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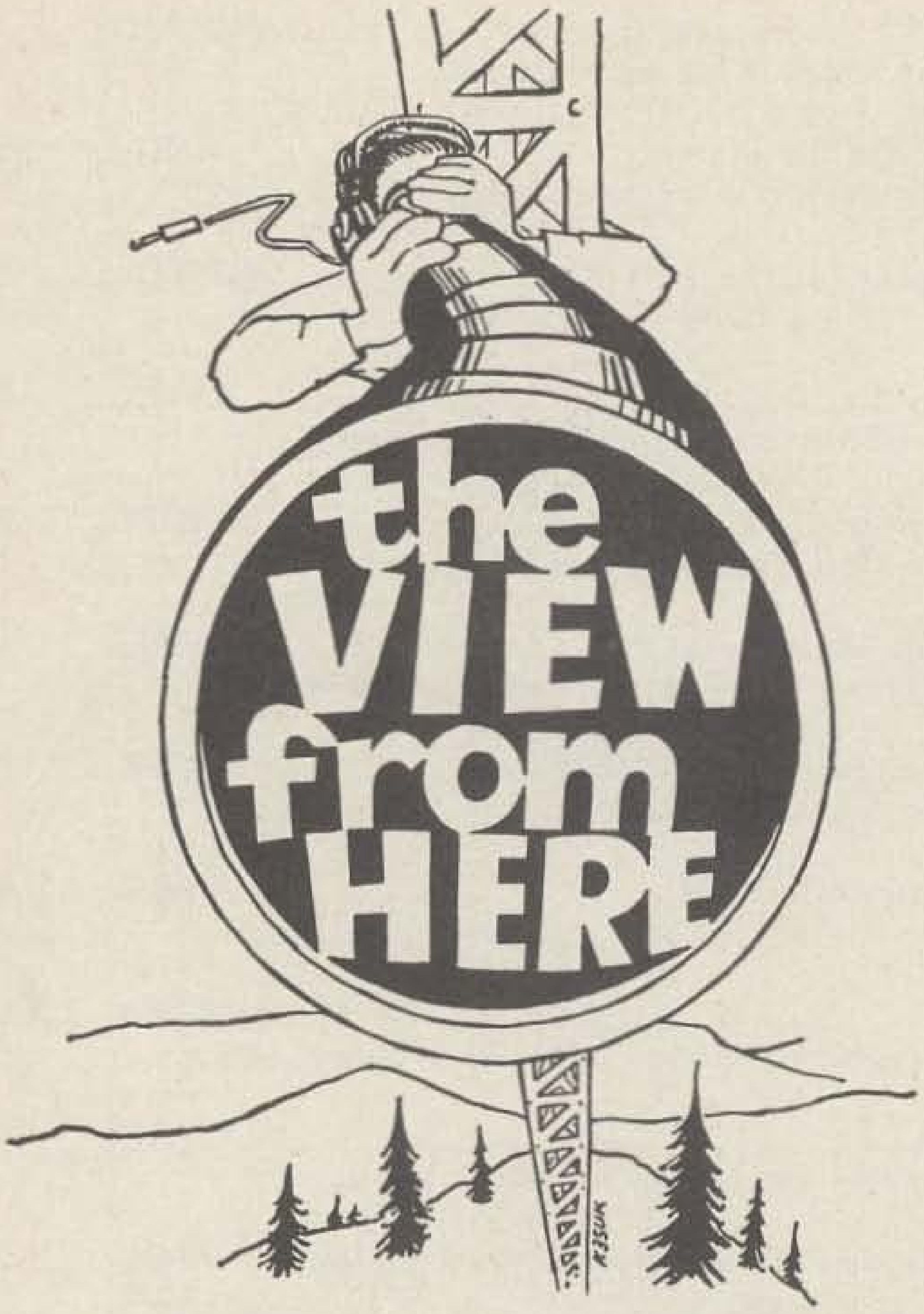


Jim Fisk is on a much deserved vacation so this month's View comes from the assistant editor.

When I was in the seventh grade in school, the intercom came on one day with the announcement that anyone wishing to become a reporter for the school paper should report to room 201. Being firmly convinced that I was something of a literary genius, I reported to room 201 where I was given a test of sorts. I was assigned a bare set of facts about which I was to write a newspaper story. I not only did not become a reporter, I darned near flunked English as a result. So, here I am, some thirty years later . . . Not a reporter . . . The assistant editor of a national magazine, yet! The moral of this story escapes me at the moment, but it makes a good opener.

The life of an Editor is one fraught with danger. One ham magazine recently sold a part of their mailing list to a mailing house in California, in connection with some new ham gear publicity. Somehow, this list became confused with another similar list and 2,000 hams received blurb sheets on a new book about sex, while 2,000 non hams received information about the latest in ham gear. Naturally the editor gets blamed for the error. Then this same editor developed a severe case of foot-in-mouth disease and wrote an irate editorial demanding action from the FCC on the incentive licensing bit. You guessed it, the editorial reached the public after the bill had passed.

The first incidence could well have been avoided. It is common practice among magazines to either sell or rent their mailing lists as an added form of income. This is where all the junk mail comes from. A sells 2,000 names to B. B then sells this list to C . . . ad nauseum. The next thing you know, you are deluged with advertising for everything from Aardvarks to Zymoscopes. If the recipient of some bit of unsavory advertising can trace how his name reached this advertiser (usually the label is the same as some other more legitimate publication you regularly receive), there is a tendency to be slightly annoyed at his lack of privacy. I suspect what is gained in income from the sale of the mailing list, is probably offset by the number of subscribers who don't renew in objection. As you may have gathered, 73 does not release its subscriber list to anyone else.

Back to our unfortunate editor. In the matter of the poorly timed editorial, I can only feel compassion. These are the breaks sometimes, though. We all knew action was about to be taken on the incentive licensing in the very near future. Had the magazine come out on schedule, (about three and a half weeks earlier) think what a coup it would have been! The editorial comes out, then the FCC gets on the ball, and the readers say, "Boy, he really made them sit up and take notice." Well, you can't win them all, especially with the deadlines we have to meet to get things to the printer. Any editor who deals with current topics, takes the chance that the situation will change before his material gets into print.

Apropos of this, think of the new *Callbook* and how this will affect us. The latest issue has everyone listed with the class of license held. Unfortunately, due to meeting printing deadlines, transfer of information from FCC files, etc., the listings cannot possibly be kept current. There will always be the Technician who passes the General or Advance class exam, but remains listed in the Callbook for several months as a Tech. Until the records finally get caught up, he is going to be viewed with suspicion every time he gets on 20 meters. After the new regulations go into effect and there are further frequency re-

(*Turn to page* 128)

de W2NSD

never say die

Miller & Company

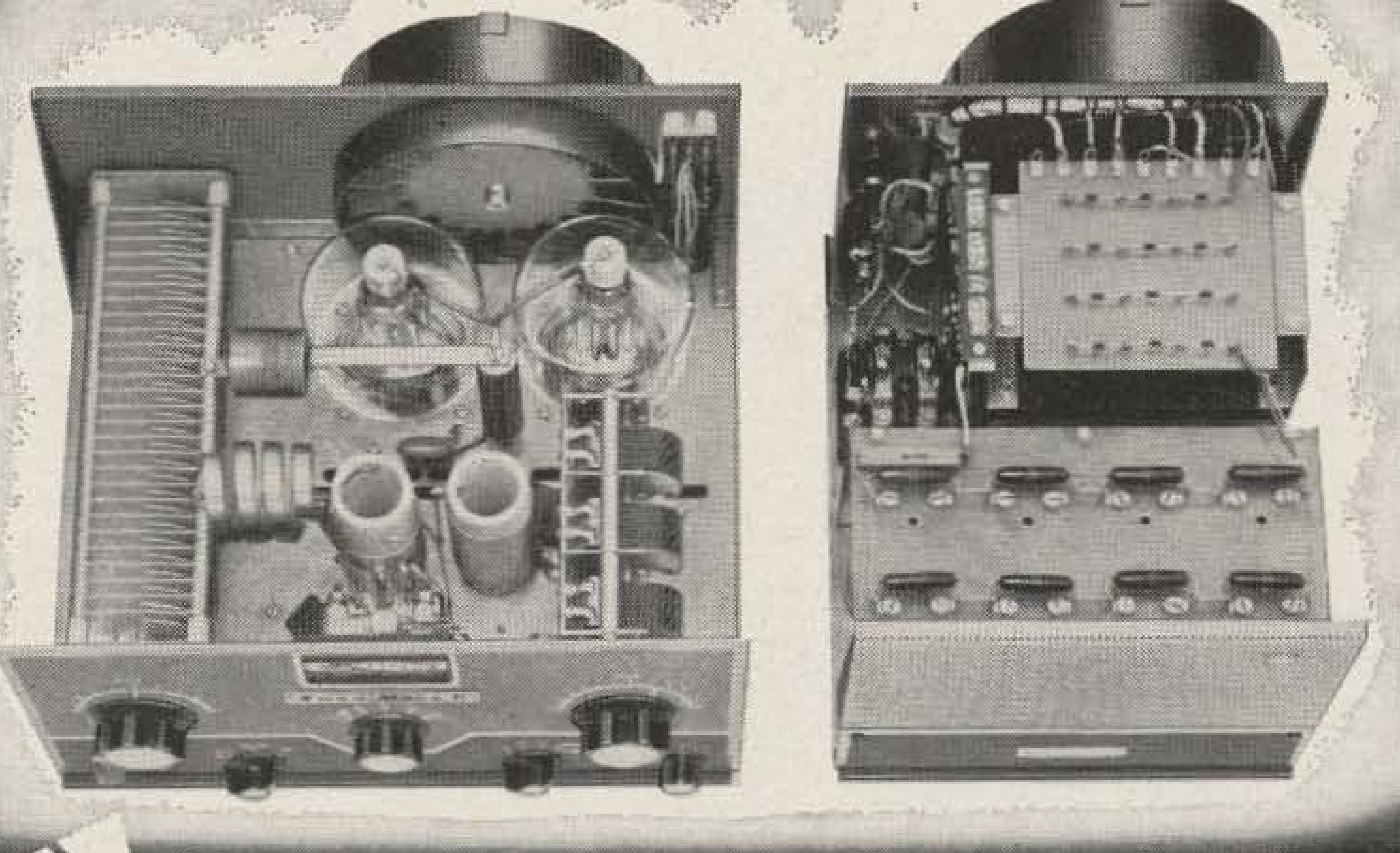
The weekend DXers have been entertained and the serious DXers appalled by Don's selective system of avoiding contact with certain stations. His explanation of this was that he merely followed the DXCC rules which suggest that overseas operators not contact U.S. operators who are violating the rules of good sportsmanship. Others are convinced that he has been using this system to punish those on the DXCC Honor Roll for not "donating" to his expeditions.

John Scarvaci W9GIL sent questionnaires to 185 stateside Honor Roll members and got back 110 replies. This poll asked particularly about contacts with VQ9BC/D, VQ9AA/D and VQ9AA/F. The BC expedition was by Bud Clabough and, though it was at about the same time as Don's trip to Des Roches, there was no connection. There was, I believe, a good deal of ill feeling, actually. The interesting thing is this: every fellow polled who tried was able to work both of the /D stations. Then Don went to /F Farquhar. Here the story was different. 47% of those who tried were unable to contact him, some keeping at it for as much as 50 hours over a four day period. Suddenly almost half the Honor Roll operators had become poor operators. And most startling of all, every single fellow who had donated to the expedition was able to get a contact with Don and not one of those who tried and failed had donated. The results of the poll leave little doubt that Don was using strong measures to force donations to his trip.

On page 60 of Don's document in answer to the ARRL complaints against him were reprinted two telegrams and one letter. The first telegram states that his Indian license had been issued as VU2WNV and for him to contact Brigadier Patel. The second states that the Vice Consul India, Nairobi, advises that he may operate from Laccadives as portable four. The letter, from the Ministry of Transport & Communications, grants permission for Don to operate from the Laccadives and is signed by V. M. Gogte and dated January 3rd, 1967. This series certainly appears straightforward and obviously proves that Don did have authorization to operate from the Loccadives as VU2WNV/4.

(Turn to page 120)

BLOCK BUSTER



NEW SWAN-MARK II
2000 WATT P.E.P. LINEAR AMPLIFIER

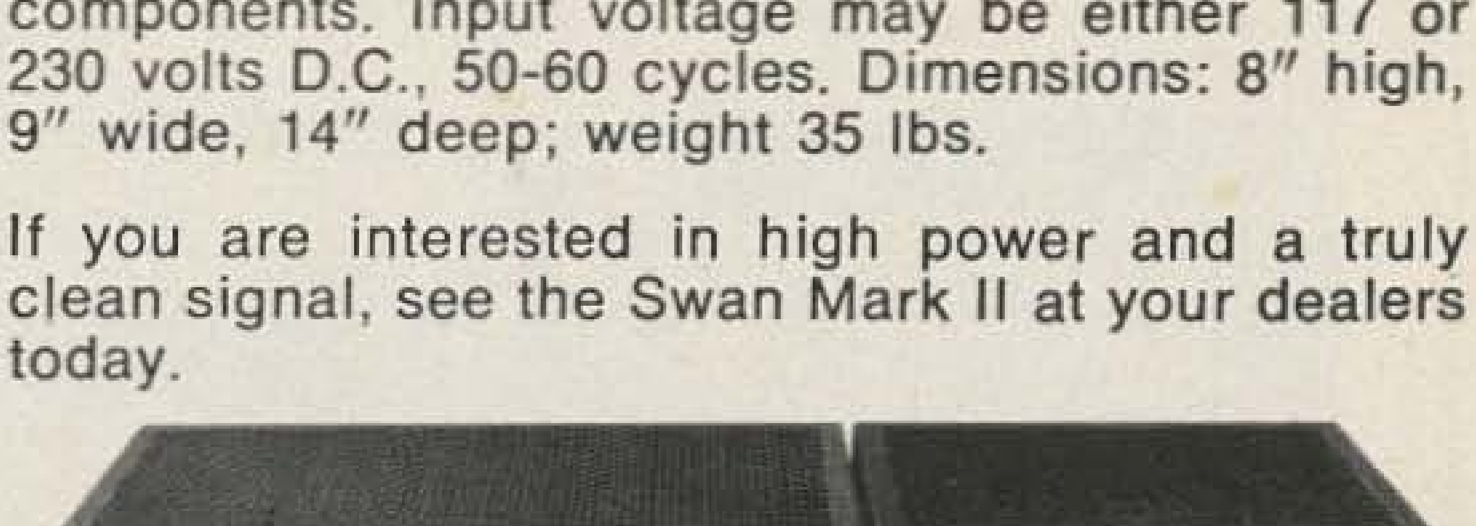
We are pleased to announce production of the new Mark II Grounded Grid Linear Amplifier, and confident that you will thoroughly approve its compact design and many quality features.

Two Eimac 3-400Z Triodes provide the full legal power input: 2000 Watts P.E.P. in SSB mode or 1000 Watts AM or CW input. Planetary vernier drives on both plate and loading controls provide precise and velvet smooth tuning of the amplifier. Greatly reduced blower noise is provided by a low RPM, high volume fan.

The new Mark II provides full frequency coverage of the amateur bands from 10 through 80 meters and may be driven by any transceiver or exciter having between 100 and 300 watts output. The amplifier measures 8″ high, 13″ wide and 14″ deep. Weight is 20 pounds.

The power supply is a separate matching unit which may be placed beside the Mark II amplifier, or with its 4½ foot connecting cable, may be placed on the floor. Component quality is of the highest caliber. Silicon rectifiers deliver 2500 volts D.C. in excess of 1 ampere. Computer grade electrolytic filters provide 40 mfd capacity for excellent dynamic regulation. A quiet cooling fan allows continuous operating with minimum temperature rise, thus extending the life and reliability of all components. Input voltage may be either 117 or 230 volts D.C., 50-60 cycles. Dimensions: 8″ high, 9″ wide, 14″ deep; weight 35 lbs.

If you are interested in high power and a truly clean signal, see the Swan Mark II at your dealers today.



MARK II AMPLIFIER with tubes $395 | **MATCHING POWER SUPPLY $235**

SEE IT AT YOUR SWAN DEALER

SWAN ELECTRONICS
Oceanside, California

Robert Suding W8NSO/WØLMD
1955 Ingalls
Lakewood, Colorado

A Cheap and Easy Frequency Counter

If you want to know exactly what frequency you are operating on, the digital frequency counter is the only answer. This unit counts up to 100 kHz and costs less than $50 to build.

After reading numerous articles on integrated circuits and frequency counters, I decided that there should be a way to build a frequency counter which would be both simple and cheap. There was! It features 24 inexpensive IC's*, 15 surplus transistors, a frequency range from 20 Hz to 100 kHz (extendable), binary frequency readout and fully automatic operation. All you have to do is connect the input leads, turn it on, push the "count" button and read the frequency. In addition, this counter is small, takes less than a week to build, and costs less than $50. Interested?

*Three Fairchild 914 IC's at 80¢ each and 21 Fairchild 923 flip-flops at $1.50 each.

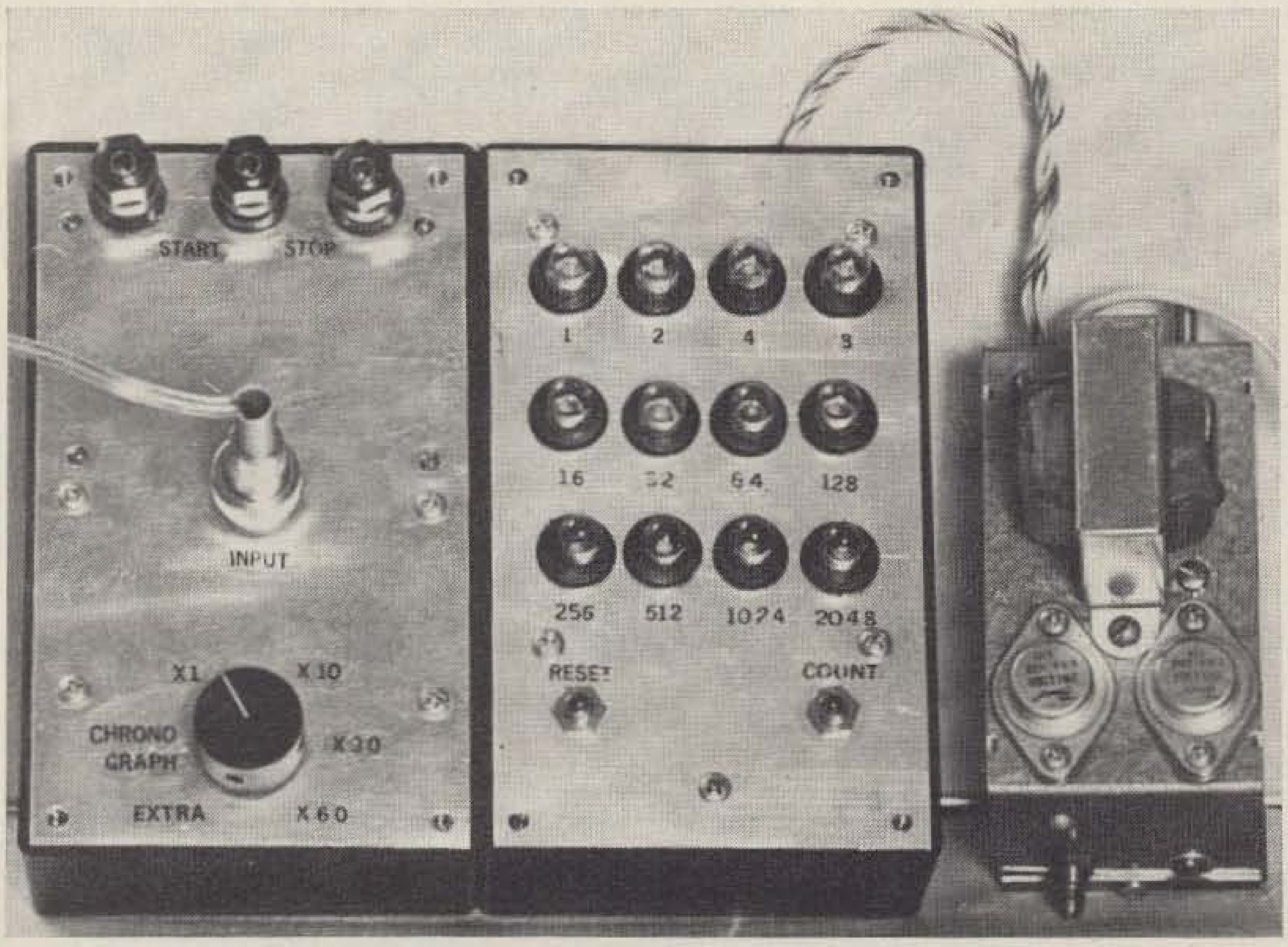
Uses

This counter has a number of standard uses, plus quite a number of special uses which I am still studying, and may report subsequently. Some of the more obvious are:

1) It can quickly and surely tune an audio oscillator. (I tuned a tuning fork with it to within 1/9th of a Hertz.)

2) I use it to tune teletype toroidal coils. (Build a small transistor oscillator that will use the coil and capacitor to be tuned, and then measure the frequency while substituting various capacitors.)

3) Check the amount of shift on a fsk signal. (Measure the mark signal; measure



Top view of the count indicator (middle), the count controller (left) and the power supply (right). The three terminals on the top of the count controller are used when the unit is used as a chronograph for measuring bullet speeds.

the space signal; subtracting the difference will give you the amount of shift.)

4) Measure the frequency drift of a receiver or transmitter. (Obtain a beat note from a stable source; measure and graph the resulting change in count.)

5) Check how far individual stations are off a net frequency. (Measure the beat note between a given station and a frequency standard.)

6) May be used as a chronograph by gun and racing buffs. Feed in a known frequency by turning the counter on and off with start and stop traps and reading the counts, then convert to speed by using the following formula:

$$V = \frac{fd}{n}$$

where V = Speed in feet per second.
f = Frequency of source signal in Hertz.
d = Distance between traps in feet.
n = Number of counts.

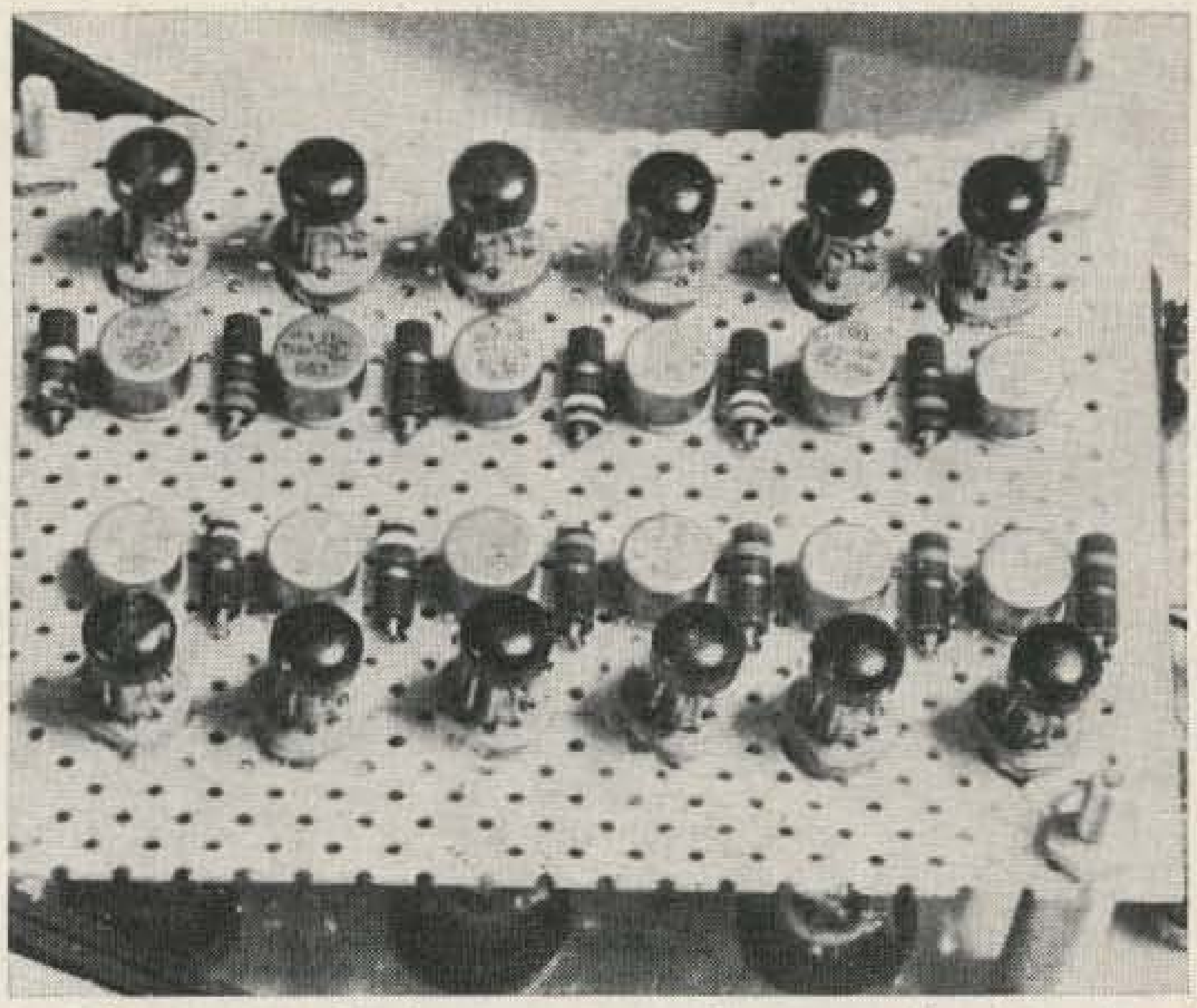
The count indicator

This counter consists of three fundamental sections: the count indicator, the count controller, and a power supply.

A count indicator may take any number of forms, depending on how complicated or complete you wish your counter to be. You may want the unit to give you decimal readout, since this is by far the simplest to read. However to build a decimal readout would add greatly to the complexity of the unit, as well as adding about $50 to the cost. The alternate which I have chosen is one giving binary readout. This has the advantages of using the least number of parts to achieve a usable readout, it is simple to build, and not too difficult to read after you get used to adding the numbers. The version that I have built is one using 12 binary counting stages giving a possible count of 4097. What's binary? Well, let's take a look.

The various stages of the count indicator are consecutively labeled in powers of 2, starting with 2°, which has the value of 1.

At the start all bulbs are off. On the first pulse, the "1" bulb turns on, the rest stay off. The second pulse turns the "1" bulb off and turns the "2" bulb on. The third pulse turns the "1" bulb on; the "2" bulb stays lit; and the rest stay off. Adding this total gives a count total of 3. The fourth pulse turns the "1" and "2" bulbs off and turns on the "4" bulb. The process continues for 12 stages on the model I have built, for a total count possibility of 4097 (one less than twice the value of the highest bulb in the counter). In summary, to read binary just add up the values assigned to the bulbs that are *lit*.



Inside view of the count indicator, showing how the 12 stages of IC's and associated transistors are mounted on punched board which measures 3 x 4¼ inches.

Construction of count indicator

If, in building this section, you put all of the parts in the same order and orientation that they have in the count indicator diagram, you will find that it can be built in just a few hours. I used integrated circuit sockets (miniature 8-pin), but you could just as easily solder them in. I bent the #4 pin up on all 12 sockets, and the #8 pin down. I then connected a wire between all of the #4 pins for a ground and minus lead, and another wire to all #8 pins for the +3.6 volt line. Next, run a wire from each #1 and #3 pin to the #4 pin, so all three pins are grounded. This completes the power wiring.

Next, connect all #6 pins to the reset button, and complete the wiring. The resistor in the base of each of the transistors may have to have its value juggled around a bit to make the bulbs glow evenly. Lowering the value makes the bulb brighter, and raising it dims them.

In the interest of simplicity, I mounted the indicator light bulbs on the front panel inside some grommets, as you can see in the picture. Instead of using sockets, I also soldered wires directly to the bulbs, and

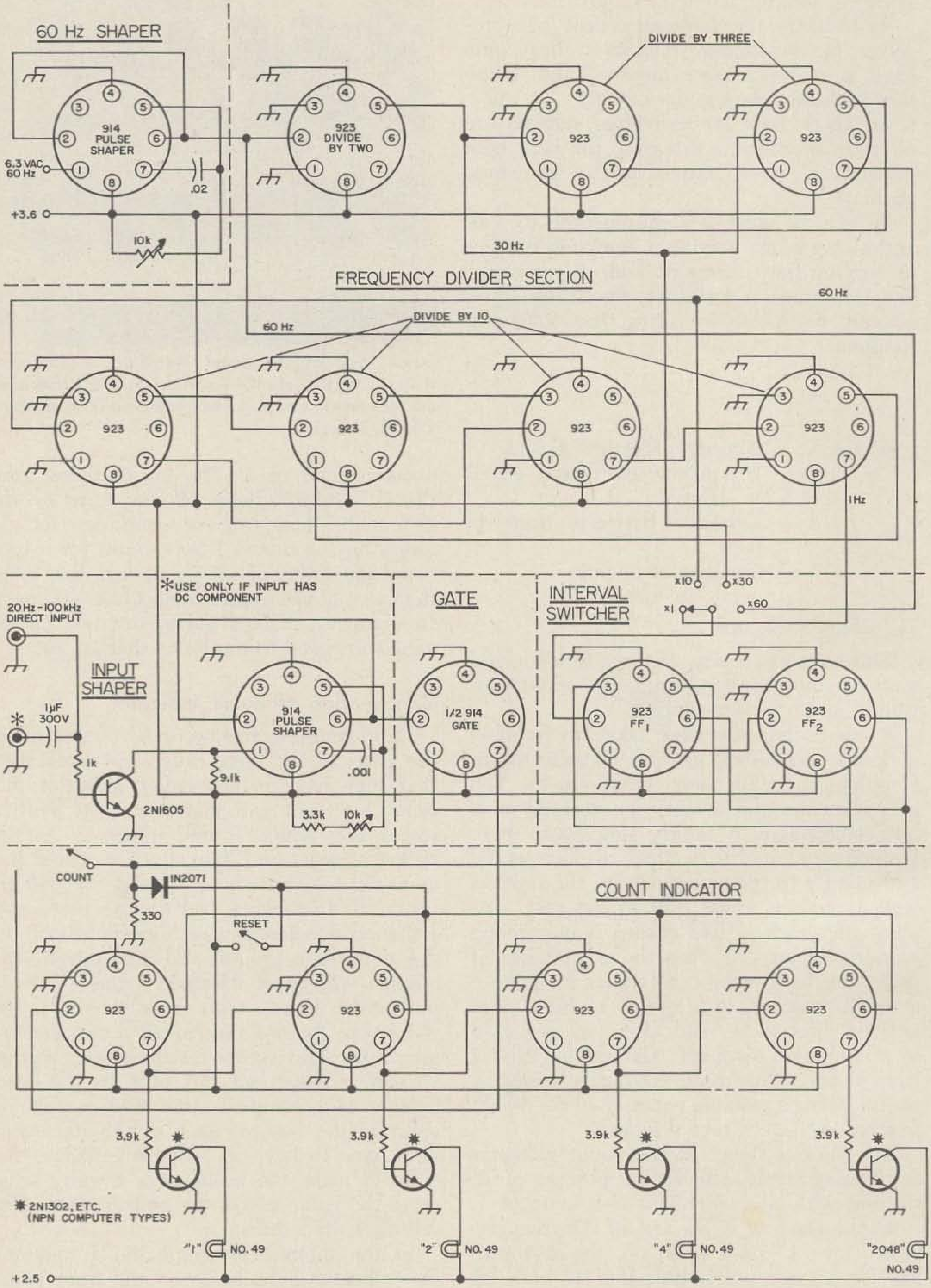


Fig. 1. Schematic diagram of the cheap and easy frequency counter. This counter uses inexpensive integrated circuits and costs less than $50 to build.

adjusted the power supply so there is only about 1.5 volts across each bulb.

The count controller

To put it in the simplest terms, the count controller must turn the count indicator on for one second then off again, so as to see how many Hertz there were in that second of time.

The count controller consists of five sections. The main section is the one which forms the one-second interval. I achieved this by taking the 60 Hz ac line frequency, and dividing by 60. Though this could be done with multivibrator frequency dividers, I chose to divide by using the 923 flip-flops which frees me of any maladjustment problems which give an output frequency other than 1 Hz. This frequency divider also provides a 30 Hz and 10 Hz output.

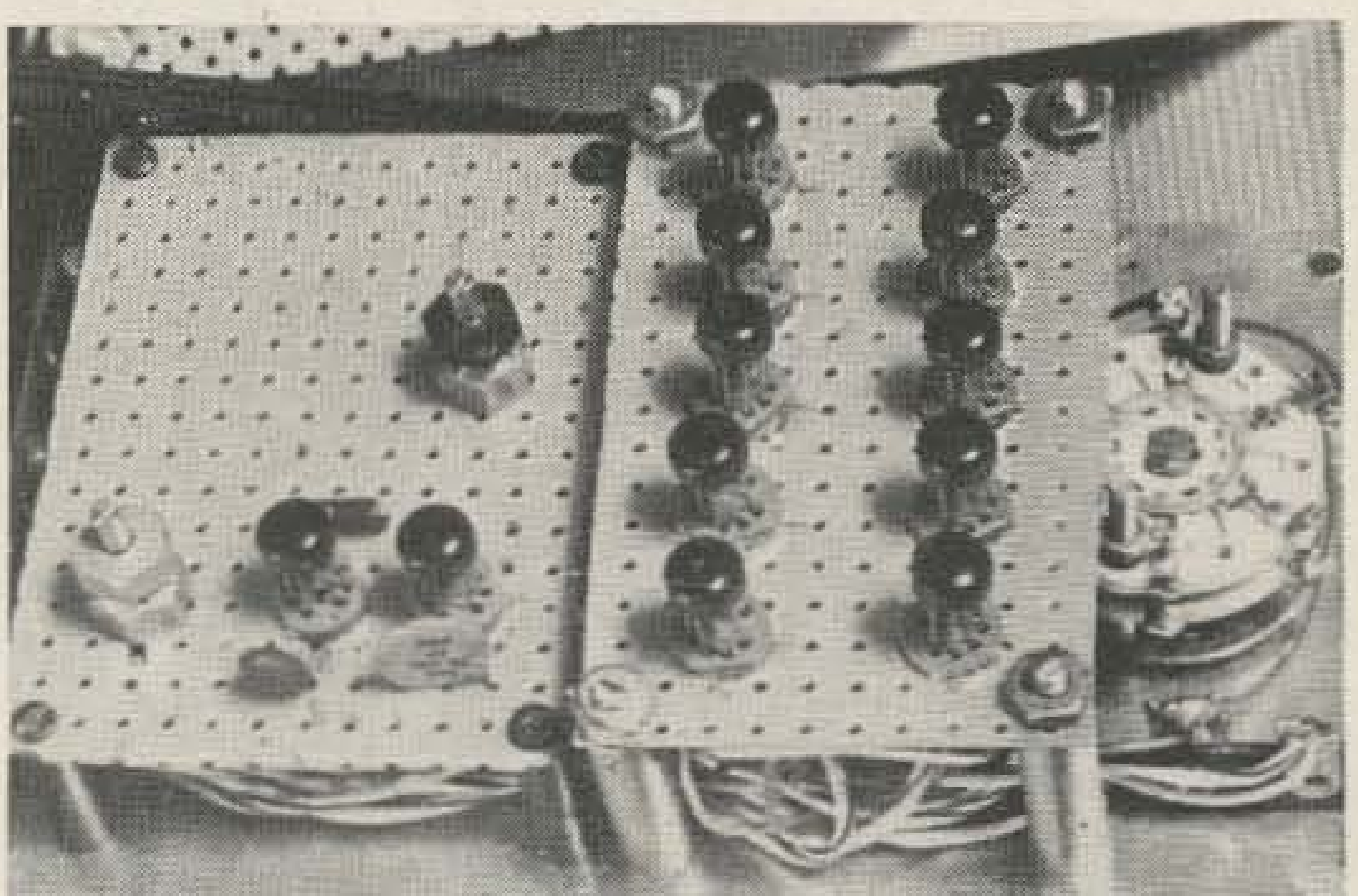
Having these four frequencies then (60, 30, 10, and 1 Hz), we arrive at the second section, which is the key part. This is the interval switcher. This consists of two 923 flip-flops hooked up in a special way. Here is how it works:

Both flip-flops are reset by the count button so that there is no voltage output at either pin #7. Upon releasing the count button, the next 1 Hz wave that goes to zero at the input of flip-flop number 1 (FF_1) will cause pin #7 to go positive, and pin #5 to go from its original positive to zero (these two pins are always at opposite states). When this happens, the count will begin to be registered on the count indicator. At the end of the next 1 Hz applied to FF_1, it will switch over to the state that it was at in the beginning, namely voltage on pin #5, but none on pin #7. This voltage on pin #5 will then cause the count to discontinue, with the last count registered on the count indicator. To prevent the next cycle from counting some more, another flip-flop, FF_2, is so connected with FF_1 pin #3 that the count is locked up until the count button is pushed once again, whereupon the whole process starts over.

An additional feature is the switch which can select various submultiples of 60 Hz, so that a count may be taken for 1/60, 1/30, 1/10, or 1 Hz. This means that the actual count will be the reciprocal of time counted times the count registered. For example, a count of 1000 on the count indicator taken in 1/30 of a Hz would equal an actual count of 30,000.

The third main section is the gate, which allows the input to be coupled into the counter for the interval selected. This gate consists of one-half a Fairchild 914 dual two-input gate. It consists of two transistors with a common collector resistor and separate base leads. When a positive voltage is applied to one transistor, it draws current and the resulting current will show almost no voltage at either collector, shutting down the other transistor in the IC. When the count is not to be taken, a positive voltage from FF_1 of the interval switcher is applied to one of the bases, thereby nullifying any signal which might be coming to the base of the other transistor in the gate. When a count is to be taken, the interval switcher goes to zero, allowing the count to go to the count indicator.

The fourth and fifth sections are similar, except that the fourth is better suited for the 60-Hz input, and the fifth is a pulse shaper, as is required to operate the flip-flop. They are monostable oscillators which give a pulse of extremely fast rise time. The duration of the pulse is governed by the value of the capacitor. The higher the value of the capacitor, the better the monostable will work at a low frequency, hence the .02 mF in the 60 Hz shaper. On the other hand, a low value must be used for a high frequency input, hence the .001 in the input shaper so that the unit will go up to 100 kHz. If you wish to measure a higher frequency than this, then change this capacitor to a smaller value. To get better low frequency response, a 0.1 will provide response from several Hz to 20 kHz.



Inside of the count controller. At the right is the switch which selects the various ranges and functions. In the middle is the frequency divider section and interval switcher with gate. This punched board measures 3¼ x 2 inches.

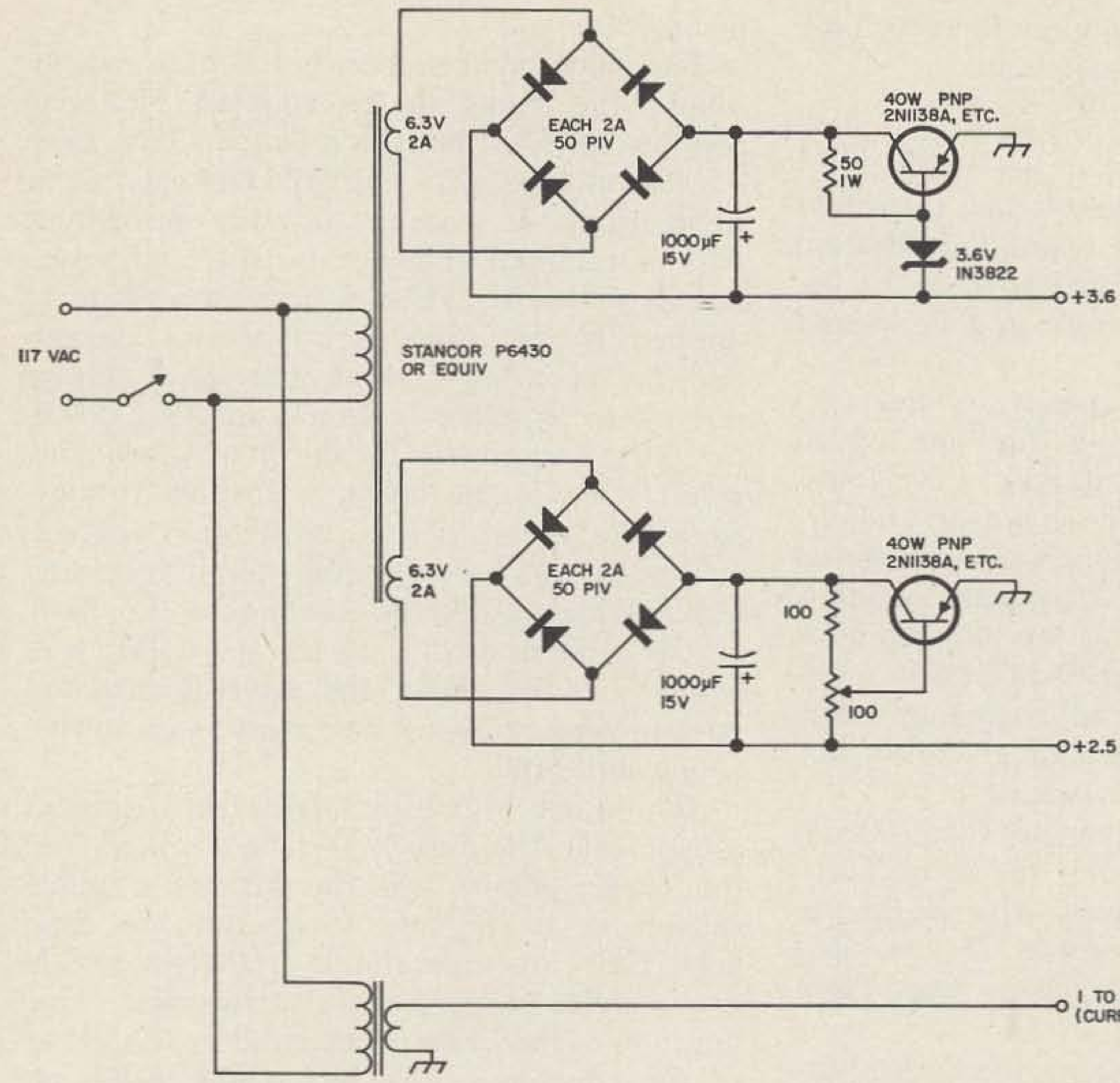


Fig. 3. Power supply for the integrated-circuit frequency counter. Two sources of regulated B+ are provided, one for the IC's, the other for the lamps and lamp drivers.

Construction of count controller

In general, the count controller is built and wired similarly to the count indicator. However, the wiring is a bit more involved to achieve the different modulus of 3 and 10, so care must be taken and the completed unit carefully checked for errors.

Power supply

This unit must supply three voltages, none of which is very critical. First of all, there must be 3.6 V to operate the various IC's. I have operated this unit from flashlight batteries—the voltage dropped to 2.3 volts before operation became erratic from one stage. At any rate, try to keep the voltage ±10% of 3.6 V and you will be assured of reliable operation. You will note that this power supply is only my way of arriving at the needed voltages, but there is a wide latitude of possibilities. In particular, the 60-Hz supply voltage to the frequency divider flip-flops is very non-critical due to the limiting nature of the pulse shaper it will feed into. Except for the 60-Hz voltage, the whole unit can be operated from dry cells.

Using the counter

After the normal checks for errors, hook up the power supply and check for proper voltages. If desired, 3 volts from batteries may be used for the IC's and another three-volt supply may be used for the lamps.

By pushing the count button, with the switch on "X1", you should get the #1 lamp to light after a pause of 1-2 seconds with no input. If this happens, things are working. If not, then the 60-Hz shaper is adjusted incorrectly. The easiest and best way to adjust this is to put a scope on pin #2 or #6 of the 60-Hz shaper, and adjust the 10k pot until you have a dependable signal. You will find that this adjustment is not at all critical, and you may have hit it accidentally. When maladjusted, there will be no output appearing at the pins mentioned. Another way, not requiring a scope, is to adjust until you do have the #1 lamp come on every time with no input. (This is a feature of this circuit which tells you that the counter is working, but that you do not have sufficient input or that the input is not hooked up properly.)

After you have achieved a reliable "1" count, proceed to couple in a sinusoidal audio signal, preferably around 1 kHz at about 1 volt amplitude rms. Push the "count" button, and see if you get a count. If you don't, then adjust the 10k pot in the input shaper section until you do. You will find that is it easier to check the unit if you have a known frequency and watch the counter count it. After getting a correct count, back off on the input ac voltage, and adjust the input shaper's potentiometer until you have the most sensitive setting. With the unit that I built, I get an input sensitivity of 0.1 volt from 700 Hz to 100 kHz. From 700 Hz to 20 Hz the minimum input requirements rise slowly, requiring 1 volt at 50 Hz and finally, 2.5 volts rms at 20 Hz. It does not overload up to 8 volts. Where possible, the input should be directly coupled rather than through a decoupling capacitor. When the capacitor is used, the minimum input requirement at low frequencies goes up.

The lights are automatically reset to "0" when the "count" button is pushed. The purpose of the "reset" button is to extinguish the lights for standby.

As mentioned at the beginning of the article, there are many number of uses for this little counter. After a little practice, and especially if you show the flashing lights to the children, you will find that this is one of the finest little units that you have ever built.

. . . W8NSO

Del Crowell K6RIL
1674 Mountain Street
Mountain View, California

Two Kilowatts PEP for 6 Meters

A complete transverter system from 10 meters.

Here is a system which is the ultimate for 6 meter SSB or CW. It puts out over 1 kW peak with less than 6 watts output from the exciter.

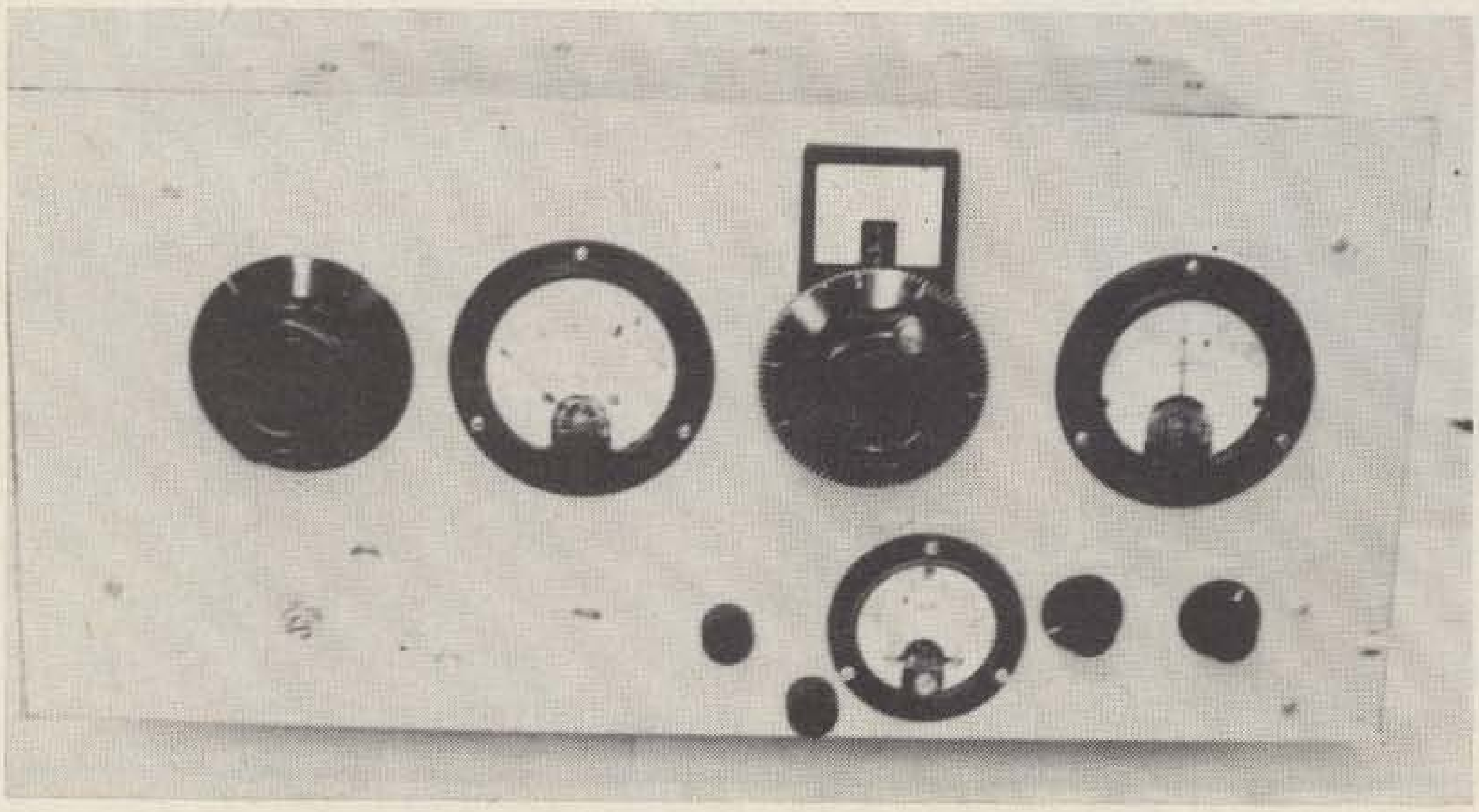
Forward scatter communication on the 6-meter band is very interesting. However, to make consistent contacts, near maximum power is required, along with the best antenna that can be used. This article covers construction of a 2 kW PEP final amplifier using the Eimac 4CX1000A along with a transverter from 28 MHz. This allows the operator to use a 10-meter transceiver or separate transmitter and receiver for the basic units. By using the low-frequency station and the 6-meter transverter, the band coverage is extended to 6 meters and the 4CX1000A final will operate very nicely at the full legal limit.

Circuit description

Transmitting converter

This transmitting converter is a much modified version of one which appeared in a magazine several years ago. This circuit is simple and very practical. Several styles have been built and used at this station, but the one used in this article was the best approach. The circuit starts out with a 6U8 triode overtone oscillator operating at 22 MHz. Low plate voltage is used for good stability; the pentode section of the 6U8 is used for isolation and provides the proper injection voltage required for mixing. This is done by selecting the proper screen limiting resistor. Too much injection voltage will produce unwanted signals. It's better to use slightly less injection than required for maximum output. A 12BY7 is used for mixing, with the local oscillator signal injected into the control grid and the driving signal fed into the cathode. The unbypassed cathode resistor serves as a load, and also as operating bias for the tube; cutoff bias is used for standby only. The 6360 amplifier operates class A with cutoff bias on standby to prevent generating excessive heat and noise during receiving periods. A stiff resistance divider is used for screen voltage.

The tank circuits are adjusted for maximum output using a CW signal input from the exciter. The link coupling in and out of the 6360 amplifier must be adjusted for op-



Front view of 2 kW transverter, left to right: output loading, plate current, plate tuning, screen current; bottom: driver tuning, driver coupling, final-grid current, final-coupling, and grid tuning.

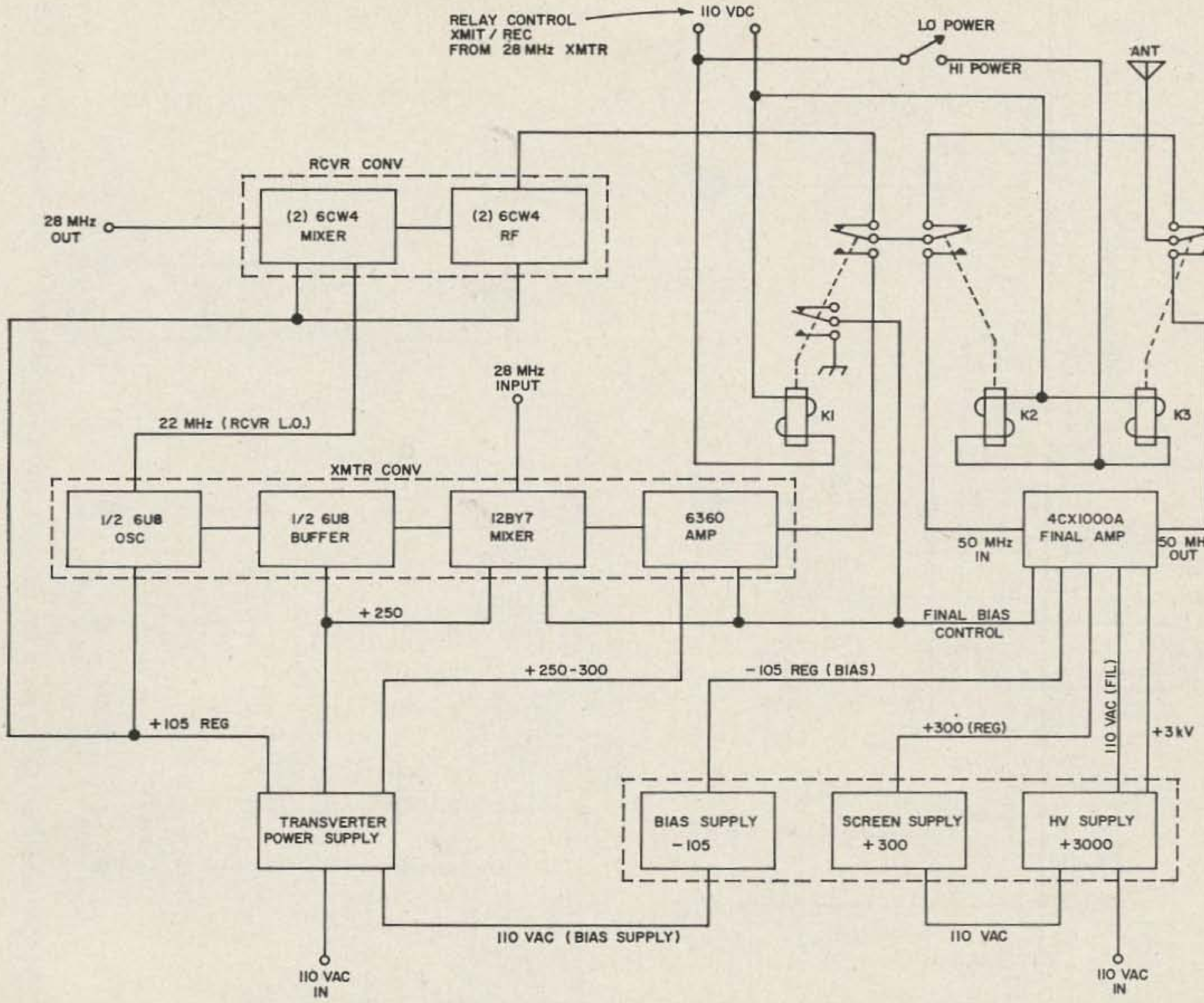


Fig. 1. Block diagram of the complete 2 kW PEP 6-meter transverter. Input and output are both at 28 MHz.

timum conditions, and maximum output of approximately 6 watts will be obtained. This power is more than sufficient to drive the 4CX1000A final, but can also be used for local contacts barefoot. Voltage requirements are as follows: 6360 B+, 250-300v; oscillator, +1050v; regulated mixer, +250v; and all filaments, −6.3v @ 2 amps.

Receiving converter

Two 6CW4 nuvistors are used in a cascode rf stage in a low-noise front end. This stage is neutralized by adjusting L3. Low plate voltage is used for best noise figure and still gives sufficient gain. A band-pass filter is used in front of the rf stage for added rejection of images, etc.

The mixer uses two 6CW4 tubes in a cascode configuration similar to the front end. The local oscillator signal is borrowed from the transmitting converter via a two-turn link on the oscillator plate coil and injected into the grid of V3. Since the dynamic range of the cascode-connected stage is greater than a single grounded-cathode amplifier, over-load problems are reduced. The overall gain of this converter is still more than needed, even with low B+ voltage applied.

This amplifier uses a standard, single-ended circuit, with a tuned input and is neutralized for best stability. This adds to the suppression of spurious signals and requires much less driving power than the passive grid method (only 3 watts drive is required). A high-capacitance and low-inductance grid circuit is used. Because of the high grid-to-cathode capacitance, a series-tuned input using approximately 75 pF for tuning is used. This will allow good balance of the input circuit and gives a proper match to the grid input.

A pi-network output, using a high-Q inductor, is used to reject harmonics. This

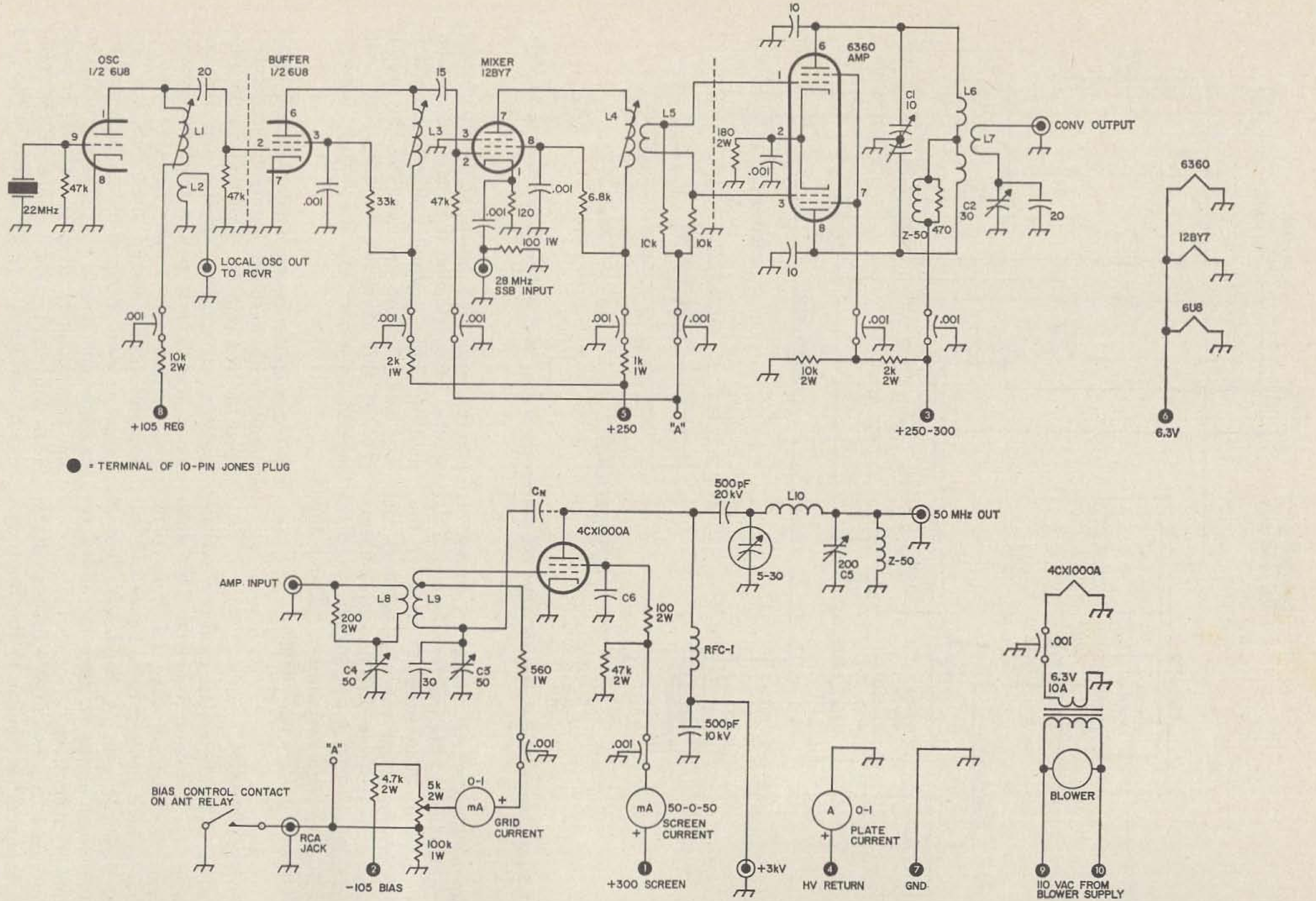


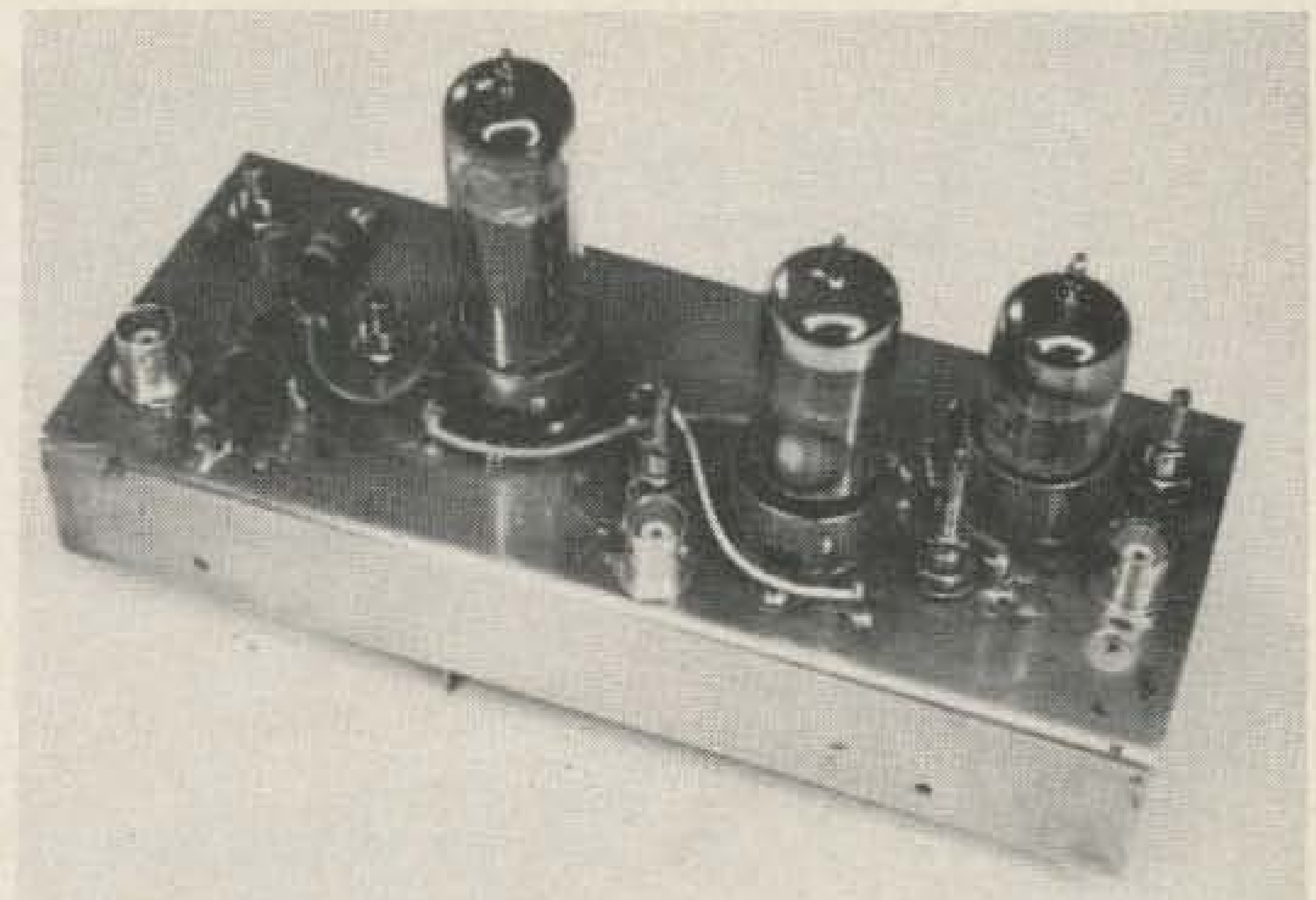
Fig. 2. Schematic diagram of the transmitting 6-meter converter and 4CX1000A amplifier. Coil values for this unit are given in Table I. All feedthrus are .001 ceramic.

helps alleviate the TVI problem. A vacuum variable capacitor is used for plate tuning, but if one is not available, a standard transmitting capacitor of good quality will do just as well. A Johnson 250 pF variable is used on the output. The voltage at this point is low, so the plate spacing can be less than in the plate circuit.

Separate metering was used for grid, plate and screen. A 50-0-50 mA was used in the screen. Depending upon loading, the screen current can vary from 0 to-20 mA and as high as +20 mA. A small bleeder, along with a series resistor, was used at the screen of the tube to prevent feedback and to keep the impedance low at all times. Screen decoupling is recommended on all tubes of this type.

The grid compartment is enclosed in a box and feedthru capacitors are used to provide isolation on all dc and heater leads. A large blower keeps the tube at a low operating temperature. The amplifier was run continuously at 2400 watts dc input and after turning it off and checking it immediately, the tube was just warm.

Filament voltage to the 4CX1000A must be adjusted to 6.0 volts. This, of course, will provide long life by preventing excessive back heating of the cathode. This tube must be operated in class AB1 with peaks of less than 1 mA grid current. A 1 mA grid-current meter is used for monitoring. At approximately 500 grid μA the tube goes into distortion; at this point the screen should show positive current. With 300 volts screen voltage and B+ of 3000 volts this amplifier is linear well beyond the 2 kW legal limit; plate efficiency is 55% or better. Cut-off bias is used on both the final and the transmitting converter. This bias level is switched by a set of contacts on T-R relay.



Transmitting converter. Top view showing the solder-in feedthru capacitors and general dc wiring.

Construction details

Transmitting converter

This transmitting converter is built on a U-shaped chassis formed from brass sheet stock. This chassis fits in the bottom of the 3-inch main chassis as shown in the photos. A hole layout is provided for locating major parts (**Fig. 5**).

All dc wiring is located on the outside of

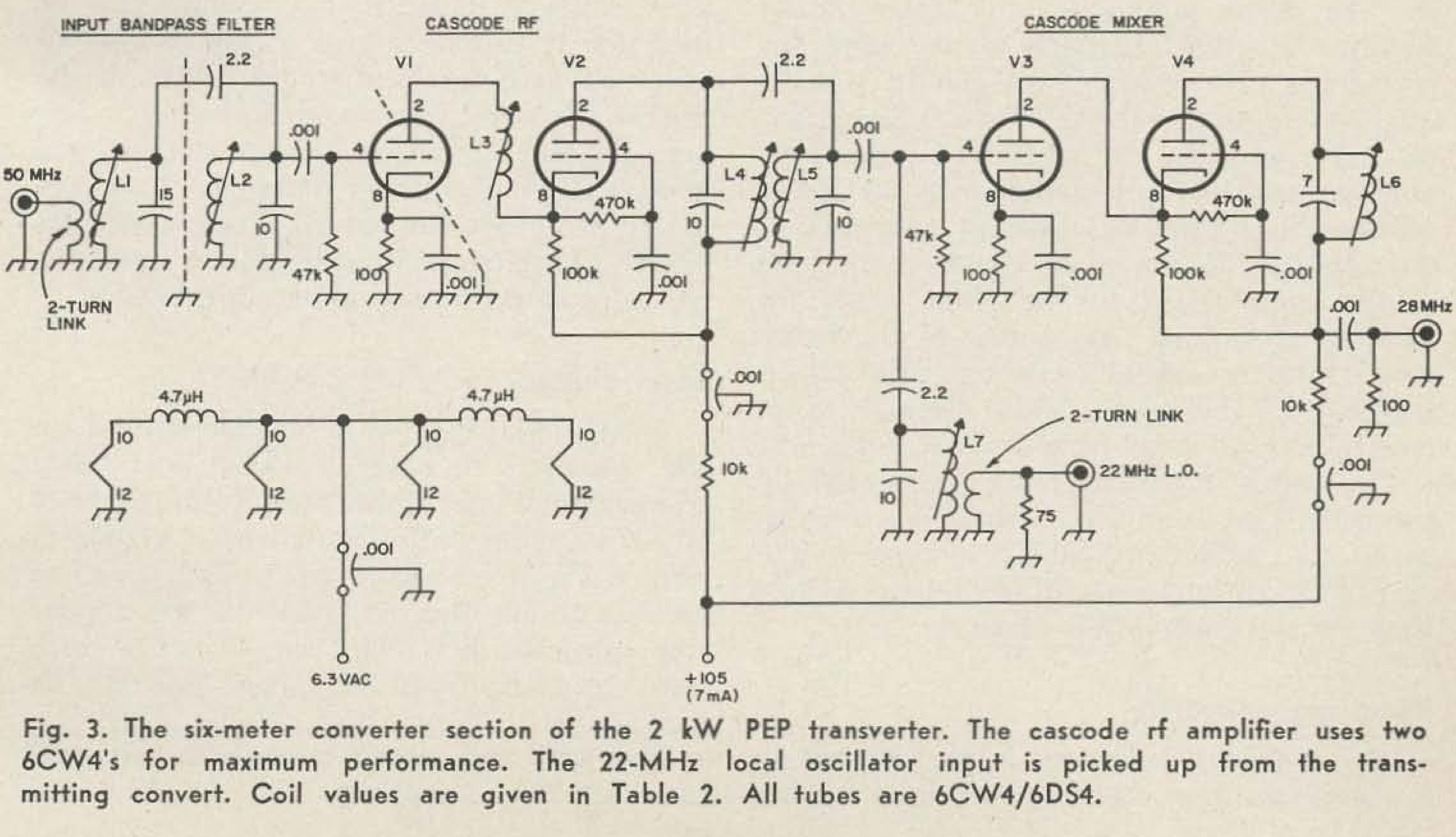


Fig. 3. The six-meter converter section of the 2 kW PEP transverter. The cascode rf amplifier uses two 6CW4's for maximum performance. The 22-MHz local oscillator input is picked up from the transmitting convert. Coil values are given in Table 2. All tubes are 6CW4/6DS4.

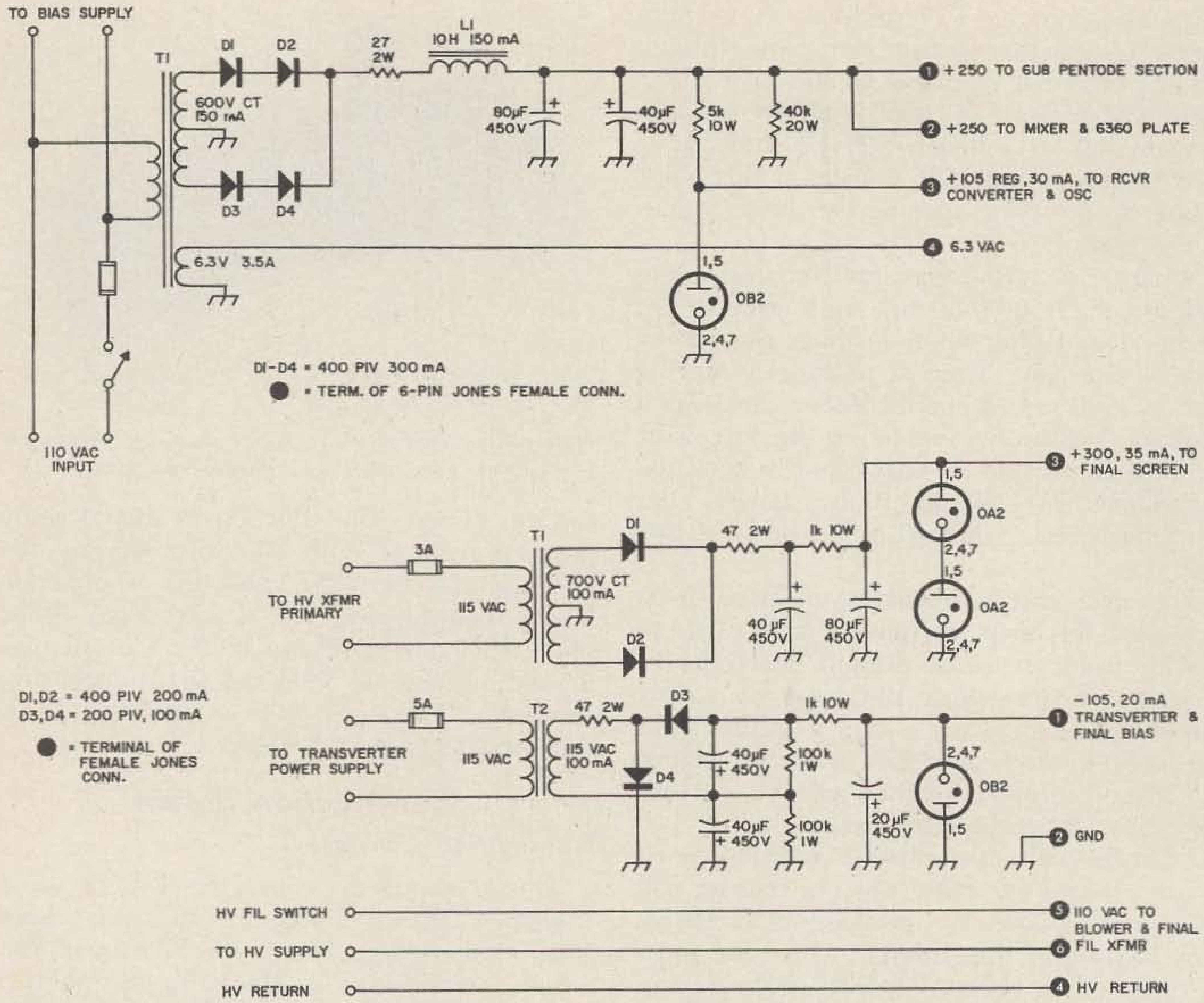


Fig. 4. The low-voltage power supply section for the 2 kW transverter. The power supply for the 4CX1000A is left up to the individual builder—its controls are shown in Fig. 7.

the chassis for simplicity and better circuit stability. Feedthru capacitors are used for by-passing. These capacitors can be a good quality solder-in or threaded type. The holes, of course, must be drilled for the type available. A cover is fabricated from brass and is soldered on. This transmitting converter is mounted inside the main chassis with long shafts brought out to the front panel for peaking at various frequencies in the band. The converter should be tested prior to installation in the main chassis. Be sure to locate the crystal away from any hot tubes, etc.

The input and output are connected by using BNC jacks on the transmitting converter chassis, and short cables are run to the rear of the main chassis. All switching is done with relays outside the chassis.

Receiving converter

The receiving converter is constructed on a chassis formed from brass (same as before) with a partition to separate the dc from the rf side as shown in **Fig. 6.** Shields are used to isolate the stages. Refer to the photos for parts placement and chassis layout. Be sure to use short connections and good VHF construction practices. This converter has outperformed all others used previously, and takes an extremely strong signal to produce cross-modulation products.

Main chassis and final amplifier

A large 11″ x 17″ x 3″ chassis is used for the complete transverter. The final plate compartment was fabricated from parts of BC-375 tuning units cut down to a 15¼″ x 7¼″ x 4¾″ box with a perforated cover. If metal working tools are available the builder can fabricate his own. An 8¾ x 19 inch front panel contains the meters and all the controls.

The grid and screen circuitry is enclosed by a 8 x 6 x 12 inch inverted chassis which

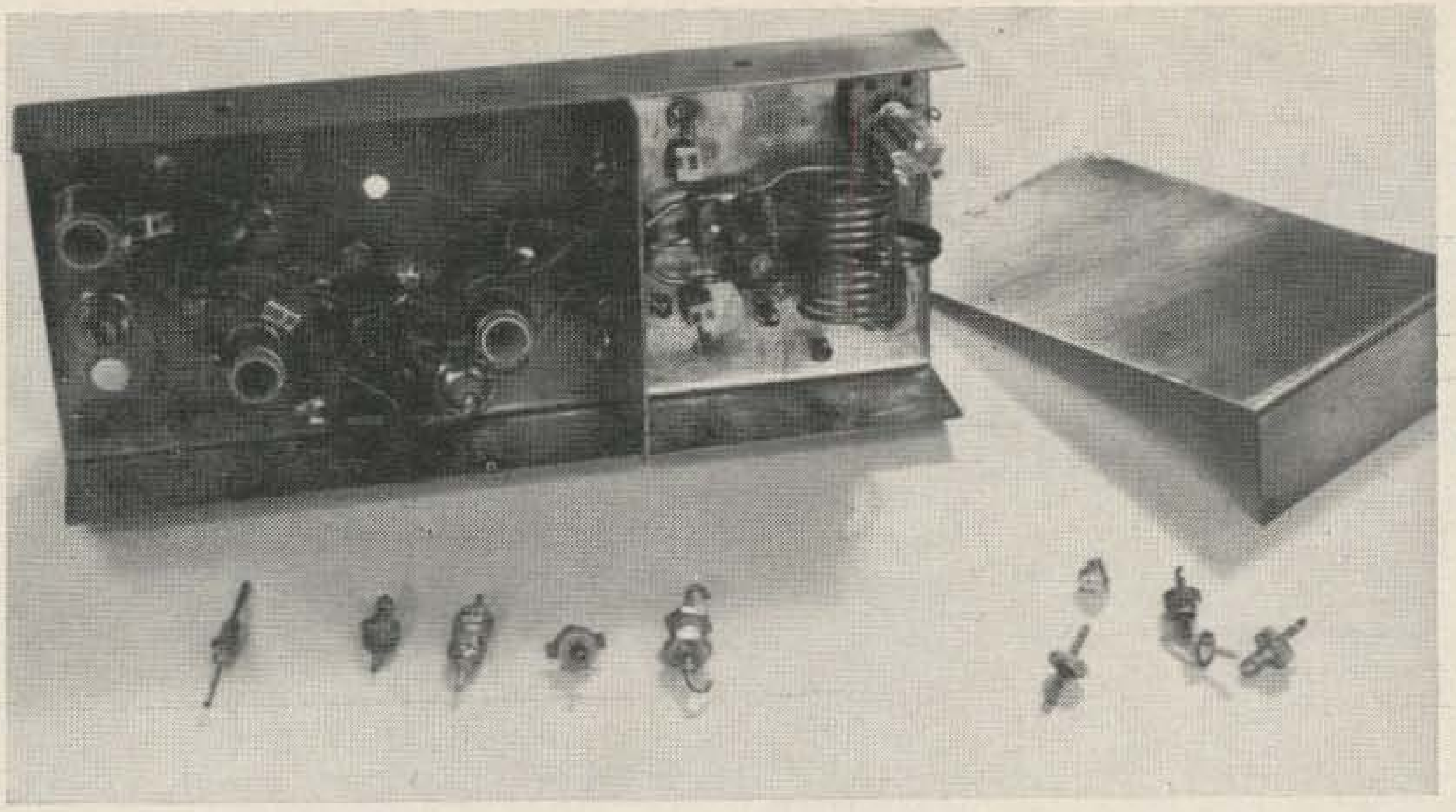


Photo showing inside of transmitting converter. Various capacitors in foreground show a few of many styles which are available for VHF/UHF use.

shields the input, and provides an air tight compartment for cooling the tube. Feedthru capacitors are used for rf suppression on the dc leads. Filament power is supplied by a 3.6V, 10-amp transformer mounted on the main chassis. The final plate coil is formed from 3 turns of ⅜-inch copper tubing with a 2-inch inside diameter, 3½ inches long. This makes a sturdy inductor and is supported by the plate and output tuning capacitors. Plate voltage is fed through RG-8/U coax, and high voltage fittings are used at the ends. The plate rf choke was constructed by winding 2 inches of #26 wire on a ½-inch ceramic stand off. A 500-pF TV door knob capacitor is used for the HV bypass. The plate blocking capacitor is a 500-pF high-current type, such as those used in most commercial systems.

The description given in this article will help the builder whether he copies this layout or simply uses it for generating his own ideas. I find most hams would like to use their own imagination.

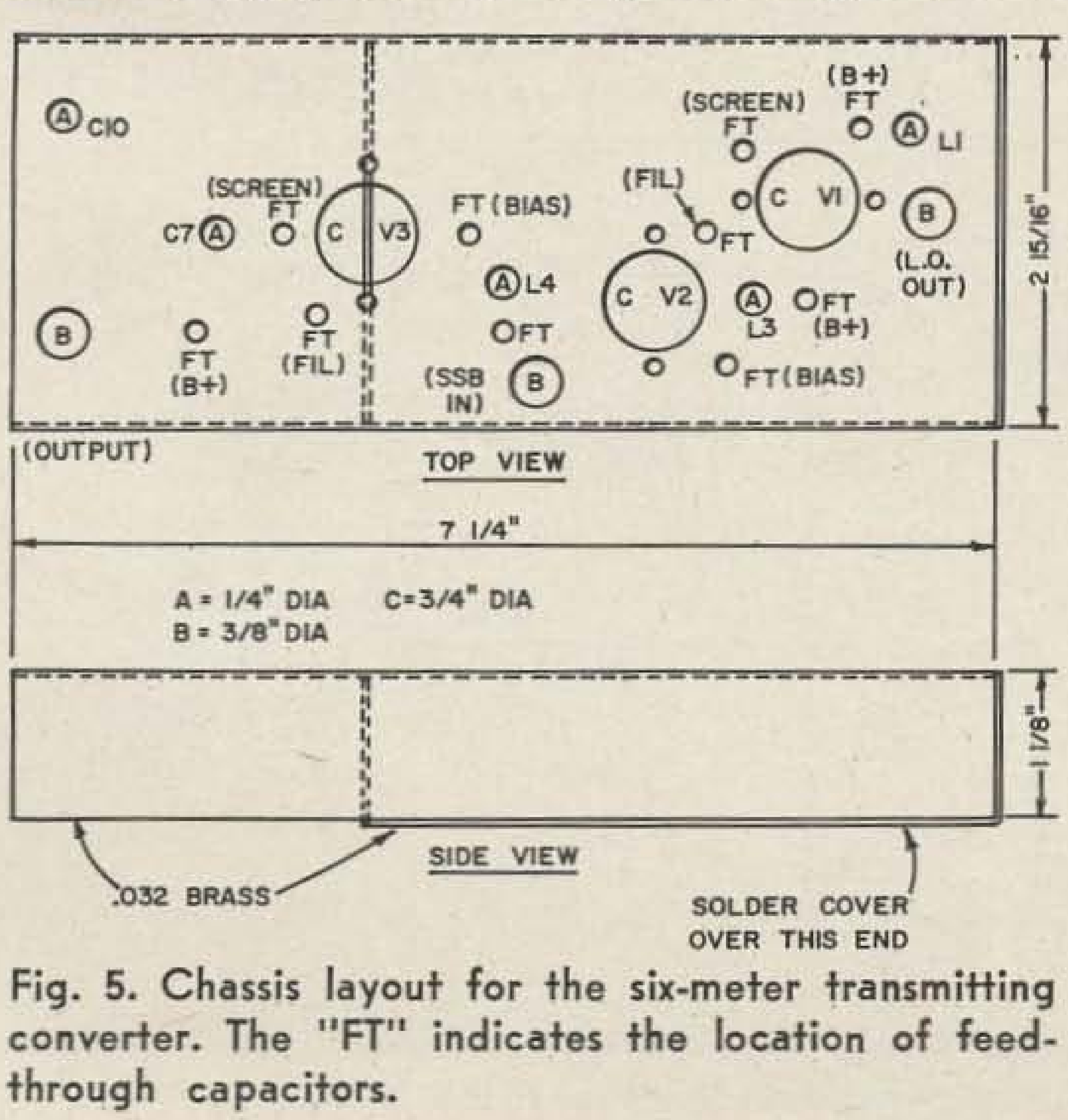


Fig. 5. Chassis layout for the six-meter transmitting converter. The "FT" indicates the location of feed-through capacitors.

The receiving converter is attached to the rear of the main chassis. This allows adjustments to be made and allows the cables to be made shorter. The transmitting converter, as stated before, is mounted inside the main chassis. With the system complete, a large cover with ventilating holes is installed over the bottom of the main chassis.

Control circuits

Provision for high or low power was incorporated in this system. When working local stations there is no need to use 2 kW PEP; the exciter output of 6 watts is adequate. Three coax relays were used to provide the switching, allowing the transverter to be used without turning on the final. The relays used were 110 V dc; however, the builder may use any relays he has available. The block diagram in **Fig. 1** shows the arrangement for this high/low power switching.

Power supplies

Power supplies were built on separate chassis. The transverter supply was built as a complete unit and delivers the following voltages: +105 V for V1 oscillator plate and the receiving converter; +250 V for the mixer and driver; and 6.3 V ac for all the transverter filaments. It also provides bias for the transmitting converter. The final screen supply was constructed on a small chassis and mounted next to the high-voltage supply. The final uses the following voltages: −105 V bias; +300 V @ 40 mA for the screen; and high voltage of +3000 V@ 700 mA. The power supply circuits shown are mainly for reference, as most hams have

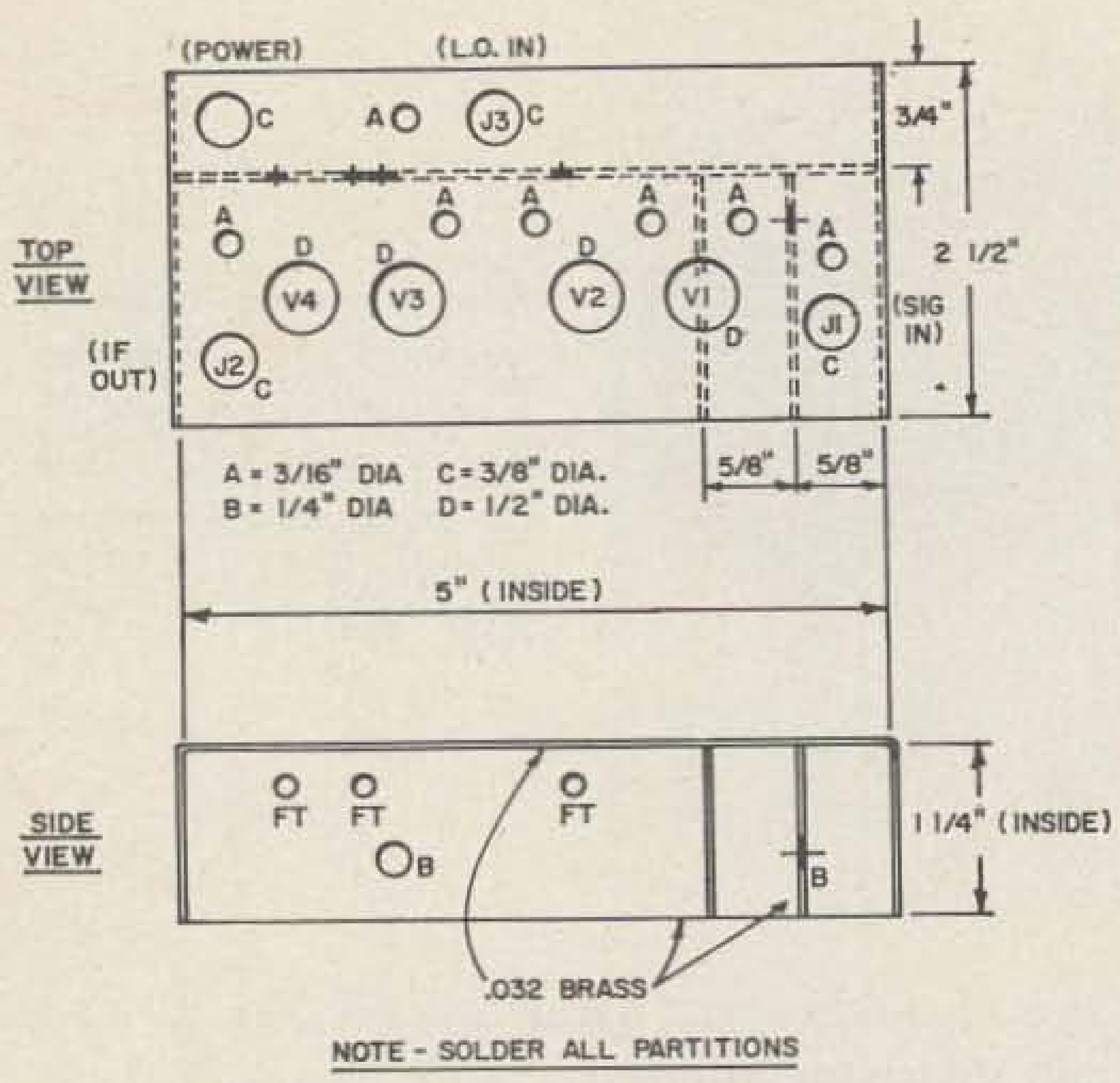


Fig. 6. Chassis layout for the 6-meter converter chassis.

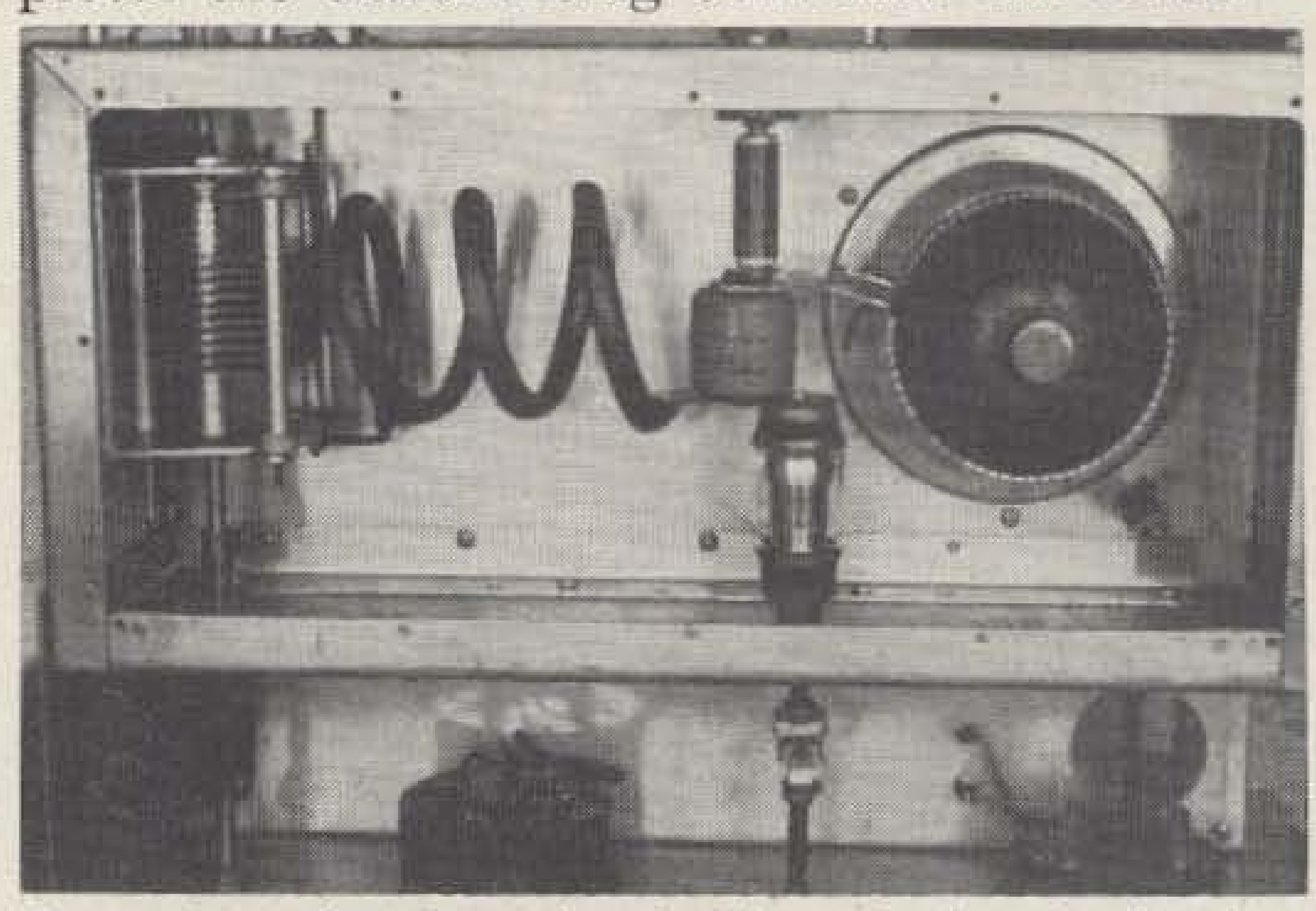
transformers of different ratings available. Well filtered and regulated supplies help to make a clean signal. Refer to the various handbooks for additional information.

A word of caution, use extreme care around the high voltages. One slip and thats all! You don't get a second chance. Use a heavy insulated screw driver to short out the B+ line before touching the innards.

Adjustment and operation

Transmitting converter

The transmitting converter should be tested prior to installing it in the main chassis. This is done as follows: using a grid-dip meter, preset all coils for the proper frequencies. Next, with a crystal connected to the oscillator, apply power and, using the grid dip meter in the diode position, peak up the local oscillator and buffer for maximum indication. Now drive can be applied to the mixer cathode. The output of the 6360 should be connected to a dummy load or wattmeter and all adjustments peaked for maximum output at 6 meters. Also adjust the coupling links at this time. The 6U8 screen resistor should be adjusted for a slight reduction in output power to insure minimum spurious signals. The rf output should now be approximately 6 watts. The cover can now be installed over the local oscillator and mixer section. Readjustment of these circuits is unnecessary; this completes the transmitting converter checkout.



Top view showing the inside of the final plate compartment. The high-Q tank circuit provides good stability. The strap in the lower right corner is used for neutralization. A homemade rf choke is supported by the door knob capacitor on the rear wall.

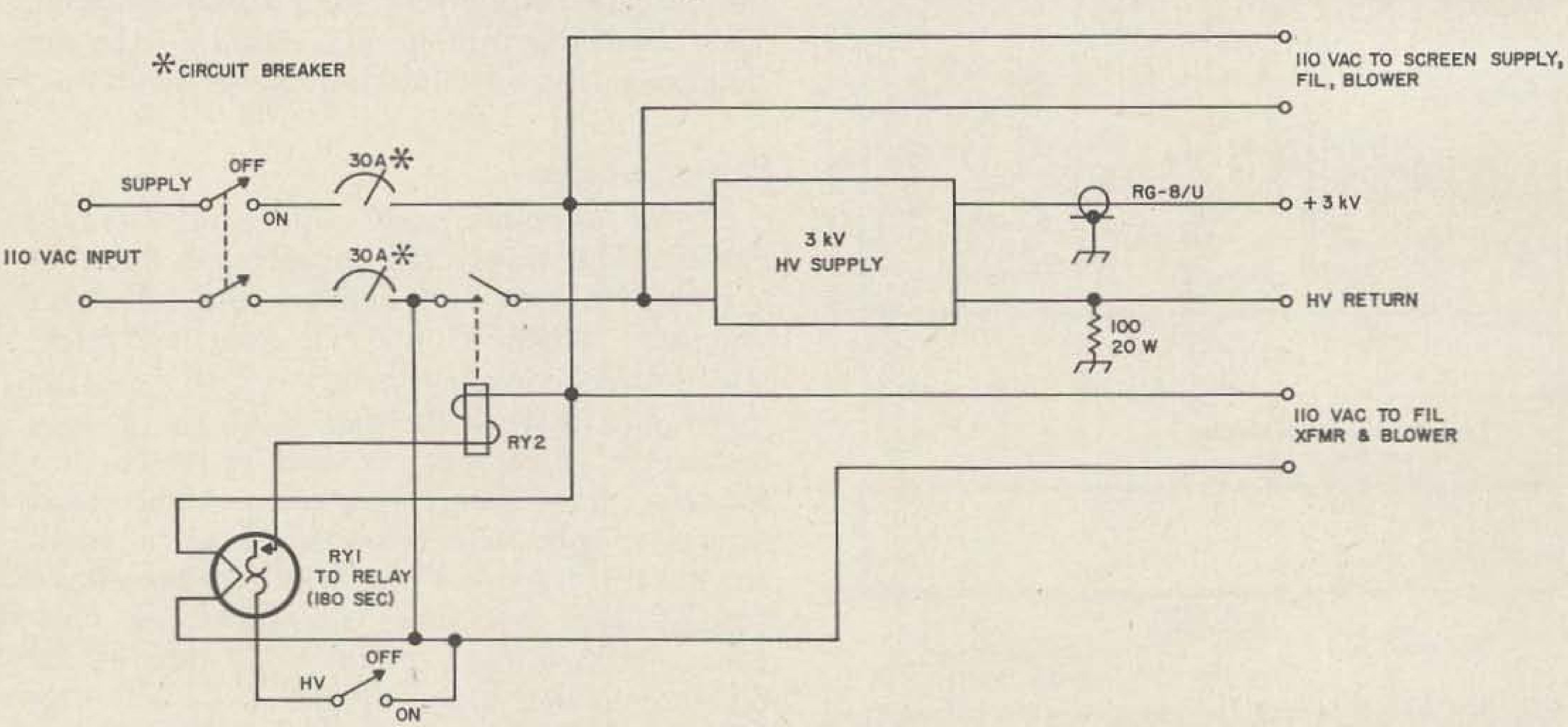
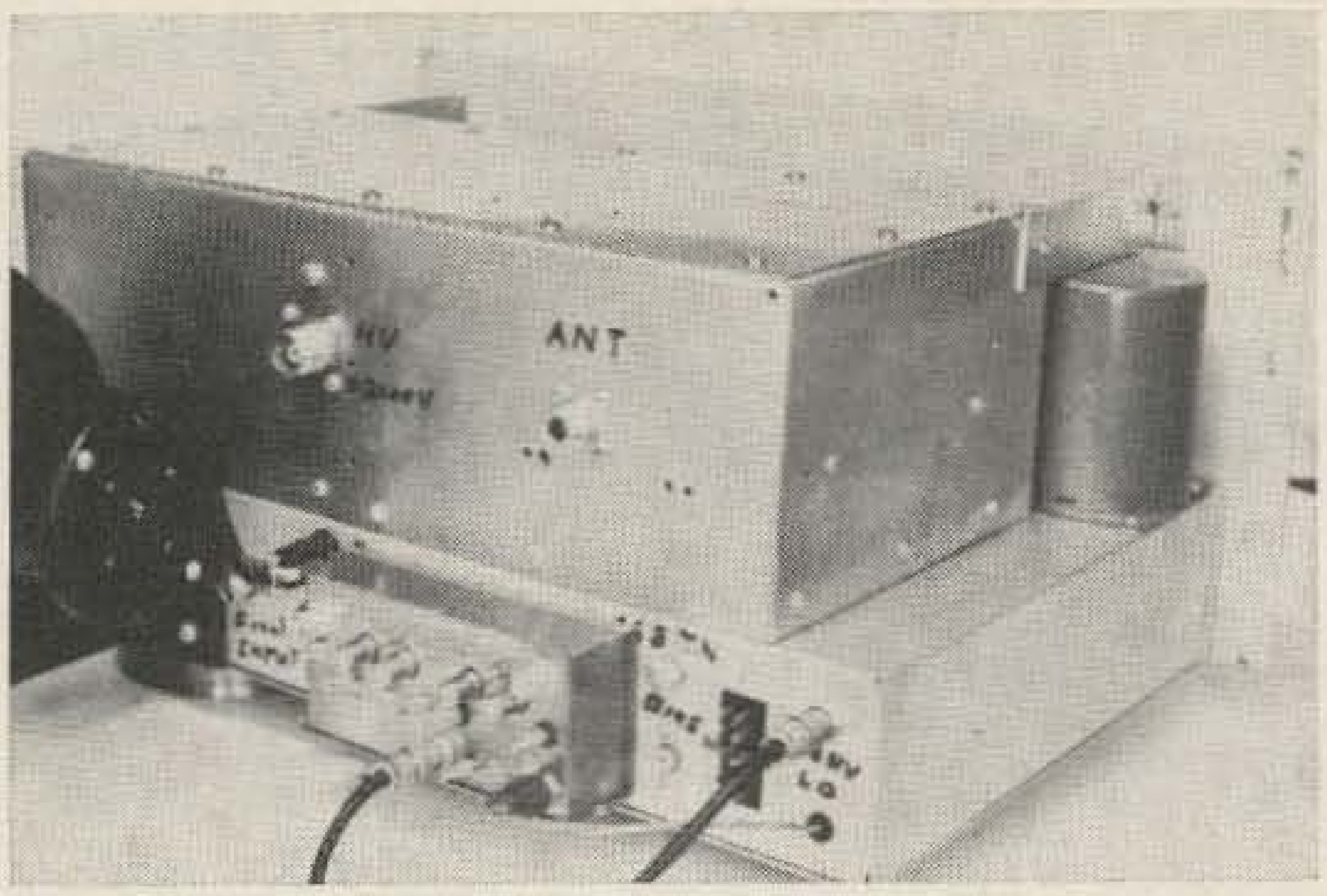


Fig. 7. High-voltage power supply controls which are used in the 4CX1000A transverter. The 3000-volt high-voltage supply is not shown since most builders will use what they have available in the junk box.



Rear view showing all input and output connections. The receiving front end on the rear of chassis allows for adjustment and ventilation. Large compartment is constructed from parts of two BC-375 tuning units with a perforated cover.

Receiving converter

Local oscillator injection is required either from the transmitting converter or another source, while adjusting. The method for this converter is very simple and just requires peaking, using a stable signal such as a 100 kHz marker or a received signal on the air. The bandpass filter can be adjusted for the desired response; however, at this station, all operating is done in the lowest 150 kHz of 6 meters.

Final adjustment and neutralization

The indivdual units should be checked out prior to installation to insure that the transverter section is working properly. When construction is complete, filament power and cooling can be applied to the final amplifier. Be sure the plate and screen leads are open circuited to prevent rectification in the screen and plate circuits.

Connect a detector and VTVM to the output connector along with a 50-ohm load. Now apply the driving power, adjust the level to about 500 mA on the grid meter, peak plate tuning and output loading for maximum level on the VTVM, adjust the neutralizing strap near the final tube for minimum level and check again to make sure the grid tuning is still set for maximum output. This procedure may have to be repeated several times. Once the final is properly neutralized, the amplifier will operate very smoothly. The power output will peak at about minimum plate current. One word of caution—be sure the screen voltage is **never** applied without plate voltage, or the screen will draw excessive current. In normal operation the final will load to about 800 mA maximum with a very slight indication of grid current. While bench testing the final, the watt meter was pegged on the 1200-watt scale. With 1200 watts output, the plate input was 1960 watts dc. Running continuously, the amplifier showed no signs of strain or detuning.

Summary

This system has proved to be very good. A lot of stations have been worked every weekend using forward scatter techniques. The exciter and receiver at this station have both transceive and separate frequency capabilities, which really makes this system a dream to use.

While using the amplifier on the air, precautions should be taken so the amplifier does not exceed 2 kW PEP as limited by regulations.

. . . K6RIL

Table 1. Coil, choke and capacitor data for the transmitting converter.

C1	10 pF butterfly variable. Johnson 160-211.
C2	30 pF single section. Johnson 160-130.
C3, C4	50 pF variable. Hammarlund HF-50.
C5	250 pF variable. Johnson E154-1.
C6	Screen bypass capacitor built into 4CX-1000A socket.
L1, L3	28 turns number 28 enameled on 3/8" slug-tuned form.
L2	2 turns number 24 insulated; wound on form below L1.
L4	13 turns number 22 enameled on 3/8" slug-tuned form.
L5	3 turns number 24 insulated wound around center of L4.
L6	10 turns number 14 tinned, 3/4" ID. Spaced at center for L7.
L7	2 turns number 14 enameled, 3/4" ID. Adjust so it is inserted halfway into L6.
L8	3 turns number 12, 1 1/4" ID, wound around center of L9.
L9	4 turns number 10, 1" OD. Tap at one turn from ground.
L10	3 turns 3/8" copper tubing, 2" ID, 3 1/2" long.
RFC1	60 turns number 25 enameled. Wound 2" long on 1/2" ceramic insulator.

Table 2. Coil data for the receiver converter shown in Fig. 3.

L1-L5	10 turns number 26 on 1/4" slug-tuned form (white slug). The antenna is coupled to L1 through a 2-turn link around the cold end.
L6	26 turns number 28 on 1/4" slug-tuned form (red or green slug).
L7	29 turns number 28 on 1/4" slug-tuned form (red or green slug). Link consists of 2 turns wound around the cold end.

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A Pulse Generator for the Amateur

An integrated-circuit design for testing transmitters, receivers, audio and ATV equipment.

"What would a ham want a pulse generator for?" asks the amateur operator. "We're not in the radar business; pulses are what we want to eliminate, not generate!" Well, first let's find out what pulses are; and then find what hams can do with them.

Webster says that a pulse (as the word applies to "radio") is "an electromagnetic wave or modulation thereof, of brief duration".[1] This definition allows us a great deal of latitude. However, the author feels that when most electronics-oriented people see the word "pulse" they think of a rectangular wave whose "on" time is short compared to its period.

A pulse train is shown in **Fig. 1**, where t_o is the "on" time, and t_p is the period, or distance between similar points on adjacent pulses. A pulse is *not* required, in general, to be rectangular; it *may* have any of a variety of shapes, like those shown in **Fig. 2.** These special-purpose pulses are sometimes used in pulse systems where it is desired to carefully control the bandwidth of the pulse signal. A pulse generator that will produce all of the pulses of **Fig. 2** is not within the scope of this article; so we'll stick to the common rectangular pulses of **Fig. 1.**

Perhaps the simplest pulse generator known to solid-state-electronics is the unijunction relaxation oscillator, as shown in **Fig. 3.** It puts out a train of pulses whose repetition rate ($1/t_p$) is controlled by R_1 and C_1 and whose "on" time (t_o) is controlled by R_2 and C_1. This simple circuit can provide a timing pulse for everything from an electronic metronome to a "V.T." fuse. With a few slight modifications, the unijunction relaxation oscillator can be synchronized and the R-C charging of the emitter-capacitor modified to linear charging.[2]

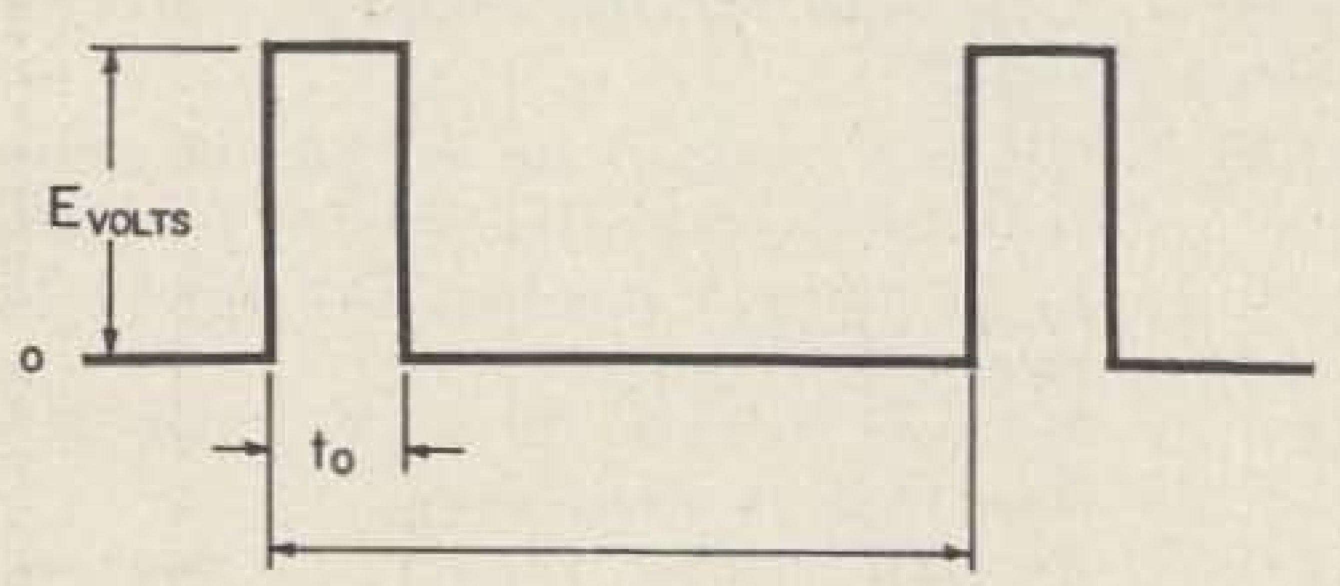


Fig. 1. A typical pulse train. The time t_o is the "on" time, and t_p is the period.

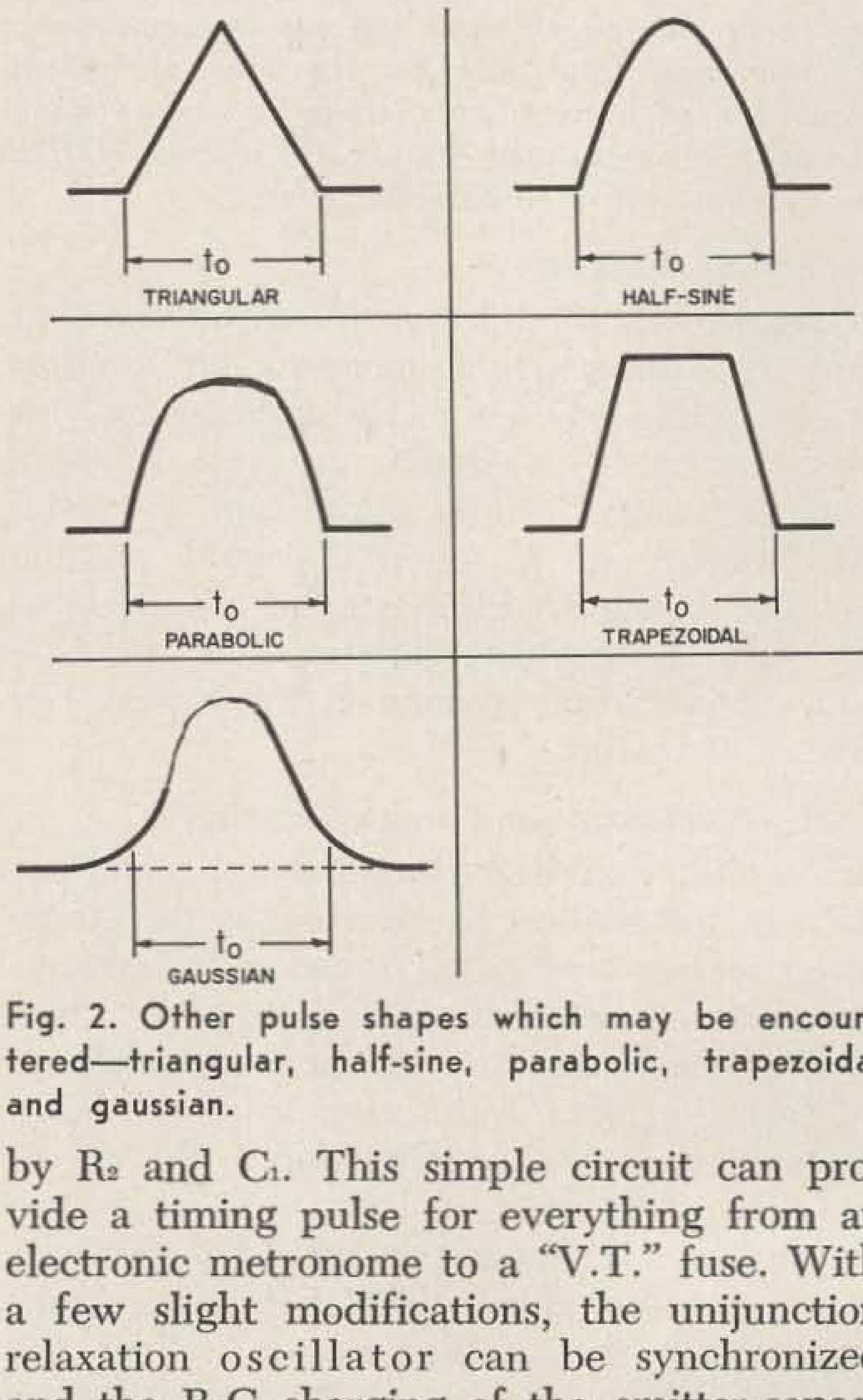


Fig. 2. Other pulse shapes which may be encountered—triangular, half-sine, parabolic, trapezoidal and gaussian.

Since the circuit of **Fig. 3** produces a pulse of rather short duration, we can use it to trigger a monostable multi-vibrator to obtain longer pulses. It is in such service that the monostable multivibrator is called a "pulse-stretcher". A realization of this simple unijunction-plus-monostable multivibrator type of pulse generator is shown in **Fig. 4.** A pulse amplifier was added between the unijunction section and the monostable multivibrator to provide both isolation and the level shift necessary. The values shown in **Fig. 4** will give pulse repetition frequencies (PRF's) of 100 to 1000 Hz and

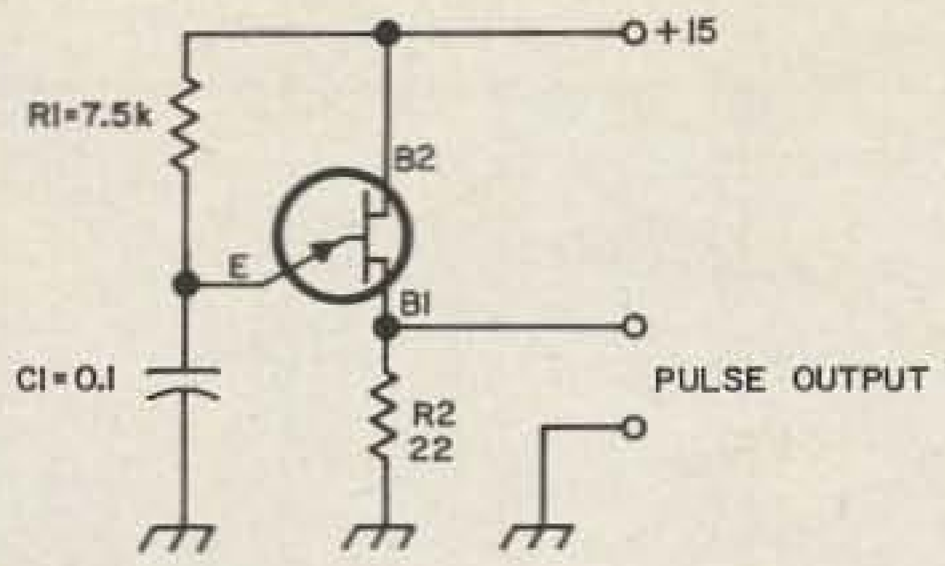


Fig. 3. A simple unijunction transistor relaxation oscillator which will generate the pulse chain. The pulse repetition rate is determined by R1 and C1; the on time is controlled by R2 and C1.

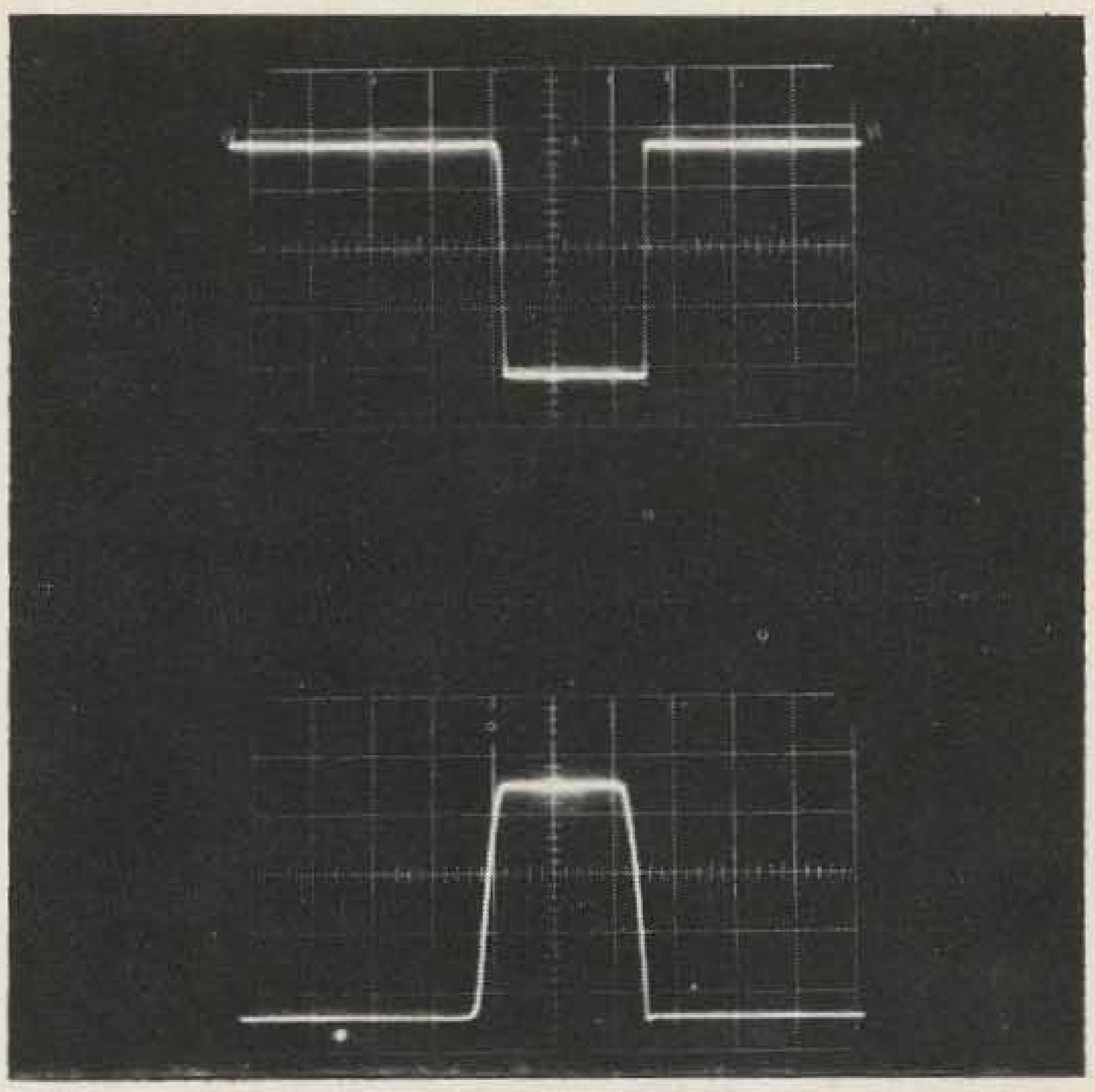


Fig. 6 Output waveform of the circuit in Fig. 5 for minimum pulse width. The sweep speed of the oscilloscope is 1 μsecond per division.

pulse widths of 30 μsec to 500 μsec. The values of R_1C_1 and R_2C_2 could be switched to provide other PRF's and pulse lengths. In spite of the fact that this simple pulse generator has only five semiconductor packages and about a dozen other components, it is a very useful unit to have around the shack.

The "sync" connection to the circuit can be either used as a sync output or sync input. A negative-going wave, from a low impedance source, put *into* the sync port will synchronize the pulse generator. Or, a negative-going pulse may be taken out from this same "sync" port. The pulse generator can be synchronized by waveforms which are multiples of its free-running frequency, and used as a divide-by-n unit.

The simple pulse generator of **Fig. 4** can be vastly improved upon, to create a general-use amateur model. Such a pulse generator is shown in **Fig. 5.** By replacing the unijunction oscillator with one using an HEP 556 integrated circuit, the need for both +15V *and* +6V as circuit supply voltages is eliminated. Only +6V must be supplied to this more versatile pulse generator.

Since the HEP 556 (a three-input ECL gate) oscillator puts out a rectangular waveform that has a logic level which is compatible with the HEP 558, no isolation amplifier is necessary. The first HEP 558 is used as a delay generator. This delay generator is a monostable multivibrator whose output pulse triggers the following stage at the *end* of its pulse. The second HEP 558, also connected as a monostable multivibrator, is the pulse generator.

To add versatility, several other transistors have been added: a split-load phase inverter, two output amplifiers, and a sync output emitter-follower.

The waveforms in **Fig. 6** show the two (complimentary) outputs when the generator is asked to produce its narrowest pulse. This narrow pulse clearly shows the rise times to be expected of our generator.

The output pulse is available either as a positive-going pulse starting near zero and going to nearly +6 volts, or the compliment of this. The compliment, of course, is a negative-going pulse starting near +6 volts and going to nearly zero.

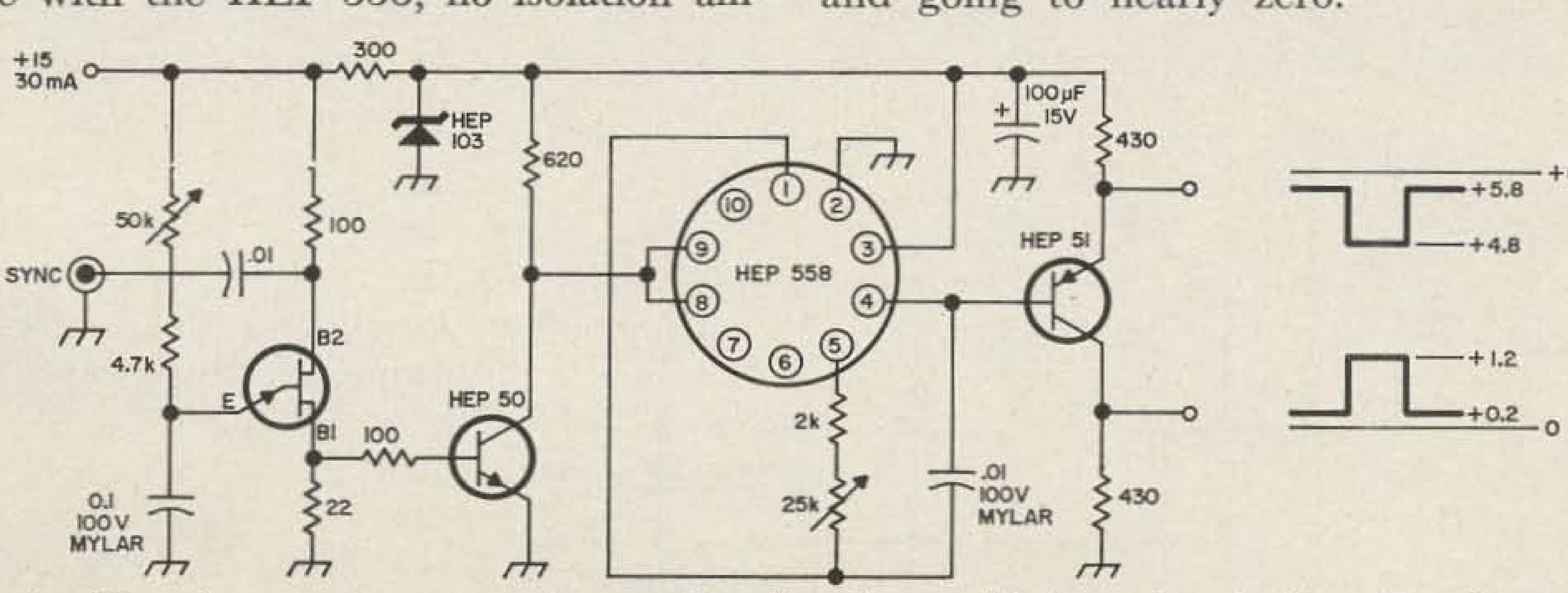


Fig. 4. In this pulse generator, a pulse amplifier has been added to the simple unijunction relaxation oscillator to provide isolation and the necessary shift level.

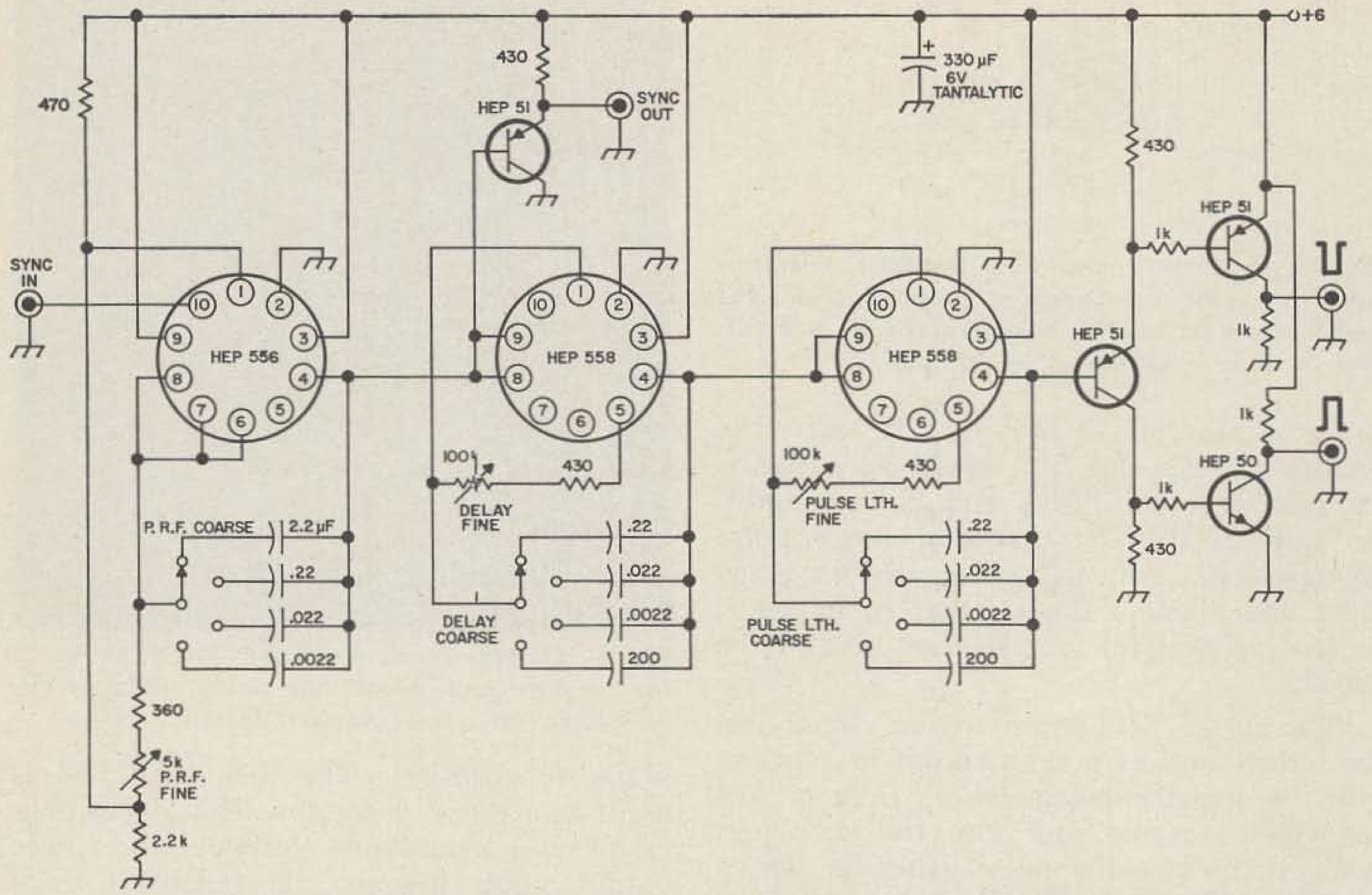


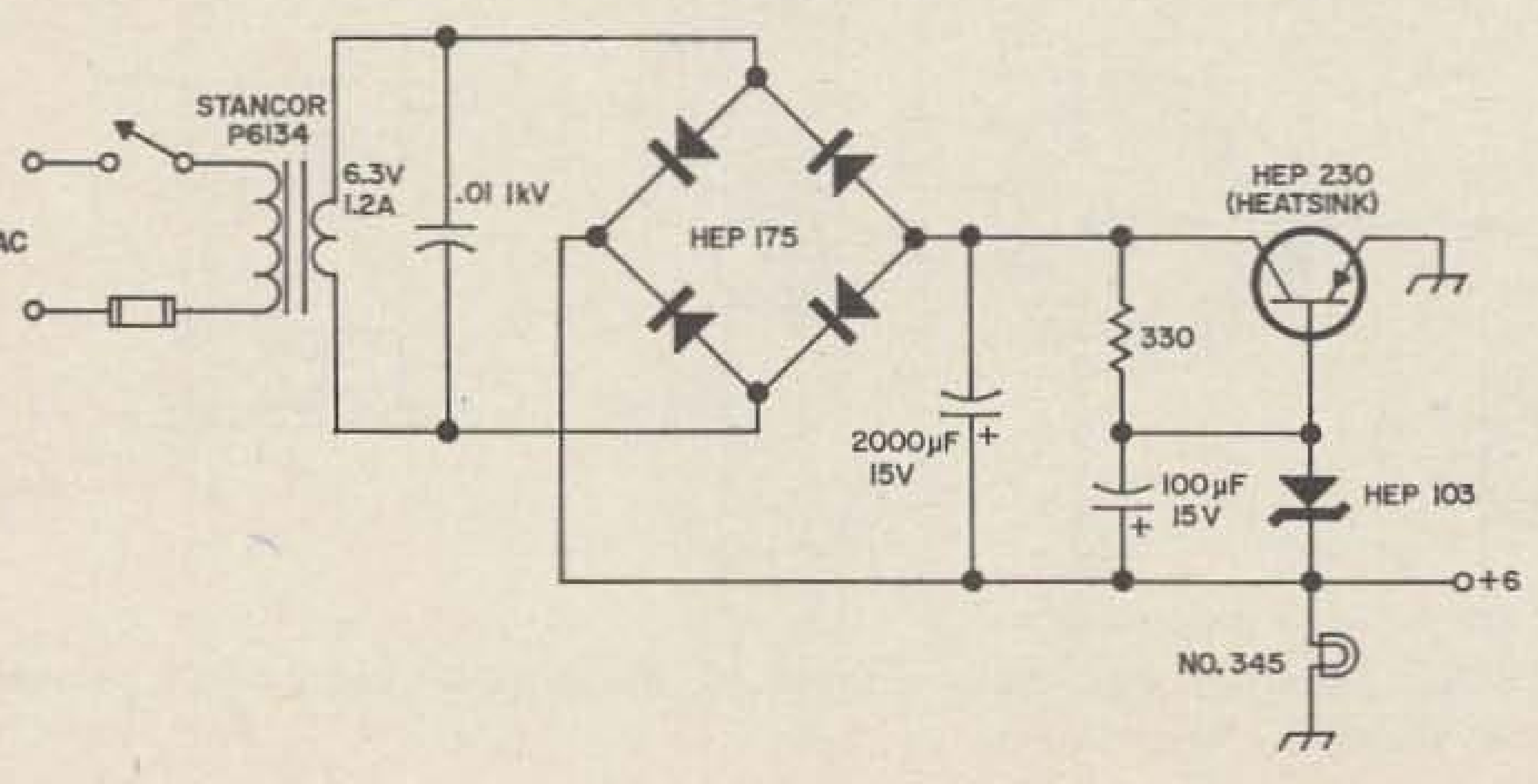
Fig. 5. The pulse generator of Fig. 4 can be vastly improved upon by replacing the unijunction transistor circuit with an integrated circuit. This pulse generator will provide complimentary outputs, variable pulse length, variable pulse repetition frequency and variable pulse delay. It will drive a capacitive-coupled 500-ohm load.

By switching the "pulse length" switch to "SQ", the monostable multivibrator, which forms the pulses, becomes a simple ÷2 flip-flop. In this mode, *nearly perfect* square waves are produced from 10 Hz to 100 kHz —just one half the normal PRF rate. This feature was added, because it was so simple; the monostable multivibrators which perform the "delay" and "pulse length" functions are basically flip-flops modified for monostable use.[3]

In the interest of simplicity, the four ports of the pulse generator are direct-coupled. Coupling capacitors, of proper size to accommodate the particular pulse one is using, can be added externally. Alternately, a series dry cell or battery can be used to adjust levels; these are best used externally.

The finished pulse generator is shown in **Fig. 7** and **8.** The generator was built in a Bud cabinet (CD-1480) for two reasons. Firstly, this was the cabinet the author had on hand, and secondly, the 8" x 8" panel allows enough room to mount all the controls. The circuit board picture, **Fig. 8**, shows *all* the generator circuitry except the power-supply. Obviously there is room to spare, and a much smaller unit could be built if miniature switches and pots were used.

Now that we've generated our pulses, let's



A regulated power supply for the pulse generator shown in Fig. 5.

have a look at their uses. The most commonly used "pulse" is the square wave, which the second pulse generator will produce. Square waves are widely used to performance-check audio amplifiers; an elementary description of this is given in the *"Motorola Integrated Circuit Projects Handbook."*[4] A more thorough section on square wave and pulse testing of amplifiers is given in reference 5.

Since the radio telegraph, radio teletype, and television modes of transmission are all based on pulse sequences, a pulse generator can be useful in the design, simulation, and testing of amateur equipment for these modes. The exact nature of the use of the pulse will depend on what the user is trying to do. If he wished to turn on a transmitter with the pulse, we'd call it "pulse (amplitude) modulation". If he wishes to turn a signal off with a pulse, we'd call it "blanking". Or turning a signal on for a desired time interval, after a desired interval would involve "delaying" and "gating". Of course, the uses of combinations of these functions are limited only by the imagination.

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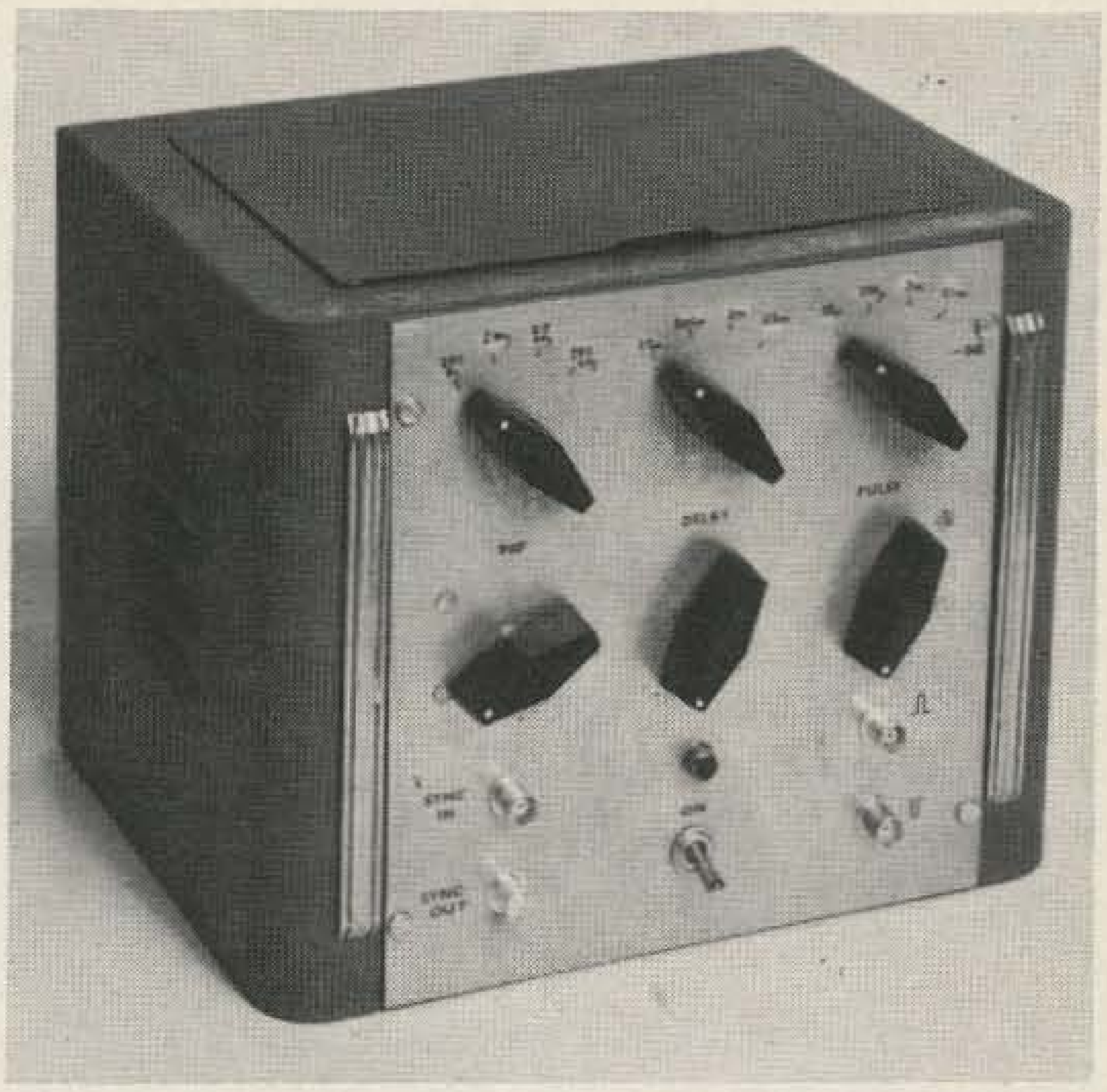

Fig. 7 The pulse generator. This unit uses integrated circuits and transistors to provide pulse repitition rates from 20 Hz to 200 kHz, pulse delays from 20 microseconds to 20 milliseconds and pulse widths from 20 microseconds to 20 milliseconds. A square wave output is also available.

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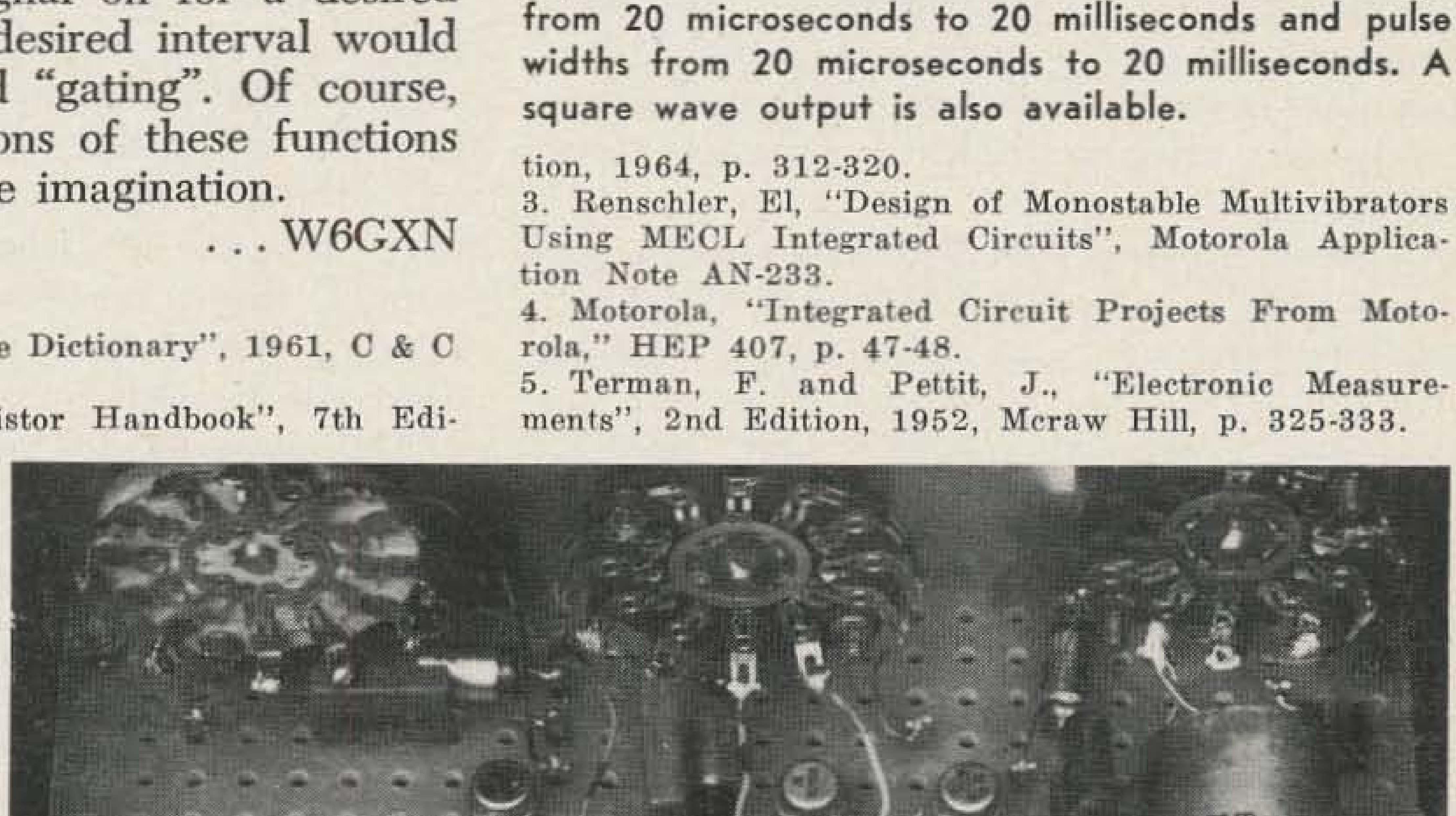

Fig. 8 Circuit board used in the pulse generator shown in Fig. 7. All components are mounted on this board except the power supply.

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Mighty Four on Six

A low cost, four transistor transmitter for six meters.

Here is a transistorized transmitter for six meters which is small in size (2¹³⁄₁₆" by 2"), complete with modulator, but still capable of putting out a very respectable signal. The modulator uses no transformers, and has a small 1½" speaker as the microphone. Only four low-cost transistors are used, and actual on-the-air reports indicate excellent performance.

The transistors specified are slightly unconventional, in that the Motorola MPS6516, used for the two modulator stages and for the 50 MHz crystal oscillator stage, are low cost (60¢), general purpose audio, and low frequency types. However, due to an f_T of better than 200 MHz specified on the data sheets, it will work nicely as a 50 MHz oscillator. Higher gain can be achieved by using transistors from this same family, such as the MPS 6517 through MPS 6523, but was found unnecessary on the two units built.

The output stage is run in grounded collector, with a slightly unconventional output. Normally a circuit such as this employs a pi output network in place of the tank shown in **Fig. 1** as L_3-C_5. Since this transmitter was to be used with only a 50-ohm antenna, and to keep dissipation to a minimum, a fixed tank circuit was used. The output transistor is a Motorola MPS 6531 plastic transistor, rated at 310 milliwatts dissipation at 25°C ambient temperature. However, as will be seen later, it will take more if certain precautions are adhered to. Again, this transistor, from the data sheets, is sold for use in complimentary audio output stages. However, the f_T on this one is 390 MHz with a maximum collector current of 600 mA. The price is 75¢.

Table 1 shows the results which can be obtained with the transmitter. Several points of caution should be noted. First, a heat sink must be used on the output transistor. The results shown were obtained with a small heat sink measuring only ½" by ¾". A suitable heat sink may be made by cutting a ½" strip approximately 1¾" long from the top of that next tin can you open. If you have a pair of small needle-nose pliers around, they'll serve nicely as the form for bending the heatsink. The shape of the MPS 6531 corresponds to this.

The second word of caution is not to use modulation with the 24 volt supply. On modulation peaks, the final may go poof. Increasing R_6 would probably reduce this chance, but due to the dissipation involved, phone operation isn't recommended at this voltage. Using it as a CW transmitter at this voltage is all right because the final really doesn't get a chance to heat up sufficiently to destroy the transistor.

If no modulation is obtained at the 9-volt level, removing R_6 and then soldering a piece of wire in its place should restore modulation. No trouble has been experienced, however, from 12 volts and up.

As can be seen in **Table 1**, the output power of the transmitter at 12 V and up, should be sufficient to drive a tube such as a 6146. Again, 24-volt operation isn't recommended, due to dissipation. Notice also how the efficiency drops off as you raise the voltage. Optimum performance seems to be between 12 and 15 volts for AM operation.

With modulation, the total drain goes up and can be as high as 200 mA on peaks at the 18 V level, but batteries the size of D

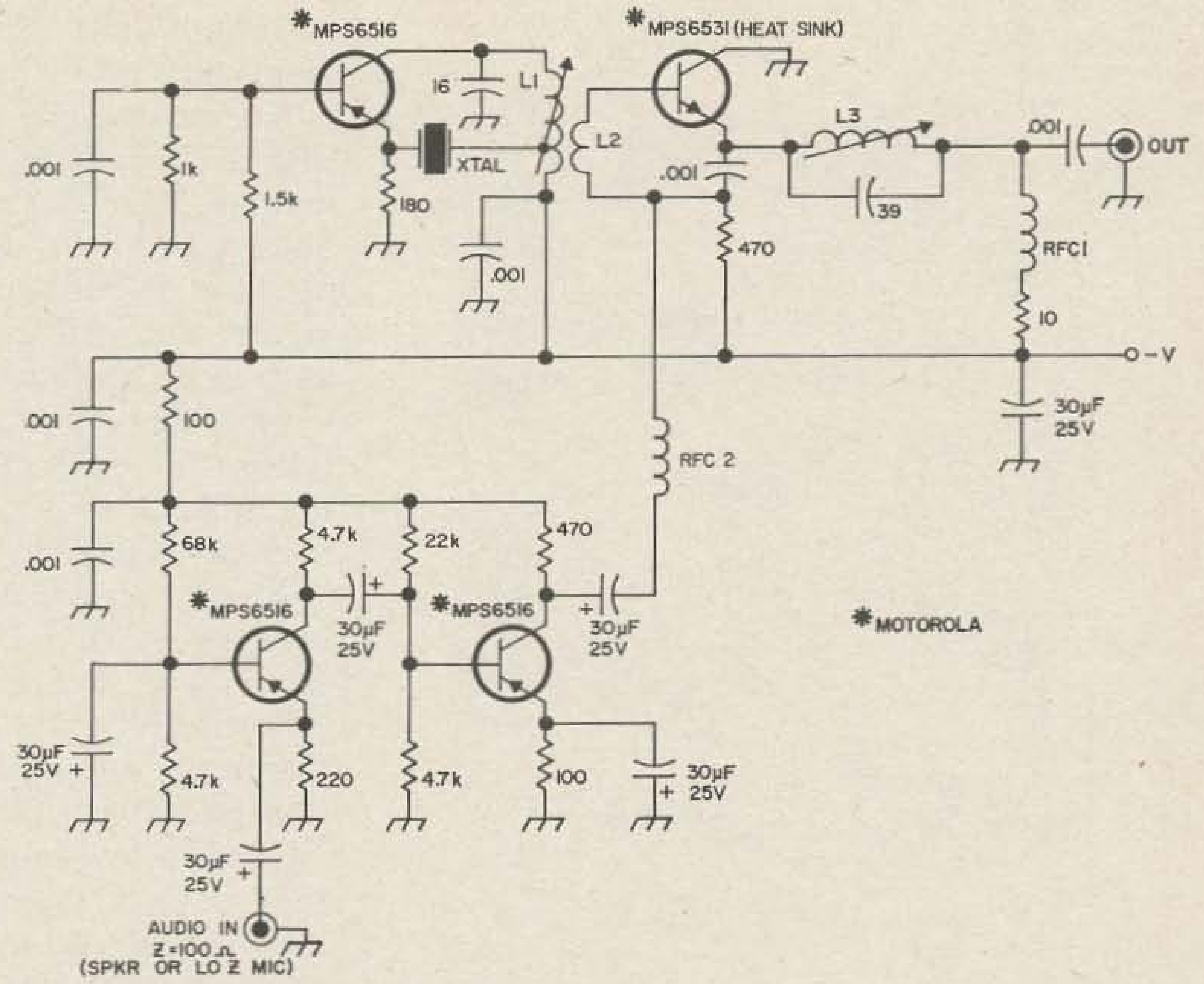


Fig. 1. Schematic diagram of the six meter transmitter employing four low cost audio transistors.

cells would be sufficient for portable operation.

The circuit shown is for positive ground, however NPN's, such as the Motorola MPS 6513, could be substituted for the PNP MPS 6516, and a PNP, such as the Motorola MPS 6533, substituted for the MPS 6531 by reversing the power supply leads. Comparable performance should be achieved.

Construction and testing

Fig. 2 shows the suggested printed circuit layout for the transmitter. The foil side is shown in 2A and the parts layout in 2B. In order to condense the size, all resistors are standing up on the board.

To build strictly for CW, but still have the option for phone operation later, just do not connect R_6 and RFC 2.

Instead of wasting money on a crystal socket, I used two pins out of a miniature 9-pin tube socket. These make a very good substitute for a crystal socket. If you're really brave (and rich), I suppose you could solder the crystal directly in, but its too easy to destroy the crystal.

The coil form for the oscillator stage was a plastic form, but could be ceramic or phenolic. A ¼" form would probably work just as well.

Build up the oscillator stage first. Using a grid dipper (or a receiver tuned to six meters), check to insure the stage is oscillating at 50 MHz. Don't worry about tuning this stage up at this time, as it'll only change when you work on the final.

Next, build the final stage. Temporarily solder only one end of R_5 (the end which goes to RFC 1). This is the 10 ohm resistor. Insert a milliameter in series with the resistor and the power supply leads.

If possible, start with no higher than 9 V initially. With voltage applied, an indication of current should now be seen. If it isn't, tune the oscillator. When current is evident, tune the oscillator stage for maximum reading on the milliameter. If no reading is obtained, reverse the leads on L_2.

Next, using an insulated tool, spread or squeeze the turns on L_3 as necessary, watch-

	9 volts	12 volts	15 volts	18 volts	24 volts
Final Current	24 mA	39 mA	49 mA	60 mA	83 mA
Power in	216 mw	470 mw	735 mw	1.080 watts	1.980 watts
Power out	138 mw	296 mw	408 mw	560 mw	795 mw
Dissipation	78 mw	174 mw	327 mw	520 mw	1.185 watts
Efficiency	64%	63%	55.5%	52%	40%
Total Circuit Drain No Modulation	50 mA	73 mA	90 mA	110 mA	145 mA

Table 1. Performance of the Mighty Four on Six with various power supply voltages.

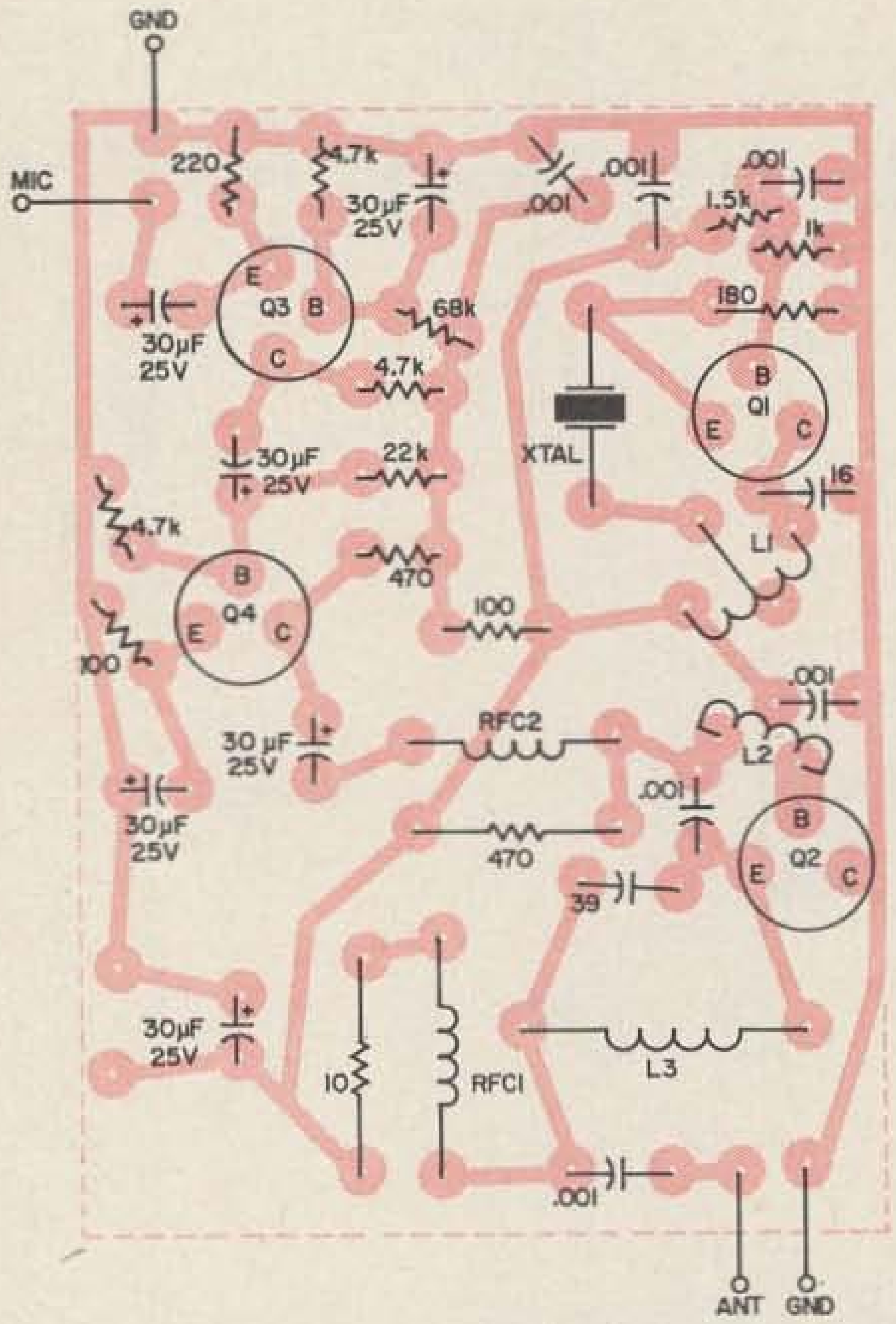


Fig. 2 Suggested printed circuit board for the transmitter. The foil side is shown in 2A and the parts location in 2B.

ing the meter for minimum current. Repeat several times until you're sure you have maximum drive from the oscillator and minimum current in the final.

As mentioned previously, the output is slightly unconventional. Tuned up in this manner, the dissipation is kept down, but doesn't produce the maximum output. At a sacrifice in dissipation, the output can be greatly detuned (for instance—removal of C_5) and more output achieved. Make sure, of course, that you have a 50-ohm dummy load connected while tuning. The results shown in **Table 1** will give you some idea of the current to expect.

Finally, build up the modulator section, connect a 75- to 100-ohm speaker, and apply voltage again. Check with a receiver to tell quickly if the modulator is working. The meter, in series with R_5, should show some deflection with modulation.

With a low-impedance dynamic mike, you may have to increase R_6 somewhat for best modulation. A scope check on modulation showed that close to 100% modulation was obtained fairly easily, so a check wouldn't hurt if you have a scope available.

Next time someone asks you what your rig is, you can tell them that you're running four audio transistors to the antenna—the Mighty Four on Six, that is.

. . . K9VXL

Vector 25X Experimenter's Kit

There's an unrecognized bargain on the market in the form of Vector's 25X Experimenter's Chassis Kit. This collection of hardware goes for about $20, and somehow their Sales Department has let it go with a really inadequate description. When I received one of these kits, the first thing I noticed was its considerable weight. Further investigation showed the Vector Co. has succeeded in putting a little bit of almost everything into it, without making quantities so small as to be hints rather than helpful.

The materials provided are about equally distributed between supplies for vacuum tubes and for solid-state breadboarding. Several different varieties of spring clip and solder lugs are included. A large piece of Vector board and four heavy aluminum channels make up a chassis-like structure and suggest more elaborate assemblies. Mounting materials for both small and power transistors, a quantity of wire, some push-on interconnecting leads, and many smaller items are also included. The tube sockets and mounting assemblies may seem a little inappropriate, but after all, we are still using a lot of tubes.

Perhaps "Basic Laboratory Kit" would have been a more descriptive title. Everything can be replaced from Vector or from general stock in order for the kit to remain useful indefinitely. A couple of mighty handy tools are thrown in for good measure. All this looks like a good thing for the fellow who likes to design his own gear, and for the beginner who needs to get a quick look at lots of circuits without getting carried away by any of them.

The 25X Experimenter's Kit is listed in Allied Electronics, Burstein-Applebee, and in Cramer Electronics catalogs. Some less expensive but simpler kits are also listed in these, and in the Lafayette Radio catalogs. You can find them easily from the manufacturer's index: Vector.

. . . W2DXH

What's new?.. DRAKE HAM GEAR

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 . . . $69.95
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).

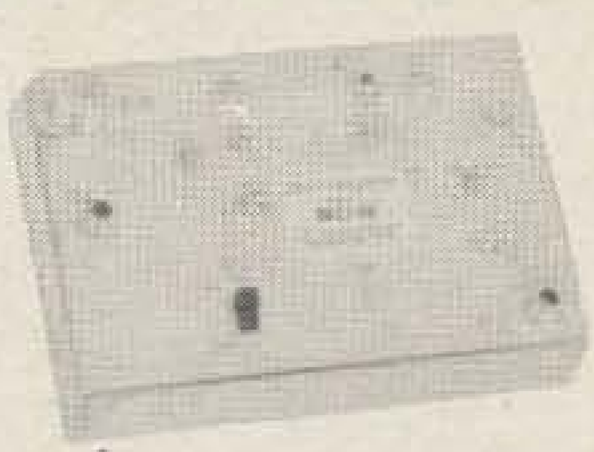
Meter reads forward power directly: MN-4, 300 watts full scale with accuracy ± (5% of reading + 3 watts); MN-2000, 2000 watts full scale with accuracy ± (5% of reading + 20 watts), and 200 watts full scale with accuracy ± (5% of reading + 2 watts).

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

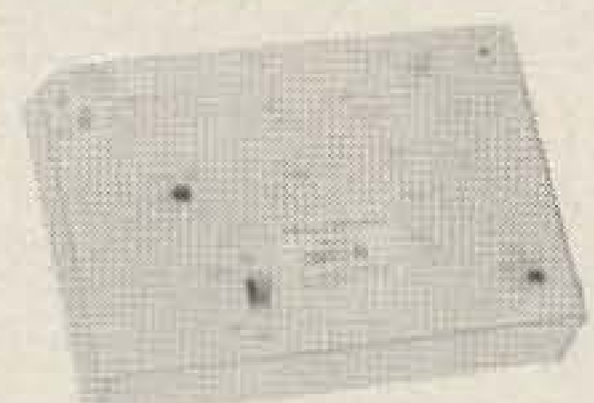
FET CONVERTERS AND ACCESSORIES

GENERAL • Low noise • Improved cross modulation performance • Uniform gain across band • Entirely solid-state • Zener regulated crystal oscillator • Improved image rejection • Low spurious response.

SC-2 and SC-6: • Input and Output impedances: 50 ohms • IF Range: 14 to 18 MHz • Power: 18 VDC at 40 Milli-amps • Frequency Range: **SC-2** 144 to 148 MHz, **SC-6** 50 to 54 MHz • Cross Modulation: **SC-2** 30 mV, **SC-6** 50 mV, 100% modulated undesired signal at antenna terminals to produce 1% modulation of desired signal • Noise figure: **SC-2** 2.5 dB, **SC-6** 4.0 dB. • **Size:** 6⅜″ L x 4 3/16″ W x 2½″ H • **Wt:** 1 lb. 5 oz.



SC-2 $69.00
for 2 meters



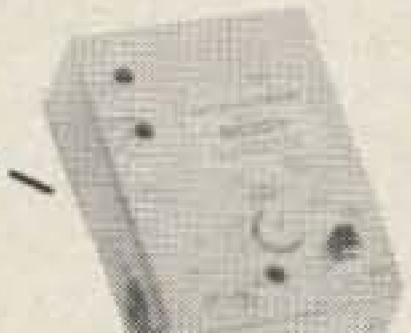
SC-6 $64.50
for 6 meters

CPS-1
Power Supply for SC-2 and SC-6
$12.50

CPS-1 • Silicon diode bridge circuit: **output**—18V DC at 100 milliamps • **Size** 3¼″ L x 4 3/16″ W x 2 1/16″ H • **Wt:** 17 oz.

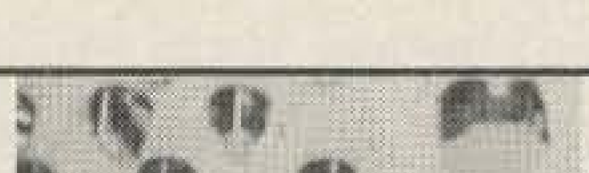
CC-1 Converter Console . . . **$24.50**

Has space for both 2 and 6 meter Converters, power supply, xtal calibrator and extra converter. Switch position permits receiver to be used direct.



SCC-1
VHF Xtal Calibrator
$24.50

SCC-1 • **Crystal controlled** 100 KHz FET oscillator • Integrated circuit divider gives 50 KHz markers • **Output** 2000 MV at 14 MHz, 250 MV at 50 MHz, 5 MV at 144 MHz. **Size:** CPS-1, **Wt:** 11 oz.



Crystal Control Unit for TR-4
Model FF-1 . . . . $24.50

• Plugs into socket in bottom of TR-4 • Gives two crystal-controlled channels in ham bands • Three-position switch provides: (1) transceive with VFO, (2) transceive with either crystal, or (3) receive with VFO and transmit with crystal

STACKING ASSEMBLY
for 4-line Receiver and Transmitter.
Saves desk space or for mobile use . . .
$15.00

Prices and specifications subject to change without notice.

Dept. 3117 • **R. L. DRAKE COMPANY** • MIAMISBURG, OHIO 45342 U.S.A.

Incentive Licensing

The report we had last month on incentive licensing was of necessity quite brief since it came out just before we went to press. Here is the complete story.

On the 24th of August the Federal Communications Commission adopted an amendment to the Amateur Radio Service Rules for incentive licensing. As we noted in our brief report last month, the new regulations include a new class of license, the Advanced Class, exclusive band segments for the Amateur Extra and Advanced Class licensees, a two-year Novice license term and deletion of Novice radiotelephone privileges on two meters.

In adopting the new regulations, the Commission noted that, in addition to comments filed by organized amateur groups, over 1700 formal comments representing the views of about 4000 licensees were received in response to the Notice of Proposed Rule Making issued in April, 1965. Each of these comments were considered, and since the majority were written in an intelligent and thoughtful manner, they were very helpful.

It is interesting to note that the proposed incentive licensing program was endorsed by two out of every three of the comments. The favorable comments supported the Commission's view that, in order to justify the continued allocation to the Amateur Radio Service of a substantial portion of the spectrum in the face of the incessant and important demands of the other radio services, there must be continuing movement towards the goals set forth in Section 97.1 of the Rules. Namely, "Encouragement and improvement of the amateur radio service through rules which provide for advancing skills in both the communication and technical phases of the radio art."

The main arguments against the proposal which were received were apparently based on the contention that an incentive licensing program would have no long-range effect. It was felt that the amateurs who studied for the higher classes of licenses would fall back to their old level of proficiency and competence after achieving the higher license. The Commission did not accept this view because education and training in any field of endeavor leads to a certain amount of permanent improvement. They concluded that an amateur who develops his skills and increases his knowledge to the extent required for the higher class license would retain a significant amount of that proficiency and learning.

New Advanced Class

Many of the comments recommended that the Advanced Class licensees be granted "grandfather" privileges to the new higher class license. Since these licensees qualified by examination for the incentive privileges in effect prior to 1952, and have had at least 15 years operating experience, they presumably have the qualities which incentive licensing is trying to foster. Accordingly, the Commission adopted the recommendation for "grandfather" rights to the new license. Present holders of the Advanced Class license will be renewed as such with all the privileges and status pertaining to the new Advanced Class license.

A large number of comments in favor of the new license suggested that it be made available to any lower class licensee without a one year waiting period. They contended that, although the primary purpose of the incentive licensing proposal was to encourage licensees to upgrade, it would actually discourage them by imposing license tenure and waiting time requirements. Also, it was frequently recommended that the proposed 16 word per minute code test requirement for the new license be reduced to 13 words per minute, the requirement for the General and Conditional Class licenses. In most cases the basis for this recommendation was that an increased code speed bears little relationship to the radio-telephone privileges which were proposed for holders of the new higher grade license. Therefore, the increased code speed requirement would present an unwarranted deterrent to obtaining the new Advanced license.

Since both of these suggestions were considered valid by the Commission, the new Advanced Class license will be available to any eligible applicant who successfully passes a code test of 13 words per minute and a written examination. Since the code test is 13 words per minute, code test credit, as well as credit for those parts of the written examination which are required for the General Class license, will be given to applicants who hold the General Class license.

Amateur Extra Class

In view of the new higher class of license, the Commission, in its Notice of Proposed Rule Making, invited comments as to whether there was sufficient interest and utility in the retention of the Amateur Extra Class license. Most of the comments in this regard urged continuation of the Amateur Extra Class. As one comment noted, "It's utility is logical with respect to the proposed Amateur First Class license in that it offers further opportunity for individual maturation . . . " In addition, the Commission noted that the number of Amateur Extra Class licensees increased a little over 25% in little more than a year. On the basis of these factors, the Commission concluded that the continued issuance of the Amateur Extra Class license as part of the incentive licensing proposal was appropriate and warranted.

Exclusive frequencies

In the original proposal, the Commission, as an incentive for the upgrading of licenses, proposed the reservation of frequency segments in the 2, 6, 15, 20, 40 and 80 meter bands for the exclusive use of the higher class licensees. In a majority of comments exclusive frequency privileges were endorsed as the most meaningful incentive which could be offered to the amateurs. They also favored the reservation of those frequencies which are most attractive and useful to the licensee.

An important exception pertained to the fact that there was no provision in the original proposal for any exclusive radio-telephone segments for holders of the Amateur Extra Class license. It was felt that this resulted in a total lack of incentive for amateurs who are primarily interested in radiotelephony to advance to this license class.

The Commission concluded that the proposal for the reservation of frequency segments for the exclusive use of higher-class licensees as the incentive for license upgrading should be adopted. It was further determined that the Amateur Extra Class licensees would be, in addition to the exclusive CW segments originally proposed, exclusively entitled to operate in the radiotelephone segments 3800 to 3825 kHz and 21250 to 21275 kHz.

A time schedule was adopted which provides that the reservation of about one half of the exclusive band segments will be implemented on November 22, 1968, and the other half on November 22, 1969. Notwithstanding this schedule, the Commission intends a careful review, and if it is determined that there is insufficient occupancy of any part of the reserved frequency segments, then the effective date of the time schedule will be stayed in whole or in part, whichever is appropriate.

A small number of comments recommended a power reduction for lower-class licensees with maximum authorized power reserved for the higher classes. This was not regarded as feasible by the Commission for several reasons. First of all is the likelihood that power limitations would present numerous enforcement difficulties. Also, the Commission noted that since a great many amateurs do not need or utilize maximum power, power limitations are not particularly meaningful, at least to these licensees, and therefore, would not provide the desired incentive.

In the proposal contained in Docket 15928, 144 to 145 MHz was also proposed as an exclusive frequency segment for higher-class licensees. Many amateurs maintained that since this band is very useful for experimental operation, it should continue to be available to all licensees. The Commission agreed with these comments, and therefore, deleted the proposed 144 to 145 MHz reservation from the adopted regulations.

Distinctive call signs

It was originally proposed that amateurs would be assigned distinctive call signs to denote the licensee's operating privileges. The primary purpose of the distinctive call signs was to enable the Commission's monitoring personnel to readily determine whether individual amateurs were operating within the range of their privileges.

A very large percentage of the amateurs who sent in comments objected strenuously —usually because they had become both attached and widely associated with their call signs. As one comment noted, "Most amateur radio operators regard their call signs as next to importance to their names . . ."

The FCC is sympathetic to the importance which most amateurs attach to their present call signs. In as much as most of the present call signs would be changed to some extent, they re-examined the basis for this proposal. They have concluded that there are two factors which will serve the effective administration and enforcement of the Amateur Radio Service without the distinctive call signs, at least at this time.

First, they feel that they can rely upon most amateurs to operate within the limits of prescribed authority and to largely regulate their own radio service. Second, automatic data processing equipment now makes listings of amateurs available which show their operating class. In fact, this has already been included in the latest edition of the *Radio Amateur Callbook*. With this information readily available to monitoring personnel for prompt identification purposes, enforcement requirements remain minimal. With these factors in mind, the Commission decided not to adopt the proposal for distinctive call signs at this time.

From the wording of the proceeding, it is apparent that the Commission is not adopting the distinctive call signs now, but they're leaving the door open. If the amateurs do not continue to police themselves, and enforcement of the exclusive frequency segments becomes a problem, they will probably take a closer look at distinctive call signs.

Two-letter calls

One aspect of the proposed call sign schedule included the assignment of two-letter calls to Extra Class licensees. At the present time there are approximately 8,000 of these calls available for assignment. Therefore, to reflect longevity and/or attainment in amateur licensing, these calls, in addition to being available to previous holders of two-letter calls, will also be assigned to Amateur Extra Class licensees who submit proof that they held an amateur radio operator's license issued by the United States Government 25 years or more prior to the date of application. The $20.00 special call sign request fee will be applicable to these requests, but applicants will not be permitted to select specific two-letter calls. And, new holders of these call signs will be limited to one such assignment since there are so few available.

Present holders of two-letter call signs can continue to hold them even if they do not meet the criteria noted above. Also, former holders of a specific two-letter call sign may regain that call if it is available in accordance with Section 97.51 (a) (1) and (2) of the regulations.

Novice Class

The Commission proposed that new holders of the Novice Class license would be given a two-year non-renewable license in place of the present one-year non-renewable term. They also proposed that the Novice radiotelephone privileges in the frequency segment 145 to 147 MHz be deleted.

The extension of the Novice Class term was intended to afford these licensees additional time for developing their proficiency and knowledge before attempting to advance to a higher class. Also, deletion of radio-telephone privileges was designed to foster their code proficiency. It has been proven that all too often the Novice spends too much of his term on phone, and when his license expires, he is not able to qualify for the General ticket.

The FCC reports that almost without exception the comments on the two Novice proposals supported them. Since the Commission felt that the considerations which prompted these proposals remain valid, they were both adopted.

Conditional Class

The Commission also proposed that the Conditional Class license would no longer be available to new applicants who claim eligibility solely by virtue of active duty in the armed forces. However, with the recent increases in the armed forces, they felt that the adoption of this proposal could adversely affect many people on active duty. Therefore, they decided not to adopt this proposal at the present time.

Summary

We have been waiting a long time for the outcome of the incentive licensing proposal, and the new regulations which go into effect on November 22, 1967, are more than fair. None of the exclusive band segments go into effect until November 22, 1968, so there is more than adequate time for everyone interested to qualify for a higher class license.

If you're primarily interested in operating on the phone bands, and presently hold a

General Class license, all you have to do is pass the advanced technical test—there are no additional code speed requirements. The Advanced Class license that you obtain will give you all but two 25 kHz phone assignments—one on 80, the other on 15.

If you're interested in operating CW, the lower 25 kHz (lower 50 kHz in two years) of the bands are available when you qualify for the Amateur Extra Class. If you are primarily a CW operator, the 20 words per minute shouldn't be too much of a problem. The more advanced technical test might be a challenge, but with a little book work this shouldn't be too tough either.

The amateur who is going to have to work the hardest is the phone man who wants to operate on the two exclusive 25 kHz Amateur Extra phone bands on eighty and fifteen meters. His code may be a little rusty, but with some concentrated effort it is possible. And, it is a small price to pay for full operating privileges.

I must agree with the FCC when in concluding they said, "In reaching its conclusions, the Commission has made every reasonable effort to provide an opportunity for the remodeling and revitalization of the Amateur Radio Service without changing its basic character and spirit and without depriving any amateur licensee of the major portion of his present operating privileges. It remains only for the licensee to prove himself and to improve the Amateur Radio Service by voluntarily upgrading his license to the highest level of achievement of which he is capable. We are confident that we can rely upon the amateurs in this regard, and that, therefore, this incentive licensing program will result in a radio service which will be a source of pride to both amateur licensees and the Commission."

Get the books off the shelf, listen to the code practice sessions on W1AW and let's get with it. Right now you have a year to prepare; don't wait until it is too late. We'll try to help you as much as we can—watch for a big technical series designed for the Advanced and Amateur Extra Class license examinations starting next month in 73. We can't help you with your code speed—all that takes is practice. But don't wait too long—start right now.

. . . W1DTY

Part 97 of the Commission's Rules is amended as follows:

97.7 Privileges of the operators licenses

(a) Amateur Extra Class and Advanced Class. All Authorized amateur privileges including exclusive frequency operating authority in accordance with the following table (see Table 1), effective on the dates shown.

(b) General Class and Conditional Class. All authorized amateur privileges except those exclusive frequency operating privileges which are reserved for the Advanced Class and/or the Amateur Extra Class.

(c) Technician Class. All authorized amateur privileges on the frequencies 50.25-54 MHz and 145-147 MHz and in the amateur frequency bands above 220 MHz.

Note: Technician class licensees may additionally operate on the frequencies 50-50.25 MHz until November 22, 1968, and 50.1-50.25 MHz until November 22, 1969.

(d) Novice Class. Those amateur privileges designated and limited as follows:

(1) The dc plate power input to the vacuum tube or tubes supplying power to the antenna shall not exceed 75 watts, and the transmitter shall be crystal controlled;

(2) Operation on the frequency bands 3700-3750 kHz, 7150-7200 kHz, 21.10 to 21.25 MHz, and 145-147 MHz is authorized for radio-telegraphy using only type A-1 emission.

Note: Novice Class licensees may additionally operate until November 22, 1968, on 145-147 MHz for radiotelephony using types of emission as set forth in 97.61.

Section 97.9(b) is amended to read as follows:

97.9 Eligibility for new operator license.

* * * * * * * * * * * * *

(b) Advanced Class. Any citizen or national of the United States.

* * * * * * * * * * * * *

Section 97.21 is amended to read as follows:

97.21 Examination elements.

Examinations for amateur operator privileges will comprise one or more of the following examination elements:

(a) Element 1(A): Beginners' code test at five (5) words per minute;

(b) Element 1(B): General code test at thirteen (13) words per minute;

(c) Element 1(C): Experts' code test at twenty (20) words per minute;

(d) Element 2: Basic law comprising rules and regulations essential to beginners' operation, including sufficient elementary radio theory for the understanding of those rules;

(e) Element 3: General amateur practice and regulations involving radio operation and apparatus and provisions of treaties, statutes, and rules affecting amateur stations and operators;

(f) Element 4(A): Intermediate amateur practice involving intermediate level radio theory and operation as applicable to modern amateur techniques, including, but not limited to, radiotelephony and radiotelegraphy;

(g) Element 4(B): Advanced amateur practice involving advanced radio theory and operation as applicable to modern amateur techniques, including, but not limited to, radiotelephony, radiotelegraphy, and transmissions of energy for measurements and observations applied to propagation, for the radio control of remote objects and for similar experimental purposes.

Section 97.23 is amended to read as follows:

97.32 Examination requirements.

Applicants for original licenses will be required to pass the following examination elements:

(a) Amateur Extra Class: Elements 1(C), 3, 4(A), and 4(B);

(b) Advanced Class: Elements 1(B), 3, and 4(A);

(c) General Class and Conditional Class: Elements 1(B) and 3;

(d) Technician Class: Elements 1(A) and 3;

(e) Novice Class: Elements 1(A) and 2.

Section 97.25(c) is amended to read as follows:

97.25 Examination credit.

(c) An applicant for the Amateur Extra Class operator license will be given credit for examination elements 1(C), 4(A), and 4(B), if he so requests and submits evidence of having held a valid amateur radio station or operator license issued by an agency of the United States Government during or prior to April 1917, and qualifies for or currently holds a valid amateur operator license of the General or Advanced Class.

* * * * * * * * * * * * *

Section 97.29(a) is amended to read as follows:

97.29 Manner of conducting examinations.

(a) The examination for Amateur Extra, Advanced, and General class of amateur operator licenses will be conducted by an authorized Commission employee or representative at locations and at times specified by the Commission.

* * * * * * * * * * * * *

Section 97.31(b) is amended to read as follows:

97.31 Grading of examinations.

* * * * * * * * * * * * *

(b) Seventy-four percent (74%) is the passing grade for written examinations. For the purpose of grading, each element required in qualifying for a particular license will be considered as a separate examination. All written examinations will be graded only by Commission personnel.

Section 97.33 is amended to read as follows:

97.33 Eligibility for re-examination.

An applicant who fails an examination for an amateur operator license may not take another examination for the same or higher class amateur operator license within 30 days, except that this limitation shall not apply to an examination for an Advanced or General Class license following an examination conducted by a volunteer examiner for a Novice, Technician, or Conditional Class license.

Section 97.51(a) (5) is amended to read as follows:

Assignment of call signs.

* * * * * * * * * * * * *

(a)

(5) One unassigned two-letter call sign (a call sign having two letters following the numberal) may be assigned to a previous holder of a two-letter call sign the prefix of which consisted of not more than a single letter. Additionally, a two-letter call sign may be assigned to an Amateur Extra Class licensee who first held an amateur radio operator license issued by the Commission, or by one of its predecessor agencies, 25 years or more prior to the receipt date of an application for such assignment. Applicants for two-letter call signs are not permitted to select a specific assignment except in accordance with subparagraphs (1) and (2) of this paragraph.

* * * * * * * * * * * * *

Section 97.59(a) and (b) are amended to read as follows:

97.59 License term.

(a) Amateur operator licenses are normally valid for a period of 5 years from the date of issuance of a new or renewed license, except the Novice class which is normally valid for a period of 2 years from the date of issuance.

(b) The license for an amateur station is normally valid for a period of 5 years from the date of issuance of a new or renewed license except that an amateur station license issued to the holder of a Novice Class amateur operator license is normally valid for a period of 2 years from the date of issuance. ■

	PHONE ALLOCATION			CW ALLOCATION	
	Extra Class	Advanced Class	General Class	Extra Class	Advanced and General Class
Current	3.8 - 4.0 7.2 - 7.3 14.2 - 14.35 21.25 - 21.45 28.5 - 29.7 50.1 - 54.0	3.8 - 4.0 7.2 - 7.3 14.2 - 14.35 21.25 - 21.45 28.5 - 29.7 50.1 - 54.0	3.8 - 4.0 7.2 - 7.3 14.2 - 14.35 21.25 - 21.45 28.5 - 29.7 50.1 - 54.0	3.5 - 4.0 7.0 - 7.3 14.0 - 14.35 21.0 - 21.45 28.0 - 29.7 50.0 - 54.0	3.5 - 4.0 7.0 - 7.3 14.0 - 14.35 21.0 - 21.45 28.0 - 29.7 50.0 - 54.0
November 22, 1968	3.8 - 4.0 7.2 - 7.3 14.2 - 14.35 21.25 - 21.45 28.5 - 29.7 50.1 - 54.0	3.825 - 4.0 7.2 - 7.3 14.2 - 14.35 21.275 - 21.45 28.5 - 29.7 50.1 - 54.0	3.85 - 4.0 7.225 - 7.3 14.235 - 14.350 21.3 - 21.45 28.5 - 29.7 50.1 - 54.0	3.5 - 4.0 7.0 - 7.3 14.0 - 14.35 21.0 - 21.45 28.0 - 29.7 50.0 - 54.0	3.525 - 4.0 7.025 - 7.3 14.025 - 14.35 21.025 - 21.45 28.0 - 29.7 50.0 - 54.0 (A) 50.1 - 54.0 (G)
November 22, 1969	3.8 - 4.0 7.2 - 7.3 14.2 - 14.35 21.25 - 21.45 28.5 - 29.7 50.1 - 54.0	3.825 - 4.0 7.2 - 7.3 14.2 - 14.35 21.275 - 21.45 28.5 - 29.7 50.1 - 54.0	3.9 - 4.0 7.25 - 7.3 14.275 - 14.35 21.35 - 21.45 28.5 - 29.7 50.25 - 54.0	3.5 - 4.0 7.0 - 7.3 14.0 - 14.35 21.0 - 21.45 28.0 - 29.7 50.0 - 54.0	3.55 - 4.0 7.05 - 7.3 14.05 - 14.35 21.05 - 21.45 28.0 - 29.7 50.0 - 54.0 (A) 50.25 - 54.0 (G)

1. The only change in Technician Class privileges occurs in the 50-MHz band. Until November 22, 1968, the Technician Class licensee is authorized all 6-meter privileges from 50.0 to 54.0 MHz. He may operate on the frequencies 50.1 to 54.0 MHz after November 22, 1968, and on the frequencies 50.25 to 54.0 MHz after November 22, 1969.

2. Novice Class licensees are authorized radio-telegraphy operation on 3700-3750 kHz, 7150-7200 kHz, 21.10-21.25 MHz and 145-147 MHz using only A-1 emission. Additionally, Novice Class licensees may operate radiotelephone on 145-147 MHz until November 22, 1968.

Gus Gercke K6BIJ
Box 143
Weimar, California 95736

Feeding the Cat Underwater

Underwater Radio

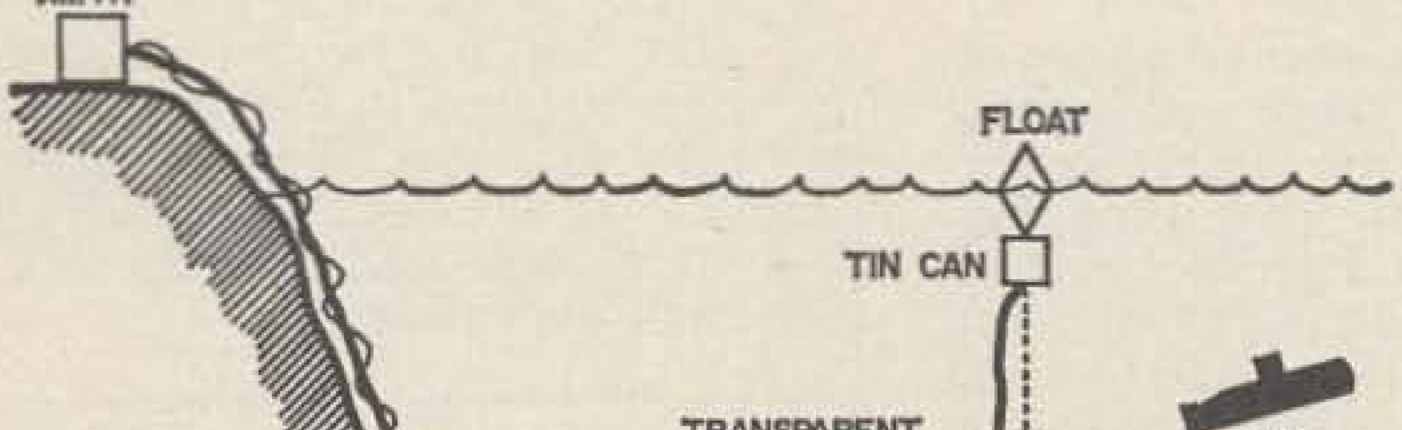
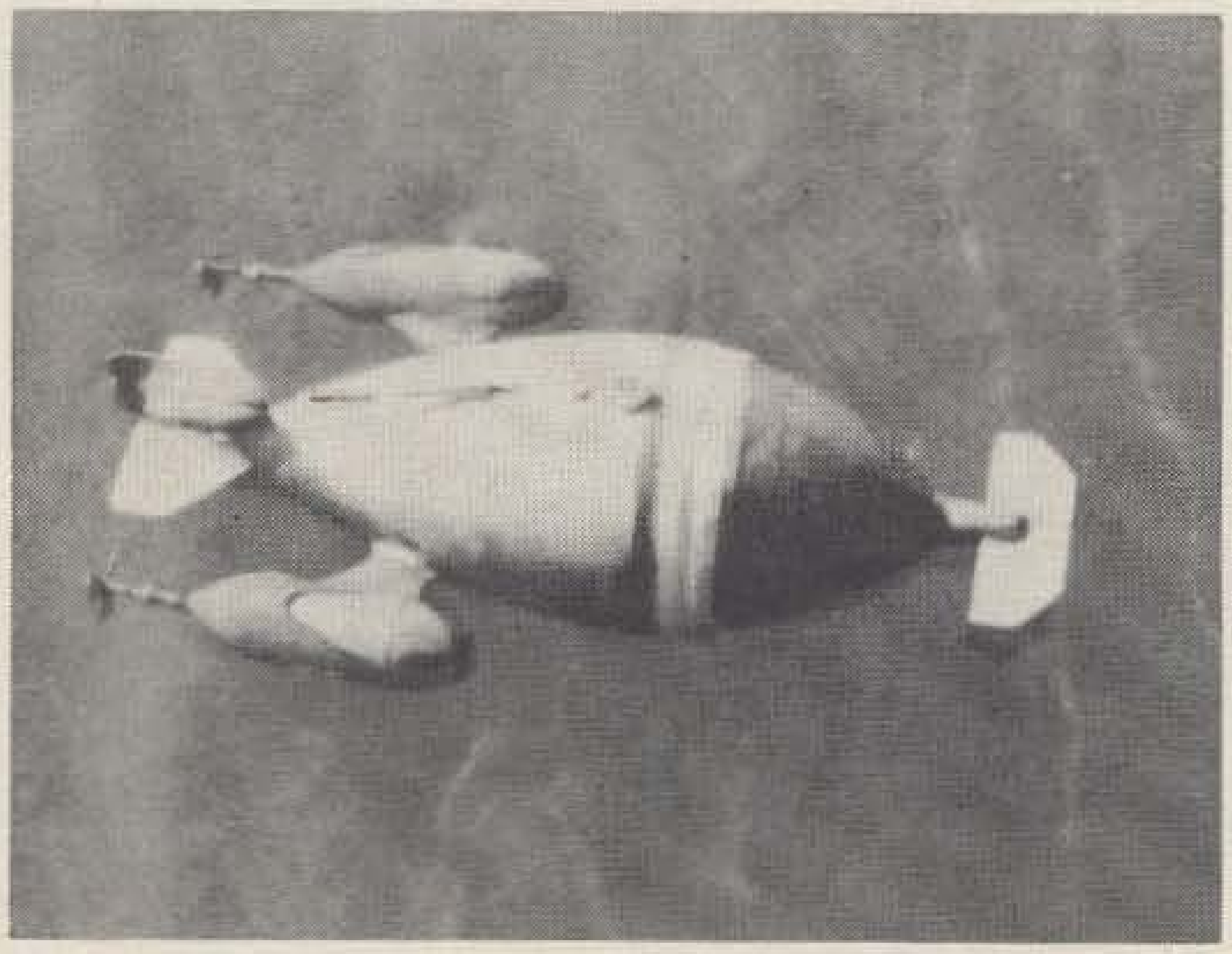


Fig. 1. Vertically polarized underwater antenna used by K6BIJ for controlling a radio-controlled submarine below the surface. Good results were obtained in tests from dc to 4 MHz.

It all started when I went to a lake in San Francisco's Golden Gate Park, to take some movies of radio controlled model boats. In talking to the people who were operating these boats, I learned they knew of no radio-controlled submarine built as yet, which could be controlled while completely submerged. A search of RC magazines, both in this country and in England, revealed only brief mention of a couple of subs which lost control the moment their antennas touched the water.

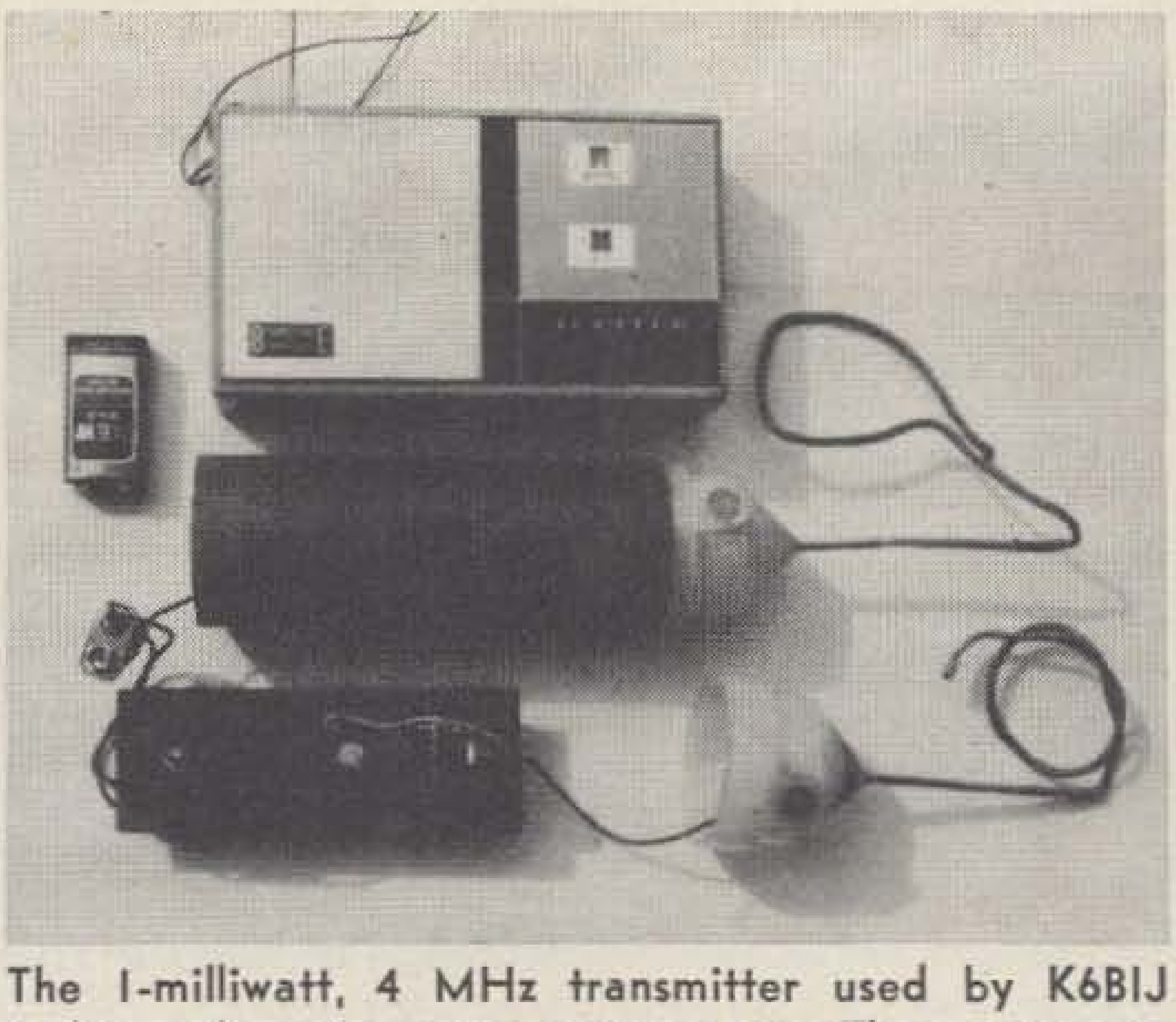


Radio-controlled submarine used by K6BIJ in his underwater radio propagation tests.

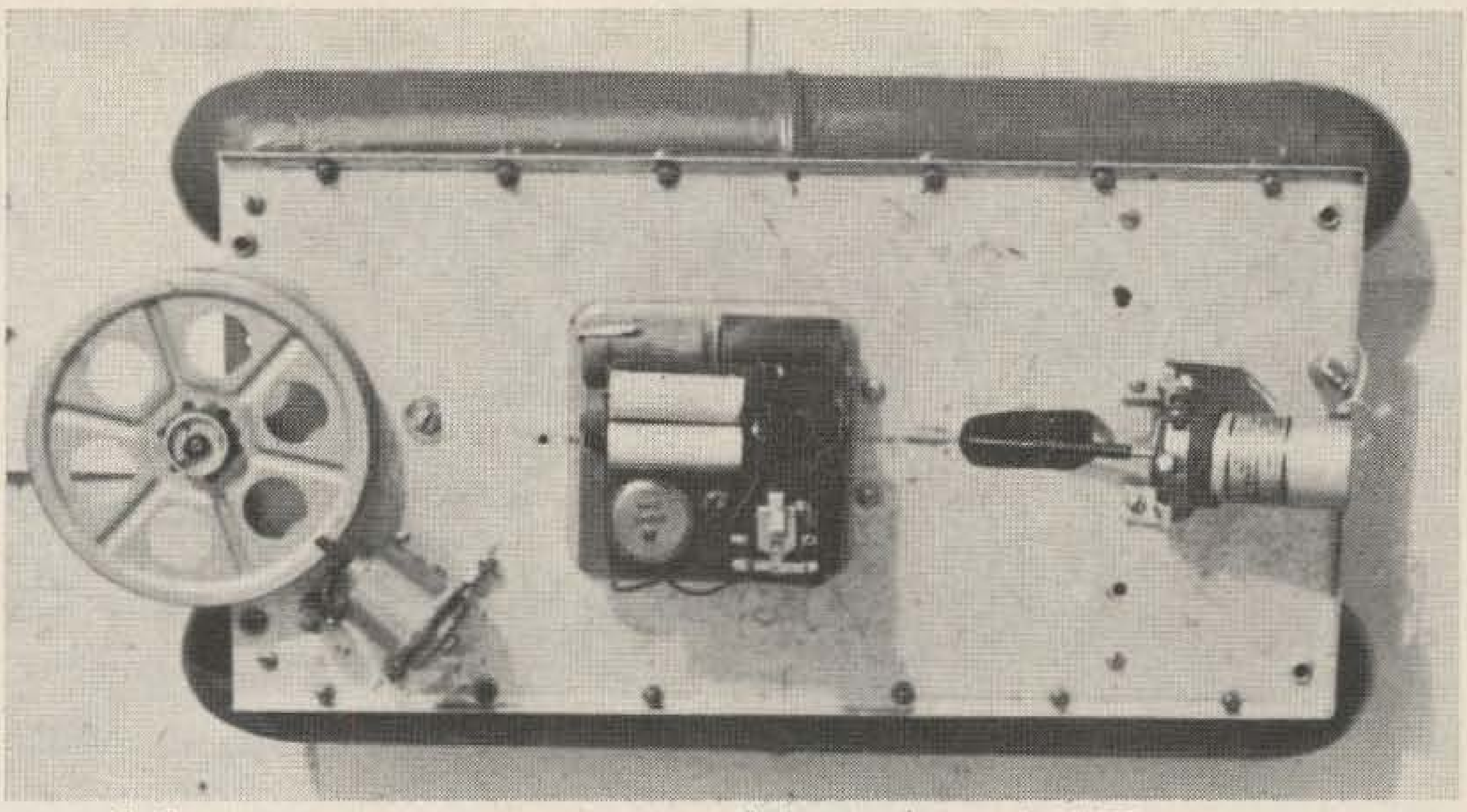
By investigating the subject a little further, it was learned that the Navy is talking to its subs while they are submerged, using Morse code on a low frequency around 18 kHz. They are using lots of power to get through. The subs, presumably, only sit up and listen. The higher frequencies are considered useless for this purpose, as water "short circuits" them or something.

I was unable to determine who made this brilliant conclusion, or what his test setup was, but I think he goofed. Most probably, he was unable to couple the output of his transmitter to the water, and lost everything at the water/antenna junction.

A little waterproof transmitter was built with a modulated output of one miliwatt which was crystal controlled on 4 MHz. It's output was coupled to an "antenna"



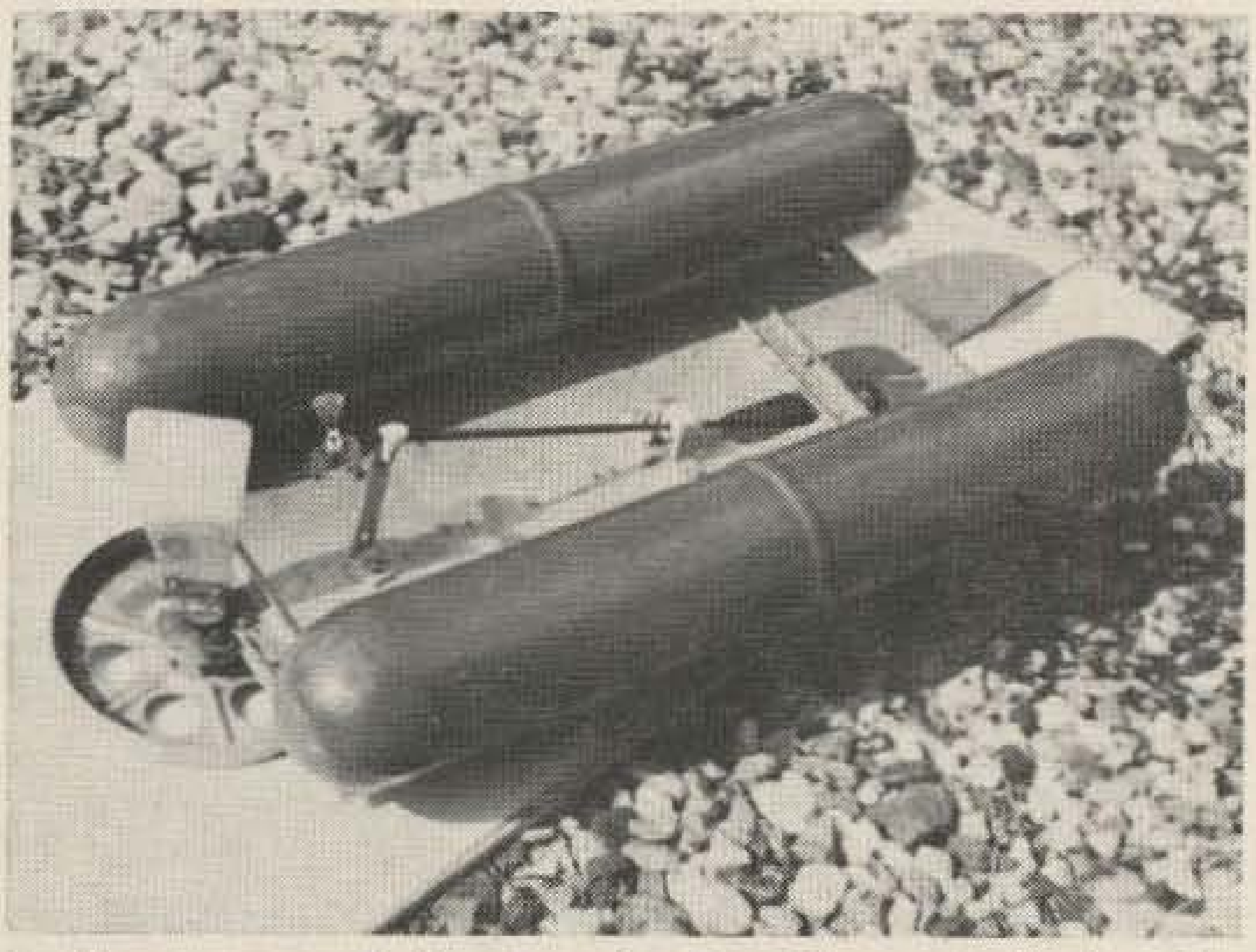
The 1-milliwatt, 4 MHz transmitter used by K6BIJ in his underwater propagation tests. The receiver is a Japanese transistor model that covers the marine band up through 4 MHz.



Top view of the underwater-radio-controlled catamaran showing the 10V Ni-Cad toothbrush battery and control devices.

consisting of two pieces of heavy copper braid, about a foot long on each side of the transmitter. This contraption was "drowned" 30 feet off shore, in a lake about 5 feet deep. It rested about a foot off the bottom. The receiver was a Japanese transistor radio with a "marine band" which extended to 4 MHz and had no rf stage. The antenna was about 20 feet of bare wire which was submerged, except for the middle where it made a single turn around the receiver. When I turned the receiver on, the signal was there, but it was a maximum distance. This test was repeated with an 8.5 MHz crystal with about the same results.

At this point, I felt a need to build a radio-controlled submarine. I constructed one using two Clorox bottles, glued back to back. I used N-Cad batteries with a car heater motor for the propeller, and a smaller motor for the rudder. Various receivers were used in the "brain", and various frequencies were tested from dc to 4 MHz.



Bottom view of the beached radio-controlled catamaran showing the drive propeller and motorized rudder control. This "cat" could be completely controlled by a radio transmitter and antenna mounted beneath the surface of the water.

A surface boat (catamaran) was built. The cat was fed an underwater signal which was picked up about a foot below the hull from a little lead ball suspended on a flexible cable which was insulated for three quarters of it's length by plastic tubing.

With this set-up, it was possible to determine that:

1. A quarter watt was sufficient output from the transmitter to give the sub, or the catamaran, a range of about 60 feet.

2. Frequencies in the shortwave range do go through the water, and can be used for remote control, teletype, telemetry, voice, and TV communications. The range can be up to a few miles with good equipment.

3. Propagation takes the form of a familiar picture of magnetic filings on a piece of

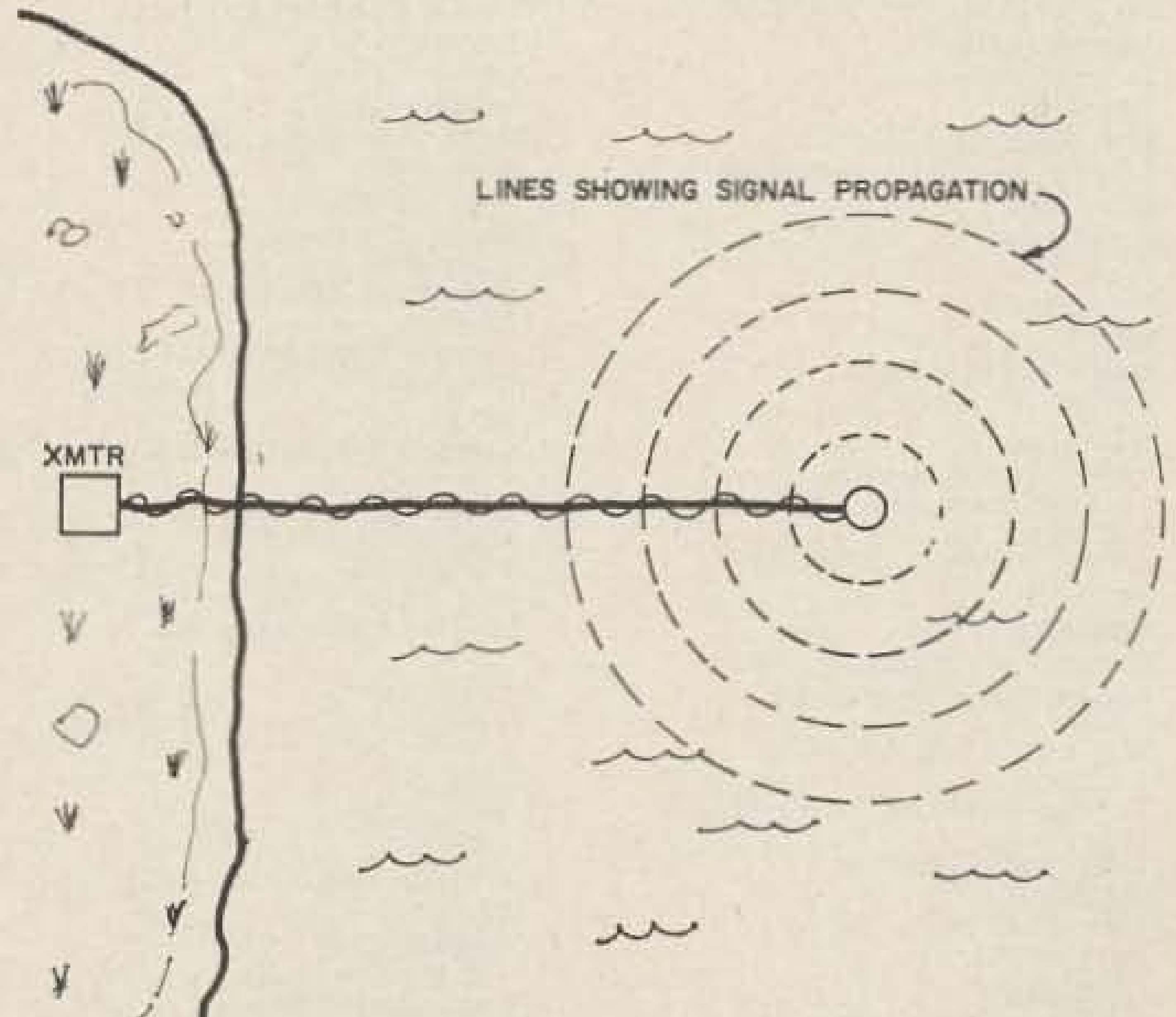


Fig. 2. Bird's eye view of the vertically polarized antenna shown in Fig. 1, showing the wavefront of a propagating signal.

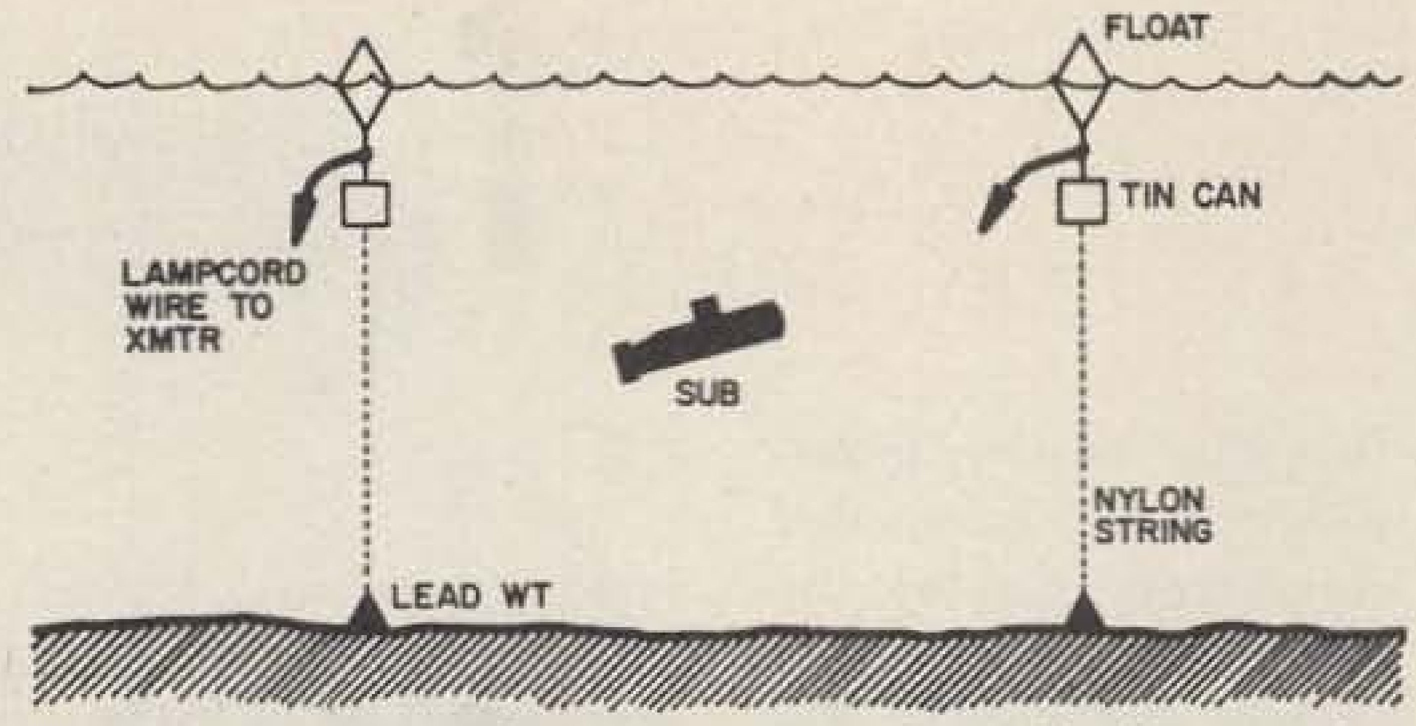


Fig. 3. Horizontal antenna used in further underwater radio control tests. The propagation from this antenna is shown in Fig. 4.

paper with a bar magnet underneath.

4. Field strength (or usable control distance) increases significantly with increase in transmitter power. The depth of water, shoreline configuration, presence of buried pipes or cables, and soil material can affect this increase.

5. The signal can be either horizontally or vertically polarized. Horozontal polarization was used for a shallow lake and the sub, while the cat's antenna was vertically polarized.

The lake was a fresh water lake with a fairly high salt content, so the results may differ a little in a pure fresh water situation, or in sea water.

It is my opinion that, with a little development, services like LORAN can be moved underwater where there would be no static or night effect. This might give the hams the 160-meter band back again. With further experiments, it is possible that we will find that water transmits radio signals better than air.

. . . K6BIJ

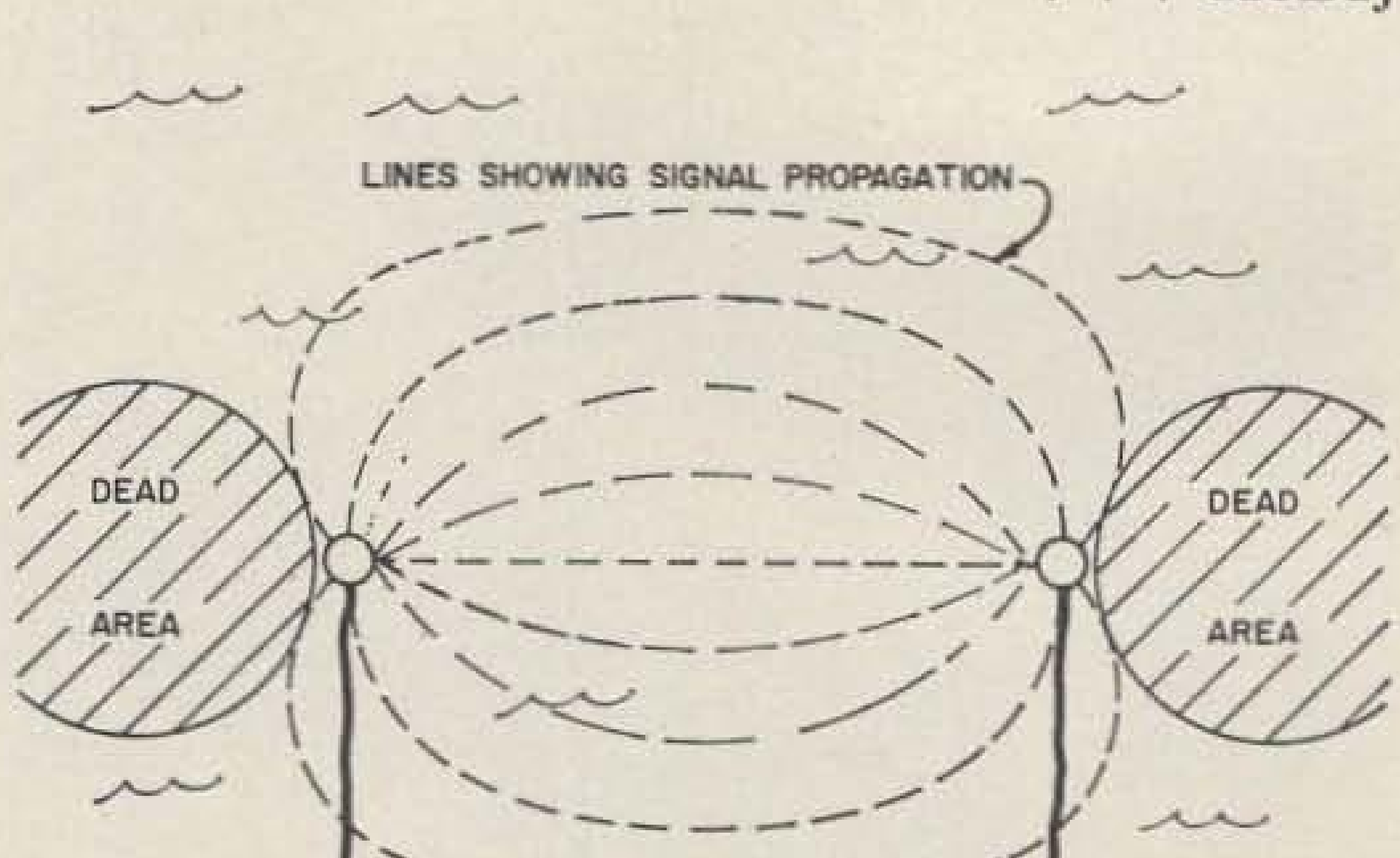


Fig. 4. Underwater propagation of radio signals from the horizontal antenna shown in Fig. 3.

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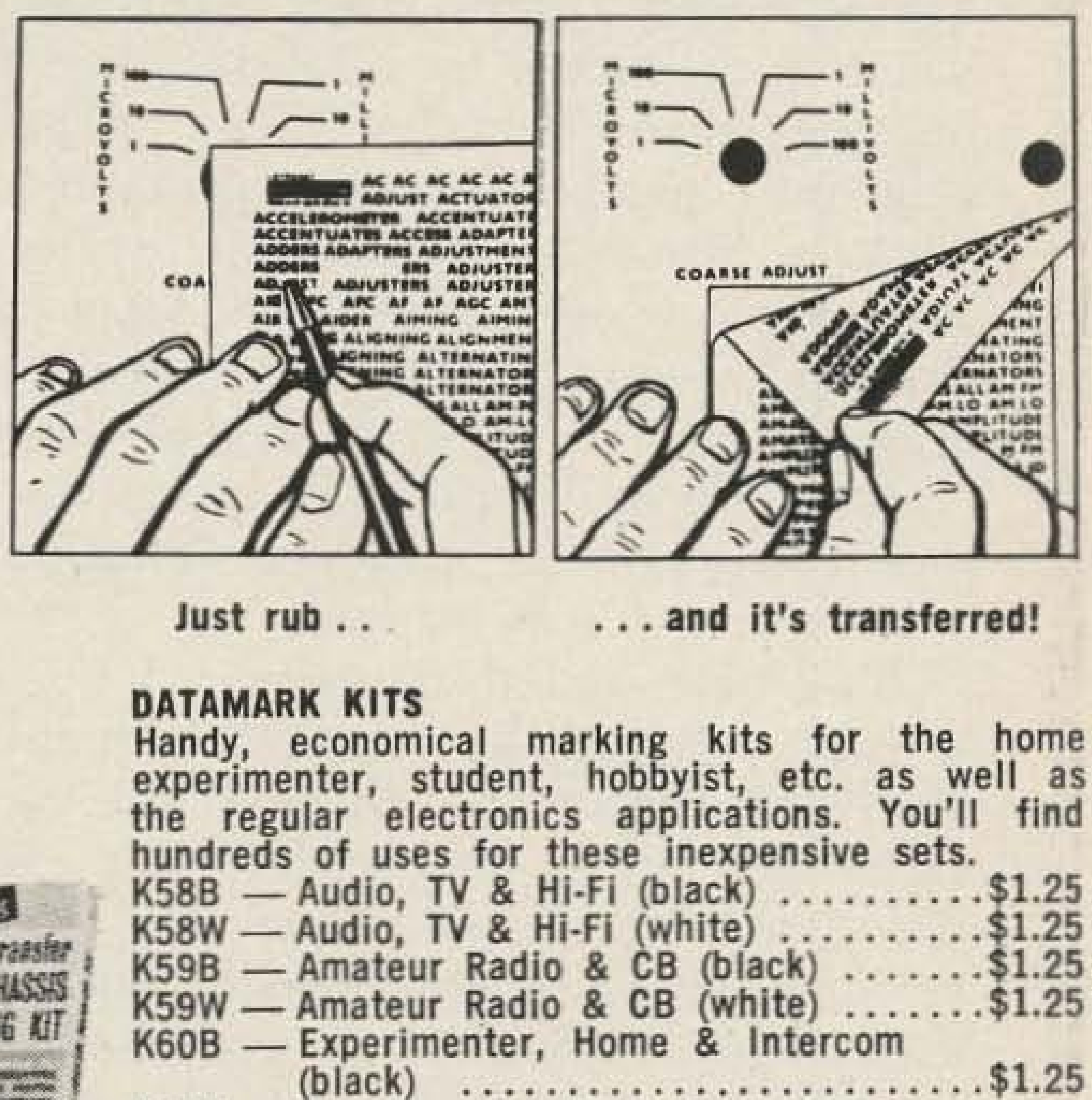

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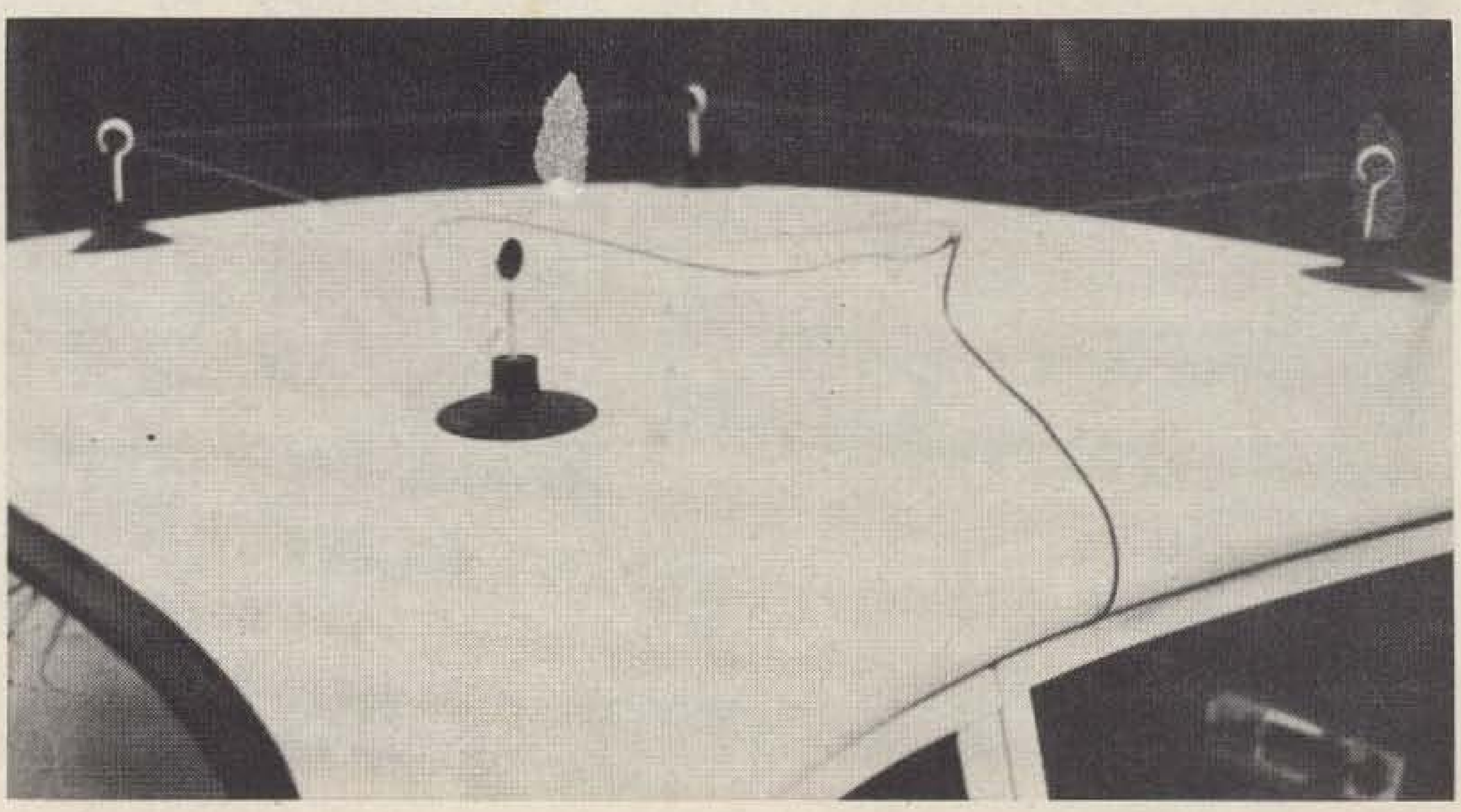
Mobile Antennas for the Non-Mobileer

Some simple but effective ring antennas which may be temporarily mounted on an automobile for operation on 20 to 6 meters. They are especially suitable for portable operation.

I have never cared for in-motion mobile operation but I have often wished, when on vacation or parked on a hillside, that I could operate what might be called, without getting into legal semantics, portable/mobile. That is, from my automobile while it was stationary. I certainly didn't want to start drilling holes in the car for a regular mobile antenna just for this occasional usage. Nor could I depend upon always having some natural support for a random length antenna near where I was parked.

Ring-type radiators appeared to be the answer because they could be mounted directly on the roof of the car (the most efficient location as far as achieving a uniform radiation pattern), and their size would permit at least a 20-meter antenna without loading elements even on a compact-car roof. Ring-type radiators, or Hula-Hoop antennas, are commonly of either ¼ or ½ λ size, as shown in **Fig. 1.** The ¼ ring or DDRR antenna has an omnidirectional radiation pattern, vertically polarized. Its height above ground should be at least .007 to .010 λ. The closer its proximity to ground, the sharper will be its resonance. At about .010 λ elevation, it can be represented by a tuned circuit with a Q of about 100 to 200. This bandwidth is certainly sufficient for operation over the phone band on 20 and 15 meters and for about any selected 300 kHz portion on 10 meters. The ½ λ ring or dipole is a lower-Q radiator and omnidirectional when elevated from ground heights comparable to ½ λ dipole. Its polarization under these conditions is horizontal. However, when placed in close proximity to ground, its resonance becomes much sharper and, like a ½ λ dipole off of its ends, it seems to exhibit predominantly vertically-polarized radiation.

My first thought was to construct such antennas from tubing, in the form of squares, so they could be self-supporting and simply placed on the car roof as desired. Such a method of construction was deemed too expensive but it might be well considered by anyone who would want to have such an



A square six-meter ring radiator mounted on the roof of a compact car. The "extra" piece of wire from the feed point is a tuning stub.

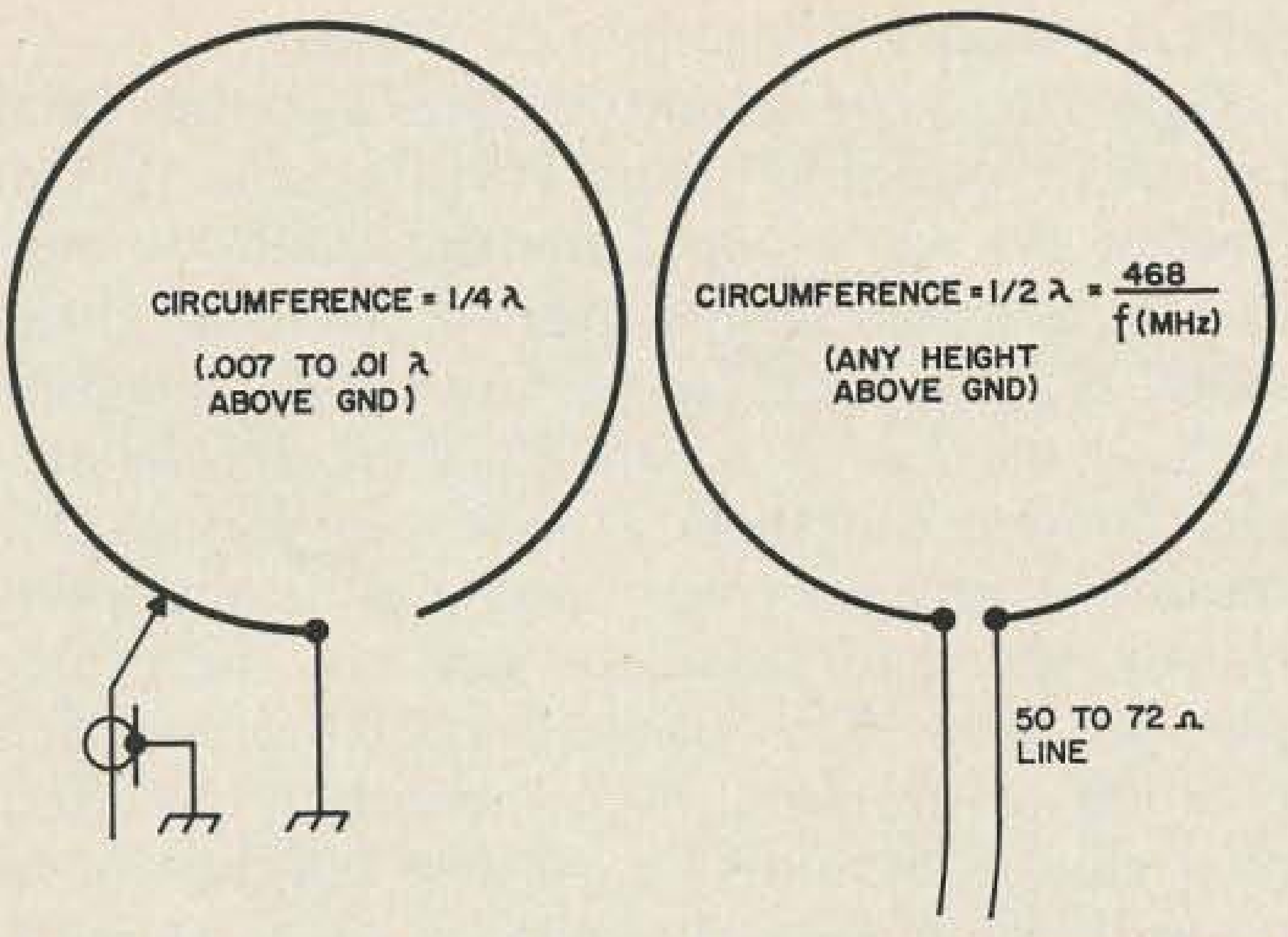


Fig. 1. Basic dimensions of the one-quarter wave and one-half wave ring radiators used for fixed/portable operation by W1DCG.

antenna semi-permanently mounted. A car-top carrier rack can make an excellent foundation for such an installation since it provides a mounting base as well as tubing which can be supported by standoff insulators and used as the antenna elements.

The method I arrived at for construction was considerably simpler and is shown in the photograph. TV standoff insulators were inserted into rubber suction cups for use as support elements for a "square" wire ring. The insulators were secured in the suction cups by small wooden pegs and epoxy cement. The suction cups themselves are replacement types for use with car-top carrier racks and can be obtained very inexpensively at almost any automobile supply store.

The wire ring is made from normal hookup wire. The feed system used for the antennas is shown in **Fig. 2.** I used 72-ohm twinlead because I had it available, and it permitted easy passage through the car door. Coaxial cable could be used equally as well, although it will sag the loop at the feed point unless a separate suction cup/insulator is used to support it. The extra length of transmission line shown in the photograph of the 6-meter ½ λ ring is a tuning stub used to improve the match between the antenna and transmission line. It may not be necessary in all installations depending up the reactive portion of the antenna feed point impedance but, in any case, its fairly easy to adjust. An approximate ⅛ λ stub is used and trimmed about ½-inch at a time until the SWR is as close as possible to 1:1. If the SWR without the stub already measures 1.5 to 1 or less, the stub can be forgotten.

When using a ¼-wave ring antenna, a gamma match is used for matching. The spacing shown in **Fig. 2** can be taken as about 1/40 λ to start and then adjusted back and forth for the lowest SWR. It should be possible to obtain an SWR of at least 1.5 to 1 or less. The grounding of the one end of the antenna should be done with a jumper of Belden braid or similar material to a small "C" clamp or other binding post on the rain gutter. A proper ground is very essential to the efficient performance of this antenna and the rain gutter connection should be as low a resistance connection as possible.

As long as the antenna is set up on the car roof in the same position each time it is used, there will be no need to change the stub length or feed point spacing. The efficiency of these antennas—both the ¼ and the ½ λ loop—has never been definitely determined. Most experimental studies have placed them as being from 6 to 10 dB below the performance of a ¼ λ whip above a flat conducting surface. I tried to compare the performance of a 15-meter ¼ λ ring radiator to that of a ¼ λ whip mounted in the middle of the car roof. However, since I wasn't willing to make a ground connection immediately at the base of the whip by drilling into the car roof, I made it to the rain gutter of the automobile. The effect of this 2 foot or so ground loop probably reduced the effectiveness of the whip somewhat. On local contacts the ¼ λ ring radiator proved to be from 2 to 3 "S" units lower in performance than the ¼ λ whip. However, it must be remembered that this performance was measured against a full-size ¼ λ whip and not a loaded whip. Therefore, on 20-meters, although the performance of the ¼ λ ring radiator might well be a few "S" units below that of a full-size ¼ λ whip, it would be equal to or even exceed that of the normal

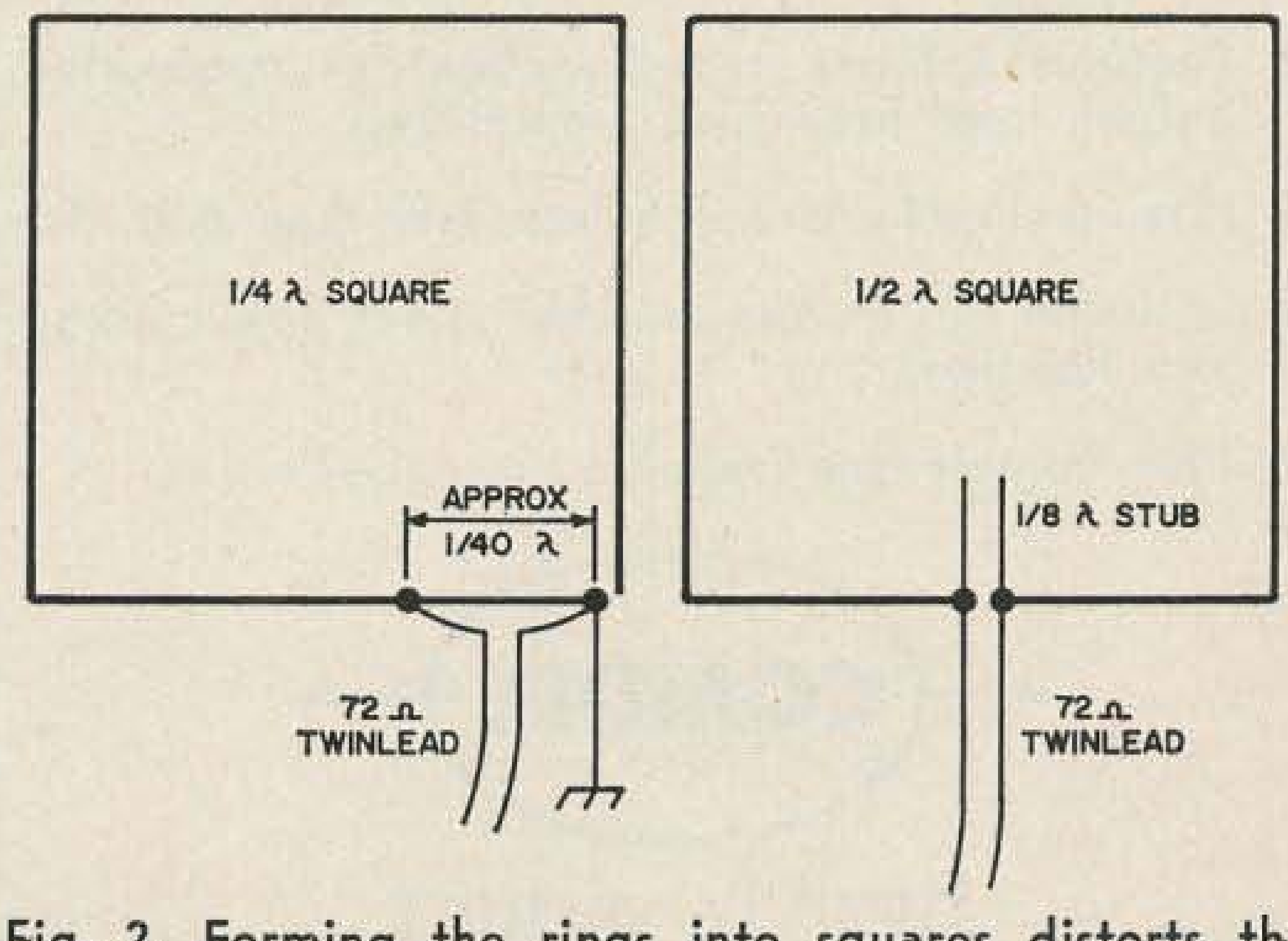


Fig. 2. Forming the rings into squares distorts the horizontal radiation pattern somewhat, but the antenna is still essentially omnidirectional.

8-foot center or base-loaded whip.

The ring-type radiators can also be used in other "portable" type installations. In the case of the ¼ λ loop some flat, metallic surface is required as the ground plane. A sheet metal type of roof, for instance, might suffice as long as the metal sheets were electronically bonded together. The ½ λ loop does not require a ground plane and can be mounted in any space of sufficient size—as, for example, an attic. The vertical radiation pattern of such an antenna will essentially be that of a dipole mounted a similar height above ground. Therefore, heights of ½ λ or more above ground are best when the antenna is to perform as a horizontally-polarized omnidirectional radiator.

. . . W1DCG

"Who needs miniaturization?"

Battery Holder

You can construct a holder to accommodate popular 9-volt batteries by modifying a twin AA holder. With a pair of pliers, break off the outside prongs of the holder's U-shaped clips to make room for the larger battery. Then bend the outside prongs inward so they have a snug hold on the battery. When inserting the battery in the holder, be careful not to short the terminals against the frame of the holder.

. . . Ray Ezelle WPE8JJQ

R. L. Gunther W6THN/VK7RG
76 View Street
Hobart, Tasmania,
Australia

Why Abuse Semiconductors?

Having trouble with blown transistors and dead junctions? No need to if you understand their limits and capabilities and follow a few simple rules.

What they do

As everyone knows, diodes rectify, transistors amplify, and a great number of other types of other semiconductors do a lot of other things. But they all semiconduct, and semiconductors can be abused more easily than tubes. There is no mystery in this (or at least not much), and a few simple procedures can save you a lot of trouble and money.

Consider diodes[1]. They conduct more easily in one direction than the other, as indicated by the typical curves of **Fig. 1.** The current axis are in different units, because a lot more current can be passed without damage in the forward direction than in reverse. By knowing the shape of these curves you can test diodes for yourself, simply by applying a variable voltage to them, and watching how the current behaves; but be sure to use a suitable resistance in series with the diode (**Fig. 3**) to limit the current, because the characteristic quickly becomes violent, and excessive current could be passed by a power source with low resistance. To test the forward current rating, apply some current, and see how hot the diode gets, then apply some more after a little while. A practical maximum current would be the value for which a silicon diode gets uncomfortably hot to the touch, or for which a germanium diode gets quite warm; this assumes that the appropriate heat sink, if any, is fitted.

To test the reverse voltage rating, apply voltage (again with series limiting resistance) until the reverse current through the *diode* starts to rise sharply. The voltage across the diode is then the *absolute* maximum value which can be applied safely to it. For this test, you should not put more than about 20 microamperes through a low current (eg., up to 1-amp forward rating) silicon diode, perhaps 500 microamperes through a high-current silicon diode, or 200 microamperes through a germanium diode. The actual maximum safe value will depend, to a certain extent, on the type of diode, and will generally be higher for lower PIV diodes. While learning how to do this you may ruin a diode now and then, but it is worth it in the long run.

The situation with transistors is rather more complicated, and I earnestly recommend that you read Chapter 2 in the *Motorola Power Transistor Manual,* and Chapter 1 in the latest edition of the *GE Transistor Manual;* both of these excellent works should be on everyone's bookshelves. Basically, however, the transistor behaves as two diodes hooked back-to-back. Taken individually, the junctions can be tested as two separate diodes, but the complications arise when a transistor is considered all together, as it is normally used.

Interpretation of the results of testing different types of diodes can be clarified by reference to **Fig. 2**, which is shown right-side-up for convenience. **Curve 1** is the typical response of a zener diode, **curve 2** is for a typical silicon diode, and **curve 3** is the behavior of a germanium diode. In each case the current rises alarmingly above the absolute maximum PIV. This is the important fact in considering how far you can push a semiconductor. In most circuits, the source impedance is low, so that even a slight voltage overload will push the current right up the curve past the danger point, and the semiconductor will be ruined (usually by shorting). In testing the devices, the trick is to provide that resistor in series, so that you can approach the critical point slowly enough to see what is happening, without danger.

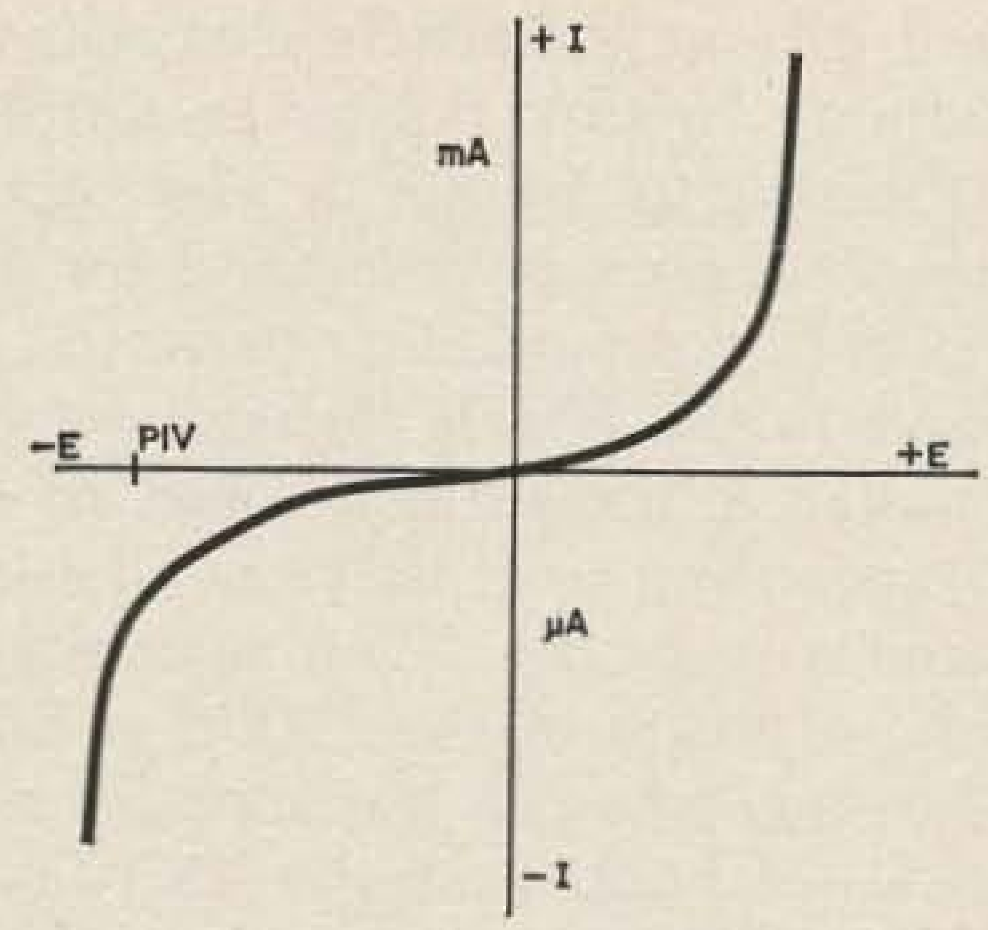


Fig. 1. Typical diode characteristics. Note that the current scales above and below the voltage axis are in different units.

What they will not do

Those of us who are familiar with the operation of tubes find it hard to take this "absolute maximum" thing seriously. We are well familiar with the fact that it is possible to abuse the current and voltage ratings of a tube considerably, with scant regard for the manufacturer's specifications. On the other hand, we do tend to be more cautious about mercury vapor rectifiers, because their PIV is indeed critical. The fact is that nearly all semiconductors fall in this latter category, and you ignore it at your peril. Apparent exceptions to this rule are illusions, as I shall show here.

Instabilities Confirm Abused Semiconductors

Recently in the Australian literature I saw a reference to "ICAS" (Intermittent Commercial and Amateur Service) ratings as applied to the use of silicon diodes in power supplies. This is dead wrong, and is a common worldwide misconception.

If you use a BY100 (or IN4006) with a 1000V peak supply, and feel pleased with yourself because it is theoretically rated for only "800V", look again, and test the actual PIV of the diode[2]. You will find that it will test for an absolute maximum peak of 1400V or better, so there is no mystery. The manufacturer has, as usual, merely rated them pessimistically. Come to think of it, I had better qualify that "as usual" slightly for American readers. The ratings of American semiconductors may or may not be optimistic. Commercial items will certainly be as good or better than the catalogue says, but you cannot trust surplus or bargain items *at all.* In regard to the latter, you will find that a diode rated at, say, 400 PIV, may actually be anything from 0 PIV to 1000 PIV when you measure it. If you depend on it being the theoretical value, you may be in strife when you go to use it. This situation tends to be worse for the "better bargains", but I hasten to add that there are several reasonably reliable distributors of inexpensive semiconductors. But you never want to make the mistake of taking their word for any ratings.

The same thing applies to transistors (and probably to FETs, etc.). The lowly OC26 (similar to HEP-230) is rated for something like 32V for BV_{cbo} (breakdown voltage from collector to base, when emitter not connected, i.e., open). I have yet to find one that tested less than 50V, and many up around 100V (whether this applies to the equivalent 2N301 is something you should determine for yourself). If a person did not know this, he might assume that he was getting away with something by using the transistor over its published rating. Nor is it safe to make the opposite assumption that since the manufacturer tends to overrate his semiconductor, you can get away with overloading it; because you don't know how far that can be carried. So we warned: there is no magic about semiconductors (compared to tubes), only mean and relatively inflexible **Absolute Maximum** characteristics which can not be exceeded under ordinary operating conditions. This stricture has special importance in the matter of the voltage rating of transistors used as class-C rf amplifiers, but that will be the subject of another article, sometime.

One among many typical examples of "ICAS" thinking is found in the otherwise excellent article on a new method for adjusting grid bias to economize on drive in class-C rf amplifiers in the *RSGB Bulletin* for March 1967, p. 143. A transistor is used to adjust grid bias according to rf drive available, and the statement is made: "The maximum collector-to-base rating of the OC28 is 80 volts at zero current, whereas the actual bias used in this instance happens to be 75 volts. This seems rather a fine margin, but currents are small, and no trouble has been experienced. However, the higher rated OC20 or OC36 would be preferable, and for those who find higher values of standing bias necessary there are a number of transistors available having considerably higher ratings . . ." There are indeed, but they may have "OC28" stamped on them. Now, in the circuit involved in this article, there is a base-emitter resistance of something like 5k ohms. The BV_{ces} (voltage rating collector to emitter with base shorted to emitter) rating of a transistor is about the same as BV_{cbo}, but as the base-emitter resistance increases, BV_{ce} decreases until, with the base floating ("open") it decreases to BV_{ceo}. BV_{ceo} can be anything from 40% to 80% of BV_{ces}, so the useful voltage rating of a transistor depends quite a lot on the amount of resistance in its base circuit. The rating with a given value of resistance can be called BV_{cer}. Now, with 5k in the base of the OC28 transistor, the BV_{cer} is certain to have dropped, say 20% at least, from its BV_{cbo} value. In this example the BV_{cer} could have been about 65V if you take the manufacturer's word for it. This is plainly inadequate

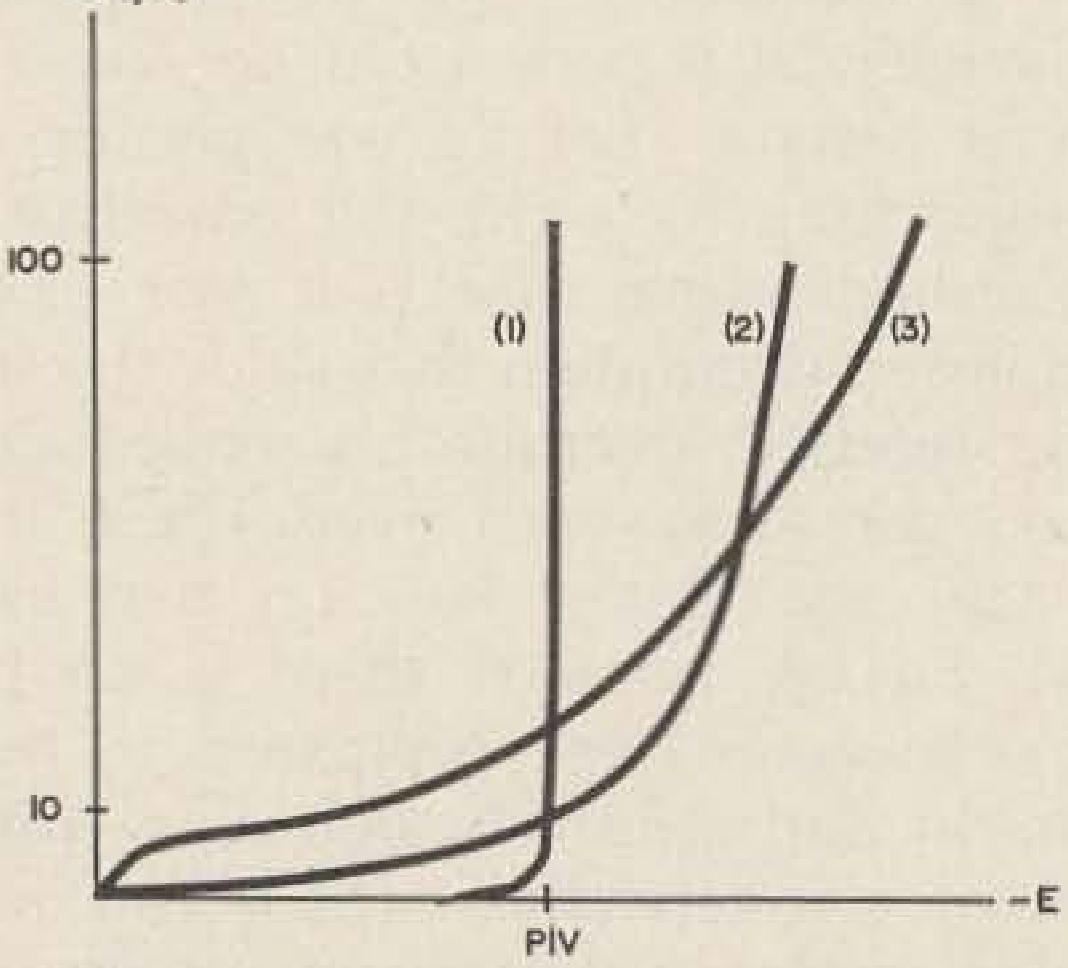


Fig. 2. The reversed-biased characteristics of zener diodes (1), silicon diodes (2) and germanium diodes (3). Note that this drawing is shown upside down from the usual presentation.

for a circuit applying 75V from collector to emitter. No, the obvious fact here is that the actual rating of the OC28 used was appreciably higher, a fact which can be ascertained by testing it. If it is tested, the transistor can be used up to a known high voltage, with greater economy and reliability. Why not? In this particular case, where the voltage applied is essentially dc, one can approach fairly close to the transistor's maximum ratings than in a circuit with ac and a source of transients from inductance.

When to derate

After you have tested a semiconductor for actual voltage rating there is, unfortunately, another factor to consider. Unless your testing equipment is rather more elaborate than usual, you will have tested the reverse voltage rating with zero current applied in the forward direction. But when a diode (or transistor) is used in an actual circuit, there is likely to be a fair amount of forward current as well. This will heat the semiconductor, and will raise the leakage current for any given value of reverse voltage. This means that the reverse voltage must be reduced, to keep the leakage within safe limits. This is called "derating". If you apply maximum reverse voltage you have to derate forward current. If you apply maximum forward current you have to derate reverse voltage; you can't have both. If maximum rated forward current is applied, the voltage derating may be as much as 75%, and should be applied as a "safety factor". When a manufacturer (e.g. Fairchild) has specified the BV_{LVO}, a good safety factor is supplied in a circuit without inductance if the supply voltage is not more than half of this rating. The BV_{LVO} is uniquely applicable to silicon diffused transistors, and is the value of BV_{ceo} you obtain when V_{ce} goes through a minimum as I_{ce} is increased through the range of 5-10 mA or so for low power transistors (but do not increase I_{ce} appreciably once the minimum is found). If you don't know this voltage breakdown value, a rough approximation could be to assume an absolute maximum BV_{ce} about one-fourth of BV_{cbo} when the transistor is drawing about one-half maximum collector current. For more accurate figures you must obtain the manufacturer's curves, or (better), measure them yourself. In general, it is desirable not to try to push too much collector current through any single rf transistor, not only because BV_{ce} is higher at lower I_c, but also because f_T is too; f_T actually passes through a maximum at a fairly low collector current.

When a semiconductor (particularly silicon, see **Fig. 2**) is operated with an inductive source *or* load, additional safety factor must be considered because of the energy stored in the inductance. At best it can double the voltage applied to the collector, if maximum signal output is obtained, and at worst, an inductance can supply a horrendous back-EMF, giving a destructive transient overvoltage.

In a transistor amplifier with an inductive load, the voltage swing at the collector depends on the inductance and on its Q. Therefore, in the case of rf power amplifiers, it is desirable to ensure that the system be kept close to resonance, and *never* run at full ratings without a load! Because of the sharp current discontinuities, this is particularly important in the case of class-C or overdriven class-A amplifiers. Remember too, that the peak voltage will be (at least) twice the supply voltage if maximum output is being obtained, and that this will be doubled again if collector modulated. Although emitter or base modulation[3] is superior in many respects to collector modulation, it faces the same problem, because of the requirement for nominally double supply voltage.

Voltage derating in power supplies

Diodes fed from a power transformer, or feeding an input choke, also have inductance problems. In these cases, the amount of voltage derating can be minimized appreciably by suppressing the circuit for transients. This can be most easily accomplished by putting a 0.01 or 0.02 μF capacitor across the primary of the transformer; do not use too large a capacitor there, or you will cause another kind of transient due to shock-excited resonance with the transformer inductance. Alternatively, a capacitor may be used directly across the diode, and this can be convenient, particularly when using diodes in series, where they ought to have capacitors across them anyhow. But this is not always a good idea, because it increases the reverse leakage current around the diode on the nonconducting half of the cycle. This could be a consideration if the load were light, as for a HV supply for an oscilloscope.

In general, the correct value capacitor to use is inversely proportional to the voltage, no matter which position you use the capacitor in. Thus, if the peak voltage is 150V, you might use 0.01 μF, while 1500V would require 0.001 μF.

If the secondary voltage is too high for a diode, you would use more than one diode in series. In spite of what has been discussed about this in the literature, the safest thing is still definitely to use an equalizing resistor in parallel with each diode (see September 1965 *CQ* article referred to previously). The resistance should be directly proportional to the PIV rating of the diode, and this allows you to use seriesed diodes of different individual PIV ratings. If more than two diodes are used in series, it is definitely desirable to parallel each with an equalizing capacitor, keeping the relationship discussed above in mind.

If you use transient suppression of any kind, the safety factor for diode PIV should be at least 1.5 times the nominal peak voltage applied to it; more about this below. If you choose not to use any transient-suppressing capacitors, the diode's PIV safety factor should be 4 or 5 times higher than the nominal peak voltage applied to the diode. If you doubt this, look in the introduction to the *RCA Transistor Manual.* Another good discussion of this subject can be found in Section 8 of the *Selected Semiconductor Circuits Handbook,* by S. Schwartz, available either in the expensive hardback edition from Wiley or in inexpensive paperback from the U.S. Government Printing Office ($2.25 plus postage, reference No. D7.6/2:215).

If you use a choke input filter, the choke can be a horrendous source of transient peak voltages. To get around this, you must either derate diode PIV's again, or transient-suppress the choke. The simplest and cheapest is the latter, and for most power supplies this can be done by putting a 0.1 μF capacitor in series with 1k across the choke; for more exact values see the January 1965 article in *QST*.

When you use a capacitor to suppress transients, remember that the capacitor must have a voltage rating at least as great as the transient that it is trying to suppress! I have found this out the hard way, where the 240V RMS line voltage here in Australia seriously strains the capability of many 600V capacitors. It is not so bad for 115V lines, but in general, the capacitor must have a working voltage at least 2¼ times higher than the nominal peak ac voltage applied to it. This is particularly important when the capacitor is used in the high-voltage secondary circuit (or across the choke).

One more brief word should be said here about current derating. In general, the current rating of a semiconductor is not quite as critical as the voltage rating, because the current just heats up the junction, and the health of the junction tends to depend more on the average temperature. But it does so only if the heat can get out of the junction. If the peak current is so high that the junction is overheated too much in a given period of time, the junction will melt, and that is that. Therefore some attention should be given to avoiding excessive peak currents in the forward direction. For diodes this means inserting a series current-limiting resistor if the load is capacitive, and for transistors, it means avoiding excessive peaks where they might occur, e.g. in dc converters or when modulating.

For silicon diodes of 750 mA size, the peak current for 60 Hz should be limited to about 30 amps, which means at least 3.5 ohms of series resistance for every 100V peak of supply. If voltage regulation is not important, I usually double this value. The tiny glass-encapsulated silicon diodes should have about three times as much series resistance, while high current diodes should have somewhat less. If some current is passed through the diode, the series resistor can get hot, so a two to five watt rating is not inadvisable for it.

When not to derate

If you only have 400V diodes (actual rating), and want a quick and simple dc supply operating from a 12V transformer, you can obviously dispense with transient suppressing capacitors. But I have seen a fair number of circuits in the experimenters' literature where no transient suppression is used at all. It is argued that, "well, this works, and diode failures are rare." I find this kind of argument appalling, because it is sloppy engineering, because capacitors are cheap, and because a suitably designed semiconductor circuit should *never* fail from transient destruction of the semiconductor. You can be quite certain that the 'occasional' failure will take place just when you are about to work a VK7 on 2 meters. Nuff said.

On the other hand, there are circuits where it is not feasible to use capacitative transient suppression. For example, transistorized dc/dc converters. Capacity in the circuit degrades the waveform, and decreases conversion efficiency. This can be tolerated sometimes, sometimes not; a compromise is sometimes desirable. You should read the discussion of this subject in the appropriate chapter of the excellent *Transistor Radio Handbook*, published by Editors & Engineers.

Transient suppression in class-C rf amplifiers can also be a problem and indeed, in class-B audio amplifiers also. A transient suppression capacitor is likely to create more problems there than it solves. In these cases, as in the dc converters, one might use an appropriately rated zener diode. But the best solution is to attempt to avoid transients in these circuits, and in any event, to use semiconductors of the maximum economically feasible voltage rating. It is most desirable to be sure that the dc power supply for these circuits is well regulated for ac—use plenty of output filter capacity. And parasitic oscillations are to be avoided like the plague.

In a tube circuit, parasitics can be a nuisance; in a transistorized one, they can be a catastrophe. This is frequently the cause of the problems about which one reads in the literature, where transistors "unexplainably" failed even though the voltage rating was apparently high enough. And I suspect that it is the cause of the problems which were encountered when it was found necessary to use germanium rather than silicon transistors in class-C rf amplifiers (e.g., *CQ*, June 1966).

The fact is, however, that germanium can be more reliable in several regards, and if all other matters are equal, I should prefer to use a PADT50 rather than 2N2993. In any event, avoid spurious oscillations when possible: keep leads short, avoid output-input coupling, *always* neutralize rf amplifiers, and avoid undesirable combinations of RFC, etc. (e.g., ref: *Radio Handbook*, published by Editors & Engineers; or *Principles of RF Power Amplifiers* by Techpress).

What is a "nominal" voltage?

I have used the word "nominal" to describe the voltage applied to a rectifier diode. What does this mean? It means the voltage peak which is supplied by the transformer, and which does not include any extra transients. It should be a simple matter to determine the nominal peak voltage by inspection of the circuit, and of the transformer rating, but many good technicians seem to flounder on this rock.

Say your transformer secondary is 71V RMS. That means 100V peak. If you feed it into a half-wave diode with a resistive load, the nominal peak on the diode will be 100V. If, on the other hand, you use a capacitor input filter, the input capacitor will add to the transformer voltage on the off cycles, and the diode will see a *200V* inverse peak! Presumably a choke input filter would be treated as a resistive load if suitable suppression were used across the choke, but I am distrustful of such things, and would rather treat it pessimistically, to assume 200V in this instance.

If the same transformer were center tapped and you used two diodes in the usual full-wave configuration, the voltage across each diode is still 100V on the off cycle, no matter whether you use capacitor or resistance load.

If the transformer is not tapped, and you use a full-wave bridge, each diode still sees 100V peak inverse, and should therefore be rated for at least 150V if transient suppression is employed.

If the same transformer is used in a voltage multiplier circuit, each diode will see 200 PIV across it, no matter whether it is a voltage doubler or tripler or whatever.

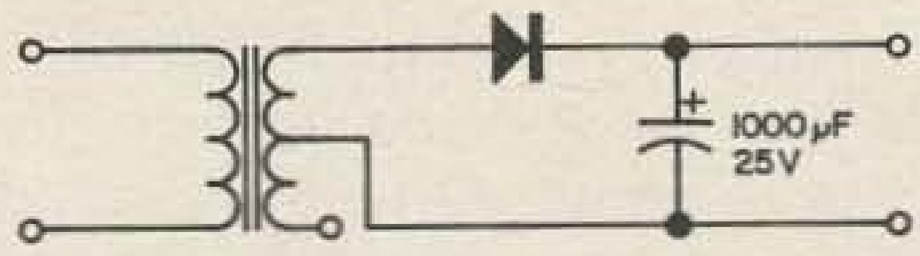
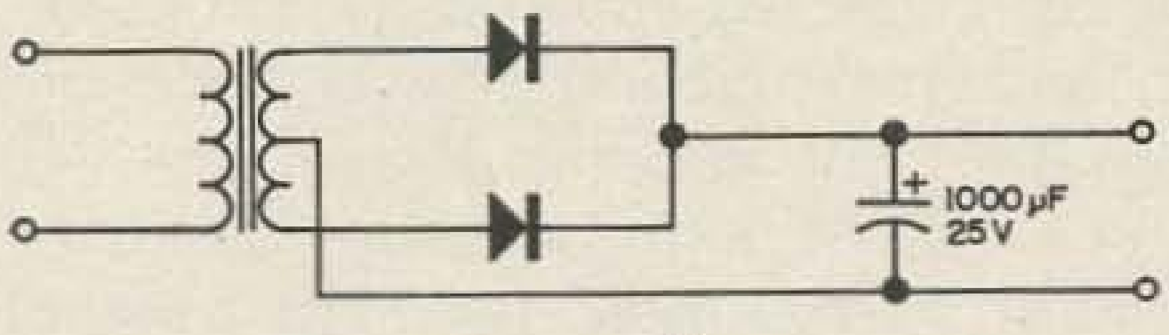
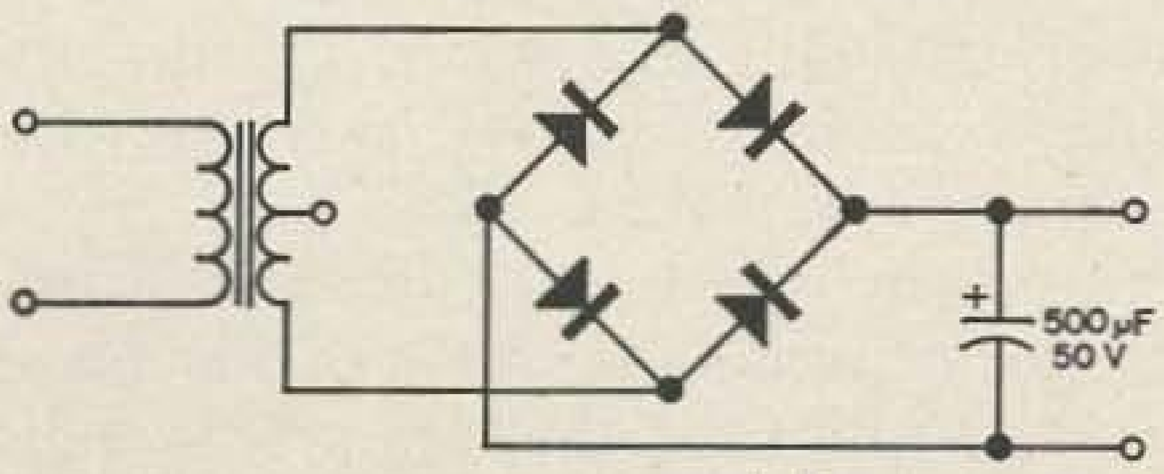
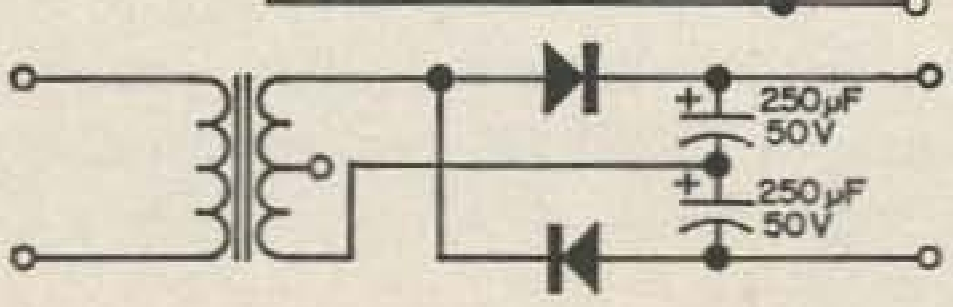
I have put all of these facts into a nice handy chart (**Table 1**), to be perused easily and casually, and have also spelled them out in order to emphasize the situation. If you are not already well familiar with them, do commit them to memory right away. It will pay off very well each time you design any power supply, and will remove any confusion about rules concerning how much output you get for how much input and how this is related to diode PIV. You already know how much you get out of the different configurations of power supplies, and need only to make sure about the diode ratings. If I labor this point, it is only because I have seen it abused in proper research laboratories where the participants ought to have known better.

There is no magic about these relationships, either. If you forget them, you can always figure them out simply, by drawing the circuit diagram, and tracing out the currents. Remember that when a diode is conducting, it can (for all practical purposes) be considered a closed switch, and when not conducting it is an open switch. The problem is to find the voltage across the switch for a given polarity, taking into account all sources of voltage—including charged capacitors.

Mechanical stress

Transistors have acquired a reputation for being rugged, but there is a limit. The *GE Transistor Manual* informs us that a 4½ inch drop of a transistor onto a hardwood bench gives an acceleration of 500g; 30 inches onto concrete gives 7 to 20 thousand g; snapping the transistor onto a spring clip—600g. And

Table 1. Peak inverse voltage characteristics of popular rectifier circuits.

Circuit	Description	PIV Across Each Diode	PIV Req'd with 71 V rms secondary
	Half-wave, Capacitive load	2.828 rms	200 V
	Half-wave, resistive load (not shown)	1.414 rms	100 V
	Full-wave, resistive or capacitive load	1.414 rms	100 V
	Full-wave bridge, resistive or capacitive load	1.414 rms	100 V
	Tripler, quadrupler, etc.	2.828 rms	200 V

even clipping the leads with side-cutters results in several thousand g. It seems to me that for practical purposes, the last-mentioned item is the most important, though you might take a little care the next time you 'throw' a transistor down onto the bench. If the transistor suffers too much vibration, the crystal will fracture, and that's it. I haven't had this happen yet, but now I snip the leads a bit more gingerly than before.

Thermal stress

There is a lot of argument on how much heat a transistor will comfortably take. Purists will have you hold the leads in heat sinks (e.g., surgical forceps, alligator clips). Others say to hold the lead with your fingers; if it gets too hot for you, it's too hot for the transistor, but this does seem drastic.

On one hand, it is obvious that the transistors will take quite a lot of thermal abuse, because they have to be soldered by dip processes into circuit boards, when leads are very short. And, I have unsoldered a number of transistors from circuit boards, and resoldered them into circuits without apparent harm—though for various reasons I do prefer transistor sockets. On the other hand, certain subtle forms of damage can be done to a transistor, germanium in particular, when heated only moderately.

It seems that when an alloy-diffused transistor, such as the 015 or 065 ($f_T = 70$ MHz) types appearing on computer circuit boards (at ridiculous prices), is heated a bit too much, its dc current gain increases, and its high frequency amplification decreases. Amazing. This does not appear to occur with the lower frequency (6-12 MHz) alloy junction types (e.g., 033, 083). And from the experience of a friend, it appears that the response time characteristics of silicon transistors can also suffer when abused. This leads into the delicate matter I shall eventually discuss here.

In general, you need not worry much about overheating if leads are not too short, and if you apply heat quickly and decisively (with all surfaces tinned). But, if there is any question, and particularly if high-frequency response is important, it is a lot safer to use transistor sockets.

Power rating

If you are going to avoid heat abuse, you also have to avoid it after the transistor has been soldered into the circuit. This is an enormous subject, and I can only touch it briefly here.

Remember that all transistor characteristics vary with temperature, usually for the worst. Leakage goes up alarmingly—particularly for germanium—and breakdown voltage goes down. But h_{FE} (dc current gain) goes up sharply above 60°C, while h_{fe} (ac current gain) goes up more slowly. For more details about this, as for much else, see the latest *GE Transistor Manual*, Chapter 6.

One of the most misunderstood ratings is that for power. One of the reasons why American ratings often appear to be so much higher than European ones, is that the former may be stated at 25°C case temperature, while the latter will be at some higher temperature. It is worth pondering over the various aspects of power ratings presented in the manuals and in the manufacturers' data sheets. The rating for power dissipation at 25°C (about 77°F) *air* temperature is a fairly practical one if a heat sink is not used, but requires that the air be allowed to circulate quite freely. For small transistors, the total device power dissipation given for 25°C air is about the same as for a 75°C case temperature, for silicon. If you want to dissipate more power, you have to use a heat sink, but in any event, it is important to keep the case temperature low enough. A rough rule of thumb is to apply power relatively gradually, until the transistor gets hot, but don't apply too much too fast! Germanium transistors should not get more than warm, nor silicon ones more than hot. How hot?

If you must obtain considerable power from a transistor, remember that the absolute maximum values are not necessarily design centers, but maxima. On the other hand, the power rating given depends on the case temperature, and the junction temperature can be higher for brief periods. How brief will depend on various things, and manufacturers' sheets should be consulted for high peak or pulsed operation. In any event, power can be dissipated as long as the average case temperature is reasonable. 75°C feels quite hot to the touch, while 100°C sizzles water or causes the experimenter to jerk his hand away so violently that the apparatus falls to the floor, thereby solving several problems simultaneously. Still higher temperatures will sizzle water more violently, and are to be avoided.

When a transistor is to be run hot, leakage considerations require that the base-emitter circuit resistance must be kept low, or very considerable base-bias stabilization be employed—for example, base bleed current equal to collector current if a germanium transistor, somewhat less for silicon.

Approximately two square inches of heat sink (i.e., one square inch on each side of a flat piece of metal) will dissipate one watt, while allowing the transistor (or diode) to reach 60°C above ambient. Since air temperature does not usually exceed 40°C (uncomfortable temperature for people), this seems like a good design value for silicon, though the prudent experimenter will increase the heat sink somewhat more, particularly if other warm things (including other transistors or diodes) are on or near the chassis. And, of course, the heat sink should be made of reasonably thick metal, preferably solid silver. Where this is impractical, copper or thick aluminum will have to suffice! The above considerations apply if heat contact of the semiconductor body with chassis is good. Use silicon grease and avoid mica if possible.

If you hope to get appreciable power out of high-power transistors at rf, remember that if the efficiency of a transistor decreases as frequency increases (e.g., above about 0.1 f_T) that represents increased loss, and that means that it will have to dissipate more heat for a given power output.

An embarrassing matter

I shall hide this point at the end of the article, in the hope that the casual reader will overlook it, while the dedicated will show understanding. The fact seems to be that it is indeed possible to overload a semiconductor partly, and thereby to degrade it without destroying it.

When they are abused, diodes or transistors do not *always* become totally "bad". This is because the semiconductor junction is metastable rather than directly unstable; it can be partly inactivated, or inadequately formed in manufacture. This has several interesting ramifications.

A damaged 600V diode may become a 100V or 50V—or even 30V—one. Therefore, always test "bad" diodes for PIV, unless the ohmmeter shows a low reverse resistance. Ohmmeter tests should be performed on the medium ohms range, because some very sensitive ohmmeters can show a finite back resistance of diodes on the high-ohms scale, particularly for low voltage or germanium diodes. On the other hand, considerable care must be exercised when using the low-ohms range of an ohmmeter to test the forward characteristic of a low current diode (or small transistor) because some types of ohmmeters can pass several hundred milliamperes. This is particularly important if you plan to test transistors routinely with an ohmmeter; it should have a sensitivity at least 10k/V, and should not be used on the lowest ohms range.

Personally, I think that one should *never* use an ohmmeter for testing semiconductors; at best the reading can be misleading, and at worst you can ruin the thing you are testing. But some people swear by ohmmeters for this—it takes all sorts to make a world!

Now, I must emphasize that these instances of partly inactivated semiconductors only happen when conditions are marginal, e.g., when source current is limited to a value which will damage but not destroy the semiconductor on one cycle or the other. I guarantee that if you exceed the absolute maximum PIV rating of a diode in an ordinary rectifier circuit it will perish within one cycle. Thus the invalidity of "ICAS" is still maintained.

Sometimes the degradation may occur from overheating, and indeed this phenomenon can sometimes be turned to advantage. Some surplus silicon diodes have inadequately formed (?) junctions, and can be "cured" to increase their PIV. In practice, you apply reverse voltage as described above, through a large series resistance, and when you reach the *turnover point* (where the current starts to increase sharply with voltage), you leave it there. If the current through the diode goes down and/or the voltage across it goes up (whichever is easiest to measure), watch what happens. The PIV may increase to some high value and stay there, even when you come back to it later; in that instance the diode is "cured" and you have produced a higher useful PIV! Or the increase may not be permanent when you return later (after removing the power), in which case you must rate it at the lower PIV. Or the voltage across the diode may increase quite a lot, then suddenly fall to zero, permanently. Tough luck. In any event, it can be exciting if you are prepared to experiment a bit.

I have found that the curing process is

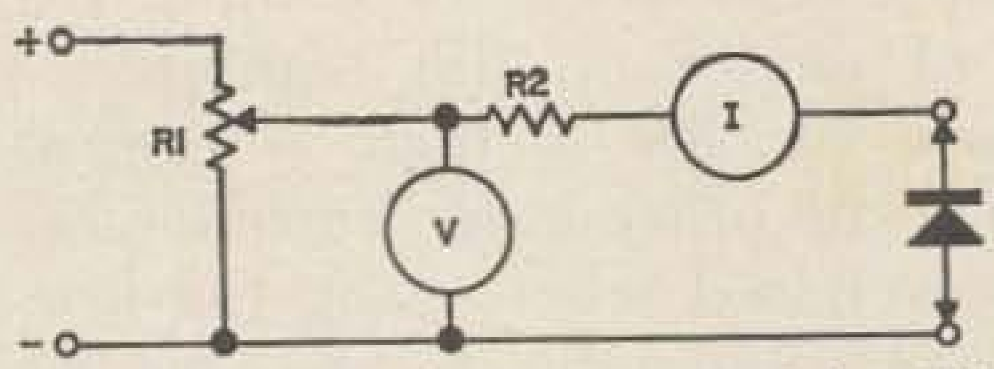


Fig. 3. A simple diode tester used by VK7RG for checking PIV.

accelerated, and made even more permanent, if the diode is heated. The heating can be either from external heat, or from the heat caused by forward current. Once, when I had to cure a whole batch of such beasts, I built a special power supply which applied suitable forward current on each half cycle, and the appropriate critical reverse voltage on the other. Does anyone know the reason for this strange curing phenomenon?

I ought to mention that when you are testing the reverse characteristic of a semiconductor, be sure that the current you are measuring is only that going through the semiconductor, i.e., not that going through semiconductor plus voltmeter. The currents involved are rather small, and the current required to drive even a VTVM can be large in comparison. In order to effect this testing more conveniently I have built a VTVM with a 250-meg input resistance; it is merely an ordinary push-pull type with meter between the cathodes, resistance of various amount (depending on sensitivity required) in parallel with the input grid, and 250 megs in series with input grid.

One fairly simple way to reduce measurement problems of this kind, is to measure the voltage on the power supply side of the limiting resistor (R_2 in **Fig. 3**), and calculate the diode voltage from Ohm's Law. In **Fig. 3**, for example, for a given I, the voltage E_d across the diode is

$$E_d = E_m - IR_2$$

where E_m is the voltage read from meter "V" (whilst ignoring the voltage drop of meter "I"), and I is the current through the diode. "I" may be a 50 μA or 100 μA meter and I

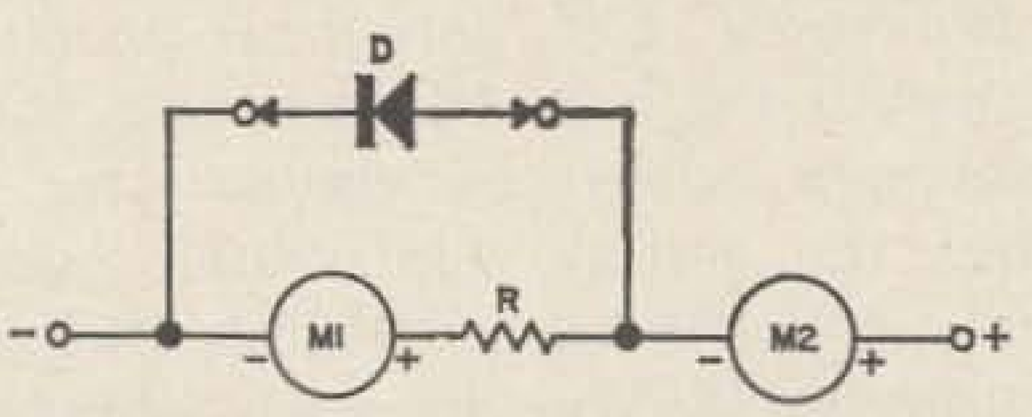


Fig. 4. Protecting a sensitive meter movement with a silicon diode. MI is the meter being protected, M2 is for temoprary measurements. The value of R is increased until meter MI reads about one-percent low as indicated by M2.

recommend that it be protected. The simplest protection is merely to shunt the meter with a silicon diode in the forward direction[4]. Still better protection can be effected by the temporary setup shown in **Fig. 4.** M_1 is the meter to be protected, and M_2 is a temporary current meter. D is any silicon diode. Just keep the current as read by M_2 at the full scale deflection (fsd) value of M_1, while increasing R. Increase R until M_1 reads about 1% low. Then replace R by the next *lower* standard value. This gives magnificent protection for M_1. Another diode in parallel with it, but in the opposite direction will protect for backward polarities, if relevant.

What do you do with a drunken junction?

Transistors can sometimes be degraded too, particularly if overheated. Their degradation may appear as lowered voltage rating, beta, frequency, or higher leakage. Therefore, a degraded transistor should be retested completely for all relevant characteristics including stability. *If* it shows certain characteristics on retesting, you can depend on those characteristics to remain stable (if it is not again overloaded), as though you had started with a poorer transistor—but on one notable occasion I found that certain transistors (diffused junction types 015 and 065 from computer circuit boards) which had been carefully overheated, increased their dc amplification factor at the expense of frequency rating. On the other hand, other transistors (alloy junction types 033, 083, ditto) didn't —so it is hard to predict behavior.

For my own purposes, I merely retest the abused transistor for voltage and gain, and dump it into the "general purpose" box, after writing the BV and beta directly on it. A friend goes even further, and won't have degraded transistors in his house. I have persuaded him to send them to me, and since his business results in a fair number of abused transistors, I have collected quite a nice pile of them. Since they were high performance Fairchilds to begin with, I have not been displeased with the resulting items with mere betas of 50-100, and such terrible frequency response as 100 MHz—heh!

It should also be noted that even if one junction of a transistor is ruined completely, there is a distinct possibility that the other junction will still be servicable as a rectifier. This is particularly important for power transistors used as diodes, but can be useful for small ones too if you are short of junction diodes. Indeed, under certain conditions where germanium junction diodes are required, these can be ideal: e.g., lower sensitivity to transients, lower forward voltage drop. But remember that a silicon transistor becomes a silicon diode, and is just as sensitive to PIV overload.

A fact often overlooked is that the reverse-biased base-emitter junction of many silicon transistors makes an excellent zener diode in the 6-12V range, depending on the transistor[5]. Unfortunately, however, only good commercial transistors do well in this regard, and the dynamic resistance of surplus ones is often hopelessly high. Out of a dozen Fairchild SE1002 transistors I tested, all had base-emitter zener voltages of the order of 6.5-6.7V at 1 mA. From a comparison of the resulting dynamic resistance with that of regular 6V zener diodes, I calculate that these are equivalent to a 300 mW American power rating, or 150 mW European or Australian power rating.

Thus, even half-damaged transistors can be put to good use, if the other half works. Perhaps in this day of affluence and low semiconductor prices, this may appear to be in the string-saving category, but my attitude in matters of this kind is colored by years of supporting a potentially expensive electronics hobby on a student's salary, and partly by the fact that those 'inexpensive' semiconductors manage to become considerably dearer after Australian Customs and the local middlemen have had their bit. Even so, its great fun in VK7; why don't you come visit us sometime and see?

. . . VK7RG

References

1. For example, see 'Silicon Diodes and Common Sense," *CQ*, Sept. 1965 and "Silicon Replacement for Tube Rectifiers," *QST*, Jan. 1965; also "Zener Diodes", *73*, October 1966.
2. This subject has been covered in some detail in a series of articles in *The Australian Equipment Exchange Bulletin* (P. O. Box 177, Sandy Bay, Tasmania, Australia) from July 1966 to July 1967.
3. See *73*, November 1966.
4. "Protect Your VTVM", *73*, August 1966, p. 82.
5. I strongly recommend the following articles to you:
   "Save That Transistor!", *73*, July 1966.
   "Zener Diodes", *73*, October 1966.
   "Zeners as Hi-Cap Variable Capacitors", *Radio-Electronics*, September 1966.
   "Solid-State Tuning", *Break-In*, January 1966.
   "Varactors", *Break-In*, May 1966. ("B-I" is the ZL equivalent of *QST*, but much better because in part they show what more can be done with partial transistors, and because they continue this semiconductor discussion more fully on important and exciting properties.)

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DC VTVM

If you're in the need for a very sensitive, high-impedance VTVM, here is a design that is simple, stable and economical.

Can you build a better dc VTVM than you can buy? Well, I suppose that depends. But if you've never tried, why don't you at least breadboard this circuit? You may find that dc amplifiers and meter circuits are not so complicated after all, if you have some good ideas to work from. And here they are!

The finished instrument reflects my own experience in test and development work. The voltage ranges increase by factors of 2 or 2.5, from 1 volt full scale (through probe) to 500 volts full scale. Direct input sensitivity is 0.1 volts to 50 volts, and has proved very useful although you have to be careful with it. The bipolar scale eliminates switching, an annoyance around transistor circuits which often have some of each polarity; none too clearly marked. The test probe has three resistors totaling 18 megohms near its tip. This minimizes disturbance of circuits, even at rf. And an appropriate bypass capacitor eliminates noise transmission from the instrument back to the circuit under test.

Although the circuit will get by with almost any meter movement of a milliampere or less, long scales are rare. For instance, the nice Lafayette meters priced around \$4.95 have a 1-inch scale. But Selectronics is selling a meter with a 6-inch scale for \$4.50. That's large enough for hand manufacture of a new scale, and you have the option of making the job easier by going full-scale and adding a reversing switch.

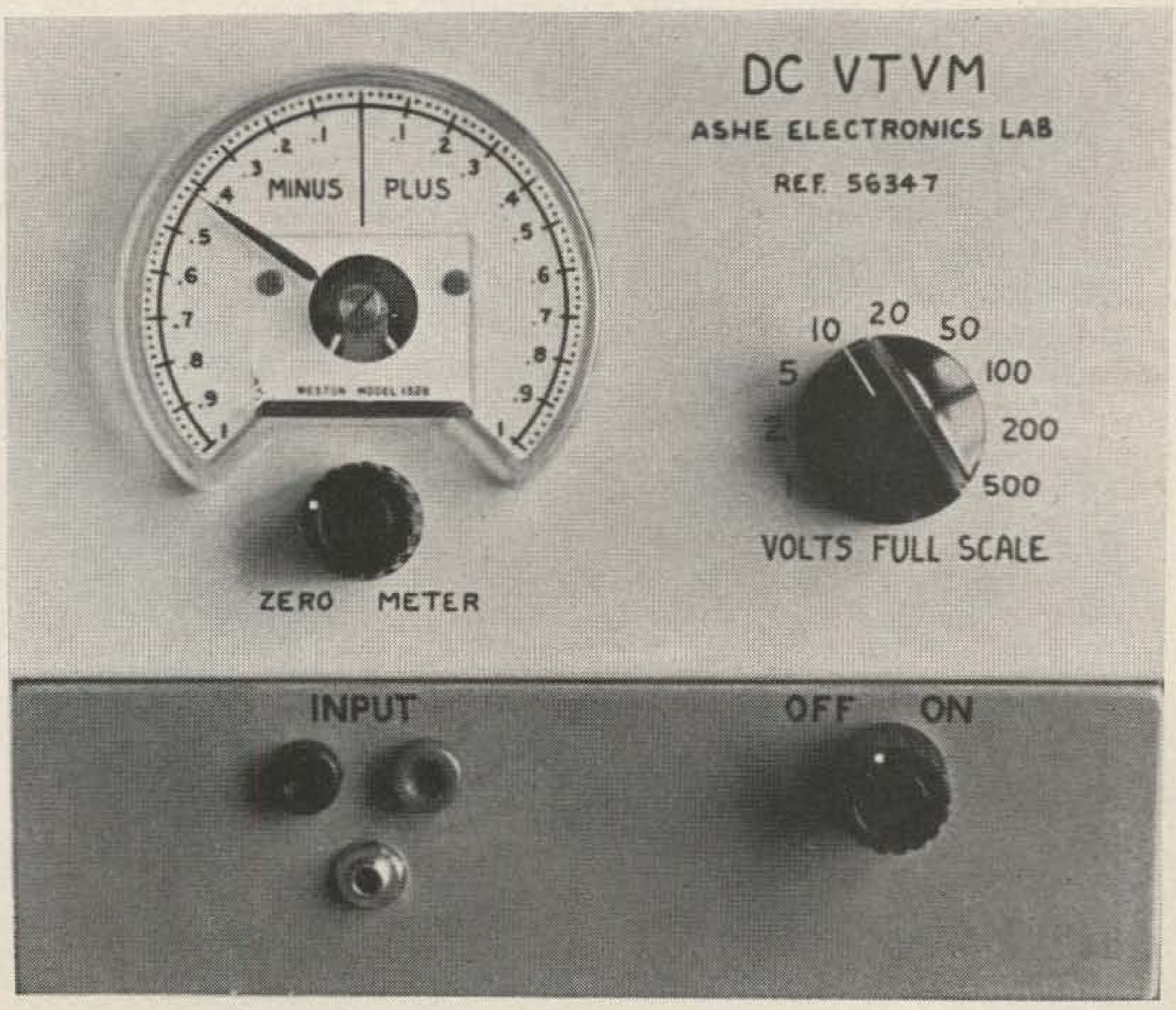


Fig. 1. Front view of dc VTVM. It exhibits 18 megohms input impedance and has nine full scale voltage ranges from one to 500 volts dc.

Fig. 2. Back view of dc VTVM. In this shot the OB2's were pulled out for a better view. The lip at top of the panel makes a convenient handle.

Circuit details

The instrument circuit breaks down naturally into four parts. They are the power supply, the input divider, the dc amplifier, and the meter driver. If you cannot exactly duplicate the circuit I have described, reread the description of the parts you're going to change, and then start breadboarding.

Because the two 0B2 VR tubes fix the critical voltages, there is no need to duplicate the supply section. Any transformer which will give you a filtered dc output of 250 to 350 volts at 20 mA or more and 6.3 volts ac at roughly 0.6 amps will be adequate. If you have any doubts about the transformer, make up a breadboard and load it to these specs for a few hours. It shouldn't get too hot to touch. When assembling the instrument, check the VR current for a minimum of 5 mA under operating conditions. I've added a neon lamp stabilized bias to the heater leads because this is said to improve tube life, and a small series resistor drops the heater voltage to within the manufacturer's specs. You have to watch that with "surplus" transformers! "6.3 volts" often turns out to be more like "big ballpark guess".

Instrument accuracy is established by the input voltage divider. But not all parts of the divider are equally critical! If the 18 megohms in the probe is in error, this constant inaccuracy can be corrected for all ranges by adjusting the calibration control. The nine resistors in the voltage divider string are the most critical, and it turns out they are all values you can easily measure on an inexpensive impedance bridge. I bashfully admit I planned it that way. When building, proceed in this order. Find accurate resistors for the voltage divider. Then use three good resistors for the probe, 10% or 5% tolerance. Calibrate through the probe. Then choose a resistor for the direct input, near 180k ohms, which gives correct readings (at 10X sensitivity).

Your nine accurate resistors may be a problem. I selected ordinary half-watt composition resistors on my Heathkit impedance bridge, in some cases putting a small one in series with a large one, so as to hit all values accurately. I used heatsinks for soldering to avoid calibration changes. Perhaps the resistors will drift with time and need to be corrected later. You might prefer highly stable 1% resistors, choosing values close to those specified, and avoiding cumulative error, as you pass up the string, by selecting values on opposite sides of true figures.

A properly designed instrument will not introduce hum and noise into the circuit being studied. If the meter input line is acquiring some ac from a nearby power lead, this may be introduced into the probe and go on from there. But a large bypass capacitor keeps this line at signal ground, and it also slows meter needle response. My meter requires about 1 second to come to a reading.

Transistors are very nice for guaranteeing vacuum tube operating points. Not out of place at all, and since only dc conditions are important, an inexpensive transistor will do a fine job. If you've had experience with in-

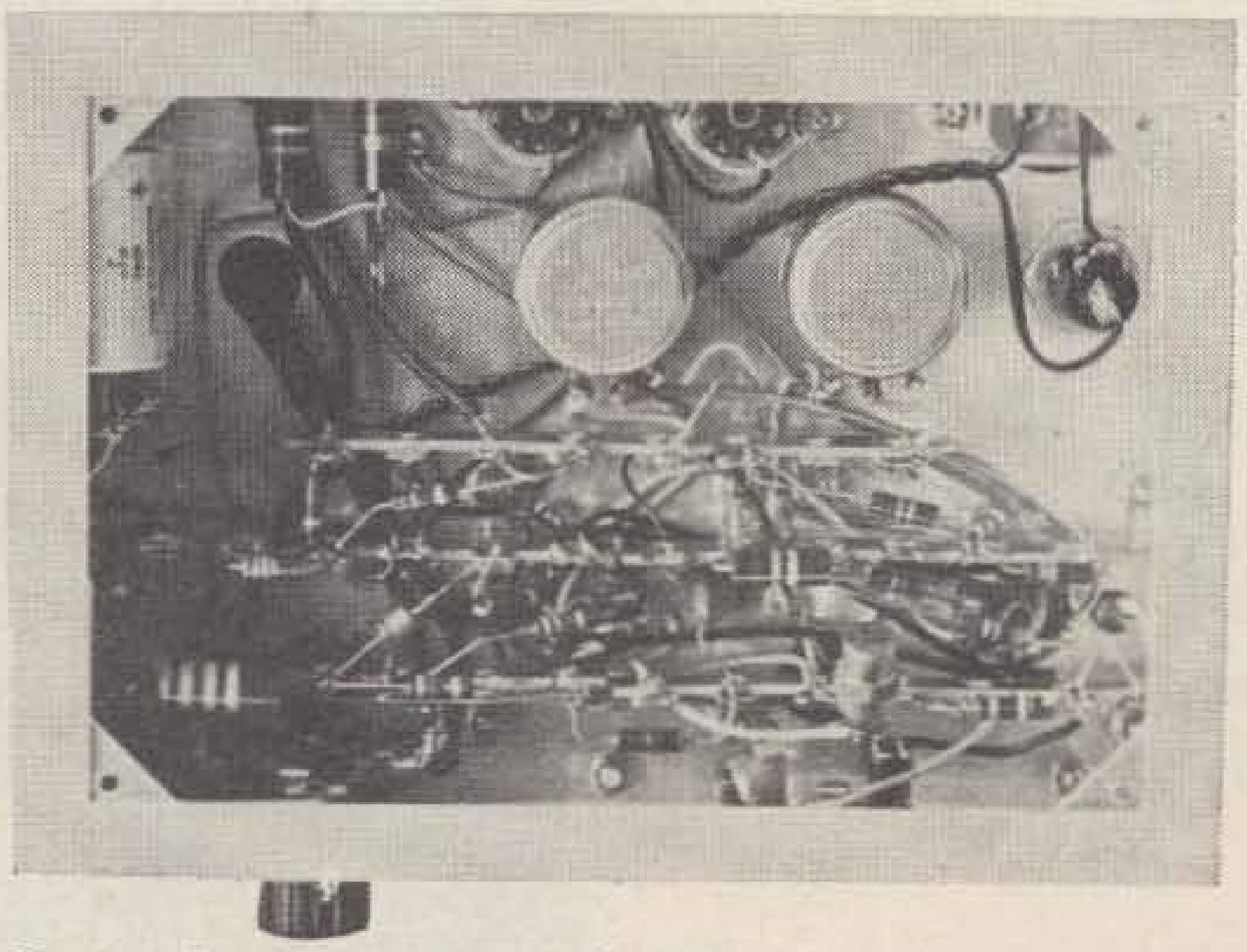


Fig.3. Bottom view of dc VTVM. Voltage doubler supply is in lower right hand corner on two lug strips on side of chassis. Circuit warmup time might be reduced by mounting the transistor on/top of the chassis.

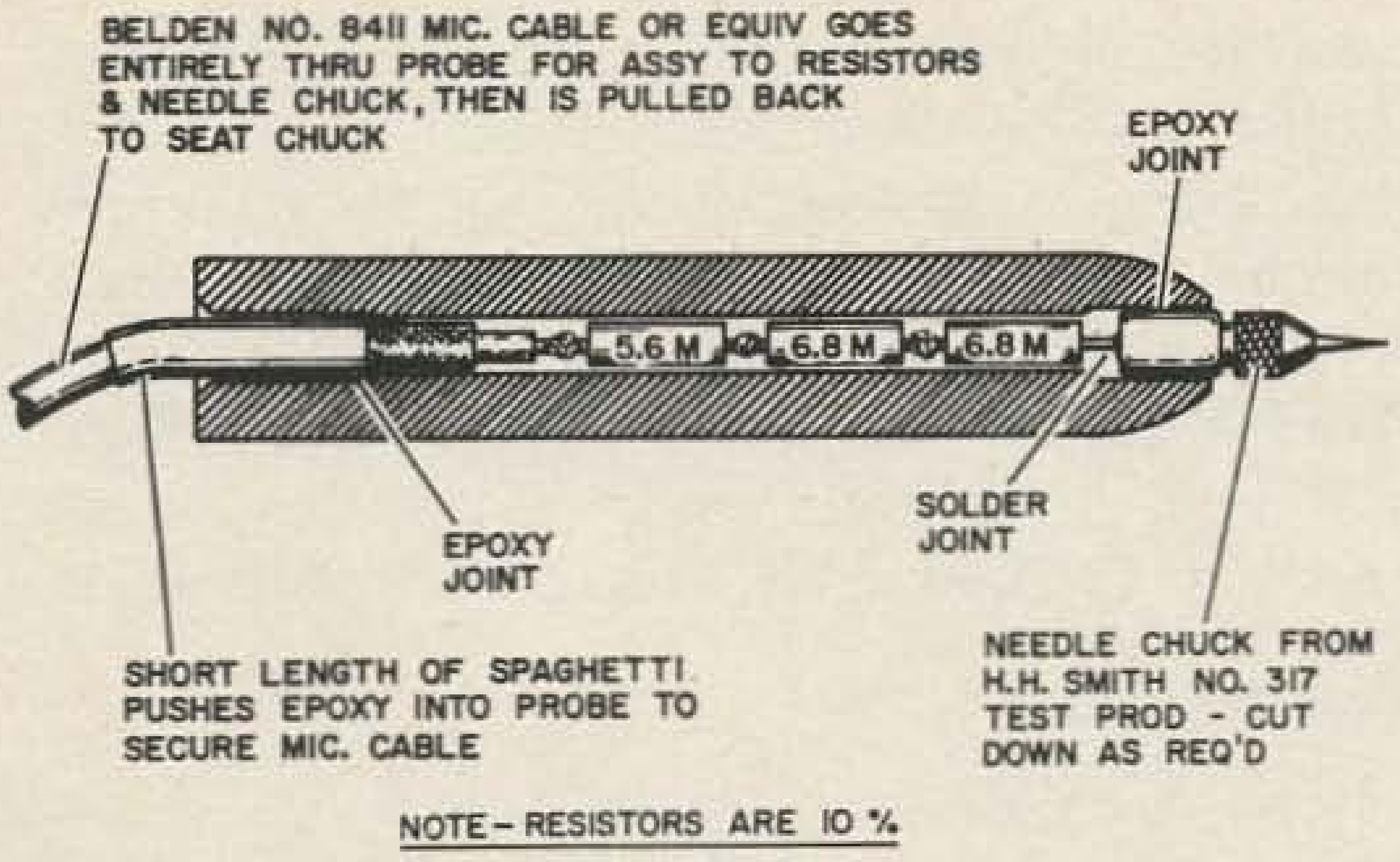


Fig. 4. Test prod construction. Simple design is permanently assembled with epoxy cement.

dustrial and computer circuits, you'll see why I call this arrangement "bobtail bias". The transistor fixes the current through its emitter resistor by guaranteeing the voltage across it, and this in turn determines the operating point of the 12AU7. The transistor base voltage is fixed by the divider across the zener diode. It turns out the zener is necessary for good stability, since the 0B2 regulated dc voltage is still pretty drifty. Choose the upper resistor (marked with an asterisk) for 3.4 volts across the 470 ohm emitter resistor. The tube cathode and anode voltages should come out right with no further effort.

The vacuum tube circuit is known as a "difference amplifier". It is used because of its relative stability: drift in one half is compensated by roughly equal drift in the other half. The circuit seems to compare voltages applied to the grids, amplifying the difference. For instance, if both grids go one volt positive, the cathode does too. Tube current remains constant, and there is no output. But if one grid goes positive and the other does not, the tube currents are unbalanced and there is a net output. This is why you cannot eliminate the apparently superfluous resistor and capacitor to ground from pin 7. There is some grid current and noise pickup, which only balances out if both grids see the same view to ground.

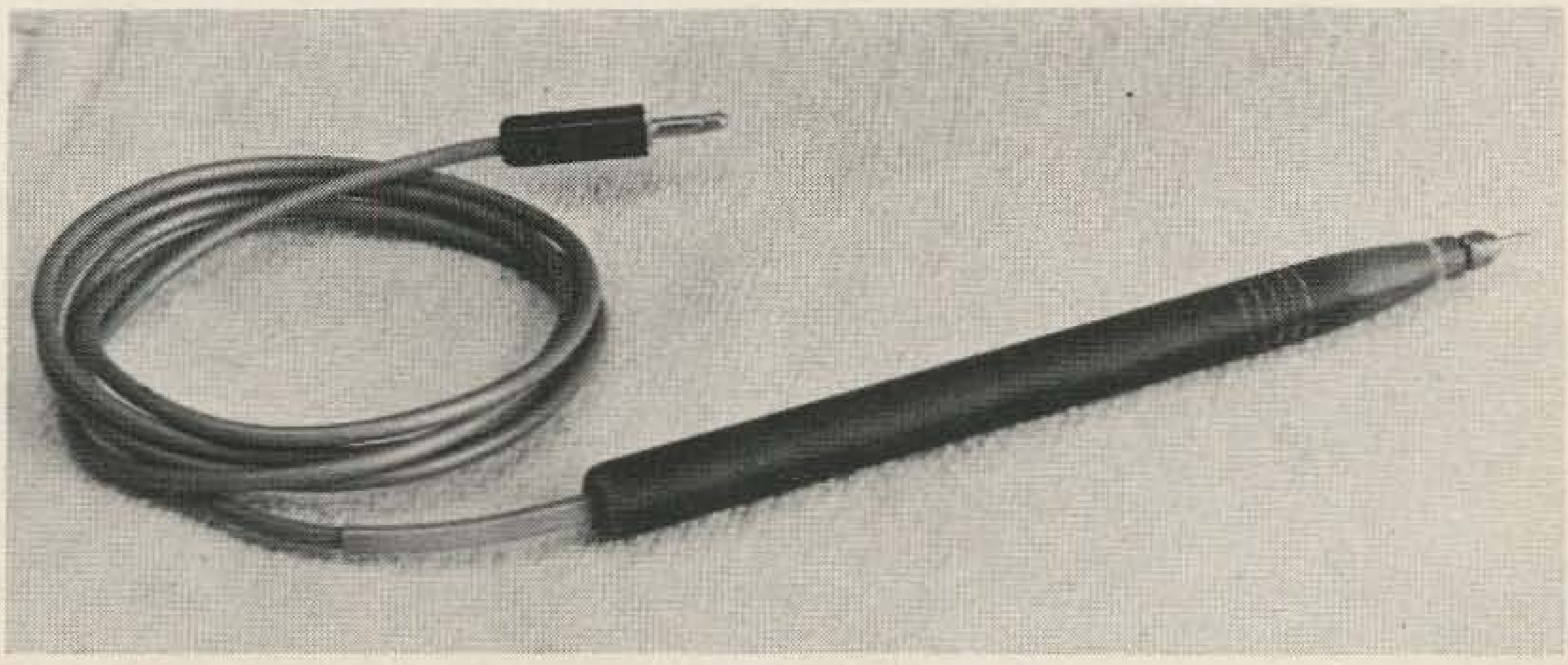
You may find some advantage in selecting the amplifier tube for stability and minimum grid current. The coarse zero control is large enough to compensate for more than the usual variations in tube properties, but some new 12AU7A's show better stability than others. Grid current in my meter produces about a 2% zero drift in going to the lowest range, which is not inconvenient, but a selected tube could probably improve on this. Don't try to use a surplus or computer variety tube for this application, because they were not as carefully controlled in manufacture as the ones you get in your nearby service shop. The state of the art *has* changed!

Since there is no negative supply voltage and a pot in the cathode circuit would spoil the nice properties of the difference amplifier, the meter Zero control is a variable resistance in one anode circuit. If the anode voltage is too high, we just put in a little more resistance to bring it down. Works fine. I've found the 12AU7A's are quite variable in the amount of correction required, so one large resistor is placed in the chassis, and a small one in the panel for vernier corrections.

The Selectronics meter has about a 1000-ohm coil, and requires 500 microamps for full scale deflection. This is a heavy load for a small, low-current vacuum tube. So I've added a cathode follower to drive the meter. This enables the difference amplifier to operate at full gain of about 10. Because the cathode follower is heavily loaded, overall voltage gain is about 3.

The electrical connections to the meter are in the insulated wire extending from the back, and the two studs also extending from the back. If you wire the circuit as I've shown in the schematic, the lead goes to the calibration pot and to pin 3; the studs

Fig. 5. The finished test prod. Make the cable a little long and shorten it if necessary.



to pin 8 of the 12AU7A cathode follower. This gives upscale deflection for positive voltages. The wire lead is the meter's positive terminal.

A small precaution is required to eliminate a front panel shock hazard. Cut or break off the two-fingered zeroing extension from the meter face into the movement. It's nickle-plated, soft brass. You find this inside the cover, not the movement. Careful, the zeroing screw is mounted in thin plastic! This connection should be broken because the meter movement operates at 12AU7A anode voltage.

If you want to use a single-ended scale, put the scale reversing switch in the difference amplifier grid circuit. For positive voltages, one grid to ground and other for signal; for negative voltages reverse grid connections only. You will probably find that you do not need to switch in a new calibration control for the reversed ranges. By swapping grid connections, the tube sees nearly the same operating conditions with opposite polarity signal input, so calibration should not be disturbed.

A lower-range meter may be used simply by changing the value of the calibration pot. A larger resistance reduces the current that flows through the meter for a given input voltage. A 50-microamp Lafayette meter ($4.95) worked well in a breadboard test.

Construction

The VTVM is assembled on a 5 x 7 x 2 aluminum chassis, with a 4 x 7 inch panel tilted back ⅝ inches at the top. A lip 1¼ inches wide takes a 1 inch wide vertical brace at each side for reinforcement. The lip is folded down a quarter inch at the back for reinforcement, also giving a convenient handle effect for picking up the instrument. The four little diagonal pieces visible in **Fig. 3** are braces omitted from many chassis but used in Premier products. They do much to strengthen the chassis.

Parts positioning is not critical, but the signal input leads should be kept well clear

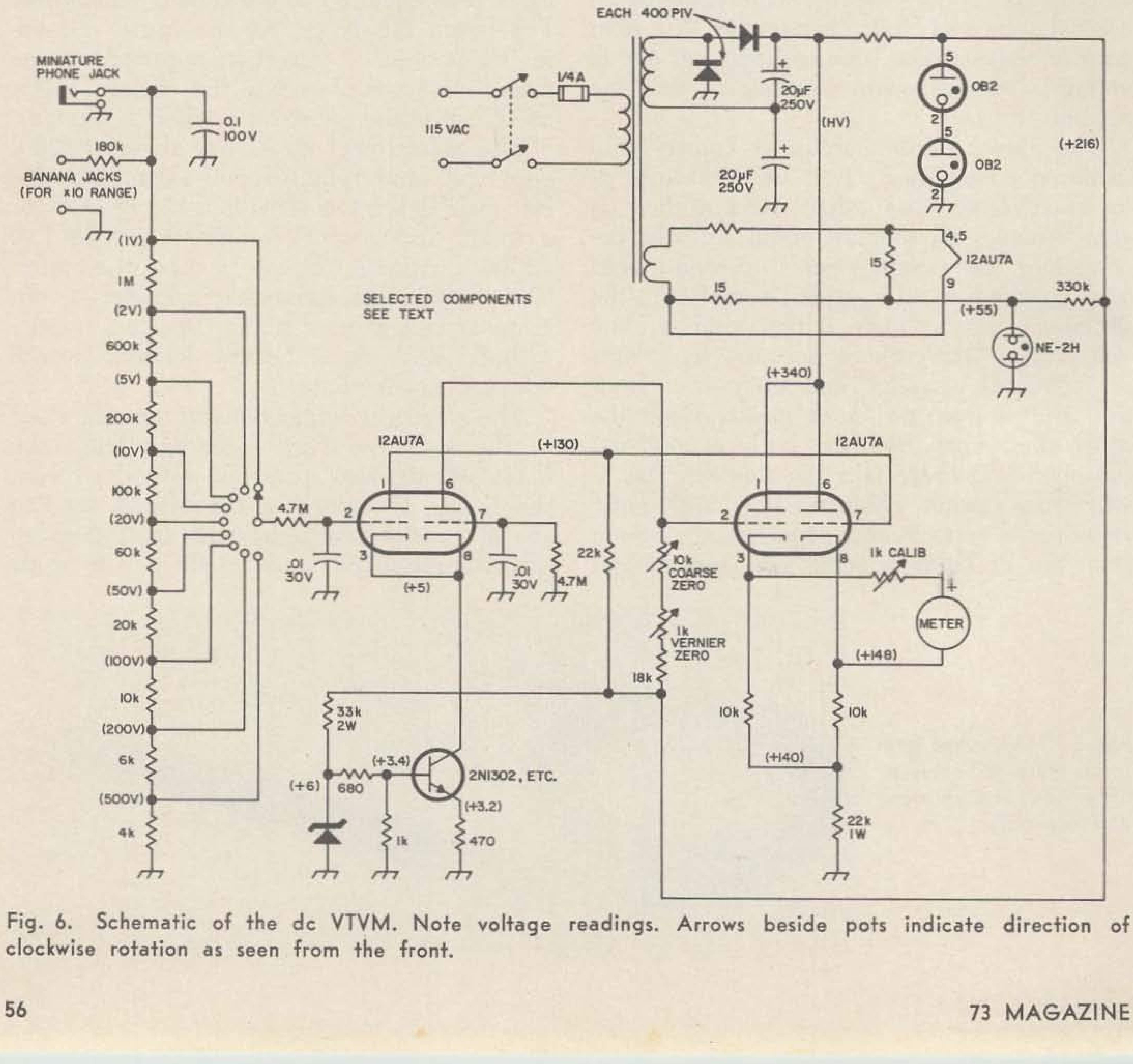


Fig. 6. Schematic of the dc VTVM. Note voltage readings. Arrows beside pots indicate direction of clockwise rotation as seen from the front.

of the heater and 115-volt input wiring. The ac won't affect the instrument but you don't want it going back into the circuit you're observing. The voltage divider uses two 1-pole, 11-position wafers, the front one serving only for tie points. They are mounted on the appropriate manufacturer's shaft assembly, which may be supplied separately.

I mounted the transistor socket by its leads on two solder lugs. The wiring follows no special layout but parts close together on the schematic appear near each other in the chassis. The statistics on the five large solder lug strips are 28 insulated lugs and five grounded lugs used. B negative and signal ground go to the metal chassis. The TV cheater cord power input is very convenient and only costs a few cents.

Since the Selectronics meter comes with no mounting brackets, the simplest way to install it is to glue it in. An Adel nibbler cuts a nice square hole, slightly oversize, and you might clean it up with a file. After painting, scrape off a couple of patches under the meter, roughen the plastic that goes over them, spread a thin layer of good epoxy glue, and slip the meter case in place. Leave the cover off. Let the panel rest overnight face up to complete the job.

I made the probe from a handy piece of phenolic plastic, a half inch diameter by 6-inches long. Details in **Fig. 4** and **5**. The rings around the lower end serve to indicate where the end is without looking at the probe. It's all held together with epoxy resin. Each half-watt resistor is rated at 300 volts so it's quite safe for poking around in circuits within the normal range of the instrument. The needle chuck is cut down to reduce probe capacitance. I have a strong preference for the phono needle tips, since they can be wedged into something while making a measurement and do not slip off when you look up at the meter.

An alternate probe construction would resemble that shown, but you could use an H. H. Smith type 317 test prod as a start.

Meter calibration

The meter scale is large enough to draw by hand in real size. Instead of going into terrific detail, I'll pass on some suggestions. You can browse around in a couple of drafting books for the necessary background. You will need a basic set of drafting instruments, which are usually available somewhere. Try a nearby school. If you're not a student, you may be a taxpayer helping to support the school.

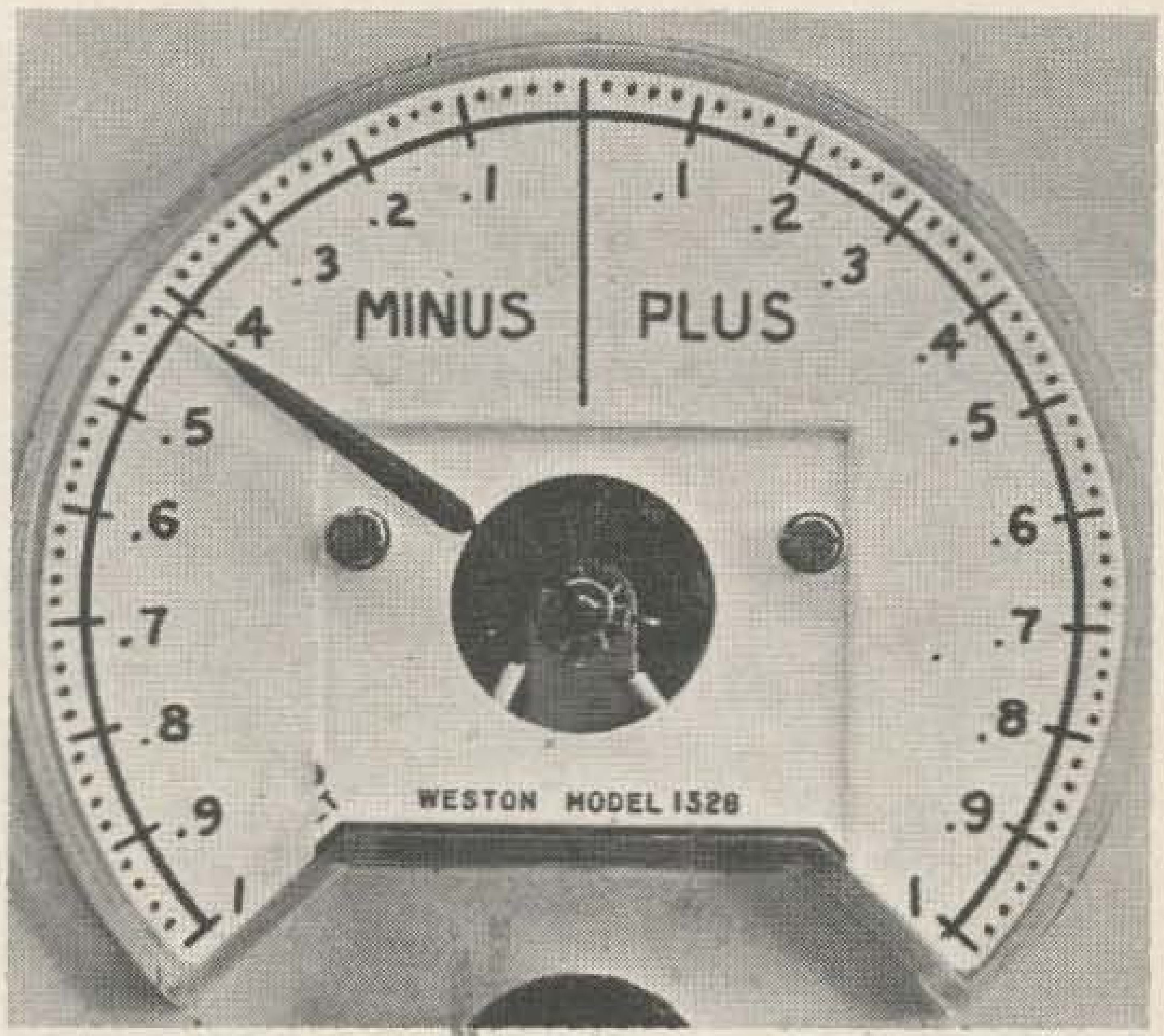


Fig. 7. Closeup of new meter scale, cover removed. Needle is at resting position with power off.

Fig. 7 shows a scale done with a Leroy penholder using a #0 tip. A soft drafting pencil, properly used, will do a very acceptable job. You may feel more comfortable working in pencil if you lack previous drafting experience. Work on a piece of ordinary white filing-card stock. When the scale is prepared, spread epoxy cement thinly over the entire back, place the new scale over the old one and let the epoxy harden. If you don't like the end result, acetone attacks the epoxy. You can clean up and start over.

Begin by copying **Fig. 8** onto the white stock. Ink or heavy in the scale arc, the center zero line (if used) and perhaps part of the lettering. Cut out careful, straight lines with straightedge and razor blade, the outside curve with scissors. Save the waste. You can fit it back into the scale to find the center for finishing up.

Masking tape will hold the scale in place well enough for calibration. Tiny pencil marks will indicate the new scale location over the original scale, since you must remove it for completion after calibration. Locate the endpoints by applying full-scale voltage in opposite directions. Find the nine intermediate points by draftsman's construction, or preferably using a Voltage Calibrator, because the meter movement isn't perfectly linear. See 73, January 1967, page 70. Set the VTVM to 10 volts full scale and make a tiny pencil mark at each volt deflection. Return the scale to the drawing board for finishing, and then install it permanently.

The meter as received has its zero at the conventional left-hand end of the scale. I rezeroed it up-scale by turning the hairspring attachments in the appropriate direction. About 90 degrees was the maximum available correction, the same change being made in front and back hairsprings. This brings the needle to the position shown in **Fig. 7**, and the zeroing to the new scale is completed electrically. This gives a possibly unnecessary option for future adjustments in either direction.

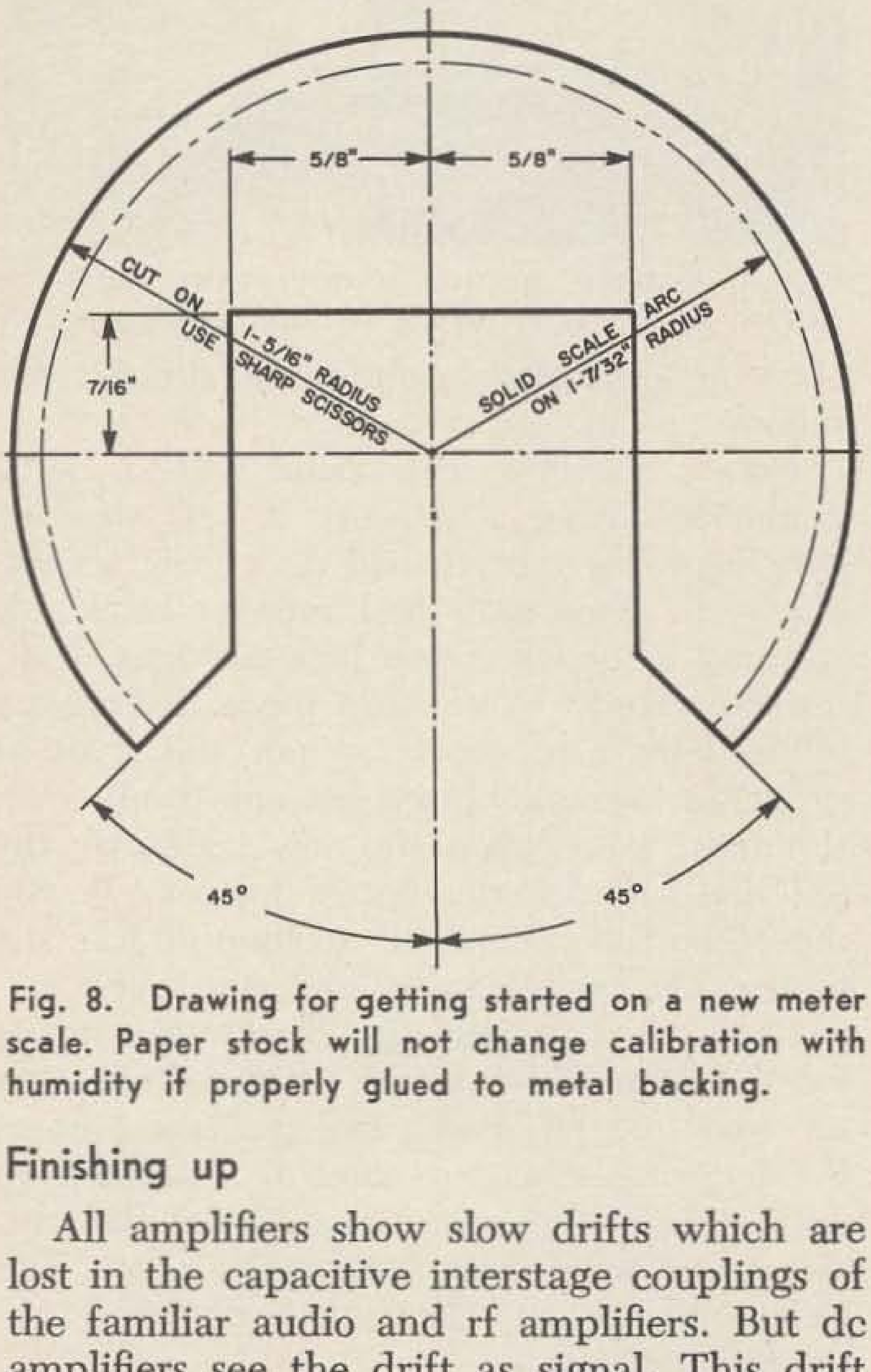


Fig. 8. Drawing for getting started on a new meter scale. Paper stock will not change calibration with humidity if properly glued to metal backing.

Finishing up

All amplifiers show slow drifts which are lost in the capacitive interstage couplings of the familiar audio and rf amplifiers. But dc amplifiers see the drift as signal. This drift problem is usually dealt with by using very stable supply voltages and incorporating additional elements whose drift is about equal and opposite to that anticipated in the signal part of the circuit.

If your meter shows erratic zero behavior five minutes after a cold start, or annoying drift later than 20-30 minutes, look for a faulty circuit or component. The best way to find the trouble is to choose one small region or candidate at a time, and invent a way to test it without disturbing everything else.

A surplus zeroing pot may have aged more than anticipated since last used, and be making poor contact. Let it hang by its leads so the shock is not transmitted to the chassis, and give it a rap with a small screwdriver handle. If the meter needle jumps, the pot at least needs some contact cleaner. Check other pots the same way, and poking at joints with an insulated rod will uncover poor solder work.

Having eliminated all possibilities in the chassis, rap the tube. As the tube warms up, mechanical stresses develop inside. One or two raps will relieve these. If the meter needle starts jumping one way and another on successive raps, you want a different tube.

Use a *Variac* to adjust the line voltage in little jumps. If the meter needle follows these jumps quickly, check the 0A2's, the zener diode, and the bias transistor in that order. Slow drifts are acceptable.

Your finished meter should be well-behaved and long-lived. I don't think the circuit can hurt the meter movement, but then I haven't really tried. I hope you won't either. Perhaps a pair of germanium diodes in series each way across the meter coil would be good insurance.

The direct input times 10 ranges turned out to have an immediate use I could have anticipated but somehow didn't. They're great for checking and neutralizing tiny VHF amplifiers. I'm working up an rf probe now, and if it doesn't appear in this issue of 73, look for it soon!

. . . W2DXH

National Bureau of Standards

The new 1967 edition of *NBS Standard Frequency and Time Services*, has just been released by the U. S. Government Prinitng Office in Washington, D. C. Known as *Miscellaneous Publication* 236, this eleven page pamphlet describes in detail the many services provided by the National Bureau of Standards' four stations, WWV, WWVH, WWVB, and WWVL. All but WWVH, which is on the island of Maui, Hawaii, are located about six miles north of Fort Collins, Colorado. *NBS Frequency and Time Services* may be ordered for 15 cents a copy from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; the Clearing House for Federal Scientific and Technical Information, Springfield, Virginia 22151; or from local U. S. Department of Commerce Field Offices, and at the NBS Boulder Laboratories.

Lew Clark WA2TOV
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A Wavemeter for 220

The 220 MHz wavemeter built from a Lafayette TM-14 Radio Field Indicator.

I have frequently noted the old Lafayette model TM-14 Radio Field Indicator among the archives in many hamshacks. I had one collecting dust and decided to see what would evolve with a little experimentation. Result—a wavemeter for 220.

First, remove all the "innards" except the meter on the front and the antenna receptacle on the top. This includes the phone jack on the rear and the magnet attached to the back cover with two screws (unless you enjoy having the wavemeter dangle precariously from some nook or cranny). Slightly enlarge the rear phone jack hole, insert a nibbling tool and cut out the back. Take a piece of fairly stiff plastic, slightly larger than the hole you just cut out and glue it on the inside. Put the cover aside and let it dry. You can still get readings on the wavemeter without this plastic window in the rear, but only a small fraction of the meter swing with it installed.

In my model a small Mylar .01 μF capacitor was connected across the meter terminals.

In the vacant "pot" hole in the front panel, install a small 15 pF variable capacitor. Next, install the diode. I used a General Instruments DR303, but I am sure the more popular 1N34 or other VHF diodes will do as good a job. Coils L1 and L2 were made of very small plastic covered hookup wire (about #24). L1 is 1 turn, ½" in diameter; L2 is 1½ turns, ¼" in diameter.

My unit covers from about 185 MHz to well above 260 MHz. It should be stated here that some experimentation may be necessary with coils L1 and L2 depending upon what diode and/or capacitor is used. Use a grid dip meter for calibration. This unit has been tested with several different grid dip meters and the results are the same on each, so it works out well and will give you a "working piece" of equipment rather cheaply if you are interested in the 220 band. It can be seen that with some experimentation this unit can be adapted to other bands of your choice.

Finally, with the weak signal emanating from a grid dip meter, I had very little success in picking up a reading using the reinstalled antenna, but received excellent readings by placing the plastic rear opening as close as possible to my source of signal. With a stronger signal the antenna can be used successfully to obtain readings without getting close to sources of rf. . . . WA2TOV

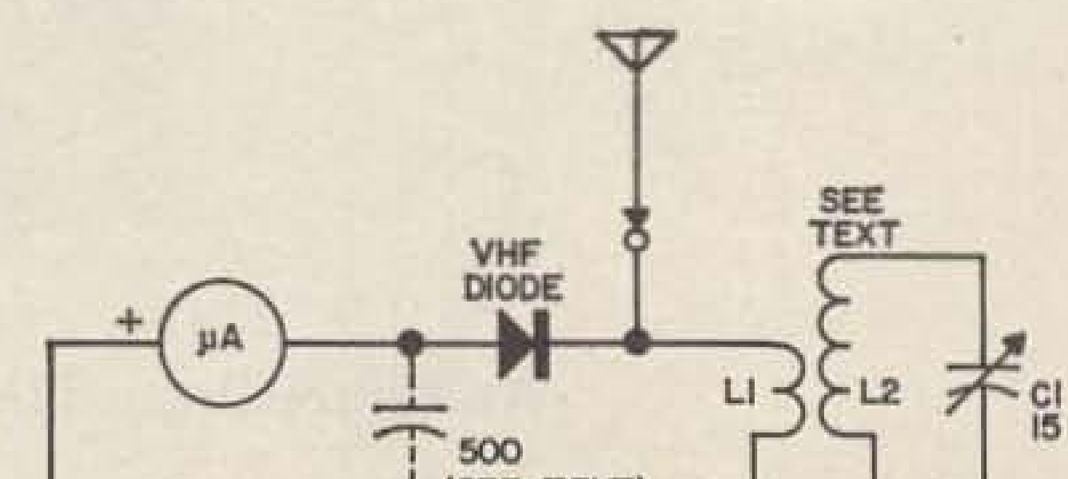


Fig. 1. Schematic diagram of the 220 MHz wavemeter. The coils are described in the text.

Second Ham Tour Of Europe

The ham tour this coming spring will be a happening that you will remember all your life. If you can possibly get away you should join our happy group traveling through Europe.

We have picked three weeks in spring as the best time of the year to visit Europe. Not only is the weather usually at its best at this time of the year, but we will be getting there a little before the big crush of tourists and won't find things all jammed up. A little later on everything fills up, it rains, and prices skyrocket.

We'll leave Boston on May 11th (Saturday) and fly first to Paris, where we will be met by a delightful group of French amateurs who will help us to see their fabulous city and perhaps entertain us a bit in their homes. We'll suggest things to see and tell you how to get around in Paris, but there'll be none of this guided tour baloney. You see what you want to see, not what we decide you should see, Louvre? Fine, you'll find a goodly group going there. The fleshpots? Heh, heh! The famous Flea Market? I'll bet a lot of us will be going out there Sunday morning to pick up some bargains.

Next stop is Vienna, home of the most wonderful pastries in the world. We'll try to have some tickets for the Spanish Riding School for those of you interested in this historical show. We're planning a get together with the Viennese hams at a hourigan where we all sit around and drink fresh wine, a Viennese specialty.

In Berlin we will have two guided tours, one of the western sector and one into the Communist Eastern Zone, through Checkpoint Charlie. You can bring your cameras and take pictures of the stark differences between the two worlds . . . the Wall . . . and incredible Berlin itself. The hams there are expecting us and we may have another great party together with them as we did on our first Tour.

The final city on our second tour will be Frankfort, where the local amateurs are eagerly looking forward to our visit so they can show us this historical area. Castle lovers can sate themselves. Car lovers will find Stuttgart just down the autobahn where he can visit the Porsche or Mercedes factories. Food lovers will go right out of their minds here.

In all we will be visiting four cities, staying about five days in each, which will give us a chance to see enough to want to come back for more and meet a number of the interesting amateurs who live locally. We will be staying at good hotels, but not at the very high priced international type hotels which are just about the same as staying in the U.S. By visiting the local hotels we get to live in the European manner and get a lot more out of our trip. It is the difference that make a tour enjoyable, not this business of never leaving home.

What Will The Tour Include?

There are considerable economies to traveling in a group. We will save enough just on our air fare to cover the bulk of the expenses of this trip. The trip fee will include jet air transportation for the entire trip, buses to and from the airports to the hotels, your hotel room, including breakfast, airport charges and taxes, sightseeing in eastern and western Berlin, and entertainments with local amateurs in all cities. You'll have to bring along enough money for your lunches and dinners. These are not included because we figured you'd like to make your own plans most of the time. Just about everything else will be paid for.

OK, How Much?

The regular Economy fare to Vienna is $602. This is the lowest fare that you can get to fly this far. Most tours like this are run for a profit and you would have to pay about $1000 per person. Our interest is international ham friendship and our fare is $990. But that is for **two** people, not one. That's right, just about half the regular cost of a tour like this. Singles will be $520 each.

We must know soon if you and your wife are going on this trip so please send $100 deposit quickly so we can make the reservations for the air seats and hotel rooms. We will probably have lots of room if you have a friend and his wife who want to come along too, ham or no.

Dates

We are planning on leaving Boston on the evening of May 11th and returning 21 days later on Saturday June first, arriving in the evening. We will be in Paris on May 12-16, in Vienna on May 17-21, in Berlin on May 22-26, and in Frankfort on May 27-31.

Europe will be in the full bloom of spring during May. It will be moderate in temperature, requiring a light coat in the evening. The daytime temperatures will probably run about 65-75°.

Cancellation

Your deposit will be returned if you cancel out up to 60 days before the tour. At that time we have to bind the airline seats and we lose the money if you change your mind.

My wife and I will be guiding the tour and we are looking forward to having a lot of long ham talks with you. Well, I am; my wife will have lot of things to talk with your wives about other than ham radio.

Please let me hear from you soon . . . and don't forget that $100 deposit made out to 73 Magazine, Peterborough, New Hampshire 03458.

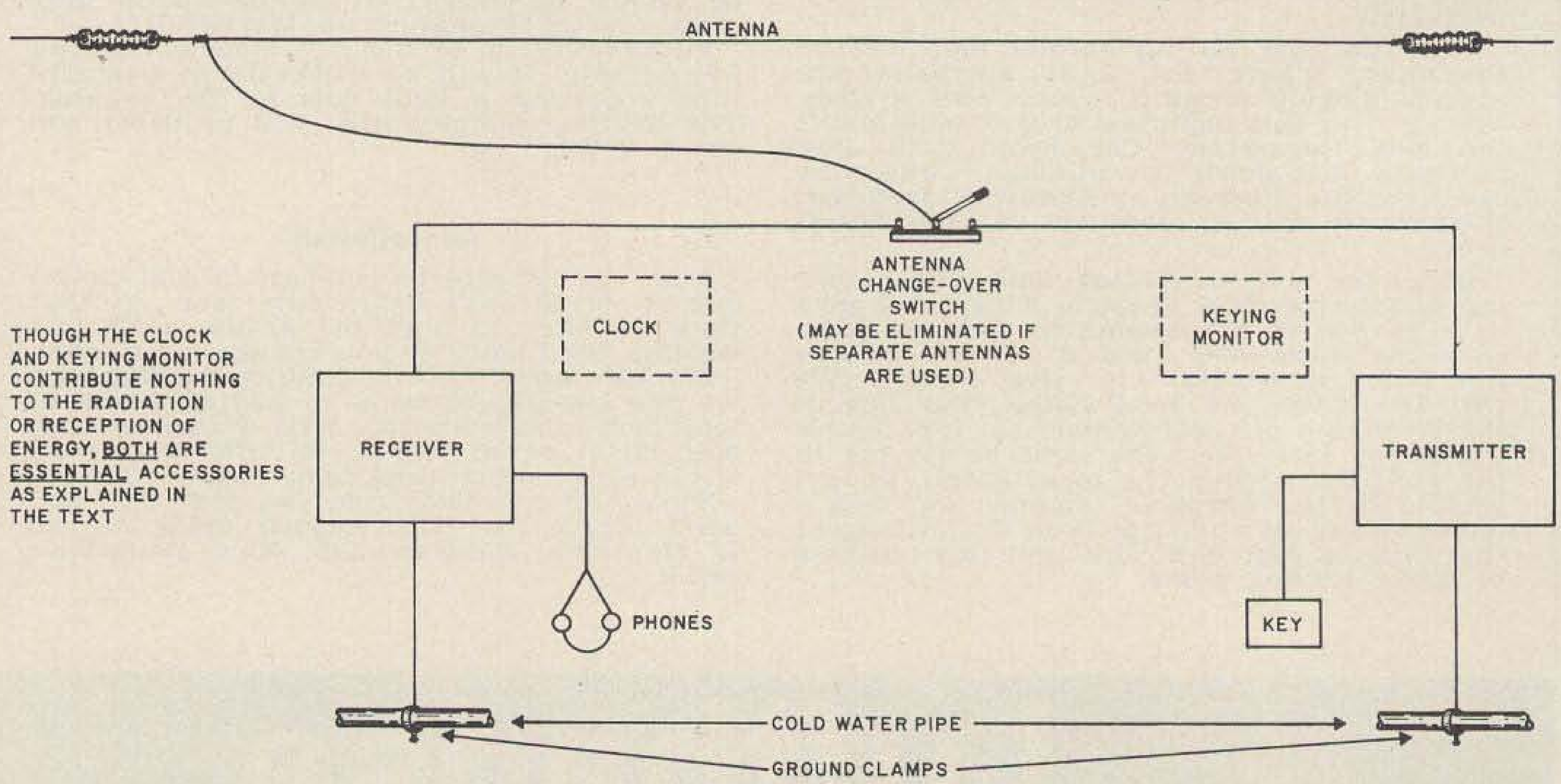
Howard Pyle W7OE
3434 74th Avenue, S.E.
Mercer Island,
Washington 98040

Choosing Accessories for the Novice Ham Shack

As a youngster you became the proud possessor of your first bicycle. Basically, this was nothing more than a pair of rubber tired wheels mounted in a metal frame equipped with a steering device, a seat for the rider, a braking device of some sort and a manual propelling mechanism. As your riding ability improved, you no doubt added numerous gadgets from time to time, generally for two reasons. First, and at your tender age probably of most importance, was the fact that other kids had them . . why not you? Next in line came increased comfort, pleasure and safety in your cycling. A horn, bell or siren, a hickey which when rubbed by your spokes in motion produced a somewhat doubtful facsimile of a high powered motor, lights of various types, reflector buttons, a carry-all basket . . . maybe even a multiple gear assembly. You probablv wound up pedalling the equivalent of your own weight in accessory equipment!

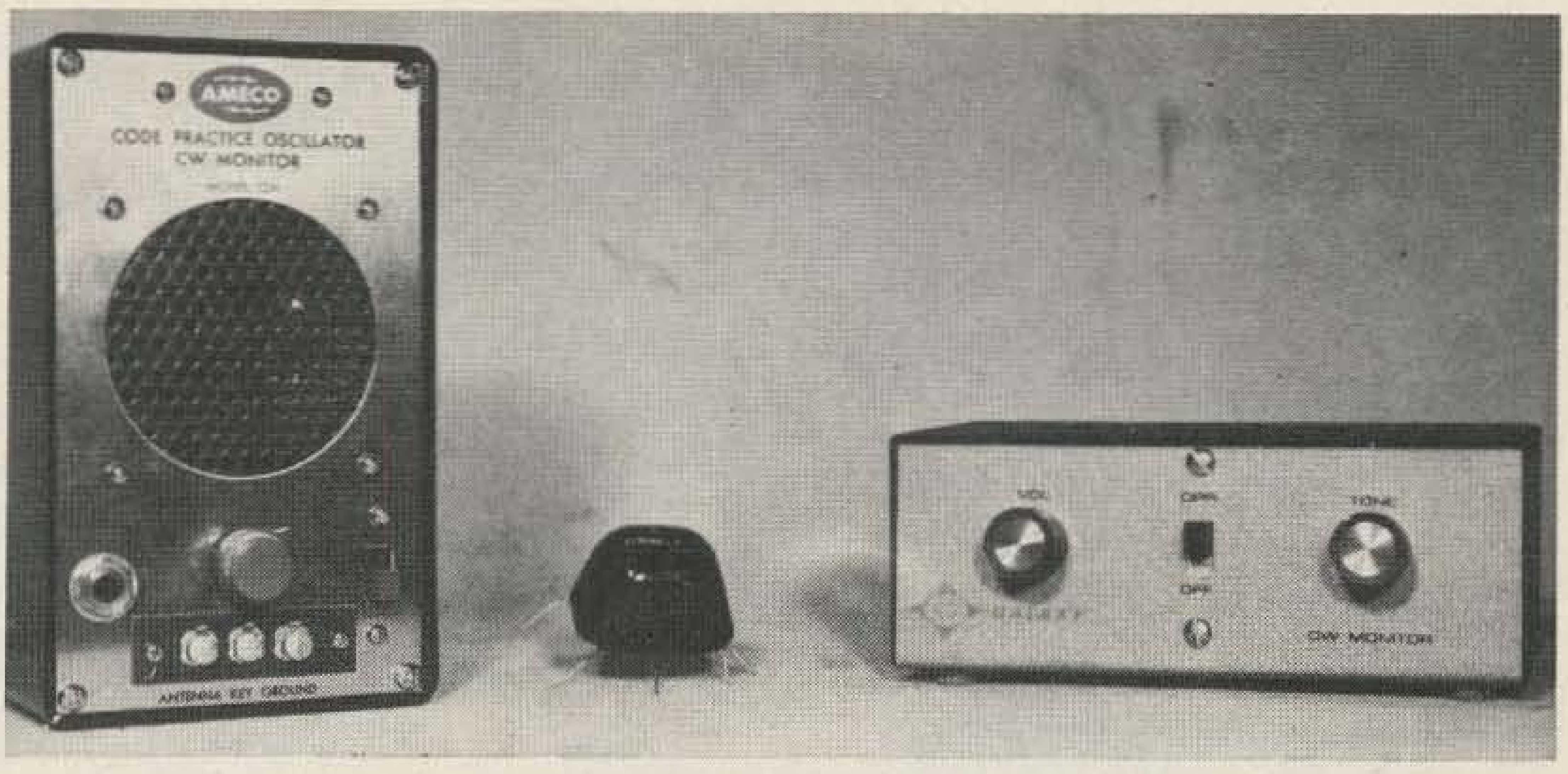
When you entered the teen-age driving group, no doubt you acquired a car of sorts, probably of rather questionable vintage. Enough of the little boy acquisitive instinct remained so that it wasn't long before a myriad of decorative (?) if not always useful gadgets, began to adorn your chariot. A radio antenna (although probably no radio!) served as an admirable support from which to display a furry fox-tail. Permanent removal of the hood provided an imposing view of chrome plated twin carburetors, distributors and like contrivances which took more time than your homework to keep in a highly polished state. Various mottled paint jobs in weird designs and often including infantile slogans and wise cracks, made for a 'posh' appearing vehicle and among the coke and hamburger crowd, you were 'in'.

Somewhere along the line you picked up an urge to become a radio ham. So, you went through all the 'chairs', resignedly learned the code, more or less studiously absorbed some of the elementary principles of radio communication and the pertinent laws and regulations. Eventually you procured your novice license, scraped the bottom of the barrel in your modest little savings account and acquired the basic station equipment with which to get on the air. This is where our story begins.



Basic equipment for the novice station. While the clock and keying monitor contribute nothing to the radiation or reception of energy, both are essential accessories as explained in the text.

Complete pre-wired combination rf monitors and code-practice oscillators are shown at the left and right. The dome-shaped module in the center contains the basic components from which the home builder can construct his monitor oscillator.



Just what *is* 'basic station equipment'? Pick up any ham magazine or handbook and you'll find dozens of illustrated descriptions of antenna tuners, SWR meters, coaxial relays, converters from this to that, and scores of similar items so 'essential' to ham radio operation or so the printed word suggests. For all the world just like you found in earlier days in the handsomely lithographed bicycle and auto accessory catalogs and literature! Your basic bicycle or tin Lizzie if they would run at all, would get you there *without* being equipped with all the fancy doo-dads and superfluous junk that was displayed on colored pages to tempt you! So it is with ham radio; your initial *essential* equipment with which to establish two-way ham radio communication over hundreds, yes *thousands*, of miles is no different than your earlier 'barefoot' bicycle or stripped down jalopy! A small radio transmitter (remember, 75 watts is the maximum legal power limit for novices), a hand telegraph key, a receiver and an antenna comprises the *basic* novice amateur station; that is *all* you need to put an effective amateur radio station on the air!

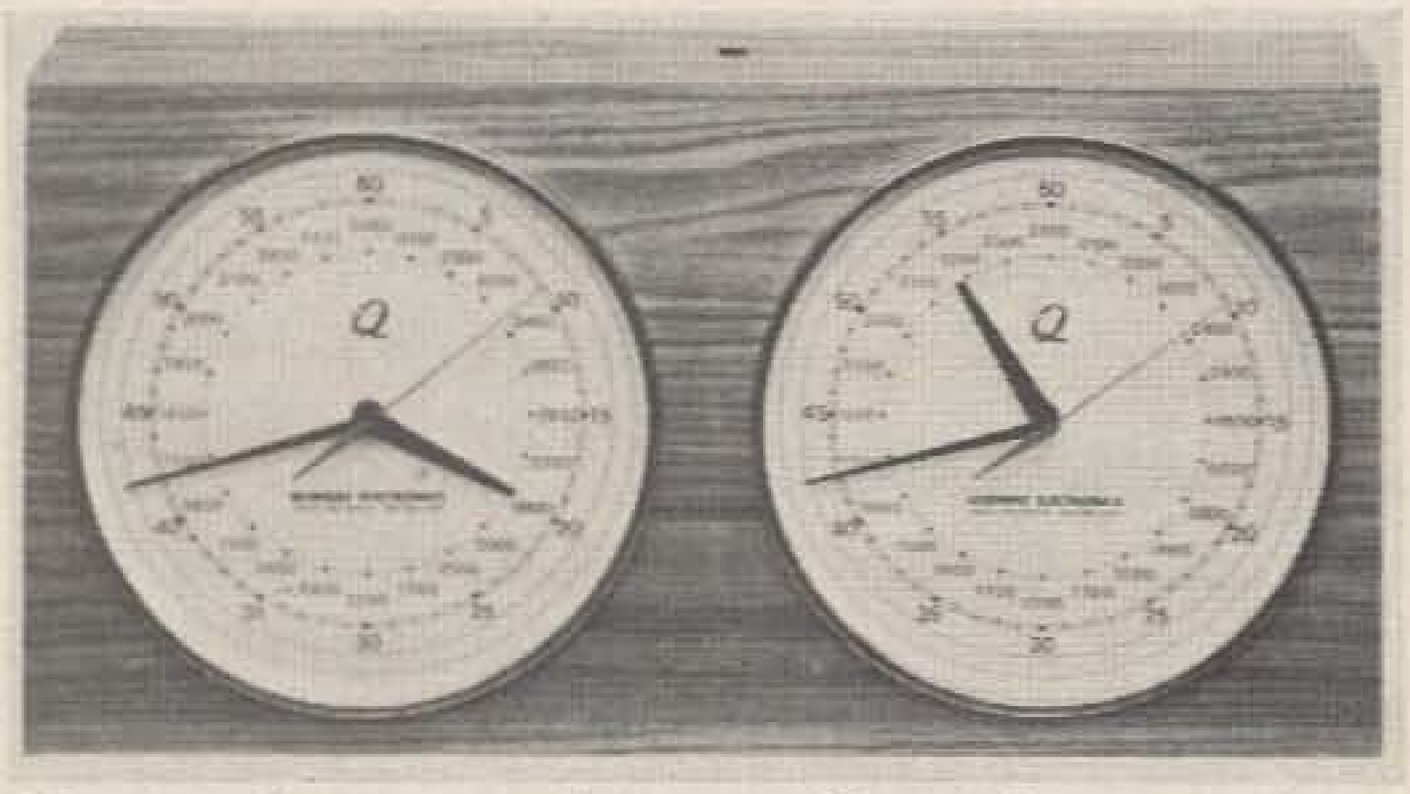
"But" you ask, "what about all this other stuff that is always being pushed at us in magazines and handbooks and in their advertising pages?". Simply 'forget' all that guff in your initial indoctrination period in ham radio; before you become steeped-in and utterly confused by what are to you many meaningless terms, get the hang of being a ham by doing things the *simple* way at first. There is plenty of time ahead to acquire and learn to use the more intricate gadgets as you progress up the amateur radio ladder. And now, against the time when such gear begins to really have meaning for you, suppose we give you a few tips in beginning the expansion of your station equipment.

Let's first spend a few minutes on the subject of antennas. If you've been smart you've started your on-the-air activity with a single strand of ordinary antenna wire, 50 to 75 feet long, suspended between your chimney and a convenient tree maybe, or some other means of support at each end. A single piece of antenna wire brought down from the horizontal span from either end or even from the middle or other convenient spot, will run directly to the blade of a simple, single pole, double throw knife switch to switch your antenna between the transmitter and receiver. One jaw of the switch connects to the antenna terminal on your receiver, the other to the antenna connector on your transmitter. A single piece of wire, bare or insulated, connects to the ground terminals on both the transmitter and receiver and continues to the nearest cold water pipe; this completes your antenna system. Note that we *skip* any such trick devices as antenna tuners or matching units, SWR indicators, band-pass filters and the like. In this early stage of your ham endeavors you just don't need them, and ten to one, they'd only confuse you and you'd adjust them wrong anyway, resulting very probably in some disappointing contacts, if you make any at all. So much for your antenna then, but let's make one more point before we proceed to the next subject. We are assuming, in ignoring any attempt to include an antenna tuner or matching device as a separate item, that your transmitter is equipped with the conventional pi-network output circuit which 99% have. Such will handle your loading and matching adjustments very nicely *without* any extraneous equipment. If however, you have some 'off-breed' output circuit in your transmitter, you *may* need some ex-

Simple control centers for the novice station: the upper unit includes the station clock; a loud speaker may be substituted as shown in the lower unit.

ternal matching device to permit proper adjustments; better to choose a transmitter which incorporates a pi-output network. We don't in the least mean to disparage the *eventual* use of various tuning devices, filters etc., in connection with an antenna system; what we *do* want to emphasize is that until you have progressed to the point where much of the literature which covers more elaborate antenna systems begins to make sense to you, you'll have mighty good luck and make many contacts with other hams both local and distant, if you let *simplicity* rule your initial efforts.

Now that we've settled the antenna question, let's go inside and have a look at the shack set-up itself. Remember, we have one object in mind . . . elimination of any *non*-essential accessory items but without sacrificing the few which will contribute to more comfortable and convenient operation. You have a satisfactory transmitter, receiver, hand-key and antenna changeover switch. This is your **basic** communication equipment which makes two-way contact with other amateurs possible. You can however, add a few items which will provide for more operating *convenience,* although they will contribute not one iota to increasing the transmitting or receiving range of your station; let's see what they are.



Photograph courtesy Quement Electronics
This double-faced clock is particularly useful because one can be set on local time, the other on GMT. $24.95 from Quement Electronics, 1000 South Bascom Avenue, San Jose, California.

First, let's pick one, which in addition to adding to your operating convenience, also happens to be a *legal* requirement for *all* classes of radio stations . . . an accurate time piece. This obligation is legally fulfilled through the simple expediency of a wrist watch worn by the operator or a somewhat passe pocket watch. Neither however, always represent a 'convenient' means for timing your log entries and your ten-minute station identification breaks. A reasonably accurate conventional alarm clock perched atop your transmitter or receiver will of course, fill the bill and provide comfortable visibility. However, inasmuch as considerable amateur operation is based on using Greenwich Mean Time (GMT), a so-called "24-hour clock" is most convenient. These are available in either the familiar circular style or the horizontal read-out, often called a 'jump clock'. One manufacturer even offers one of the latter type with a built-in ten-minute alarm buzzer (can be switched on or off) to remind you to identify your station each ten minutes as required by FCC regulations. And, while we are on the subject of clocks, a most novel offering is available in a 24-hour international time indicator which tells you at a glance, not only your own local time, but that in any part of the world! So, providing yourself with the best clock your piggy-bank can handle is not only legal compliance, but an investment which will serve you throughout your entire ham career.

Next in order of importance in station accessory equipment, is a CW keying monitor. While not legally required, it should be considered one of the most desirable accessories in *any* ham station; this is particularly true for the novice class. The novice understandably approaches his telegraph key initially with some timidity. He is about to put a radio telegraph signal on the air which will be heard by countless hundreds of other stations! His previous operating experience has been limited to practice work with a local oscillator which was also used for his formal code examination. His 'fist' or formation of code characters will be shaky at best. Without some method of 'monitoring' his own sending, he cannot evaluate his spacing or the proper formation of his dots and dashes. The result is often a barely understandable transmission which frequently penalizes him by a frustrating lack of contacts with other stations. Some hams resort to listening to their transmissions by using their own receiver as a monitor. This is an unsatisfactory and make-shift method, particularly for the novice who seldom works with other stations having identical crystal frequencies. This means retuning the receiver for each transmission and reception, an awkward procedure at best.

Fortunately, a number of manufacturers offer CW keying monitors of various types and over a rather wide, though nominal price range. Basically the majority provide an audio tone of a pleasing pitch, fixed in some but variable in others. The volume of the monitor signal produced is also fixed in the simpler types but may be varied in those of more elaborate design. Practically all of them have the desirable feature of serving as code practice oscillators as well, and when so used, neither the transmitter nor receiver need be turned on.

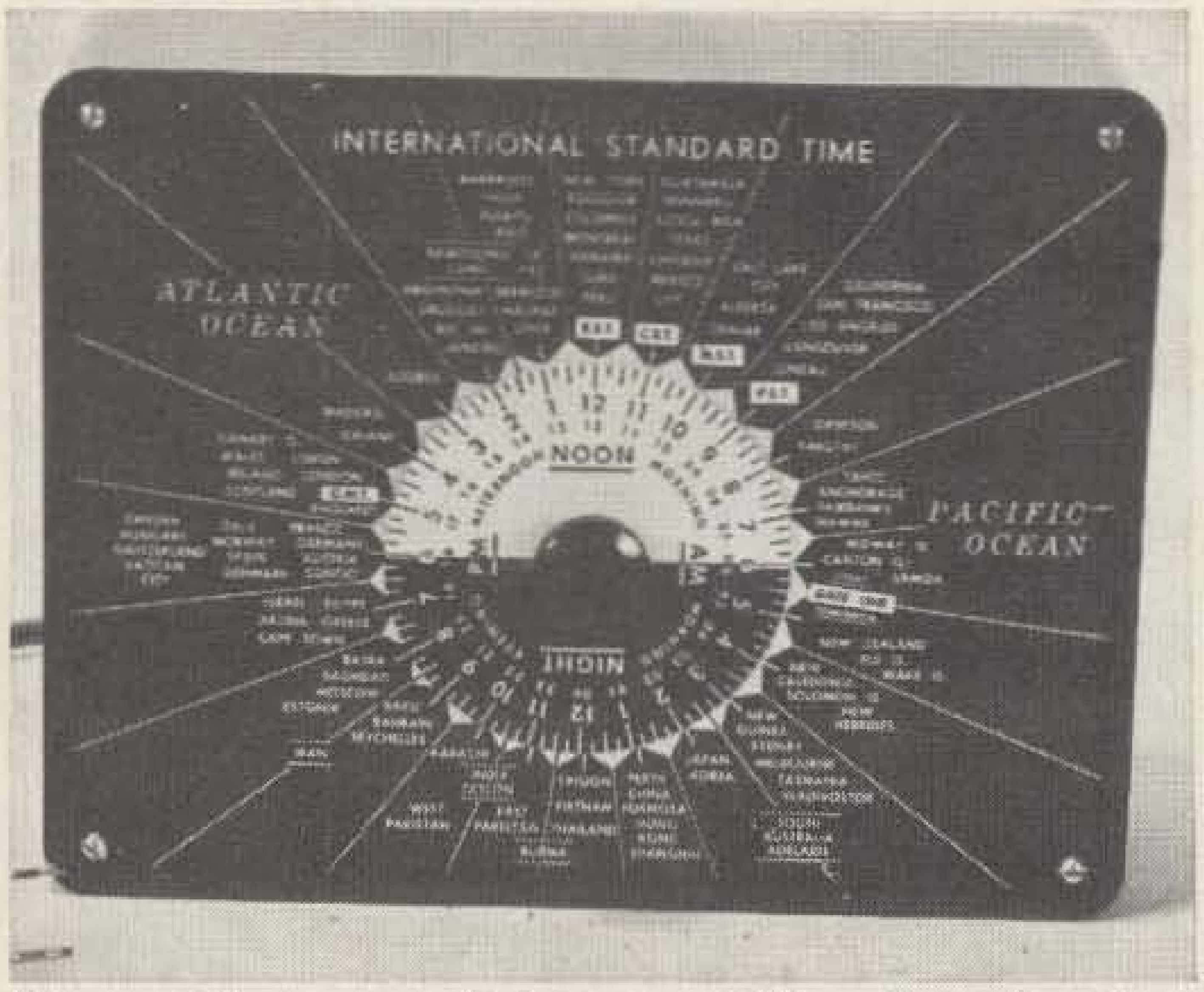
Many such monitors require *no* connection to either the transmitter or receiver; they operate as an entirely independent unit. Such are activated by the stray rf currents present in the vicinity of a transmitter or feed line. It should be remembered though that the tone produced by the monitor is *not* that of the actual rf signal being radiated; this can only be checked by listening on a conventional oscillating receiver. The monitor tone is that generated by it's own integral oscillator.

As we mentioned previously, such monitor devices are available in a number of types; they can also be purchased in either

Photograph courtesy Pennwood Numechron Company.
A 24-hour digital clock with horizontal readout and ten-minute identification reminder alarm.

kit form or completely factory-wired. While all are nominally priced, at even less cost a ham can easily make such a simple device himself. Handbooks and frequent magazine articles offer construction details covering those of the 'home-brewed' variety. Recently one manufacturer has simplified such monitor construction by making available a rock-hard plastic module in which the transistors, resistors and capacitors forming the heart of the monitor circuits are imbedded. Five protruding wires permit ready connection to a flashlight battery, loud speaker and a short piece of wire for an rf pickup antenna; that's all there is to it!

Whatever you choose in the way of a monitor, you'll find that such a device will result in helping you to rapidly improve your character formation, which, in turn, will gain you a gratifying increase in the number of contacts you make. While we're on the subject of 'keying', it is probably a good time to inject a note of warning; to emphasize *one* accessory item that should *never* be included in the novice station equipment until he has become thoroughly proficient in transmitting with a conventional hand telegraph key. We refer of course to the 'semi-automatic' type of keyer, more often referred to as a 'bug'. In the same category is the so-called 'fully automatic' electronic keyer, a more recent development. Either of these devices in the hands of an inexperienced operator positively



Photograph courtesy International Time Recorder Company.

This novel world time device makes a valuable addition to any ham shack. Available from International Time Recorder Company, Post Office Box 165, Albany, New York for $12.50.

murders the telegraph code! Making as they do, a string of dots or both dots and dashes by pressing the actuating lever, they will run wild until the operator through constant *'off-the air'* practice, has mastered the fingering technique essential to forming readable characters! Buy one if you must, but before ever making a single dot on the air, spend a good many hours using it with a code practice oscillator. To put it on the air without proper finesse will earn you only the wrath of your fellow hams; many of them will avoid answering your calls entirely!

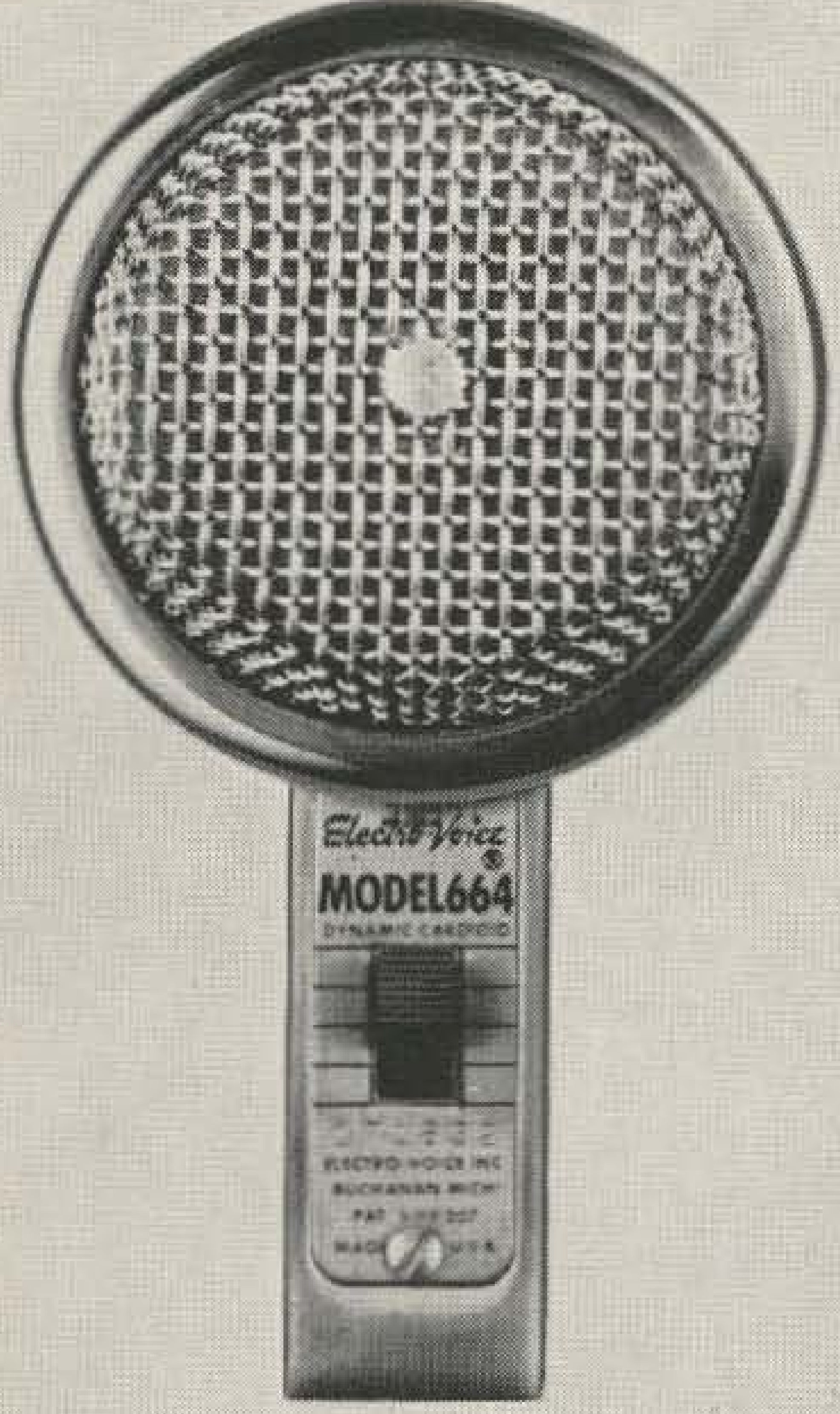
Not so important an accessory to station operation, but adding greatly to operating convenience, is a 'station control center'. Such is not available as a commercial product probably due to the great diversity in operating requirements. It is strictly a home-brew project and can be made as simple or as elaborate as the builder feels warranted, over a wide latitude. A control center is just what it's name implies; a point from which control of all of the equipment in the shack is centalized. Each item of equipment can be individually switched on or off at will at the control center and by appropriate panel indicating lights, the equipment in service can be immediately determined at a glance. Individual, independent fusing for each item of equipment should be provided for in the central unit as well. Remember though, to either jumper out the fuse in the equipment cabinet itself or replace with one of substantially higher current rating so that in the event of fuse failure, it will be in the control center itself. This will save you many minutes in hunting out the faulty fuse and this can often be real time-consuming, particularly in equipment where the manufacturer has seen fit to bury the fuse well within the confines of the chassis, requiring removal of a generous handful of screws to gain access!

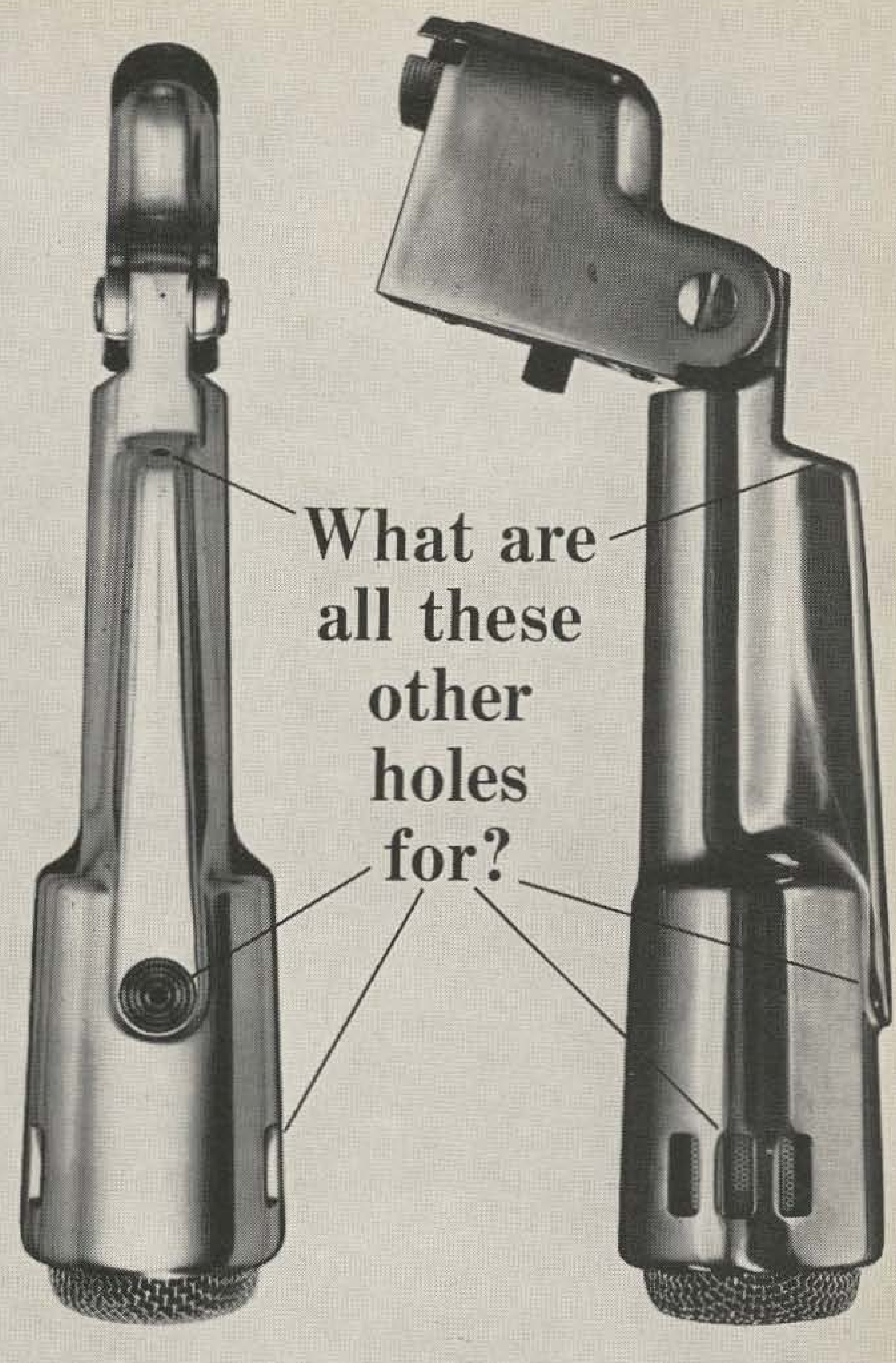
Work out your own design for a control center, build it well and provide sufficient switches, fuses and indicator lights to permit adding control of additional equipment as you acquire it. By all means, provide a 'main switch', fuse and panel light, wiring it so that by simply throwing the main switch to 'off', all power is removed from the control center and thus from all equipment. At the end of an operating session then, you need only throw the main switch and hit the hay, confident that you haven't inadvertently left one piece of gear 'on'. Control centers can of course, be expanded to house many other equipment components than merely switches, lights and fuses. Some hams choose to mount their station clocks therein; others prefer to house a speaker in the cabinet. CW code monitor components can be incorporated . . . noise limiters, audio filters . . you name it. The control center is *one* piece of gear where you can let your design ingenuity have full play!

The foregoing paragraphs pretty well cover the accessory equipment which will bring the novice station into an effective and convenient modern amateur radio station which will readily lend itself to future expansion as the owners' experience increases and his license grade advances. Then, and not until then, should he begin to evaluate his antenna system and his over-all equipment installation with increasing efficiency in mind. He is ready then to think in terms of antenna tuners, folded dipoles, beams, a VFO, perhaps a linear amplifier. As the pages of handbooks and magazines obviously indicate, the realm of amateur radio has no bounds . . . it is one of the very few hobbies which never stands still; how far you pursue it is strictly up to you. Be methodical though in your approach; keep it simple at the outset, add equipment as you 'grow up' in ham radio and enjoy this most fascinating of all hobbies to its' fullest measure.

. . . W7OE

If the Electro-Voice Model 664 picks up sound here...





EV. The holes in the top, sides and rear of the Electro-Voice Model 664 make it one of the finest dynamic cardioid microphones you can buy. These holes reduce sound pickup at the sides, and practically cancel sound arriving from the rear. Only an Electro-Voice Variable-D® microphone has them.

Behind the slots on each side is a tiny acoustic "window" that leads directly to the back of the 664 Acoustalloy® diaphragm. The route is short, small, and designed to let only highs get through. The path is so arranged that when highs from the back of the 664 arrive, they are cut in loudness by almost 20 db. Highs arriving from the front aren't affected. Why two "windows"? So that sound rejection is uniform and symmetrical regardless of microphone placement.

The hole on top is for the midrange. It works the same, but with a longer path and added filters to affect only the mid-frequencies. And near the rear is another hole for the lows, with an even longer path and more filtering that delays only the bass sounds, again providing almost 20 db of cancellation of sounds arriving from the rear. This "three-way" system of ports insures that the cancellation of sound from the back is just as uniform as the pickup of sound from the front—without any loss of sensitivity. The result is uniform cardioid effectiveness at every frequency for outstanding noise and feedback control.

Most other cardioid-type microphones have a single cancellation port for all frequencies. At best, this is a compromise, and indeed, many of these "single-hole" cardioids are actually omnidirectional at one frequency or another!

In addition to high sensitivity to shock and wind noises, single-port cardioid microphones also suffer from proximity effect. As you get ultra-close, bass response rises. There's nothing you can do about this varying bass response—except use a Variable-D microphone with multi-port design* that eliminates this problem completely.

Because it works better, the E-V 664 Dynamic Cardioid is one of the most popular directional microphones for demanding communications applications. To learn more about Variable-D microphones, write for our free booklet, "The Directional Microphone Story." Then see and try the E-V 664 at your nearby Electro-Voice microphone headquarters. Just $85.00 in satin chrome or non-reflecting gray.

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Chuck Miller DL5AF

Trim for Ten

The design of a pi-network that will tune 80 thru 10, can become quite a problem. To retain a high "Q" on all bands requires a large tuning capacitor for 80, and a small capacitor for the 10 meter band. The basic, or full open capacity of a large plate tuned capacitor is at times almost too much for ten meters, and the tuning is very sharp and critical since all of the rotor plates come into mesh at the same time.

There are several ways to solve this problem. One way is to use two capacitors ganged together with a switch to select the large or small. Another way is to use fixed capacitors with a rotary switch to select the size that is needed. This switching system is at times very difficult to design and keep working for the average home builder without machine tools, etc. The easiest way to have a smooth, one knob, switchless tuner is to modify a stock capacitor to alter the basic capacitance and the linearity of the capacitance turn rate ratio.

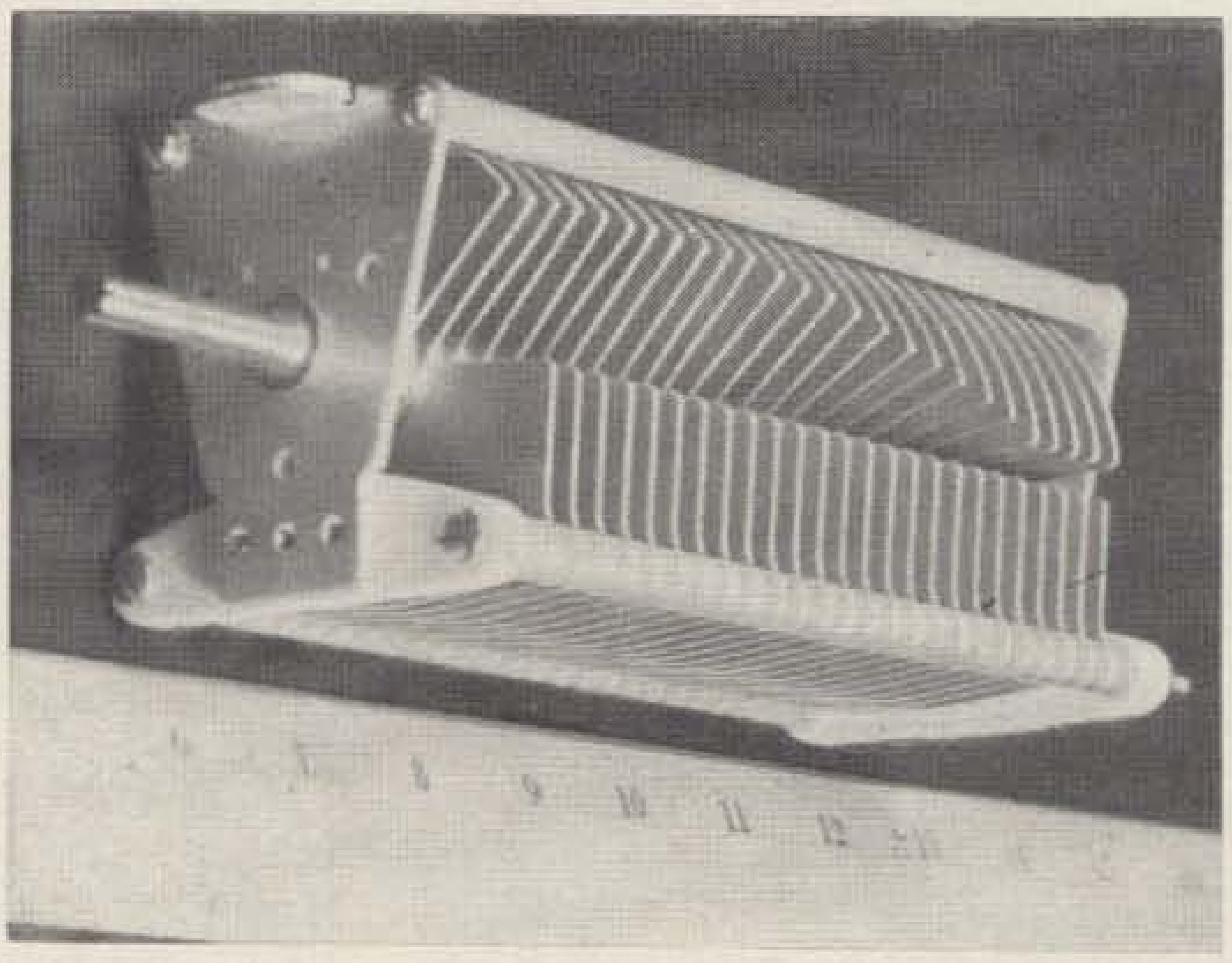
This modification will spread the tuning of ten and fifteen meters to about twice the range obtainable with the stock capacitor. The basic capacity is slightly lower and the linearity curve has a swoop rather than a straight line. The total, full mesh, capacity is lower, but that can be overcome by starting with a larger capacitor. What is gained is that the capacitor is turned through almost twice the range from basic capacity to 100 pF, spreading out this area of tuning; very similar to the bandspread on a receiver.

The modification starts with a stock capacitor and a few hand tools. Remove the rotor from the capacitor and trim some of the rotor plates so that they are smaller than the original half circle shape. Instead of the 180° shape, trim them to 120° for about half of the length of the rotor. About half way down the rotor, start leaving about 5° more on each plate as you work your way along. Leave the last few plates as they were originally. This will give a taper to the trim as can be seen in the photograph. The trimming must be done with care so as not to bend or distort the plates, or loosen them from the shaft. The cut edge can be smoothed with a fine file and finished with fine emery paper. All exposed plate edges must be free from nicks or sharp points, as arcs will jump from any point much more easily than from a smooth edge or surface. Rough alignment can be made, and the capacitor reassembled. Final alignment of the capacitor plates can best be done with a pair of long flat-nosed pliers, or duck bills. A layer of plastic tape on the jaws will avoid nicks and scratches during this process.

The point to remember before starting this is to trim the plates on the approach side of the rotor as the tuning is done. Hold the capacitor in your hand and look at it as if you had it in the rig. Tune the capacitor and, with a crayon, mark the rotor plate end that starts into the stator. If you trim the wrong side of the rotor plates, you will have to tune counter-clockwise, or turn the capacitor end for end in the rig and put an extension on the short rear shaft.

The picture shows the overall look to the finished capacitor. The taper or stagger trim starts halfway back on the rotor. The rearmost plates are the original shape and the front plates are trimmed. Good luck with this simple modification and enjoy easier tuning on ten and fifteen.

. . . DL5AF



The trimmed variable capacitor which provides easier transmitter tuning on 10 and 15. About 60° is trimmed off half of the plates; a slight taper brings them back to the original size toward the rear of the capacitor.

J. Delson WA3GEV
712 Old State Road
Berwyn, Pennsylvania 19312

The Longest QSO

How to yak and love it!

I am sure that there are many people who will scoff at this account, think that we are nuts or something, but here it is all the same, the account of the longest unofficial two-way QSO on Amateur radio.

After the moving van had left our new QTH, and the boxes were unpacked, I proceeded to temporarily set up my 6-meter beam in the good old Pennsylvania clay, unpack my HE-45A, and get used to the new location. After about a week of operating, I called a teenager about my age whose name was George and who lived about 10 miles away. I discovered George was the off-beat type with a big mouth, and since I was about the same, we had some long, drawn-out QSO's.

. . . I proceeded to temporarily set up my 6-meter beam.

One day in July my copy of 73 arrived, and when I read about their RRC* award (the one you get for yakking for 6 hours), I gave George a shout, and he jokingly replied, "while you're at it, why not try to talk for longer and break the world record of 85 hours?" Completely serious, I replied, "That would be fun. But lets try for about 100 hours to be on the safe side." The reply I got was extremely watered down, as there are FCC monitors around. However, George finally agreed, and preparations were started for the longest QSO in history.

A system was worked out, and is as follows: the two of us would be at one QTH, and two friends would operate at another. Rigs were checked out, new tubes put in, parts replaced, as this would be the all important link. Tents were set up at both QTH's because it was necessary to become self-sufficient (as the parents would not have appreciated an extra person hanging around for 5 days). Sleeping bags were set up, power-lines installed, antennas erected, and a good supply of discussion material collected. Operating schedules were made, and it was planned to have one person on while one would sleep, eat, etc. Every 6 hours they would change around. Radios, television sets and tape-recorders were set up. Cokes and food were all around. A fence was set up to keep out nosey neighbors and blowers were set up to keep the rigs running cool. This was to be a true test of physical and mental endurance, as well as

*Real Rag Chewer.

This was to be a true test of physical and mental endurance.

a test of the rigs, which consisted of an HE-45A, and 5-element beam at our end; an Ameco TX62 with a Hallicrafters receiver and converter at the other.

We started on August 7, 1966 at 12:00 noon, after weeks of hard work, planning, and expense. The day was hot, and I was at the rig. We had clocks hooked up to tell us when to identify, and also to tell us when our shifts were over. It took quite a while to get into a routine, but we found it was best to eat while on the air (food was within close reach) and either rest or help out when off duty. Near the end the need for sleep hit us strongly, and we were almost always sleeping in the off shift. We were forced to drink cold coffee to keep awake while we were operating. The strain of this undertaking was immense. During the first day or two, we were ready to give up but were saved by the fact that we had planned well to eliminate boredom during the long hours. We watched and discussed TV programs and had running discussions on everything from UFO's to books. We discussed the ARRL, *73*, and *Mad* magazine and even had one delightful and stirring discussion of *Playboy*. We read each other books and jokes, and even did a book of "brain teasers" to keep alert.

All in all, it was a hard thing to do, and I would *not* like to do it again. However, things were running well until disaster struck! The receiver part of my HE-45A blew a capacitor while George was transmitting on it. In order to make our claim valid, the QSO had to be continuous, so George was forced to continue the transmission until the receiver could be repaired. I turned the rig over and cut off the power to that section. With safety gloves on I removed the part (still smoking) and went to find a replacement while George continued his monologue. Discovering I had no replacement, and couldn't get one for several hours, we took turns transmitting until a new part was obtained. Seeing that we had gone 70 out of the planned 100 hours, we were lucky that nothing really serious happened, but it sure was close at that!

The hundred hour mark approached, and between lack of sleep, curious neighbors, and untimely trips to the toilet, we were glad to see it arrive at 4:00 PM on August 11. George was at the mike, but together we wearily signed off, glad, and at the same time sad, that our long field day was over. For the rest of our lives we will fondly remember that longest QSO, and if we *must* defend our honor, you can sure bet that we will!

. . . WA3GEV

With safety gloves on, I removed the still smoking part.

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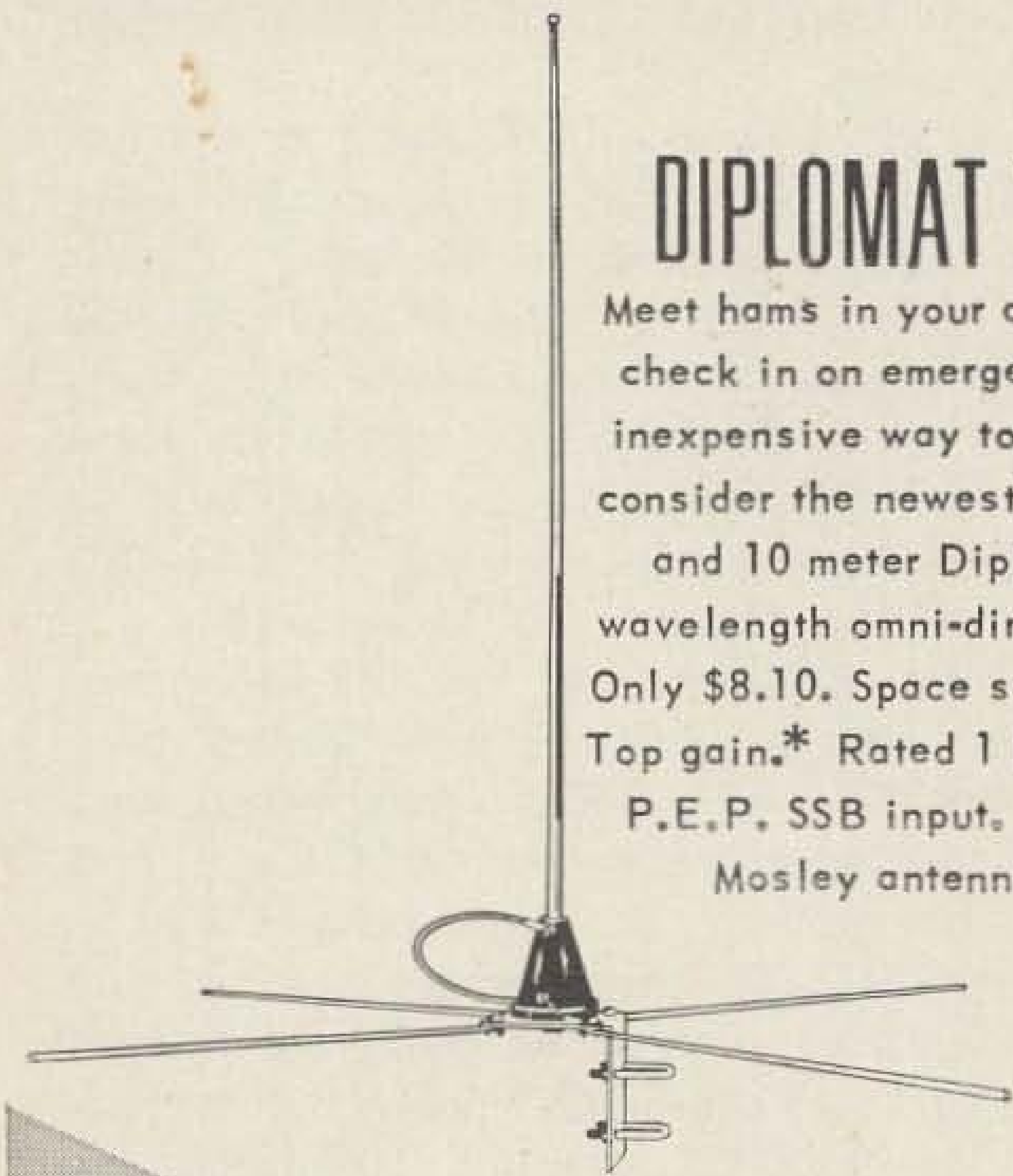

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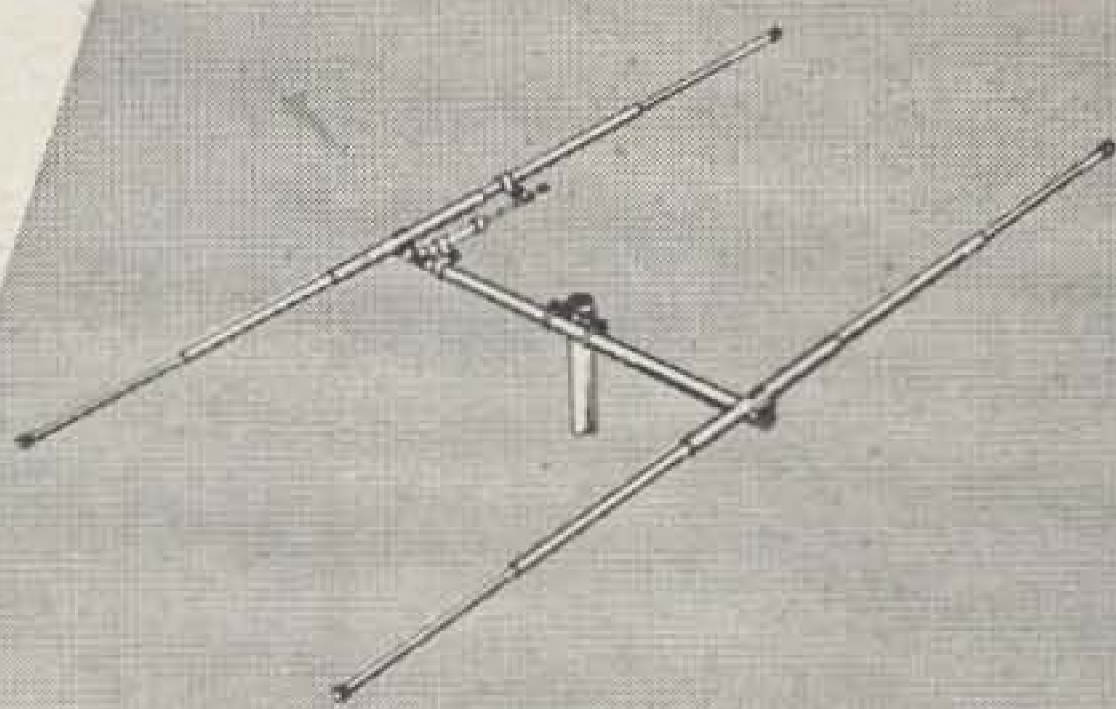

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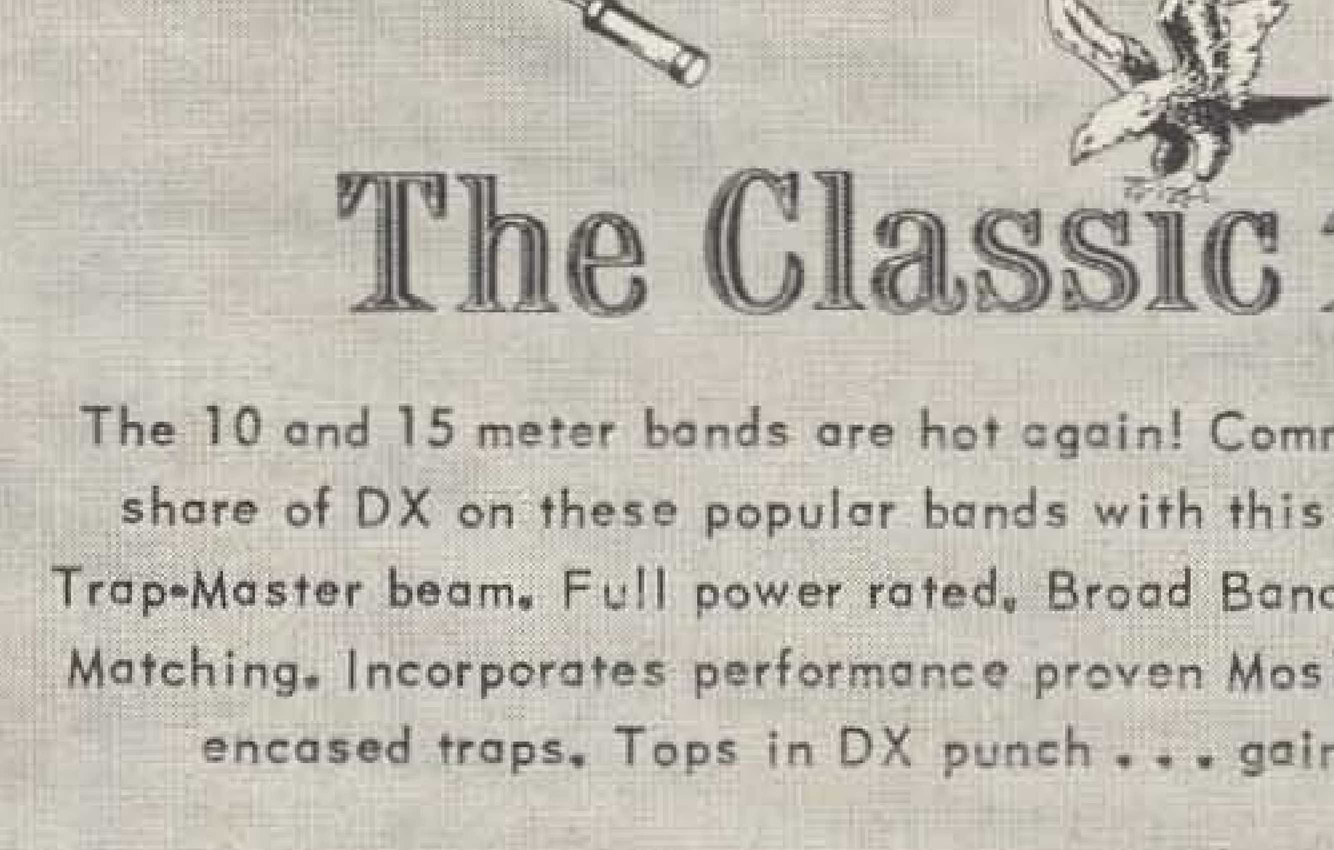

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The Death of Amateur Radio

After reading the editorial in the July 1967 73 magazine I am in partial agreement. True, CB is drawing almost all of the youngsters interested in radio. But why? Why don't they go into ham radio? Why does CB have much more attraction than amateur radio? I'm sure almost every ham exhibits a rather unfriendly attitude toward CB'ers. But why? Why don't we closely associate with the CB'ers? I am going to suggest a few answers to these important questions.

Several years ago the FCC created the CB band. From that time on, the growth of amateur radio has fallen. Now, if we look at all of the old sales and manufacturer's catalogs, we find a new type of communications mode beginning to gain popularity. This new mode was called SSB. At first the price of the equipment was "in line" with the rest of the AM and CW equipment. The first SSB equipment was rather simple but it soon became more complex. Along with the extra complexities came the extra price. This meant SSB rigs began to cost more than AM/CW rigs. Soon the prices went higher and higher. Also, the complexities began to increase until today few SSB'ers ever repair their own rigs. Fewer yet even think of building. When this happens, the SSB hams become SSB operators which means they are glorified CB'ers.

Now let us take a youngster. He can be a potential ham or a potential CB'er. This youngster will seriously look at ham radio. He will see that he *will* have to learn the code and theory. He will see that if he gets a novice license he *will not* be able to use a microphone. The youngster may look at the exorbitantly high prices of the real good SSB rigs. Together these factors can be highly discouraging to the youngster.

Sooner or later the youngster will be exposed to CB. CB has everything ham radio has to offer and more. The youngster can use a microphone on CB. He can run all the power he wants—even though it is illegal. Running 100 watts to even a kilowatt is a very common occurrence on CB. It is so common that the FCC cannot even try to keep up with it. The most ironic thing about this illegal CB power is that the rigs are old AM ham rigs. The CBers use Valiants, Johnson 500s, Heathkit DX100s, or any high power AM rigs they can get their hands on. They buy these rigs extremely cheap too.

New SSBers dumped their old AM rigs on the market with the result that the CB'ers snatched almost everyone of them up. For instance, I have been trying to get a Johnson ranger for several months at a well known radio store in Milwaukee. My result —nil! Not even one. The Rangers are bought almost instantly by CB'ers. The result is that CB is a hundred times cheaper than ham radio.

On CB there is no testing and no code to learn. The simple $8 permit fee is nothing to a CB'er. After paying next to nothing for his equipment he can easily afford the extra $8. On CB there is the excitement present in the very fact that they are breaking the law by running high power and QSOing across the country. The chances that any illegal CB'ers will get caught are a million to one. CB indeed has more attracting power than ham radio. After all, what's so great about paying a kilobuck to go SSB to talk across the country when on CB you can do the same for $150 or less? If you were a youngster, what choice would you take? Anyone with any brains at all would take CB!

This brings us to the question of the hams disliking the CB'ers. If you really explore the problem, two facts come to mind. One is that the CB'ers are having as much, or more, fun than the hams are, and the CB'ers are doing it cheaper! Two is simply that the hams are jealous of this basic fact!

What can we as hams do to correct this

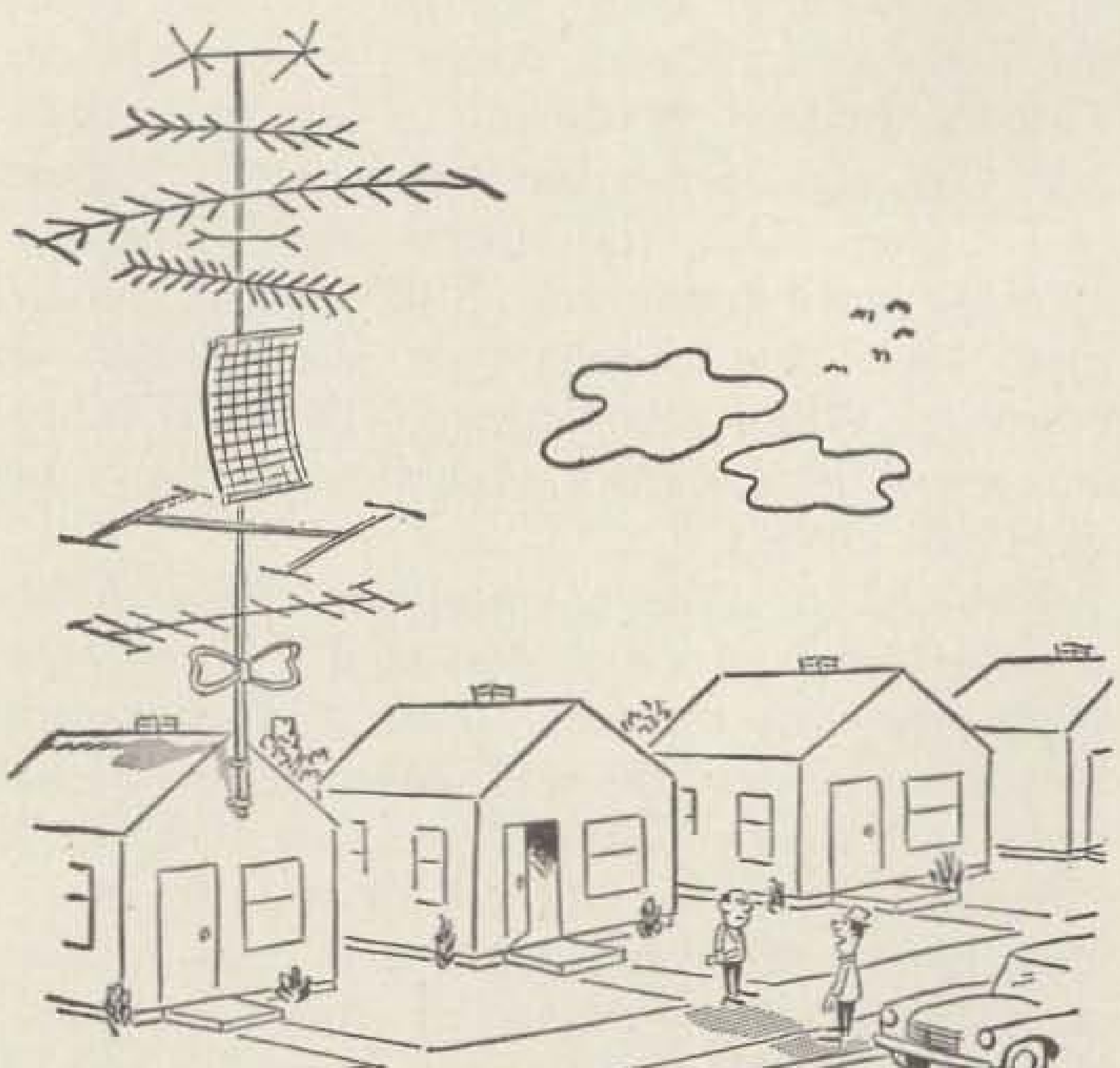
situation? We can and *must* do several things if ham radio is to survive at all! We must stop the flow of the cheap AM equipment. One way or another it will wind up in a CB'ers hands if it is sold to anyone other than another ham. We must not trade in the AM equipment when buying SSB equipment. If the equipment is traded in it quickly winds up in a CB'ers shack. We must keep the old AM equipment at any cost! Then we must push for more stringent rules concerning CB. It is necessary to drastically increase the size of the FCC monitoring and enforcement force. The FCC at present is trying valiantly to stop illegal CB activity but it is already a lost battle unless the FCC monitoring force is increased to 50 or 100 times the present number. This will cost money but why not get the money from the CBers? Increase their fee to $50 or $100 a year like all the other commercial users have to pay. After all, CB is a commercial business band! This also might very well prove to be a deterent to stop the illegal operator. A high license fee would keep the "goof-offs" and other trouble makers out of CB while the code and theory exam would keep them out of ham radio.

Presuming we could accomplish this, we now would be left with finding something to attract the youngster into ham radio. We need something with enough drawing power to hold this youngster's interest through the code and theory. What do we have that can attract the potential ham to ham radio? Whatever we decide on must be cheap, for as anyone knows, a fifteen or sixteen year old boy cannot muster seven or eight hundred dollars for a SSB rig! Besides, SSB has no attraction worthwhile to the potential ham. It is infinitely complex for him to build and much too costly. So we must look to other things. AM always was an excellent "drawing card." The newcomer could experiment with ultra-modulated AM. This is one facet of ham radio that is sadly neglected. He could try narrow-band FM. This would have high voice quality and excellent signal performance. Experimentation with low power NBFM could produce some startling results! It is true that our satellite communications experiments are interesting, but for the newcomer they are very expensive and require high-priced elaborate equipment. Moonbounce is interesting but also very expensive and complicated.

One of the better attracting devices we had was the low-priced add-on kits available with AM equipment. I know myself that I spent many countless evenings comparing the various add-on adaptions once offered by the various manufacturers. There was a thrill to amateur radio when the novice took his CW transmitter and added a modulator to it. There was the satisfaction of having accomplished something. This is what drew the youngsters to ham radio and not the factory-built, only mike and antenna needed, SSB rigs. There is no thrill and no excitement to unpacking an SSB rig, plugging it in and hollering CQ like any old CB'er!

If we do not take action to entice the youngsters to ham radio, then ham radio will be doomed to the fate of the passenger pigeon which became extinct because of foolish and stupid human greed! Let us use our brains. Let us create an interesting hobby. SSB is indeed worse than useless in this aspect. There is no excitement, no objective and certainly no goal in SSB. The faster SSB grows, the faster ham radio races to oblivion. Let us stop this trend and divert it to much more useful projects. Let us not be like the murderous hunters who killed the passenger pigeons until they became extinct. If we don't change, in another twenty years there will be no AM, and there will be no SSB simply because there will be no ham radio.

. . . WA8FVD



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Spook Up Your Club's Civic Activities?

October 31st is not the only witching time, but time for hams to bring out their mobiles in the manner of the Huntsville Amateur Radio Club, of Huntsville, Alabama. Each year the club sponsors a Spook Patrol on Halloween night from dusk to midnight in the rocket city.

One purpose of the patrol is to provide extra supervisory protection for the "little spooks" ghosting across darkened city streets in hot pursuit of treats to fill their little bags. Should one fail to see an oncoming car or a hidden obstruction in a strange front yard, or encounter any other hazard in the dark, a mobile unit in radio contact with police and ambulance services gives added protection in case of trouble. A second purpose is discouragement of "older spooks" where innocent pranks might not be so innocent.

Three methods are used to carry out this purpose: first, widespread publicity in newspapers and on local radio stations of the forthcoming spook patrol, with its radio-equipped unmarked cars in contact with a fixed station in the city police headquarters. The second method is making the existence of the patrol "highly visible" to potential troublemakers. The mobiles drive through the parking lots of well-known teenage hangouts (hamburger and milkshake drive-ins) at irregular times. To insure that their presence is noted by the youngsters, the hams keep their windows open and receivers at maximum volume. The net control stations operators voice, identifying with "this is K4XXX in the Spook Patrol" is heard by car occupants in the drive-in who turn to watch the mobile unit exit on patrol. (Each operator usually makes a point of getting a hamburger and coffee at the drive-in, leaving the radio turned up while away from the car, presumably so he can hear if he is called. Actually so the youngsters in other cars can hear!)

That the young people are "condition-reflexed" (as one doctor-ham put it) to the thought that any car they see *might* be in radio contact with the police is often verified by the youngsters themselves. Frequently they approach a ham's car to tell him of "trouble" (exaggerated or imagined usually) which they think ought to be reported. The ham dutifully radios their report in to satisfy them, and, if it appears worthy of investigation, the report is passed on to the

police desk sergeant or a mobile unit is asked to drive down the street in question.

The third method we use is borrowed from standard police "saturation patrol" techniques. When a report of vandalism in any part of town comes in, all patrols are directed to make one pass through that area on their next round. The youngsters in the neighborhood who see the mobiles get the impression of constant surveillance—and usually go home to watch TV!

When a group of teenagers in a passing

car appears suspicious, the ham notifies the NCS of their route, whereupon they see another ham mobile sitting at an intersection ahead, watching them and with his microphone to his mouth as they go by. One group left a teenage dance to "have some fun" and drove back dejectedly a half-hour later to tell others they saw "those ham patrols everywhere". Actually only two of the cars they spotted were spook patrol members directed into their path by another ham. The rest were figments of their imagination—and guilty conscience! A church group trick-or-treating-for-UNICEF claimed that they saw "twenty or thirty" in the area their church covered in the campaign. Only five were actually on patrol throughout the city at that time, and none in that part of town! They thought every car with an antenna (including broadcast) was a patrol.

Though a boomtown, Huntsville has never had any serious Holloween disturbance. The Huntsville Amateur Club likes it that way—and urges hams in other cities to follow their example, not only for Halloween, but for any possible civic disturbance such as those which rocked many northern cities this summer.

"It's surprising what the feeling that some unknown person is watching you in the dark will do to young people bent on mischief," commented one member of the club. "Most of the kids don't even intend any harm, they just let things get out of hand due to youthful bad judgment when suddenly faced with temptation with no one around to see. We like to think that we are their conscience. We aren't everywhere, but we are glad they think so—and stay out of trouble."

A second and third purpose of the Huntsville Amateur Radio Club's Spook Patrol is training of its members in controlled mobile emergency operations—and good public relations in the favorable publicity given amateur radio as a public service by the press and local broadcast stations. These last two reasons make the project worthwhile even in cities where there is no Halloween problem making such additional protection necessary.

In Huntsville, where tornadoes are an annual threat and the nearby Redstone Arsenal missles complex a prime military target, the Huntsville hams consider training in mobile communications an important part of their club responsibility. The annual Spook Patrol aids in this training.

. . . K4HKD

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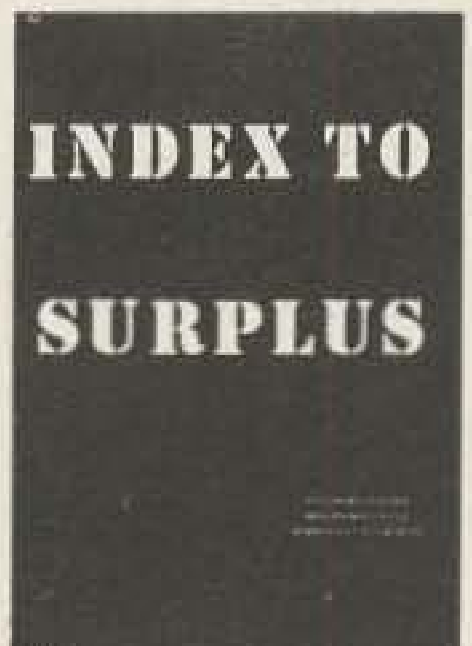

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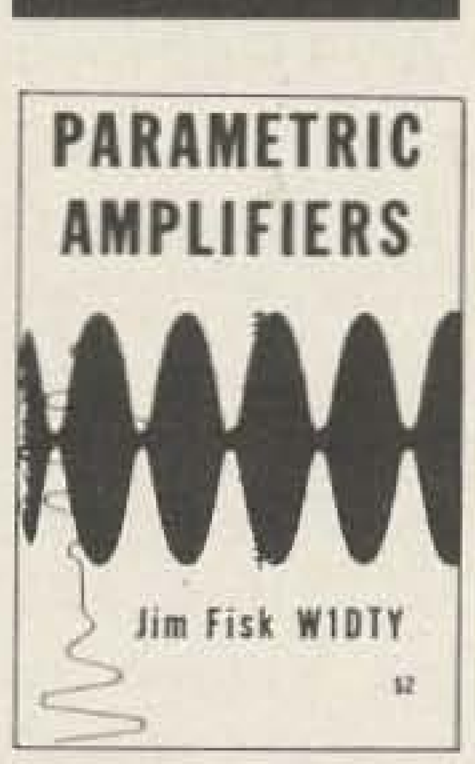

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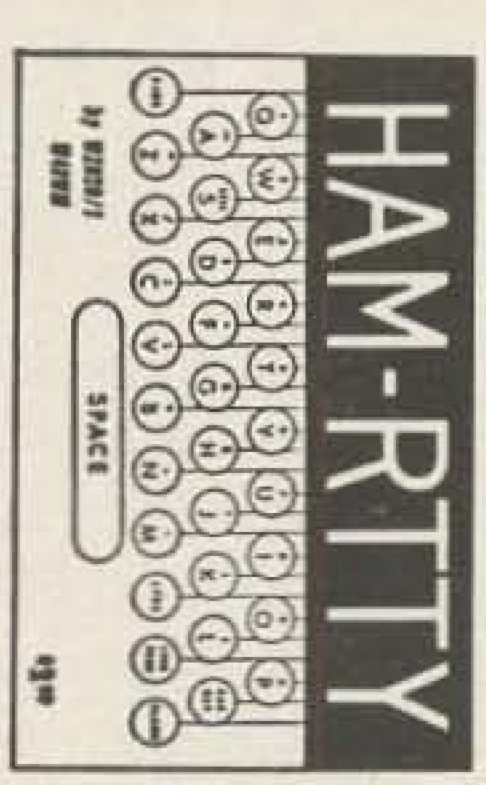

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Simple Modifications for the HW-12, 22, and 32

Recent articles have appeared in various publications telling how to put these transceivers on CW, and retune for the CW portion of the band. These have been good as far as they go, but they leave out the convenience of bandswitching. I have the 80-meter transceiver, modified with the Dynalab Deluxe conversion kit, and have further modified it as described here. The original purpose of the modification was to enable me to work the European phone segment of 80, while at the same time, maintaining immediate capability to get onto the local MARS frequency of 3996.5 kHz. The answer was quite simple: parallel C-130/C-131A with a fixed 60 pF and a 7-45 pF ceramic variable.

Do not run directly to ground, but instead through a switch. For those who wish to make a no-holes modification as I originally did, and for those who do not have the calibrator installed, the leads running to the calibrate switch may be removed and taped. One switch lead is then run to ground, the other to the end of the added capacitors. Operation is simple: for normal operation (on 80) leave the calibrator switch in; for the lower coverage, pull it out.

The trimmer (7-45) may be adjusted, and in doing so, you will find that you have lowered the frequency approximately 200 kHz. I imagine a more accurate means could be found, but this was satisfactory for my purposes once I established that 4.0 MHz would be 3.8 MHz on the dial in the lower position. For those persons having the Dynalab conversion (or the straight 40 and 20 meter transceivers) throwing in the added capacitance will *raise* the frequency 200 kHz. This is fine for those hams who want to work the 14.405 and 14.505 MARS frequencies, but for normal operation a somewhat different approach must be tried. In this case, after installing the additional capacitors, pull the switch to put them into the circuit, then recalibrate in the normal manner, which is now *high*. Pushing the calibrate switch *in* will then *lower* the frequency putting you in the 40-20 meter CW band. The same could be accomplished with a subminiature toggle switch which will blend nicely into the cabinet. This modification (addition of capacitors) is easily accomplished above chassis by using one of the printed circuit mounting screws run through the hole on the trimmer case.

Other simple, but useful, modification I have installed is a three-inch round internal speaker, mounted on the right side of the case next to the top. Use a good grade speaker because the thin paper in the economy models will dry out and start to rattle quickly. A small vernier dial which was added to the panel is an excellent aid in tuning, especially when mobile. I have also added a stereo type jack on the front panel, and I can use a head-set-boom mike by simply plugging it in. Lastly, I have added sideband selector lights to go along with the Dynalab kit. Wiring is run through the unused side of the sideband selector switch and an added rotary switch section on the added bandswitch (this is necessary because the sideband switches on the various bands). To complete my rig, I am using a Knight Audio Compressor which gives an added 3 dB gain on most contacts. From my location at Ramstein Air Base, Kaiserslautern, Germany, mobile, I have worked as far as Australia and Alaska on twenty meters using the modified transceiver, HP-13 power supply and Hustler antenna. Hope you all have as much fun with your rig as I do mine—at their low cost, one can easily afford to experiment.

. . . DL4XO/W3BQE

Alan Ross VE3FKY
18 Catherine Street
Dorchester, Ontario, Canada

Project Milk Wagon

You two can form a club.

When I first moved to the small village of Dorchester two years ago, there was only one other active ham; now we have five and some others who are working towards their "tickets". We also have a communications trailer which is probably the only one of its kind in the country.

It all started when I arrived and met the other ham. He said, "Well, now that there are two of us we can form a club. I'll be President and you can be Secretary." To make things confusing we both have the same surname, although unrelated. We have just about given up denying that we are brothers.

For a while it was a good gag; each time we met was, of course, a club meeting with 100% of the membership present. However, last year we decided to make our debut with a station for Field Day. A local campground operator volunteered the use of his site, and equipment was begged or borrowed in a hurry. A 40-foot aluminum ladder was used to raise our inverted vee and I can recommend this as a useful portable mast. Guy it at the twenty foot level, climb up and attach your antennas and top guys and push it up from there. It is easily transported on top of a car. My tent trailer was used for operating and sleeping quarters, and we put up a reasonable score as a one-band station. One of our operators, rather bushed after a long session, was heard to say to a W9, "You are 6 and 9 Ontario section OM" to which the W9 replied, "That's the best report I've had in 20 years of ham radio!"

Our fame must have spread because when the annual parade and fall fair came round we were asked to assist the parade marshalls by providing mobile communication. We figured this to be a good chance to boost ham radio in the area and arranged to have a station operating in the fairground all day. The parade went well with the aid of two friends from a nearby city, and the four mobile 'Twoers' kept things moving and parade officials informed. Although our station at the fair was cramped in a corner behind prize bails of hay, we had many enquiries. Also, we managed to hook up our local member of parliment with the minister of agriculture in Ottawa. Good for publicity!

As any ham knows we are always meeting people who say, "I have always wanted to be a ham; how do I go about it". We had

After six months of searching, we located an old horse-drawn milk cart that we could convert to a communications trailer.

The North Dorchester Amateur Radio Club's communications van. Converted from an old horse-drawn milk truck, this trailer serves as field day headquarters and emergency operating station.

already decided that if we were going to have a club we needed more than two members. Since we were the only two hams in the village, there was only one way to get members and that was to 'grow' our own. At the fair we handed out leaflets announcing a class to start in my home the following week. On the following Wednesday we were pleasantly surprised to find that ten people showed up, including two YL's. It was a good thing my XYL was out on Wednesday evenings! Of course, as was expected, the group dwindled after a few weeks, leaving the dedicated group who stayed with us all winter. On the occasion when our first student got his ticket, his XYL baked a special chocolate cake which he brought to the club. The second to get his ticket was a 15-year-old high school student of whom we are especially proud (15 is the minimum age for a license in Canada). Chris is very keen and hopes to start a high school club in the fall. We look forward to helping with this project and already have more enquiries from would-be hams for another class.

You will have gathered from other articles in 73 that 1967 is a big year for Canada. Last fall when our class was moving along nicely we heard a lot about other clubs running centennial projects. This seemed to be out of the question with our small group and limited funds. However, our president, Norm, had the great idea of building a communications trailer. This seemed ridiculous until he pointed out that there must be a bunch of old horse-drawn milk wagons around which could be picked up cheaply and converted.

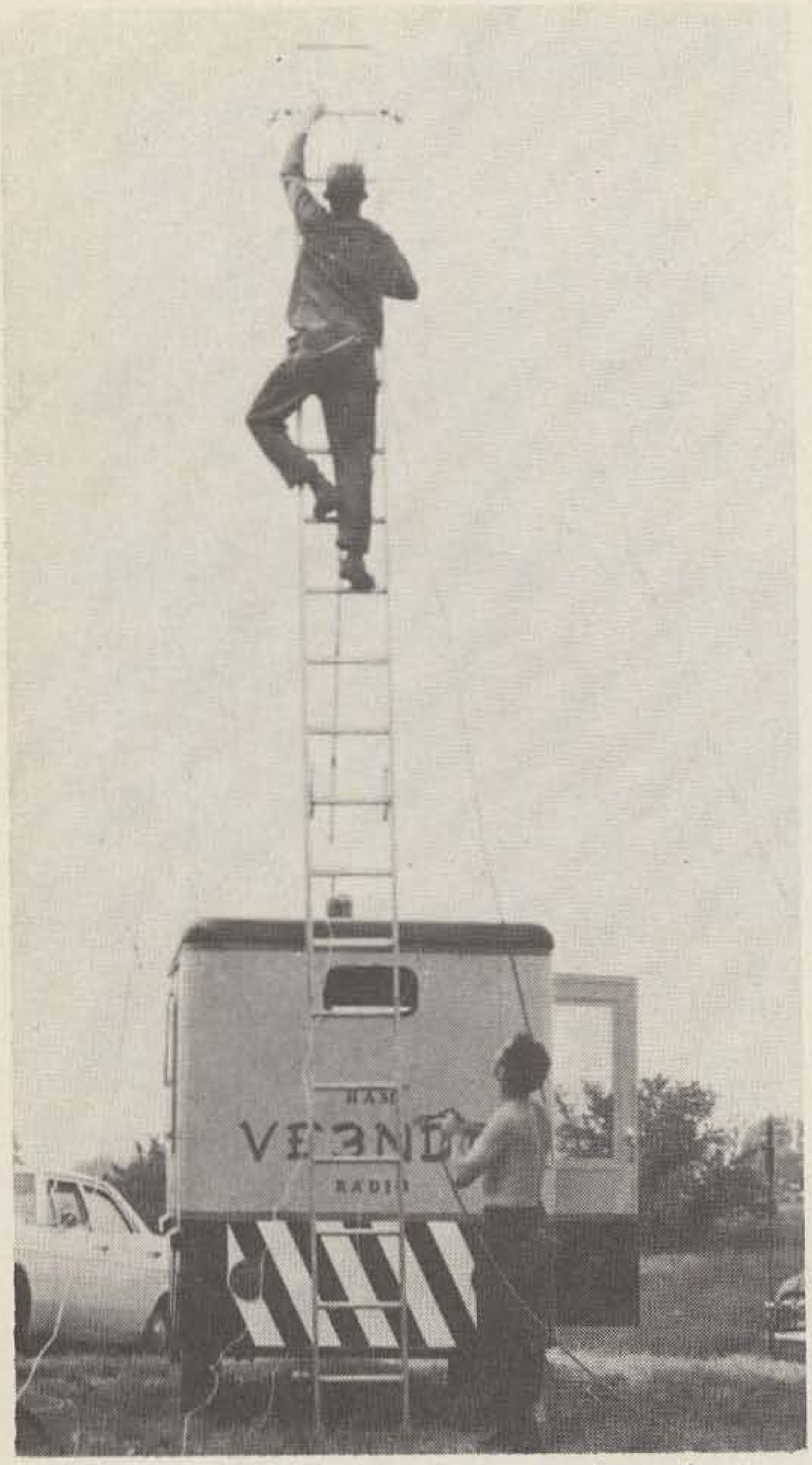
It wasn't so long ago that some country dairies switched to trucks. Being a traveling man, I was nominated to look for one. Suddenly there was not a milk wagon to be found. I got a little tired of calling on dairies and asking everyone I met, "Do you know where I can find a milk wagon?" Of course the reason had to be explained each time.

Spring rolled around and finally, after a six months search, my enquiries paid off. I was told I could find one in a certain farmyard. When I rolled up, I found ten of them in all shapes and conditions. The following weekend the gang went out and we picked out the best one for our purpose. The horse shafts were still in place but the dairy loaned us a hitch and I towed it home.

I was pleased to find that it was a well-sprung vehicle and towed beautifully. I also got a kick out of the stares of my neighbors as I towed it up the village street.

After being a ham for some time you get used to the neighbours saying, "What is that crazy nut up to now?"

Getting the wagon home was just the beginning; there were windows to be fixed, the doors needed replacing and of course the interior had to be fixed up. Finally, a good paint job and lettering. The shafts had to be replaced by a trailer hitch as we had no intention of using a horse!



VE3DNR on a field day site. A 40-foot aluminum ladder is used as an antenna mast.

Fortunately, our group was growing, and some useful people were involved, so we were able to get supplies at a minimum cost. Also, we were getting them trained in the good old ham art of scrounging. There was still some expense of course, and a draw was run locally to raise funds. I am glad to report that we are now 'in the clear'.

The deadline for getting the trailer ready was June 24. This turned out to be, not only Field Day, but the day for a big centennial parade and shindigs at the fair ground. It looked like a big weekend for us as we were once again asked to marshall the parade. The trailer was entered in the parade so we got to work on the conversion and were hard at it right up to the day. There was not time to finish the inside but we managed to install a bench and chairs for field day operations. The important thing was that the outside was finished and made a smart entry in the parade.

Marshalling went off without a hitch, and the trailer was an attraction at the fairgrounds which helped us to sell tickets for our draw. At 3 PM we drew the winning tickets and pulled out, heading for the campground to start field day. Everything was set up and working by 5 PM for a good start. The campground owner is now one of our members so we have a good pitch there with a pool and snack bar. Sitting in our trailer was a real pleasure after the usual tent-type operation.

We had some equipment problems but the trailer had a good workout and gave us a chance to find out what else had to be done. The main item is a reliable power supply which can be kept in the trailer so that we can take off in a moment in case of emergency. Wiring and meters will be installed as well as mobile antennas, in case the ladder cannot be used. Bunks and a table will be fixed in the rear half. The front end is used as the operating position, and three operators can sit side by side. Several club members have trailer hitches so that anyone of them could pick up the trailer and take it to an emergency location. We will also use the trailer for mobile meets and other outings so that members will get plenty of practice.

Incidentally, our membership is now eight. How many clubs can say that they have quadrupled their membership in one year? We also have our own callsign, 3C3NDR (North Dorchester Radio Club). In the first year much has been accomplished. The only drawback has been that Norm and I have been too busy to do much hamming. Perhaps now we can let the new members take over and get back on the air. Two main conclusions have been reached; one is that recruiting and training new hams is a rewarding experience and renews interest in the hobby. The other is that, a project like the milk wagon keeps members busy and maintains their interest in the club. We have met every week for almost a year but have never had a formal business meeting or speaker. We have just had too much to do and talk about.

Recent figures show that not enough new people are coming into the hobby, so fellows, why not get out there and do a selling job? You don't have to be a big group with large funds. Remember: you *two* can form a club!

. . . VE3FKY

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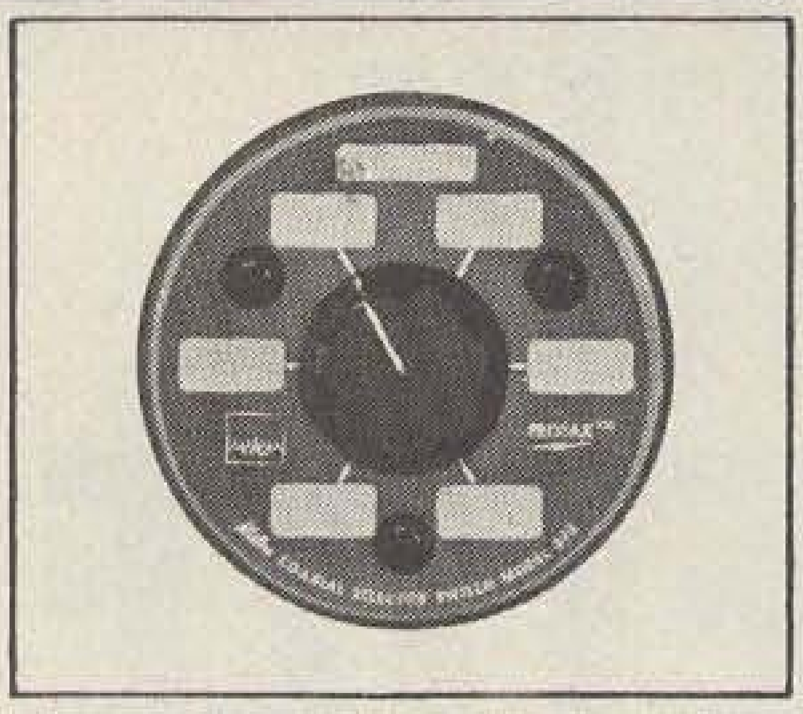

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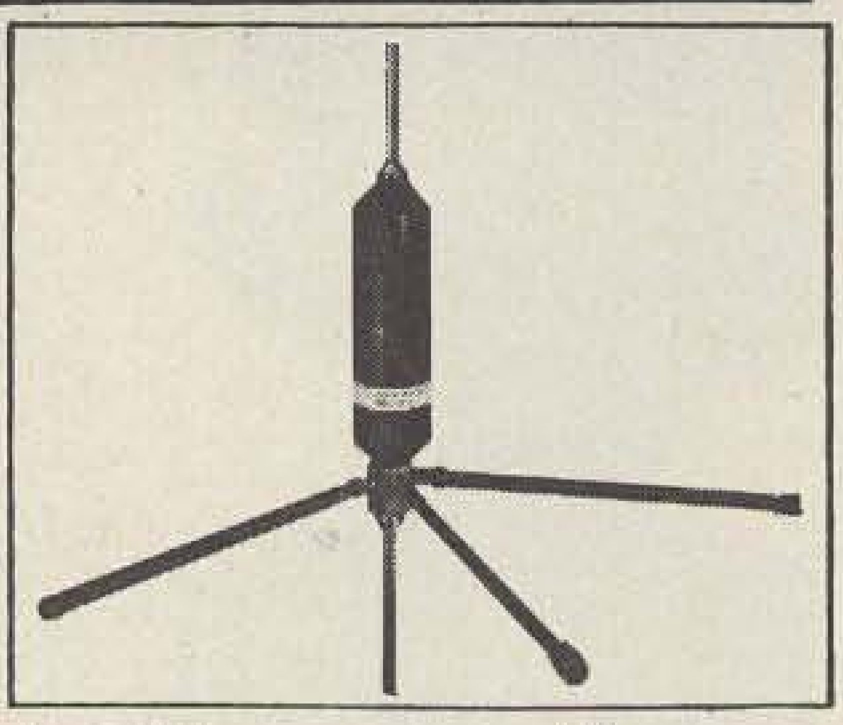

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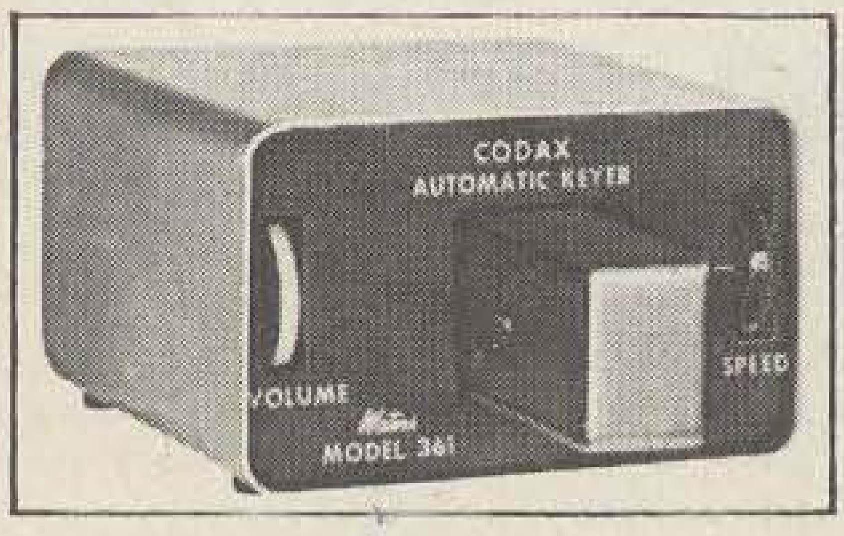

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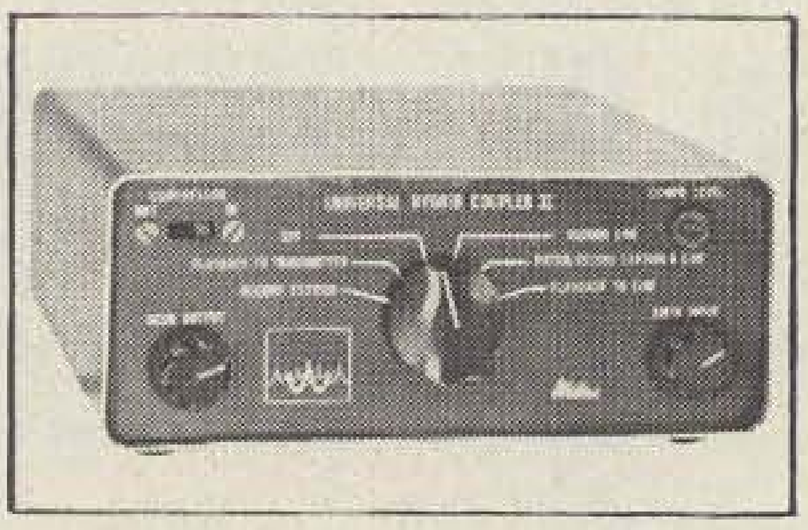

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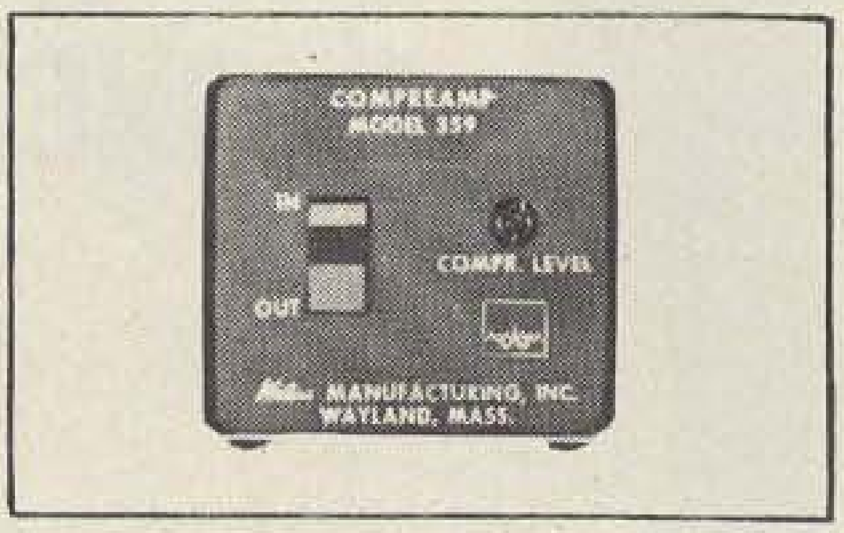

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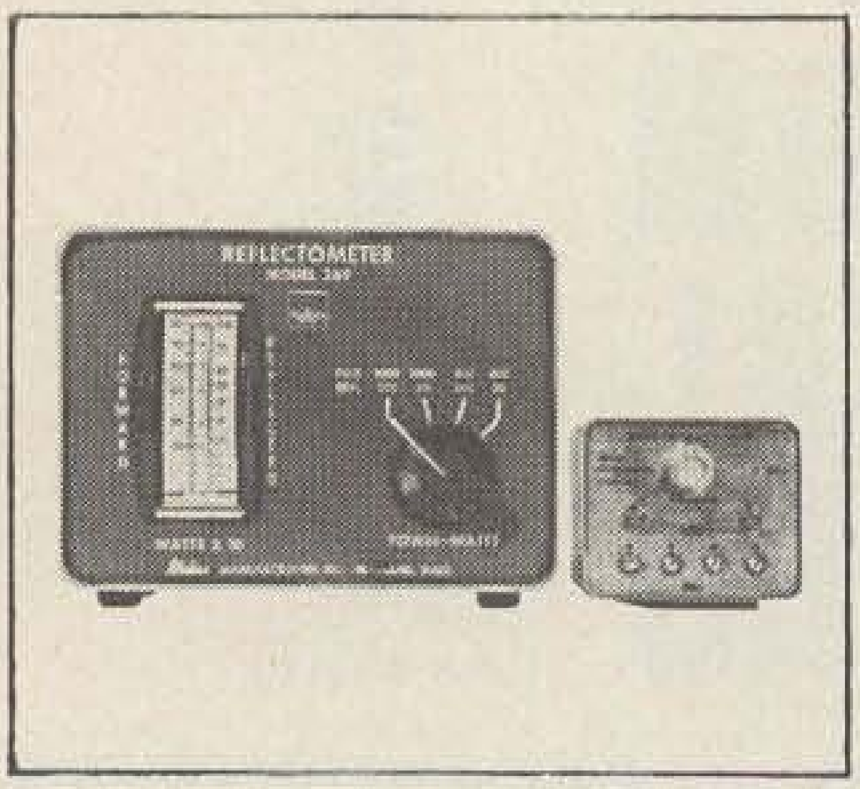

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The Drake MN-4 Antenna Matching Network

Almost all of the amateur transmitters today use a pi-network tank circuit which is designed to work into a 50-ohm resistive load with an SWR of less than 2:1. This resistive load can only be achieved with a resonant antenna. For the ham who is only interested in working on one band this doesn't pose too much of a problem since he usually has space for at least one antenna. However, if he wants to work on more than one band, and preserve the 50-ohm load to his transmitter, he has to use some type of antenna tuning unit or matching network.

The new Drake MN-4 Antenna Matching Network takes care of all these problems very nicely. It will provide an optimum match with multi-band antennas, measure the feedline SWR and reduce the SWR at the transmitter to 1:1. It will match the transmitter output to a linear amplifier which does not have a 50-ohm input impedance. In addition, it monitors transmitter power output in watts directly and continuously. Since it attenuates the second harmonic of the transmitter from 25 to 35 dB, it may eliminate the need for a low-pass TVI filter.

These are just a few of the jobs for which the MN-4 is tailor-made. It will also match the transmitter to an antenna across a complete amateur band; permit "off-the-air" transmitter tuning and antenna matching at low power using a dummy load; or, help localize antenna problems by comparing transmitter output into the antenna with the output into a dummy load. Also, it will "store" the loading adjustment for the transmitter when switching adjustment for the transmitter when switching from barefoot to linear amplifier operation because the matching network is bypassed in the direct position of the bandswitch.

The Drake MN-4 consists essentially of a wideband pi-network with a series capacitor for tuning out any reactive component of antenna impedance. The input side of the network consists of a set of fixed capacitors which are selected by the bandswitch—not unlike the pi-network in most transmitters. The pi-network inductance has taps for each band with a special coil for ten meters. Two positions for the 3.5 MHz band—80A and 80B—insure sufficient tuning range to cover the entire band.

In addition to selecting the band in use, the bandswitch may be used for direct or alternate operation. In the direct position, as we previously noted, the matching network is bypassed. In the alternate position, the matching network is removed from the circuit and the rf is connected to the alternate coaxial socket on the back of the unit. This socket is made to order for a dummy load, and is very useful for initial transmitter tuning.

The special wattmeter which is built into the MN-4 makes tuning the unit a real snap. In most antenna tuning units, the SWR indicator is of the "monimatch" variety. One of the big disadvantages of this type of SWR pickup unit is that it is sensitive to frequency changes—being more sensitive on the high frequencies than the low. Not so with the wattmeter in the MN-4. In this wattmeter the pickup unit consists of a specially wound toroid transformer with no significant differences in sensitivity in the frequencies of interest—3.5 to 29.5 MHz. Thus you can tune the unit for minimum SWR without continuously juggling the sensitivity control.

With an SWR meter that is not frequency sensitive, it is a relatively simple matter to tune up the MN-4. All you have to do is vary the resistance tuning knob for an SWR dip, turn the reactance tuning slightly to bring the SWR upscale and tune the resistance knob for another dip. If the second dip is downscale from the first, you're tuning in the right direction and should continue to alternately tune the resistance and reactance controls until a minimum SWR indication is obtained.

If the second dip reads higher on the scale than the first dip, you're tuning the reactance knob in the wrong direction. Turn it in the opposite direction and dip with the resistance control until you obtain a minimum SWR indication on the meter. If the

Drake MN-4 Specifications

Frequency range:	3.5-4.0 MHz, 7.0-7.3 MHz, 14.0-14.35 MHz 21.0-21.45 MHz, 28.0-29.5 MHz.
Input impedance:	50 ohms resistive.
Load impedance:	50-ohm coax with SWR of 5:1 or less (any impedance angle). 75-ohm coax with lower SWR may be used.
Power capability:	200 watts continuous.*
Insertion loss:	0.5 dB or less on each band after tuning.
Built-in wattmeter:	Reads forward power in watts or SWR.
Wattmeter accuracy:	±5% of reading +2 watts.
Size:	5½x10¾x8½ inches.
Price:	$69.95.

*Although the MN-4 is rated at 200 watts, Drake will be coming out with the MN-2000 in a couple of months. This unit will be rated for the full legal limit.

dips are so low in magnitude that it's difficult to tell whether one dip is lower than another, you can increase the meter sensitivity. With the added sensitivity it may not be possible to dip the meter to zero, but any residual reading will, in most cases, represent less than 0.1 watt.

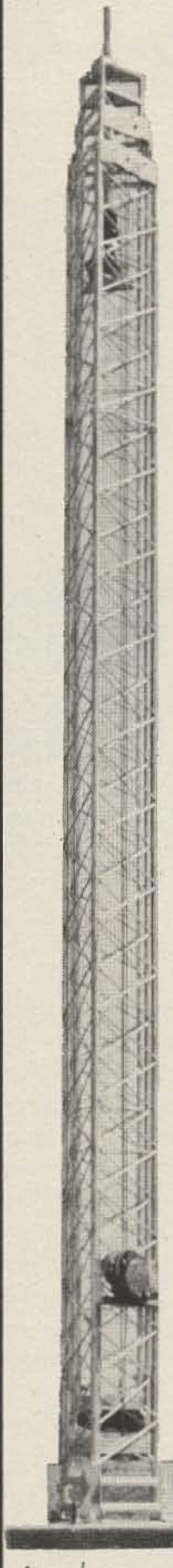
I was surprised, and pleased, to find that you can tune up the MN-4 in less time than it takes to talk about it! With most antenna tuners it's a matter of juggling the controls *and* transmitter loading *and* SWR sensitivity. Not with the MN-4—in about 30 seconds you can tune it up from scratch. And, when you move from one end of the band to the other it's only a matter of seconds to get the SWR back down to 1:1 again.

Remember though, the matching network only matches your transmitter to the transmission line. The mismatch at the antenna still exists. Although you can get some rf into the antenna, it won't perform as well as an antenna which is resonant.

A set of tuning curves which is provided in the instruction manual show the resistance and reactance control settings versus load impedance. These curves may be used to determine the approximate load impedance of the antenna you're using. Or, if you already know the load impedance of your antenna, the curves may be used for setting up the initial control positions on the MN-4.

For the amateur who is limited to one antenna, and wants to work more than one band, the Drake MN-4 Antenna Matching Network is a natural. Not only is it simple and quick to tune, it will match a wide variety of sky wires. And, even if you have the space, the idea of only one antenna should appeal to the XYL.

. . . W1DTY



The Omega-t Antenna Noise Bridge

If you have to adjust any antenna matching sections, determine antenna resonance frequencies or cut coaxial lines ¼ or ½ wavelength long, the new Omega-t* Antenna Noise Bridge is one of the slickest little gadgets around. When you're trying to prune an antenna or tune a gamma match with an ordinary antenna impedance bridge and grid-dip oscillator, you almost need five hands. Not so with the TE-7-01 Antenna Noise Bridge—it will fit in the palm of your hand and the only auxiliary equipment you need is a receiver.

Since the noise bridge covers the frequency range from 1 to 100 MHz, and will measure impedances from about 10 to 100 ohms, it is ideal for the 50-ohm systems used by most hams. To tune up an antenna all you have to do is connect the antenna and receiver to the bridge terminals and set the dial near 50 ohms. Then you tune the receiver over the frequency range for which the antenna was designed looking for a null in the noise output of the noise bridge. Since noise output is more than sufficient to mask any received signals, false indications are eliminated. When there is a noise null on your receiver, either in audio level or minimum S-meter reading, the resonant frequency of the antenna may be read off the dial of the receiver.

After the resonant frequency has been determined, the noise bridge dial is adjusted for best noise null. The antenna impedance may be read directly from the dial. When the noise null is found, the potentiometer (impedance dial on the front of the bridge) may sound scratchy and noisy. This is because of the high resolution capability of the device. The balanced-bridge condition represents a ratio greater than 30 dB and measurement resolution is a small fraction of an ohm.

*Omega-t Systems Inc., 516 W. Beltline Road, Richardson, Texas 75080.

Therefore, slight movements of the dial cause a large change in the noise null level.

The Antenna Noise Bridge may also be used to determine the electrical length of coaxial line—either one-half or one-quarter wavelength long (or multiples thereof). An antenna-matching system may be adjusted to the proper impedance with the noise bridge (after the antenna is tuned to the desired resonant frequency) by alternately adjusting the match and the noise bridge. Because of the effects of coaxial-line length this should be done with the noise bridge connected directly across the antenna terminals. However, if a coaxial line must be used, it should be one-half wavelength long or a multiple thereof.

The secret to the operation of the Omega-t Antenna Noise Bridge is the special quadrafilar wound toroid shown in **Fig. 1.** On one side of thos toroid is the wideband noise generator; the antenna, receiver and calibrated potentiometer are connected to the other winding. When the noise across the resistance arm equals the noise across the antenna, the bridge is balanced and minimum noise is applied to the receiver.

The wideband noise generator is a circuit designed specifically for this job. The noise source itself is a reverse biased diode—especially selected for wideband noise output. The noise is amplified and applied to the quadrafilar transformer through a three-transistor circuit. The design is such that the noise is balanced across the generator side of the transformer.

One of the big advantages of the Antenna Noise Bridge, of course, is its size and the speed with which impedance measurements can be made. This applies to any antenna that you may use—whether it is a beam, a dipole, a quad, whip, long wire, or random length wire with an antenna tuner. The only limitation is the frequency and impedance range of the unit. For most hams using 50-ohm coax this should pose no problem.

There are several other jobs that you can do very simply with the noise bridge. If, for example, you want to know what frequency range you must operate in to limit your SWR to less than 2:1, all you have to do is run some impedance points from one end of the band to the other. For an SWR less than 2:1, your upper and lower band limits will be determined by the point where the impedance indicated by the bridge is less than 25-ohms or more than 100-ohms. For an SWR of 1.5:1 or less, your points would be 33 and 75 ohms.

Omega-t TE 7-01 Specifications

Frequency range:	1 to 100 MHz.
Impedance range:	0 to 100 ohms (for nominal 50-ohm coaxial systems).
Associated equipment required:	Receiver which tunes frequency of interest. S-meter useful but not required.
Signal level:	Masks normal received signals to eliminate false indications.
Circuit:	Quadrafilar wound bridge transformer, 3 transistors, 1 special diode.
Systems which may be tested:	Antennas—quads, beams, dipoles, whips, long wires, random length wires with matching networks. Coaxial matching systems — series, shunt, gamma.
Power supply:	9-volt transistor radio battery.
Size:	2¼x3¼x3 inches.
Price:	$24.95.

Another application for the Antenna Noise Bridge is checking baluns. Have you ever wondered if that balun *really* represented a step down of 4:1 (or 1:1)? Just connect a 200-ohm resistor across the output terminals of the balun (50 ohms for 1:1 baluns) and measure the input impedance with the bridge. You can also check the balun to see what frequency it is cut for—at frequencies very far off its center frequency it won't provide the desired transformation ratio. A similar check can be run on the broadband baluns that are currently on the market. Since the Antenna Noise Bridge may be used

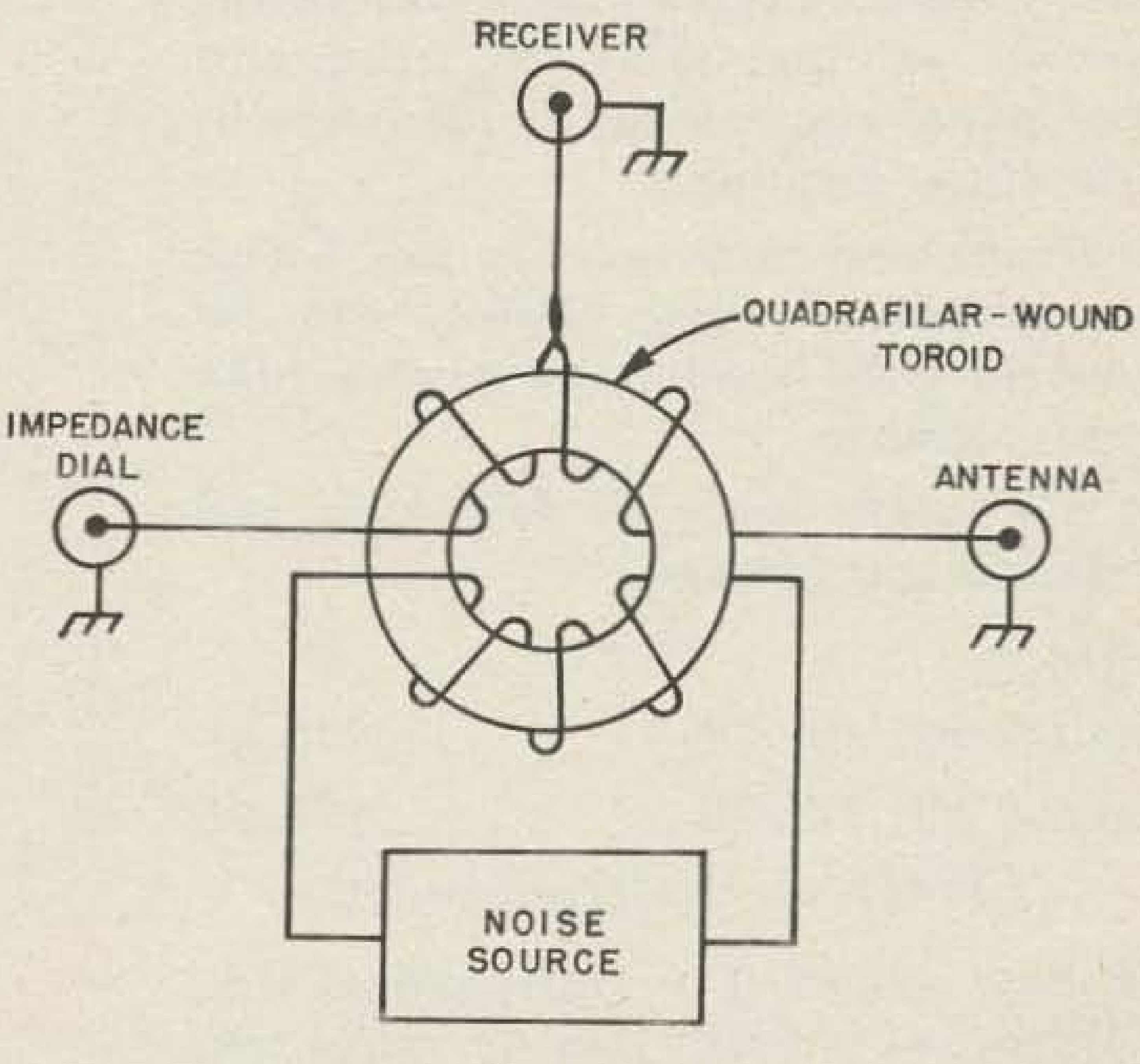
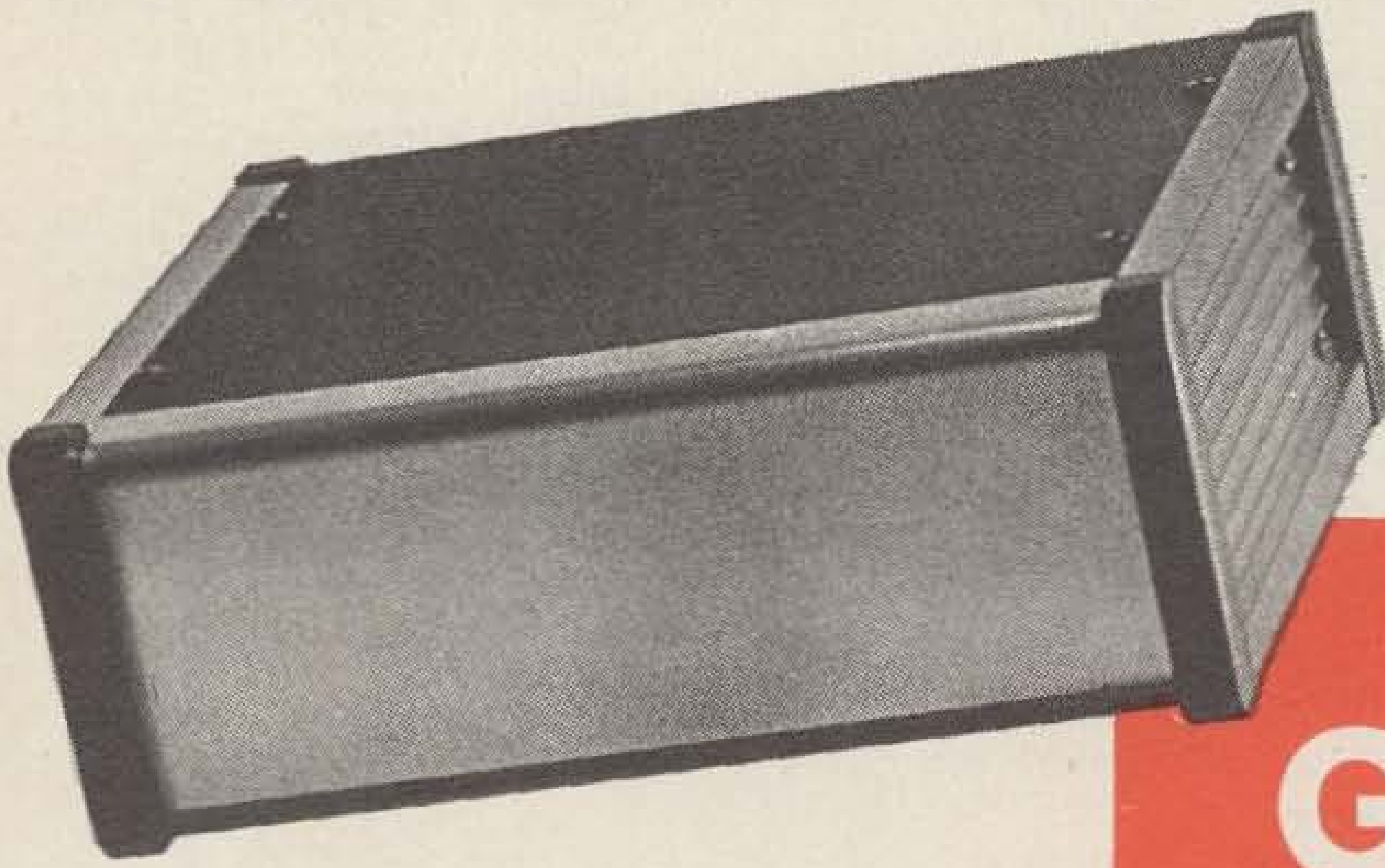


Fig. 1. Diagram of the Omega-t Antenna Noise Bridge. A wideband noise source is connected across one side of a balanced, quadrafilar wound transformer; the receiver, antenna and calibrated potentiometer are connected across the other.

Long Needed By Homebrewers!



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40	3.25	5.75	9.50	41
50	3.25	8.75	7.50	52
60	3.25	8.75	9.50	68
70	3.25	11.50	7.50	71
90	3.25	11.50	9.50	92

AT YOUR LOCAL DEALER OR DIRECT FROM **justin, inc.** BOX 135, SAN GABRIEL, CALIFORNIA — DEALER AND DISTRIBUTOR INQUIRY INVITED from 1 to 100 MHz, it is ideal for checking wideband systems.

It may also be used for checking the resonant frequencies of trap dipoles and beams. When checking a properly adjusted three-band beam, for example, you will find three separate and distinct resonant points. If the resonant points aren't in the parts of the band where you want to operate, it's a simple operation with the antenna noise bridge to adjust the traps right on the money.

After plodding along with an old homebrew antenna impedance bridge excited by a grid-dip oscillator for a good many years, the Antenna Noise Bridge was a welcome change. For versatility, simplicity, and use, it's going to be pretty hard to beat. If you are planning on doing any antenna work in the near future, give yourself a break—the time you save will be well worth the small investment for one of the handiest gadgets I've seen in a long time—the Antenna Noise Bridge.

. . . W1DTY

RTTY Hints

For some unknown reason, military surplus Model 15 page printers more often than not come without paper spindles. I made a more-than-adequate substitute by wheedling the chemistry department out of two 1" tapered rubber stoppers with a center hole. When pushed on a shaft made of any rod material that will fit the machine, the stoppers do a good job of wedging the paper anywhere on the shaft.

The problem of re-inking faint ribbons is easily solved. Actually, no "re-inking" is necessary: very seldom does a ribbon, either TTY or typewriter, lose its ink—the ink dries out. Therefore, it is a simple matter to reactivate it with ordinary 3-in-1 oil. Simply remove ribbon (wound fully on one spool) and the take-up spool. Wind a turn or two on the take-up spool. Unroll about six inches of ribbon from the full spool and put a thin line of oil on the first three inches. Roll up the six inches. You will notice the oil seeping through from the oiled ribbon on the unoiled part that is rolled on top of it. Follow this procedure until the ribbon has been fully wound on the take-up spool. Let the spool set at least overnight so that the oil can be absorbed evenly throughout the ribbon.

. . . Horton Presley KØHVK

Comdel CSP-11 Speech Compressor

Ops interested in being on top of the heap, or in getting a few more dB output on VHF without the usual distortion, will be interested in the new Comdel Speech Processor. In tests at W2NSD/1 and K1RA, reports with the CSP-11 were somewhere around 3 dB higher than without it and with a noticeably louder signal.

Actually, the CSP-11 is designed for use in any system that uses a microphone for voice transmission, and results in useful talk-power gain, as well as in a concentration of the power in the frequency range that gives the best intellegibility. This has the effect of narrowing the transmitted signal width—a highly desirable feature in SSB work, producing, in effect, a gain of about 10 dB, and having little effect on the power supply because it is actually the same power but more concentrated.

The Comdel is interesting from an engineering standpoint. The big problem with speech clipping is to avoid the distortion that usually accompanies it, and this is a serious problem in sideband operation. Comdel came up with a tricky solution: basically they have built a complete sideband generator which changes the audio input to SSB, clips it and demodulates it back to audio. The undesirable clipping products are lost in the process and you come out with nice, clean, compressed speech.

In the CSP 11, the original audio frequency spectrum, centered around 1.5 kHz for the human voice, is translated to a much higher center frequency. In the audio range, human speech represents almost a 10:1 range—from 300 to 3000 Hz. This is a little more than three octaves. When the speech is translated to a higher frequency, its bandwidth represents much less than an octave, and it is somewhat easier to process with minimum distortion.

Peak limiting the translated signal produces the usual harmonics, but they are easily filtered out, since they are considerably removed in frequency. The amplitude-limited

*Comdel Inc., Beverly Airport, Beverly, Massachusetts 01915.

Comdel CSP 11 Specifications

Frequency response:	500 to 2500 Hz at −3 dB points.
Input impedance:	0.5 megohm.
Minimum output load:	5000 ohms.
Signal to noise ratio at limiting point:	36 dB minimum.
Input level at limiting point:	10 mV peak.
Output level at limiting point:	50 mV peak.
Power requirements:	9 Vdc at 18 mA.
Battery life:	300 hours.
Size and weight:	5½ x 3¼ x 7½ inches; 32 oz.
Price:	$120.00 postpaid.

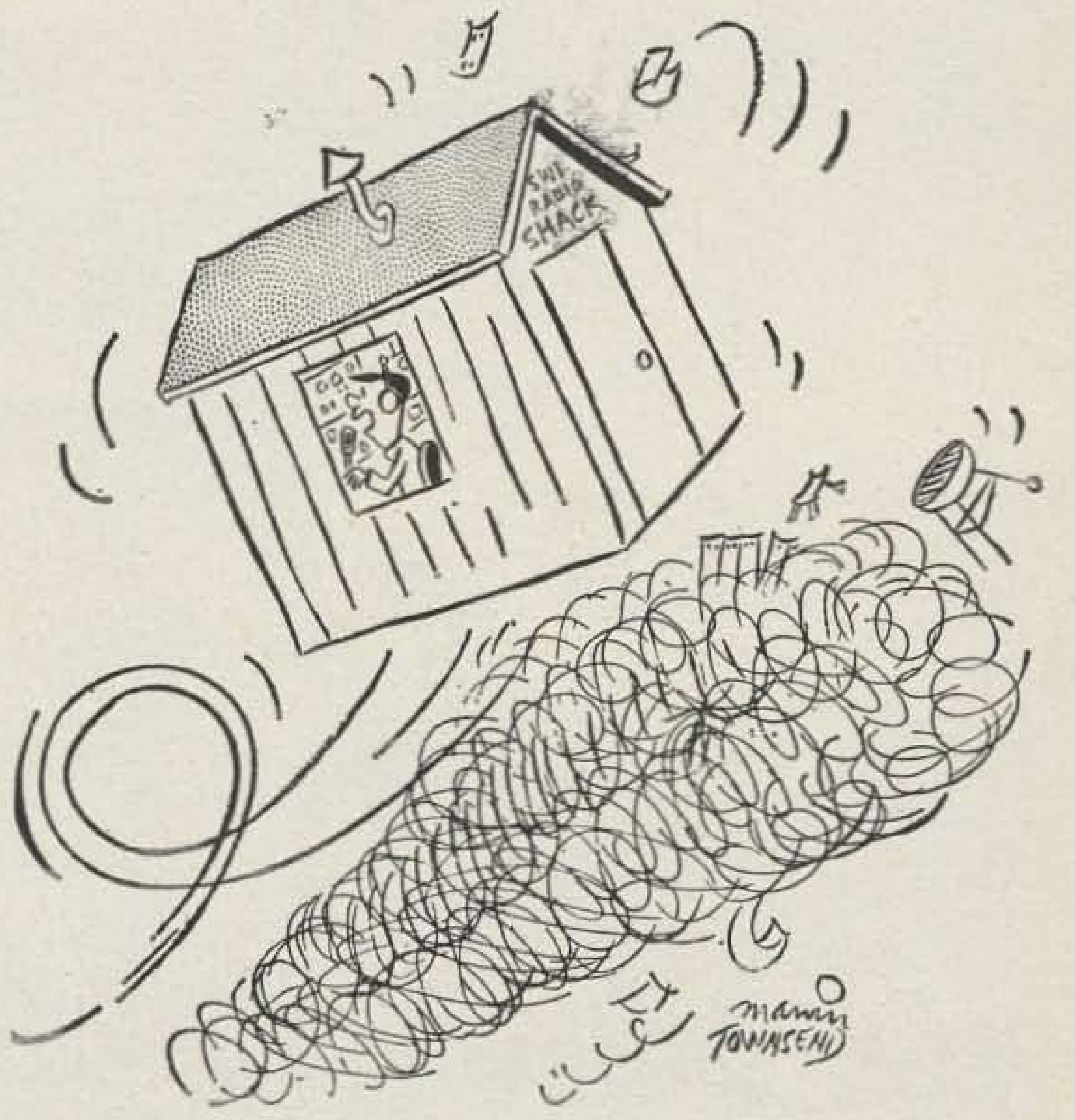
spectrum is then translated back to its original position. This results in peak-limited audio signals free of harmonic distortion.

The Comdel Speech Compressor is completely transistorized and requires a minimum power supply—9 Vdc at 18 mA. Provision is made for six 1.5 volt "D" cells connected in series. However, power may be obtained from an external source or powered in 12-volt mobile systems without any external components. The unit is designed to be used with fairly insensitive, high-impedance microphones having a peak output of 25 mV on voice peaks. Most communication type microphones give considerably more output, necessitating a reduction of the front panel level control.

When the Comdel CSP 11 is used, the resultant output of your transmitter is no higher on peaks and there is no apparent broadening of the peak spikes, but the envelope seems to be a bit fuller down the slopes.

There were a few reports that the voice was a bit more natural with the unit out of the circuit, but that the signal was clean and usefully louder with it in. Depends on what is important to you . . . sounding like the star you are, or working the DX a few contacts earlier in the pile-ups. At $120.00, plus batteries, or with a 12-Vdc supply, this is an economical way to get a nice boost in output.

. . . W2NSD/1 & K1RA



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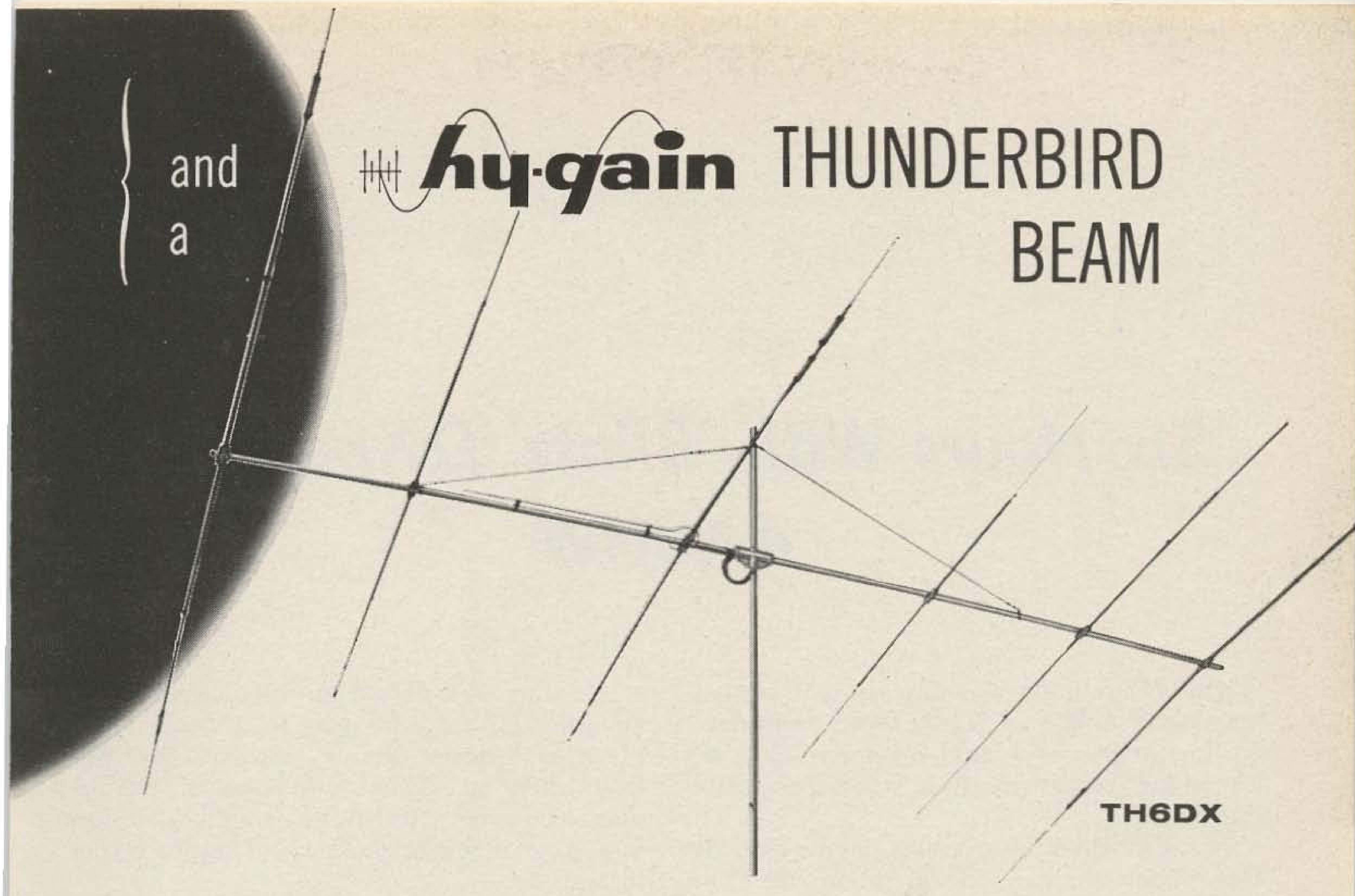

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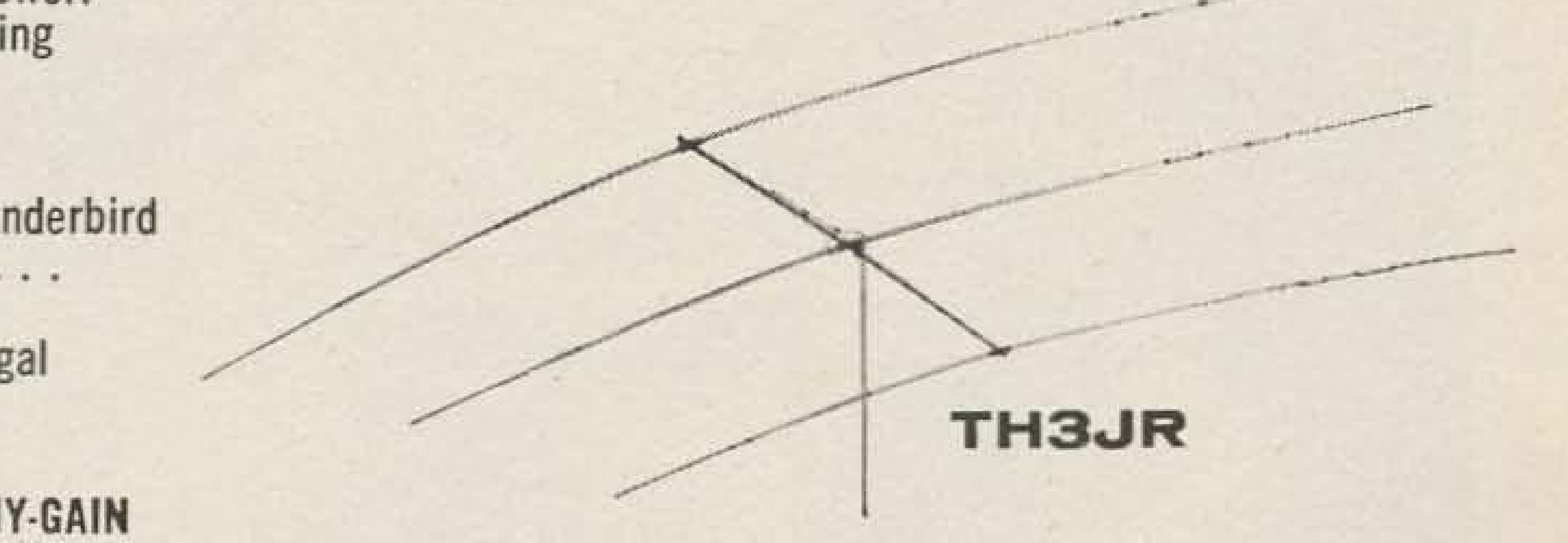

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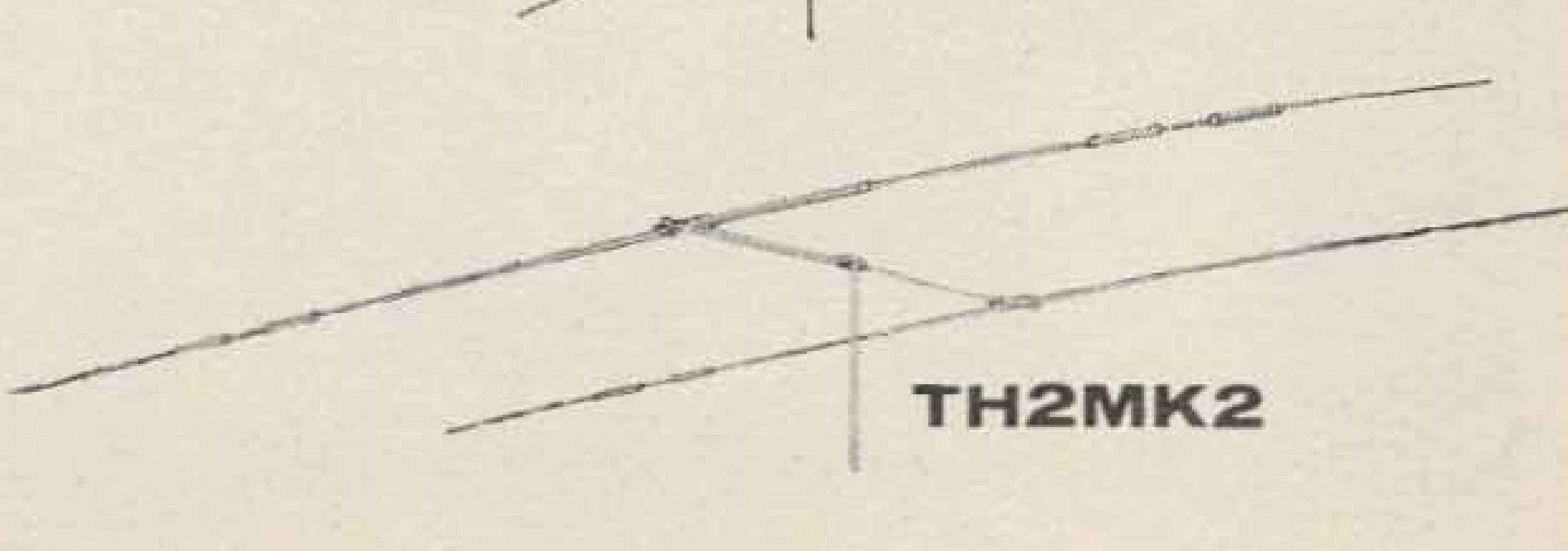

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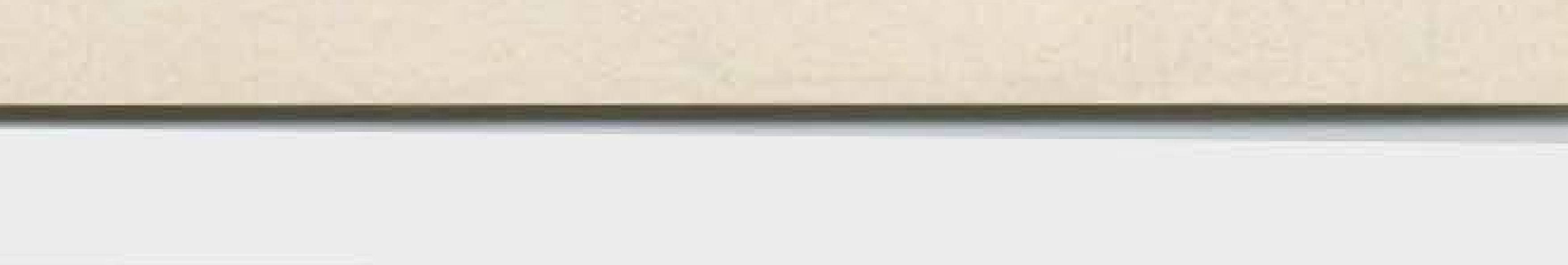

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Six Hours With *Blintz' DXpedition 4X8HW

This DXpedition was already in the planning on the 6th of June. From that date, we knew that we would be operating a 4X something, but at that time we did not know exactly when.

From Wednesday evening on the 7th, we had chosen our place of operation: the "Old City of Jerusalem." Since there were operating restrictions, we had to wait to get permission to operate until the last minute.

Then the day came. In the morning, we received notice by mail that all amateur radio stations may resume their normal activities. We immediately set about getting a Jerusalem permit. Before we knew it, we were given the call 4X8HW. Operators of the station were 4X4WH David, Al WB6AXG/4X (who's Swan 350 did all of the shouting) and 4X4TP, who operated the same station as 4X8TP part of the time.

We had planned to be on the air at 1500 GMT, but due to a flat tire we were off to a late start. We missed an appointment with an army official who was to arrange for a place to operate, so we were on our own from then on. There we were in the redeemed former Heshemite Kingdom of Jordan (may it rest in peace) looking for a spot to operate.

Our first try for a place was the Hebrew University at Mt. Scopus. We managed to scrape up an old generator at the University, but it was too weak and in service for only a few hours during the night. Our next stop was across the hill . . . the ex-Jordanian hospital, Augusta Victoria. Here we received a flat "no", and the only help we received was a lift out the door.

Due to the late hour, we decided to give it one more try, and if it didn't work we would return to Tel-Aviv and forget the whole thing. Luckily this was it. The manager of an old hotel let us make use of his electricity. The only problem was that we

Just to show we were really there!

Our biggest problem was having to operate from the car to avoid disturbing the hotel guests.

had to operate from the car so we wouldn't disturb anyone in the hotel.

Early in the evening we made our first stateside contact, but the band closed up on us completely for about another hour and a half. After that it was all "go" until about six in the morning. In the middle of it, K6YRA managed to break through the east coast QRM followed by five other Californians. Unfortunately no sevens were heard, and besides Ws we worked only about 25 other stations.

When the band closed, we packed up shop and went for a little trip through Bethlehem and Rammallah and back home. We would have stayed longer, except for Al's exam in Organic Chemistry, and Dave's girlfriend who had to get back to the army. She was brought along to help with morale problems (Dave's) late at night.

We had planned to go out again, but the Swan power supply (serial no. M110702) and Swan VOX unit were stolen along with a Knight P-15 SWR meter. Because of this, future expeditions will not be possible until the equipment is found or until some kindhearted person will replace it for us.

If we get the equipment, your roving arabs will be going to 4X8 again, and also 4X6, the Gaza strip and Sinai.

. . . 4X4WH and WB6AXG/4X

*For the enlightment of the uninformed, a Blintz is a Jewish Creppes Suzette filled with either fruit or cheese, fried in butter and slathered with sour cream. Drool . . .

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Bouvet Island

All the while we were on Bouvet Island, the ice breaker was slowly circling the island, taking pictures and plotting a depth chart of the ocean in the immediate area around the island. They were down there with the idea of looking into the possibilities of finding a place on the island to install a weather station. I am not sure of the exact size of Bouvet island, but I would estimate it to be about 5 miles on each side, and it is more or less square in shape. The wind seemed to blow all the time from the southeast, and that's where the cold weather came from I suppose. Why anyone would want to possess such a place on this earth is beyond me, unless someday the earth shifts on its axis and Bouvet Island is shifted further north making it a habitable place to live.

Radio conditions were fine almost all the time. The bands went out about 3 AM and would start to open again around 6 AM. But all signals had that far away sound most of the time, with the exception of stations in the southern part of Africa, which was only around 1,500 miles away, making them just the right distance to get their first hop reflection from the Heavyside layer. Oh yes, you should have heard those S-9+ signals from ZS2MI over on Marion Island and the same with signals from the VP8's over on the Falklands, South Georgia, South Shetlands, and the signals from the boys down on Antarctica were "out of this world" —solid S-9+ everytime I heard them.

It's funny how your source of QRM shifts as you travel around in the world. On Bouvet it was the ZS stations and a few VP's and the others on Antarctica. But since there were not too many of these, it was no bother to me unless they were within a few kHz of stations I was in QSO with. Bouvet was just about the most QRM-free spot I have even been, I would say. The W/K's, most of the time, were up around S-8 when the band was open, and it stayed open to W's almost all the time. The W's actually were the QRM makers!

The most difficult places to work were Australia and New Zealand, not because of the distance, but because they were fairly well shielded from the point where I was located on Bouvet. How any VK or ZL ever got a signal through to me seems impossible, since they were on the other side of the straight up and down cliffs. Possibly it was some kind of reflection or back scatter, but I did manage to work a few of them. To the rest, I say, "I'm sorry—but I tried my best to work everyone I could hear."

Each day I had a number of schedules with the boat as it circled the island doing survey work. Just how many times they made this circuit I never did find out. I think they made each trip around a little further out so they could have a good depth chart of the waters around Bouvet in case they ever wanted to return there at some future date. The longer they stayed the better it suited me.

At the end of the 4th day they told us to be ready to depart the next morning around 10 o'clock. That night I stayed up and never did get in the sack. I did manage to have a few QSO's on 80 meters after all the other bands went dead. But the vertical I used was not made for 80 meters and the SWR was something around 10:1 as near as I could measure. Which made for not too good efficiency on that band and when you consider I was only barefoot all the time, I guess I did OK. The next morning about 9 o'clock we had our last QSO from Bouvet Island. My stay at Bouvet was not as long as I would have liked it to be, but at least I got there and made almost 5,000 fellows happy by giving them another "new one." It seems absolutely impossible for anyone to go there unless they come across another "ice breaker" to get them there. To charter one of these monsters is out of the question with the normal contributions you receive from the fellows back home. You could probably charter one of these boats but considering the cost of chartering a much smaller boat, I would think it would be something like $10,000 per day. The price continues while you are on the island operating. So by doing a little quick figuring, let's say it takes two days from Capetown to get there, plus five days on the island and then 2 days more back to Capetown you will have tied up the ship for seven days—$70,000. We all know that a ham DXpedition can't afford to spend this kind of money just to put one DX spot on the air.

After a lot of rushing around taking down the tent, taking the vertical down and separating all the sections so it could be put back into the waterproof bag, wrapping up the power plant, all the suitcases, etc. took about one hour. We just made it by the time the small boat came up for us. After slipping all over the frozen rocks and loading the lifeboat as it went up and down with the slow-moving ice floes, we jumped into the boat and after another hours trip we arrived back at the ice breaker. The derrick-like crane lifted us back on to the ship and The Bouvet Island DXpedition was over. The captain of the ice breaker decided to head south after LH4 land, possibly even going down to the South African weather station on Antarctica. While the ship banged away at the ice floes, I got busy and put up a long wire for some /MM operation.

While we were on our way, I wanted to keep the boys informed of our progress. My own opinion of Bouvet Island—it's a miserable, cold, damp, Godforsaken place and not fit for humans. My last view of the island, some 10 or 15 miles away, was a big white chunk of ice sitting on top of the water. I got going on the air late that afternoon and the first 3 QSO's I had asked me, "when was I going back to Bouvet." They said they had missed me! I told them not to hold their breath until I returned. Of course, if I had the chance, I would go there again tomorrow.

The further south we went, the heavier and thicker the ice pack became. It took a lot of backing up and full steam ahead to break up the ice for the ship to get through. An ice breaker works like this: the bow of the ship protruded some distance out from the ship at a very slight angle. Up under the bow the bottom of the ship had a rather sharp edge and when the ship wanted to get through the solidly frozen ice pack it would back away from the ice and then full steam ahead. The ship would slide up on the ice and the sheer weight of the boat plus the sharp edge underside would sort of break and cut through the ice. When the ice broke there would be a sharp snap, then a big splash as the bottom of the boat hit the water up under the ice. Then it would back away and steam ahead into the solid ice again. This was repeated over and over, gradually bringing us closer to Antarctica.

After about 3 days and nights of this maneuvering we were finally some 200 or 300 miles south of Bouvet and all the time the ice pack was getting thicker and the weather getting much colder. It was rough going and very slow forward motion too. At the rate we were going, it's hard to say how long it would have taken us to get to the continent of Antarctica. I never did get the chance to find out because one time we banged into the ice and then the water started to freeze in back of the ship, making it difficult to back up for the next banging ahead job. The Captain decided, right then and there, that it was time to stop going south since the ice breaker might get frozen into the ice pack if the weather and water got a bit colder. After a lot of back and forth effort the ship was finally turned around and we headed straight for Capetown, South Africa.

All this time I was on the air except when I was out on deck watching all the action that was taking place breaking through the ice pack. Getting back to Capetown took three days and nights. After two days we departed from the ice floes. The ice pack starts at a sharply defined line and when you leave this line you only see a few pieces of floating ice here and there and an occasional iceberg.

Leaving the ice floes, we came into what I call the "whale waters." Many of them were seen, usually in herds it seemed to me. Sometimes as many as 25 or 30 would be seen with their water spouts spouting water. When we were close enough I could actually hear them "blow." I suppose that's where the expression "there she blows" comes from. Many times the ship would get right into the middle of a "herd" of these whales and most of them would dive straight down, with that big tail flipper sticking straight up. When you consider the size of these animals, it's hard to believe how well they can get around in the water. Nothing sluggish about them that I noticed; they had plenty of life. The afternoon of the 3rd day, the big mountains just out of Capetown could be seen. Suddenly we were back in civilization again —and it did seem good to be back.

There on the docks were my friends Jack and Marge (ZS1OU and ZS1RM) waiting for me. They both pitched in and helped me unload everything and we went to their home some 25 miles out of the city at a beachside place called the Strand. As usual, they had their "Fridge" full of Cokes especially for me. Their fruit season had come in while I was away, so they were loaded with every kind of fruit you could imagine. Peaches, grapes, figs, plums, apples, melons and some other fruits I had never seen before. Since my stay was a short one, I didn't have time to really "do my duty" in regards to eating all that fruit.

With regrets, the time came for me to depart. I had lots of places to visit and operate from before heading back to South Carolina . . . and Peggy. . . . W4BPD

Down Under Award

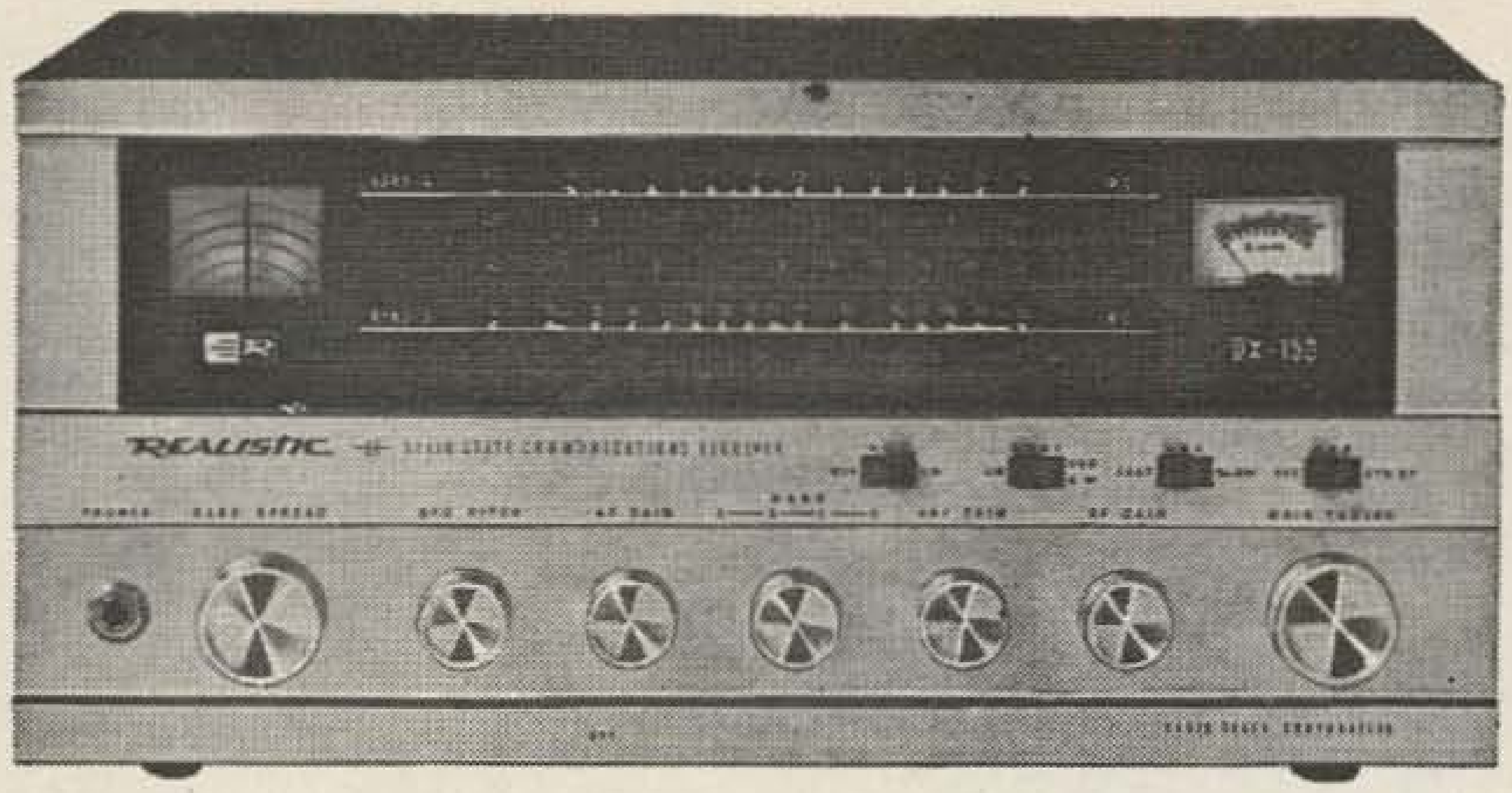
This large colored attractive certificate will be awarded to any license ham who has QSL confirmation of having worked the following VK areas:

1. 50 VK's worked on three (3) bands, and in five (5) areas, VKØ–VK9.
2. Plus five (5) oceania countries.

Send list of QSL's and declaration by two club or committee members confirming they have seen the QSL's to VK4SS, 35 Whynot Street, West End, Brisbane, Queensland, Australia. Cost: 5 IRC's or one dollar in stamps. Free to shut-ins and handicapped.

Mark Losseff — Ex U2GU and active SWL

We have been informed of the passing of Mark Losseff of Kaluga, U.S.S.R. Mark was an amateur before the war and was licensed as U2GU. He was the first Russian amateur to work the U.S. on 7 MHz in August 1927. This was done with 5-watts power, and a two-tube receiver. He was also a commercial operator aboard merchant ships and ice breakers. He was a political prisoner during the time of Stalin, and had been an active SWL since the war.



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ONLY 119⁹⁵

New, big, exciting, professional — the Realistic DX-150 obsoletes tube receivers and warm up, banishes forever your dependence on house current to stay in operation. For example: **the DX-150 will run 100 hours on 8 D-cells** if current fails, or isn't available, or on field day. Additionally, it will operate from a car's cigarette lighter or any other mobile or base 12VDC source! Of course a 117VAC power supply is built in. DX-150 is a husky brute: 14⅛ x 9¼ x 6½", with a massive silver extruded front panel, solid metal knobs, grey metal cabinet, 14 pounds of quality.

A NEW STANDARD OF RECEIVER VALUE!

Priced Radio Shack's way (factory-to-you) the DX-150 saves you about $100 off traditional pricing methods. Yet it offers 11 front controls; dual power supply; 12¼" slide-rule dial in 5 colors; **continuous coverage** from 535KC through 30MC, including 160 through 10 meters; separate detector circuits for AM (diode, and SSB/CW (4-diode bridge); sensitivity good to 0.5μv at 30MC. Nobody **but nobody** but 44-year-old Radio Shack could have created this unique product for $119.95. You better believe it!

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RHODE ISLAND — Providence, East Providence
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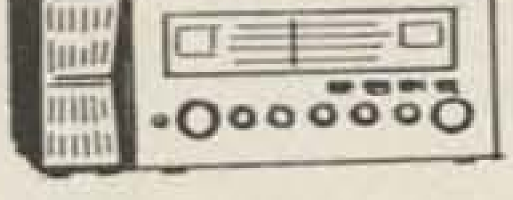

Exact-match external Voice-Frequency speaker cuts out built-in monitor, includes lead and plug. 20-1500: $7.95 (4 lbs.)

12VDC portable pack with all cables, plugs, 8-long-life batteries; includes plug-to-plug and plug-to-lighter cord sets. 20-1501: Only $7.95 (wt. 4 lbs. w/batteries)

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Dept. SV

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I enclose $________, plus 50¢ for postage and handling:

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Gus Browning W4BPD
Route 1, Box 161A
Cordova, South Carolina 29039

WTW Report

After a visit with Wayne and Jim when Peggy and I were on our way to Expo 67, some of the rules of WTW are being changed. The basic rules are unchanged. Starting from this time on we are going to accept cards in multiples of less than 100. We are starting a WTW Honor Roll which will be in each issue of *73 Magazine*. The interest at this time is growing by leaps and bounds and we think by having a monthly Honor Roll the interest will grow even more. Here are the new rules about submitting your cards:

28-MHz CW or Phone: After WTW-100 you may submit cards in multiples of 10 or more up to 150; any number over 150.

21-MHz CW or Phone: After WTW-100 you may submit cards in multiples of 25 or more up to 200; any number over 200.

14-MHz CW or Phone: After WTW-100 you may submit cards in multiples of 25 or more up to 200; any number over 200.

7-MHz CW or Phone: After WTW-100 you may submit cards in multiples of 10 or more up to 150; any number over 150.

3.5-MHz CW or Phone: After WTW-100 you may submit cards in multiples of 10 or more up to 150; any number over 150.

160-Meter CW or Phone: You may submit cards in multiples of 25 or more up to 50; any number over 50.

Submit your cards along with your tally sheet to your usual QSL check point as listed in *73 Magazine*. If you don't have this information, drop me a line with an SASE (self-addressed stamped envelope) at the address shown above. The address of your check point will be sent to you. Don't send any cards to me unless you are sure there is no check point for your area. There are presently check points for most areas of the world and the U.S.A. (See list in last month's issue of 73.)

I want to caution everyone again about the possibility of sending in cards that are not authentic. Cards are inspected very carefully for such things as call-sign changes, date changes, signature changes and comparisons, and general card appearance—one that doesn't look like any card that has been submitted before. Remember fellows, I look at lots of cards and I know how most of them look. I also see many reports of stations that the DX'ers have been working—especially the rare ones. If you are the only one in the world that has worked some rare spot and you get a card for the QSO, I am going to write the sender of the card and ask questions. Fraudalent cards may disqualify you from WTW—we intend to make this an honorable award and we are going to keep it that way. I have been around a long time and I know something about DX; I also know something about photography and the printing business. But mainly I know what DX and other fellows have been working and I know what stations don't QSL as a rule.

Please police your own cards OM and let's both of us keep from embarrassing each other. I hate to have to say such things, but it's necessary because at times I have to do some of the things mentioned above. If your cards are good honest ones you have nothing to worry about. So much for the QSL card situation—I hope I have not made anyone mad by the above comments and remarks.

Everyone who has received our WTW Country/Tally sheets, please, in the blank spaces I allowed enter the obvious countries I missed. One of these days I will be making up new lists on a greatly reduced scale.

When they are ready for distribution I will let you know. Space will be allowed on them for about 10 years of record keeping and this time there will be *no* missing countries like the first run has. Another item I would like to mention is about QSL cards you send me or to the verification points. Please understand how we operate—we send $1.00 along with each application to *73 Magazine*. This helps defray the cost for the certificate, mailing and handling. Now the problem of returning your cards. Whether you want them returned by registered mail, or certified mail (cheaper than registered), first class, or third class is up to *you*. We will return your cards via the class of mail that you cover in your allowance for this. This is above and beyond the $1.00 for the certificate. Please don't send any cards directly to *73 Magazine*—this upsets our system and slows everything down.

I would like to say again that the WTW DX award is not in competition with any other DX award. It's a new DX award and will stand on its own feet. It's designed with the weary DXer in mind, something new for him to shoot for. If you are too old, and not interested in working the DX that's in there, it's not for you. There is always 75-meter phone, 10-meter short skip, traffic handling, etc., for those of you who are not DX'ers any longer.

Miller WTW Credits

The seemingly conclusive and massive evidence than Don Miller actually never visited the Laccadive Islands and actually operated from some other place when he signed VU2WNV/4 caused a good deal of distress for the WTW award committee, as you can appreciate. Obviously this meant that the serious questions that had been raised about other Miller expeditions should be considered with less weight being given to Don's "word" and more to the statements of others and the circumstantial evidence.

The award committee rapidly found itself getting into the same hassles as the ARRL committee, which is an extremely unenviable position. Happily, a solution suggested itself which seems simple in retrospect. Since WTW accepts any country for the award that is accepted by any national amateur radio society, it was a simple matter to carry this one step further and accept any DXpedition or unusual operation that is accepted by any national amateur radio society.

This is bad news for the DX'ers, unfortunately, for this means that the Don Miller operations at St. Peter and Paul Rocks, Heard Island, Chagos, Laccadive Islands, and Navassa Island cannot count for WTW, since not one national society accepts any of these operations as valid. And it seems highly probable at this writing that the ARRL DXCC Award Committee may at any time rescind its credit for the Baha Nuevo, Niue Island, Blenheim Reef, Minerva Reef, and one or two others, many of which will affect the WTW credits if deleted.

We would have infinitely preferred it if we could have accepted as many operations as possible for WTW, but the prospect of trying to get positive proof of where Don has or has not really been is exhausting for he seems to have little or no evidence to offer in support of his claims for his operations.

Worked The World Rules

The WTW award is issued by 73 Magazine and is available to radio amateurs who can provide proof of contact with amateur radio stations in 100, 200, 300, and 350 countries on one particular band using one mode. All contacts must be made within a five year period, with no cards dated before May 1966, the start of the award.

Now, to define our terms. A country is any place in the world which is accepted by any national amateur radio society as a "country."

Proof of contact is normally a QSL card which clearly shows the band used, the mode used, the call of the station contacted, the time and date of the contact, the signal report, and the location of the station sending the card.

Separate awards are available for phone and CW and for each amateur band.

Cards may be sent to Gus Browning W4BPD, Route 1, Box 161A, Cordova, South Carolina 29039 together with $1 or seven IRC's to help defray administration expenses or to any other societies or clubs listed in the WTW columns in 73. It is a good idea to send your cards registered and include first class postage for their return.

The WTW award is for your enjoyment and it is hoped that no one will attach more importance to it than it really deserves. Certainly, cheating is unforgivable.

. . . 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 W4NJF
2. Bob Wagner W5KUC
3. "Hop" Hopple W3DJZ
4. Bob Gilson 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

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

7 MHz CW WTW-100

1. Rex G. Trobridge W4BYB
2. R. Sigismonti W3WJD

NEW PRODUCTS

Lafayette HA-600

The Lafayette HA-600 is an all transistorized, general coverage, receiver which incorporates both 117 Vac and 12 Vdc power supplies. Covering five amateur bands, this new receiver uses 2 FET's in the front end rf stages to assure high sensitivity with a low noise factor. Ten high-performance transistors and 8 diodes compliment the FET's to provide a new high in receiver engineering. Tuned rf and mixer stages combine with two mechanical filters to provide high sensitivity with superior selectivity for AM/CW/SSB reception.

Other fine features include a variable BFO, series-gate noise limiter, avc, electrical bandspread, 100 kHz crystal calibrator product detector for SSB/CW, and accessory 117 V socket. Selectivity ±6 kHz at 60 dB down, ±2 kHz at 6 dB down. Intermedite frequency: 455 kHz. BFO frequency: 455 kHz ±2.5 kHz. Antenna impedance: 4, 8, and 500 ohms. Headphone impedance: 8 ohms. For further information about the HA-600 write Lafayette Radio Electronics Corporation, 111 Jericho Turnpike, Syosset, L. I., New York 11791.

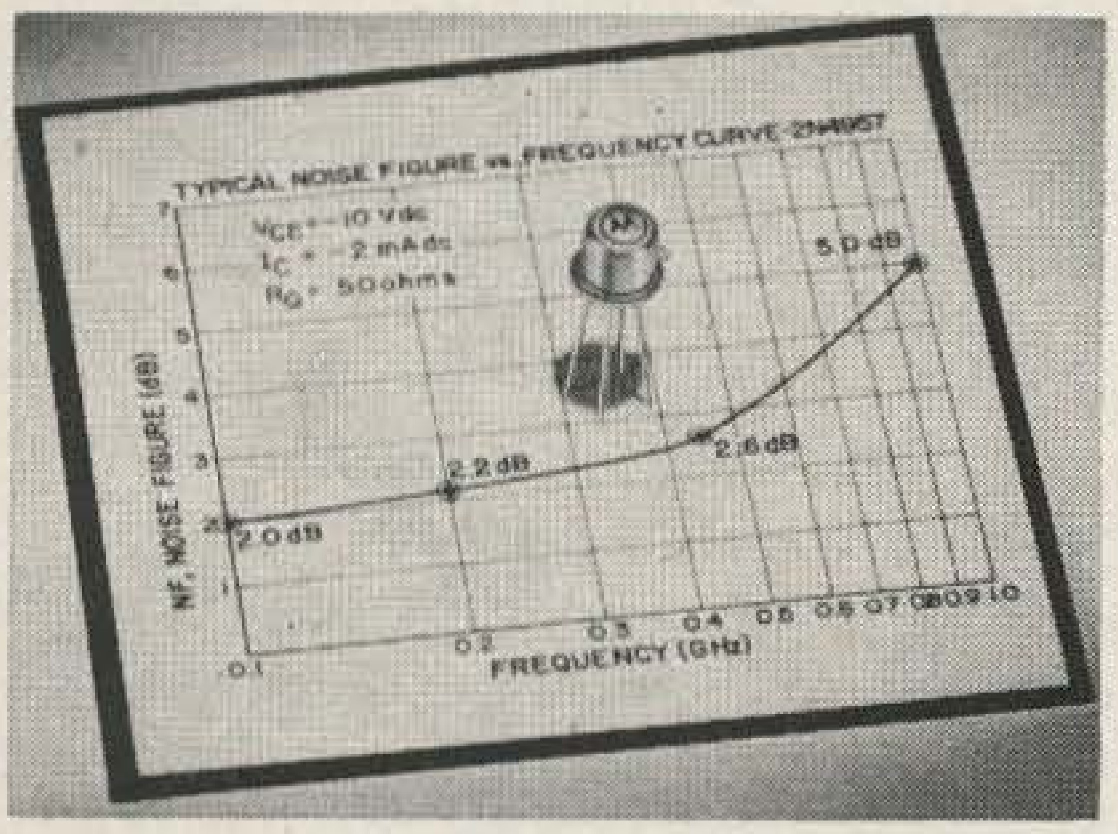
Barker & Williamson LPA-2000

Barker and Williamson has announced production of a new rf power amplifier capable of delivering the maximum legal power of 1 dc kolowatt input for the amateur service. Designated the LPA-200, this amplifier will deliver better than 1400 watts PEP output to the antenna at the 2 kW input level on SSB. The power supply utilizes silicon diodes to maintain low heat and maximum efficiency. The operator can select either 3000 volts for SSB, or 2100 volts for CW, RTTY, and tune up. Two meters on the face of the amplifier monitor all circuits. Relative output sensitivity can be adjusted from the front panel.

The B & W LPA-2000 Linear Amplifier is designed for a frequency coverage of 80 through 10 meters with overlap for MARS. It employs a 3-1000Z Eimac zero-bias triode with a rating of 1000 watts plate dissipation. This desk-top unit has a built-in power supply and uses forced air blowing for cooling. It stands approximately 18 inches wide, 16¾ inches deep, and 11 inches high; weight is approximately 75 pounds.

Complete technical details are available on request from Baker & Williamson, Bristol, Pennsylvania.

Motorola Silicon Transistors



A new series of silicon transistors for high-gain, low-noise amplifiers and mixers or other VHF/UHF small signal applications to 1 gHz is now available from Motorola Semiconductor Products Inc. The 2N4957-9 series of transistors features maximum noise figures as low as 3 dB and minimum power gains as high as 17 dB at 450 MHz in the common emitter configuration. At 1 gHz the 2N4957 delivers a typical common emitter power gain of 13 dB at a typical noise figure of 5 dB. This performance makes them well suited for critical front-end applications with a relatively low price in comparison with other transistors designed for operation at these high frequencies.

Further information and complete specifications are available from the Technical Information Center, Motorola Semiconductor Products, Inc., Box 955, Phoenix, Arizona 85001.

Shure Model 444T

This new variable output, transistorized base station microphone, specifically designed for radio communications applications, provides optimum performance when used with single sideband transmitters as well as AM and FM units. It is particularly useful with transmitters which lack sufficient gain to attain 100% modulation.

The Model 444T gets its variable output advantages from a built-in, two transistor preamplifier with volume control. The preamplifier unit is equipped with a self-contained battery with a life of over 300 hours. In design and appearance, this new microphone is similar to the Shure Model 444. It has an extremely rugged controlled-magnetic element, and provides tailored frequency response for highest "talk power" as well as protection from clipping or overload. The frequency response is 200 to 6,000 Hz. Other features include press to talk bar, adjustable height (9½-12 inches), and a rugged Armo-Dur case. For additional information write Shure Brothers, Inc., 222 Hartrey Avenue, Evanston, Illinois 60204.

Amperex Power Transistors

A series of silicon n-p-n Power Transistors, A200/A201/A202, which feature high-power output and high-power gain with excellent fail-safe characteristics, has been announced by Amperex Electronics Corporation. They are low-voltage devices, intended for use in

Antenna Handbook, Volume 1

Ken Glanzer's new *Antenna Handbook, Volume 1* published by Cowan presents some very good information, but be careful of errors, K7GCO's style of writing is charming and except for a few drafting errors, the illustrations are bountiful and clear. However, I found several places where I could argue for accuracy or generalization of specifics.

The author, for example, in referring to rf ammeters in balanced feeders between his tuner and antenna, says, "The rf ammeters will show unbalance in the feedline, indicate modulation percentage, relative impedance, and adequate grid drive." First of all, what unbalance in the feed system—the tuner, the antenna, the feedlines, or all three? Also, correct modulation percentage will be indicated *only* if a pure sine wave is used and carrier shift can nullify that; voice modulation cannot be accurately determined. Furthermore, the rf ammeters will indicate relative impedance only in the absence of reactance or its common power-factor problem. And lastly, the rf ammeters in the feedline will indicate adequate grid drive only in very carefully controlled laboratory demonstrations which are of little practical value to the ham. For the newcomer, this is too much generalization of fact if he seriously wants to learn the amateur game. The author has rolled over other minor sins almost as rapidly.

I regret very much that I can not recommend the first edition of this handbook to anyone who is unable to readily sort out opinion and typographical errors from what he needs to build his knowledge upon.

. . . George Bonadio W2WLR

Conductive Silver Epoxy

The Starnetics Company has just brought out a new aerosol-packaged conductive-silver coating called CS-1. This material results in surface sheet-resistivities of less than 0.1 ohm per square. It is air drying, and has applications in shielding, grounding, terminations and repair operation. Pure silver is dispensed within a plastic binder, resulting in a dense, thick, adherent film with a conductivity approaching that of silver. Trial six-ounce containers are available at $14.50 each. For further information, write Starnetics, 10639 Riverside Drive, North Hollywood, California 91602.

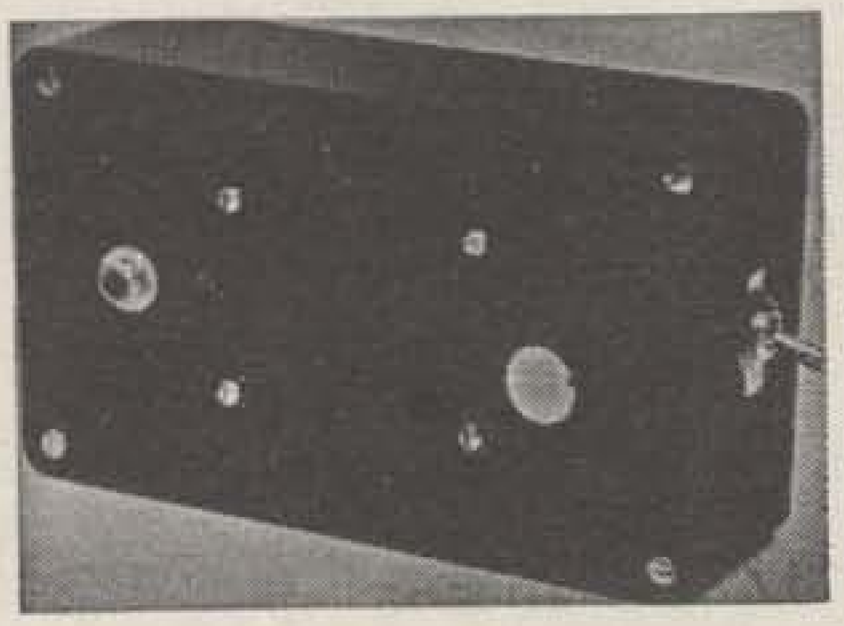
"HAM" BUERGER'S
October Specials . . .

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

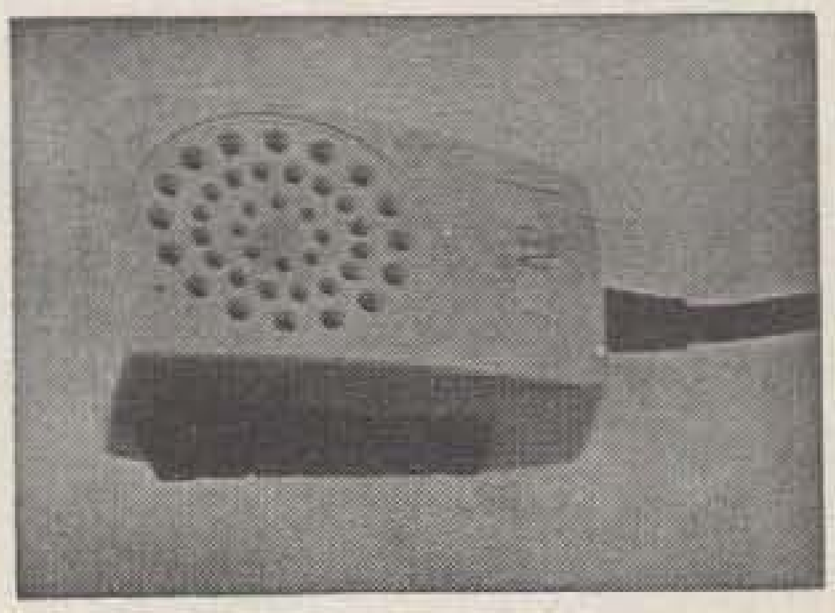


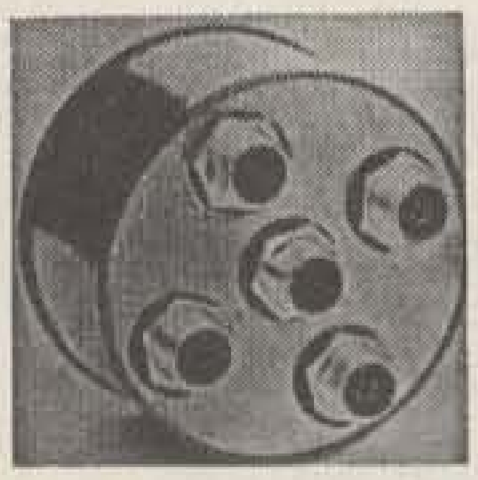
AJ-1 Audio Filter. Ideal for CW and SSB transceivers. Variable audio range. 28 dB down at 100 cps—peaks 200 cps. 4 ohm input and output impedance, built-in in and out switch. 6¼" L x 3¾" W x 2" D.

Special $7.95

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

$6.50



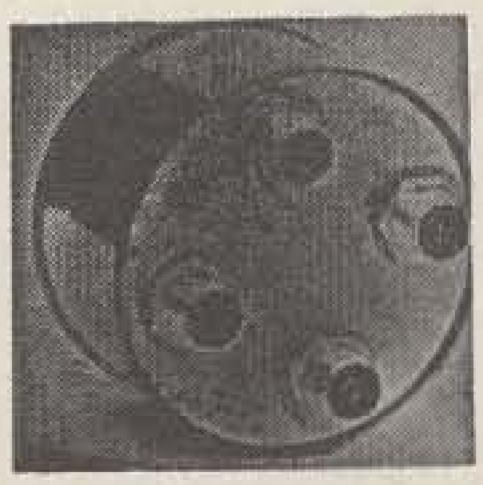


CO-4 4 Position Coaxial Antenna Switch. Uses low loss connectors and a ceramic switch. Complete with knob. Regular price **$9.95.**

Special price $6.95

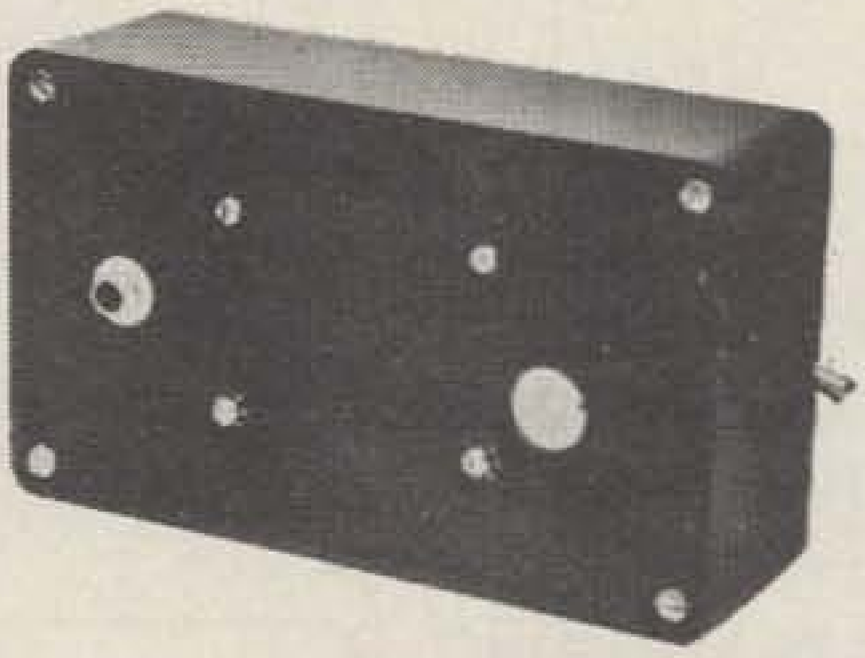
CO-2 2 Position Coaxial Antenna Switch. Same construction as the CO-4 switch to the left. Used for switching linear amplifier in and out of the antenna line. Regular price **$8.95.**

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.

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Transistors for Audio Frequency

Transistors are being incorporated into more and more amateur equipment today, and many hams are interested in their applications at high frequencies. However, before you can use them at HF and VHF, you have to know something about their characteristics and behavior at the lower audio frequencies. G. Fontaine, the author, provides a very detailed study of the principles of the audio frequency applications of the transistor, not by providing a series of amplifier circuits, but by a thorough explanation of the significance of the various parameters and the ways in which they can be used in the design of an audio-frequency stage.

The text is excellently illustrated, in many cases with three colors, and the mathematical calculations are kept simple and direct. The first chapter covers concentration curves, a relatively new means of explaining both static and dynamic effects of transistors, and stresses their importance. These curves can be used to explain characteristics, and to give a qualitative explanation of the capacitive effect found in semiconductors. The importance of these effects becomes quite clear when you start to use solid-state devices in radio frequency and switching applications.

The chapters in the second part cover small signals, transistor configurations, choice of coupling systems, stabilizing and biasing circuits, transistor noise, large signal response, symmetrical audio frequency stages, negative feedback, thermal behavior and cooling problems and practical circuit design. Whether you are a newcomer to solid state or a seasoned oldtimer, this book will be a welcome addition to your bookshelf.

Lafayette 1968 Catalog

Lafayette Radio Electronics Corporation announces its new 1968 512-page catalog, No. 680, with the latest in electronics and stereo high-fidelity, now available free upon request. This new catalog features all major manufacturers, plus Lafayette's own top-rated components. Several new pieces of equipment feature new integrated circuits. A complete selection of stereo hi-fi, citizens-band 2-way radio, tape recorders, ham gear, test equipment, radios, TV's and accessories, cameras, optics, marine equipment, auto accessories, tools, books, etc. The free Lafayette 1968 catalog No. 680 may be obtained by writing to Lafayette Radio Electronics Corp., P.O. Box 10, Dept. PR, Soysset, L. I., New York 11791.

Propagation Chart

NOVEMBER 1967

ISSUED SEPTEMBER 6

J. H. Nelson

EASTERN UNITED STATES TO:

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

CENTRAL UNITED STATES TO:

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

WESTERN UNITED STATES TO:

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

A. Next higher frequency may be useful this hour.

B. Very difficult circuit this hour.

Good: 2-5, 7-14, 20-25, 27-29
Fair: 1, 17-18, 25, 30
Poor: 6, 15-16, 19
VHF: 3-4, 13-14, 22-25, 28

W2NSD/1

(Continued from page 4)

But, let us see what the Department of Communications of the Government of India has to say about all this. ". . . the letter of January 3, 1967, which was claimed by Dr. Miller to have been issued by this Department to him and the authorization contained in it, has not been issued under the authority of the Government of India. So far as this document is concerned, it appears to be a clear forgery. Amateur licenses/permits are never issued by us in this form and the letterhead of the forged document is an old one which was in use in 1963 and before, and the officer under whose signature these licenses are issued is not Mr. V. M. Gogte, but another officer. Dr. Miller had with him a 1963 communication, addressed to him by Mr. V. M. Gogte that it would not be possible for the Government to issue him an amateur license to operate from Sikkim, Bhutan and Andaman Nicobar Islands, etc."

The Department of Communications, in another letter, says, ". . . the telegram to Dr. Miller asking him to contact Brig. Patel to collect his license for amateur operation from Bombay is an authentic one. But the telegram which has been claimed by Dr. Miller to had been received from the Indian Consul in East Africa . . . is obviously false and ficticious. The copy of the telegram does not at all indicate that it was sent by the Indian Consul in East Africa. In any case, there is no such person in East Africa . . . Neither the office in Mombasa nor the Indian Mission in Nairobi authorized any Dr. Miller at any time to operate any radio station from the Laccadives."

The same letter goes on to say, "It has been confirmed by the authorities in India that Dr. Miller never landed in any of the islands in Laccadives during the period."

Well, friends, would you say that there is a reasonable doubt left as to whether Don was either licensed or actually visited the Laccadives? If Don did not visit the Laccadives then most certainly a lot of hams have been hoaxed.

Isolated Incident or Pattern?

Let's dig back a bit into the past and see what we find. A letter from Iris Colvin just received from Sierra Leone and prompted by my September editorial says, "The only really authoritative statement that I can make about Don (or Chuck), is that Chuck was *not* on Ebon Atoll. The first that we heard about the problem of Chuck's operation from Ebon, was information from Jimmy Gima KG6SB, who is with Communications for the Trust Territories of the Pacific, in Saipan. He stated that he had had many complaints from hams saying that beaming directions would indicate that many of the Don Miller operations in the Pacific could not be from the stated localities.. It was believed that Chuck was actually on one of the Caroline Islands and, from the viewpoint of the Trust Territorial Government, operation in either the Carolines or Ebon was illegal, because no permission had been granted by the Trust Territories. Jimmy requested, officially, that we investigate, first-hand, as to whether Chuck had been on Ebon. Chuck's arrival and operation on Ebon would be almost like saying that someone had been visiting you in your apartment for several days, but you just didn't happen to see him or any evidence of his having been there. An operation on a remote island, where strangers are feared, and ships are a rare treat, where the area is constantly watched by the natives gathering food and the inevitable fishing boats, which must supply fish daily, where there is no electricity or lights at night, where any indication of unusual sounds or light would be noticed, is an impossibility which stretches the limits of the imagination. There was no grain of evidence to support the fact of his presence . . . no tin can . . . no cleared area . . . and not even a rumor of suspicion among the natives. There are other indications that Chuck was not on Ebon and that Don is even more involved than Chuck."

"We heard Chuck operating from Ebon and on several occasions gave him a call. Each time he immediately went off the air. After Chuck had rejoined Don we contacted him and asked for more information. Each time Don would take the mike and say that no matter what we thought or what Ebon we were on, Chuck had been on *Ebon*. It was Don who described the island, the one with the long wooden wharf. The description sounded good, except that there is no wharf on Ebon Atoll. Don is such a good salesman that I began to wonder myself if perhaps there were not another Ebon, one actually owned by Ecuador, but the latitude and longitude of his Ebon was the same as the Ebon on which we were then located."

"Don has many tricky tactics. He immediately accused us, saying that it was only our word against his. We sent a statement signed by the Officials of Ebon to the ARRL. A carbon of this document is enclosed. Someone should get to the bottom of Don Miller's questionable operations. Many hams have taken beam bearings and sent the information to ARRL, but no one has disclosed the full story to the world. If the accusations are true we should not wait for the State Department or foreign governments to take action. The hams should be allowed to decide what they expect of a good radio operation and then insist that these standards be upheld. No ham can exist without support of other hams and their QSO's."

"Everywhere we have been, the hams have been our greatest help in obtaining licenses. Previous DXpeditions or temporary amateur radio operation has served to open the doors for additional operations . . . at least to the extent that the previous amateur has helped to establish precedent and procedures for licensing. Illegal operations increase the distrust and misunderstanding of anything connected with amateur radio. When written approval cannot be obtained, verbal approval of the operation is the next best thing, especially if the amateur is friendly, helpful, causes no trouble, and creates interest in a new and fascinating hobby. A single few days operation should not be considered the end and completion of a project. If it hinders future amateur radio operation, it has failed, even though it may have temporarily succeeded as having counted as a one-time new country."

"The amateur fraternity has always been capable of monitoring it's own frequencies and have maintained a strictly non-commercial and non-political communication. This has developed into an international confidence between individual hams. This image of the amateur and this confidence that our bands will not be used illegally must be maintained. This is a job for the amateurs themselves."

There is little that I can add to Iris' letter. She certainly has made a point that every one of us should think about.

When the first rumors of irregularity reached me about the Ebon operation I asked Chuck on the air about it and got no answer. Then I called Don and asked him. He said that Chuck was positively on Ebon Atoll. I asked how come, if he was there, the natives had not seen him. Don said that Chuck had come in at night from the ocean side of the island and landed and had not gone into the lagoon where he might have been seen. Since the entire rim of Ebon is ringed by a partially submerged reef about 100 feet offshore this explanation was not credible. I've been on enough atolls to know you aren't going to land from anywhere but the lagoon and I've skin dived around enough coral reefs to know that you aren't going to fool around with them.

While Chuck's subsequent demise makes speculation about Ebon rather academic, it certainly is an interesting study as a Don Miller managed expedition.

As the evidence mounts up against Don, all hamdom is waiting for him to produce a documented report on his past travels that will once and for all prove that he did actually operate from the countries he says he did. Iris suggests this . . . I have asked for this . . . and perhaps all of you can get after Don when you work him and insist that he stop beating around the bush on this long overdue report. Don is a very sincere and convincing person when you meet him, and I know that all of us who had considered ourselves his friends are extremely upset that he has not come up with satisfactory answers.

Let's start with Laccadives. Here we have the Government of India flatly saying that Don positively was not there . . . did not operate from there. When you contact Don request him to provide an official document, such as a passport, showing that he was in the Laccadives during the VU2WNV/4 operation. I think you will get anger and abuse, but no proof. I would like to see a copy of the documents, and I know ARRL would. How about *you?*

Amateur Responsibility

"The amateur fraternity has always been capable of monitoring its own frequencies, and has maintained a strictly non-commercial and non-political communication. This has developed into an international confidence between individual hams. This image of the amateur and this confidence that our frequencies will not be used illegally must be maintained. It is a job for the amateurs themselves," writes Iris Colvin from 9L1KG in Sierra Leone. It is certainly about time that we got to the bottom of Don Miller's operations. There is no reason why we should wait for the State Department, the FCC, or foreign governments to take action. This is, basically, *our* problem.

A letter has just come in from the Indian Brigadier General who helped Don get his Indian license saying that, " . . . Don Miller never landed on the Laccadives Islands and, therefore, could not have operated from these islands. As a result of my intervention with the authorities he was issued a call sign VU2WNV. This was given to him for Bombay only and it was made amply clear to him that this license was NOT valid for operation from the Laccadives Islands."

Yet I have here a QSL card confirming a contact with VU2WNV/4, Laccadives Island, Don Miller W9WNV operator. This gives me the choice of believing either the Indian Brigadier General who, incidentally, is a good personal friend of mine, and whom I have every reason to trust, or Don Miller, who has so far refused to present any evidence proving that he was there, or, for that matter, that he was actually at any of the many other spots where serious questions have arisen about his true whereabouts. A letter to Don about this brought evasive answers. A letter to his attorney brought no answer.

It seems to me that every amateur who donated money to finance this series of DXpeditions has a right to know whether he has been the victim of one of the biggest hoaxes in the history of ham radio or not. I think all of us want some clear proof that Don actually was in the Laccadives when he said he was operating from there. Was Don, as the circumstantial evidence seems to indicate, almost 1500 miles from the Laccadives?

When it comes down to it, this is not my responsibility, it is not the responsibility of the ARRL . . . it is *your* responsibility. The amateurs who found beam headings off should raise cain. Every time a serious suspicion was raised, there should have been an outcry that could be heard around the world. And the very most of all, we should have been reading about this in the ham magazines long before this. Come on fellows, these are your frequencies, protect them.

The New Rules

Most of the fellows I've talked with on the air seem to have accepted the new regulations calmly. A few of the Generals were rather put out at the prospect of having big lumps of their phone bands taken away.

My first reaction is one of disappointment. I am disappointed with the ARRL for bringing this whole matter down on our heads and I'm disappointed with the FCC for getting conned into doing the ARRL bidding. I'm further disappointed that after all this effort the FCC passed up opportunity to move amateur radio ahead by updating band allocations and instead has, for the most part, just put us back where we were twenty years ago.

With the bottom 50 mHz of 80-40-20-15 allocated to Extra Class only, the fellow who is going after DX in the future will have to have an Extra Class license or else he just isn't going to have a ghost of a chance on CW.

Now it most certainly is true that most of us can get that Extra Class license if we really want it. The fellow who is interested in CW will automatically get his code speed up over the 20 wpm requirement, so that is no real obstacle. The phone man merely has to sit down and practice code for a few months, like it or not. Of course, as the armed forces found when they taught code, there are about 25% of us who just will never be able to do much with code, no matter how hard we try or how long we work at it. Too bad about them. Tough luck.

Assuming that you do have a natural sense of rhythm and that you swing with the code, there is still that matter of the theory exam. I ran a poll a few months ago and found that ⅔ of the Extra Class readers of 73 are working in electronics. By the way, over 90% of the Extra Classers read 73, whatever that means. I've talked with a few non-engineers on the air that have managed to get their Extra. They reported that it took a massive effort on their part to make the grade, but that they felt a great sense of accomplishment when they made it. Very few have gone this route so far. The great bulk of the Extra Class licensees are long time CW ops who are engineers and had merely to report for the exam to pass it.

The DXer either has to specialize in 40 or 20 meter phone DX'ing or else get that Extra ticket. Even 80 and 15 meter phone DX'ing will be out for him. This isn't too serious for there are only about 10,000 ops who are interested in DX chasing anyway, so only a small percentage will be affected. The great bulk of the active amateurs will be able to continue their rag chewing, RTTY, traffic handling, emergency nets, VHF, and the like unperturbed. Perhaps we could start a Help The Needy Plan for DX stations to occasionally come on up to the General Bands and be kind to the handicapped.

Reciprocal Licensing

Agreements with foreign countries are coming along, but very slowly. It seems to take years for simple paperwork to pass through Foggy Bottom. A letter from a U.S. ham in Spain gives us a good idea of what some of the problems are that other countries have to face when dealing with State. "I can tell you what is holding up reciprocal licensing between the U.S.A. and Spain. A guy named Black in our own State Department in Washington who continues to insist that the U.S. hams must have privileges in Spain that just are not available to the Spanish themselves! I persuaded the Embassy to go in with recommendations that a treaty be signed allowing reciprocal operating privileges under the existing regulations of both countries—no soap with Black, so the better than 90 hams here who can meet the Spanish requirements are left in the cold and without U.S. support." He goes on to say, "We need heavy support from the hams in the U.S., and I do not mean the ARRL, as they seem to care less. All I get from them is platitudes."

Another U.S. ham, recently returned from Yugoslavia and Hungary, reports that they are, for the present, issuing licenses unilaterally to visiting hams. Since the number of YU and HA hams visiting the States is about zero I can see why they might not worry about reciprocal licensing. When I visited those countries a couple of years ago they were on the verge of this move, so it doesn't surprise me. Our little Vietnam do seemed to be holding things up as much as anything, at the time.

Back issues

Each month we have tried to print a few thousand extra copies of 73 so that we would have them available as back issues. Recently, with the 84th issue of 73 coming out, even our large storage facilities were beginning to feel the strain. We checked with the post office to see if old magazines might be mailed as books since the advertising was well out of date. Getting an OK on this, we published the ad for the back issues at $1 per year, figuring that it would cost us about 25¢ per bundle to gather them together, wrap them, address them and mail them. The postage should have been about 20¢ per year, plus perhaps another 5¢ for record keeping, and leaving 50¢ profit each. Alas, after the first few hundred bundles someone got eager at the post office and word came back that the postage would have to be for parcel post or the transient magazine price, which came out to close to $1 per yearly bundle. Too late to do anything about it now . . . the ad had not only run in the August issue, but was set for September and it was too late to stop it. We appealed all the way to Washington . . . no, advertising is never too old to be anything but advertising and we would have to pay the full postage charges.

Adding up the disaster, and neglecting the original cost of the magazines of about $3.00 per year just for the printing, we managed to take an interesting net loss on the project. If any of you readers find you are really enjoying the back issues we have sent to you we will not reject any conscience donations. We might even pull one or two of the pins out of your voodoo doll.

Say, while you're sending money, why not include an extra $3 each for binders to hold all those magazines? This keeps friends from barrowing them as well as making them look FB on the shelf. Our binders are stamped with the year so don't forget to tell us what years you have. ...W2NSD

The View from Here

(*Continued from page* 2)

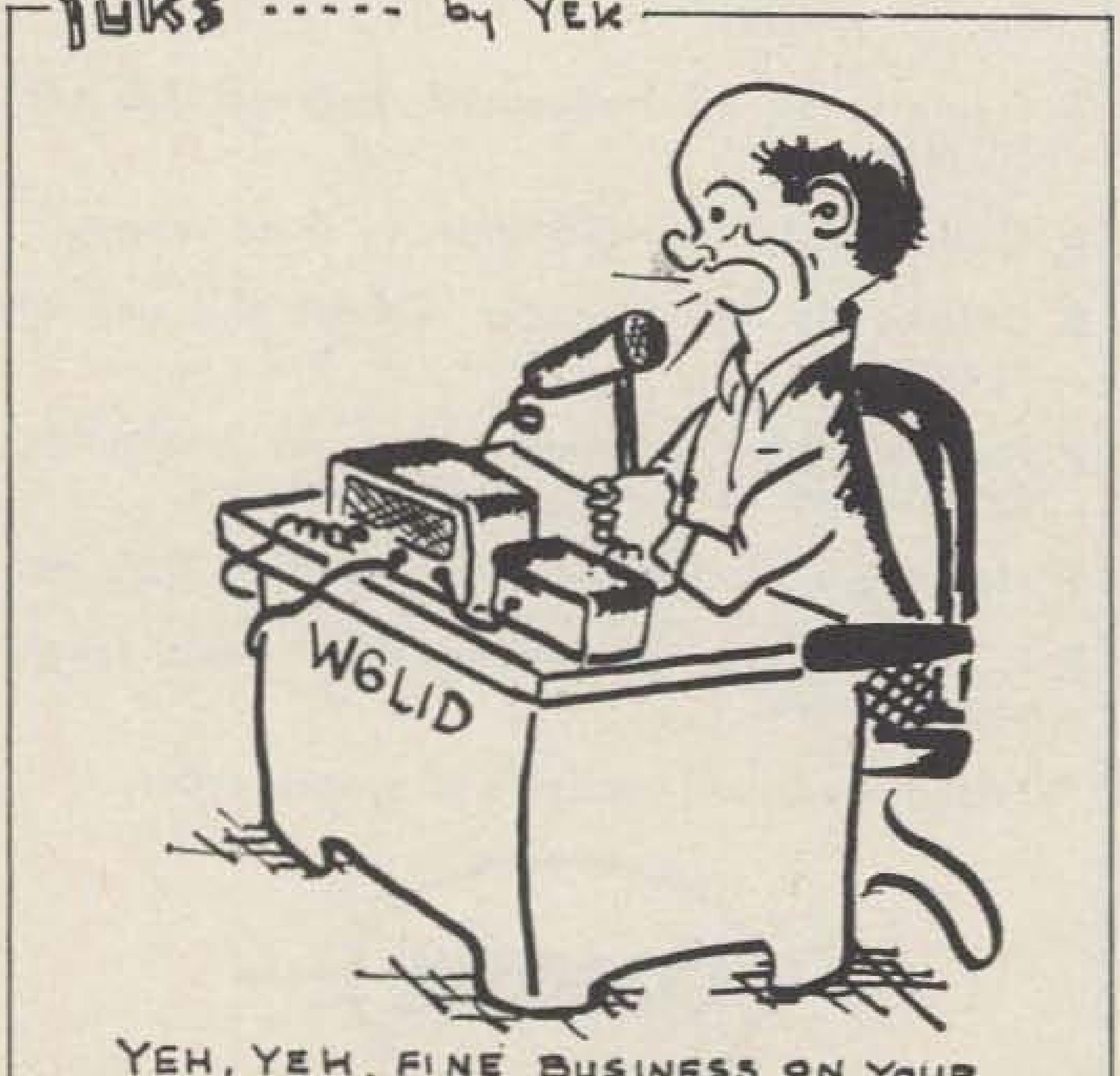
strictions, the same will apply to the General who passes the Extra exam, and operates in the restricted parts of the band.

Although Wayne is covering the DXplosion pretty much, I would like to report that we have strong evidence that Don *was* legitimate on Niue Island. I gather that the natives were a bit restless and that they wouldn't welcome him back for a second time, but he *was* there at the time he said he was. Chalk one up for Dr. Miller. The license was issued to Ted Thorpe and the call sign was ZK2AF.

In a letter from ZK2AE, he tells me someone has been bootlegging his call. Harry is the only ham operating from Niue at the present time and is active *only* on 75 meter AM! He has been receiving cards for SSB contacts on other bands and would like this clarified. One card said the signal had come in from a heading toward South America. Harry says, "Unless we accidentally got moved into the South Atlantic by General De Gaulle playing with fireworks not far away, we are still where we should be (Longitude 169° 50′ W and Latitude 19° S)." He also mentions that he is awaiting a SB400 from Heathkit, and if it ever arrives he will be available to give all of you that needed ZK2 card.

. . . WØHJL

Yuks ---- by Yek



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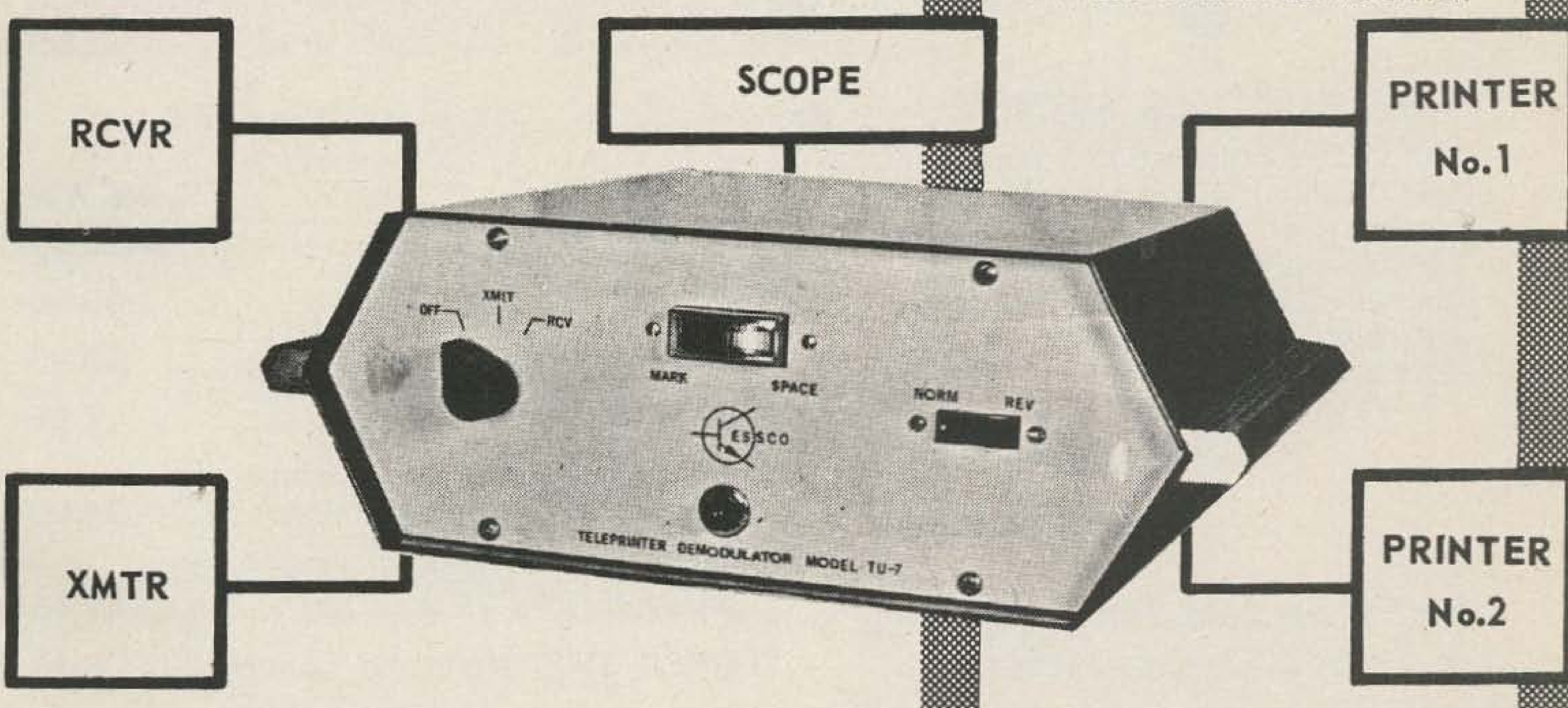

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SM-1, Sel. Mag. Driver	$24.95	$29.95

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Letters

More AM/SSB

Dear 73,

. . . I'd like to congratulate you on your editorial in the June issue. It is about time someone had the fortitude to present a case against "Ancient Modulation". It would be wonderful if someone proposed to the FCC that a law be made outlawing A3 operation, say in two years. That would give the few diehards plenty of opportunity and time to make the changeover. That such a ruling is going to be necessary is a certainty. There will always be a few individuals that will hang on to the last, regardless of the fact that AM is spectrum wasting and less efficient than sideband.

Joe Hiller W4OPM
Virginia Beach, Virginia

Be careful about saying A3, Joe . . . SSB is also A3!

Dear 73,

Your editorial on SSB and AM has certainly raised some eyebrows. Whether or not I agree with your opinions is immaterial; I congratulate you for taking a definite stand on the issue.

Jack Dolcourt
Lakewood, Colorado

Dear 73,

. . . DTY says he is not advocating appliance operating. If he isn't then I must have read his articles wrong, because unless a new ham has a fat wallet, what chance has he of going to SSB? I don't think there are many hams starting out in the hobby that are technically qualified to build a SSB rig on his first home-brew project. This is usually worked up by building a few CW and AM rigs first and learning along the way. The man who can lay a thousand bucks on the counter, take home and plug in his appliances, and as NSD says, make a noise that can be heard around the world sixteen hours a day, is nothing more than a high-power CB'er with ham privileges. There should be more to our hobby than flicking a couple of switches and talking.

. . . My subscription has over a year to go yet, but unless your magazine adopts a more tolerant and responsible policy, I am going back to the competition, whose magazine is not so good, but their policy is easier to swallow.

Bob Young VE3FCW
Fruitland, Ontario

Dear 73,

Since you wish to eliminate all AM I can well do without ur *73*. At 76 years of age, I am not investing in rigs that may well be obsolete (SSB) in 5 years or so. Of course you are so BIG now that losing a few thousand old timers don't matter. W1DTY is going to help you a lot—or is he? I serve MARS about 80 hours a month on AM and doubt if he is serving his country that much on SSB.

Bruce O. Cline
Christiana, Tennessee

MARS has eliminated AM operation on all frequencies except VHF.

Dear 73,

. . . It seems to me the idea of eliminating AM phone is contrary to the principles *73* has stood for in the past—that is, home brew and non-appliance gear? What about the new ham? what about the fellow to whom $100 is a lot of money? There was a day when a fellow could get on phone with an 807 and an ARC-5 and have lots of fun. To eliminate AM would be to force the inexperienced ham and the fellow who isn't rich to forfeit half the fun of ham radio.

. . . Why not allot the high end of the 10 meter phone band to AM phone only, for novice and general alike, especially since most SSB gear these days won't go up there anyway?

Clarence Wager K6TBW
Paradise, California

Dear 73,

Just received my August *73* . . . I enjoyed very much the "letters" section and had a couple of good laughs under "SSB vs. AM". Who are those "Ancient Mariners" trying to kid? "SSB is on the way out"; "DSB would defeat SSB"; etc. AM is a nice way of communication but people who make remarks like that are either selfish or ignorant. Selfish, because they like blanking out 10 kc (at least) with their FB carrier . . . and ignorant because they don't appreciate what SSB has over AM.

Mike W. Palawaga VE5PI/3
Ottawa, Ontario

Dear 73,

After reading the comments on "The View From Here" by W1DTY, I want to say I have nothing personal against Jim, but I think you should keep your editorials neutral about AM and SSB. That is why I dropped *QST* and *CQ*. I have talked to a great number of prospective hams and here is a general view of what they tell me: "We are very much interested in amateur radio, but we cannot afford to buy commercial transmitters or transceivers and what is the use of getting or building an AM rig when all the radio magazines are against our using AM? . . . it isn't worth while, so we are going CB".

Of course I know you won't believe this because your mind is fixed and nothing will change it. I'm not going to get anything beyond a General, so I will go on 10-6-2 later. I don't like the minority that tries to force the majority . . . or else.

Edgar J. Bowser
Rumford, Rhode Island

Dear 73,

. . . It is editorials like yours that are going to split the amateur radio fraternity into two warring parties, each bent on destroying the other. Evidence of this can be seen already on the bands and it is getting worse all the time.

I could care less if SSB is more efficient than AM. If you want to get nasty, I could spend hours listing the advantages of CW over SSB and could even advocate the elimination of phone altogether.

Amateur radio must stay together to work towards a common goal, and fighting on or off the bands is not helping to further amateur radio.

Michael F. McCrackin WB6SCV
Anaheim, California

Dear 73,

I hope you don't mind long letters because I am afraid this is going to be a long one.

First of all, the AM vs SSB controversy. I personally think that AM should be outlawed on 80 through 10 meters. On 160 and the VHF bands it is ok. I want to quote from the **NAB Engineering Handbook, 5th Edition*. This is what it says about CSSB (Compatible Single Sideband).

1. An effective 2 to 1 power gain for a given signal fidelity.
2. A reduction in adjacent and co-channel interference.
3. A reduction in certain types of selective fading distortion.
4. A potential improvement in audio fidelity which, besides improving reception of musical programs, improved intelligibility of speech, thus increasing service range.
5. A reduction in television-receiver radiation interference.

I don't know if you know this, but three broadcast stations in 1958 were using CSSB. They are KDKA, Pittsburgh; WABC, New York; and WSN, Nashville; with KBIG, Catalina Island adding it later. This fact was not too well publicized. There are probably more stations using it now. CSSB is quite similar to standard AM transmission, except that the spectrum energy is concentrated on one side of the carrier (thus making it possible for the little table top radio to receive the broadcasts).

This quote from the NAB is what KDKA says about CSSB.

"The chief gain to KDKA of using CSSB is the reduction of adjacent channel interference between KDKA on 1020 kHz and WBZ in Boston on 1030 kHz. The removal of KDKA's upper side frequencies has relieved interference to WBZ's reception, and the ability of receivers tuned to KDKA to tune slightly off resonance away from WBZ and toward the radiated lower sideband of KDKA has also given KDKA some additional immunity from WBZ.

Next, please don't cut down on CW saying it is outmoded. Maybe it is, but there is one thing that most confirmed CW addicts will tell you and that is that CW is *fun*. Another thing, don't let anyone tell you that the 20-meter CW band is 14.000 to 14.200. It's not! It is 14.000 to about 14.080. RTTY from 14.080 to 14.100, and foreign SSB from 14.100 to 14.200. No argument intended; just a fact.

One more thing, please look into this Don Miller thing. I heard him talk down at the Dayton Hamvention and I don't think too much of him.

Charles Collingwood WA8PVN
Findlay, Ohio

*National Association of Broadcasters.

Dear 73,

Well, you really did it this time! Technically speaking, there can be no question about the fact that SSB is superior. It is, and any engineer can prove it. But that still doesn't mean that all of the AM boys should be shot out of the saddle. In spite of the popular rumor, the bands are not that crowded . . . yet.

. . . Wayne stubbed his toe in September *73* also. In his DX'ing article it sounds like Wayne is secretly advocating illegal overpower operation. Assuming proper operation and reasonable efficiency, since when is a "big" 2000 W PEP any stronger than a "small" 2000 W PEP? Of course the FCC measures average power, and there is a difference. Wayne can't tell me that he doesn't know that a large number of the boys with the "big" kilowatts are habitually running over the legal limit.

Oh, yes, I'll renew. It's still a good rag.

William J. English WA4RME
Miami, Florida

Dear 73,

. . . Maybe the AM operators who don't know enough to build a sideband transmitter should have a march on Washington . . . and turn in their licenses. And, for that matter, so should a lot of SSB operators. The ones who don't even know how their transmitters work. Oh, sure, they know it has a crystal filter (maybe) and it has audio phase shift network (maybe), but they don't even know what the words mean.

Anyone who thinks a sideband transmitter has to cost 30 dB above 1 dollar (that is calculated by 10 log because money is power), drop me a post card (6 dB above a penny is what they cost), and I'll send you plans for a sideband rig you can build for $25.

Re your August editorial . . . all you hams out there who start yelling about novices on 10 meters; *don't yell!* It's a great idea. Maybe we can get some operation on 10, and if we get it, maybe, just maybe, 10 meters won't go the same as 11 meters did.

Give the novices part of 10 meters. Let them run 75 watts on AM and CW, extend the license for 2 years and SAVE 10 meters.

Joe Hollan W4BGN/3
Annapolis, Maryland

Dear 73

I just finished thumbing through the September issue of your magazine, and was inspired to write this letter on the AM-Sideband feud. I believe that both modes have their place, but what about NBFM, FM, PM, and ultra narrow band FM (160 Hz wide)? Surely these modes are compatible, especially on VHF. But the simplest fact is that you hear very few stations using these modes. I feel sure that bands like 160 meters are ideal for Ultra NBFM. Because it is FM it is not susceptible to QRN and LORAN, and because it is narrow band, it prevents QRM to other stations.

What is happening to the ham community, are we satisfied to fued over SSB and AM, and not even try to use the other modes of operation offered to us?

Carl Russo WA1BOZ
Waltham, Massachusetts

Dear 73,

I agree that SSB has it's distinct advantages; however, I do not feel that it is right to completely eliminate AM from the specified bands. I think SSB'ers should have half of each band to themselves, and AM'ers the other half. Many hams already follow this unwritten law.

Alex Arevalo WA5MZU
San Antonio, Texas

Dear 73,

In reading your article in the July '67 *73*—you want to know why there are not many taking an interest in ham radio? Well, I would like to be one, but I find I can't quite do 13 words a minute. Written test—not so bad. Maybe that's why I joined the CB's too.

Just a reader of 73 magazine
Lansing, Michigan

QSLs

Dear 73,

Like many others, I used to sit at the home QTH and complain about how the DX never QSLs. When I arrived in Scotland, I swore that I would QSL 100%, for sure. After six months of operation, I've had a chance to see the American ham in operation. Keeping in mind that GM-land is hardly rare DX, here is how the Ws stack up so far with me.

Prefix:	W1	W2	W3	W4	W5	W6	W7	W8	W9	WØ
Sent:	27	45	27	27	14	21	15	32	23	19
Rec'd:	14	24	18	12	9	11	9	10	15	11

Return percent: 52.8%.

. . . So far I have sent out over 1400 cards and have received some 350. Like most of the boys here, I will continue to send them out when requested, plus or minus a mistake now and then. All most of us ask is that you do not say you *will* QSL and then *don't*. A QSL is never required for a QSO. After having a ticket 18 years, I do not suddenly expect 100% return, but do expect the boys to keep this in mind when they complain.

Doc Kelly GM5AFF/W7NXJ
Edzell Angus, Scotland

Bouquets, etc.

Dear 73,

I should send you a doctor's bill for getting my eyes uncrossed over that up-side-down figure on page 15 of the August issue, but the Army did it for free, and besides, the article on "Designing Transistor Oscillators" cured several headaches for me, so we are even. Aside from the ramblings, I feel that you are doing a tremendous job in the electronic field in the state-of-the-art department. Just reading your fine articles is an education. I don't know if you are getting the fine authors because you are tops in publications, or if you are tops in publications because you get fine authors. Don't care. Just keep it up.

Glenn H. Kuklewski K8UST
Huntington, West Virginia

Dear 73,

Thank you for your fine magazine, and for Heaven's sake, don't ever publish the kind of trash the other two do.

Michael Mladejovsky WA7ARK
Salt Lake City, Utah

Dear 73,

Covers like the one on *73*, August 1967, and articles like 'Climbing the Novice Ladder" make me say 73 to 73.

Jon Fortune WN1TTO
Reynolds, Illinois

Dear 73,

I have just read my first copy of your magazine and as far as I'm concerned it is one of the best magazines I have ever come across. I find the articles excellent, and appreciate the fact that you have both American and Canadian authors.

Although I am only a ham to be, I have been studying amateur regulations and procedure for three years. I feel that Jim Fisk's editorial on the decrease in the number of amateurs and lack of publicity for amateur radio is much more serious than meets the eye. The one thing Jim's letter has going for him is the urgent need for more electronics technicians. However, I feel that what would be more beneficial to amateurs at the present time, would be to raise the interest level for amateur radio in other countries.

From what I gather, every country has one vote at the Geneva convention as far as the frequency allocations are concerned. If there is a sufficient number of countries who vote for the withdrawal of amateur stations from certain frequencies, then the present crowding conditions will worsen. If the countries concerned could be shown the benefits and advantages of having amateur radio, they may be more willing to promote it.

I therefore feel that it is up to us, the amateurs (I'll be included soon) to firstly publicize amateur radio in other countries to get their support, and then to publicize in our own countries.

Ronald Rosmer
Salmon Arm, B.C., Canada

Dear 73,

Why are we so concerned about what the manufacturers believe is right for amateur radio? Was it they that made ham radio possible? As far as I am concerned they should stay on their side of the line and just continue to sell equipment to those wishing to purchase their products. They should stay clear out of amateur radio politics unless asked for an occasional opinion or comment.

It will not be the manufacturers who will pull amateur radio through the next Geneva Conference but it must be us amateurs ourselves. And we had better get to work and support, petition and uphold both the ARRL and FCC in these matters.

The manufacturer has a primary interest in the mobile radio services (police-fire-taxi) and will not place amateur radio or even CB for that matter, ahead of a more profitable business. They are fighting us now for more frequencies.

Gary L. Carlson KL7FRZ
Haines, Alaska

Public Service . . .

Dear 73,

Last evening when I tuned in the radio there had been a previous call thanking a ham operator for some service. While I was listening, someone called and gave your address and said you would be happy to hear any comments.

My niece's husband volunteered to go to Antarctica for one year to further the study of meteorology for the US Government. Each week, through the kindness of a ham operator, my niece was able to talk to her husband by telephone, sometimes for as long as a half hour, and at the cost of a local telephone call. Needless to say, these calls were a Godsend, not only to my niece's husband to learn about the family first hand, but to all other men when they received an opportunity to talk to someone from their own homes.

Keep up the good work and do want you to know how much we all appreciate the great kindness and generosity of these good ham operators.

Margaret Sammon
Arlington, Massachusetts

Dear 73,

I wish to inform you of a service rendered my family by a ham operator. The operator, George Jette W1UE of Wellfleet, Mass., called our home to tell us that he had received a message from our son who is attached to the USS Forestall. The message informed us that he was OK and would write soon. Of course we were elated as we had been waiting anxiously for word as to his well being since the disastrous fire. Once again, I would like to say how much we appreciate the above service.

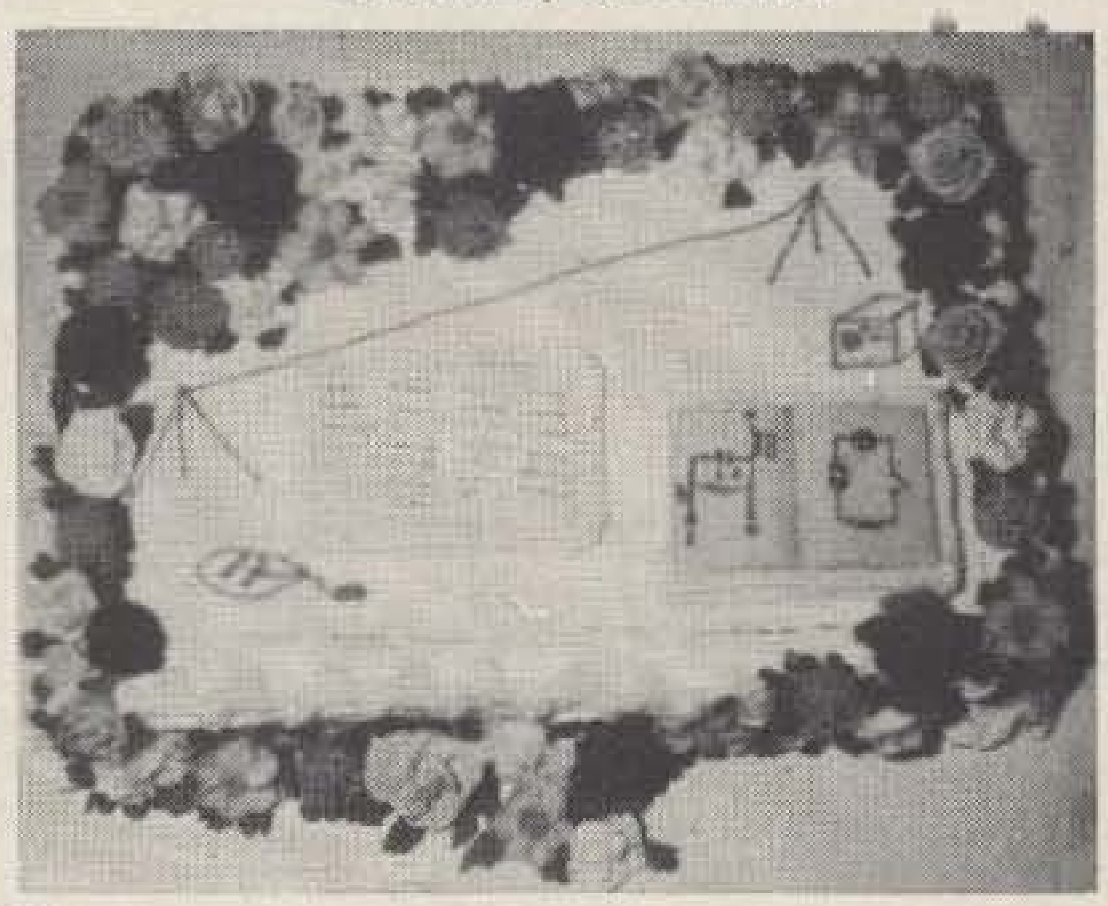
Mr. A. Martin and family
Malden, Massachusetts

Thanks go to several Boston area radio stations who have been giving us some nice publicity recently.

Dear 73,

Our club regularly conducts free Novice, General, and Extra Class courses. At the concluding session of our last course, one of our student supplied the cake shown in the accompaning picture to celebrate the successful completion of the course. He and his wife baked and decorated the cake for the group . . . we thought this might be of interest and might stimulate interest in running courses in a few other clubs.

Marie R. Welch WA6VTM, President
LERC Amateur Radio Club W6LS
Burbank, California



Dear 73,

Gee fellows, you are doing a great job with **73 Magazine.** For my money it's the best. In fact **73** has eliminated all other ham magazines from my mail box. Other subscriptions are checked at the book store and seldom do we have to buy brand X because it has been covered in some issue of **73.**

However, anyone who plays with electronics will soon have a short circuit. Even when writing about electronics, it is possible to develop short circuits.

If you will refer to August 1967 **73** on page 115 you will find a very fine article by Jan Underdown, **K8LUR** of Napolean, Ohio. While Jan's article on phone patching is very timely and informative, I just can't buy his call letters. I'm **K8LUR.** Where's the short circuit?

Walt Wilkerson K8LUR
Elkins, West Virginia

Sorry about that Walt, Jan Underdown is K8LVR.

Dr. Miller?

Dear 73,

With interest I read your write-up on Don Miller W9WNV in the July 1967 issue . . . With reference to Don's DXpedition to the Laccadives, my comments are as under:

a) In August 1966, I asked the Government of India for permission to operate from the Laccadives for a second time. After several reminders, I was given the hint—"No permission".

b) In January 1967, I was told that Don had been to the Laccadives and operated from there. I took up the matter, through our Society, and questioned my government for refusing me permission while granting the same to a foreigner.

c) The Licensing authorities here categorically denied having issued permission to any foreigner to operate from the Laccadives. Consequently the Editor of the IRA intimated to the ARRL about Don's "Mischievous operation" from the Laccadives. This was done to warn other hams not to flout rules and regulations of a country and indulge in such unauthorized activities which might ultimately endanger the Reciprocal Agreements.

d) Thereupon the ARRL sent us a photostat copy of an authority, presumably issued by our government, which permitted Don to operate from the Laccadives. With this photostat copy we rushed to our licensing authorities for their comments—**we were furious!**

e) Detailed investigations of the police, customs, and port authorities confirmed that no operation was carried out from the Laccadives and the photostat copy submitted by Don Miller was a **"Forged document"**. Investigations also confirmed that for this purpose, Don used a letter issued by this Government about three years back. To reveal facts, the Licensing Office in this country has long been redesignated and the officer whose signature appeared on the document has not handled Amateur License portfolio for the last three years. Our government has addressed a letter to ARRL giving all the information in this regard.

Needless to say that in this part of the world, we amateurs do not attach importance as the W/K boys do to this facet of ham radio viz., DX hunting. However, in 1961, I carried out the **first** DXpedition to the Laccadives and recently I had been trying to go over there once again but failed to obtain permission in spite of my being an official in the Ministry itself. As such, there is no question of my trying to out-maneuver Don in his sport.

Besides, for the last eight months, no fresh licenses have been issued to hams in this country, the policy being under review. **Hence, any operation by Don Miller from the Laccadives would again be nothing but "fraud".** Thus far, we were avoiding any sort of write-up on Don's Laccadives operation in the IRA but now the situation demands it and the next issue shall bear a write-up on this vital subject.

B.A.N. Raju VU2NR
New Delhi, India

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REED RELAYS SPST-N.O. Coil rating: 2.9 volts at 12 ma. Contacts rated for 12 VA; max. 300 volts or 0.50 amp. Sample usage circuits included. Body size 1" x ½". New low price $2.35 plus 25¢ handling and postage. Airstar Products, P. O. Box 323, Marion, Iowa.

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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. W1DTY, RR 1, Box 138, Rindge. N.H. 03461.

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.

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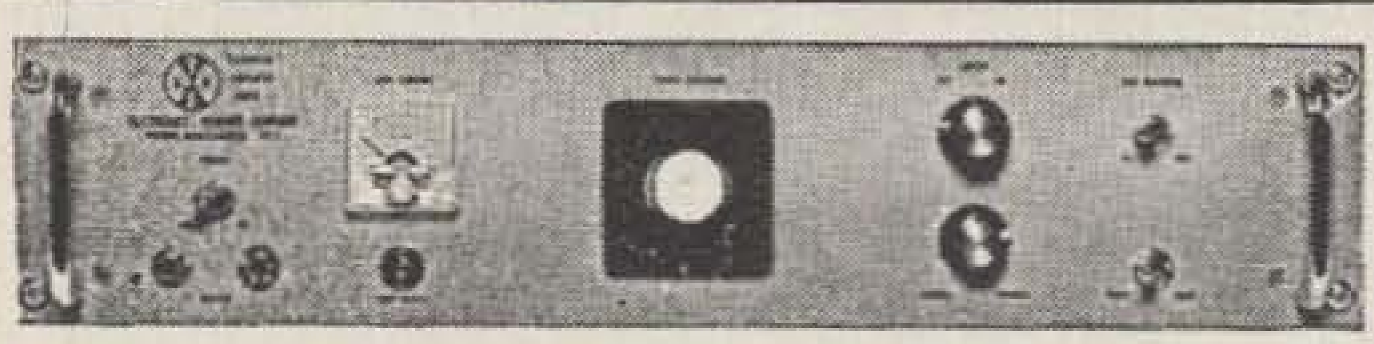

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MOTOROLA new miniature seven tube 455 kc if amplifier discriminator with circuit diagram. Complete at $2.50 each plus postage 50¢ each unit. R and R Electronics, 1953 South Yellowsprings, Springfield, Ohio.

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SELL BC-348 receiver, excellent, $50.00. B&W FC-30A & filament transformer, 7.5 V 21 Amps, both $25.00. W6WGJ/5, 4215 Darwood Dr., El Paso, Tx. 79902.

MIDWEST VHF GROUP, 2nd annual ladies night and get-together will be held at the Rolling Meadows Holiday Inn (Chicago area N.W.) on Saturday evening November 4th. Reservation and dinner $5.00. Send to Ken Lane, W9VIT, 3400 Meadow Drive, Rolling Meadows, Ill. 60008, 312-255-7281.

WRL's used gear—trial—terms—guaranteed. NC303—$199.95; 2B—$199.95; HQ170AVHF—$279.95; SB-300—$239.95; Galaxy 300—$149.95; SR150—$269.95; 753—$119.95; G76—$99.95; 650A & VFO—$99.95; G66B—$39.95; Viking 2—$84.95; Champ 350—$84.95; Champ 350—$149.95; Thor 6—$169.95. Free "bluebook" lists hundreds more. WRL, Box 919, Council Bluffs, Iowa 51501.

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RTTY-NAVY URA8A discriminator subunits. Unused complete with tubes, data and schematic. Hurry; we have only 10. $10 postpaid. Terry, K7LWY, 1004 NW 178th St., Seattle, Wash. 98177.

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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.

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AMATEUR RADIO: Its Effect On Society. Masters research paper $2.00. A must reading for all hams. Michael K. Gauthier, K6ICS, Box 216, Lynwood, California 90262.

COLLEGE EXPENSES: Eico 753/solid state VFO, variable ALC; 751 AC P/S. Good condition, both for $150. W8DND, Phil DeCaire, 3074 Evanston, Muskegon, Mich. 49442.

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WANTED: RFL-107A magnet charger, also RFL-889B magnetreater or substitutes. W5VP, 1118 Del Rio Dr., El Paso, Texas 79915.

CAN'T GET THE CODE. Sell Knight R-100 receiver, Ameco 15-watt transmitter, 2-meter converter, all. Best offer. Lowell Terry, Route 4, Box 27, St. Charles, Mo. 63301.

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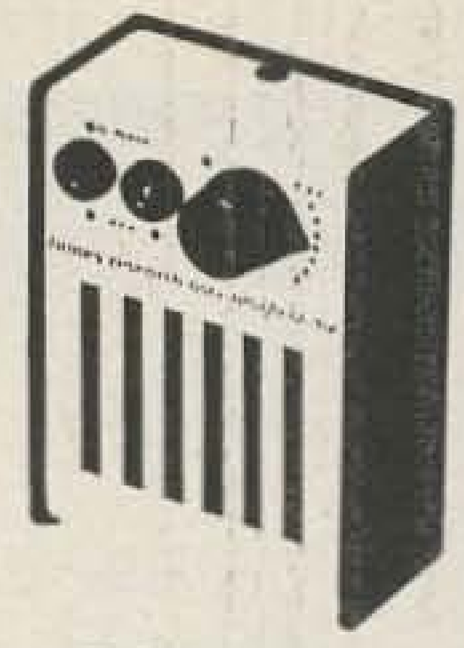

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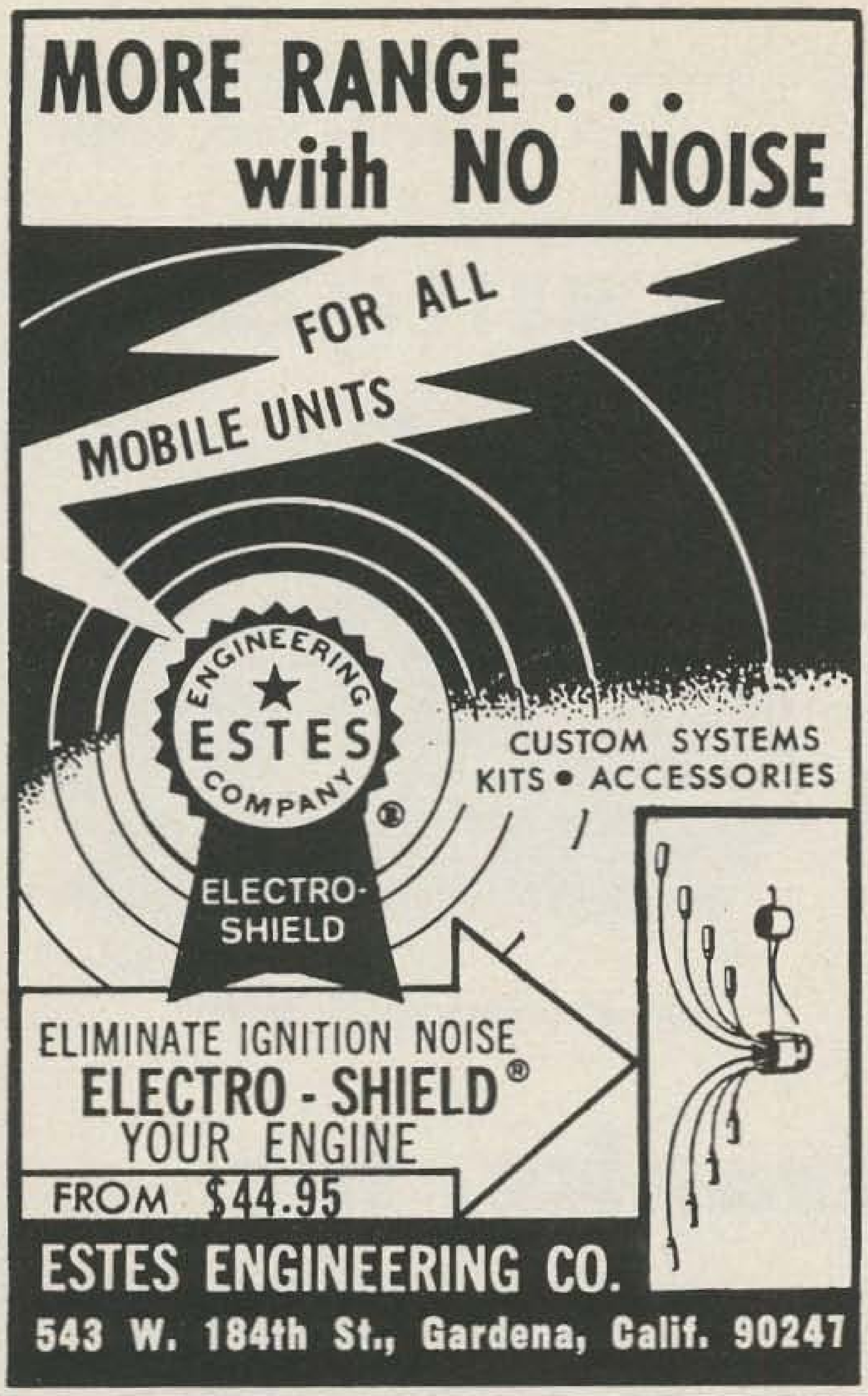

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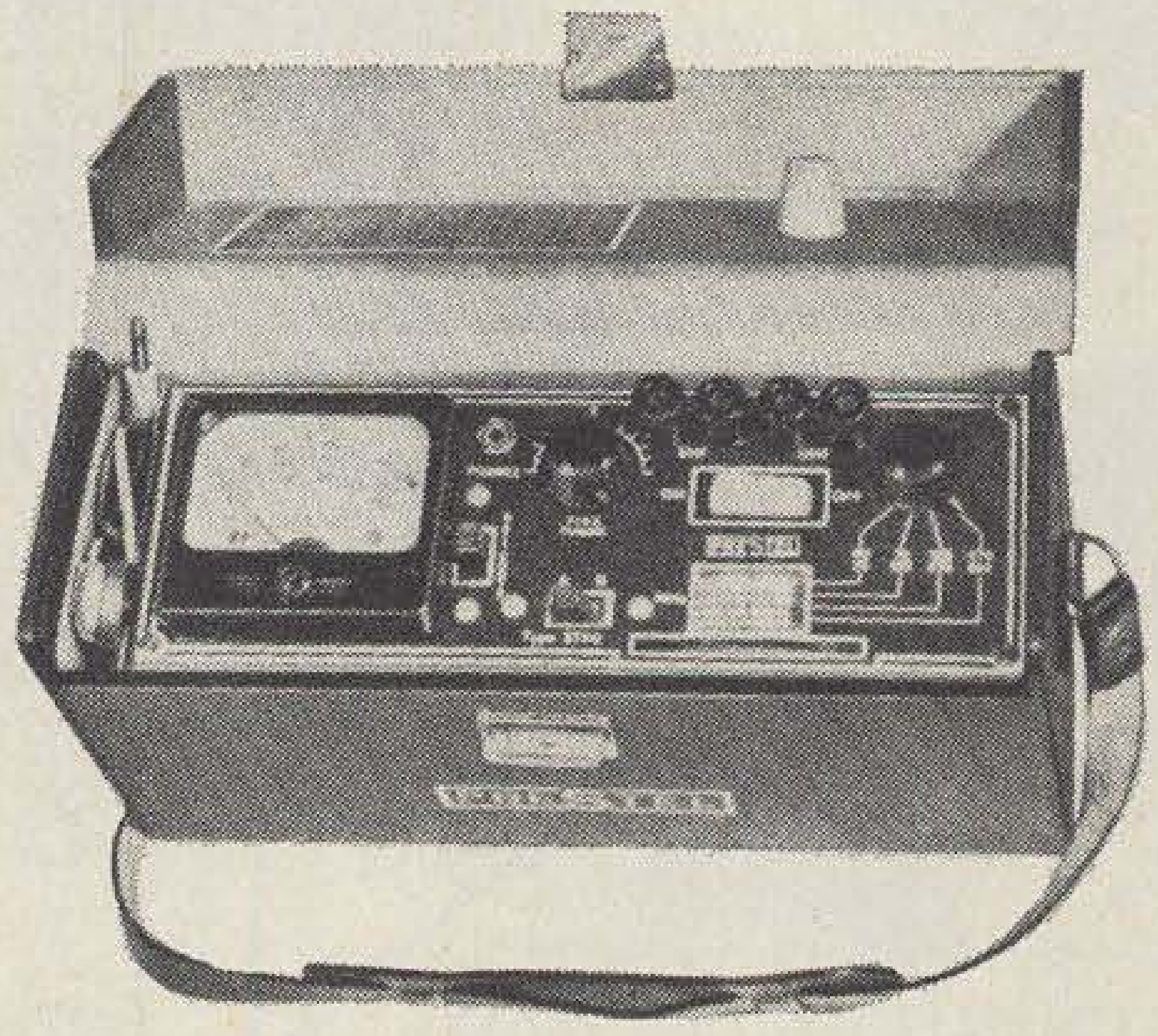

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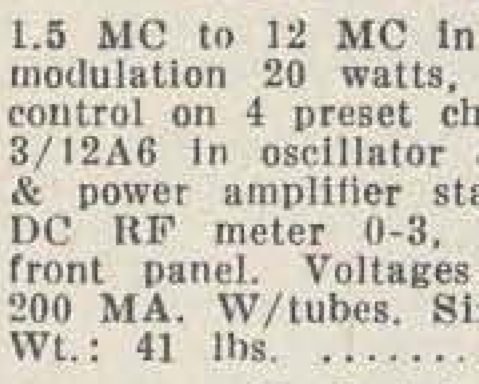

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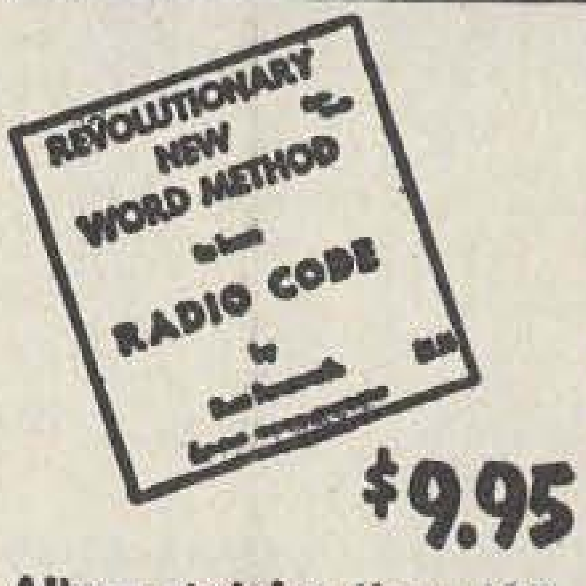

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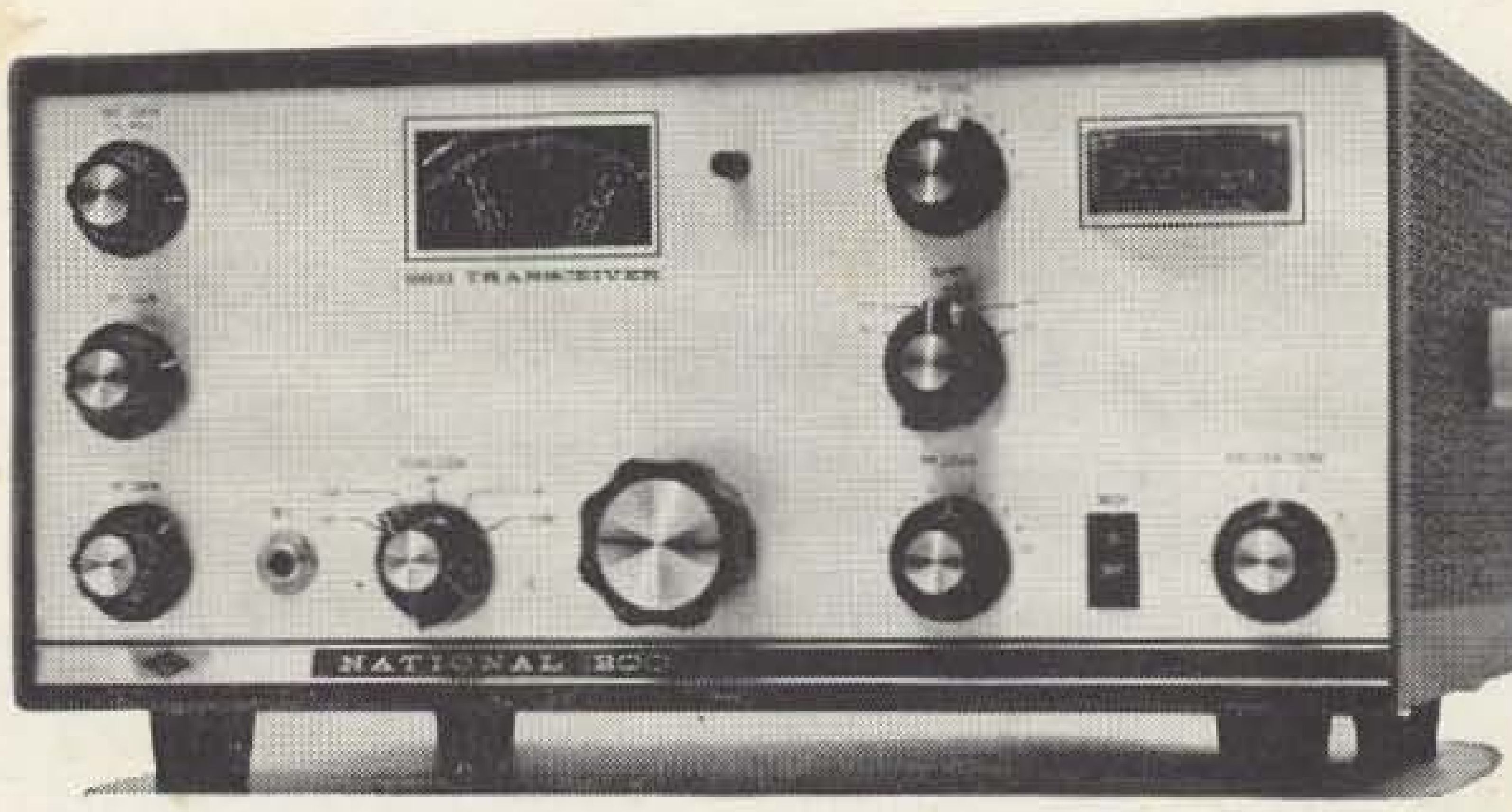

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