	7	7	7	7	7	14	21	21A	21	21
PHILIPPINES	14	14	7B	7B	7B	7B	7	7A	7B	7B	7B	14
PUERTO RICO	7A	7	7	7	7	7	14	21A	21A	21	21	14
SOUTH AFRICA	14	7A	7A	7B	7B	14	21	28	28	21	21	14
U. S. S. R.	7	7	7	7	7	7	14	21A	14	7B	7B	7
WEST COAST	21	14	7	7	7	7	7	14	21	28	28	21

CENTRAL UNITED STATES TO:

ALASKA	21	14	7	7	7	7	7	7	14	21	28	21A
ARGENTINA	14	14	14	14	7	7	14A	21	21	28	28	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14	21	21	21	21A
CANAL ZONE	14	7A	7	7	7	7	14	21	28	28	28	21
ENGLAND	7	7	7	7	7	7	14	21	21A	21	14	7
HAWAII	21	14	7	7	7	7	7	7	14	21A	28	28
INDIA	7	7	7B	7B	7B	7B	7B	14	14	7B	7B	7
JAPAN	21	14	7B	7B	7	7	7	7	7	7B	7B	14
MEXICO	14	14	7	7	7	7	7	14	14	21	21	14
PHILIPPINES	14A	14	7B	7B	7B	7B	7	7	7A	7A	7B	14
PUERTO RICO	14	7	7	7	7	7	14	21	21A	21	21	21
SOUTH AFRICA	14	7	7	7B	7B	7B	14A	21A	21A	21	21	21
U. S. S. R.	7	7	7	7	7	7	7B	14A	14	7B	7B	7B

WESTERN UNITED STATES TO:

ALASKA	21	14	7	7	7	7	7	7	7	14A	21A	28
ARGENTINA	21	14	14	7	7	7	14	21	21	28	28	28
AUSTRALIA	28	28	14A	14	14	7B	7B	7B	14	21	21	21
CANAL ZONE	21	14	7A	7	7	7	7	14A	28	28	28	28
ENGLAND	7B	7	7	7	7	7	7B	7B	14A	14	14	7B
HAWAII	28	21	14	14	7	7	7	7	14	21A	28	28
INDIA	7A	14	7A	7B	7B	* 7B	7B	7	7	7B	7B	7B
JAPAN	21A	21	14	7B	7	7	7	7	7	7B	7B	14A
MEXICO	14	7A	7	7	7	7	7	7	14	21	21	21
PHILIPPINES	21A	21	14	7B	7B	7	7	7	7A	7A	7B	14A
PUERTO RICO	14	14	7	7	7	7	7A	14A	21A	28	28	21
SOUTH AFRICA	14A	14	7B	7B	7B	7B	7B	14	21A	21A	21	21
U. S. S. R.	7B	7	7	7	7	7	7B	7B	14	7B	7B	7B
EAST COAST	21	14	7	7	7	7	7	14	21	28	28	21

A. Next higher frequency may be useful this hour.

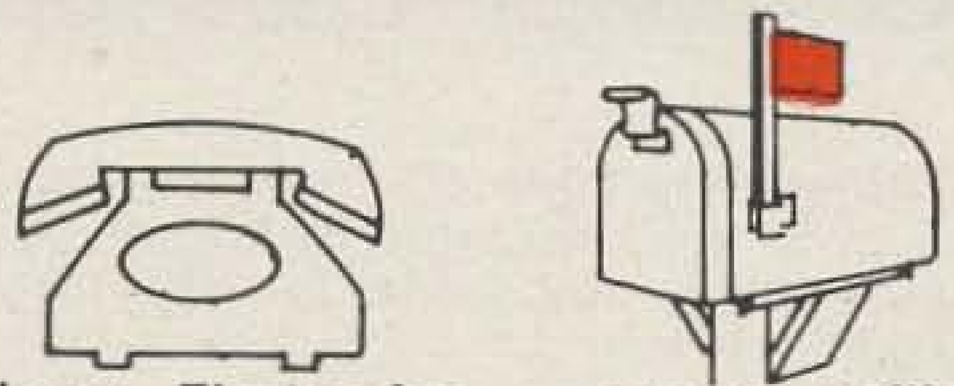
B. Very difficult circuit this hour.

Good: 1-3, 5-12, 15-17, 20-24, 26, 27
Fair: 4, 13, 14, 18, 19, 25, 28, 31
Poor: 29, 30
VHF: 4, 21

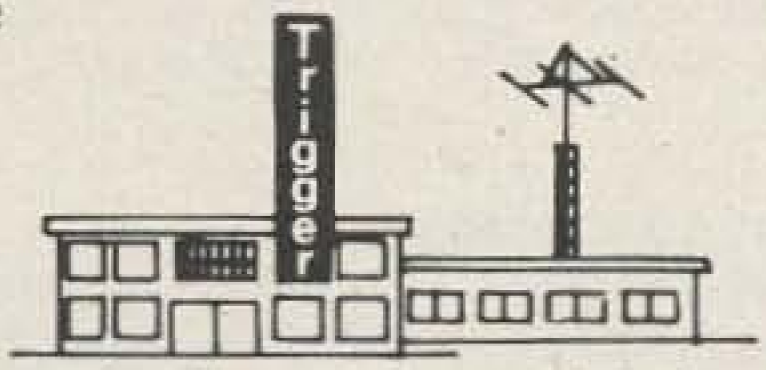
Hundreds of Bargains

...SO WHY PAY MORE FOR THE BEST!

Instant Credit, Instant Shipment On Time Payments & Cash Orders



Trigger Electronics is as near as your phone ...or your mailbox



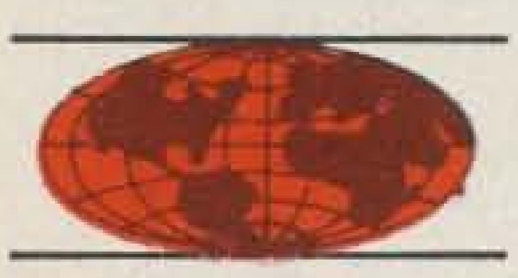
Trigger—for the most complete inventory of amateur and CB equipment. Everything in stock for your convenience!

Trigger has cut the red tape of time-consuming credit delays. Just pick up the phone and call us (no collect calls, please) and your goodies will be on their way—usually the same day!

another important TRIGGER service:

WE BUY USED HAM GEAR FOR CA$H

PROMPT SERVICE... PROMPT CASH!



No company processes foreign orders and inquiries with greater dispatch than Trigger

TRIGGER Attn: W9IVJ
7361 North Avenue
River Forest, Illinois

RUSH THE FOLLOWING: Amount Enclosed

____

____

NAME______________________

ADDRESS______________________

CITY__________ STATE__________ ZIP__________

ORDER BLANK TO: trade ur present gear, order equipment, sell ur gear for cash.

STORE HOURS (CENTRAL TIME) Weekdays 11:00 A.M.—8:00 P.M. Saturdays 9:00 A.M.—3:00 P.M.

ALL TELEPHONES (312) 771-8616

WHY IT WILL PAY YOU TO DEAL WITH TRIGGER

- Amazing Trades
- No Down Payment Required
- Low Budget Terms
- Midwest Bank Credit Cards Accepted
- Fast, Efficient Service
- No Waiting
- 20 Minutes From Downtown Chicago Or O'Hare Airport
- Near Junction Of Routes 64 & 43
- Plenty Free Parking
- Open Weekdays Until 8:00 PM
- COME IN, BROWSE AND GET ACQUAINTED, AND SEE THE MOST COMPLETE INVENTORY OF HAM AND CB GEAR—ATTRACTIVELY DISPLAYED.

NEW EQUIPMENT ON LOW BUDGET TERMS

Ameco	**Hallicrafters**	**Numechron**
Astatic	**Hammarlund**	**Regency**
B & W	**Hy-Gain**	**S B E**
C D R	**Johnson**	**Shure**
Cush-Craft	**Mark Mobile**	**Swan**
Dow Key	**Millen**	**Trimm**
Drake	**Mosley**	**Vibroplex**
Eico	**National**	**Waters**
Finco	**New-tronics**	**Weller**

and many other major brands

LIKE-NEW EQUIPMENT ON LOW BUDGET TERMS

Ten-Day Trial **30-Day Guarantee**

Tops in performance and appearance, thoroughly and beautifully reconditioned, and clean as a pin. Alignment, calibration as good as new, and frequently better. Listed below are but a few of the hundreds of items and accessories currently available. Write for complete listing and prices.

LIKE-NEW BARGAIN SPECIALS FOR DECEMBER

SWAN 350	$319	SX111	$147	EICO 720	$ 49
SWAN 250	239	SX122	199	EICO 730	27
117XC AC	84	S38D	37	HEATH SENECA	177
SBE 34	329	HT32A	279	HR10	79
SB2LA LINEAR	189	HQ145C	179	DX60A	77
SBE33 INVERTER	37	HQ170AC	279	10ER KIT	37
100V	399	HQ180AC	379	2ER WIRED	47
INTERCEPTOR B	329	NCL2000	499	2ER DC SUPPLY	17
DRAKE R4A	319	NC60	44	SB610 SCOPE	87
P&H LA400C	117	NC183D	199	SB630 CONSOLE	74
ZENITH S/WAVE	44	NC303	199	KNIGHT VFO	27
MATCHBOX W/SWR	74	220MC CONV	19	KNIGHT T60	47
GONSET 3 2MTR	169	GLOBE V10 VFO	37	KNIGHT K600B	37

SPECIAL

LIMITED QUANTITY NEW EICO KITS

753 SSB TRANSCEIVER $139
751AC OR 752DC $59
720 90 WATT CW $67
723 60 WATT CW $39
722 VFO W/AC SUPPLY $34

SPECIAL

A SMALL DEPOSIT WILL HOLD ANY UNIT ON LAY-AWAY.

TRIGGER Electronics

7361 NORTH AVE. • RIVER FOREST, ILLINOIS 60305 (WEST SUBURBAN CHICAGO)

SUNDAY TELEPHONE SERVICE 11 A.M.—3 P.M.

Caveat Emptor?

★ Price—$2 per 25 words for non-commercial ads; $5 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

★ Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

★ We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

★ For $1 extra we can maintain a reply box for you.

★ We cannot check into each advertiser, so Caveat Emptor . . .

QSL CARDS???? Samples 25¢. Sakkers Printery, W8DED, Holland, Michigan.

FOR SALE: Hallicrafters SR-46 6-meter AM transceiver, $125. WA1EPK, Dwight Perkins, 559 Fulton St., Medford, Mass. 02155.

HQ-145-X, $155. and DX-60 with HG-10 VFO, $65., you ship. Must sell to finance college. WB6LNQ, Rt. 3, Box 60, Chico, Calif. 95926.

QSL CARDS—reasonable prices. For samples send self-addressed stamped envelope to George, WA4QKD, Box 282, Valparaiso, Fla. 32580.

BARGAINS: HQ-170-C, new, unpacked, $290.00. Mint SB-400, $280.00. SB-33, Mobile Inverter, Mike, $190.00. Much more; send stamp for list. J. Shank, 21 Terrace La., Elizabethtown, Pa. 17022.

FOR SALE: Central 100V and Drake R4-A. Both in excellent condition. $325 each. Cy Humphreys, K8SWD, 2313 Timberlawn, Toledo, Ohio 43614.

WANTED KWM-2 needing repair. State price and condition. 4-1000A's for swap. WB6SBR/KG6, 1132 R.T. APO 96334, San Francisco.

DRAKE 1-A receiver, CW & SSB, calibrator, FB for Novice. Money back gty. PPD USA48. $119.50. K1RA, 11 High St., Peterborough, N.H. 03458.

CENTRAL ELECTRONICS 20A like new with 458 VFO, $75.00. HQ-129X with speaker and Q multiplier, $50.00. Dick Acker, W9TOK, 5434 S. Kostner Ave., Chicago, Illinois 60632.

SPECIAL SALE: Three-transistor converters, 50-54 mc in, 14-18 mc out. Wired, tested, printed circuit. Crystal controlled, $6.00. Tuneable, $5.00. Syntelex, 39 Lucille, Dumont, N.J. 07628.

KNOB FOR COLLINS 75A receivers, 6 to 1 reduction, $7 postpaid. Jules Wenglare, W4VOF, 1517 Rose St., Key West, Florida 33040.

LATE MODEL SWAN 350 & 117XAC p/s. Mint condition. $400. WA5AKF, Box 323, A.C., Sherman, Texas.

NATIONAL INCENTIVE LICENSING POLL: Tnx to all who voted. QRM to many who did not. Poll submitted to FCC as you read this. Vast majority against incentive licensing. Final figures soon. Seems hams have not been faithfully represented by any organization. WA2NOD, Box 685, Moravia, N.Y. 13118.

GONSET COMMUNICATOR III. 6 meter with 4 crystals, mike cord and manual excellent condition $100. Daniel Kane, 9-05 166th St., Whitestone, N.Y. 11357, 212-939-1454.

PROTECT YOUR CAR and ham gear. Burglar alarm decals will keep thieves away. 4/$1, 10/$2. Daniel A. Kane, 9-05 166th St., Whitestone, N.Y. 11357.

WANTED: TEST EQUIPMENT, laboratory quality such as Hewlett-Packard, General Radio, Tektronix, etc. Electronicraft, Box 13, Binghamton, N.Y. 13902. Phone: (607) 724-5785.

DUMMY LOAD 50 ohms, flat 80 through 2 meters, coax connector, power to 1 kw. Kit $7.95, wired $11.95, pp Ham KITS, Box 175,, Cranford, N.J.

MECHANICAL DEVICES "Great Buys" catalog, 10¢. *IF* assembly 30 MHz load with miniature components, cost government hundreds, $5.95. Transistorized computer boards, assortment totalling 75 transistors or more, $5.95. Teletype model 14 typing reperforator with automatic tape take-up rewinder electric driven 115VAC 60cy SP, both units new unused, $69.95. Bonanza specials, $2 each (generous quantity) gears, knobs, relays, toroids, switches: rotary, toggle, lever. Satisfaction guaranteed. More information on request. Fertik's Electronics, 5249 "D" Street, Philadelphia, Penna. 19120.

$1 BRINGS construction data for the new and unique Barb'd Wire Antenna. An easy, low-cost application of the fat-dipole theory. C. Leroy Kerr, Box 444, Montebello, California 90640.

WANTED: Used radio and electronic textbooks. Anything from before 1900 to present day. I will buy any copies that I do not already have in my personal collection. Please state title, author, date, price and condition. WIDTY, RR 1, Box 138, Rindge, N.H. 03461.

COMMUNICATION SPECIALISTS. Transmitters, receivers, repaired. Kits wired, tested, Alignment & calibration. Custom building. Product detectors added. Receivers up-dated. J & J Electronics, Windham Rd., Canterbury, Ct. 06331.

FT-243 CRYSTALS: 3500 to 8700 kc .01% setting, $2.00 each. Novice 1.00 each ± 2 kc. Denver Crystals, 776 S. Corona, Denver, Colorado 80208.

NOVICE CRYSTALS, all bands, $1.30 each. Also other freqs. Free list. Dealer and club inquiries invited. Nat Stinnette, Umatilla, Fla. 32784.

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

NOISE BLANKER, eliminates ignition and power line noises. Insert between converter and receiver. Free brochure. Westcom Engineering, P.O. Box 1504, San Diego, Calif. 92112.

WANTED: January 61 issue of 73 Magazine, desparately needed to complete set. Also need QST March 61 and July 60, and CQ July 1965. Box 1167B, 73 Mag., Peterborough, N.H. 03458.

PLASTIC HOLDERS—each display 20 QSL cards. 3 for $1.00 or 10 for $3.00 prepaid and guaranteed. Free brochure of other ham goodies included. Tepabco, Box 198N, Gallatin, Tennessee 37066.

ETCHED CIRCUIT PROJECTS from 73. Send your name, address and 4¢ stamp for a catalog of etched circuits boards, to Harris Company, 56 E. Main St., Torrington, Conn. 06790.

WANT TO CORRESPOND with Hams and SWLs in USA and other parts of the world. Would also like to receive club magazines from radio clubs. K. Harvant Singh, 31, (774), Upper Museum Rd., Taiping Perak, West Malaysia, Malaysia.

1963 BOUND VOLUMES OF 73. $10 each from 73, Peterborough, N. H. 03458.

MILITARY SURPLUS TV EQUIPMENT, by Roy Pafenberg, giving schematics of CRV-59AAE TV Camera, CRV-59AAG high sensitivity camera, CRV-52ABW TV transmitter, CRV-60ABK TV monitor unit, and CRV-46ACD TV receiver, all for $1.00 from 73 Magazine, Peterborough, N.H. 03458.

WANTED: All types of aircraft, ground radios and tubes, 4CX1000A's, 4CX5000A's, 304TL's, etc. 17L7, 51X, 618S, 618T, R388, R390A, GRC units. All 51 series. All Collins ham or commercial items. Any tube or test equipment, regardless. For fair, fair action. Ted Dames Co., W4KUW, 308 Hickory St., Arlington, N.J. 07032.

RTTY GEAR FOR SALE. List issued monthly. 88 or 44 MHy torroids 5 for $1.50 postpaid. Elliott Buchanan & Associates, Inc., 1067 Mandana Blvd., Oakland, California 94610.

MOTOROLA new miniature seven tube 455 kc if amplifier discriminator with circuit diagram. Complete at $2.50 each plus postage 50¢ each unit. R and R Electronics, 1953 South Yellowsprings, Springfield, Ohio.

TOROIDS—DIODES—COAX—CONNECTORS. 88 mH toroids—45¢ each, 5/$2.00. 1000 PIV 1 Amp Top-Hat Diodes—55¢ ea, 2/$1.00. Connectors, PL259, SO-239, M359—45¢ ea, 10/$4.00. Button feedthroughs (while they last) 500 pF @ 500 V. 20/$1.00. Add sufficient postage. R and R ELECTRONICS, 1953 S. Yellowspring St., Springfield, Ohio.

ELECTRONIC PARTS: Components, transistors, diodes, kits, relay and many special items. Guaranteed. Send 25¢ for 100-page catalog. General Sales Co., P.O. Box 2031-F, Freeport, Texas 77541.

WANTED: Military, commercial, surplus. Airborne, ground, transmitters, receivers, testsets, accessories. Especially Collins. We pay freight and cash. Ritco Electronics, Box 156, Annandale, Va. Phone 703-560-5480 collect.

WANTED: January and March, 1961, issues of 73 Magazine for my personal collection. S. B. Young, WØCO, Rural Route 3, Box 94, Wayzata, Minnesota 55391.

WANTED: Tubes, transistors, lab instruments, test equipment, panel meters, military and commercial communication equipment and parts. Bernard Goldstein, Box 257 Canal Station, New York, N.Y. 10013.

PLEASE INCLUDE YOUR ZIP CODE WHEN YOU WRITE 73.

VARIACS—General Radio and Ohmite. 60 cycles, Input 120V—output 0-280 V. 1 amp or input 240 V—output 0-280 V. 2 amp. PULLOUTS IN GUARANTEED EXCELLENT CONDITION $6.95 plus postage. Shipping weight 10 lb. R & R ELECTRONICS, 1953 S. Yellowspring St., Springfield, Ohio.

HALLICRAFTERS SX-101A excellent no-drift receiver $150. Shipped prepaid upon receipt of certified check or money order. WB2YJS, Mike Tarnowsky, 24 S. Middletown Road, Montvale, N.J. 07645, 201-391-6450.

GONSET G-76 transceiver including AC-DC supplies and manuals, $190. TA-33 Junior Triband with AR-22 rotator and 50 feet RG-8 and rotor cable, $60. Webster all-band whip, $20. All in good working condition. Roger Stern, K1FKB, 10 Adams Street, Lexington, Mass. 02173.

VALIANT $100; DX-40 $30; R-100A and S meter $85. Herman Zeldenrust, West 182nd St., Box 469, Lansing, Illinois 60438.

TRADE HEATH GP-11, 12V mobile power supply, for 6V supply. Tim Watkins, WN6WQA, 4838 Reynolds Dr., Torrance, California 90505.

GET ON OUR monthly mailing list. Surplus electronic equipment and other items. Send name and address to Bob-Frank Electronics, P.O. Box 1327, Harrisburg, Penna. 17105.

EMBOSSED STEEL PLATE with your call letters, 2½x7. Red or black background, white letters. Only $1.50. A-1 Products, Box 60, St. Louis, Mo. 63166.

GONSET GBS 100 AM/SSB/CW transmitter $170; GBS 201 linear $195; Ham-M rotator and control box plus TH3 antenna $125. All excellent. N. Capon, 43-34 172nd St., Flushing, N.Y. 11358. 212-359-7759.

HAM TV—RCA 7038, $15. Sylvania TV camera, $145. Telephone, $6. Kepro printed circuit board kit, $15. RCA 6DS4 nuvistors, new $1 each. WB2GKF, Stan Nazimek, 506 Mt. Prospect Ave., Clifton, N.J. 07012.

VIKING ADVENTURER transmitter with modulator. Very good condition. Also a Vibroplex "Original" bug. Best offers. Ernest Meunier, 143 Harris St., Pawtucket, R.I. 02861.

BURGLAR ALARM DECALS. "Warning Electronic Alarm System". Protect your mobile rig and car from theft. 4/$1, 10/$2.00, PD. P & S, 15 Eldridge St., New York, N.Y. 10002.

FOR SALE: Heath all-band SSB transmitter HX-20, $125; Receiver, HR-20, $60; A/C P/S, $20; D/C P/S, $25. Whole works, $200. FOB. E. M. White, 848 Broad St., Shrewsbury, N.J. 07701.

MERRY CHRISTMAS and a Happy New Year from WØCVU. See you at ARRL national convention in 1969 at Des Moines, Iowa.

COLLEGE EXPENSES: National 200 transceiver; AC-200 power supply, $350. Like new condition, 10 hours air time. Craig Stock, 5935 Shore Pkwy, Brooklyn, N.Y. 11236.

COSMOPHONE 35 transceiver and Eldico SSB 500 final. Both in perfect shape. Two spare 4CX250B's, relays for barefoot or highpower operation, and mike. $300.00. Art, K2QHT, Glamore Ct., Smithtown, N.Y. 11787. 516-265-6479.

SWAN 350 with 117X Power Supply and 14X DC module. Transceiver can be used on AC or DC. All cords with unit. Excellent condition $375.00 FOB. Bruce Adams, Box J, Lincoln, R.I.

SHACK CLEANOUT: Drake L-4 mint, $525. Millen Transmatch KW mint $85. Galaxy 3, AC&DC slupplies, ext. PTO and mobile mount $300. SX73 (like SP600) $200. Waters 3002 patch (never used) $50. UTC-VM5 500 w. mod. xfrm and chart $25. All following items postpaid: Ameco CN144(14.IF) and PS $30. Heath IT-21 tube tester mint $25. Heath IT12 sig. tracer mint $10. Jack WØKXZ, Box 538, Brookings, S.D.

GROUNDED GRID FILAMENT CHOKES: 10 amp, $3.00; 22 amp, $3.50; 30 amp, $4.00. RF plate chokes 800 ma, $1.95. PPD USA48. William Deane, 8831 Sovereign Rd., San Diego, California 92123.

32-S3, $525; 516-F2, $75; 75S3, $400; 312-B4, $125; SB-200 linear $175; HO-10 monitor scope $50. 10% off on package deal. K1VCB, Fern Belanger, 61 Lafayette St., Fall River, Mass. 02723.

NOVICE TRANSMITTER. Old mags. Modified Heathkit AT-1, AC-1, balun coils, coax, all manuals. QST 1956 to 1963, CQ 1956 to 1963. Best offer. W1HMW, 16 Knob Hill Road, Norwalk, Conn. 06851.

BC453-B, Q5'er ex orig. cond. $10.00. BC-733 G. cond. $6.00. Hallicrafters S-38C rcvr. used G. cond. $15.00. WB2ZAR, R. H. Denney, 9-15 127th St., College Point, N.Y. 11356.

REGULATED POWER SUPPLY KIT: 0-15 volts, 0-.5amp, $22.50. Terms $5 down, $5 per month. Grid dip meter adapter kit for signal gen. $9 cash, meters included. R. H. Denney, 9-15 127th St., College Point, N.Y. 11356.

DRAKE 2B w/calibrator; C.E. 20.A, 458 VFO, with manuals; AR-22. All excellent condx. Best offer takes any or all. Paul Wentzel, 2923 E. 34th St., Apt. 304, Minneapolis, Minn. 55406.

WANTED: General Radio GR-720 heterodyne frequency meter. R. W. Hobbs, Alliance Mfg. Co., Alliance, Ohio 44601. Phone 216-821-5360.

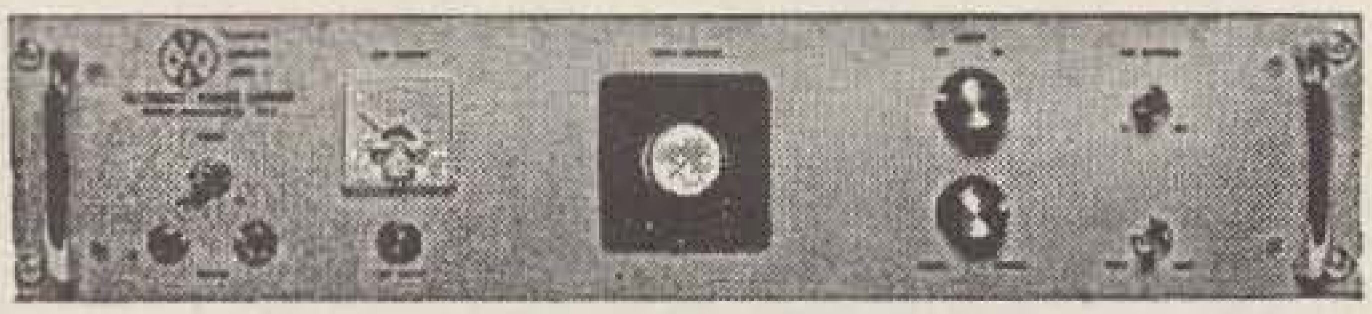
NCX-5 with AC and DC supplies. Spare finals. $535. Hy-Gain 14AVQ, roof mount, 2 80 meter coils $25. WA8ARZ, 453 Francisca Ave., Youngstown, Ohio 44504.

HAMMARLUND HQ-110 receiver, clock and matching speaker. Very good condition. $175. Knight TR-106 six meter transceiver, matching V-107 VFO, both like new, both $140. Testor R/C Skyhawk. See page 148 Lafayette catalog. New condition. All electronics, Edward Morris, WA2VLU/3, Box 487, Blue Ridge Summit, Penna. 17214.

SB-10 and APACHE. $60 and $90 respectively, $140 for the pair. Beat high cost of SSB. Immaculate, with manuals. W9REW, 4811 Forest Ave., Fort Wayne, Indiana 46805.

SBE-33 latest model with instruction sheet, in original carton, A-1 condition, $175.00. WA7ASC, L. J. Sams, W. 2816 Olympic, Spokane, Wash. 99208.

GALAXY V and AC supply; Galaxy 2000+ linear and AC supply, $295 and $345, or $600 for both, delivered prepaid USA48. Both in good condition and can be heard 7AM or 8PM EST on 3970 on Eye-Bank Network. K1RA, Jack Morgan, 11 High Street, Peterborough, N.H. 03458.



ALLTRONICS-HOWARD MODEL L RTTY CONVERTER

Telewriter Model "L" frequency shift converter designed for two-tone AM or FM with limiter operation available by switch. Solid state ratio corrector compensates for fading signals. Permits copying on Mark or Space only. Selector magnet dc loop supply built-in with bias supply and octal socket for optional polar relay to key transmitter. 6W6 keyer tube. Plug-in discriminator for 850 cycle or other shifts. Cathode ray or dual eye indicator. Auto-start control system optional. Prices for 19" rack mounting: Model "L" with dual eye $199. Model "L" with C. R. tube indicator $279. Cabinet $19.50

ALLTRONICS—HOWARD CO.
Box 19, Boston, Mass. 02101. Tel. 617-742-0048

LEARN RADIO CODE

THE EASY WAY!

- No Books To Read
- No Visual Gimmicks To Distract You
- Just Listen And Learn

Based on modern psychological techniques—This course will take you beyond 13 w.p.m. in LESS THAN HALF THE TIME!

$9.95

Album contains three 12" LP's 2½ hr. Instruction

Also available on magnetic tape. See your dealer now!

EPSILON RECORDS

206 East Front Street, Florence, Colorado

S S B 's—SWAN 500's
NOW IN STOCK—$495.00

KWS-1	$795.	Viking 500	$375.
KWM-2	795.	NCX-3	199.
Poly-Comm 62	225.	Eico 753	159.

LARGE STOCK OF USED EQUIPMENT ON HAND

FRECK RADIO & SUPPLY CO., INC.
38 Biltmore Ave., Asheville, N. C. 28801
Ph. 704-254-9551 — CLOSED SATURDAYS
T. T. Freck, W4WL — Sandy Jackson, WN4AAL

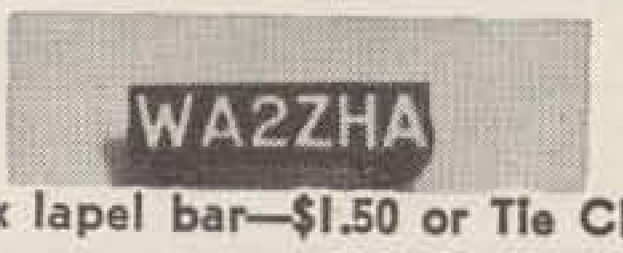
DON'T BUY TUBES

UNTIL YOU GET OUR LOWEST PRICES IN THE WORLD ON BRAND NEW SPECIAL PURPOSE, BROADCASTING, RECEIVING TYPES. ESTABLISHED 1920. SEND FOR OUR CATALOG.

UNITED RADIO CO.
56-B FERRY ST., NEWARK, N.J. 07105

ARNOLD'S ENGRAVING
Personalized

Works on 110 VAC—$10.95



Metallex lapel bar—$1.50 or Tie Clip—$2.25

ARNOLD LINZNER
2041 Linden St. Ridgewood, N.Y. 11227

WRL's USED GEAR—trial—terms—guaranteed. NC-303—$199.95; 62S1—$589.00; Thor VI/AC—$169.95; G76—$99.95; SR-150—$269.95; Eico 753—$119.95; SB2-LA—$159.95; 2B—$189.95; HQ-170-AC—$239.95; HQ-110C—$139.95; HT-37—$199.95; HW12—$94.95; HQ-180-A—$299.95; Request free "Blue-Book" list of hundreds more. WRL, Box 919, Council Bluffs, Iowa 51501.

MANUALS, $3.00 each: ARN-6, ARN-12, ARN-30, ARC-27, BC-342, PE-75. Many others. Inquiries invited. Stamp please. S. Consalvo, W3IHD, 4905 Roanne Dr., Washington, D.C. 20021.

WANT, GUARANTEED like-new SP600JX/51J3, and HF receiver or general coverage converters. Trade like new 75A2, plug-in product detector, Fairchild turntable, amp and preamp (mono). W4FXN/3 7408 Stanmore Ct., Towson, Md. 21212.

WATERS 1000-watt Dummy load, good condition, $75.00. K1RA, Jack Morgan, 11 High Street, Peterborough, N.H. 03458.

FOR SALE: Eico 753 with 751 power supply, factory wired, new, still in factory sealed boxes. Write offer to Grover Thompson, Route 1, Drake, Kentucky.

ARIZONA REPEATER ASSOCIATION, a new club, has been formed. Meetings will be the 4th Mondays at the First Federal Savings & Loan Bldg., 20th St. & Camelback, Phoenix, at 7:30 P.M. Repeater frequencies will be 146.34 input and 146.94 output. Joel Kaplan, WA7ERH, is Secretary.

WANTED BACK ISSUES of 73 Magazine. October 1960; January, February and March of 1961, and June of 1962. Joe Furiak, VE7BAD, 1311 Second Trail, British Columbia, Canada.

MECHANICAL DEVICES "Great Buys" catalog, 10¢. *IF* assembly 30 MHz loaded with miniature components, cost government hundreds, $5.95. Transistorized computer boards, assortment totalling 75 transistors or more, $5.95. Teletype model 14 typing reperforator with automatic tape take-up rewinder electric driven 115VAC 60 cy SP, both units new unused, $69.95. Bonanza specials, $2 each (generous quantity) gears, knobs, relays, toroids, switches: rotary, toggle, lever. Satisfaction guaranteed. More information on request. Fertik's Electronics, 5249 "D" Street, Philadelphia, Penna. 19120.

NOVICE STATION FOR SALE. HT-40, $45, and S-120, receiver, $40. Both for $75. David E. Cleve, WN6VHH, 641 East "J" Street, Ontario, California.

HQ-110C $120; SK-20 $15; DX-60 $60; HG-10 $30; DK-60-G2C $15. Perfect condition. Complete station $225. WA4PFD, Terry Wells, Route 2, Greenville, Tn. 37743. Phone 615-638-6082.

PUBLIC NOTICE: TO WHOM IT MAY CONCERN—L. W. Babcock Co. is discontinuing business operation effective immediately, due to lack of adequate business capital.

TUNAVERTERS!!

10 to 2 meters for HF & VHF AM-FM Marine, SW, and Police, Fire, etc! Tunable RF converters.
For all auto and home radios! Transistor & 6-1 tuning!
(See Complete listing in Apr. '67 73 ad, page 107.)
Dept. 79, Woodsboro, Texas 78393
HERBERT SALCH & CO.

Index to Articles Appearing in 73 Magazine in 1967

Equipment Modifications

CW and Keying

DX

Features, Fiction and Humor

Novice and Beginner

Power Supplies

Receivers

High Frequency

VHF, UHF Receivers

RTTY

Semiconductors

Surplus

Technical Articles

Test Equipment

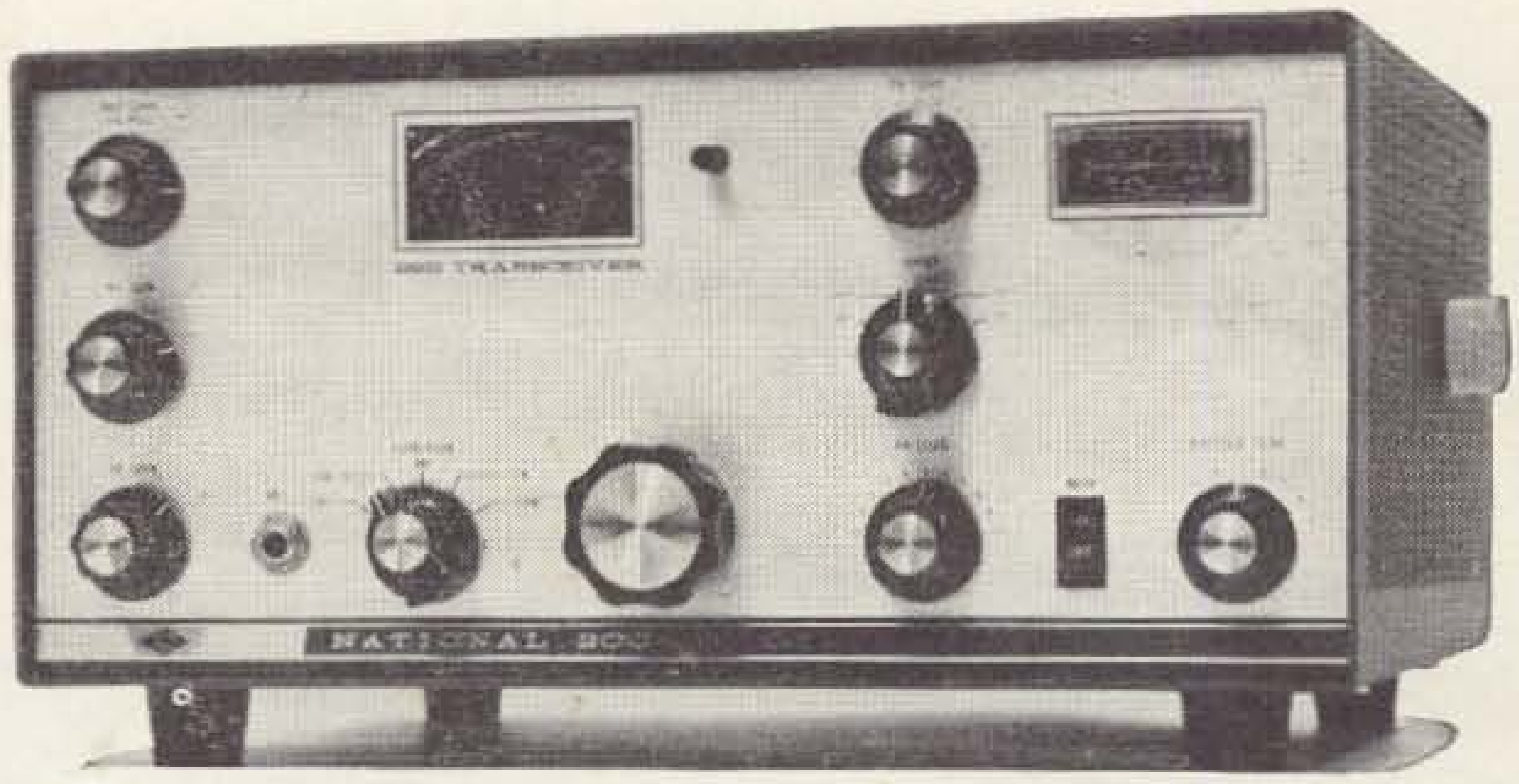
Transmitters

High Frequency

VHF

INDEX TO ADVERTISERS

Start with America's most versatile 5-bander... only $359!



For only $359, the new National 200 puts you on the air, with complete SSB, CW, and AM coverage of the 80 through 10 meter bands. You'll get years of enjoyment from this husky rig, thanks to National's field-tested design and workmanship, and these terrific performance features: *200 Watt PEP input on SSB, grid-block keying on CW, and compatible AM operation *Separate product and AM detection plus fast-attack slow-release AGC in all modes *Crystal-controlled pre-mixing with single VFO for high stability, plus identical calibration rate on all bands *Crystal lattice filter for high sideband suppression on transmit, and rejection of adjacent-channel QRM on receive . . . plus solid-state balanced modulator for "set-and-forget" carrier suppression *Universal mobile mount included.

Boost your power to a full 2000 watts... only 38¢ per watt!

Only 38¢ per Watt adds 1800 Watts PEP input to your National 200 . . . lets you push out the maximum power allowed by law. The NCL-2000 is a completely self-contained 2000-Watt SSB PEP linear amplifier for the 80 through 10 meter bands, with minimum peak output of 1300 Watts. *Amplifier Bias Control Circuit (Pat. #3,328,715) reduces distortion. Operate CW? AM? RTTY? The National NCL-2000 is rated for full kW operation in these services. You *know* you'll be heard when you add on this desk-top package of dynamite! The price? . . . $685, when you're ready for the big time.

Both the National 200 and the NCL-2000 are covered by National's exclusive One Year Guarantee against component failure.

National Radio Company

37 Washington Street, Melrose, Massachusetts 02176