73

DECEMBER 1965
A Merry 50¢

Amateur Radio


SEASONS
GREETINGS
R. Sax

73 Magazine

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de W2NSD/1

never say die

As an inveterate rag chewer I take great umbrage at the stupid contests that louse up my rag chewing bands with QRM and with those damned DXpeditions that fill up big parts of the bands with fellows calling hours on end. On the other hand, as a DX enthusiast, I don't see what everyone is complaining about when I take an hour or two to get a contact with Gus. Contests, too, are a ball and I love them.

One of my fondest dreams in the past was to do well enough so I could go out on DXpeditions to rare spots and operate for a few days. This dream was enhanced by my taste of the sweets at Navassa (KC4AF) in 1958. Now, with 73 prospering and with fortune in the offing, the time is nearing when I could consider working out some of my DXpedition dreams.

So what has happened? Between the ubiquitous Gus Browning, Don Miller and Chuck, Lloyd Colvin and the Hammerlund DXpedition of the Month, there just isn't any place left for me to go. Rats. Well, next spring I'm going to see if it is possible to break the Coast Guard's iron will opposing my return to Navassa.

Speaking of Don Miller, I managed to work him at the last couple stops of his . . . HS . . . 1S9, but it was pretty hard work. The bands were really buzzing after Don finally pulled the plug for apparently he had made it a practice of not hearing the top men on the DX lists and many of them found themselves calling him 16 hours a day for almost three days . . . then, just before he went QRT, Don worked them all. I don't know if he was trying to convince them that it would be prudent for them to send some money to support his effort or whether he was just trying to do them one of the best favors he could do them and get them to break the DX habit. This worship of a top listing in QST is a terrible thing. A few hundred fellows take this stuff incredibly seriously. I heard some complaining that Don made them stay away from work for a day so they could work him. Never once did they even consider of what possible importance this contact was to anyone. If Don can bring a dozen or two of the top DXers to their senses he will have helped ham radio more than all of his travels.

On the money end . . . there really is no reason to pay anyone to put a country on the air. There are fellows who have the money to do this and would be happy to do it. When we went to Navassa we accepted donations, but we lidn't really need them. The fellows who go on DXpeditions are more than paid for their effort by the fun they've had.

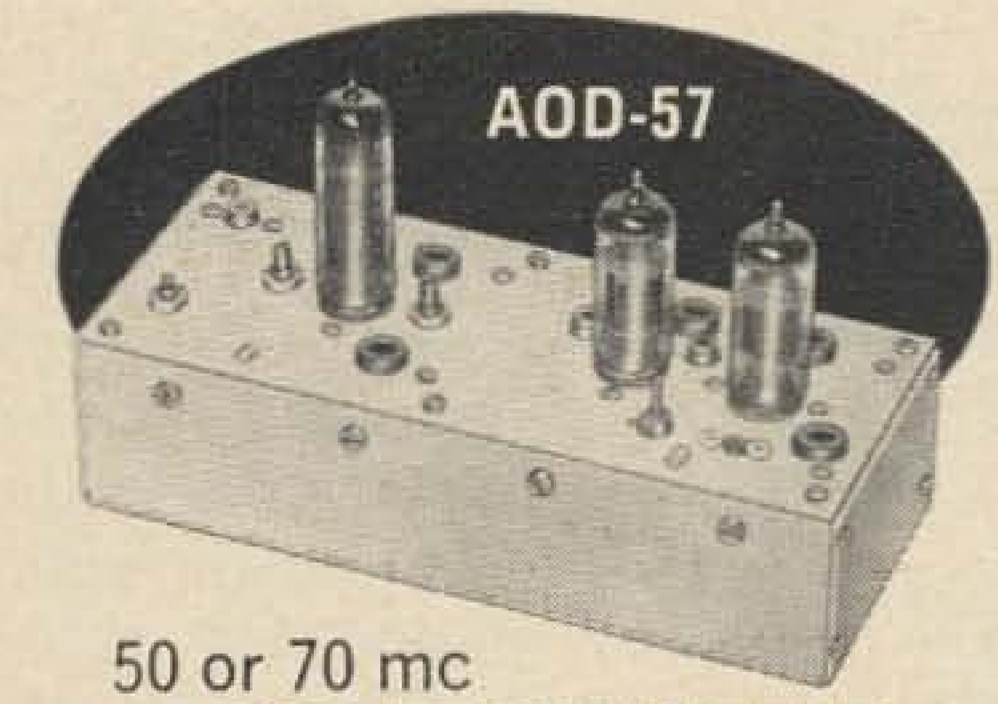
The basic problem behind all this DX nonsense is, of course, the ARRL DXCC award and the infamous listing in QST of the dis-Honor Roll. I don't think the prefix award of CQ's is any better . . . and I'm the one that brought that darb out. I consider the county award a new height in futility and an incredible time waster. I note with satisfaction that Clif Evans has a county award now so those with soft brains for this trivia can get their certificates from him instead of the now discredited one from Brand Y.

Why do I complain? Well, I like to talk on the air and I get pestered by kids of all ages calling me to get New Hampshire for their WAS . . . they don't want to talk with me at

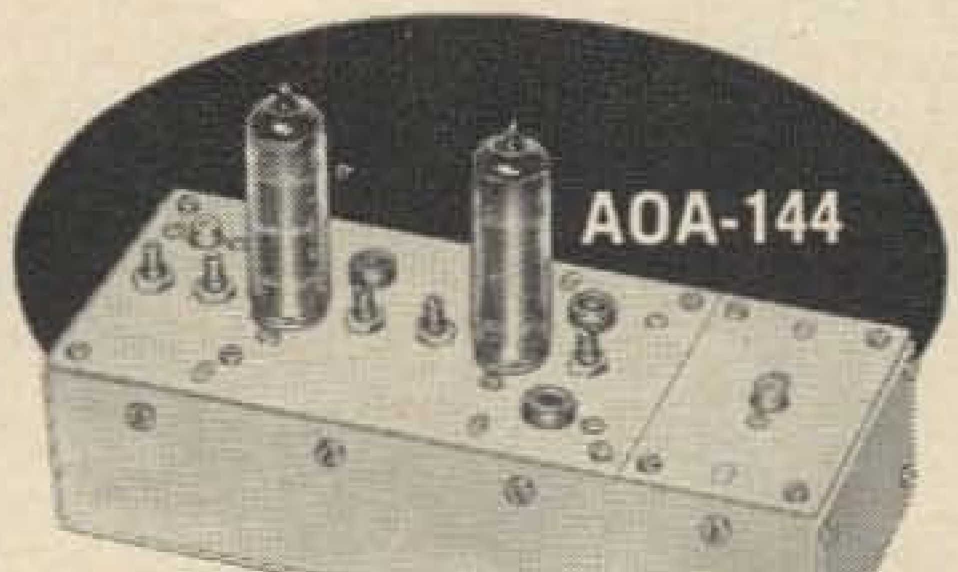
NEW FROM INTERNATIONAL

VHF/UHF UNITIZED TRANSMITTERS 50 mc – 420 mc

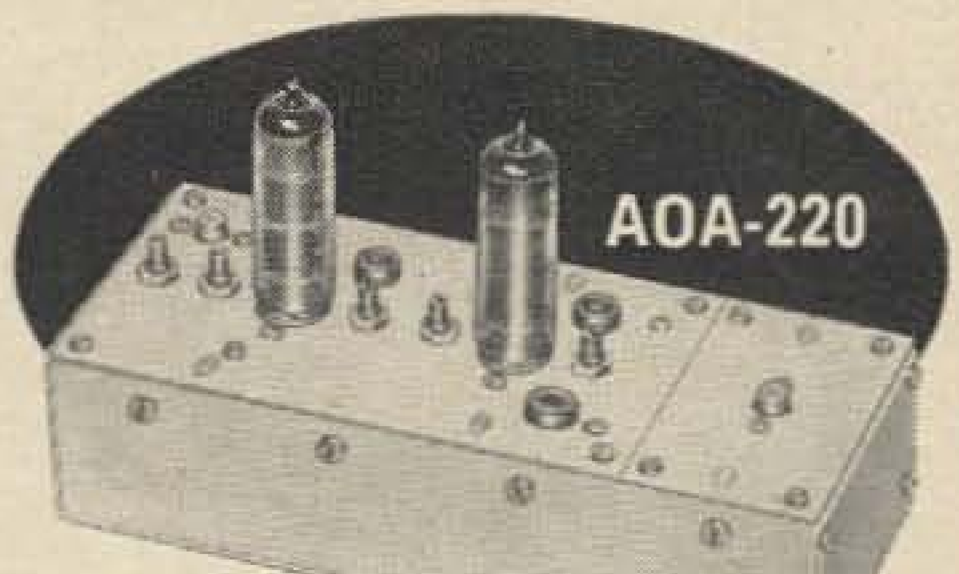
International's new unitized VHF/UHF transmitters make it extremely easy to get on the air in the 50-420 mc range with a solid signal. Start with the basic 50 or 70 mc driver. For higher frequencies add a multiplier-amplifier. All units are completely wired. Plug-in cables are used to interconnect the driver and amplifier.



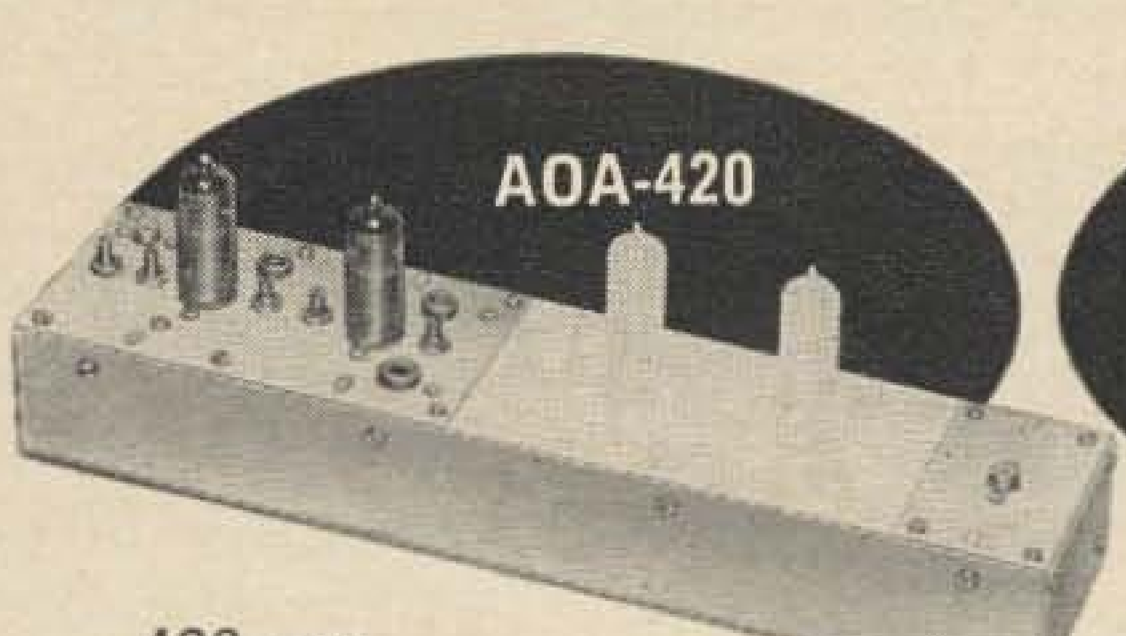
50 or 70 mc
DRIVER/TRANSMITTER
The AOD-57 completely wired with one 6360 tube, two 12BY7 tubes and crystal (specify frequency). Heater power: 6.3 volts @ 1.2 amps. Plate power: 250 vdc @ 50 ma.
AOD-57 complete..........$69.50



144 mc
MULTIPLIER/AMPLIFIER
The AOA-144 uses two 6360 tubes providing 6 to 10 watts output. Requires AOD-57 for driver. Heater power: 6.3 volts @ 1.64 amps. Plate power: 250 vdc @ 180 ma.
AOA-144 complete.........$39.50



220 mc
MULTIPLIER/AMPLIFIER
The AOA-220 uses two 6360 tubes providing 6 to 8 watts output on 220 mc. Requires AOD-57 for driver. Heater power: 6.3 volts @ 1.64 amps. Plate: 250 vdc @ 150 ma.
AOA-220 complete.........$39.50



420 mc
MULTIPLIER/AMPLIFIER
The AOA-420 uses two 6939 tubes providing 4 to 8 watts output on 420 mc. Requires AOA-57 plus AOA-144 for drive. Heater: 6.3 volts @ 1.2 amps. Plate: 220 vdc @ 130 ma.
AOA-420 complete.........$69.50

RELAY BOX
Four circuit double throw. Includes coil rectifier for 6.3 vac operation.
ARY-4 Relay Box complete $12.50

FILAMENT SUPPLY
The APD-610 provides 6.3 vac @ 10 amperes.
APD-610 complete...........$9.50

MODULATOR
The AMD-10 is designed as a companion unit to the AOA series of transmitters. Uses 6AN8 speech amplifier and driver, 1635 modulator. Output: 10 watts. Input: crystal mic. (High Imped.) Requires 300 vdc 20 ma, no signal, 70 ma peak: 6.3 vac @ 1.05 amps.
AMD-10 complete $24.50

COMPLETE TRANSMITTER

6 METERS	50 mc	AOD-57
2 METERS	144 mc	AOD-57 PLUS AOA-144
	220 mc	AOD-57 PLUS AOA-220
	420 mc	AOD-57 PLUS AOA-144 PLUS AOA-420

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all, but as long as I'm in New Hampshire they climb all over the stations I'm trying to work so they can get my card. County hunters beware . . . I am the only active station in Greene County . . . because I made the county up.

The other day someone called me and suggested that 73 put out some DX certificates or run a contest. Man, we already have a DX certificate. You'll find a listing of our available certificates toward the back of this issue. I'd like to run a contest, but I really haven't the slightest idea what it should be like. If there are any DX clubs out there that would like to run a DX contest I'd like to hear from you. You'll have to work out the rules . . . I'll print them and get them circulated to the DX countries . . . you'll have to tabulate the logs and let me know who the winners are. I'm willing to make it worth while for the winners to submit a picture of their station by paying, say $100 for the picture of the winning station, $50 for the runner up, and $25 for the next two. I'll also provide certificates for all of the country winners and state, etc., winners. So, any suggestions . . . any offers? Now that 73 has one of the largest DX circulations of any ham magazine in the world I suppose we might as well start a contest of some sort going.

73 Cover Contest

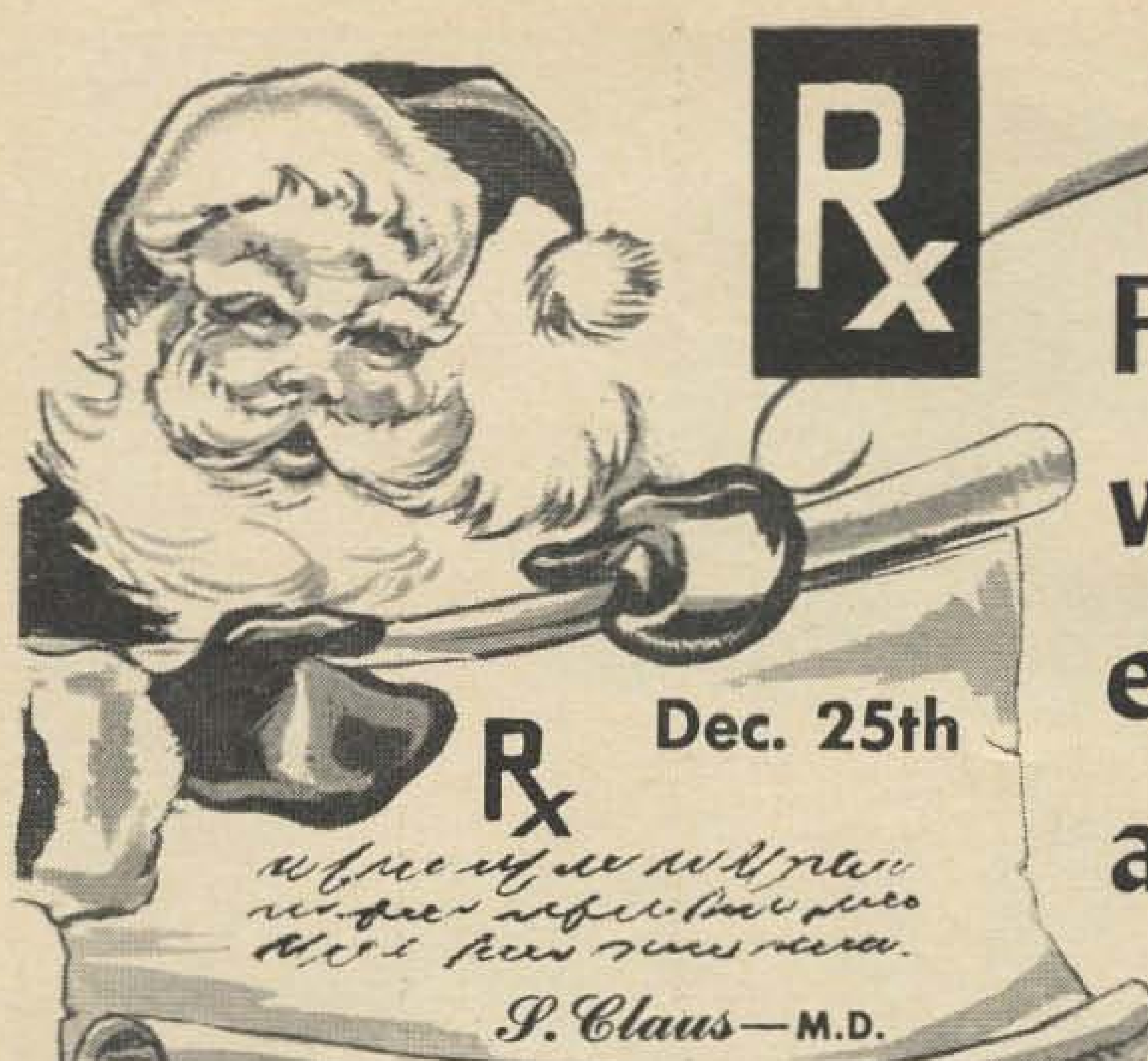
We'd like to have more interesting covers for you, but are held back by the weakness of our imaginations. If you have an idea for a cover you might clean up. The contest will end Feb. 15th. We will pay $100 for the best cover received by that date, $50 for the second best, and $25 for any others that we can use. Covers should be complete and ready for engraving, using a two color overlay. They should be prepared about twice finished size. We're open for any ideas . . . pen and ink . . . charcoal . . . scratch board . . . oil . . . water colors . . . tile . . . linoleum block . . . or whatever you can imagine.

The covers should have something to do with amateur radio . . . please.

April Issue

If you have any interesting ideas for April type articles you should start working on them for we are planning one of the most unusual April issues ever published. We expect this to be the straw that will finally drive both QST and CQ, if they are both still in business, out of what is left of their minds. Articles should be submitted before February first.

(Continued on page 114)



Rx For the ham who has practically everything... add *Waters*

S. Claus — M.D.

He's a wise cookie, old Doc Santa! Figures every ham to be the smart guy he actually is and prescribes a simple "Add Waters" to improve his amateur operating. Could be Santa himself is something of an operator . . . and a good one, too! How else could he know that any piece of "Convenience Engineered" Waters gear would make even the well-equipped ham the happiest ham on the holidays? And long, long after, for that matter!

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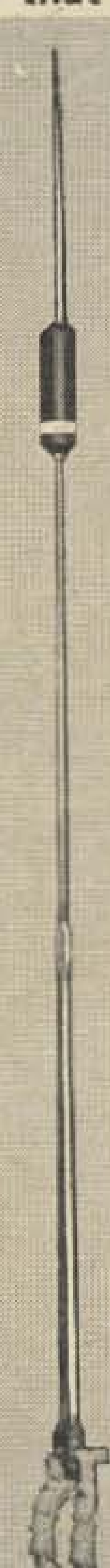
Coil 370-20 . . . . $13.45
Coil 370-15 . . . . $12.75
Coil 370-11 . . . . $11.95
Coil 370-10 . . . . $11.95



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You can give him that increased "talk power" he talks about with the sensational CLIPREAMP. Solid state, self-powered and compact it installs in a jiffy in the mike line of either mobile or fixed rig. Great for that added punch when QRM and band conditions are tough.

Model 372 $21.95 (less batteries)

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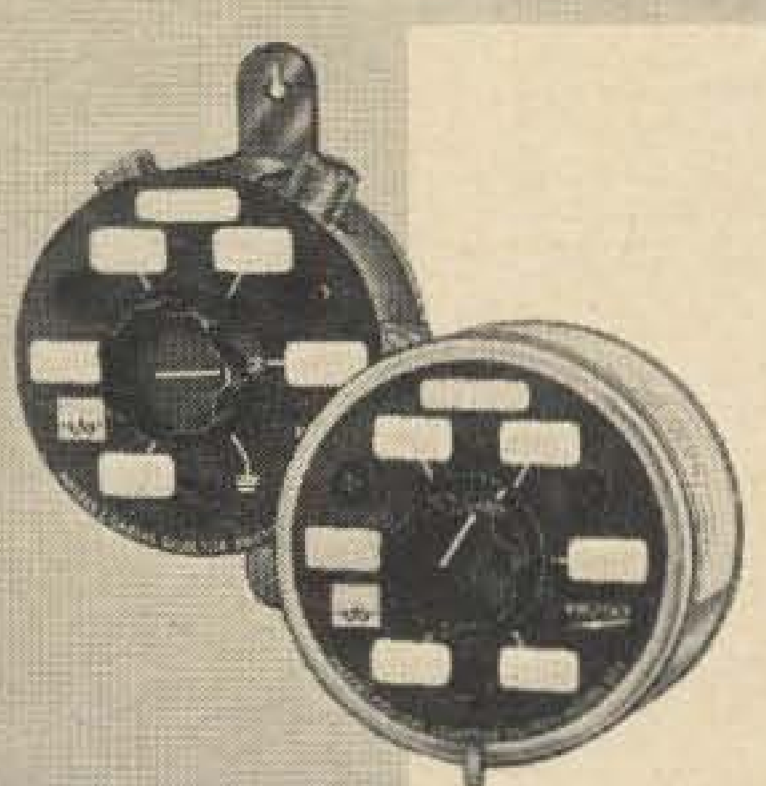
CODAX — the automatic keyer that puts rhythm-smooth CW at his fingertips. Never anything like it! Feather-touch double paddle is automatically timed for 5 to 50 WPM. Operates block grid or into mike jack for VOX or CW on either sideband. Monitors his signal, too!

Model 361 $92.50 (less batteries)



Waters PROTAX™

A must! Brand new Coaxial Antenna Switch that automatically grounds the antenna system when the shack is shut down. Handles a full 1000 watts . . . comes complete with knob, escutcheon plate with erasable marking panels. (mounting bracket on Model 376)

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Model 376
5-position side radial connectors $12.50

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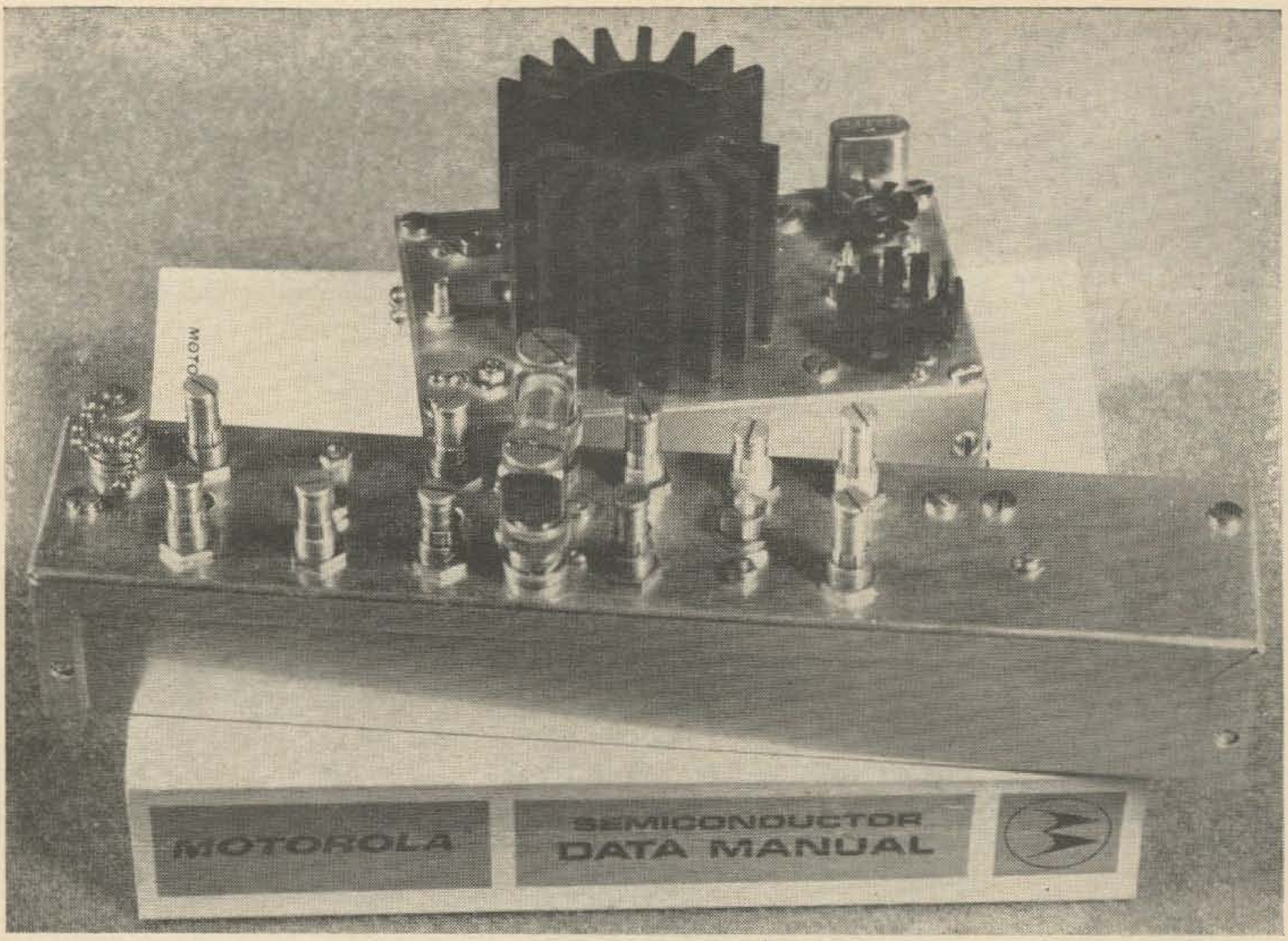


Ronald Vaceluke W9SEK
17 W 540 Hillcrest
Wooddale, Illinois

Solid State 432 mc Exciter

When I was first contemplating the construction of an exciter for my ATV station, I had hoped to have the entire unit solid state. However, at that time, the prices of the transistors were quite high. I then settled for two tubes and a varactor.[1] Since then prices have come down, as much as 50% on one transistor in particular. It was decided that the plunge had to be made even if for no better reason than my own personal satisfaction.

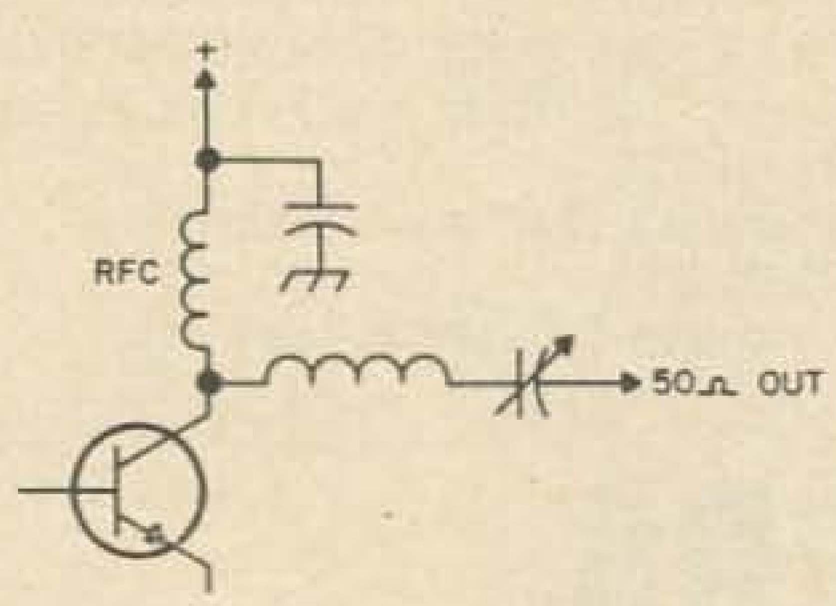


Fig. 1. Alternate output circuit to provide 50 ohm output for the 2N2950.

Although the ultimate goal of the circuits shown is 432 mc energy, these can be broken down to give output power at the following frequencies:

48-50 mc—— 3 watts
48-50 mc——20 watts
144 mc——13 watts
432 mc—— 8 watts

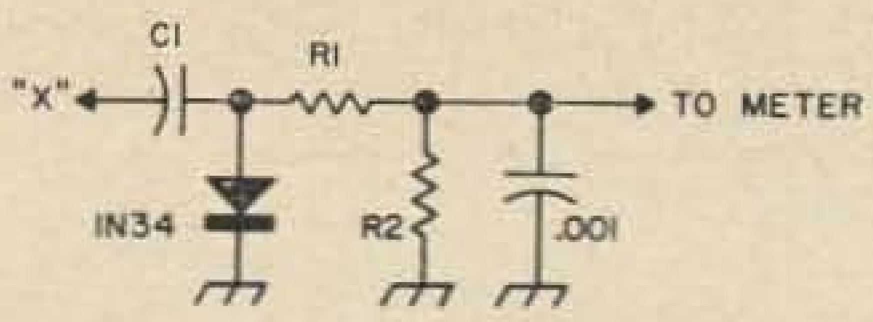


Fig. 2. Typical metering circuit. One needed for each stage.

From the above it can be seen that by using the transistorized exciter alone, up to 20 watts can be obtained on six meters. By following this with the first varactor tripler, we then have a 2 meter exciter and of course the second varacter stage gives us the 432 exciter. If only 3 watts is desired on six, then the first three transistors are used. Refer to *Fig. 1* for an alternate output circuit using Q3 to drive a 50 ohm load. With this arrangement I have obtained up to 4.5 watts output with the 2N2950 but this is driving it rather hard. The 3 watt figure given is a safer and more conservative amount.

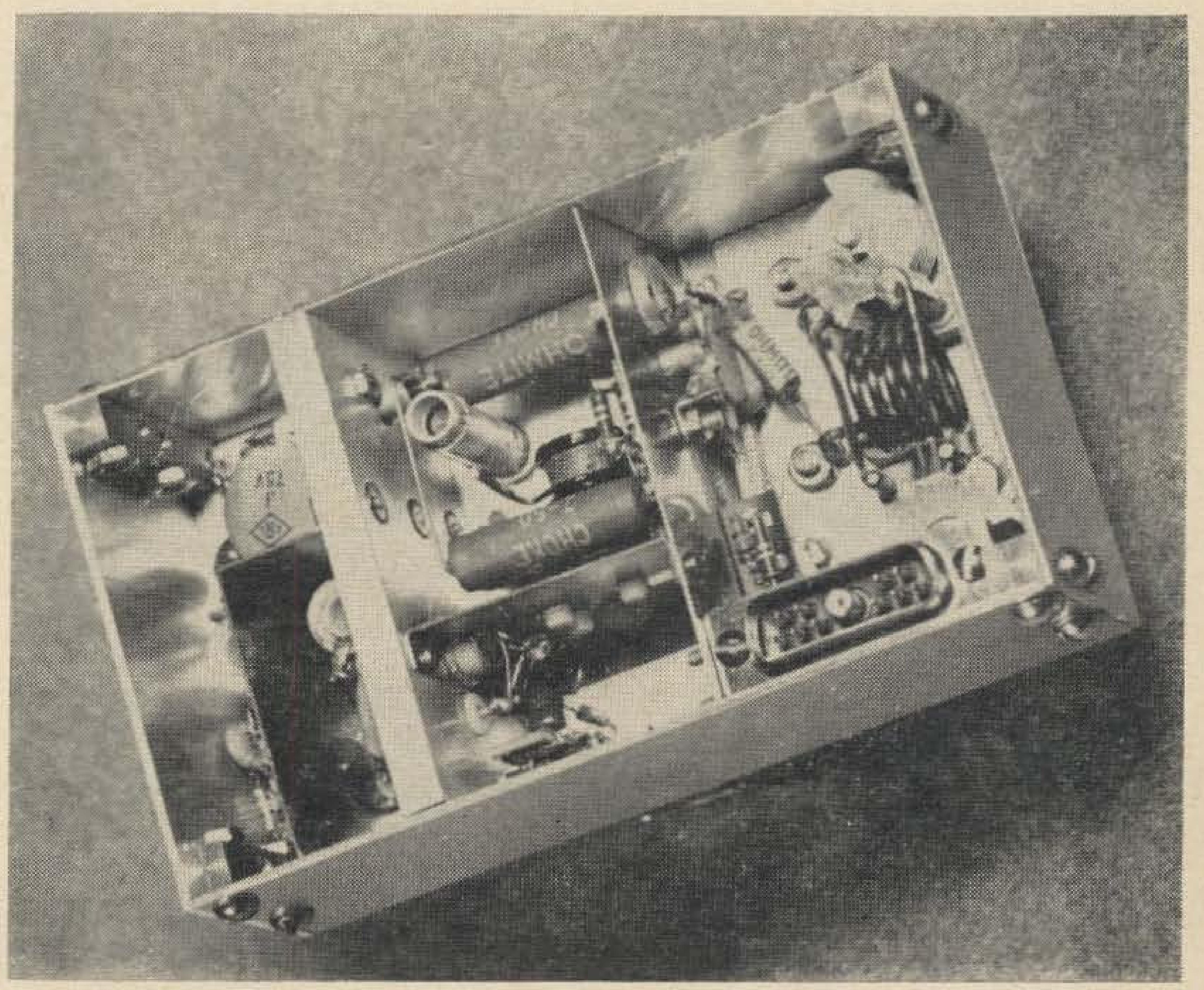
One thing I wish to bring up at this point is that all of the above figures are under CW conditions and at 24 volts. If amplitude modulation of the transistorized stages is desired, then the collector voltage must be kept down to around 12 volts (on the modulated transistors) with a resultant decrease in output.

It may seem strange to some but my first thoughts on construction was of heat sinks. Since compact construction was in order, a large dissipator was out of the question, yet a big dissipating area was needed for Q4. This paradox was solved with an IERC TO3-250-200. This sink provides ample dissipation while presenting a small area on the chassis base. This is necessary in order to maintain short lead construction under the chassis. Transistor Q3 is mounted on a piece of 1½" x 2¾" x ¼" aluminum which doubles in duty as an interstage shield. Transistors Q2 and Q1 use smaller IERC dissipators in order to keep them down to proper temperature limits.

One of the most difficult things to get used to when using transistors is the low impedances. Once this fact is accepted, no trouble should be encountered. All circuitry is straight-forward without any fancy frills. In fact most of the basic circuitry was obtained from the data sheets on the Motorola transistors and varactors I used. The inputs of Q2, Q3, and Q4, as well as the output of Q4, are metered by the rectified RF method (see ***Fig.* 2**). A diode fed by a small capacitor samples the RF and feeds a voltage divider to provide sufficient DC to give an indication on a microameter. No values are given for these sampling circuits because these will change, depending upon what collector voltages are used, etc. Some may prefer to measure the collector currents but this is up to the builder.

The transistor exciter (**Fig. 3**) is built on a piece of 4¾" x 2¾" 16 gauge aluminum. The corner posts are made of drilled and tapped

Bottom view of the 48 mc driver. Note Q3 mounted on ¼ inch heat sink/shield with a shield between the base and collector.



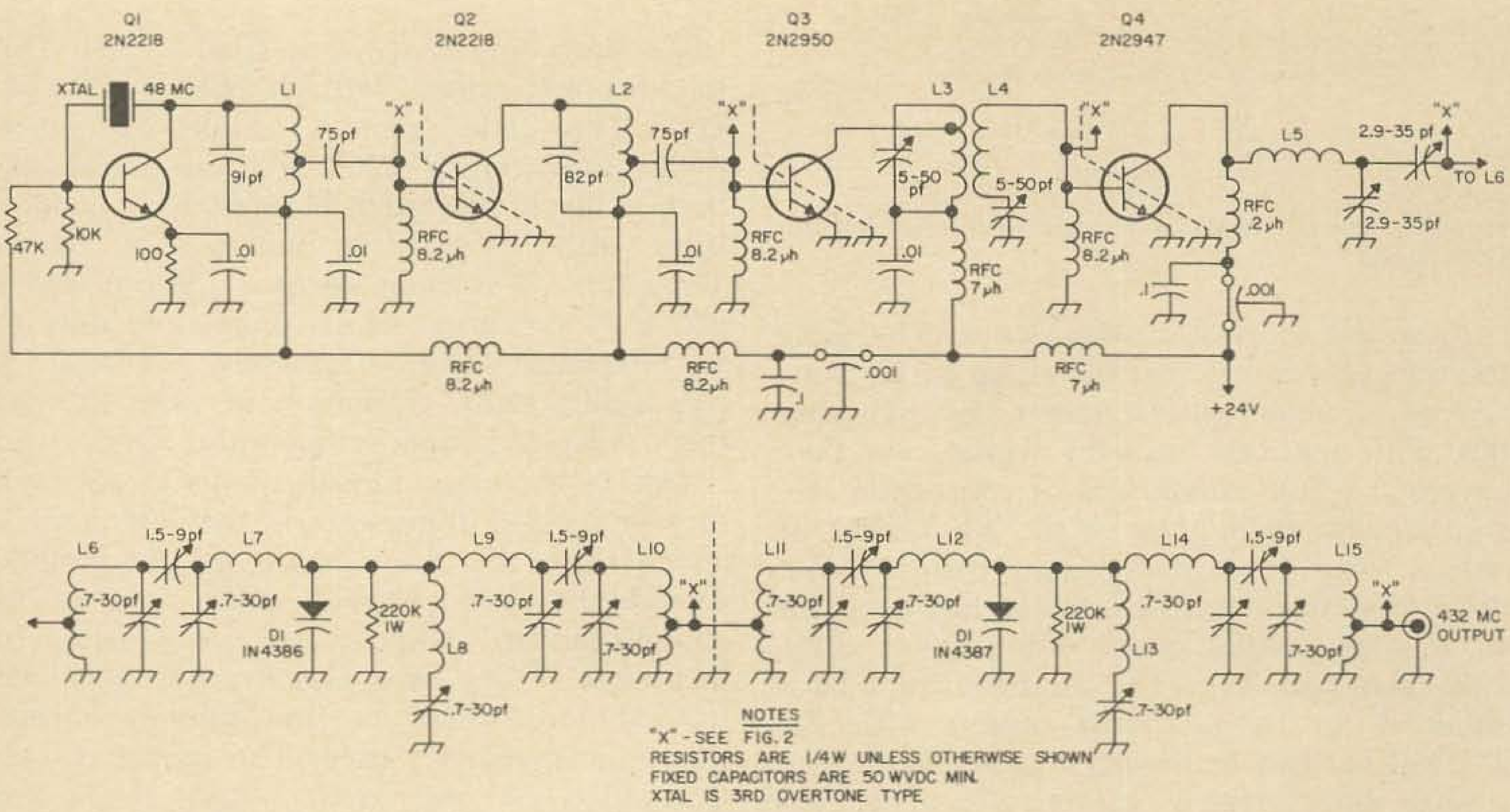
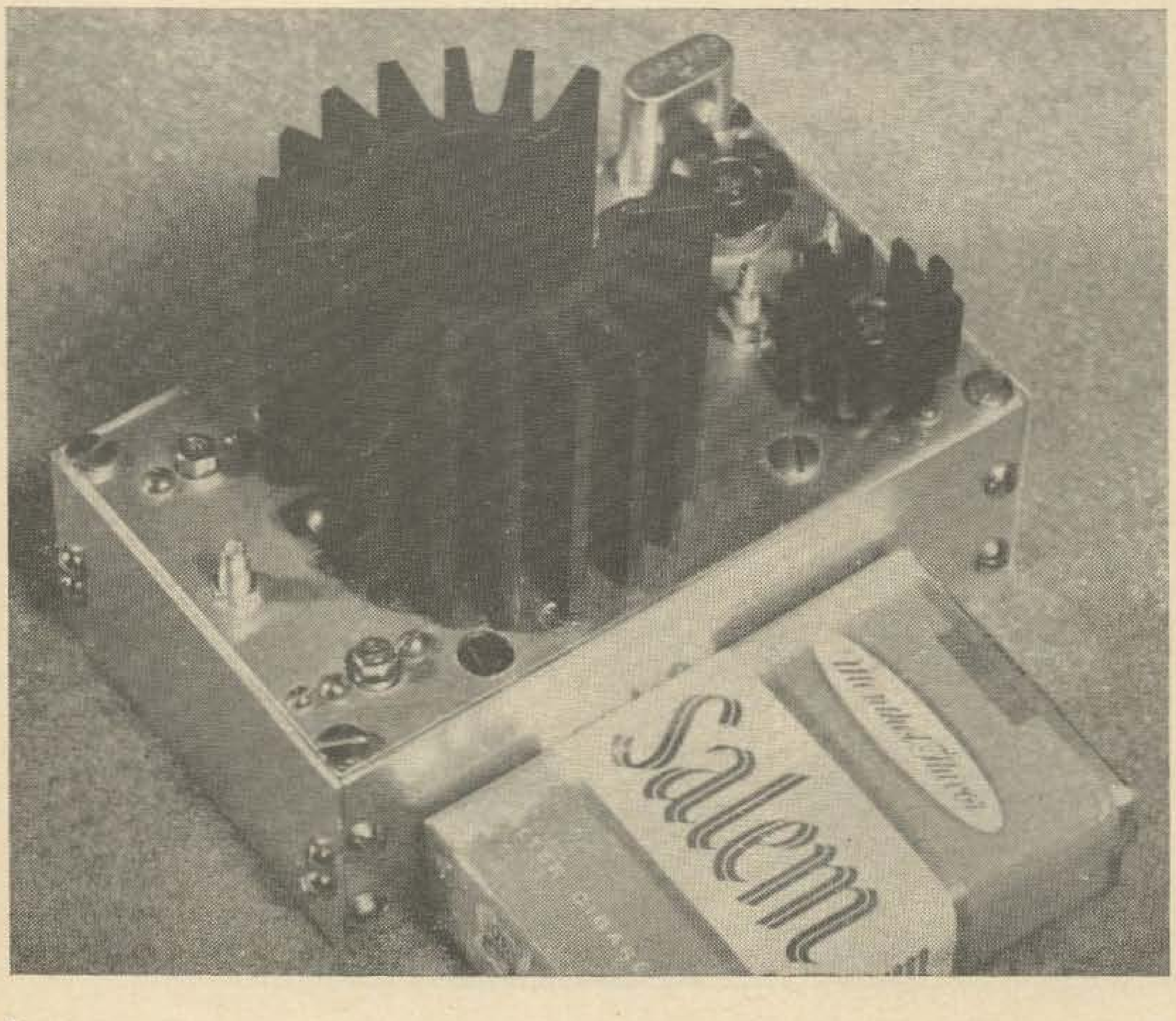


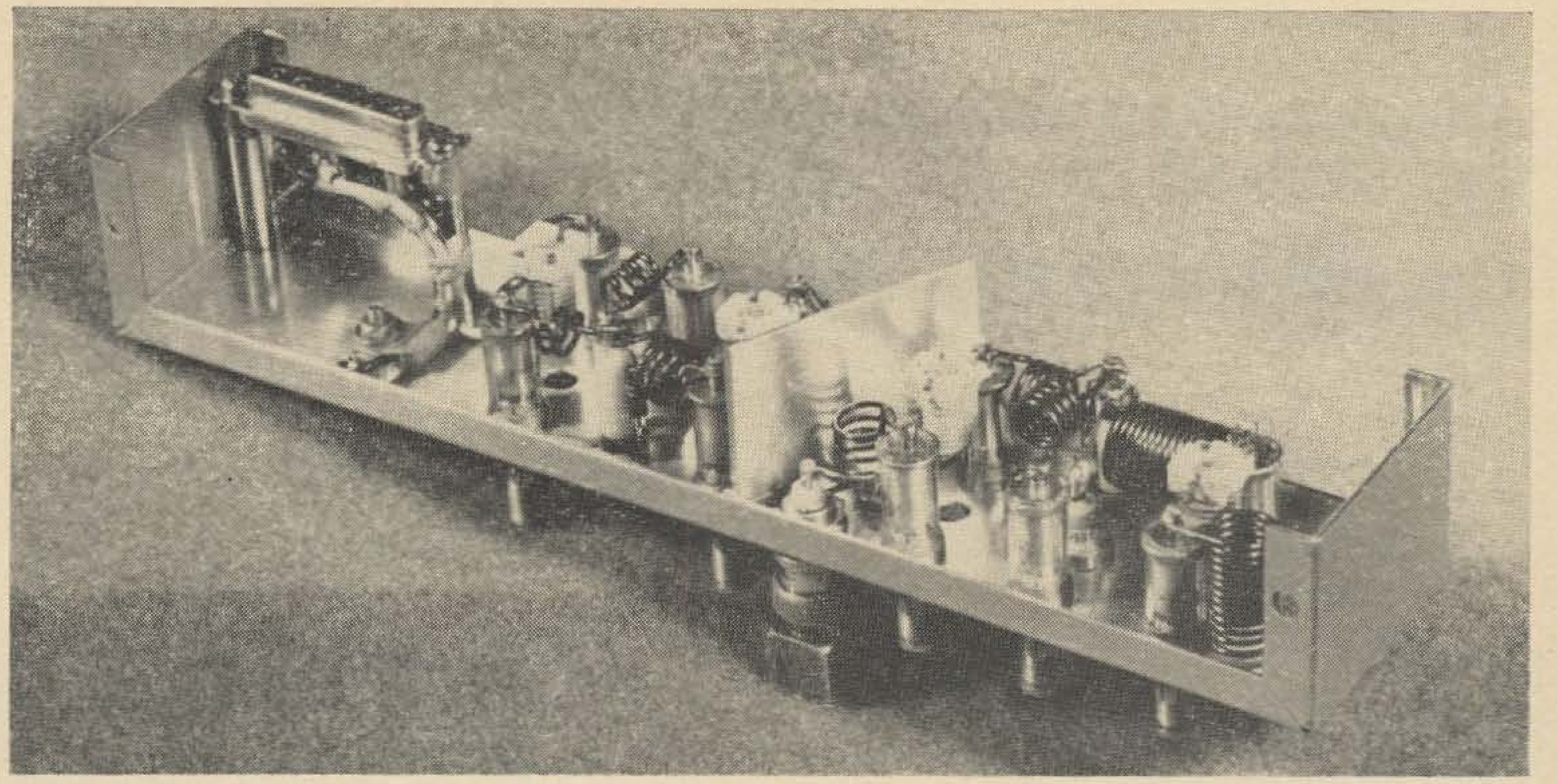
Fig. 3. Solid-state 432 mc exciter. The top section is the 6 meter driver good for 20 watts output. The bottom is the dual tripler using two varactors to get to 432 mc. Heat sinks are: Q1, IERC TXBF-032-025B; Q2, IERC LP5A1B; Q3, see text; Q4, IERC, TO 3-250-200.

¼" square brass rods. Four pieces of aluminum fasten to these rods to form a complete chassis. The two varactor tripler stages are built in a 1⅝" x 2" x 10" minibox; however, the entire circuitry can be built on a single larger chassis. The two chassis construction I used was to suit my particular requirements in my ATV project. The only things to be sure of in construction is to have short leads and proper shielding between stages. Power and RF connections on both chassis are brought out on miniature connectors which have their mates on a master chassis in my project. The coax connectors on top of the units shown here are just for testing. However, the builder can choose whatever method serves him best.

When tuning up for the first time, it is recommended this be done stage by stage and



Top view of the 48 mc driver. This unit will produce 16-20 watts depending on the individual transistors used.



Bottom view of the varactor multiplier stages of the solid state 432 mc transmitter. On the right is the multiplier from 48 mc to 144 mc. Left of the shield is the multiplier from 144 mc to 432 mc.

disconnecting power to the preceding stages. All three amplifier stages are run Class C so when drive is removed there is no current flow; however, a stage that has drive but has its output out of resonance can be damaged. Tune up can be done much more safely with a lower voltage and a regulated supply with high and low voltage output is recommended.[2] If the exciter is tuned up at low voltage it will have to be re-peaked when full voltage is applied. This is because the junction capacity varies with voltage but all tuning will be quite close because of the high C circuits used in the outputs.

The two varactor triplers are of straightforward design which have been described many times before and we need not go into it again. The same applies to tune up but it is recommended that the first stage be tuned by itself before the second stage is connected. I have a jumper made of two right angle BNC connectors for tune up purposes. This is normally left connected but can be removed and a directional wattmeter inserted in the line for checking efficiency, etc.

Of course 432 mc is not the high frequency limit to the use of varactors. Quite the reverse is true in that varactors perform well and are most practical as the frequency goes up. The exciter described here could be followed by another varactor tripler (such as the Motorola MV-1808 as an example) and give about 4.5 watts output at 1296. Although I haven't tried this scheme yet, I would like to and describe it to the readers of 73.

This manuscript is not submitted primarily as a construction article but to show mainly what can be done today with available semiconductors. By available I mean that they can be purchased from large industrial parts houses (such as Newark Electronics) and are not merely laboratory curiosities. The devices shown here are not cheap and yet they are not unreasonable when thinking of long term usability. As time goes on this type of semiconductor circuitry will become more and more common. When this happens you can look back and say, "Shucks, *73 Magazine* had that a long time ago—so what else is new?"

. . . W9SEK

1. "A Hybrid 432 mc Exciter," *73* March, 1965, Pg. 38.
2. "A Regulated Solid—State Supply," *73*, December, 1965.

Coil Table

L1 and L2	4 T #18¼" dia. Tap at 1¼ T from cold end. ¼" long, slug, tuned. X
L3	4½ T #18 7/16" dia. Tap at ¾ T from collector end. ¼" long.
L4	4½ T #18 7/16" dia. ¼" long.
L5	4½ T #14 9/16" dia. ½" long.
L6	12 T #16 ⅜" dia. Tap at 3 T from cold end. 1" long.
L7	13 T #16 ½" dia. 13/16" long.
L8	4 T #16 5/16" dia. 7/16" long.
L9	4 T #16 ⅜" dia. ½" long.
L10	4 T #16 ⅜" dia. Tap at 1 T from cold end. ½" long.
L11	4 T #16 ⅜" dia. Tap at 1 T from cold end. ½" long.
L12	4 T #16 ⅜" dia. ½" long.
L13	3½ T #16 3/16" dia. ⅝" long.
L14	2 T #16 ¼" dia. ⅜" long.
L15	3 T #16 3/16" dia. Tap at 1 T from cold end. 13/16" long.

Augusto Lovisolo I1LOV
Malnate, Varese, Italy

8058 Nuvistor Preamplifier for 432 mc

This preamplifier is built around the 8058 Nuvistor triode which is especially designed for grounded grid rf amplification up to 1200 mc. In practical tests, it outperformed the 6AM4, the EC88 and even the WE 417A, which never seemed to work too well at these frequencies anyway. Two of these amplifiers could make a good front end for a crystal mixer converter. They would easily cover the 4 mc bandwidth usually required for such converters (430 to 434 mc). At I1LOV, we use one ahead of a modified Centimeg converter with two stages of rf amplification to get up over the noise for the weak signals. Since the plate circuit tunes continuously from 410 to 440 mc, it can also be used to tune in some commercial radio links from 418 to 425 mc.

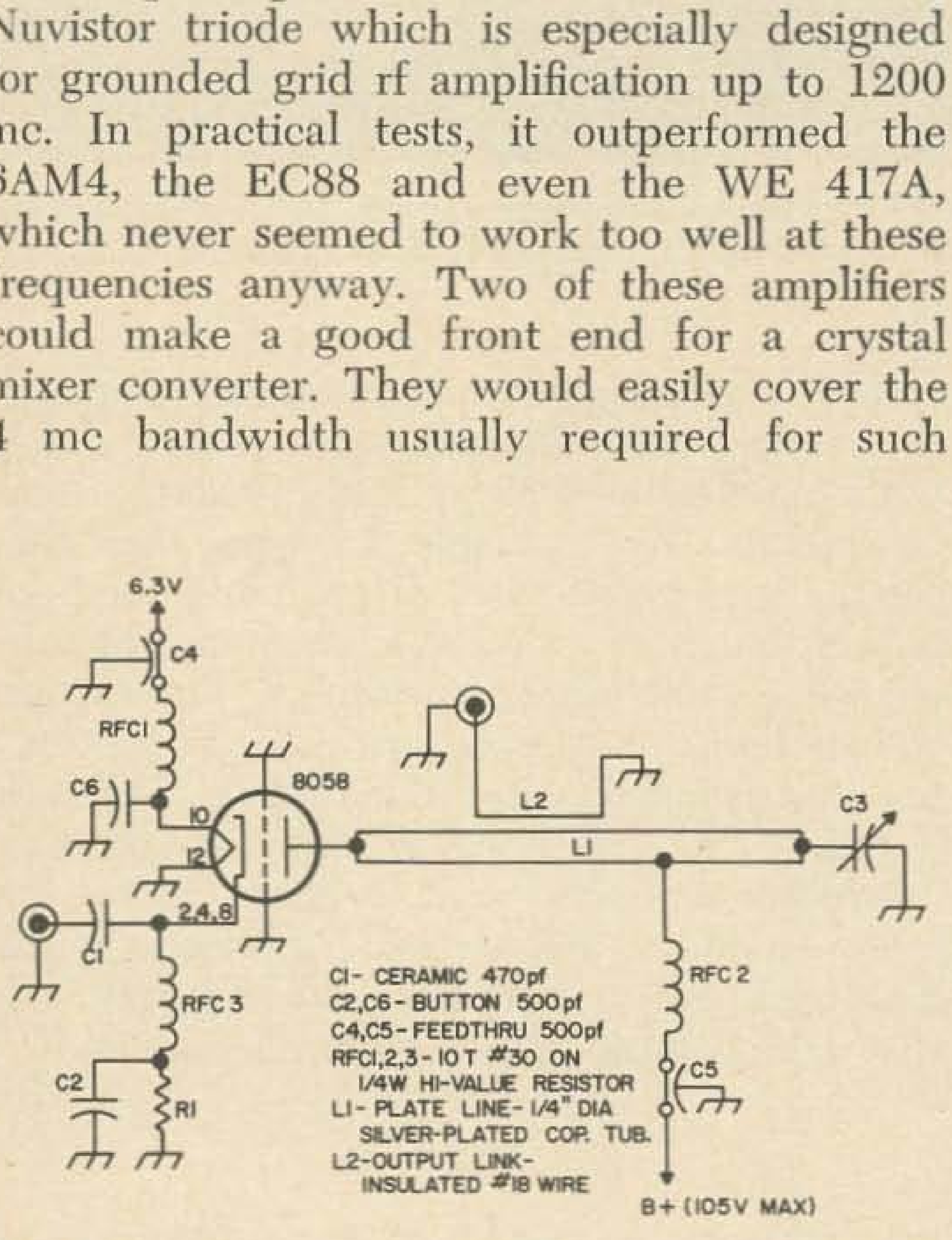


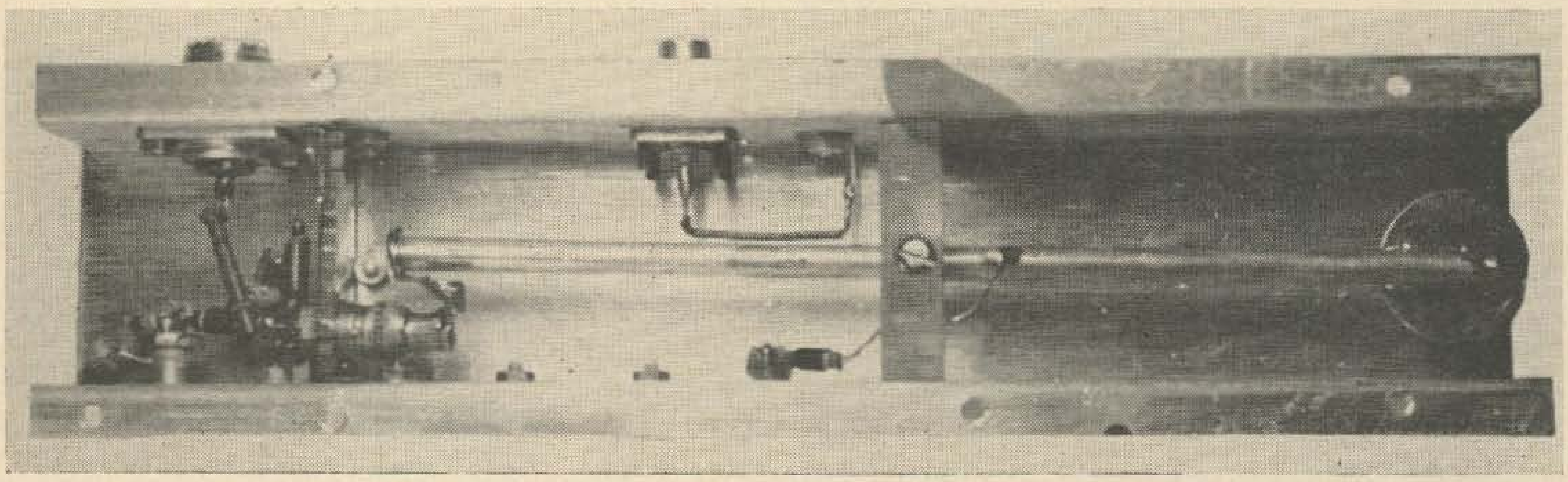
Fig. 1. Schematic of the 8058 preamp for 432 mc.

The circuit is the usual simple grounded grid amplifier usually used at these frequencies. It has an untuned cathode and a half wave plate line with link output. The grid connection of the 8058 comes out on the external body of the tube, which allows a very positive ground and ensures stable operation with no regeneration.

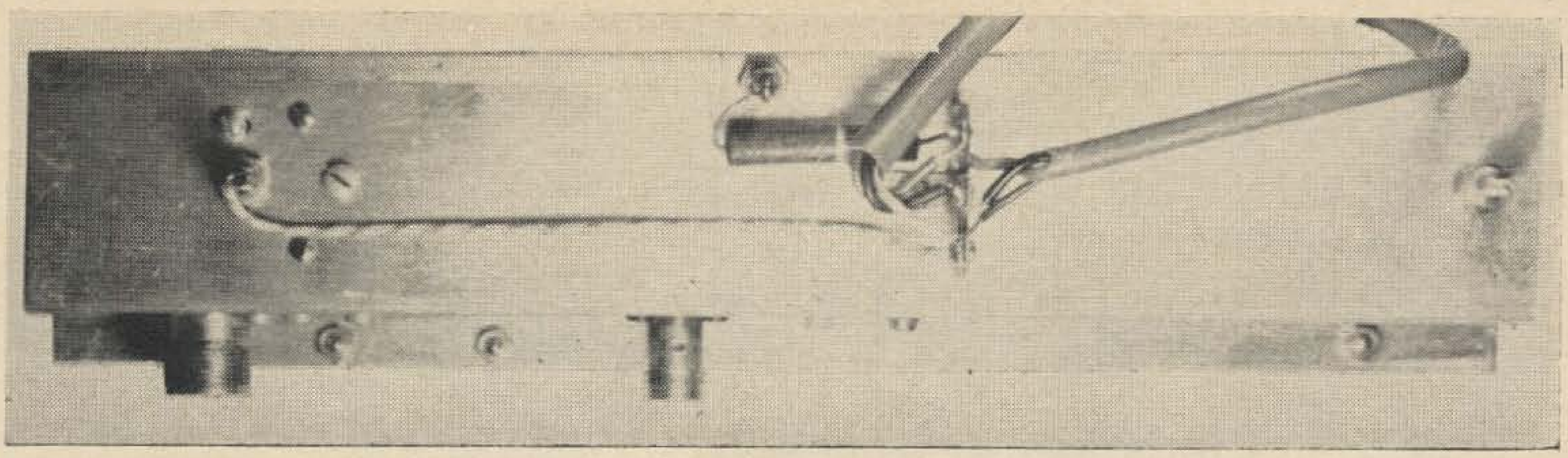
Construction

Aluminum was used for the external body of the preamplifier. Brass or copper would be much better since all ground connections can be soldered directly to the chassis. Cut the plate to the dimensions given, then drill as shown, and last, bend it.

Cut the partition on which the Nuvistor socket is soldered as shown in detail C. Drill



Inside of the 8058 Nuvistor preamp. C3, the plate tuning capacitor, is at extreme right. L1, the plate line, runs from the tube to C3. RFC2, the plate feed choke is near the center support and the output link L2 is just above it.



This top view of the preamp shows the output receptacle at the left with the filament bypass over it. The output jack and B+ feedthrough are in the center and the tuning for C3 at the right.

it and solder the socket in place as shown. Next, solder the partition on the body of the preamplifier. The finger stock shown soldered on the partition can be omitted with no sacrifice in performance.

The plate line is connected to the Nuvistor plate cap with a fuse clip and short strip of copper foil. This allows quick removal of the tube without disassembling the plate line.

The plate line is made of a short length of silver plated copper tubing with a copper disk soldered on one end. The line is supported at the center by a square of thick plexiglass held to the chassis with three self tapping screws. A fourth screw holds the line in place. The plate tuning capacitor is made with two copper discs. One is soldered to the line, the other to the tuning screw of a discarded coil. A standard brass screw and bolt can be used. Other details are covered in the pictures and drawings.

Operation

Let the 8058 warm up for at least ten minutes. This is the time required for the transconductance to reach its maximum. Apply plate voltage (no more than 150 volts) and connect to the converter receiver setup. Tune to the middle of the band with the receiver and put C3 at maximum capacitance. Then turn it back till you hear an increase in noise in the receiver. Next adjust the output link L2 for maximum noise. Tune in a weak signal and run an insulated screw driver down the plate line. You will find a point where the reception is unaffected by the screwdriver. This is the lowest rf point. Disconnect B+ from the preamplifier and solder RFC2 to this point. You can improve the noise figure by trying different values of plate voltage. My preamp works best with 70 volts.

. . . I1LOV

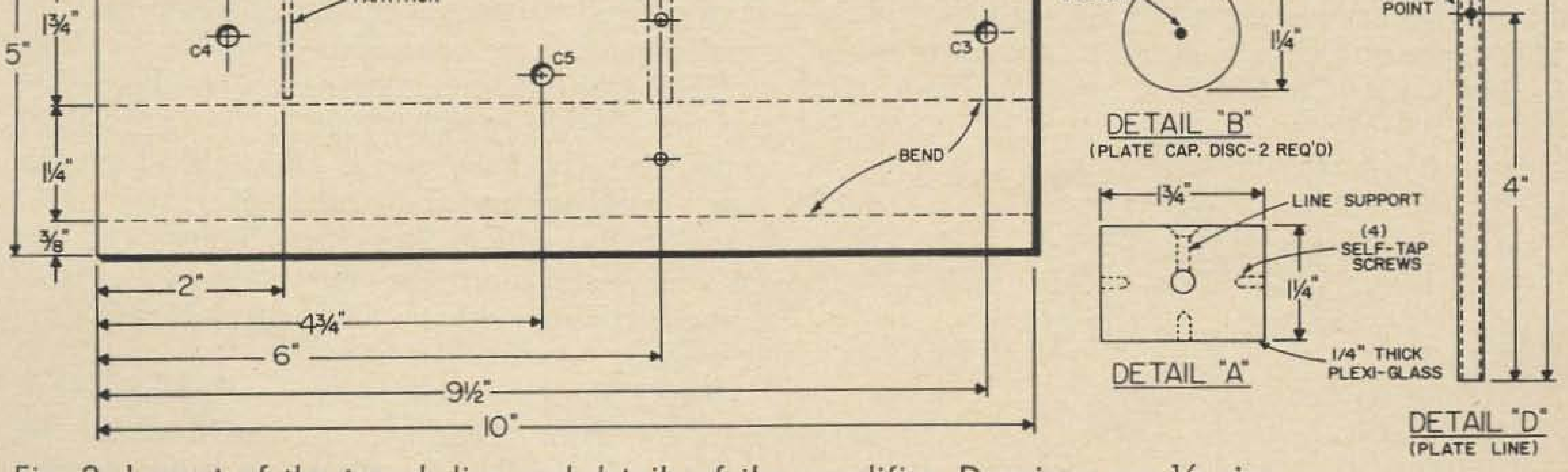


Fig. 2. Layout of the trough line and details of the amplifier. Drawings are ⅓ size.

Paul Franson WA1CCH
Peterborough, N. H.

VHF-UHF Dipmeter

50 to 600 mc with almost no work or cost

Not too long ago, I decided to make a 432 mc converter. There were very few requirements in this design. First, it had to be unlike anyone else's (a matter of pride. Anyway, their junk boxes don't have the same things in them that mine does.) Secondly, it had to be transistorized, since tubes are obsolete for this type of use, and transistors are much cheaper, easier to build with, use less power, and should have unlimited life. Thirdly, it had to be moderately simple so that I could finish it quickly. I have the attention span of a two year old and my basement is full of almost finished and unfinished (and some finished!) projects. Fourthly, it should work, if possible.

So I did some looking. I happened to talk to W100P, who said 2N3478's were good. Then I was down at W1BU before Sam left and he showed me a simple converter using them. So my mind was made up, and I ordered the transistors. Sam's converter used coils, but they looked sort of indefinite, as coils often do at those frequencies, and I decided to use trough-lines as in a 432 converter I saw in *UHF Berichte*, a European VHF magazine. I computed the sizes of the lines, checked and saw that they were right and built it. Then while I was waiting for the proper crystal for the local oscillator, I started to wonder if those rough lines would really tune to 432. Needless to say, none of the four commercial dip meters around here and 73 went that high. Most gave up before 200 mc, and were unsatisfactory there. So I looked around. The*ARRL*

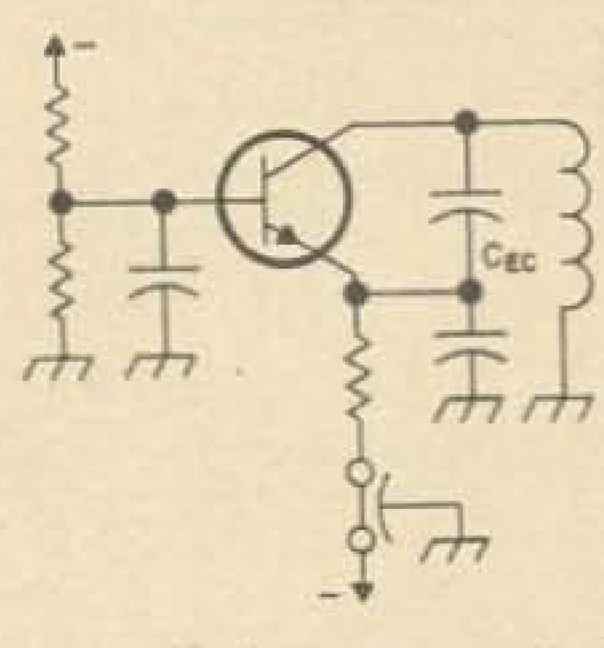


Fig. 1. Basic grounded emitter Colpitts oscillator.

Handbook had a UHF dip meter, but it uses tubes and transistors, AC line *and* batteries, not to mention *five* coils to cover 271 to 565 mc! W5AJG described a surplus conversion a few months ago, but I don't have the unit he converted and doubt that I could find one and it would be too expensive and big anyway. There was a simple UHF dipper in Sam's VHF column in *QST* a while back and it looked pretty good, as did K1CLL's, which is similar in principal (but that's about all.) So I built one, but wasn't really happy. It should be possible to improve and simplify it. So I tried. And I think I did. Here's how:

Many hams seem to think that a transistor oscillator has nothing that dips. So all the transistor dippers have used a small sampling diode and amplifier to indicate resonance. This diode can introduce unwanted dips, reduce sensitivity—and always complications.

But a little thought and experimenting reminds us that class C transistor crystal oscillators differ from tube ones in that they draw most current at resonance. Load the tuned circuit or detune it and the stage draws less current (dips). The same goes for free running oscillators. Measure the collector current and you'll get a dip when the tuned circuit is brought near another circuit tuned to the same frequency.

And that is how this simple dip meter works. It requires no amplifier, diode, tapped coil, dual capacitor or expensive components. It is a UHF Colpitts oscillator easily reaching 700 mc using a cheap ($2.06) RCA 2N3478. NPN transistor. The base bias is adjustable for variable sensitivity and the emitter current is monitored with a cheap 2 or 3 ma meter. The dip is very deep and the circuit exhibits very smooth tuning with no false dips. Here's how it works:

Fig. 1 shows a standard grounded base Colpitts oscillator. Feedback is furnished by the tap on C1 and C2. As you go up in frequency, C1 becomes smaller and smaller until the distributed and internal capacitances are sufficient for feedback.

And that's what the finished dip meter is. **Fig. 2** gives the schematic and **Fig. 3** the layout. The power components were put in a small Minibox with the meter and base bias pot. A cable runs to the rf components. They can be in another small box or on a piece of copper laminate board, as you wish. A plug-in arrangement will get you up to 300 mc, but a separate rf head is necessary for higher frequencies. Be sure to keep those leads short.

Notice that the transistor case-shield is not grounded, but is connected to the emitter to furnish a little extra capacitance that helps sustain even oscillation at the low end of each range.

I made a number of rf heads. The lowest frequency one (50 to 300 mc; could go lower) uses a 25 pf variable, a crystal socket and lots of coils ranging from a short of #16 tinned to about 20 turns. A larger capacitor would permit you to use fewer coils to cover the range, but would decrease your upper frequency a bit.

One that covers 250 to 450 mc uses a 15 pf miniature variable and the tank is a piece of copper sheet 1 cm (⅜ inch) by 10 cm (4 in.) bent into a U. I don't know the thickness, but it's the foil often used for embossing at summer camps, so you could probably get it at a hobby shop.

I made another and stuck in an old *if* can for protection and looks(?). It covers 320 to 500 mc. The capacitor is 8 pf, and the inductor is heavier copper, maybe 1 mm thick, 1 cm wide and 7 cm (2¾ in.) long. It's also bent into a distorted U. You could go higher with a smaller capacitor and coil, but since you can't reach 1215 mc this way, why bother? Incidentally, this case is resonant at 380 mc. That's the only false dip. Maybe the open construction isn't so bad.

In the two high frequency models, the inductor is soldered to the two stator posts and

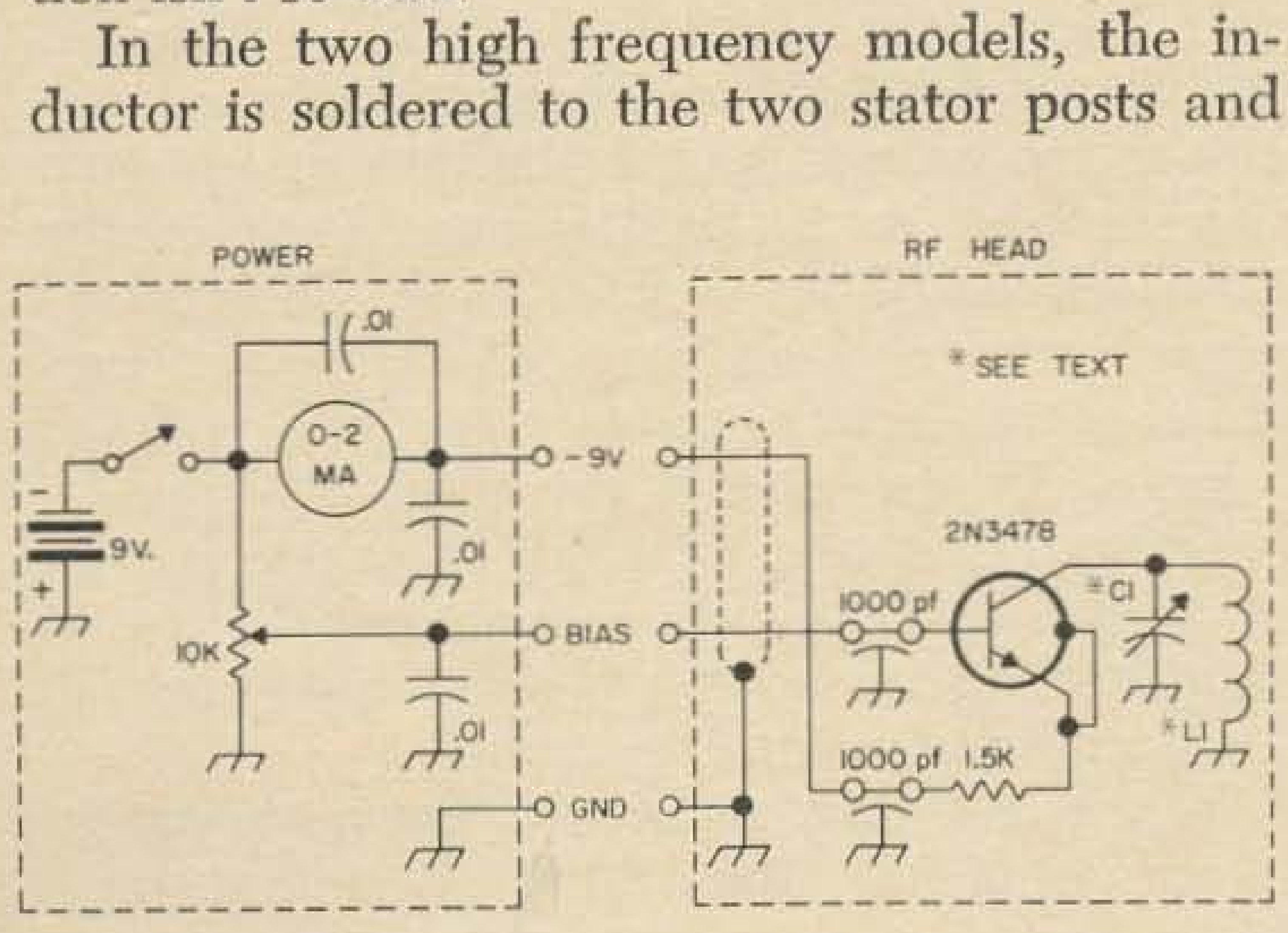


Fig. 2. Final circuit of the dip meter.

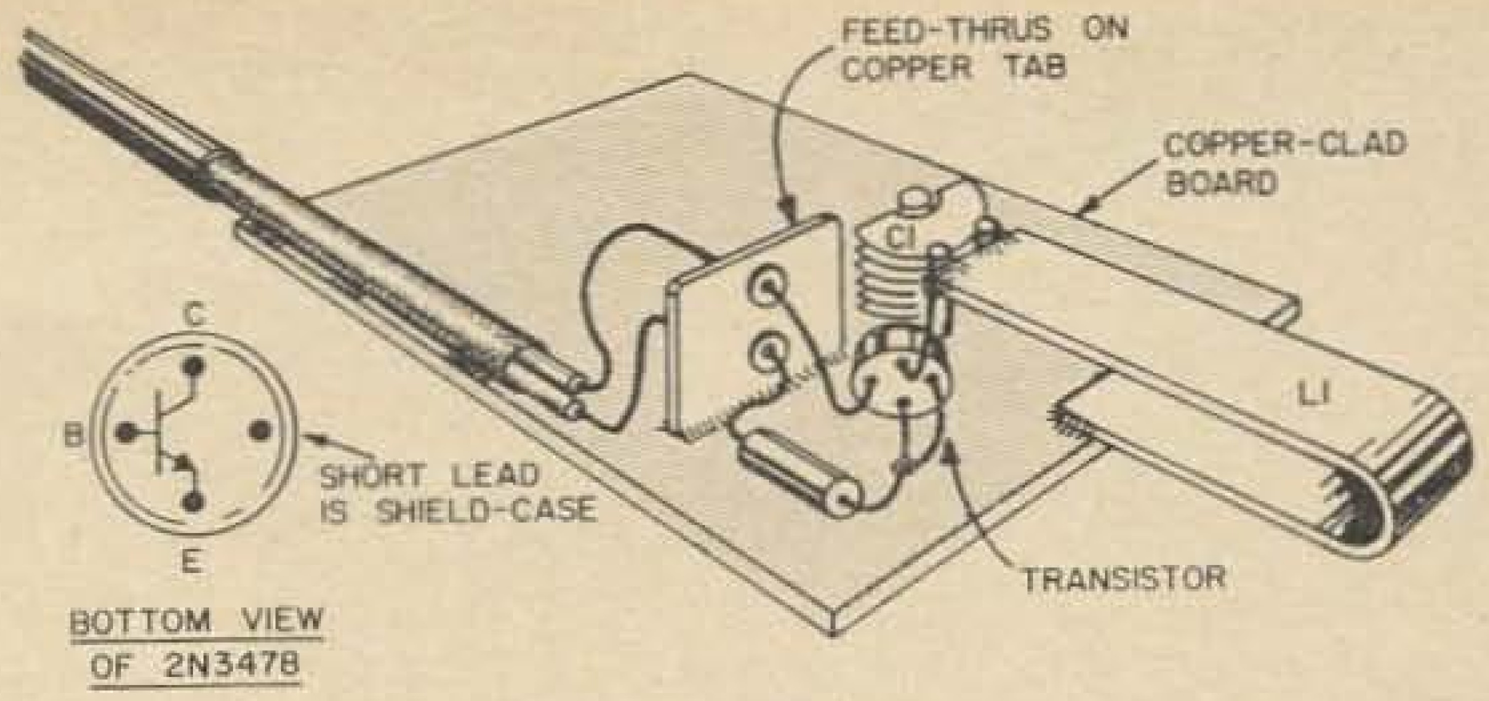


Fig. 3. Layout of the dipmeter. Note the screwy basing guide on the 2N3478.

to the PC copper. Note that the case in the higher one is just for looks. The oscillator is built on a piece of copper clad board and held in place with the variable capacitor mounting nut.

After you've finished construction, turn the base pot down and turn the power on. If the meter pins, you turned the pot the wrong way. Correct it quickly. Then adjust for about 1 ma collector current. Touch the coil with your finger. The current should dip as the oscillator goes out of oscillation. Now take your finger off and tune through the capacitor. If the current decreases more than a small amount (0.2 ma), bend the transistor a bit closer to the hot end of the collector line (stator of the variable). But don't short anything. A little experimenting with small tuned circuits, odd cavities and orange juice cans will show you that the dipper is most sensitive with small values of collector current, say 0.5 to 1 ma.

Calibration requires a little more work. The easiest way is to borrow or buy an absorption wavemeter, such as the ones made by K1CLL (Hoisington Research). Or QRM your UHF TV set. Or use lecher lines, as described in the *RSGB Handbook* or *VHF Amateur's Handbook* or almost anywhere else.

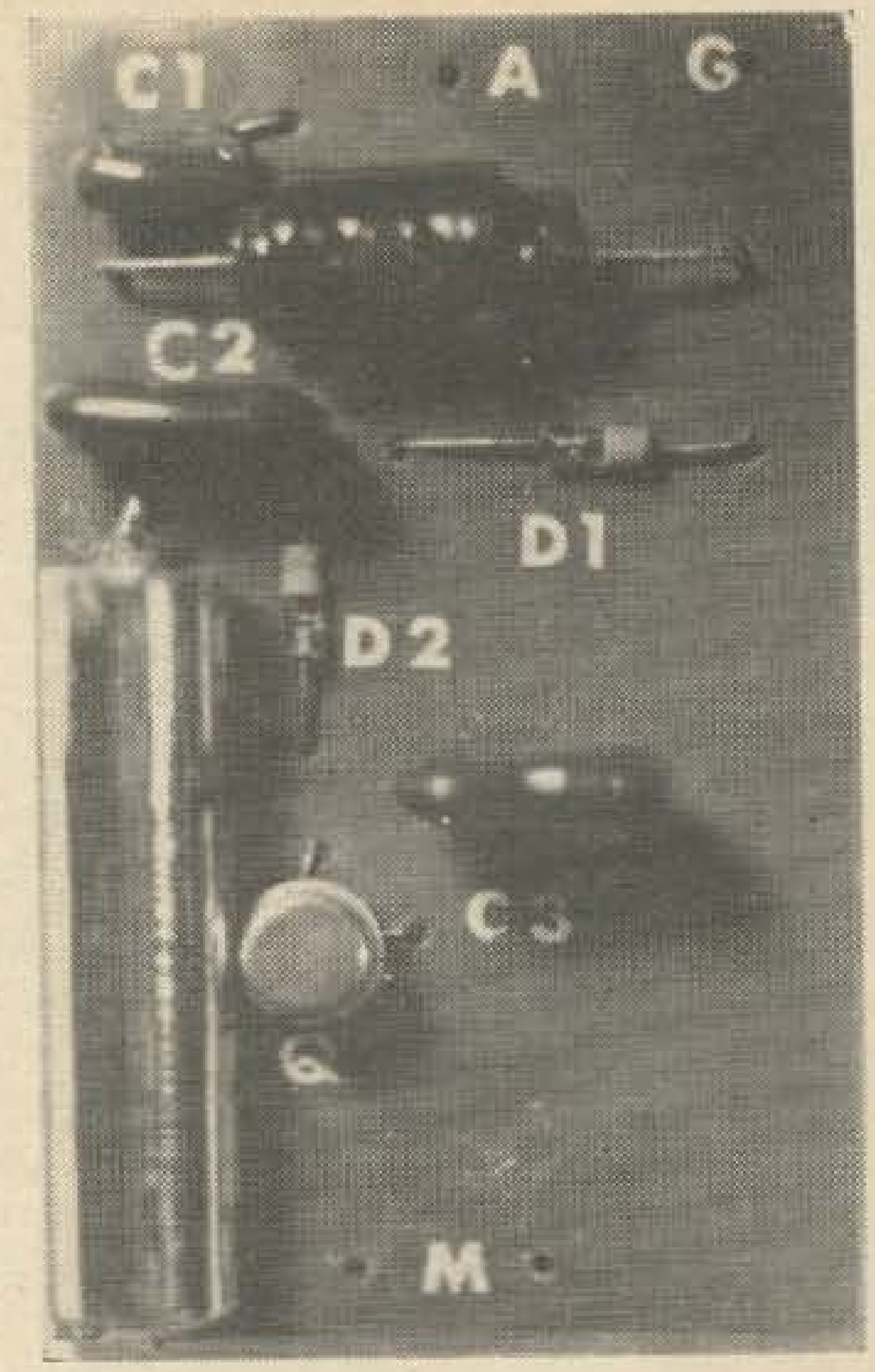
A few notes: You might be able to use other UHF transistors. I haven't tried, except with a 2N706. It worked grudgingly up to 200 mc with a smaller emitter resistor (220 ohms) and small (1 pf) feedback capacitor between the emitter and collector. The feedback capacitor (ceramic, mica or small copper tab) might be necessary on lower frequency dip meters using the 2N3478.

These dip meters are very smooth in operation and well worth the small time and few dimes required to build them. They operate as easily as a HF dip meter and are a necessity for the UHF builder. They proved to me that those trough lines were in the proper range and they can help you play around with UHF. It's a lot of fun. What are you wating for?

. . . WA1CCH

Robert Corbett W1JJL
46 Prospect St.
Torrington, Conn.

Transistorized Field Strength Meter



The unit to be described is a sensitive field strength meter that I constructed for use in tuning up some antennas that I was experimenting with.

As shown in the photographs, the unit is constructed on a printed circuit board. This makes for a small, light compact unit. Although not shown, my unit is installed in a small mini-box, with a coax connecter at one end and a regular phone jack at the other end. In use, a dipole cut for the frequency that you are interested in is connected to the coax jack and a 0-1 milliammeter connected to a long twisted pair and a regular phone plug is connected to the phone jack. The long wire on the meter is so that you can have it located where you are tuning the antenna. Did you ever try to see a meter from 100 ft. or more away?

Now to the circuit. As may be noted, there is no tuned circuit for the input. Instead an rf choke is used. Next you will note that there are two diodes and three capacitors. C1 serves to isolate the antenna, and along with the rfc makes a broadly tuned input circuit.

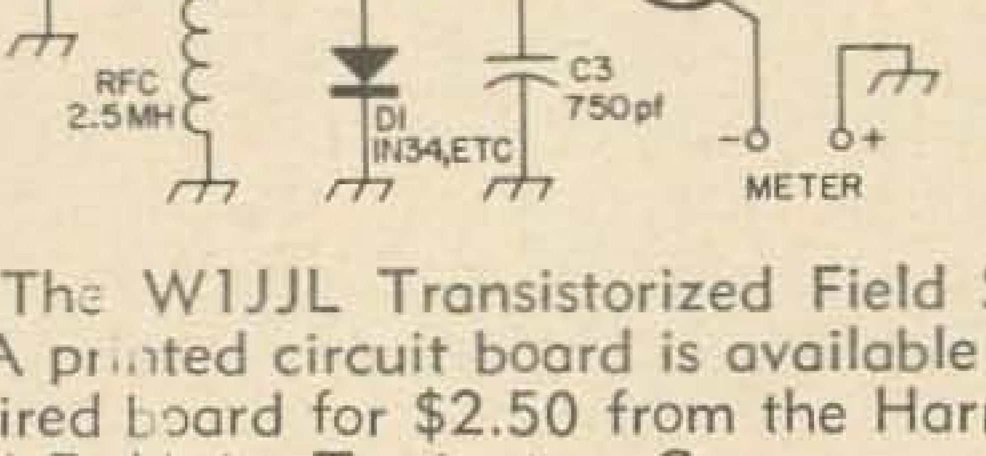


Fig. 1. The W1JJL Transistorized Field Strength Meter. A printed circuit board is available for 50¢ and a wired board for $2.50 from the Harris Company, 56 E. Main, Torrington, Conn.

C2, D1, D2 and C3 form a voltage doubling circuit that increases the sensitivity, and the transistor Q1 serves as a dc amplifier that further increases the sensitivity. From this it may be seen that a very sensitive unit is obtained with just a few parts.

Just as a sidelight; depending on the transistor that you use, the current through the meter with no signal is the leakage current of the transistor, about 0.1 ma. For this reason no zero adjustment is provided or needed.

Although I used a type PNP transistor in my unit, it is easy to alter the circuit for use with a NPN type. All that is necessary is to reverse the diodes, battery and meter connections.

With the 2.5 mh choke shown the unit works good up through the 50 mc band. I have another unit that is identical except for the rfc, that I use on the VHF bands. In this unit I use either a VHF rf choke, a different one for each band, or I connect a tuned circuit to the coax jack with the pick-up antenna link coupled to it. In this case (use of the tuned circuit) I use a 2.5 mh rfc. It is necessary to use an rf choke in all cases as it provides a complete circuit for the voltage doubler. If you leave it out nothing works.

Although construction may be done by use of tie points, I strongly recommend the use of a printed circuit as it provides support for all parts and makes for a neat unit.

You won't find many simpler projects, or more useful ones, than this. Why not spend a few minutes on it?

. . . W1JJL

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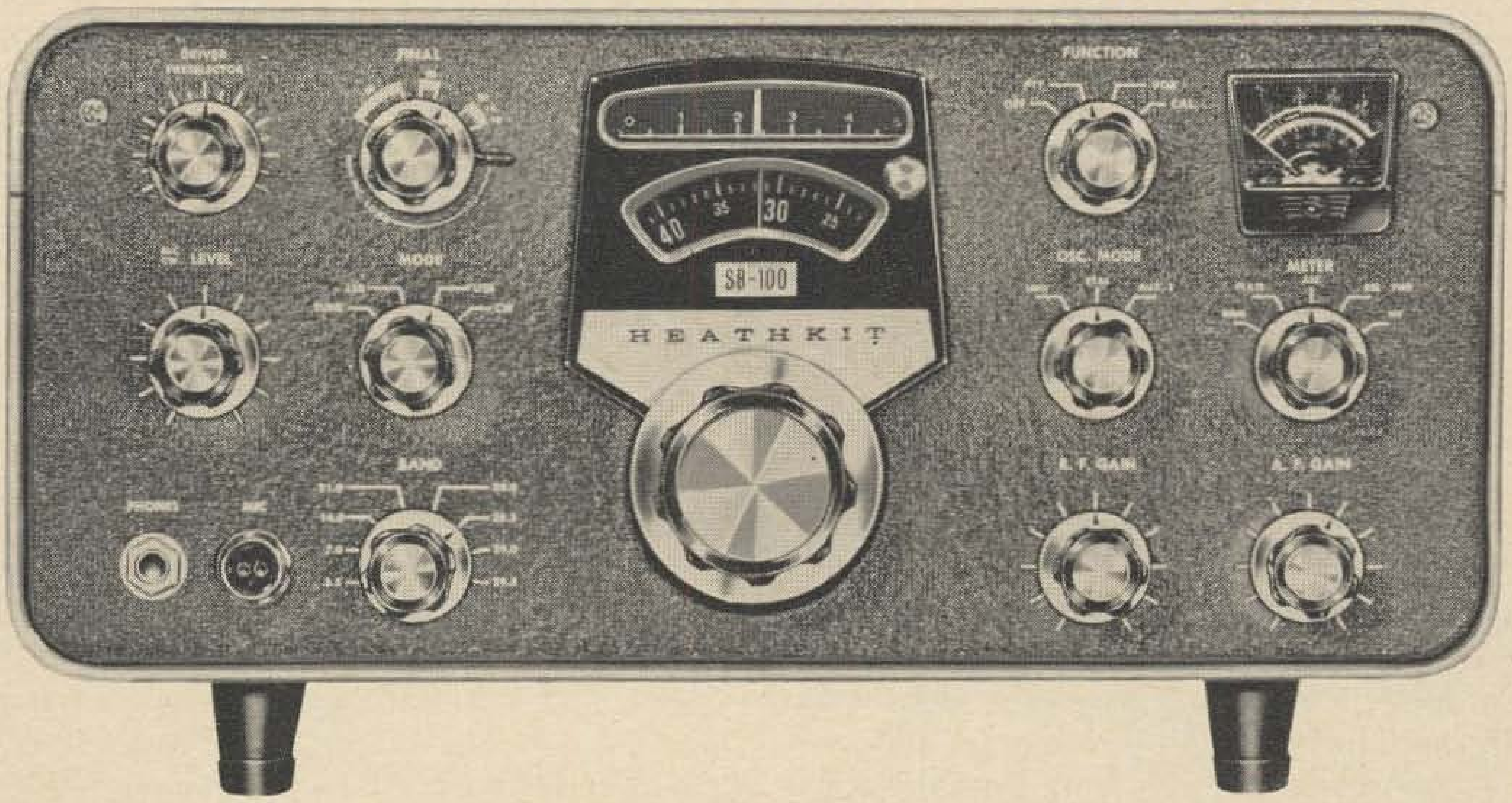

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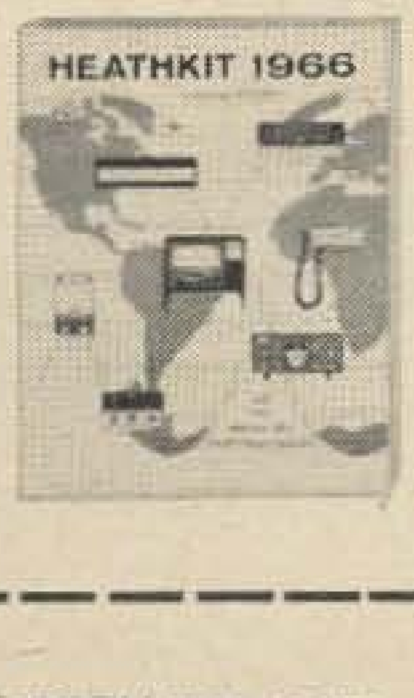

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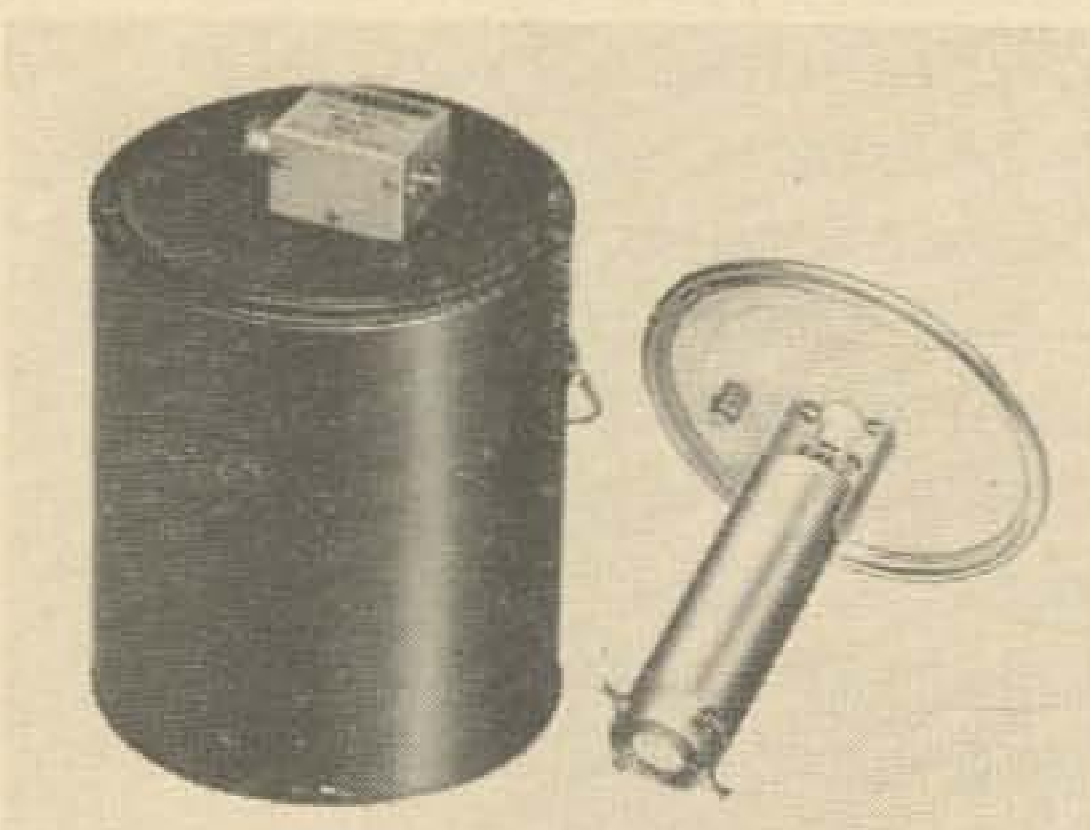
Ham Christmas Gifts

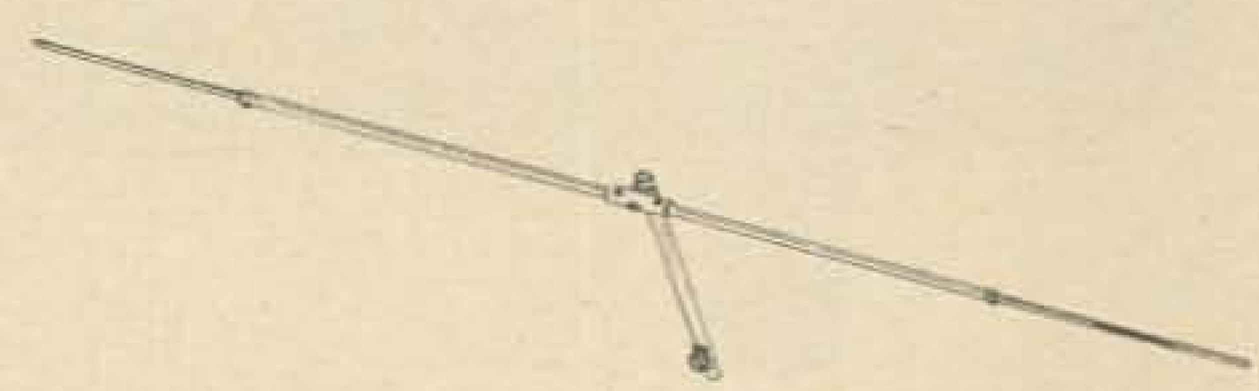
About this time each year, hams start trying to figure out how to get hammy gifts instead of the traditional ties, pajamas and socks they usually end up with. Unfortunately, unless a ham is unusually ruthless and buys his own presents, he ends up being happy with the socks. This section of gifts priced under $10 may help you a bit. Circle the most interesting ones in red and leave this copy of 73 open conspicuously for a month or so. Maybe it will do the trick.

These are some typical gifts that any ham worth his salt should enjoy. Prices generally don't include postage. If there's any question, consult a catalog or the ad in 73.



Heath Cantenna—$9.95

It's impolite, illegal and inefficient to tune up and try out transmitters on the air. You should have a dummy load. One of the best is the Heath Cantenna. It has a VSWR of less than 2 to 1 up to 400 mc, 50 ohms impedance, and can handle a kilowatt in ICAS. It's a kit that won't take you more than a few minutes to build. Heath Company, Benton Harbor, Michigan.

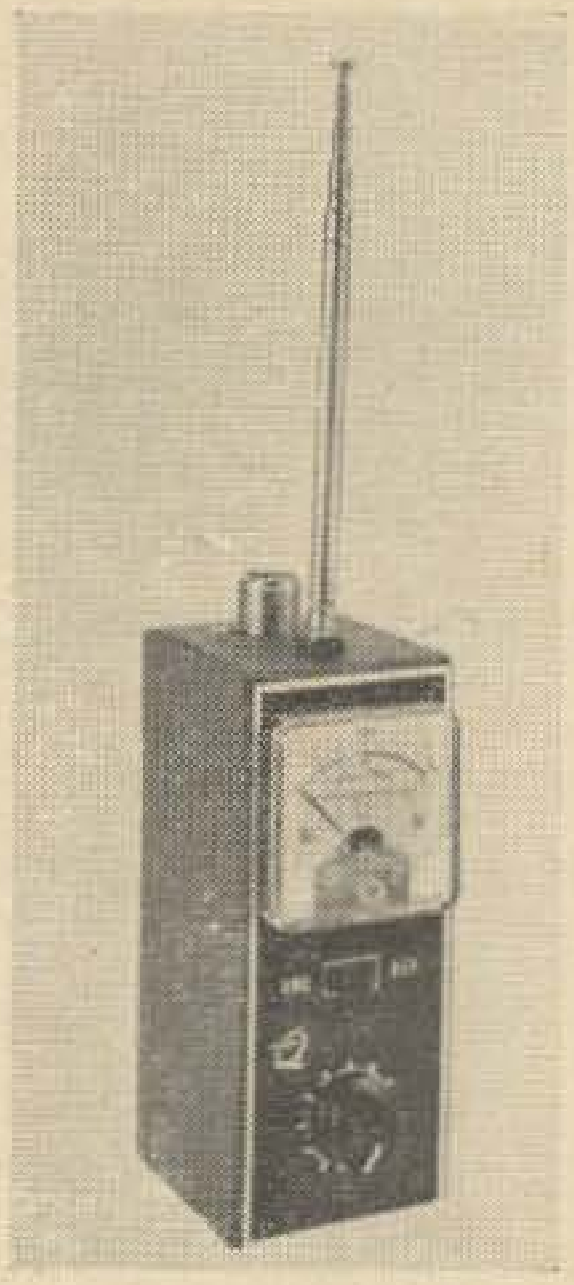


Cush-Craft Trik Stik—$6.45

The Cush-Craft Trik Stik is the universal antenna. This one lightweight low priced antenna can be mounted vertically or horizontally and the arms telescope for different frequencies. It's for CB (half wave vertical), business band, TV, CD and emergency, police, fire and other monitoring, SWL'ing, FM and hamming. Extends to 188". From distributors. Cush-Craft, 621 Hayward St., Manchester, N.H. 03103.

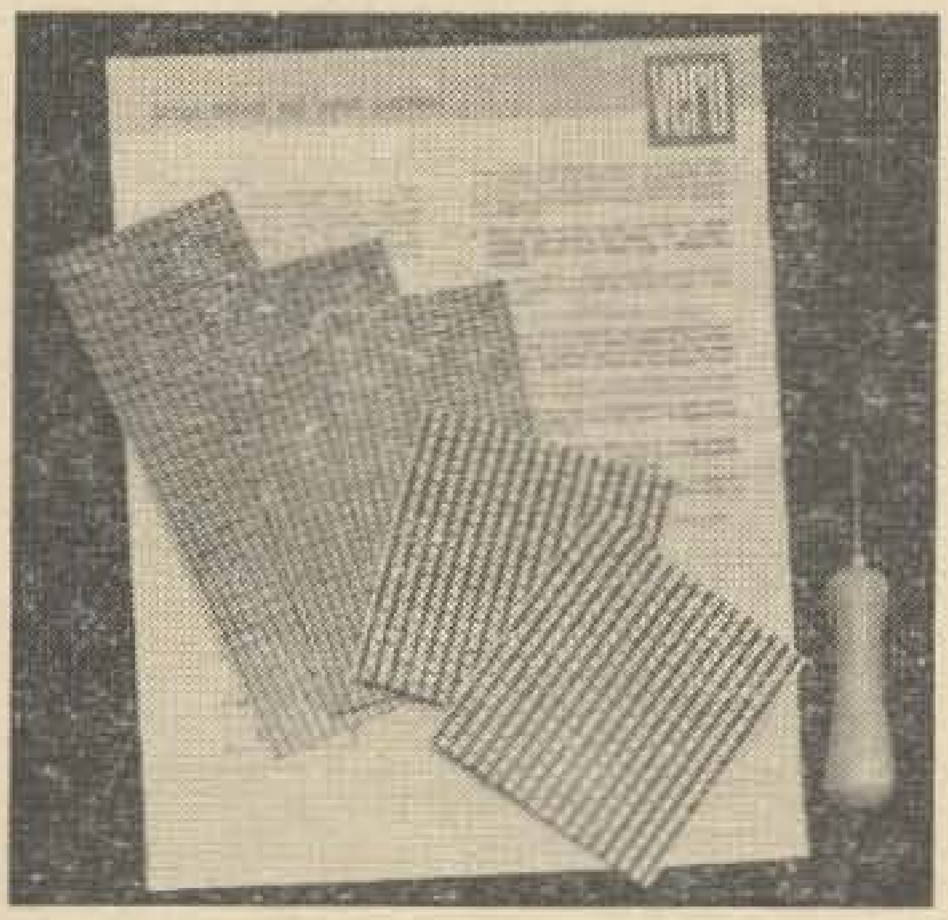
Gift Shop Tie Clasp—$3.50

Like to have *your* QSL card reproduced on an attractive durable metal tie clasp? The Gift Shop will do it for you for a very reasonable price. The card is photographed and reduced to the proper size for the clasp. The lettering is under the surface, so is protected. Gift Shop, Box 73, Northfield, Ohio 44067.



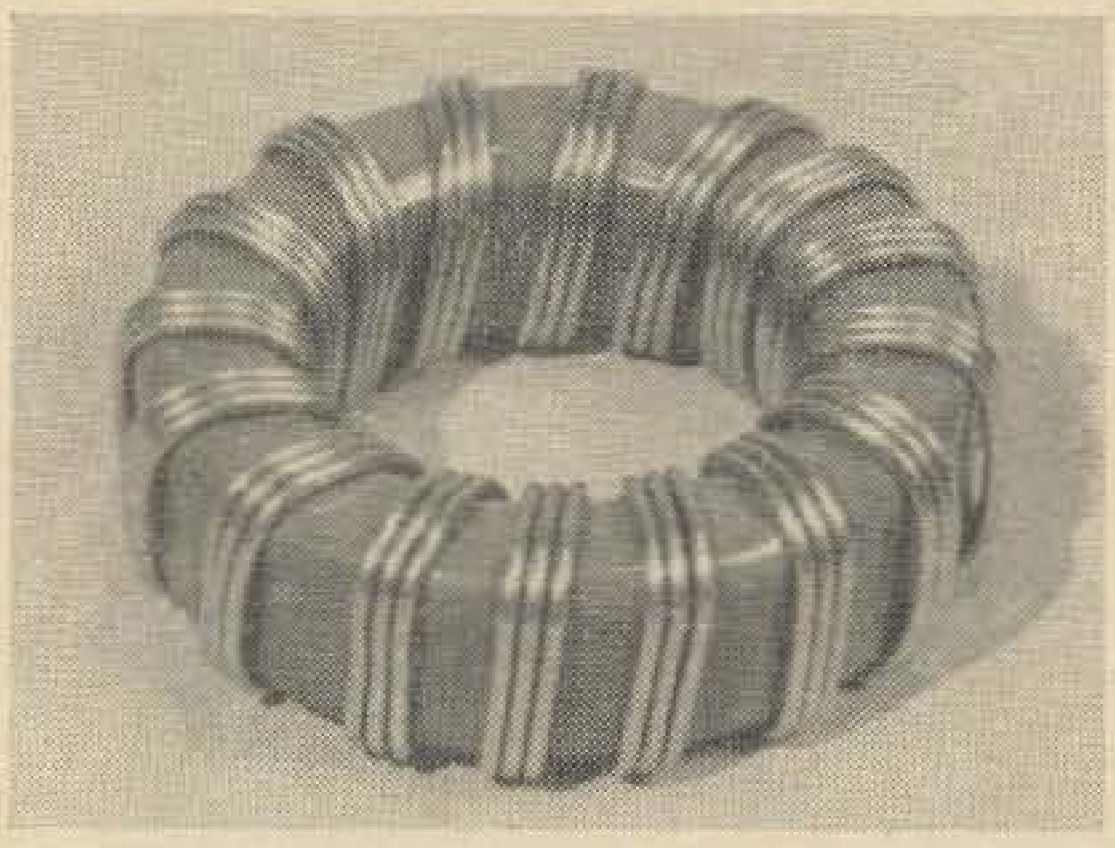
Quement SWR Bridge—$9.95

This Quement SWR bridge and field strength meter will help you get the most out of your antenna (and transmitter) at minimum price. It will take a full kilowatt and can remain in the line all the time. It's 52 ohm impedance, of course. The instrument comes complete with instructions and schematic. Quement Electronics, 1000 South Bascom, San Jose, California.



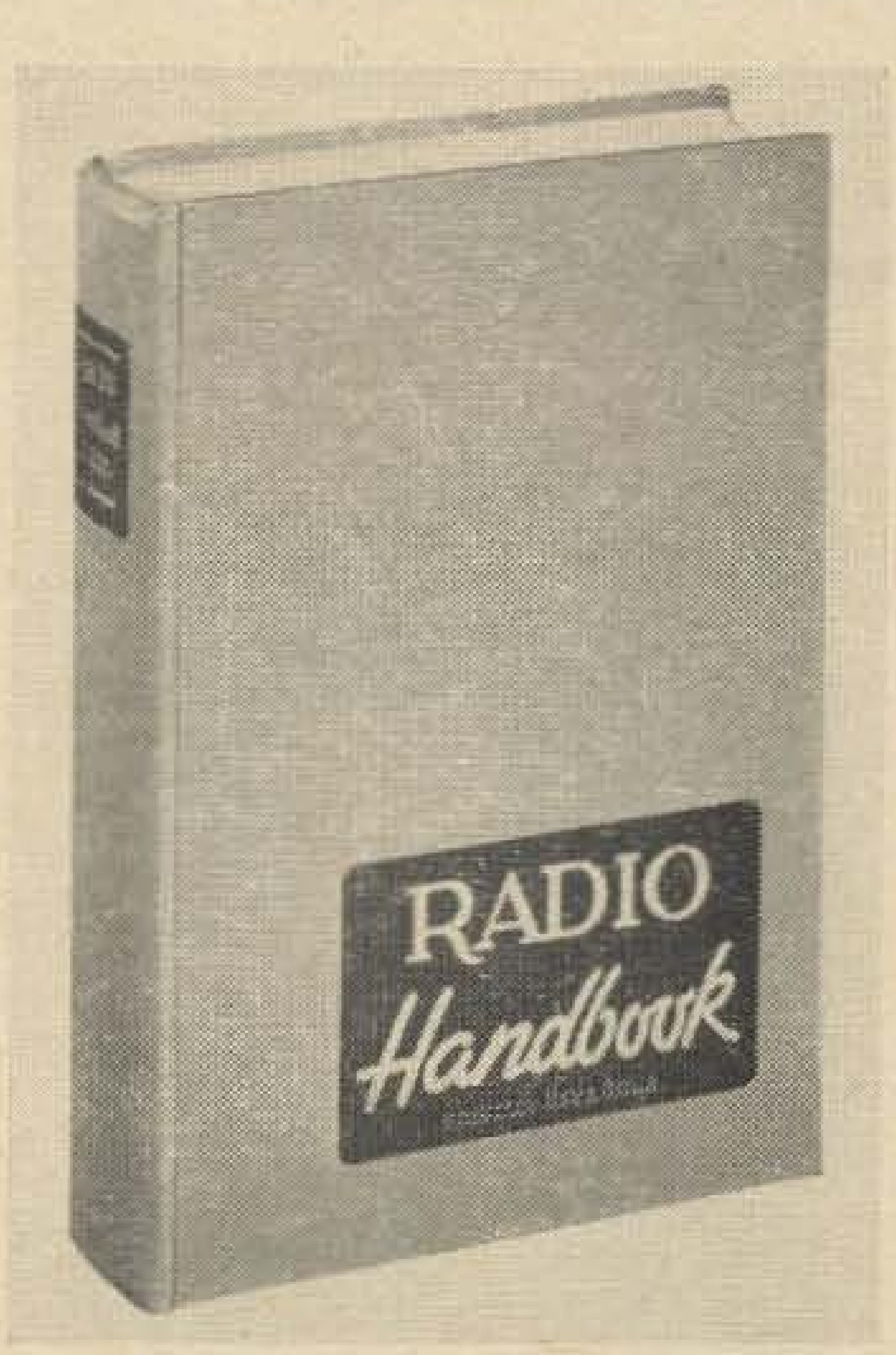
Veroboard Kit—$5.95

Any ham who builds will find this little kit very useful. It's the easiest, most convenient way to breadboard circuits I've seen. In fact, not only is it good for experimental work, but is perfect for finished projects as well. Each Veroboard is a piece of bakelite punched with a grid of holes and covered with strips of copper foil. A special tool furnished with the kit removes copper where you don't want it, and you end up with a simple-to-make printed circuit. This kit also includes six associated Veroboards and complete instructions. You can order it direct from Vero Electronics, 48 Allen Blvd., Farmingdale, N.Y.



Ami-Tron Balun Kit—$5.00

The Ami-Tron toroid balun kit makes a 4:1 or 1:1 balun for use between 80 and 6 meters. It's furnished with #14 epoxy insulated wire, a two inch powdered iron RF core and complete instructions. The balun will handle full legal power. It's easy to wind, too. Takes about two or three minutes. You can buy the kit at radio distributors such as WRL, or direct from Ami-Tron Associates, 12033 Otsego Street, North Hollywood, California.



The Radio Handbook—$9.50

Most hams are familiar with this tremendous handbook. It covers practically every phase of radio theory in simplified, easy-to-grasp form. The Radio Handbook gives you the latest design and construction data. Its complete, basic information will help you design and build modern high-performance ham equipment from power supplies to UHF. Plans in the book include full details, even tips on attractive styling. It's a fat 816 pages of what you need to know. You can buy the Radio Handbook at most distributors, from 73, or direct from Editors and Engineers, P.O. Box 68003, New Augusta, Indiana 46268.

Tepabco Certificate Holders—$1

The picture of Lloyd Colvin of Berkeley, California and some of his wall paper shows us how nice they look in the new Tepabco plastic certificate holders. Certificates mean a lot of work to most of us and these holders will keep them clean and neat and display them to maximum advantage. Each one holds five certificates and a package of three holders is only $1. Ten are $3 postpaid from Tennessee Paper and Box Co., P.O. Box 198, Gallatin, Tennessee 37066.

Radio Amateur's VHF Manual—$2.00

Any VHF'er or prospective VHF'er should have this excellent handbook by W1HDQ. It gives you a brief history of ham VHF activity, then goes into almost all of the nooks and crannies of the VHF and UHF world for a look at theory and practical construction. As they say in the ad, "It deserves a place on the bookshelf of every amateur . . ." A tremendous bargain at $2. It should cost twice that. From QST in Newington, Conn. 06111.

Knight LC-1 CPO Kit—$7.95

Know someone who'd like to become a ham but hasn't learned the code? Maybe your wife or children or a neighbor? This Knight-Kit Code Practice Oscillator will help you help them. It's a modern two-transistor oscillator with plenty of volume for group practice, plus a jack for private listening with head phones. The kit will just take a couple of hours to build from the complete instruction manual. It comes complete with key and battery. Allied Radio, 100 N. Western Avenue, Chicago, Ill. 60680.

Epsilon Code Records—$9.95

One of the best ways to learn code is the system used in this album. It's based on modern psychological techniques and is said to take you to 13 wpm in less than half the time usually required. Epsilon Records, 206 Front Street, Florence, Colorado.

And others—

There are plenty of other gifts under $10 that any ham would like to receive. How about a 24 hour clock, such as the attractive Mastercrafters 2324. Or an impressive Hy-Gain "On the Air" sign? Ungar makes a nice Technicians Soldering Kit for about $3.50; give a new ham a decent soldering instrument so he'll start out right. A builder likes to keep records of what he's been doing and an electronics template is helpful for neat work. Moody makes a nice assortment of miniature tools, such as a set of taps for 0-80 to 4-40 screws. Dymo tapewriters are awfully useful and they seem to be getting cheaper each week. A specialized set of tools for hams is radio tap and dies. Nutdrivers are nice for those who don't have them. And how about small parts cabinets? Who *doesn't* need them? Finally, how about a pound of Ersin 5 core, 60-40, 18 gauge solder? Most of these gifts are available from any large wholesaler or mail order distributor. Some may be a bit off-beat, but all would be useful and fun for a ham. Merry Christmas. WA1CCH

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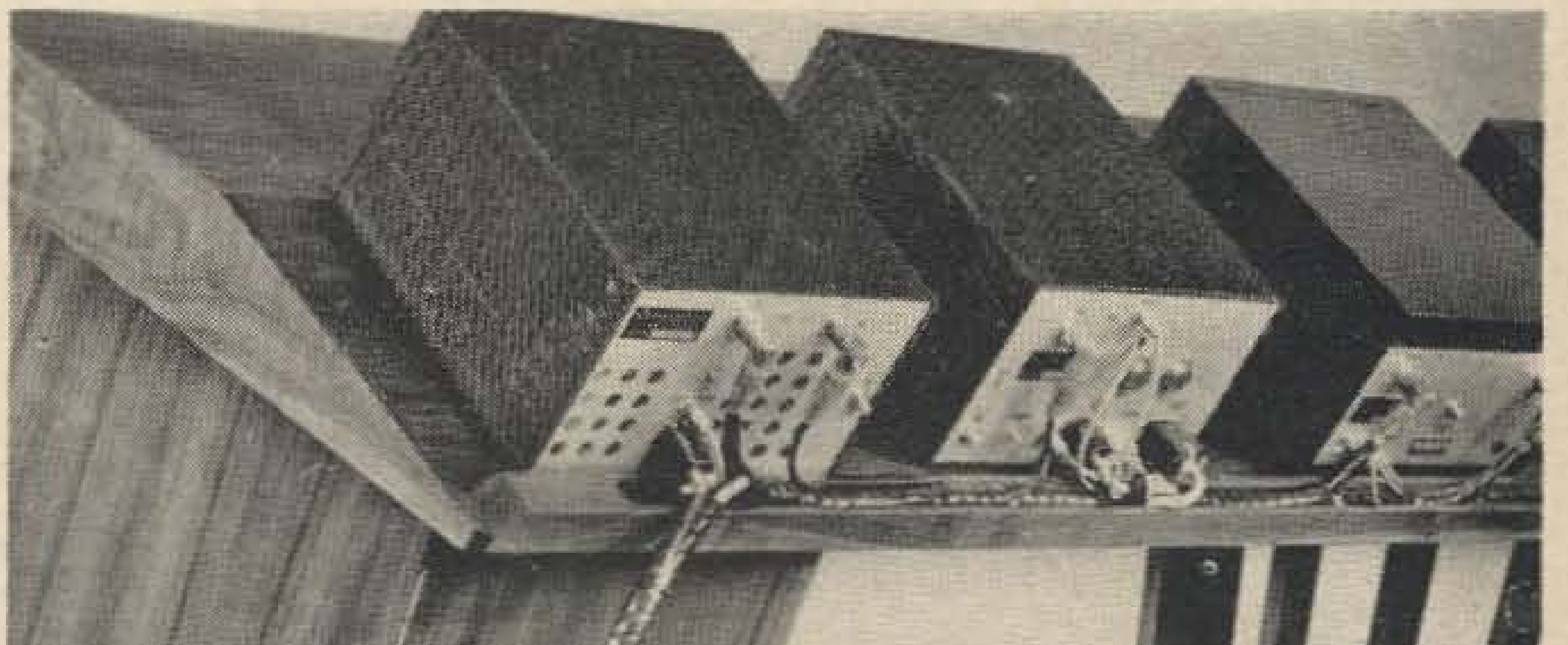

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Building and using a Q-meter and impedance bridge.

RF Measurements

Jim Kyle K5JKX
1236 N. E. 44th St.
Oklahoma City, Okla.

Any ham who builds equipment (and if you don't, why do you read 73?) has frequent need to measure the characteristics of things. DC measurements are simple; ac measurements in the audio range aren't too difficult—but when you get up into rf measurements, the picture changes.

Most of us have a grid-dip oscillator which lets us measure the frequency of a resonant circuit, and not quite so many of us have vtvm's for use at dc and the audio range—but that just about ends the list of rf measuring devices in wide use among hams.

Two other gadgets, costing about $5 each to build, can extend our measurement techniques in the high-frequency range to approximately equal those available to us in the audio area. And strangely, though these gadgets were described in print at least 10 years ago, they seem not to have caught on! Maybe it's not so strange at that—the gdo lay ignored for some 20 years from its first description before gaining its present popularity.

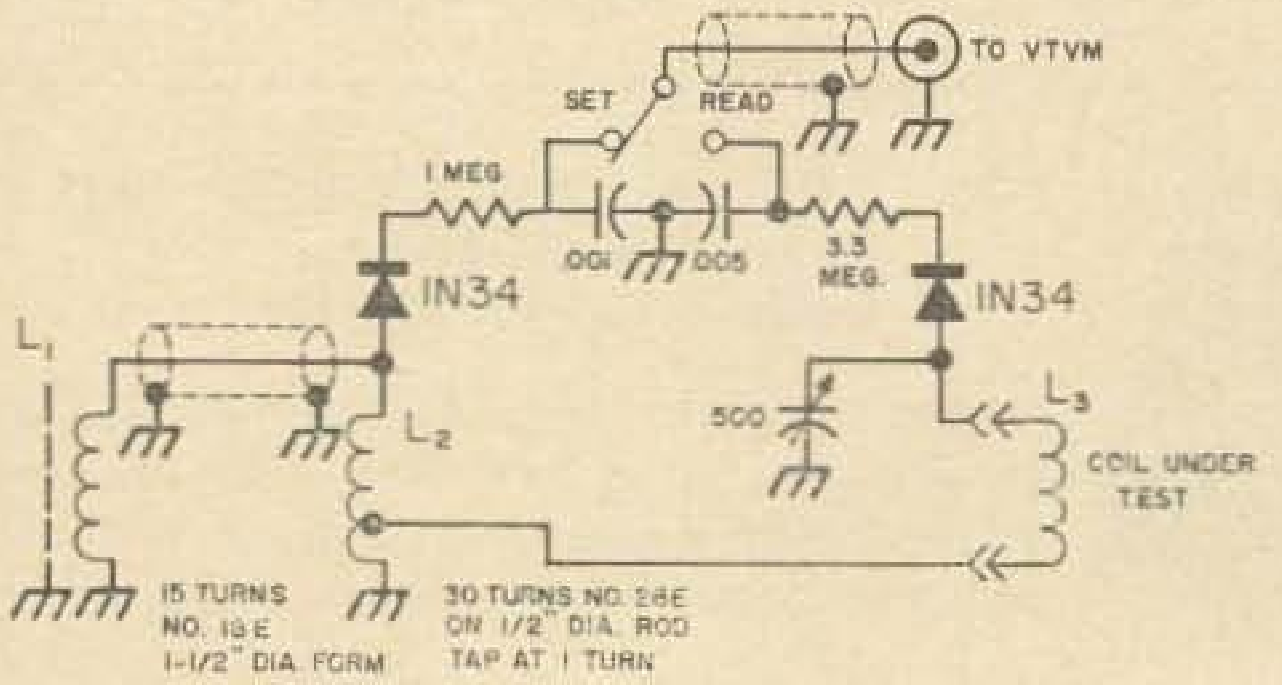

Fig. 1. Shematic of Q-meter.

Anyhow, the two gadgets are a Q-meter and a resistive impedance bridge. The Q-meter allows you to make direct measurement of inductance and Q on any coil, at any frequency you like in the 3-30 mc range, while the impedance bridge allows you to measure the resistive impedance of anything you like within the same range of frequencies.

Though inexpensive to build, both devices are every bit as useful as elaborate laboratory equipment. Their accuracy will be as good as you make it—but can easily approach that of any similar devices.

Both require a gdo or similar low-power signal source, and a vtvm. We assume that if you're interested in rf measurements, you already have both.

Interested? Let's see how they're built first, then how to use them. We'll start with the lesser-known Q-meter.

The Q-meter, first described by Elbert Robberson W2FRQ, in 1954, determines the Q of a coil by measuring the voltage developed across the coil in comparison to the voltage fed into the coil in a parallel-resonant circuit. By definition, the Q is equal to the ratio of the parallel voltage compared to the series voltage.

The schematic appears in Fig. 1; typical layout is shown in Fig. 2. Only a few points are critical—aside from them you can vary things to suit yourself.

The first critical point is that the coil being tested must be supported in the clear, with no metal or other objects in its field. In the original model, this was accomplished by placing the test terminals on the far end of 1½ inch

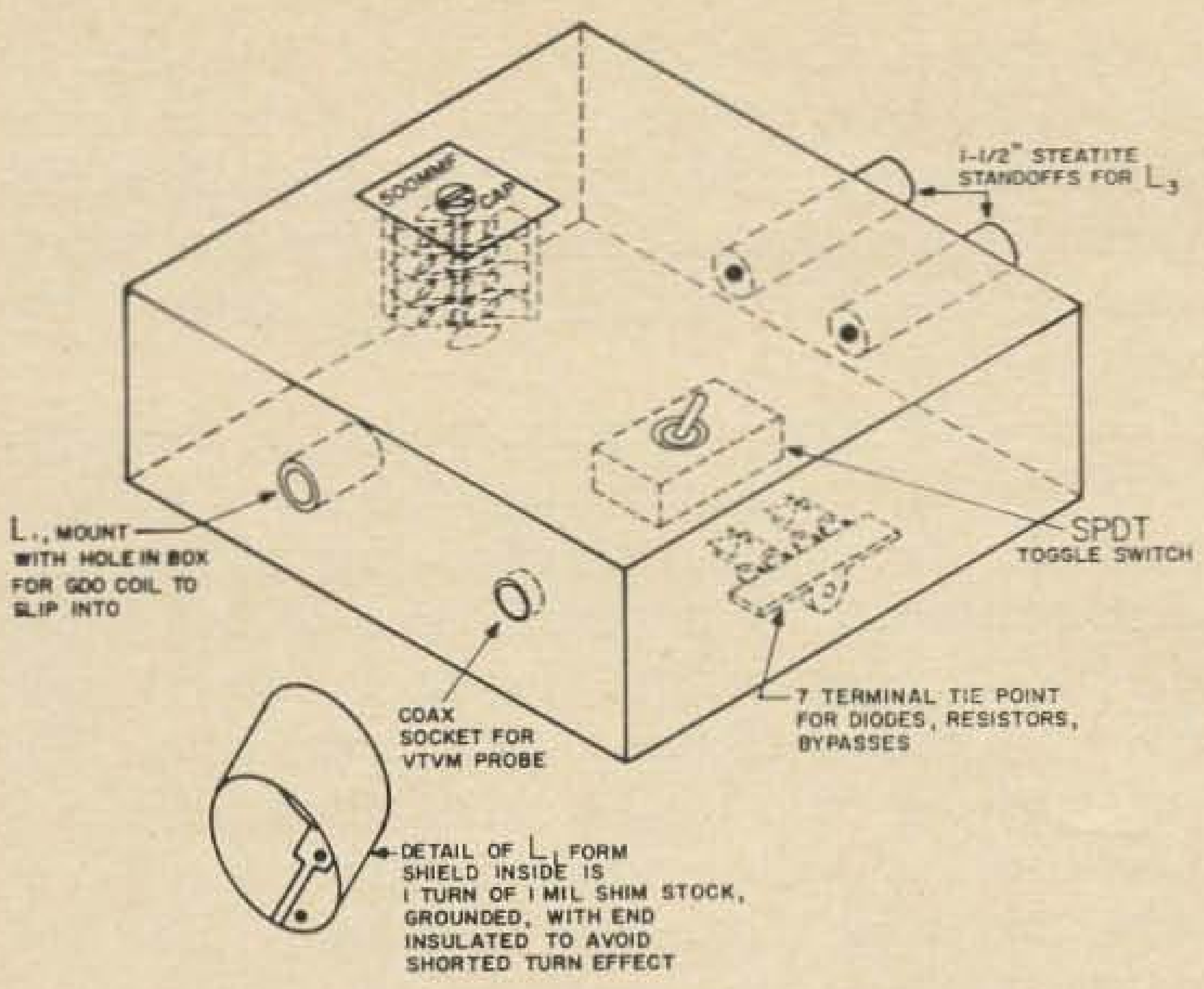

Fig. 2. Suggested layout of Q-meter.

ceramic standoff insulators, and putting them on the far side of the case from all controls, as shown in Fig. 2. Any position in the clear and far enough from controls to eliminate hand-capacity effects is suitable, however.

A second critical point is the use of a Faraday shield between the gdo and the coupling coil, L1, together with coax cable from L1 to L2 in the Q-meter. These eliminate the probability of direct coupling between the gdo and the coil under test, so that any voltage measured across the coil you're testing must be that developed by the series voltage fed in. The shield consists of a strip of brass shim stock insulated on one side with Scotch tape so it won't form a shorted-turn, and fitted inside the coil form for L1. It is grounded at one point only.

A third critical point is the apparent duplication of components in the rf voltmeters made up of the two diodes. Don't try to economize by using a single diode and switching rf. This will cause varying loads on the circuitry, and will reduce the accuracy attainable. As shown, all circuits operate with constant loading effect, and switching the VTVM has almost no effect at all.

The final point—not so critical but important nevertheless—is the location of the tap on L2. With the tap at 1/30 of the total number of turns, the actual series voltage will be just 1/30 of that measured in the "Set" position. The tap *must* be at one turn, but the total number of turns can be increased to 50, say, to change the series voltage to 1/50 of that read.

Naturally, all leads should be kept as short as possible, consistent with proper separation of coils. Total shielding is recommended, and occurs automatically if a metal box is used.

Assuming that you've built the gadget as shown and without change, here's how to use it. First, the dial of the capacitor should be calibrated. The simplest way to do this, if you have access to a capacity meter, is by direct measurement and marking. Otherwise, you'll be fairly close to simply subtract the minimum rated capacity of the unit you use from the maximum value and divide the resulting capacity range by 10. Then mark off a semi-circle in 10 equal 18 degree segments. and mark the lowest one with minimum value. Add the figure you got in the division to this and make that the second point; follow this same routine until you reach maximum capacity.

This calibration is used primarily to measure inductance, by substituting the capacity setting required for resonance and the frequency at which resonance occurs into the formula: 25,330 equals L times C times f^2, where C is in mmfd, f is in mc, and L is in microhenries.

To measure Q, let the gdo and the vtvm warm up, then set the Q-meter switch to "Set" and adjust the coupling between gdo and Q-meter until 0.3 volts is indicated on the vtvm. (You are actually adjusting to put 1/30 of this, or 0.01 volts, into the coil under test.) Next, switch to "Read" and tune the capacitor for maximum reading. When you have it, switch back to "Set" and check to make sure you still have a reading of 0.3. This will usually change, due to increased coupling at resonance. Re-adjust coupling for the proper reading. Now switch back to "Read" and multiply the figure you read by 100; the answer is the Q of the coil! It's that simple.

If you have changed the size of L2, for instance, so that you have 50 turns instead of 30 the procedure would be the same except that your reading on "Set" would be 0.5 rather than 0.3. The 1/50 voltage division provided by the tap would give you 0.01 volts applied

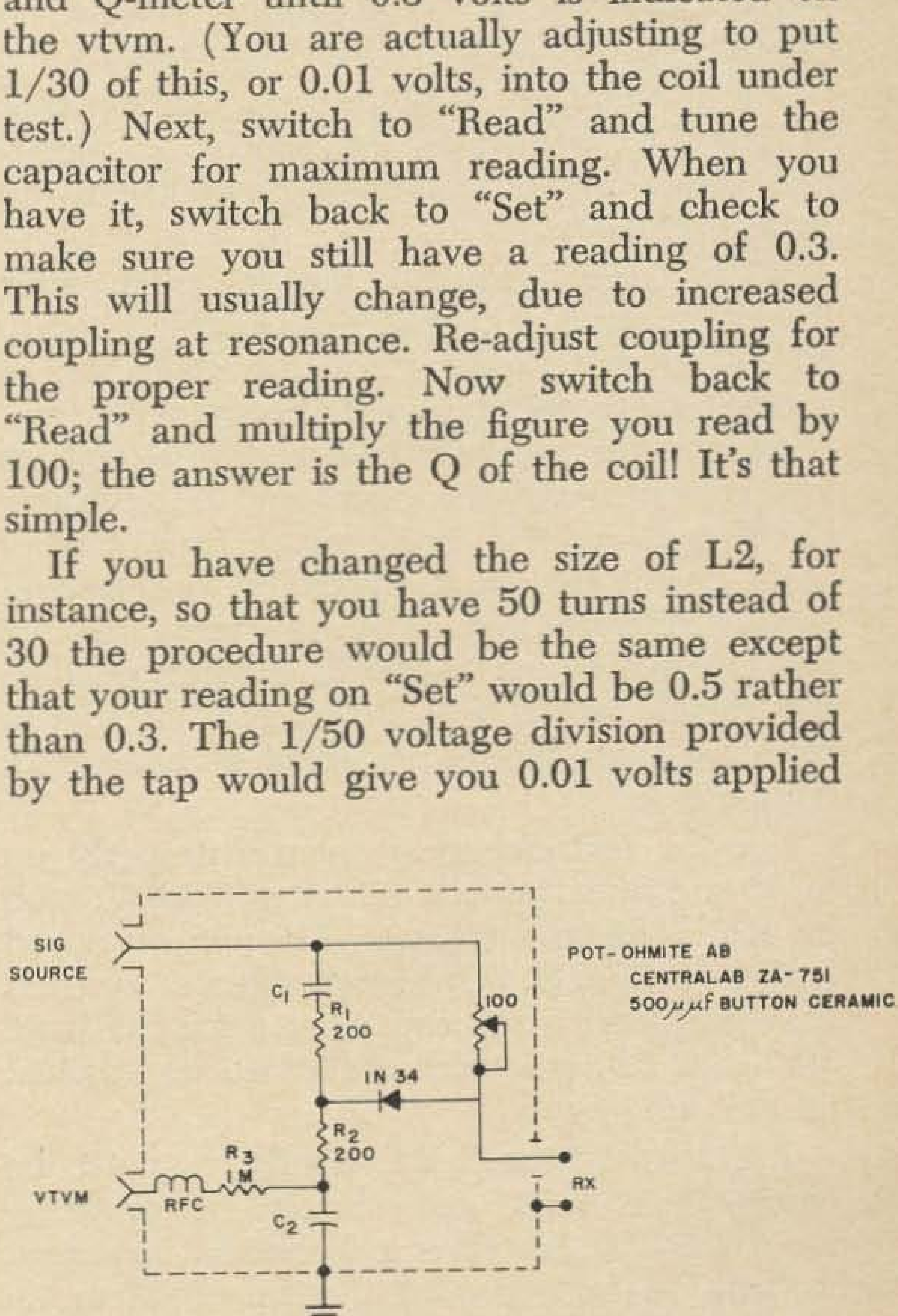

Fig. 3. Schematic of Impedance Bridge.

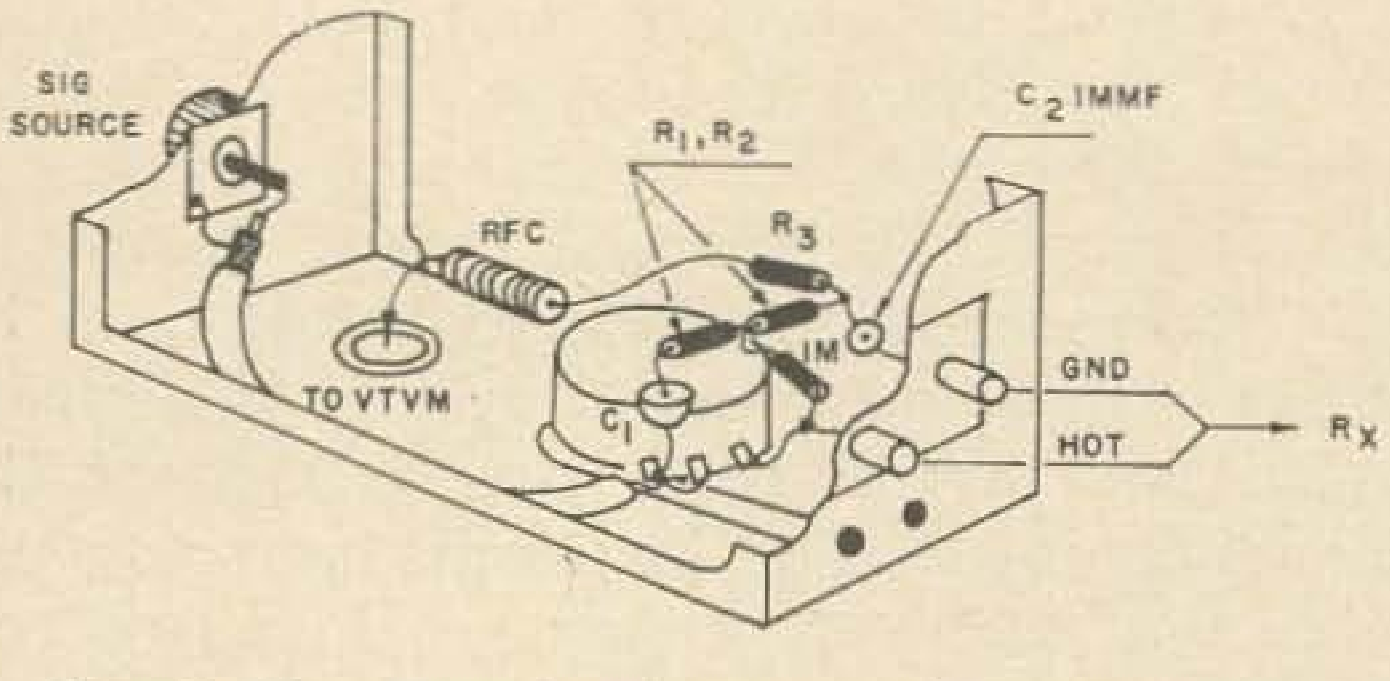

Fig. 4. Cutaway showing parts location.

to the coil, so the rest of the operation would be the same.

No harm to readings will result if you switch ranges on the VTVM between "Set" and "Read" provided your VTVM is accurate on both ranges used.

Now let's look at the impedance bridge. This device was described, also in 1954, by Wil Scherer of "TNS" fame. Incidentally, a complete kit of similar design has been available from Allied Radio for several years.

The schematic of the bridge is shown in Fig. 4, with layout in Fig. 5 and detail drawings for drilling of the box in Fig. 6. In this device, physical layout is highly essential to success and no changes are recommended.

The bridge itself is similar to a conventional Wheatstone bridge, as the schematic shows. The major difference is in the location of the indicating meter.

When the resistance of the unknown under test is the same as that of the variable resistor, no voltage will appear across the diode and as a result there will be no dc across C2. However, until the bridge is balanced an rf voltage *will* appear across the diode and be rectified. If either Rx or the signal source form a complete circuit for dc, the rectified voltage will appear across C2 and can be measured by the external vtvm. Since in normal practice the signal source will be a gdo through a coupling loop, this requirement of a dc path will be met.

For the instrument to operate properly up to 30 mc, it is important that no substitution be made for the Ohmite AB pot employed for the variable. Ordinary volume controls have too much stray capacitance for use here. With the AB, passable results can be attained up through 54 mc.

Resistors R1 and R2, similarly, must be composition units and should be perfectly matched. The exact value is not so important as long as both are of the same value; an ohmmeter check is satisfactory. The same matching requirement extends to C1 and C2; if operation above 30 mc is not intended, it would be best to use 2 per cent silver micas here. However, for operation at higher frequencies the button-type ceramics are necessary, so matching with a capacity meter is the only way out.

The only really critical point in the construction of the impedance bridge not evident from the drawings is the mounting of the variable resistor. It is mounted on a ¼ inch block of polystyrene, which in turn fastens into place by means of two 6-32 tapped holes. The pot must be clear of the shield since all terminals are hot with respect to the case; this is why the ¾ inch hole for the shaft, also. And naturally, don't use a metal knob!

To calibrate the dial, connect an ohmmeter between the "hot" Rx terminal and the center conductor of the coax input terminal. Mark the scale at 0, 10, 20, etc. ohms as read on the ohmmeter; subdivide at as small an interval as you wish.

To test the instrument, couple a gdo to the input terminal (a convenient shielded coupling cable is shown in Fig. 6) and connect your vtvm to the meter jack. Connect a 47-ohm composition resistor to the Rx terminals, using the shortest possible leads, and set the gdo to some frequency below 20 mc. Adjust the knob of the impedance bridge until you get a definite, sharp null on the vtvm. Ignore the gdo meter. The null should be very close to 47

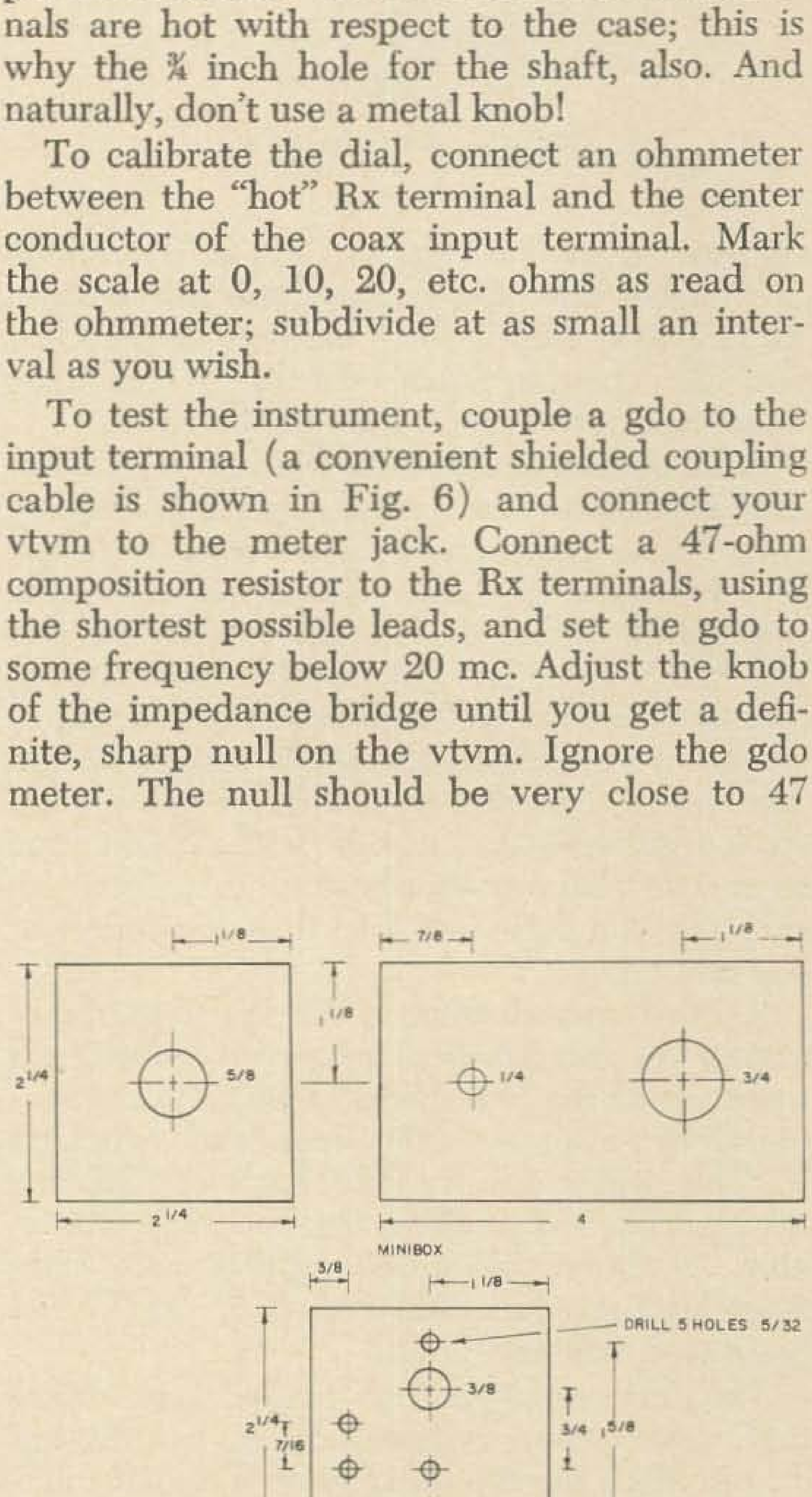

Fig. 5. Box drilling details.

ohms on the dial (within the tolerance of the resistor used). If no null can be achieved, check for errors.

If you get a good null, increase gdo frequency until you can no longer obtain a complete null. The frequency at which this occurs should be somewhere above 60 mc if built as described, and somewhere above 30 mc if silver-mica capacitors are used. Wherever it occurs, it marks the upper limit of frequency for your instrument to give accurate readings, although relative readings can be achieved at any frequency at which even a partial null can be obtained.

In use, the unknown impedance is connected to the Rx terminals and the gdo set to the desired frequency. Then the nob is varied for a null. When null is reached, check the gdo meter to make sure you have a true bridge null and not just a loss of power from the gdo, then read the resistive impedance from the bridge dial.

Like any other resistive-impedance meter, this will not give accurate results if reactance is present in the unknown. However, for most antenna and receiver measurements, this is no disadvantage as any reactance present can be tuned out before measurement.

Now that we've built our two rf-measuring devices, let's look at some uses for them.

The straight measurement of coil Q of course is an obvious use for the Q-meter—but how about using it to find the optimum coupling point for a transmitter output tank?

To do this, set the Q-meter capacitor to the same value you will use in the transmitter, and prune the coil to resonance. Attach the coupling coil, and connect a 47 or 51 ohm composition resistor to the coupling coil to substitute for the antenna. Now measure coil Q. As you vary the coupling of the antenna coil, Q will vary over a wide range; for most uses, you want a reading of 15 to 20. When you get the proper Q value, make the coupling adjustment permanent. That's all there is to it.

The impedance bridge is a natural for measuring the input resistance of antennas; simply connect it through a half-wave line to the antenna and take your reading.

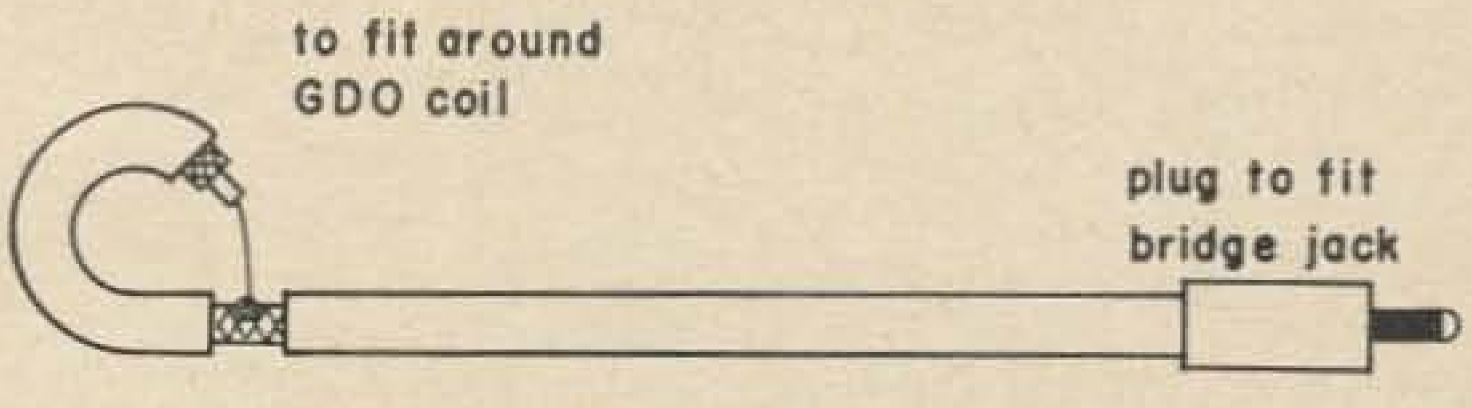

Fig. 6. GDO coupling cable.

But it also comes in handy for preparing the half-wave line to start with. Make a coupling loop at one end of your length of coax and measure off a free-space half-wavelength down the line. Don't cut it—stick a pin through to short the inner conductor and shield together temporarily. Set the bridge dial to 0, and start moving the pin toward the bridge end of the line. Somewhere about 2/3 of a free-space half wave, you'll find a null point on the bridge. This is your electrical half wavelength. Cut here and you have it. Any integral multiple of a half wave can be located by the same technique.

To measure a quarter-wave line with the bridge, you have to cut the coax since an open-circuit at ¼ wave reflects as a short to the bridge. You can start by measuring a half wave, then dividing it in half and adding six inches or so. Trim off the far end only about an inch at a time until you reach the null point, which will be your quarter wave.

This impedance bridge measures only in the range 10 to 100 ohms; to measure unknowns outside these limits the inverting properties of quarter-wave lines may be used. This is best illustrated by an example.

Let's assume you want to measure the impedance of a voltage-fed antenna at 21 mc. You know to start that it is in the neighborhood of 2000 ohms. First measure off a quarter wave of 300 ohm twinlead. Use this to connect the impedance bridge to the unknown. When you get a null, the relationship of the dial reading to the true value of the unknown will be dial/line equals line/true; thus, with 300 ohm line, if you get a null at 90 ohms on the dial you have 90/300 equals 300/true, which may be solved to get a true value of 1000 ohms. Had the null occurred at 60, the true value would have been 1500.

. . . K5JKX

Edgar Wagner G3BID

International Licensing in the Belgian Rallies

The Belgians were probably the first to organise truly International Mobile Radio Rallies giving temporary mobile licences to all Amateurs, irrespective of whether their country gave reciprocal facilities to the Belgian Nationals, or not.

It began in April 1963, when an International Rally was organised by the newest and smallest section of the Belgian National Radio Association U.B.A. by ON4PL in Verviers near the Dutch and German frontiers. Licences were obtained from the Belgian authorities for all participants to operate in Belgium for a week.

This Rally was so successful that the second rally was organised in September 1963 by the headquarters of U.B.A. in Brussels in close co-operation with the Belgian Red Cross Society to celebrate the Centenary of the Red Cross.

The installation in ON5ZE/M-G3BID/M's Bentley.

At the opening of the rally, ON4VY was able to announce that the Belgian Government had agreed to grant temporary mobile licences to foreign Amateurs for short periods at any time irrespective of whether there was any organised rally taking place at that time.

On questions of International licences Belgium is far ahead of all other countries, and their rallies are becoming regular events.

Last year two International Mobile Rallies were organised in Belgium, and so arranged as to take place on successive weekends so that foreign visitors to Belgium could participate in both rallies on one trip.

The first took place on the 29th and 30th August in the Ardennes and was organised by the Province of Luxembourg section of the U.B.A. (This must not be confused with the Grand Duchy of Luxembourg–LX, which is not prepared to grant licences unless reciprocal facilities exist). This then was organised by the Province of Luxembourg section of the Belgian Club U.B.A. and took place, of course, entirely on Belgian territory.

The rally took place at Nisramont in one of the most beautiful parts of Belgium. The rally was organised on a two day basis, the first day being entirely informal and was designed to allow the various participants to meet each other, examine one another's installations, discuss radio problems and generally meet on a social basis. The organisation was quite remarkable. Everything which the mobile Amateur could desire was available.

Next to the rally site was the Hotel Rochers du Herou where those who wished to spend the night in a hotel could obtain accommodation and, of course, meals and refreshments were available at all times.

For those who prefer to camp or bring caravans, adequate parking space was provided and tents were even available for those who wished to take advantage of them. These were provided by the Belgian Red Cross, and it should be stressed that complete co-operation existed throughout between the Radio Society U.B.A. and the Belgian Red Cross who greatly contributed to making the event so successful.

A large tent had also been provided as a meeting place in the event of bad weather. But the weather remained perfect throughout.

Thus many mobiles turned up on the Saturday and met one another and generally had a most enjoyable party.

On Sunday the competitive part of the rally was due to begin at approximately 13.30 local time on 3.5 mc and 144 mc.

Here one of the most remarkable pieces of organisation was witnessed.

The rally organisers had laid on a three-course lunch, hot soup, hot chicken and two vegetables and a sweet for about 300 persons. A delicious meal it was too. This was a feat of organisation we had not expected and was due to the co-operation of the Belgian Army with Radio Club and the Red Cross. This meal incidentally was free and was included in the modest subscription fee of 100 Belgian francs which also included the third party insurance which is compulsory in Belgium for all rallies of this nature.

The competitive element of the rally was divided into two groups—the 80 metre group and the 2 metre group.

The vehicles left the headquarters at intervals and after passing the first rally sign had to contact their control station before passing the second sign. These signs were at 4 kms and 8 kms from the control. After exchanging a message, the competitors had to proceed to the first control point. Here a few questions had to be answered on a questionnaire before proceeding to the second control point.

Between the first and second control point, stations had to make 4 QSO's with other mobile stations who had passed the first control point, and exchange numbers which they had received in their envelopes. Here one was, of course, free to use any frequency on the band on AM or SSB at one's own choice and QSY'ing about the band was very much the order of the day.

At the second control point, a further series of questions mainly concerning articles of radio equipment in shop windows of the town of Bastogne.

Some of the cars at the Ardennes Rally.

And so on to the next control with more radio contacts.

Complaints had been heard of some rallies in Europe that the competitors found them too difficult. On this occasion, this could not be said. The competitive part of the rally was generally very easy and, in fact, the judges had much difficulty in deciding the winner.

This is a good thing. The rallies need not be difficult to be enjoyable: in fact, most people come to meet their fellow amateurs, to see their equipment and talk about their experiences, especially when these rallies are of so international a nature as this one was, with members from Belgium, Holland, America, France, Germany and Britain.

We would like more of these rallies which do not overstrain one's capabilities and, therefore, result in a really relaxed and friendly atmosphere.

After the return from the excursion we re-assembled at the rally site and the prizegiving took place. The Prince of Merode, the Governor of the Province distributed the prizes.

And so a very enjoyable party ended.

The other rally centred around Bruges.

Bruges is one of the most lovely towns in Belgium with its beautiful old buildings, its magnificent belfry, its canals, its churches and its museums. But clearly to make the rally itself meet in Bruges would be highly unsatisfactory as the town is congested enough as it is and to throw a further burden on the already congested town would be undoubtedly highly unsatisfactory.

The countryside around Bruges is quite different from that in the Ardennes and is generally flat and the interest does not centre so much on the countryside as on the interesting little villages, churches and other curious and interesting places around.

The rally organisers fully realising this, therefore, organised a different type of rally. It was not going to meet in Bruges itself. The rally assembled at the restaurant on the end of the Mole at Zeebrugge. Here there was a restaurant which provided meals for those who wanted them.

As usual the rally was divided into 80 metre and 2 metre groups and each participant received an envelope which contained the rally instructions, a Michelin Map of the area, and two sealed envelopes only to be opened in case of emergency.

The vehicles were to contact control station which was located in Bruges at 2-minute intervals. Watches were synchronised and every station given the exact time he was to call the control station. Control station then gave each participant a group of code letters which correspond with an instruction contained on the instruction sheets in the envelope. These instructions told the competitor where to go and to carry out an inspection of some interesting object and answer a question or two.

This method enabled the competitors to be sent off in different directions and dispersed over the country side and not concentrated in one place. This avoided any congestion which might be caused by the rally proceeding altogether. It also provided a test of communications. The QRM on the 80 metre band, for example, was very heavy. Various other stations not in the rally kept on turning up on the rally frequency and skip conditions being quite long all sorts of unexpected stations would cause QRM. It also required a certain degree of map reading though this was greatly assisted by the maps with which we had been provided on which the various points we were to go to were marked.

This operation must have taken the organisers a great deal of time and a lot of work.

This method of running a Rally enables the organisers to show their visitors all sorts of

View of rally site with cars returning after the contest.

interesting parts of the country which they would certainly otherwise not have seen. My own particular route included a tour of a tower used for hanging people in the Middle Ages:

We had to find out the purpose of the tower by questioning the local population.

An 11th century font in a church: an inn with some 197 beer mugs hanging from the ceiling, and numerous interesting points, as well as the club shack of the Bruges club.

Every 25 minutes on the dot we had to call control station again and get fresh instructions. In all 10 contacts had to be made with control station giving 9 different instructions, the 10th being to congregate at the finishing point which was a restaurant called "Le Lac" at Loppem, where prizes of a very generous character were distributed.

Thus, in one week we had two rallies of very different characters in different parts of Belgium but in between the two rallies before the rallies and afterwards, we were all, of course, free to use our Belgian licences on all bands permitted in Belgium.

In this connection it should be noted that 160 metres is not permitted in Belgium.

Fortunately, the 20 metre band was in very good form, and it was good fun to work DX from the car with the Belgian Call Sign during the two weeks in Belgium. I worked all continents from the Mobile Station and about 40 countries, including—JA1: KR6: UA9: 9M2: 9K2: VK2: ZS4: UL7: UO5: plenty of W's and VE's including a VE7 as well as a large number of European stations, of course.

The pleasures of operating a mobile station in a foreign country are really considerable, not least of which is meeting the locals and, in Belgium, their hospitality was tremendous.

ON4VY took us to dinner in Brussels to a mussel meal. Brussels is famous for cooking mussels in dozens of different ways. The mussel meal in Brussels will long remain in our memories.

For the rally in the Ardennes I chose to stay at La Roche en Ardenne. Here too the cooking was of quite an extraordinary high order.

We met many friends who we had originally met on the first International Rally at Verviers, including its organiser—ON4PL; that great German mobile operator—DL1KN: that French mobile enthusiast—F8TH, who had succeeded this time in bringing the Secretary of the French Club, REF,—F9OE with him.

Several Americans in France or Germany turned up at the Ardennes Rally, including —K3JOH/DL414: WØAJW/F7EN: K1ECT/DL4HU. . . . G3BID

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A New Two Meter Hetrodyne Exciter

Use a suppressor balanced mixer to get on two

While SSB is becoming widely accepted on the high frequency bands, AM still reigns above 30 mc. Drift is the foe of VHF SSB since both transmitters and receivers have to stay within 100 cycles to be of any use. Lack of stability is one of the greatest factors keeping HF SSB men from enjoying SSB on VHF in spite of its many advantages.

But drift can be conquered. Conventional techniques for VHF call for multiplying a fundamental many times to the required band. This obviously multiplies drift many times, too, so that most HF vfo's are unsatisfactory on two and above. But the method of changing SSB frequencies is heterodyning. This additive process keeps the drift down to reasonable levels. High quality overtone crystals for this process are now available at low prices. In fact, you can often borrow a little oscillator injection from your receiving converter.

Frequency generators and mixers

When used as frequency converters, modulators are more commonly called mixers. A broad classification of mixers is into balanced and unbalanced types. These can be further divided into efficiency and power (brute force) mixers. Balanced mixers provide suppression of the carrier and excellent distortion figures. However, they are a little more complicated than unbalanced ones.

Brute force mixers are rarely used in practical heterodyning equipment because of the high power requirements. Efficiency mixers are much more common. Various schemes of modulation have been tried in mixing—grid, screen, cathode, grounded screen. Each has its merits and demerits:

grid: low drive and modulation requirements but low output.
screen: high output but high screen current.
cathode: good output but low plate efficiency.
Grounded screen: low screen current and good quality but low efficiency.

One form of mixer which has not seen much use in the HF and VHF bands is the suppressor modulated pentode. While it is true that screen current can run higher than normal because of the negative bias on the suppressor grid, this type of mixer possesses excellent quality, stability and overall efficiency. Drive required is very small. Because the suppressor

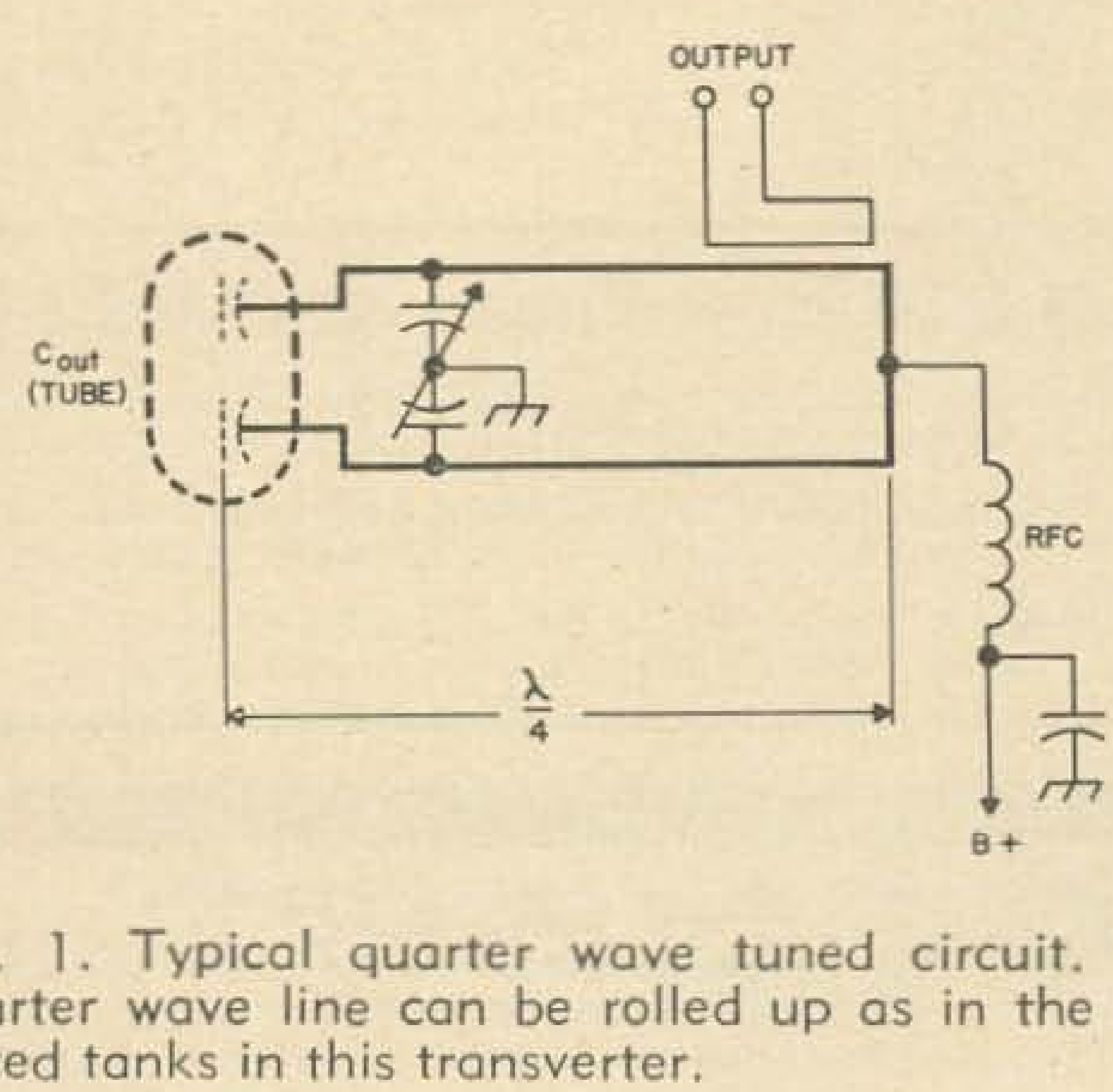
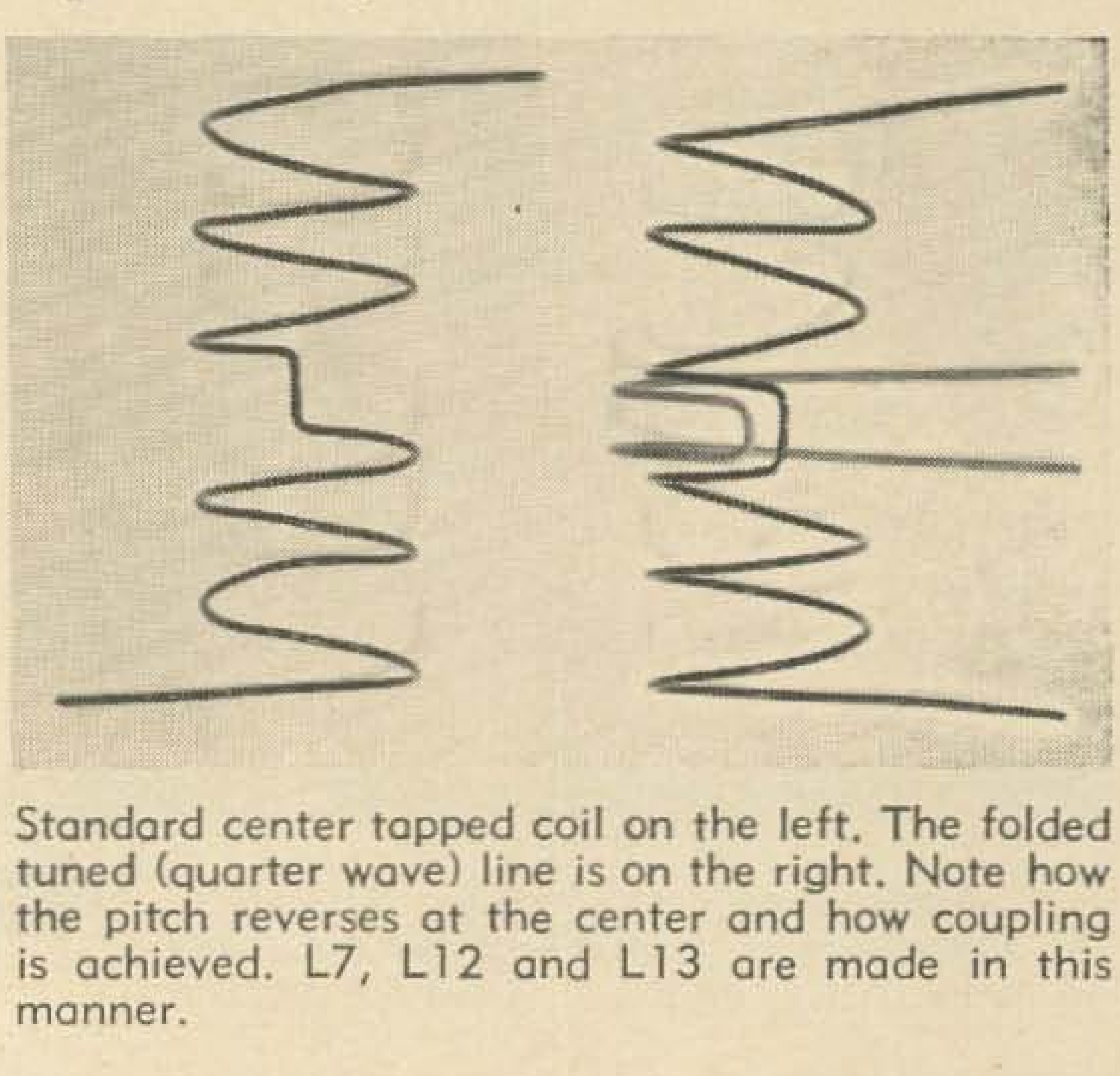


Fig. 1. Typical quarter wave tuned circuit. The quarter wave line can be rolled up as in the balanced tanks in this transverter.



Standard center tapped coil on the left. The folded tuned (quarter wave) line is on the right. Note how the pitch reverses at the center and how coupling is achieved. L7, L12 and L13 are made in this manner.

has a negative bias on it the modulator need supply only voltage in most cases. Plate efficiency can run as high as that of the same stage operating in class B. Quality is excellent through high percentages of modulation. The rest of this article will describe a two meter heterodyne exciter using a balanced suppressor mixer.

In recent experimenting with a 50 mc mixer, I came across a very attractive circuit using the 6BU8.[1] This tube is designed for combined sync separator-clipper and AGC in television receivers. Nevertheless, it does an excellent job as a balanced mixer for ham applications. The basing leaves a lot to be desired, but the layout I used provided excellent results with no cross socket shielding. The 7360 could possibly be used in this circuit since its maximum operating frequency is above 100 mc. The major advantage of the 6BU8 over the 7360 is its relative tolerance to magnetic fields. The 6BU8 can't be mounted on the filter choke in your power supply, but it does not need the extensive shielding required by the 7360. Incidentally, the 6HS8 is very similar to the 6BU8.

Circuit details

Briefly now, an explanation of the operation of this unit. V1, the 6AB4 (or half a 12AT7) is a standard third overtone oscillator at 41 mc. The 51 k grid resistor was chosen for good output with best stability and a minimum of crystal current. V2A, the triode section of the 6AU8A, triples the 41 mc output of the oscillator to 123 mc. V2B, the pentode section, operates as a class C amplifier and supplies ample drive for the mixer. This amplifier also provides isolation from the oscillator string and furnishes an extra tuned circuit for cleaner drive.

Grid number 1 of V3, the 6BU8 mixer, is fed with the 123 mc local oscillator signal. The 21 mc from your SSB or other transmitter is fed push-pull through the L4, L5, C4 network into the suppressor grids. The 144 mc sum signal is selected by the push-pull plate tank L7, C5 and coupled to the grid of the class A 6AK5 driver, V4, through the two L8's (oops), and C6. Again, an amplifier is used to insure a clean signal and sufficient drive to the following stage. The output of the driver is then applied in push-pull to the grids of the 6360 final. Output is about 10 watts PEP or 4 watts of carrier depending on what you feed to the suppressors of the mixer.

With 225 volts on the plates, the output of the final is sufficient to drive a pair of 4CX300A's to full input. The quality of the

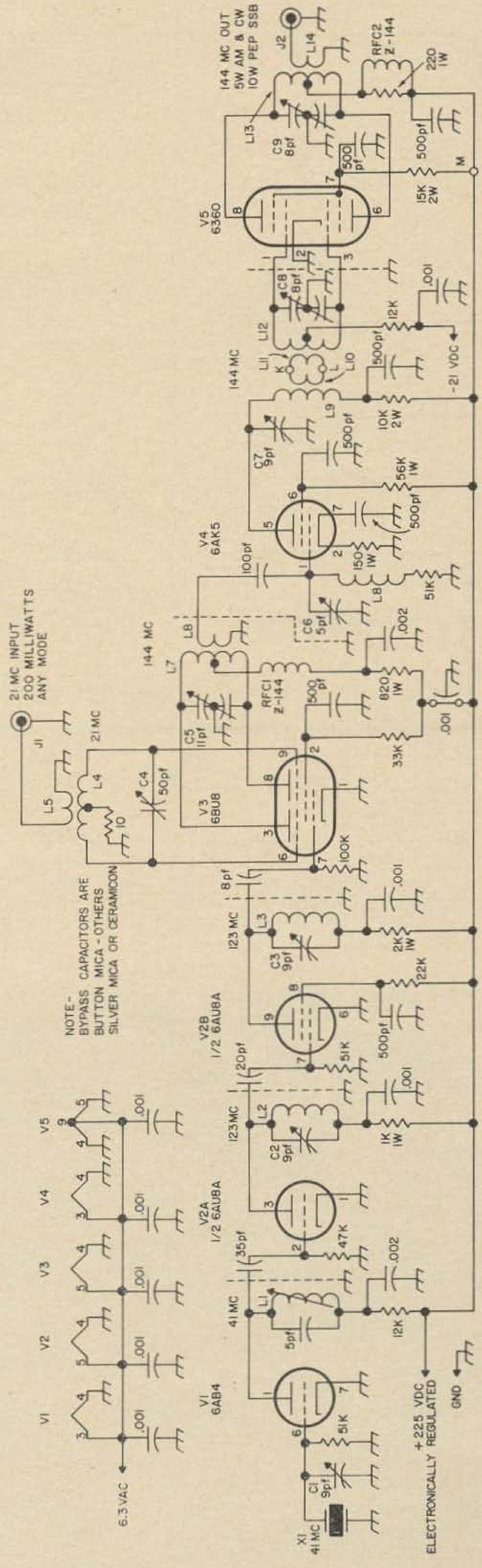


Fig. 2. Schematic of the Two Meter Heterodyne Exciter. 200 mw at 21 mc gives you 10 watts PEP output on 144 mc. For layout and shielding details, refer to the photographs.

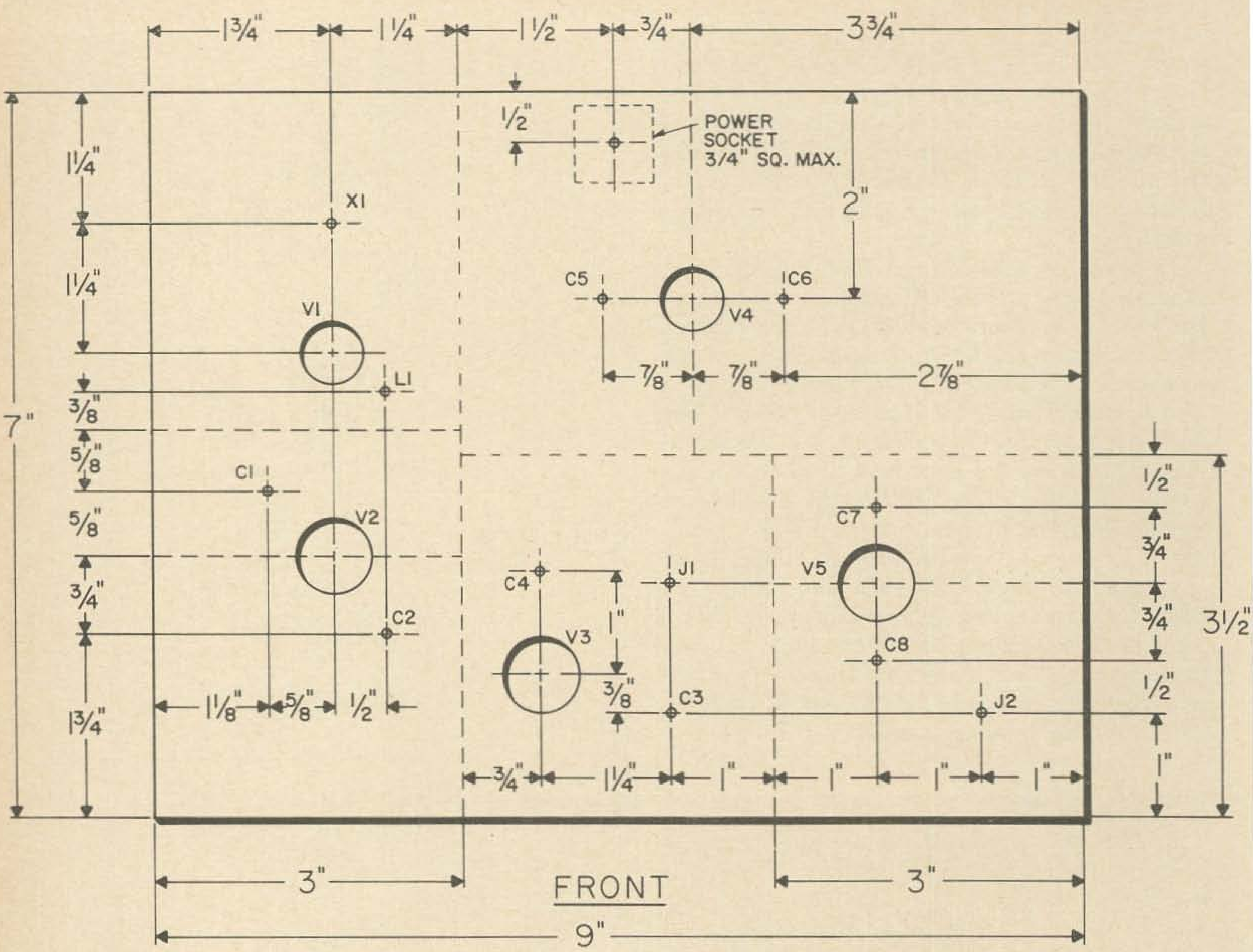
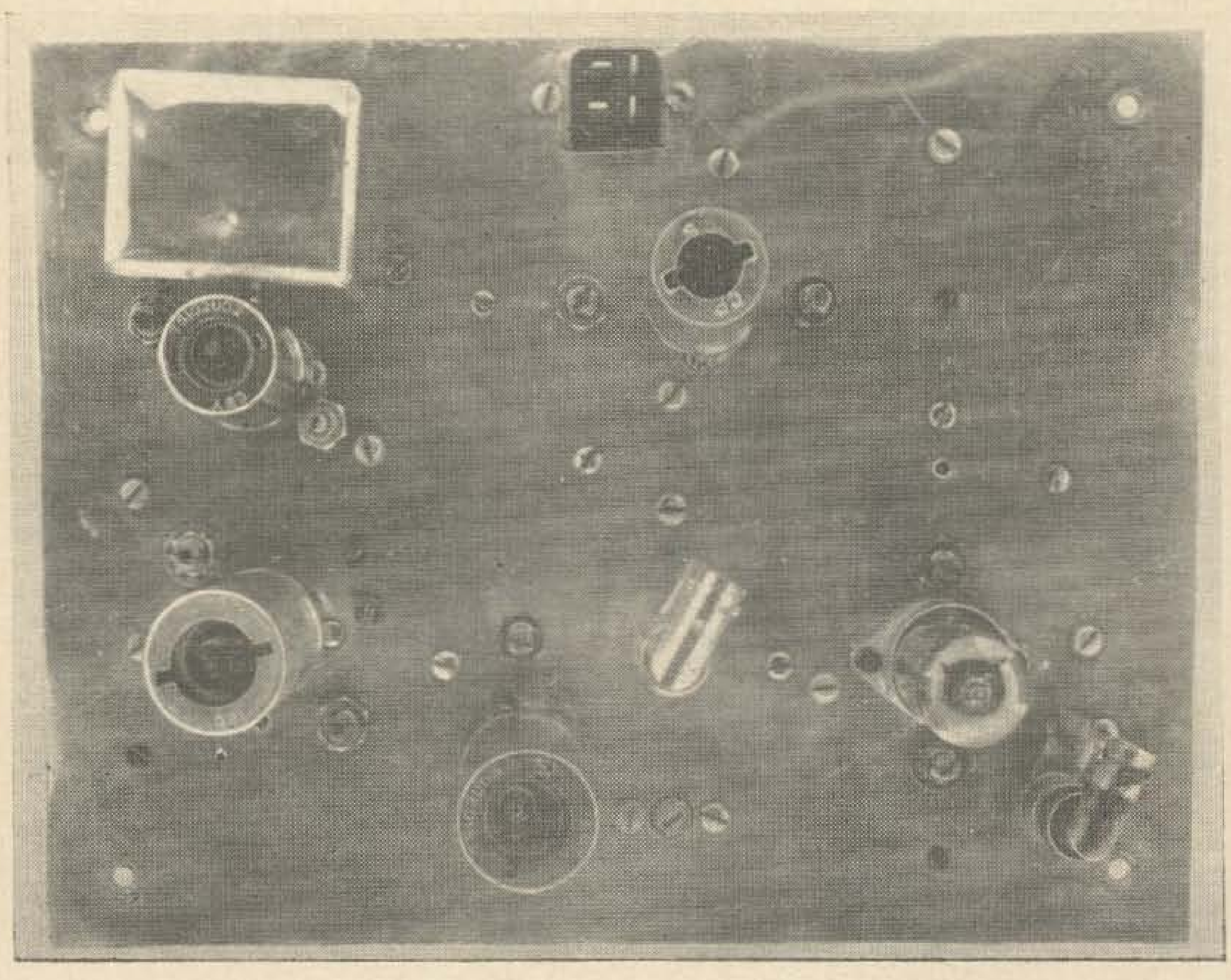
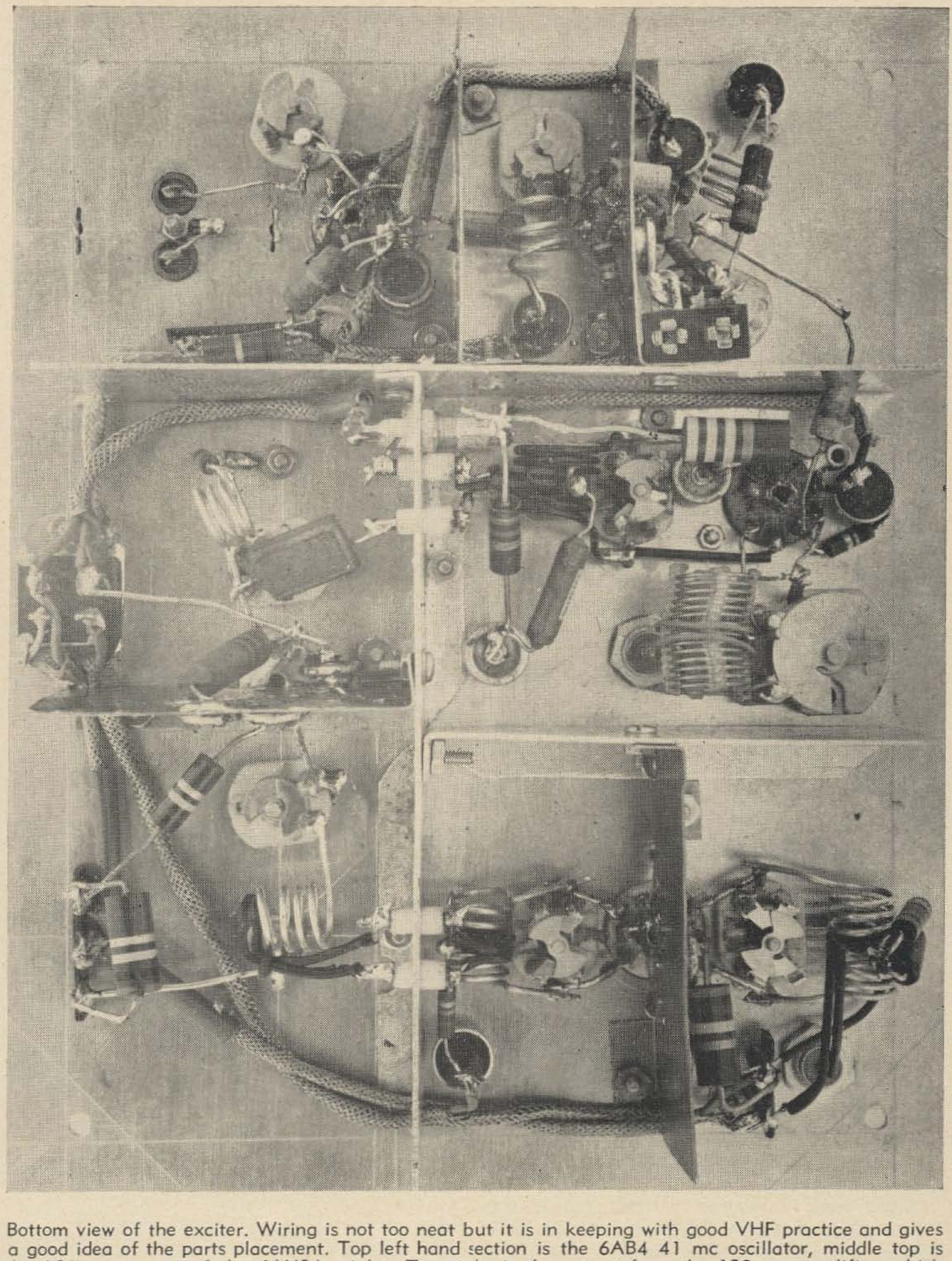


Fig. 3. Half size drilling template for the 144 mc transverter. Small circles only locate mounting centers. The dashed lines indicated shielding. The unit was built on a 7 x 9 inch aluminum plate which was bolted to a 7 x 9 x 2 chassis.



Top view of the exciter. Counter-clockwise starting at the top left are crystal, V1, V2, V3, J1, V5, J2, V4 and the power plug.



Bottom view of the exciter. Wiring is not too neat but it is in keeping with good VHF practice and gives a good idea of the parts placement. Top left hand section is the 6AB4 41 mc oscillator, middle top is the 123 mc output of the 6AU8A tripler. Top right is the output from the 123 mc amplifier, which feeds into the 6BU8 mixer below. Output of this mixer goes to the 144 mc input of the 6AK5 amplifier on the middle left. The plate circuit of this 6AK5 is in the lower left. It is link coupled to the grid of the 6360 final in the bottom center. The output of the 6360 is in the lower right to a BNC.

Table 1 Voltage Chart

Tube Pin	*V1 6AB4*	*V2 6AU8A*	*V3 6BU8*	*V4 6AK5*	*V5 6360*
1	+115	0	0	0	−21
2	0	−0.15	+165	+1.25	0
3	6.3 vac	+220	+225	6.3 vac	−21
4	0	0	0	0	0
5	0	6.3 vac	6.3 vac	+160	0
6	−3	0	0	+100	+225
7	0	−1.15	−6	+1.25	+195
8	—	+135	+225	—	+225
9	—	+190	0	—	6.3 vac

output signal is as free of distortion as the HT-32 that drives it. Incidentally, quality will be degraded if you feed over ½ watt into the mixer. You'll need to retune the circuits if you travel over 400 kc.

Power supply

I am using an electronically regulated supply for B+. This is recommended as it assures a constant voltage on the oscillator for stability and constant voltage on the stages in linear operation.

Adjustment

You'll need a 20,000 ohms per volt multimeter and relative power meter or swr bridge for initial tune up. A grid dip meter is a great help in pruning coils and setting tuned circuits to frequency.

With B+ only on the oscillator (check this voltage) and the slug as deep into the oscillator coil L1 as it will go, slowly screw the slug out until the 6AB4 starts to oscillate, as evidenced by bias developed at pin 2 of V2. Set the slug in this position. Turn the plate voltage off and then reapply it to be sure that the oscillator takes off again. If it does not start up again try a different setting of the slug. In general, the optimum setting is at a frequency slightly higher than the setting which produces maximum output. Turn the power off and connect power to the tripler and the injection amplifier. Reading bias voltage developed across the grid resistor of the 6BU8, tune C2 and C3 for maximum voltage. In order to get a reading to tune C2, the meter may have to read the voltage on pin 7 of V3. At this point check the voltages at all pins on V1 and V2 against the voltage chart.

Again turn the power off and connect the B+ to all other stages and the bias to the final. Before turning the B+ on, be sure that there is −21 volts of bias on both grids of the 6360 (pins 1 & 3 of V5). Apply power and check the rest of the tube pins for voltage against the chart. If less than one volt or more than three volts appear on pins 2 & 7 of the 6AK5 (these voltages must be positive) turn off the power and determine the cause. Check for plate voltage first. If it is present, check to see if the cathode resistor or bypass capacitor is defective, if so, replace the faulty component and try again.

When bias is present on the cathode of the 6AK5, apply about 100 milliwatts of 21 mc drive to the suppressor grids of the mixer and, using the power indicator, tune C4 through C9 for maximum 144 mc output. Remove the 21 mc signal and be sure that the output goes to zero. All 144 mc tuned circuits should hit 144 at about half capacitance if they have been properly constructed. With the exception of L8A, C6 all 144 mc circuits should not tune lower than 133 mc. If output remains after 21 mc drive has been removed, get out the GDO and find out why. If good shielding practice has been observed there should be no trouble with spurious oscillation.

When all appears to be in proper order, reapply the 21 mc drive at about 100 mw. If grid voltage on the 6BU8 is near that listed in **Table 1.** the local oscillator chain may be retuned for maximum output at this time using the power meter for reference, this step may not be necessary. Slowly increase the 21 mc signal until the output peaks. Note the setting of the drive control or loading at this point and, when on the air, operate with a little less 21 mc power than this. If the 21 mc drive is at a higher level than this the unit will overmodulate, distort, and the output will drop. A good idea is to construct an attenuator to drop the full output of the generator to that level required by the heterodyne unit.[2]

My grateful thanks to Bill Ashby (K2TKN) and Paul Todd (W2UM) for assistance and encouragement on this project and in preparing this report. Thanks and praise are due John Peoples, a fellow employee, for turning out the excellent pictures for this report.

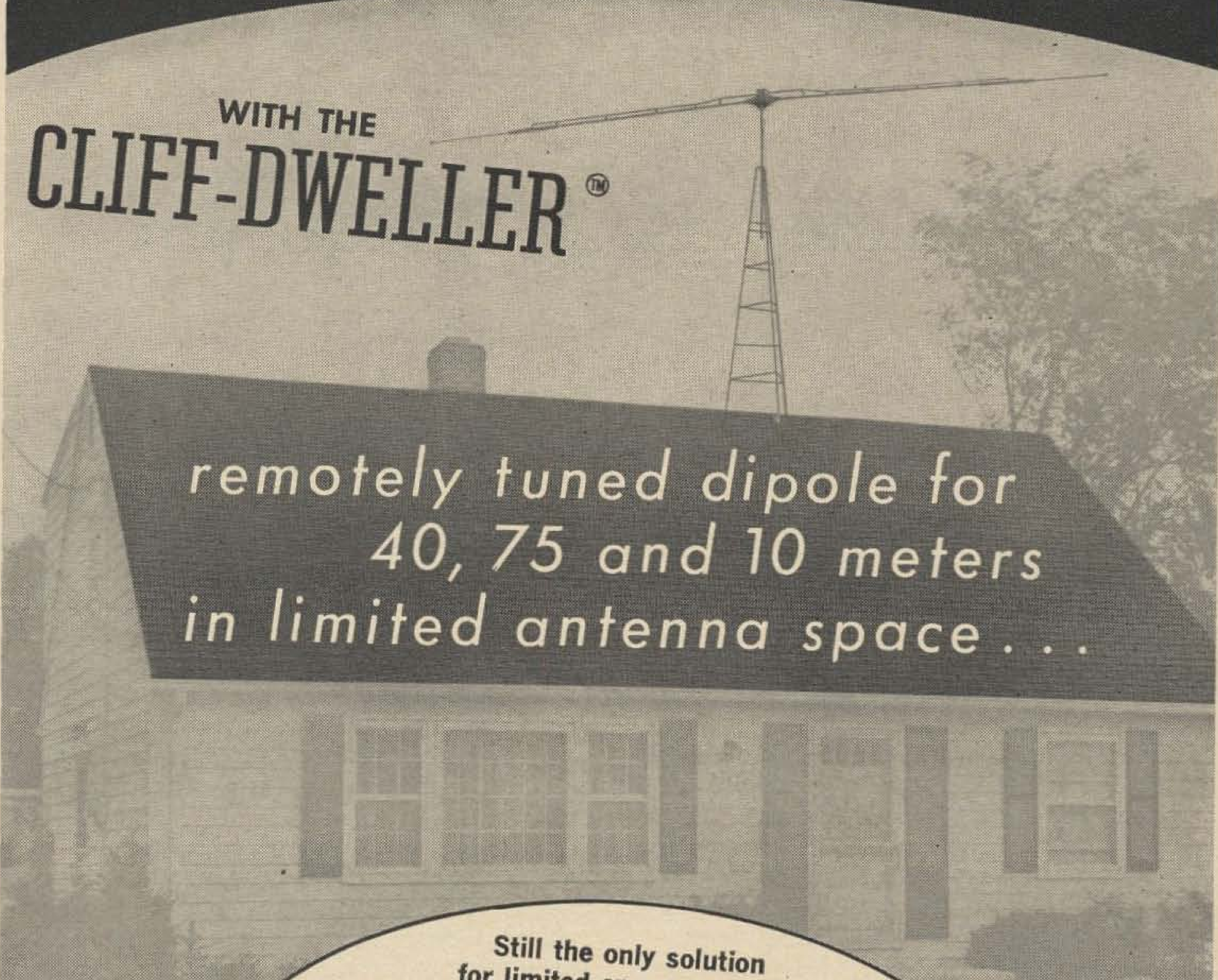
. . . WA2JAM

1. Heterodyne Exciter with 6BU8 Twin Pentode Balanced Mixer *G.E. Ham News Sideband Handbook,* First Edition, p. 11-36. 2. W9ERU, "A Step-Type RF Attenuator." *QST,* December 1959, p. 20.

Coil Table

	Turns	*Diameter*	*Wire*	*Form*	*Length*
L1	8	⅜	22 en.	iron slug	close wound
L2	3	⅜	16 tin.	air wound	⅜
L3	4	⅜	16 tin.	air wound	½
L4	14 CT	½	20 tin.	air wound	⅞
L5	2	Insulated hookup wire at center of L4.			
L6	There is no L6			Folded line. See photo.	½
L7	4½	½	16 tin.		
L8	1	Insulated link at center of L7.			
L8A	3	⅜	16 tin.	air wound	⅜
L9	4	⅜	16 tin.	air wound	½
L10	1	Insulated link at cold end of L9.			
L11	Same as L8.				
L12	5	⅜	16 tin.		Same as L7.
L13	7	Same as L12.			
L14	Same as L11.				

performance equal to full size dipole!



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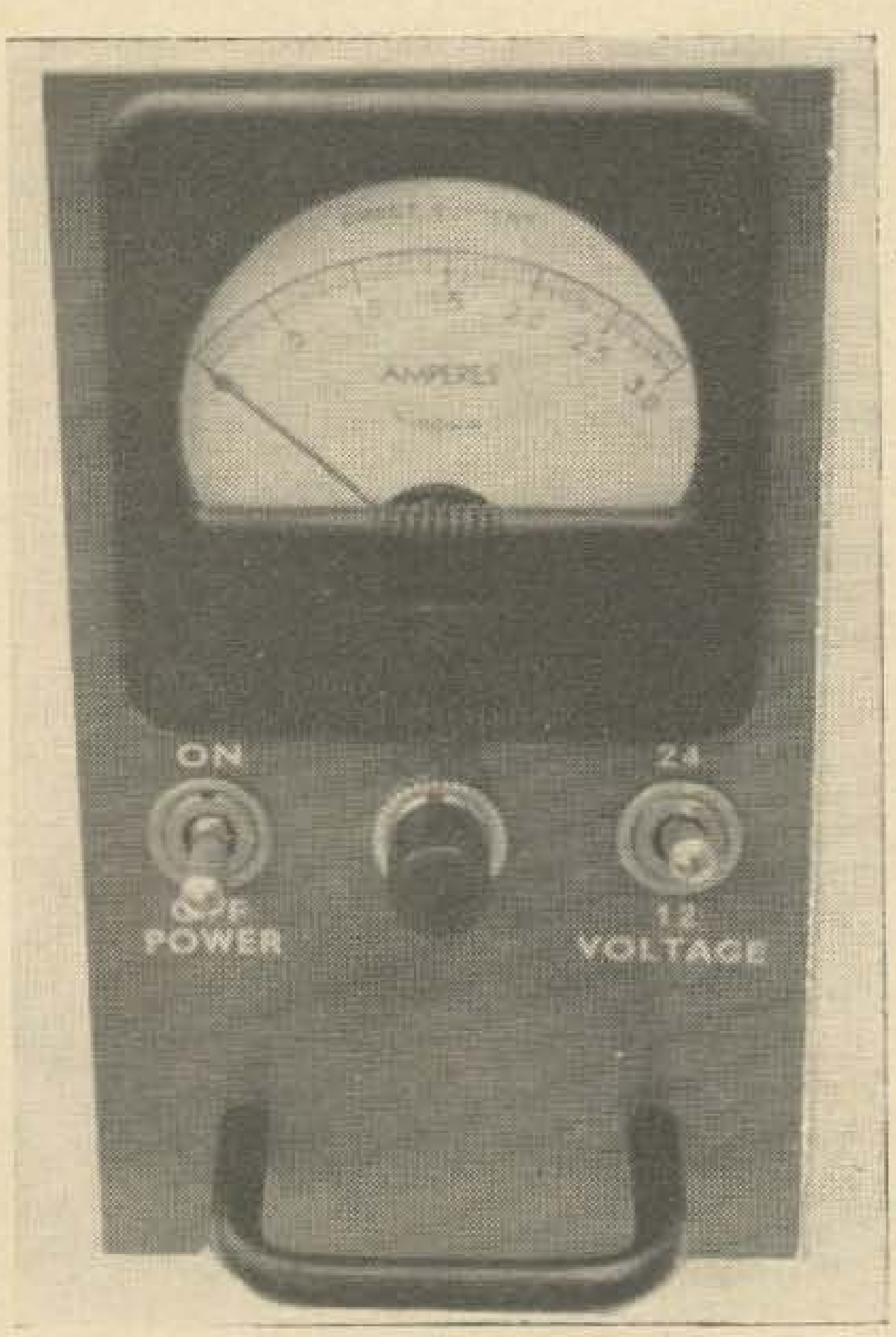
A Regulated Solid-State Supply

In the old days when vacuum tubes were in vogue, it was an easy matter to obtain operating voltages for experiments and testing equipment. This was done by tapping off power supplies in whatever gear was at hand. Then came a wonderful little device known as the transistor (sometimes known as a "three legged fuse"). Most everyone was happy with these semiconducting devices (except for tube manufacturers), especially battery manufacturers. This was a shot in the arm for new and better batteries. Battery power was fine for the old breed of transistors that only consumed milliamperes, but the new breed has some mighty hungry units that consume AMPS. The old dry cell doesn't last long with this kind of power drawn from it. And the wet cell—the less said about this messy device the better.

A short while back I started a project on a solid state UHF exciter. My first thoughts were on how best to power the unit. Since the total power consumption of the unit was to be about one-and-a-half amps, batteries were out of the question. A transformer and bridge rectifier was OK, except with a small load (the oscillator and buffer in my case) the voltage was high. As the load increased, the voltage of course came down. Since the junction capacitance of a transistor will change somewhat with varying voltage, this makes it difficult to keep a stage tuned properly at the higher frequencies. The only solution to the problem is to stabilize the voltage.



The regulated solid-state power supply.

There are many ways to make a stable voltage source, some of which get rather involved and expensive. Since my needs were not too critical, I chose the simplest method which is the series regulator, which will hold within 2 volts from no load to full load. In my case I needed 24 volts for the exciter under normal operating conditions; however, it was deemed desirable to be able to reduce this voltage for initial testing and experimentation. What finally evolved was a 12/24 volt supply capable of delivering 3 amps at 24 volts and 1½ amps at 12 volts. The current limitation at 12 volts is set by the dissipation of the transistor and heat sink. Power dissipation of the transistor is approximately equal to supply voltage in minus

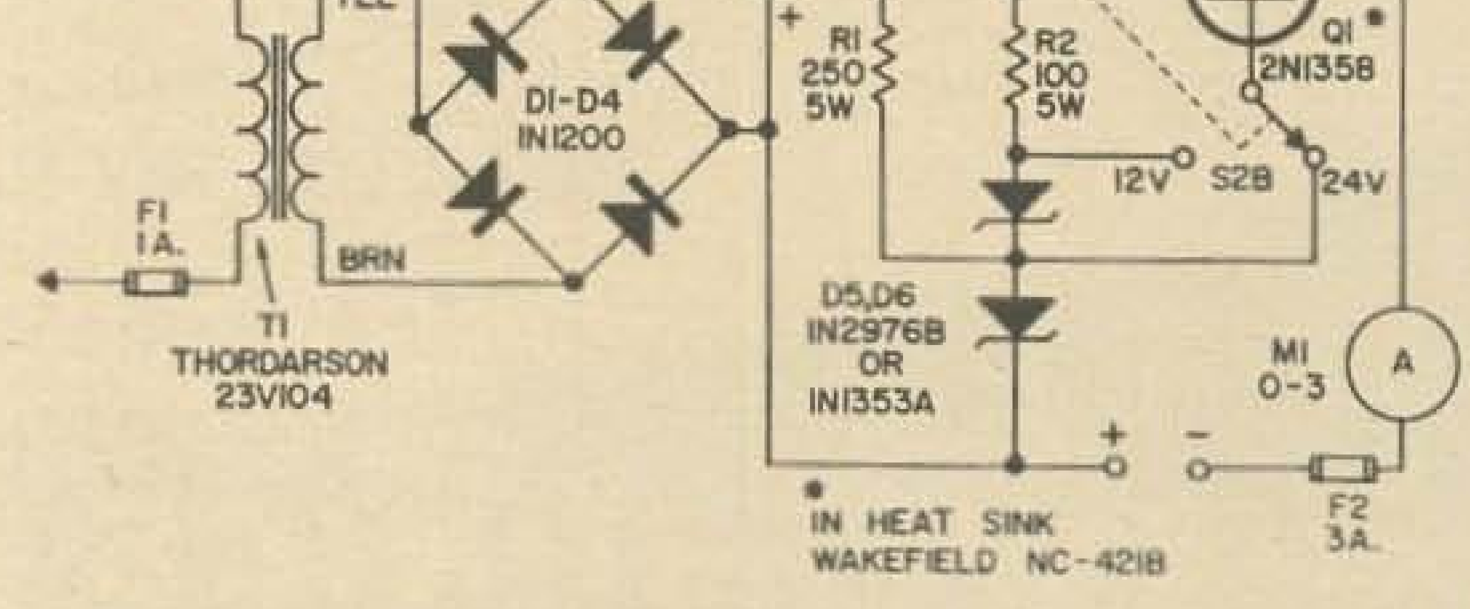
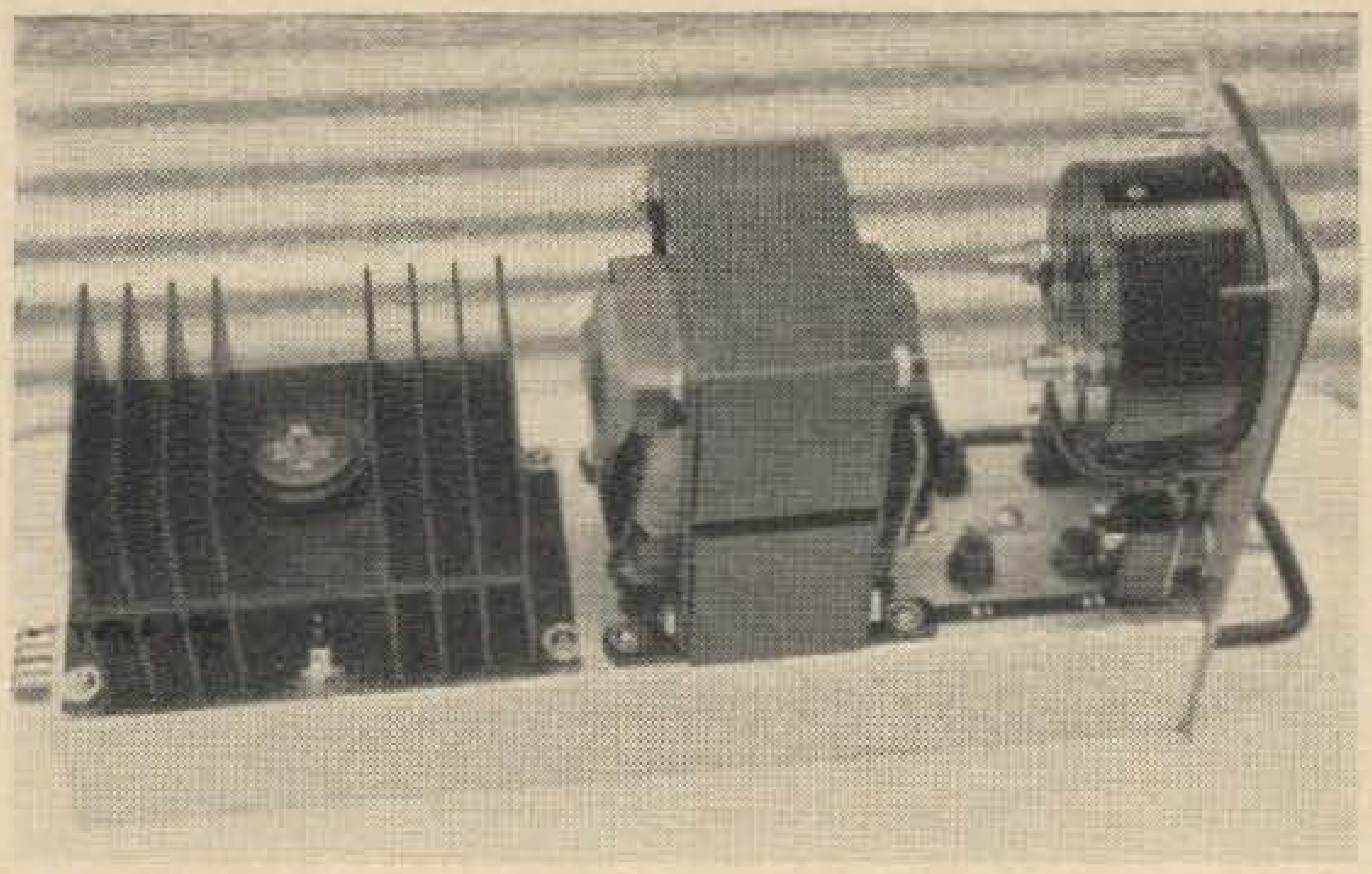


Fig. 1. Schematic of the supply.



Side view of the regulated power supply.

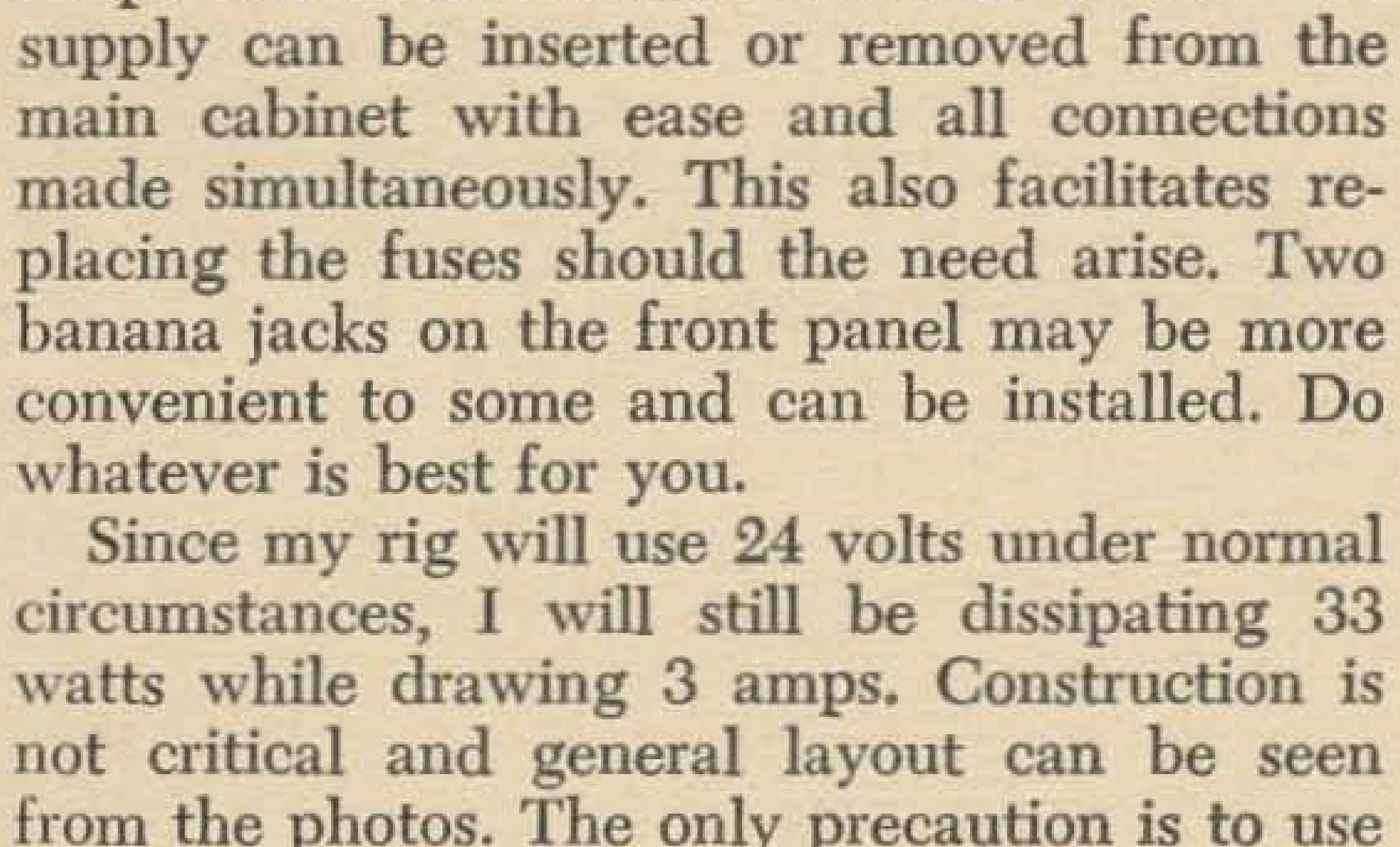
voltage out multiplied by the load current. Since the supply voltage is approximately 35 volts, it can be seen that 34.5 watts is dissipated with a load of 1.5 amps with the output set at 12 volts. This is close to the maximum safe limit for the heat sink I used and keeping within the temperature rating of the regulator transistor.

The supply was built on a home made chassis 11" x 3¼" x 1½" with a small front panel 3½" x 6⅝" in size. The rear apron has an Amphenol Blue Ribbon Connector so that the supply can be inserted or removed from the main cabinet with ease and all connections made simultaneously. This also facilitates replacing the fuses should the need arise. Two banana jacks on the front panel may be more convenient to some and can be installed. Do whatever is best for you.

Since my rig will use 24 volts under normal circumstances, I will still be dissipating 33 watts while drawing 3 amps. Construction is not critical and general layout can be seen from the photos. The only precaution is to use heavy gauge wire in the unit to prevent IR losses.

For those who wish to use different transistors and/or voltages, I refer them to Motorola Application Bulletin No. AN-103 from which I received my data.

. . . W9SEK



Bottom view of the supply.

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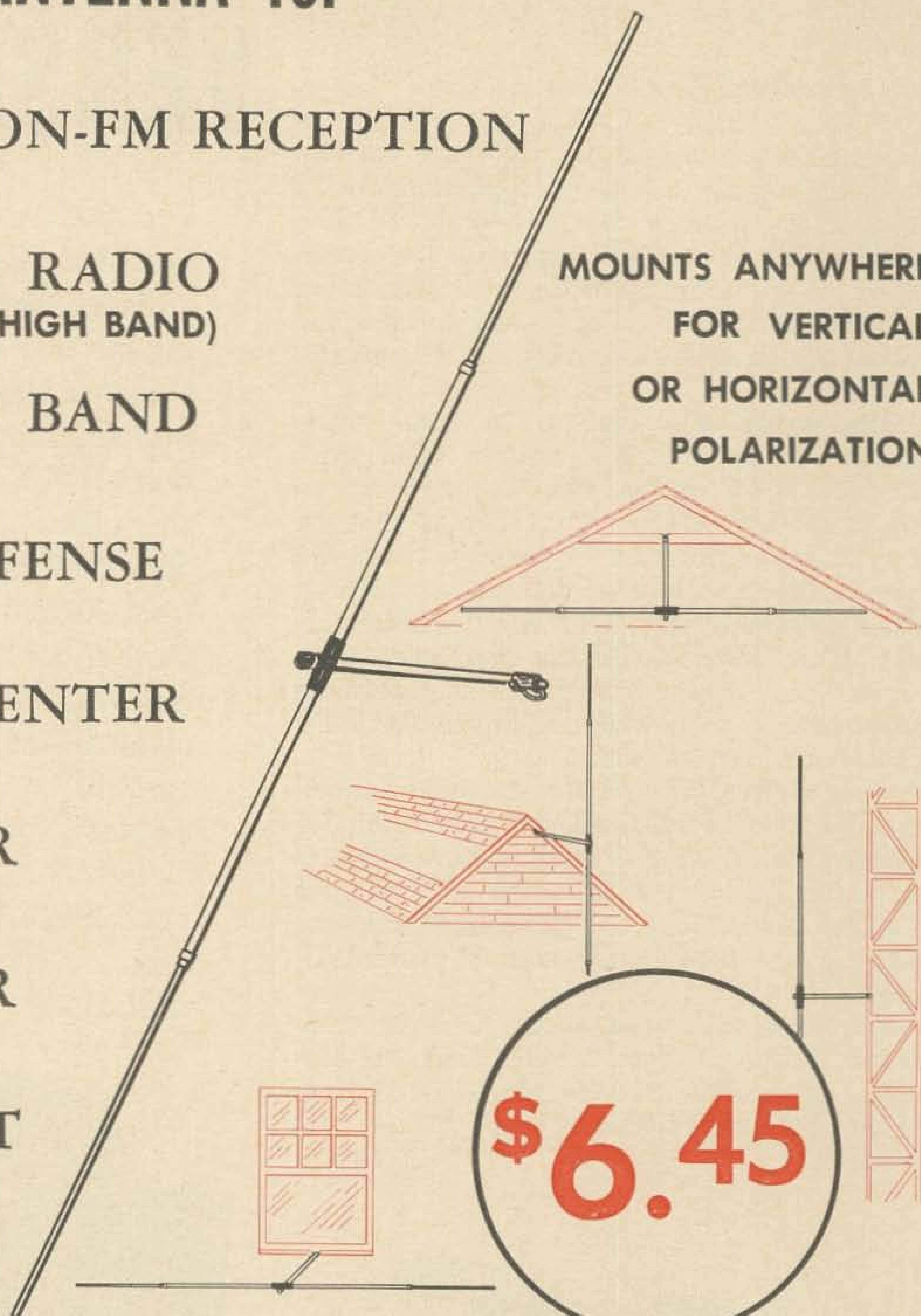

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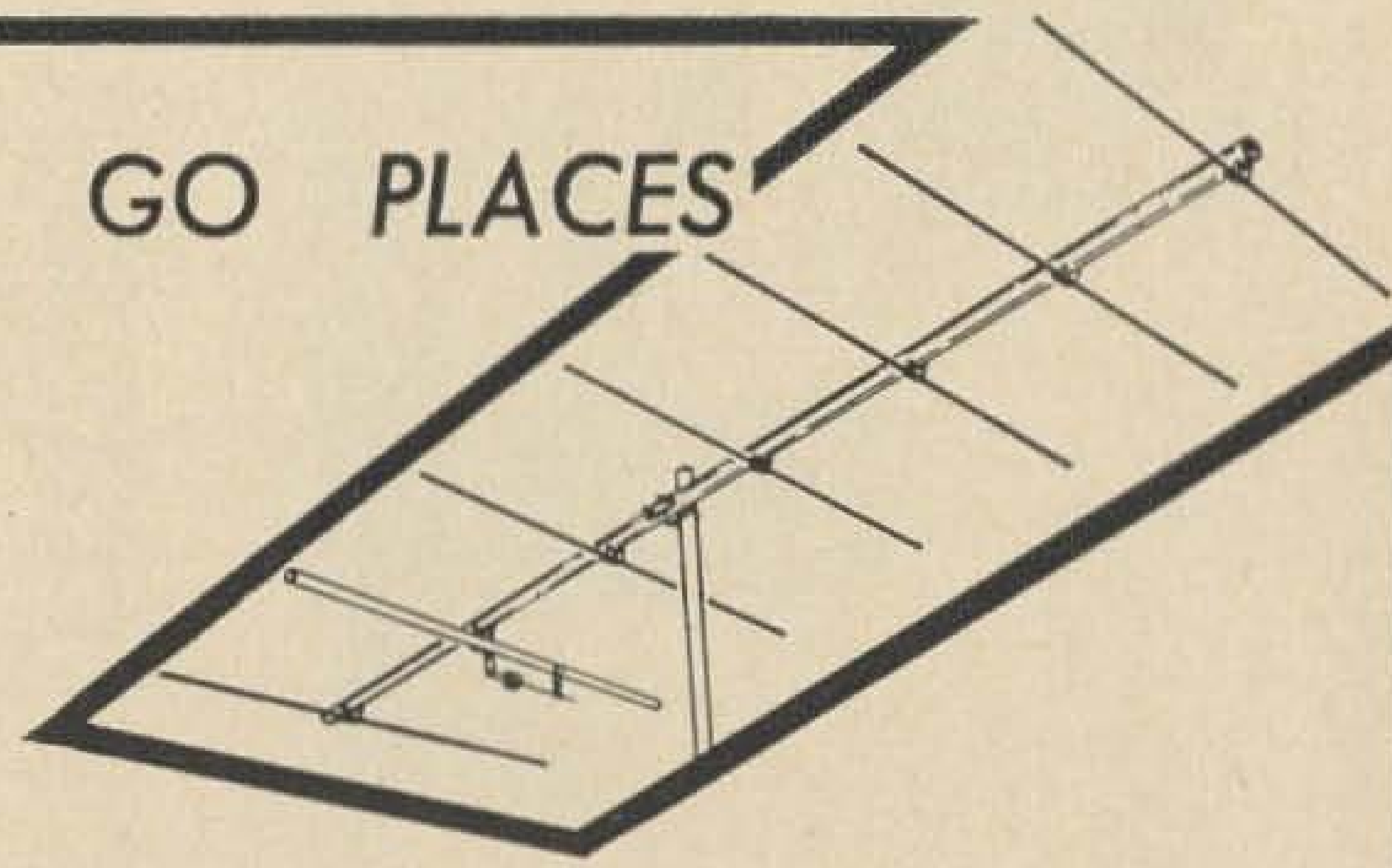

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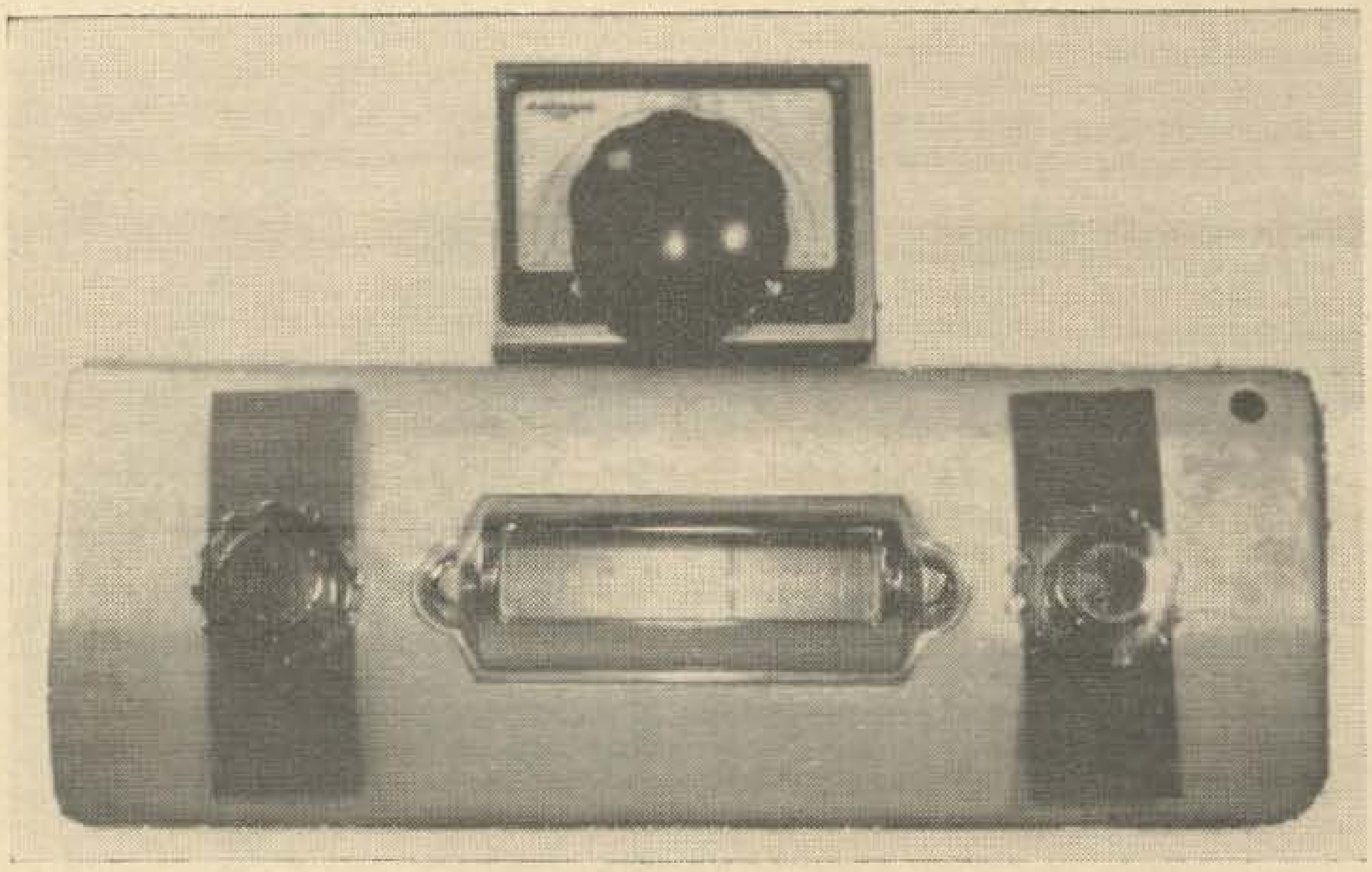


Transistor Twenty

Robert Scott
58 W. 78 Place
Los Angeles, Calif.

Here is one project which won't be stuck on a shelf when you finish it. It's a tunable 20 meter transistorized converter for use with a standard broadcast receiver. I'm using it with a converted auto radio and it does a fine job of dragging in those DX stations.

At first glance, it can be seen that there are two broad band RF stages followed by the mixer. In a separate compartment is the oscillator which is tuned by the main tuning dial. The whole thing is powered by a self contained 9 volt transistor battery. Current drain is about 3 ma.

The nice thing is that no major operation on your car radio is necessary to use this converter. Just plug in the antenna and output cables and turn the switches and you're in business.

Good design practice would be to tap down on the coils for proper impedance matching, but these miniature coils are hard to tap, so I used them without taps. It works fine and the loading helps flatten the passband. Glass coupling and tuning capacitors were used because of their small size, but either ceramic or mica would work fine.

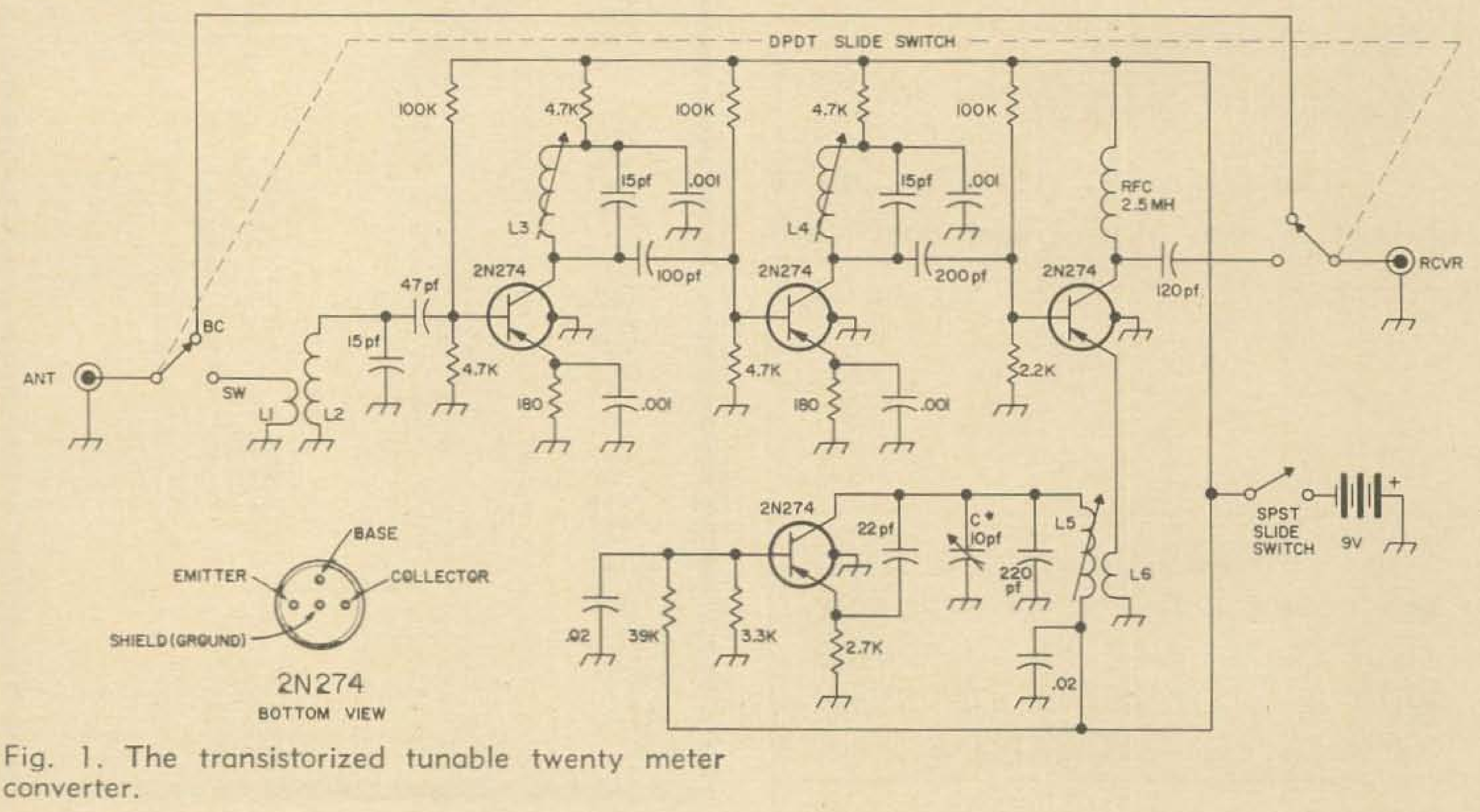
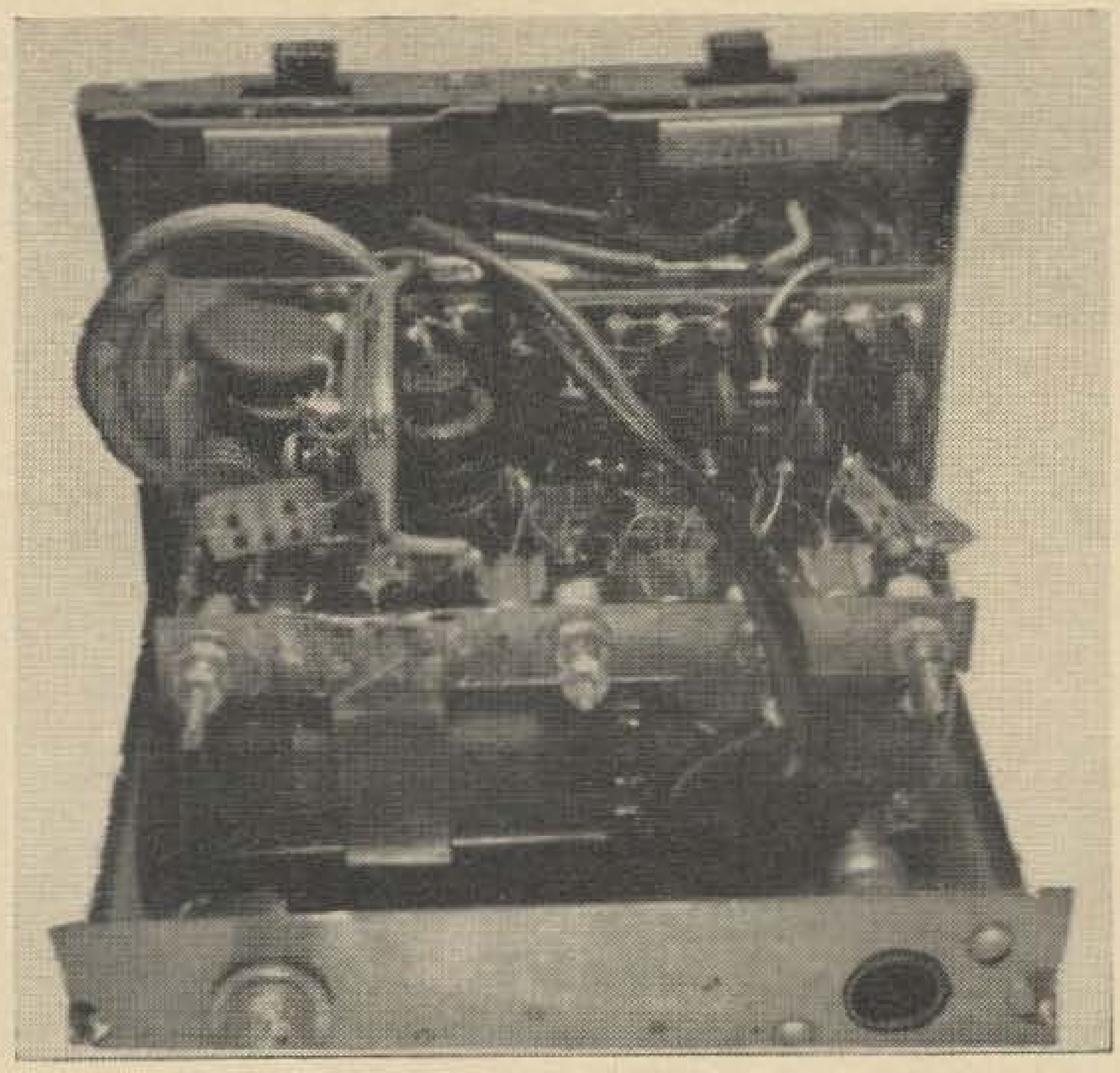


Fig. 1. The transistorized tunable twenty meter converter.



Interior view of the converter.

The transistors are mounted in fuse clips which are riveted or soldered to the chassis so they won't bounce around—and off. Small terminal boards were used to mount most of the components. Layout was made with the ideal of using a National MCN dial and the panel had to be large enough to mount it. You could make the converter much smaller, however. The variable was a surplus one, but any small 10 pf one should do.

Alignment is not difficult, but a grid dip meter, signal generator and VTVM are necessary. First dip all coils to the proper frequencies with power on, then see that the oscillator is operating and tune it to frequency using the GDO as a detector. Connect the converter to the receiver to be used and feed a small signal to the antenna input. Use 14.25 mc and tune the receiver to somewhere between 1400 and 1600 kc where there is no signal. Now tune the oscillator coil until some signal is noticed and peak the antenna and RF coils for maximum AVC voltage on the receiver.

As for performance of the converter, I tested it with a HQ-160 receiver. A signal was fed into the input from a Hewlett Packard 608D signal generator. It took a 2 μv signal for S9. S6 was 0.2 μv. All in all, this seems to be a hot little converter and is ready and willing to go to work almost any place. You could put it on other bands for a little fun. For higher frequencies, you should use a more modern transistor.

. . . Scott

Coils

L1 . . . 3 turns #32 on cold end of L2.
L2, L3, L4 . . . Miller 4306.
L5 . . . Miller 4303.
L6 . . . 3 turns #32 in center of L5.

Howard S. Pyle,
3434-74th Ave., S. E.,
Mercer Island, Wash.

Framing your Awards

Most of the ham stations which I have visited over many years, both those of the 'old timer' as well as the embryo ham, are proud to display the awards they have won in ham radio and which are generally in the form of a 'certificate' resembling a bond but, unfortunately, un-negotiable, of course . . . hi! It has always seemed somewhat of a shame to me to see such awards thumb-tacked or taped to the shack wall. Most of these have been earned by hard work and buckets of sweat; why desecrate them through slip-shod mounting and display?

Certainly, it will cost a bit more than 'peanuts' if you have each one commercially framed but you don't have to do it that way. your local novelty or dime store no doubt has many framed photos of movie stars, landscapes etc., for sale at very nominal prices. I've purchased many for from 35c to 75c each. This includes not only a machine cut, perfectly mitered frame but the glass and backing as well. Mostly available are the narrow, dull black finished frames; these are ideal for certificate mounting; they make a dignified appearance on the shack walls. It's the *certificate* you want to display, *not* the frame!

All you need do is to remove "Marilyn Monroe" or a scenic view of a mountain range, ocean or desert, insert your award certificate and you've got it made. You may have to trim your certificate a bit on the edges but in every case I've seen, ample room is available for such 'cropping.' Most award certificates are on either 8" x 10" or 8½" x 11" paper stock; the majority of frames which I have encountered in the variety stores, accommodate this size nicely. If the certificate is smaller than the frame area, secure it first to a 'mat-board' backing before mounting in the frame. Mat-board is generally available at variety stores also and is simply a heavy cardboard, available in a variety of colors although a buff seems to be most in demand. Generally such mat-board has a 'pebbled' surface on one side; this makes a pleasing contrast between the certificate and the edge of the frame.

Mounting the completed frame assembly on your shack wall is no problem. If your shack occupies a bedroom or a similar area in the home, you can hang it in the conventional manner using picture wire and a small brad, phonograph needle or 'push-pin.'! Any of these will leave only a tiny hole in the wall surface, easily patched if you have to move, with a spot of chewing gum or window glazers putty; neither will ever be noticed.

One objection to the above type of mounting is that the frame will no doubt, occasionally become askew and need a bit of levelling by eye. If you can get away with *two* tiny holes in the wall, a more satisfactory method as used by the writer will eliminate this occasional annoyance. Tiny screw-eyes which are available at practically all hardware, variety and novelty stores, can usually be had for about 10c a card; cards ordinarily contain ten or twelve of these miniature screw-eyes; enough to mount five or six frames.

Screw one of these little eyes in the center of each of the vertical members of the frame. Be careful here to make a 'pilot hole' with a small brad or similar so that the screw eye won't split the frame member. Using tiny (#4 or #2) round head blued steel wood screws about ½" long, passed through the holes in the screw eyes, will permit mounting to any solid surface, such as a wood wall. If it is a plastered wall, you may need longer screws; you'll have to determine that to suit your condition.

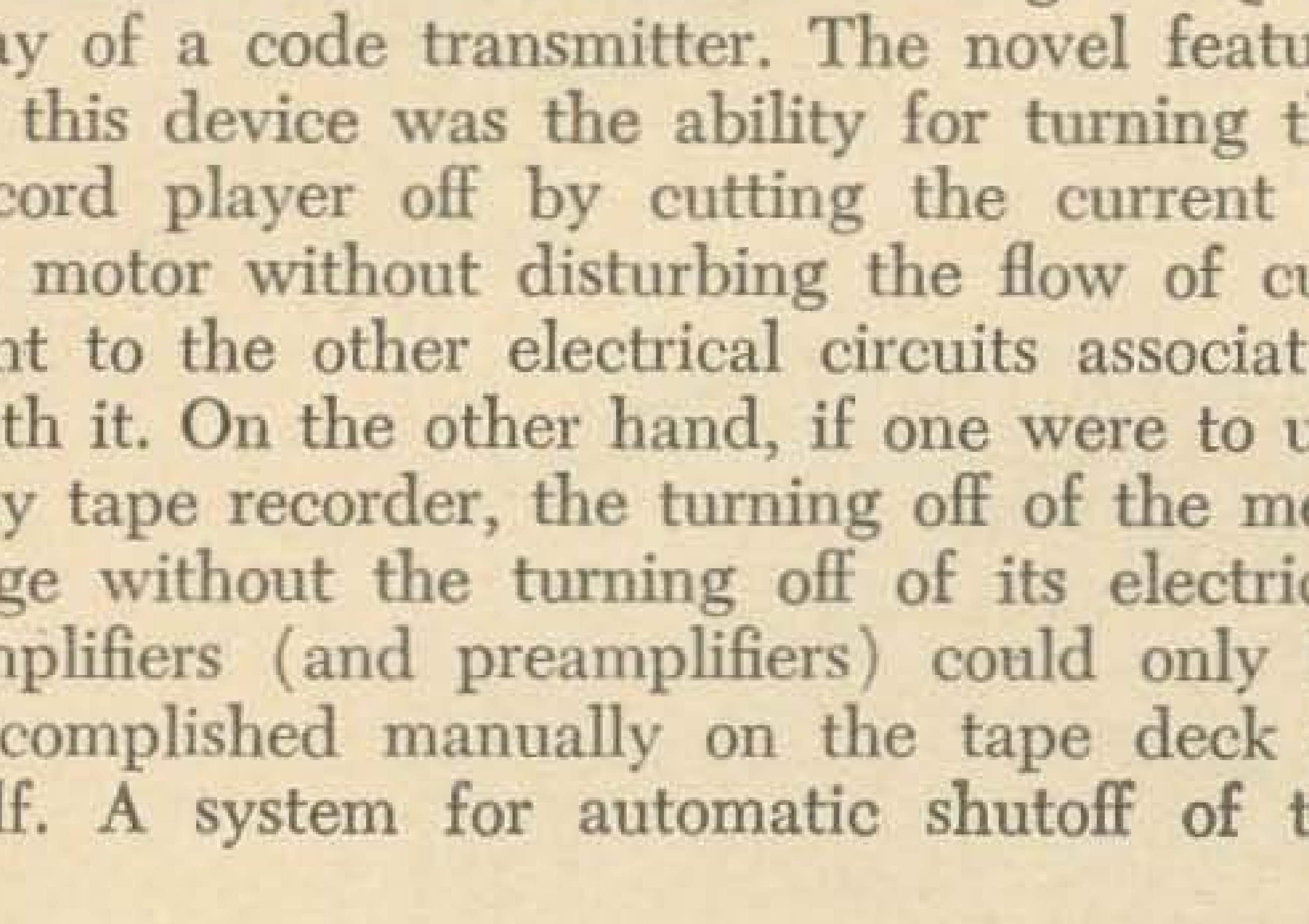
This is but *one* suggestion for making your station neat and presentable to visitors at all times; take a good look at many items of station accessories; you'll find many ways in which they can be cleaned up with little effort. Any efforts you make in this connection can only reflect in respectful admiration from your station visitors, be they ham or layman; it's worth thinking about isn't it?

Alex Labounsky WA2MTB
Wayaawi Avenue
Bayville, N.Y.

The Lazy Man's Phone CQ'er

It is obvious to the vast majority of radio amateurs that the installation and use of nothing more than a standard tape recorder for the purposes of calling CQ over the amateur bands is simple and effective, not a novelty. However, uniqueness in such a system can only be achieved when provision for automatic message-shutoff is added to a standard tape recording system for the ham shack.

Before advancing to the description of such an automatic feature for amateur radio, a brief analysis of the present scene concerning amateur equipment for pre-recorded CQs is in order. A device for pre-recording CQs for code (A1 or A2) purposes and for its eventual playback over the amateur radio station is shown in Skutt's article in QST.[1] It consisted of a modified record player which revolved a punched disc; in turn, this punched disc actuated a photo-electric cell for the production of the dits and the dahs for calling a CQ by way of a code transmitter. The novel feature of this device was the ability for turning the record player off by cutting the current to its motor without disturbing the flow of current to the other electrical circuits associated with it. On the other hand, if one were to use any tape recorder, the turning off of the message without the turning off of its electrical amplifiers (and preamplifiers) could only be accomplished manually on the tape deck itself. A system for automatic shutoff of the message (at the end of the message) is required without shutting off the power to the same tape recorder and without the annoyance of operating the stop control on the tape deck. The reason is self-evident in that the radio amateur desires full freedom of action at the end of a CQ for his tuning in on his amateur receiver for possible calls in response to his CQ.



1. Robert R. Skutt, "Lazy Man's CQ'er," *QST*, October 1961.

Fig. 1 illustrates such an automatic device. The audio output of the tape recorder's playback preamplifier is fed into the audio input of the amateur's transmitter and into the jack denoted as Audio Input in Fig. 1. The diode, a 1N34, rectifies this audio signal and feeds it into the 1 megohm potentiometer, R1, and C1 network. This network achieves a maximum time constant of one second. This is an ample delay period to prevent accidental tripping of the circuit's relay, K1, during pauses between each word in the pre-recorded message. R1 should be adjusted to meet the specific voice characteristics of the radio operator involved. In turn, this aforesaid network inserts a pulsating direct current across the base resistor, a five-thousand ohm resistor. This presents a rather high input impedance to match the output impedance of most tape recorders' playback preamplifiers for maximum energy transfer. A 2N104 relay amplifier actuates the circuit's relay, K1. Any energy losses incurred in the R1 and C1 network are compensated for by the added sensitivity given to this 2N104 relay amplifier. The terminals designated as tape control are connected in series with the current line supplying energy to the play-stop relay in the tape deck. This will be elaborated upon further. S2 must be closed in order to start playing the pre-recorded message (of course, in conjunction with the play switch on the tape deck). Once the message has been started, S2 must be opened in order for the device in Fig. 1 to operate in accord with its automatic features, because at the end of the message the relay, K1, will open and the tape will automatically be stopped while the motors and electronic circuitry of the tape recorder are still operating.

The electronic and mechanical assembly of Fig. 1 was built upon a 5in. by 4in. by 4in. "minibox." Since a standard minibox was not available to this author at the time, the above mentioned box was constructed using standard sheet-metal techniques. R1, S2, the Audio Input jack, and the Tape Control jacks were mounted on its front face. S1 and BT1 were mounted directly in the back of this box. All circuitry was kept as close to the components in the front as possible, using standard solder strips for this purpose.

It was mentioned before that the connections from the Tape Control terminals would be discussed further for more clarity in this regard. This author uses a Concertone type 61 recorder in which two separate supply and takeup motors are used in addition to a separate drive, capstan motor leaving a total of three motors. All of its functions are operated by several pushbuttons (five, to be exact) in conjunction with relays and solenoids. Furthermore, the mechanical stopping-arm which electrically stops the play operating position without affecting the capstan motor and electronics at the end of one reel of tape, actuates just one micro-switch, which is connected to the tape deck electronics via two wires. (This switch, in other words, is a spst switch.) Therefore, in order to stop the reeling-in of tape in the play position without turning off the motors or electrical circuits, one must just break one connection of one of these two aforementioned wires. And that's where the connections from the Tape Control terminal are made in series with this above mentioned micro-switch.

The benefits from such a system are numerous. To explain several would be in order. Having mentioned its use as an automatic CQ-er, one may note that it may also be used as a source of automatic test signals for realizing the full capabilities of an amateur radio transmitter. Turn on your transmitter and turn on your voice via this system! You are now set up for BCI and TVI testing in your home. Of course, at the end of such a test period (preferably ten minutes), this unit may be connected so as to turn off not only the reeling of the tape on the tape deck, but also the amateur transmitter. How automatic will amateur radio become?

. . . WA2MTB

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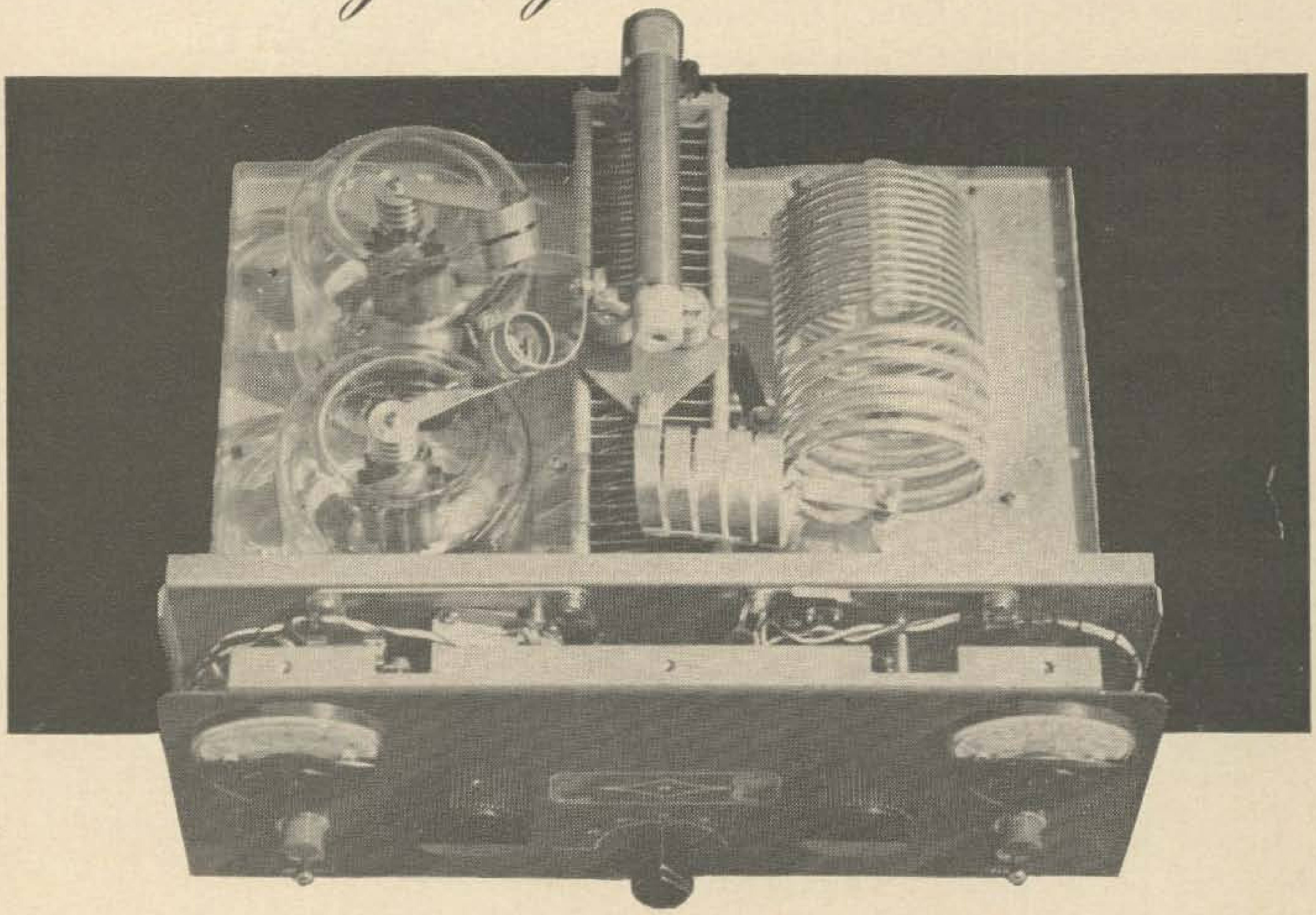

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The 1215 Transistor Superhet

Part I: the Mixer

UHF experimenting is fun. Talking to someone on 432 or 1250 takes some work, but gives you the thrill of knowing that you have accomplished something that few other hams have done. In the May 1965 73, I described a tube-type station for 1215 mc. Since it was developed, I have done some more work and come up with a this simple-to-build transistorized receiver for the band. It is for broadband reception, but can be modified for narrowband use if desired. You can have a lot of fun with this receiver. You can receive APX-6's, the narrow band boys on 1296 mc, modulated oscillators such as the one I described before, or (low power?) transistor transmitters.

Perhaps something should be said for modulated oscillators on UHF. They're a convenient way to get on the bands. No one claims that you are going to work real DX with this simple equipment, but moderate distances can be covered easily and you can have plenty of fun experimenting with antennas, mixers, etc. The stabilized boys look down their long string of multipliers at modulated oscillators, but there's plenty of room (85 mc) for many newcomers, whether they use 10 mc wide TV signals or CW, modulated oscillators or SSB.

This article, the first of three, describes the mixer for the 1215-1300 mc receiver. Future articles describe the local oscillator and *if*-audio strip. The mixer and oscillator are built in modular form (i.e., Miniboxes). You can unplug the tunable local oscillator and substitute a crystal-controlled one and you can replace the broadbands *if* with a communications receiver. And you can use the same *if* with other oscillators and mixers for the 430 mc or other bands.

Details of the mixer

The mixer in this receiver is considerably easier to build than the cavity mixer I used in

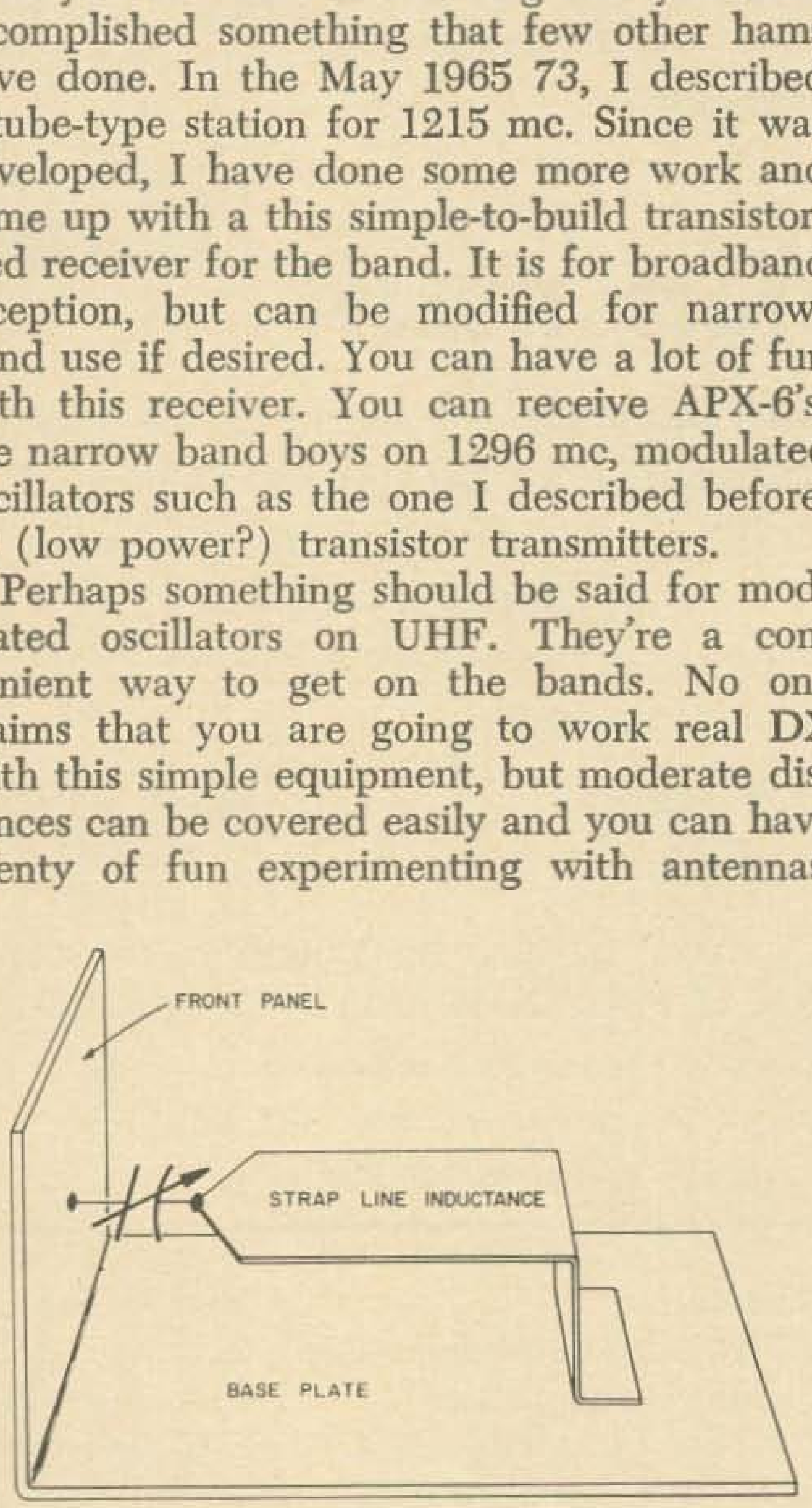

Fig. 1. Simple strap line tuned circuit. Good on 432 and even up to 1200 mc.

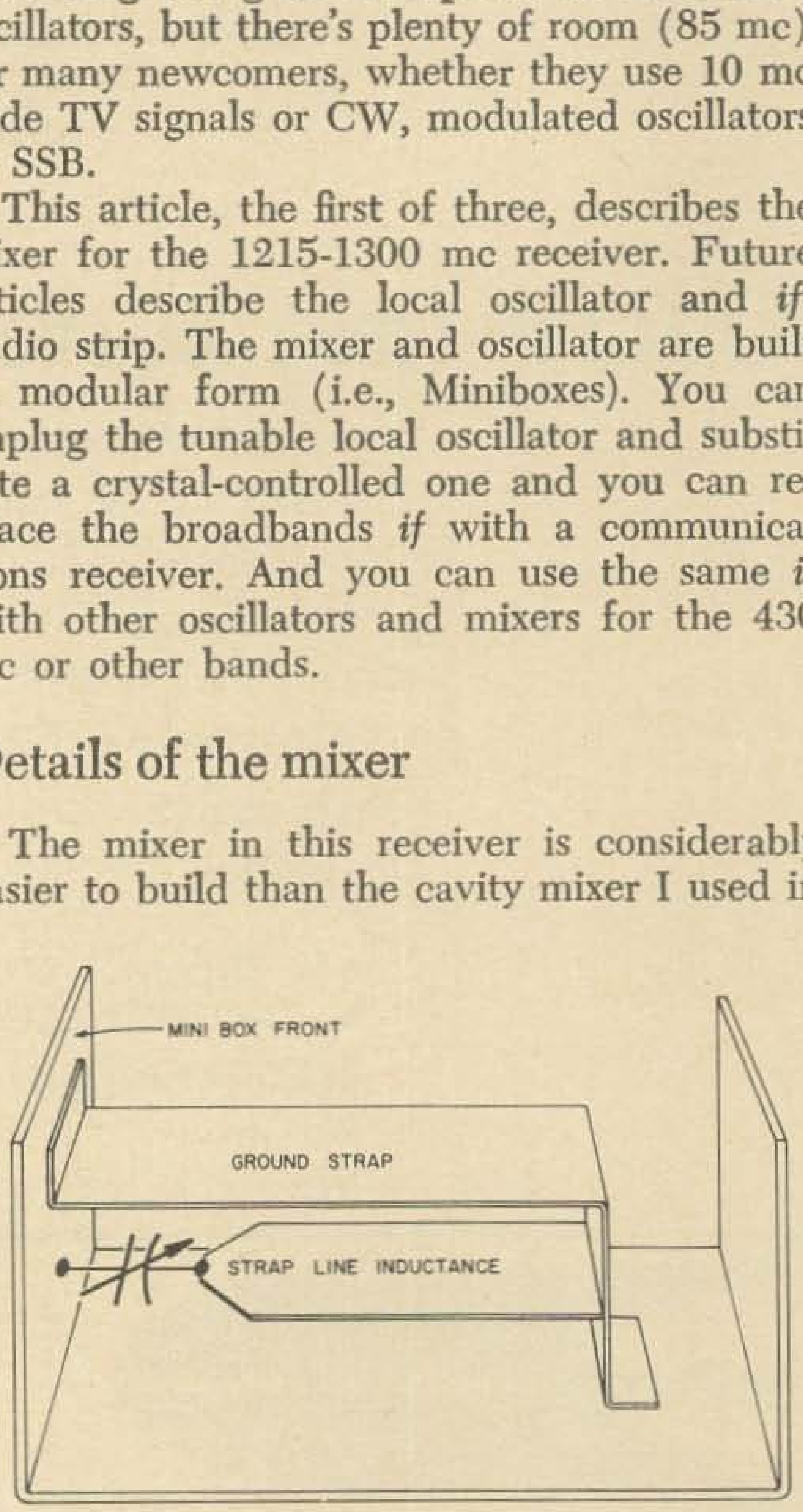

Fig. 2. Strap line with ground plane over it. Note similarity to trough line.

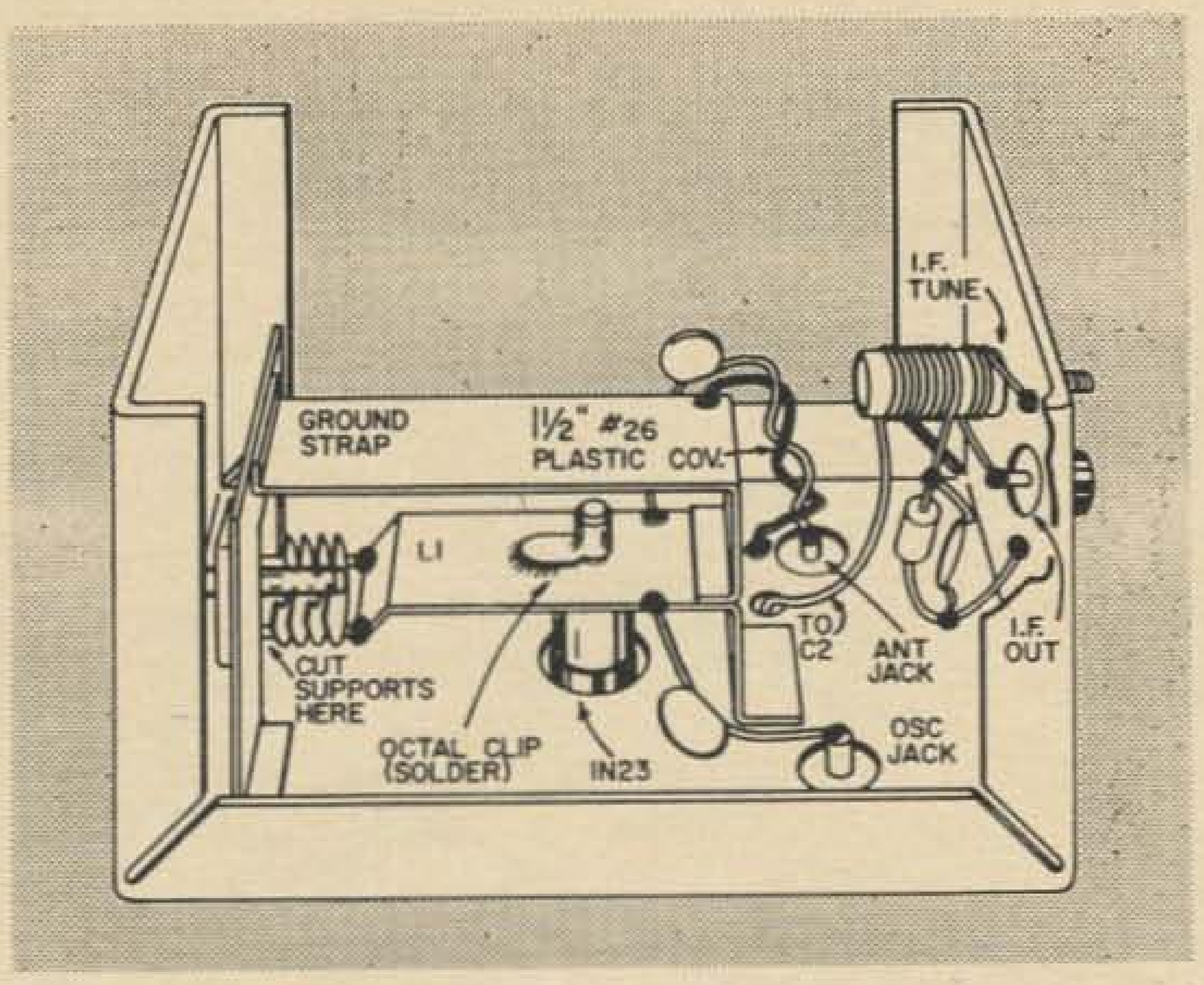

Fig. 3. Overall view of the 1200 to 1300 mc mixer.

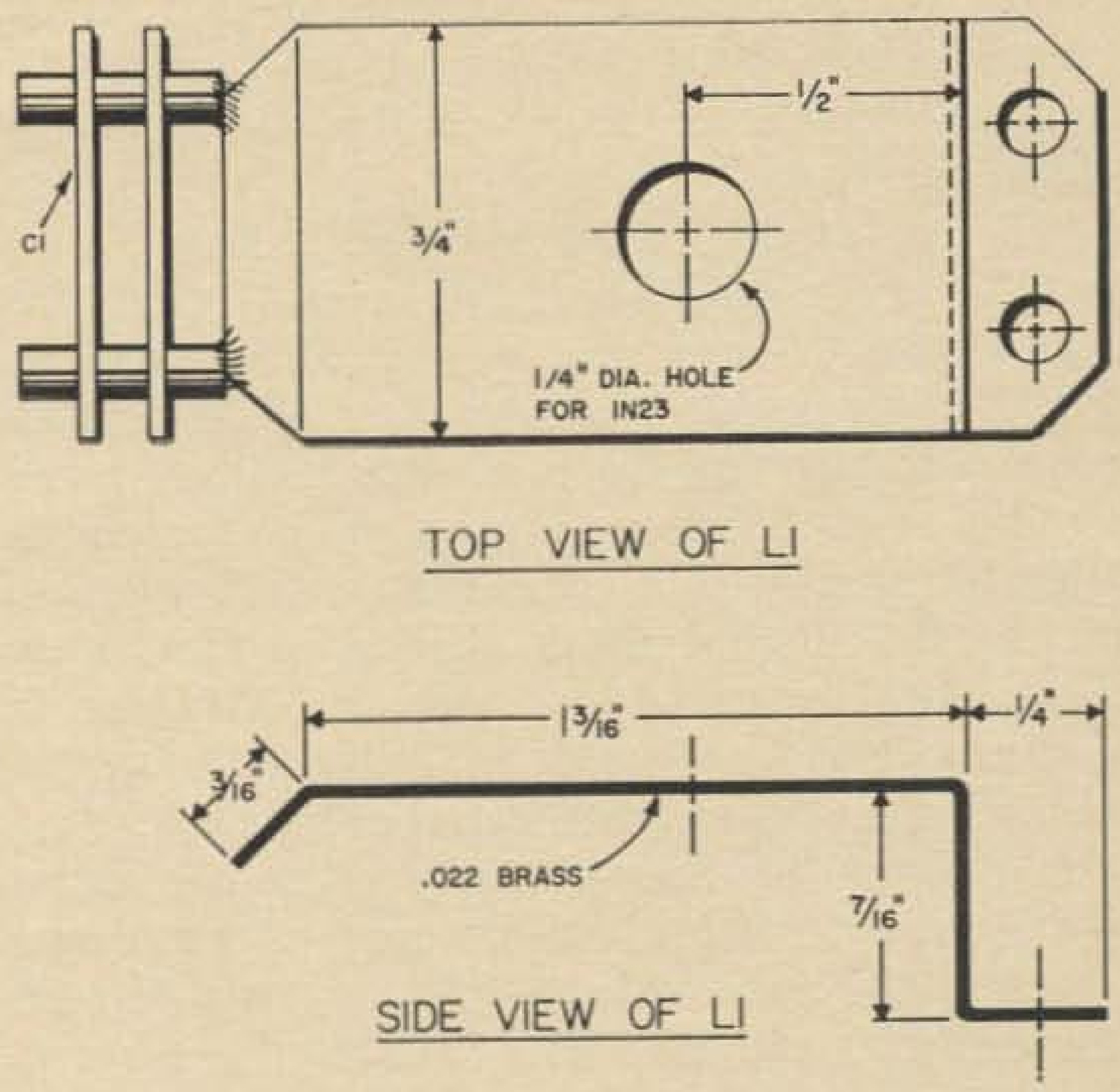

Fig. 4. Details of LI. See Fig. 3 for location.

the tube rig. But it took a long time and a lot of work to perfect. Now that I know how, though, I've made a bunch of them and they all work fine.

There are two tricks that make this mixer possible: First, cutting the stator plate supports off the ceramic base of the capacitor after the tuning strap is soldered in place. Second, making a skeleton cavity with flat ground plates on each side of the main portion of the flat strip tuned circuit.

A further benefit from the second item is that once you have enclosed the tuned circuit in the ground planes or returns, you can insert the assembly in a Minibox without change in frequency.

So let's get down to details. **Fig. 1** shows a single strapline tuned circuit. This configuration works pretty good on 432 and can even be tuned to 1200 mc. But just try to box it in! I worked for weeks on that one. The solution is to put a second ground plane above the strap as shown in **Fig. 2**. Now it can be put in a box or even built right on one side of a Minibox. The sides make a convenient place for connections since they are grounded for RF and DC.

Construction and components

Now for the details on the 1200 to 1300 mc mixer. **Fig. 3** is an overall view. As for the capacitor, use the smallest variable you can find (Hammarlund MAC-5). Cut the supports very carefully after you've soldered the tuning line in place. I used dentist's scissors.

L1 is shown in **Fig. 4.** It is fastened to the Minibox base with 4/40 bolts and nuts and then soldered to C1. Then cut off the stator supports after soldering. The stator plates will remain in the proper position.

The crystal used is a 1N23. Crystals such as the 1N23B or C are more expensive and can offer a lower noise figure. Use whatever suits you—even a surplus one may be fine. Don't forget that the noise figure is determined by the *if* as well as the crystal. UHF TV sets have used the 1N82A, but it's not as good as the 1N23.

In the mixer shown, the small tip of the crystal goes clear through L1 and slides into

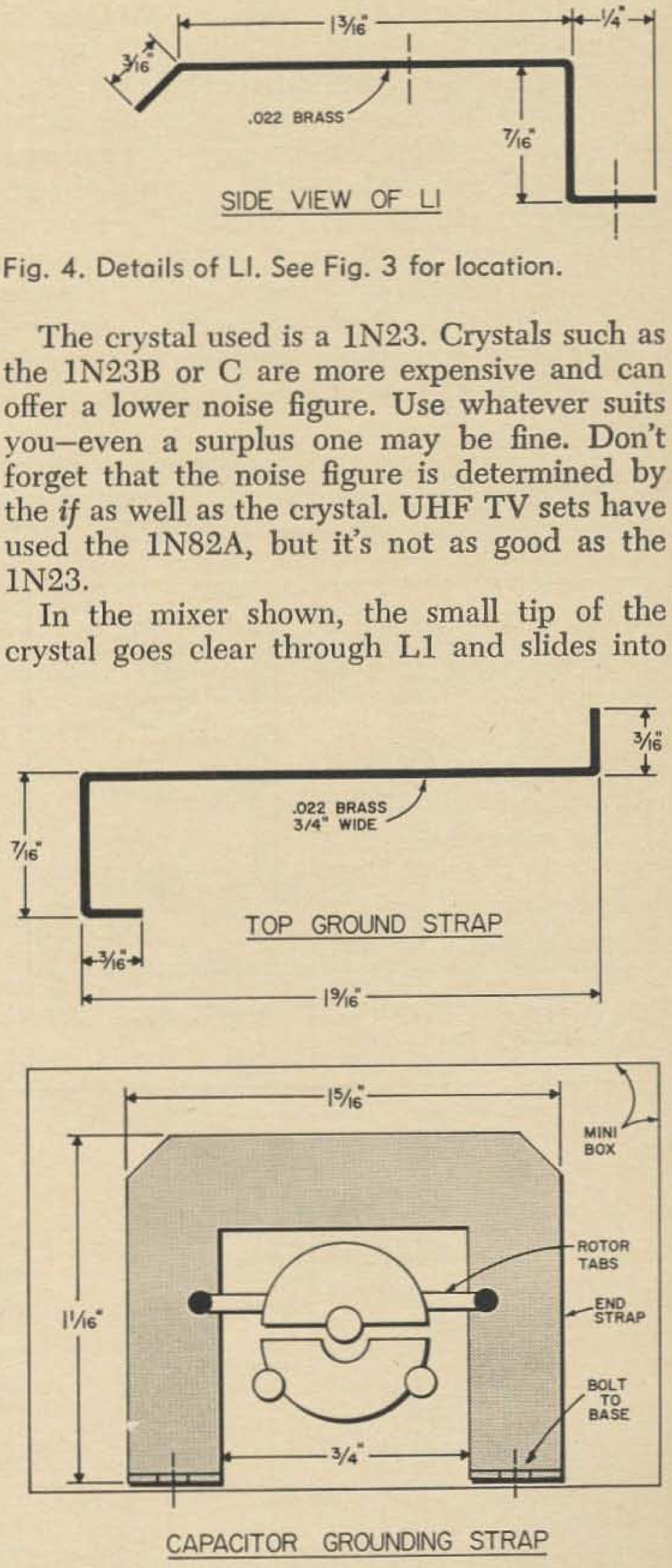

Fig. 5. Details of the top ground strap and the capacitor grounding strap.

a clip taken from an old octal socket. This clip is soldered to the top of L1—preferably with a defunct 1N23 to hold the clip in place while soldering.

The top ground strap is shown in **Fig. 5** and is not very complicated. Solder on top of L1 and to the C1 grounding strap also shown in **Fig. 5**. Solder the two rotor lugs of C1 to this piece after bolting down to the Minibox base.

The crystal bypass capacitor is shown in **Fig. 6** along with the oscillator and antenna jacks. A ¼ inch hole is drilled in the brass plate for the cartridge and the Minibox is drilled out to nearly ½ inch. The crystal should not be allowed to short to the Minibox. And don't forget insulating tape under the brass plate. An insulated lead goes right down through the box to the inside and over the 28 mc tuned *if* coil, L2. This coil can be a store-bought slug tuned 10 m coil or you can make your own. The 1000 ohm resistor in series with the crystal return is needed to furnish some bias for the mixing operation. You might try different values of bias for optimum results.

I used phono jacks with ceramic insulation for RF connections. I trimmed them down with a razor saw and used 1/72 bolts (2/56 will do. I just wanted to show off that I had 1/72 bolts.) You can get them and the razor saw in a hobby shop. The jacks are located on either side of L1, as shown in **Fig. 4.** The oscillator jack has a one pf small disc capacitor with about ⅛ inch leads connected to it. The other lead goes to L1 about ⅛ each from the cold end.

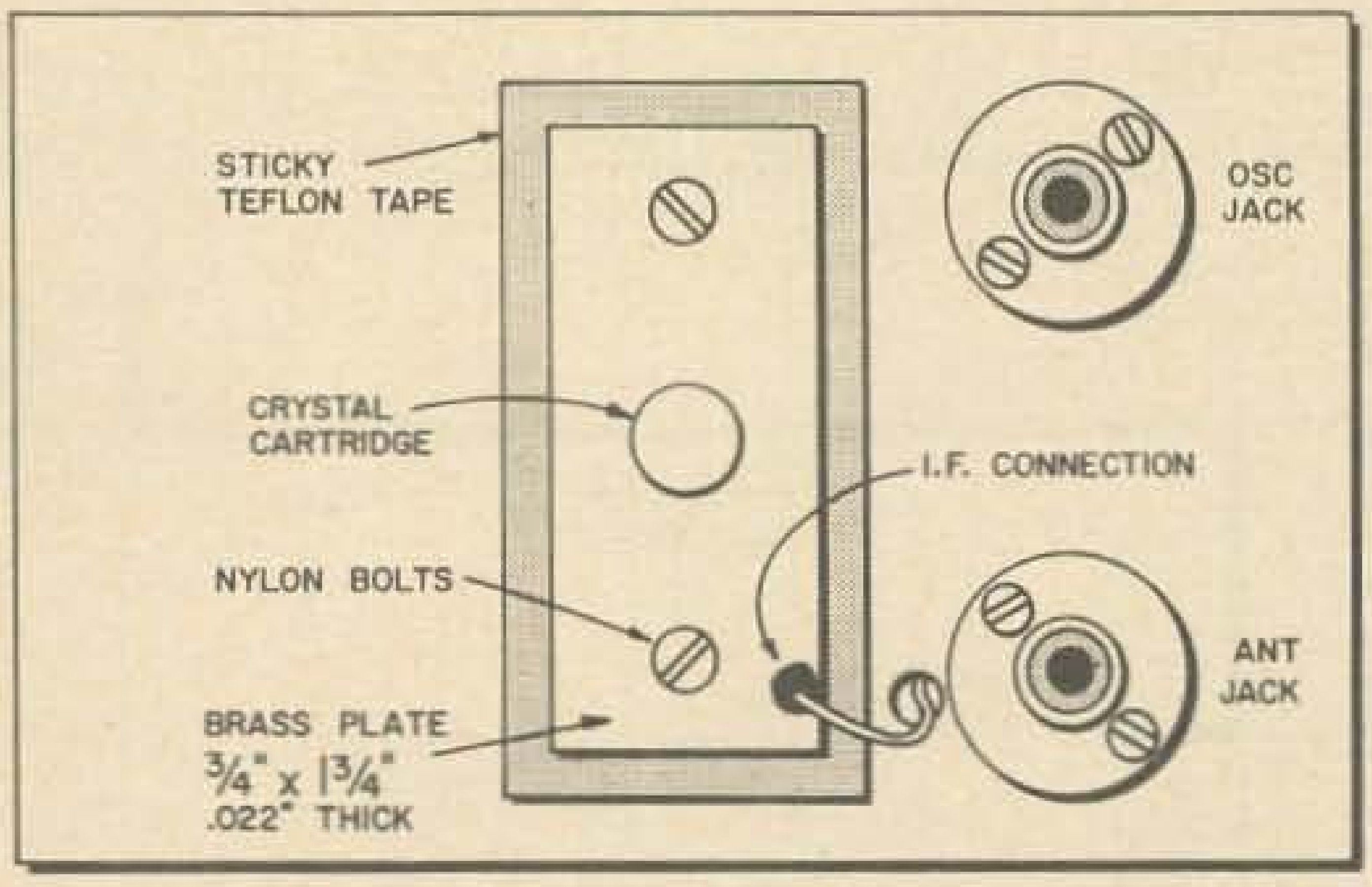

Fig. 6. Crystal bypass capacitor and back view of the Minibox.

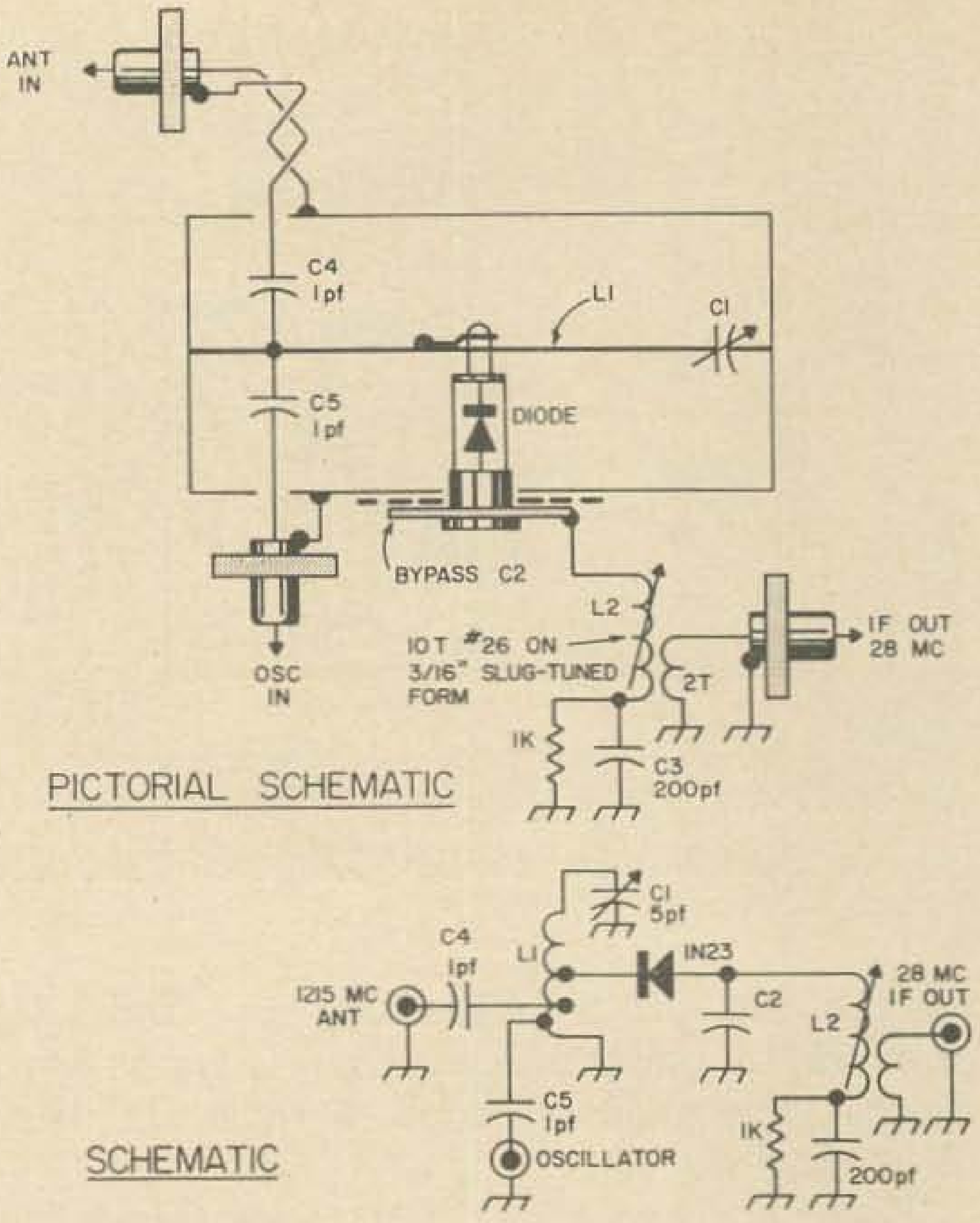

Fig. 7. Pictorial schematic and schematic of the 1250 mc mixer.

Some pulling of the oscillator can be found as C1 is tuned, but not too much. Of course, you can use a 200 mc *if* to reduce this, but that brings up other problems. The 28 mc *if* and local oscillator will be covered in future articles.

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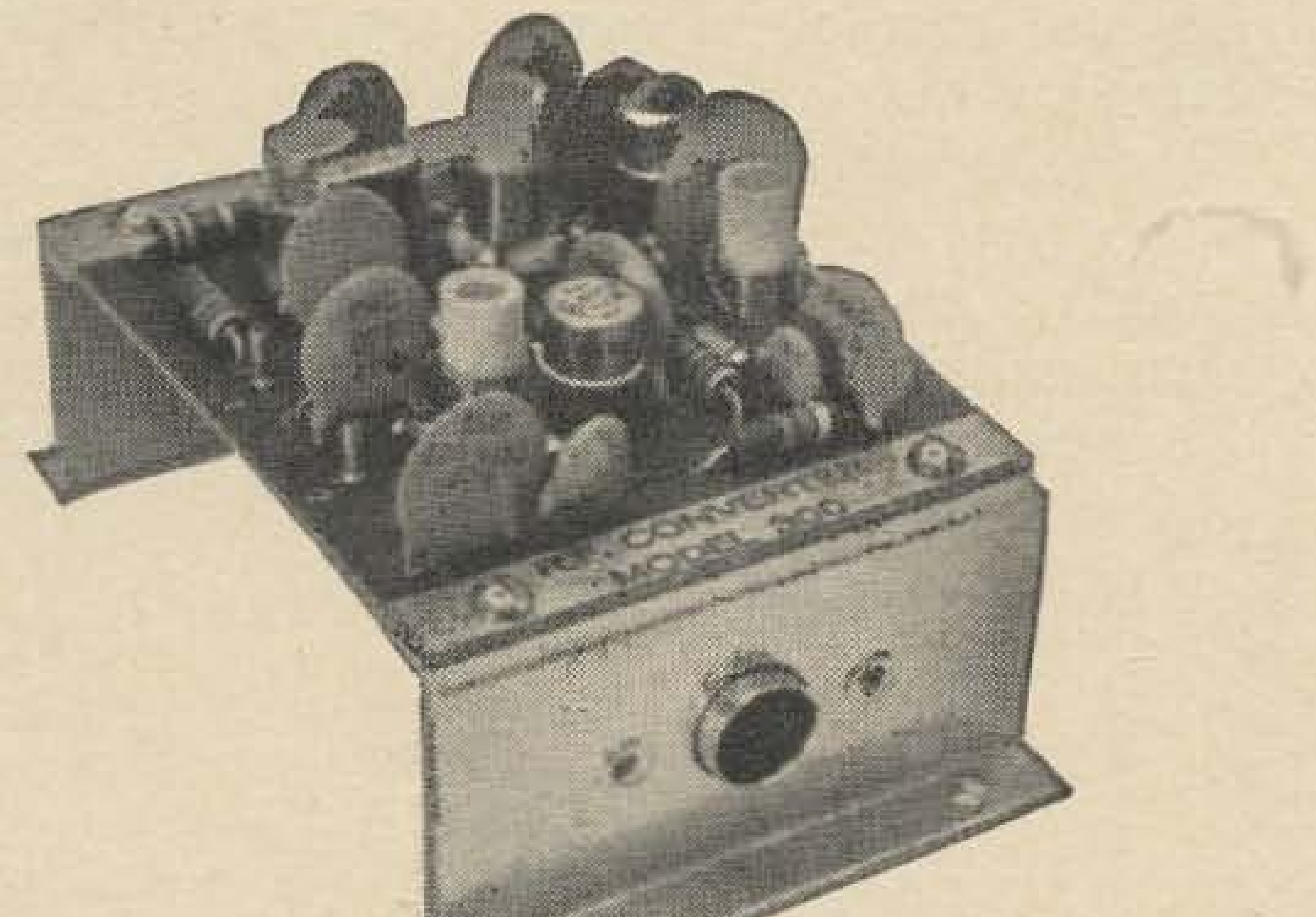

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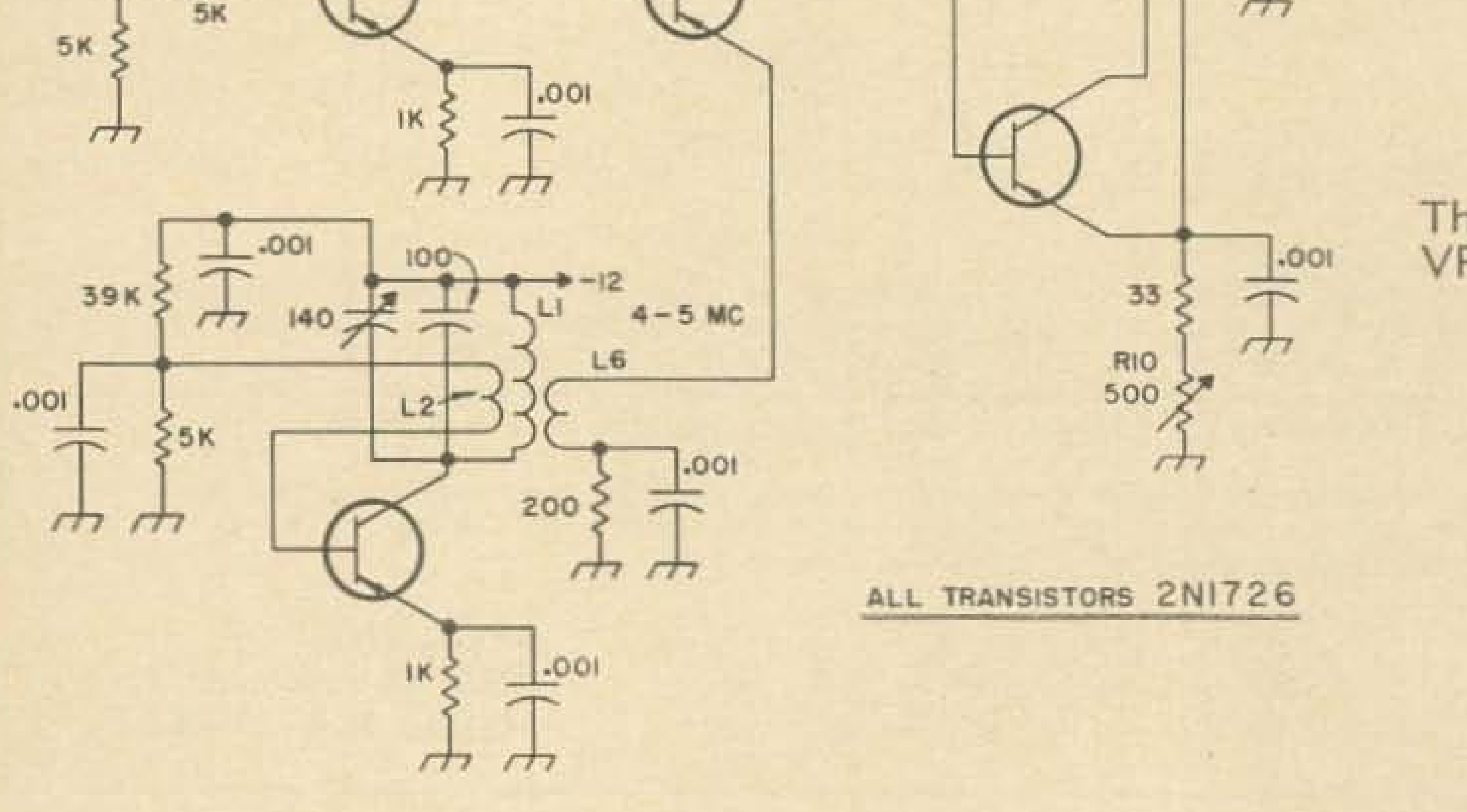
The Solid State Slippery Six

A really low cost practical heterodyne VFO rig for six meters is described. The Sprague 2N1726 transistors used are listed amateur net, quantities 1 to 99, for only $1.15. And as you will see they are actually easier to handle and tune up than tubes, once you get used to them. No line cord, no transformer power supply, just a small 9 or 12 volt battery and away you go, shack, car, or on foot.

First a brief word on the heterodyne VFO principle for new readers (and others) that may have missed the Compactron heterodyne-VFO in 73 before. Six meters has been for some time, to a major extent, a VFO band. You get rock-bound and you are really tied up. Friends, new stations, chatting gaily a little away on the dial, and you can't reach 'em. And with the highly portable feature (house, car, or on foot) of this transistor transmitter you can develop an advanced case of frustration when you arrive on a nice hill an hour or so from home, plenty of interesting new calls batting in on the receiver, if you do not use the VFO feature.

So you need a VFO. My advice: don't build a low frequency one that has to be ultra-stable because it multiplies up in frequency. Start with a 45 or 46 megacycle



The six meter solid state heterodyne VFO exciter.

crystal oscillator, *add* on a simple 4 to 5 mc oscillator in a mixer, and there you are, on 50 mc, stable but not rock-bound. No hum, no drift, no FM'ing, easy zeroing in, and highly portable. How can you lose?

The Sprague 2N1726 transistors are made in New Hampshire on some pretty fancy automatic machinery which is probably paid for by now, as they list for only $1.15 amateur net. Of course you can go hog wild with your dough and use 2N1745's for $1.80 each, that's up to you. A little more gain, but I use the 2N1726s myself.

Fig. 1 is the schematic. Both oscillators are strong oscillators having been maximized for gain and efficiency and will work at very low voltages which is always a good test for oscillators. The 4 to 5 mc one uses a collector winding L1 made of No. 26 DSC, two pi, each 25 turns, using a mixture that I call "progressive jumble" wound, for a total of ⅝ inch. L2 is wound between and over the two sections. The coil form is impregnated paper with internal thread and a 6/32 threaded core for adjustment. You can use another form if it tunes 4 to 5 megacycles with a total capacitance close to that shown in **Fig. 1**.

L2 is 6 turns No. 30 DCC and is wound in the same direction as L1 and the base then goes to the opposite end from the collector. For the fixed capacitor across L1 use a dipped silver mica. The crystal oscillator is just as straightforward and neat. L3 is 9 turns of ⅝ diameter air wound, 8 turns per inch, and is tuned to 46 megacycles. L4 is two turns small plastic covered wire wound on top of L3 near the middle. If L4 is wound in the same direction as L3 connect the base to the opposite end from the collector, and you can't miss.

In both these oscillators the 1K resistor in the emitter will protect the transistors whether they are oscillating or not. A milliammeter in the mixer collector return lead to the minus 12v during tune-up will serve as an RF indicator for the oscillators if you don't have a handy-dandy RF detector.

The mixer does not need external DC bias as it is driven by the RF from the oscillators which develops the correct amount of bias on the 200 ohm emitter resistor. Transistors are natural born mixers. This one gave out with lots of 50 mc immediately on being fired up.

L7 tunes 50 to 51 megacycles and is 10 turns of ⅝ diameter air wound, 8 turns per inch. L8 is semi-adjustable. I used about 1½ turns on the cold end of L7. Not critical, but it pays to trim up for power and tune-up for frequency.

The RF amplifier does not use any external DC bias either as it develops what it needs in the emitter resistor due to the rectifier action in the base-emitter diode circuit.

The variable 500 ohm resistor can be replaced by a fixed one but there is a consideration here. The 2N1726's are low cost low power units and when you light a No. 48 or 49 bulb bright you are pushing them. So the 500 ohm variable is known as a "drive control" and works quite well at it. I would suggest somewhere around 10 or 12 mils collector current for the two RF finals in parallel. More on that later.

L9 is 10 turns airwound, 8/per inch, not critical. A No. 48 bulb across 2 or 3 turns from the cold end of L9 will light up dull red with R10 set at 100 ohms and over, and fairly bright with R10 at zero ohms. Once again, watch those collector mils!

If you want to push things even a little more you can add two 1.5 volt cells to the minus 12 volts, 15 volts total, and get out like mad. You should have some spare 2N1726's on hand though!

So, that's it for now, see you on six from one of those beautiful big QRM free walk-up mountain tops!

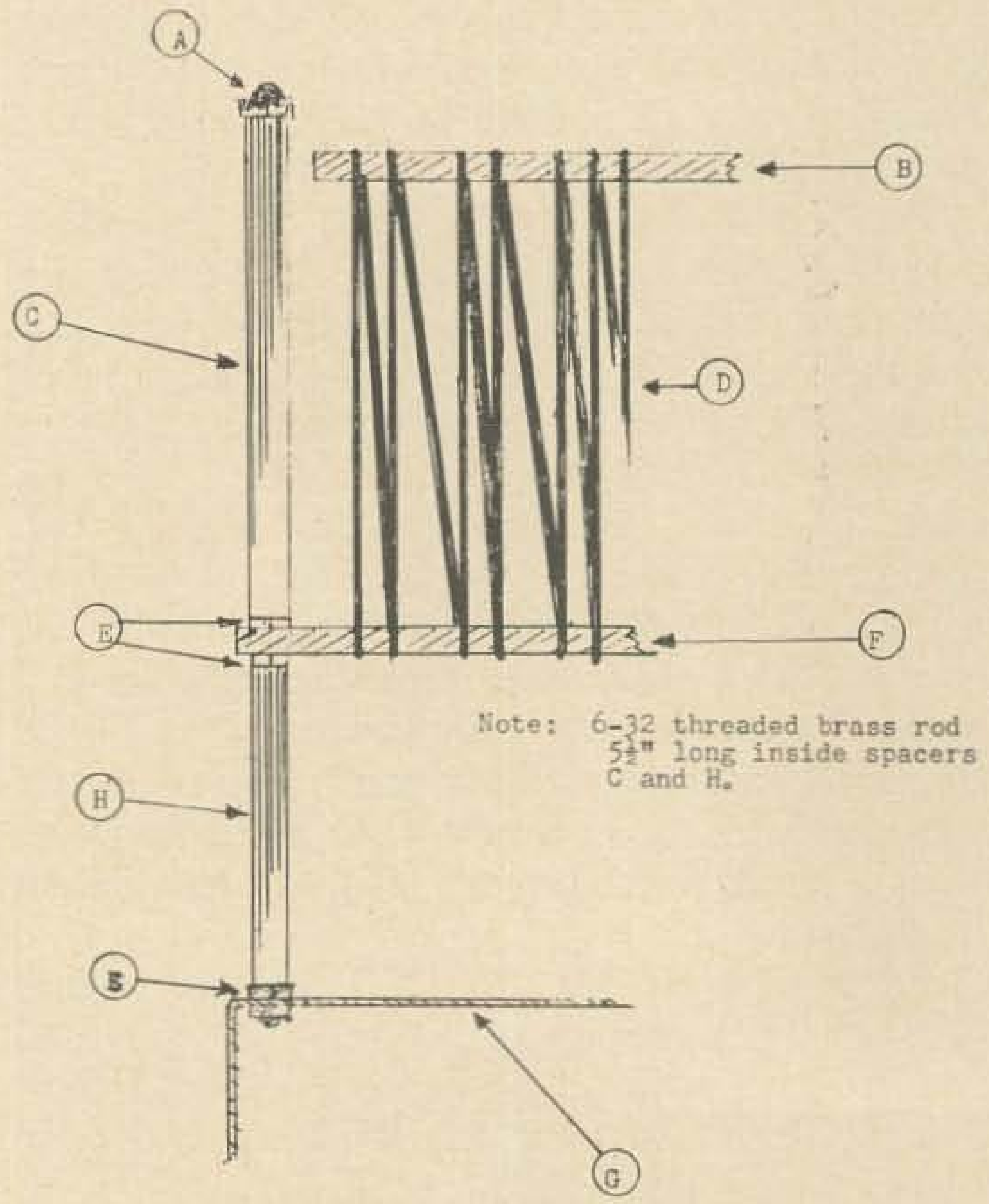
. . . K1CLL

Howard Pyle W7OE
3434-74th Ave., S.E.
Mercer Island, Wash.

A Tip for Transmitter Owners

Regardless of whether your amateur transmitter is a factory wired job, one built from a kit or completely "home-brewed", chances are good that the final amplifier tank coil is exposed on the top of the chassis. You occasionally find it necessary to make repairs or a check of components on the underside of the chassis. To do so means turning the chassis over and laying it on your work-bench. In many cases, this puts the weight of the entire chassis with its heavy transformers and other components on the final amplifier tank coil for support. These coils are not designed to serve as supports. More frequently than not, using them as such results in breaking the spacer bar on top of the coil.

I had this experience with my first Viking Ranger. The steatite spacer bar on top of the coil took the entire chassis load when the chassis was turned over to perform minor service operations. It immediately broke at one of the grooves in which the wire was wound. I've had several Rangers as well as other transmitters since then, and in every case, before I reversed the chassis for any reason, I fitted it with a support rod to carry the weight. Such support can remain in place as a permanent part of the chassis. It does no harm



Mounting Details for Support Stud
A—6-32 Acorn nut
B—Upper steatite spacer bar
C—Metal spacer (optional)
D—Final tank coil winding
E—6-32 Hexagonal nuts
F—Lower steatite spacer bar
G—Chassis
H—Factory supplied spacer.

either electrically or mechanically and will often save you the necessity of replacing or repairing the coil spacer bar; a rather ticklish job at best. The accompanying sketch shows how I handled the situation on the Viking Rangers. This same idea is of course, adaptable to transmitters of any make or configuration of components if they present a similar problem. Minor modifications of this scheme will probably be necessary for transmitters other than the Ranger but the object is the same: provide support for the chassis other than by the tank coil!

Dimensions shown on the sketch apply to the Ranger II and will naturally vary with other transmitter types.

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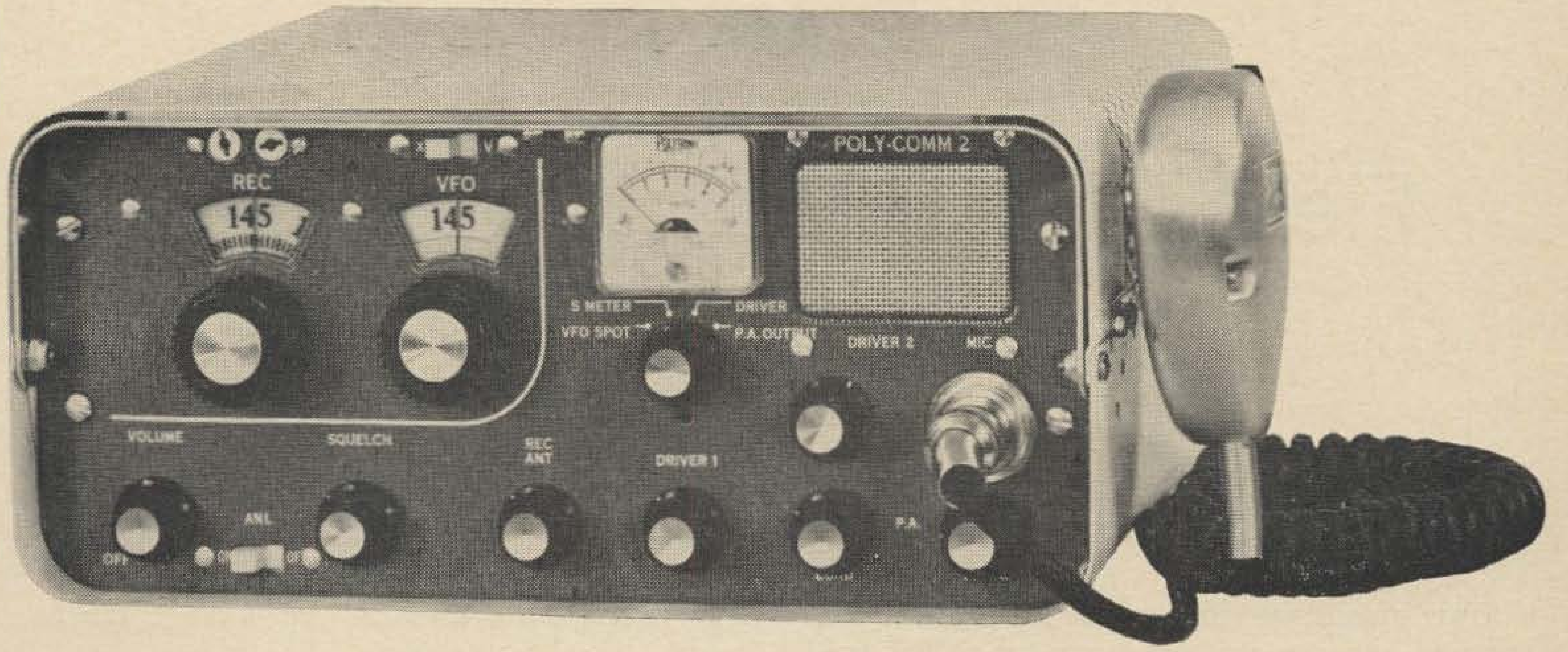

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Field Effect Transistor Primer

How would you like to use a transistor that behaves like a pentode vacuum tube? The field effect transistor (FET) is just such a device. With this transistor it is possible to take just about any tube-type circuit and transistorize it by changing one resistor and the power supply voltage! You don't even have to change the power supply if you add a dropping resistor. The FET has many desirable features that should be popular including high input impedance, low noise and voltage controlled operation. This device also features very high power gain, evceeding that of conventional transistors in the audio range. Field effect transistors have been available commercially since 1960, but until recently the cost of individual units has been too high to be considered for amateur applications. However, there are now field effect transistors on the market for as low as one dollar apiece.

The concept of the field effect transistor actually pre-dates the junction transistor. Just after World War II, scientists at Bell Telephone Laboratories were trying to develop a semiconductor version of the vacuum tube. However, the prototype device failed to give the predicted results because of problems with the semiconductor surface. It was the research into these surface problems that led to the discovery of the point contact transistor and the ultimate development of the junction

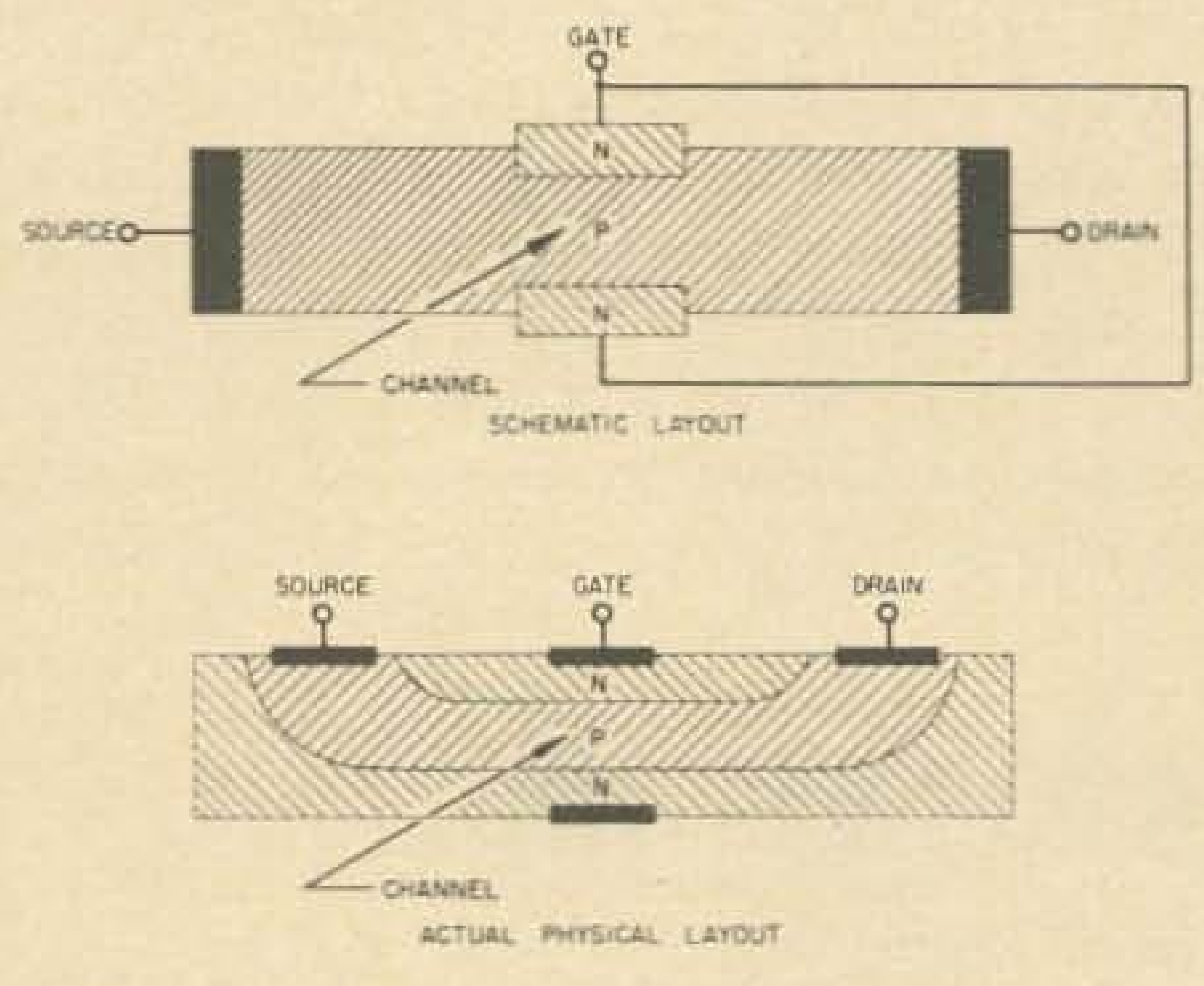

Fig. 1. The Field effect transistor.

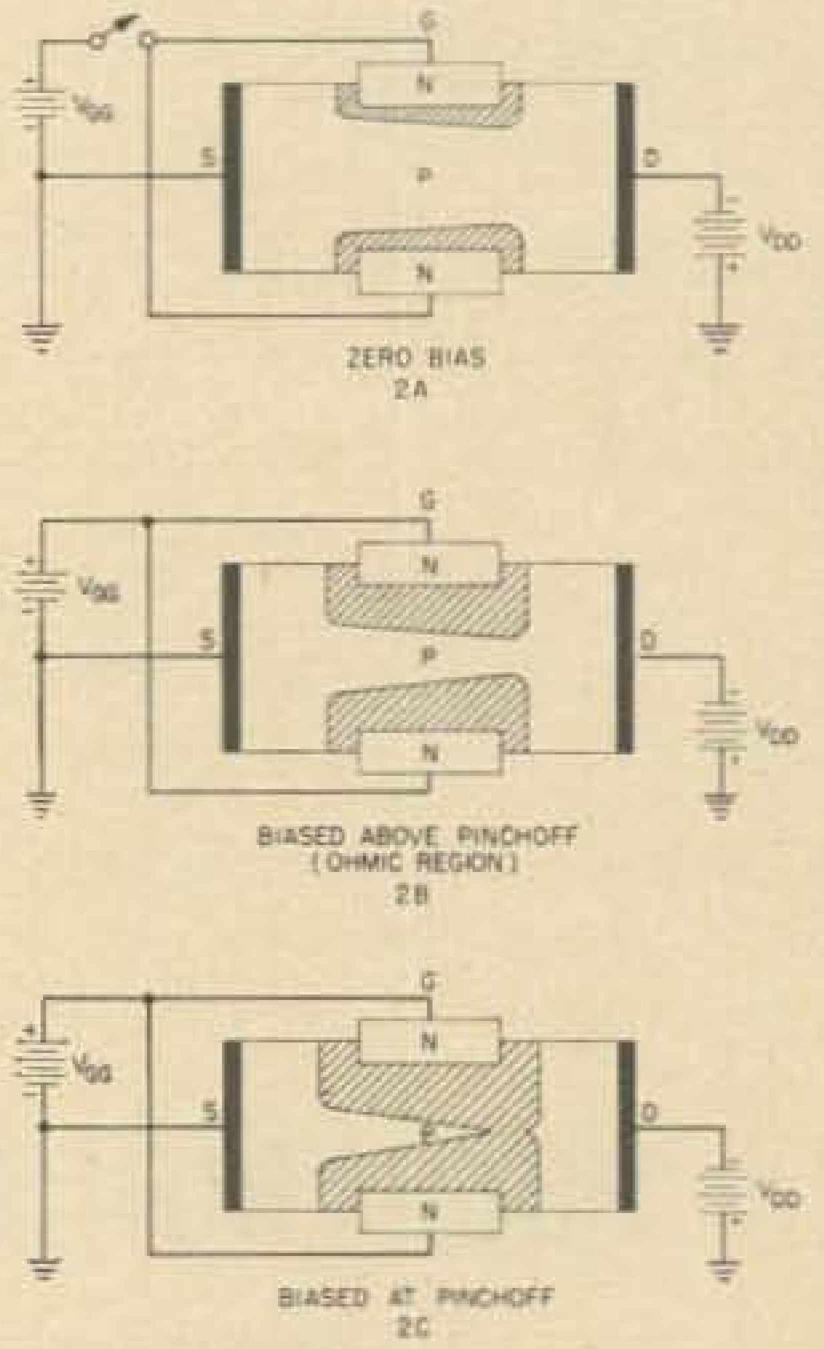

Fig. 2. FET depletion regions.

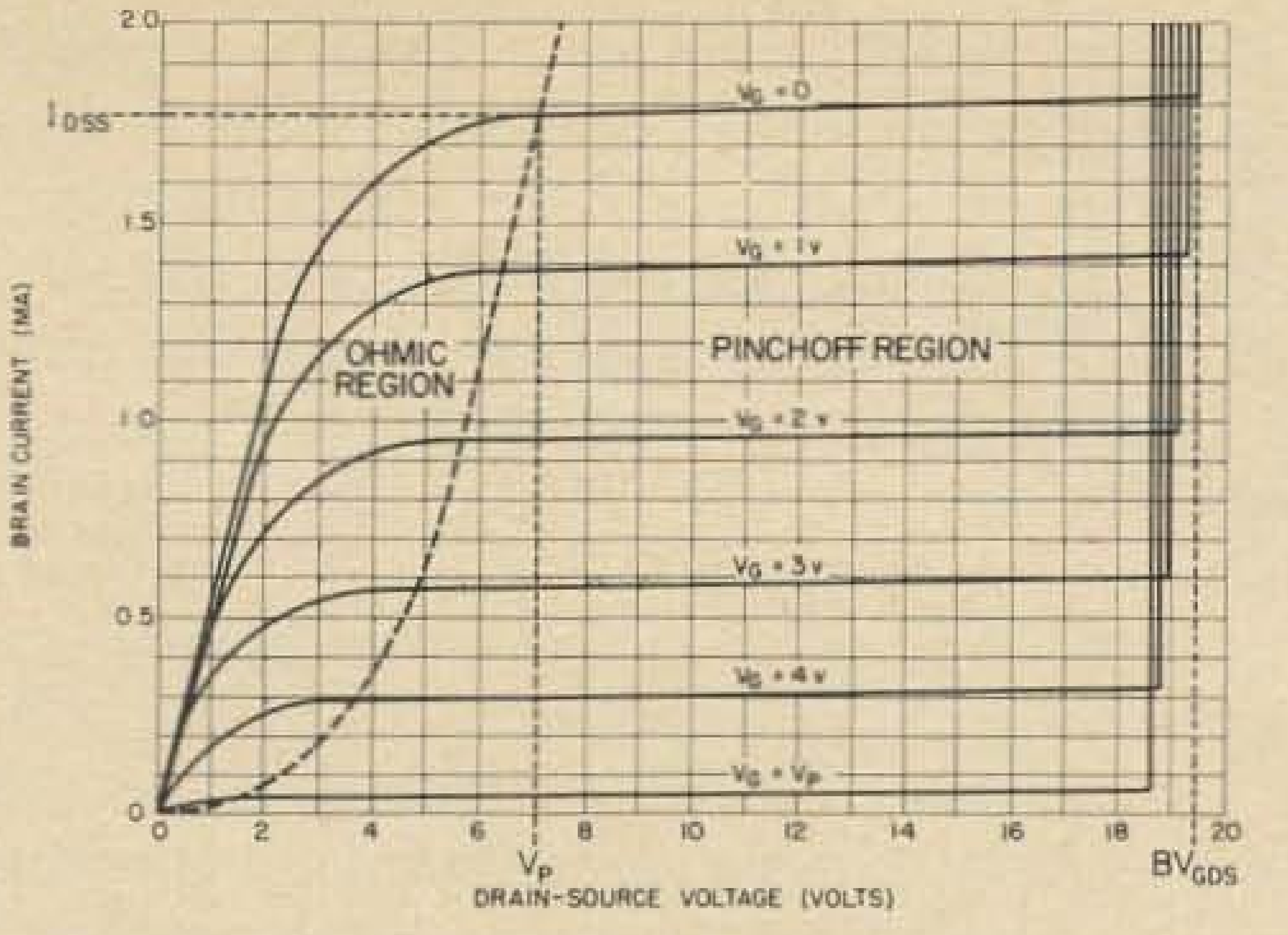

Fig. 3. FET drain characteristics.

transistor. Had industry first concentrated on perfecting the FET rather than the conventional junction transistor, it would be reasonable to say that most circuits would be using FET's and conventional transistors would be used only for special applications, a complete reversal of the situation today.

The basic elements of the field effect transistor are the source, drain and gate, corresponding respectively to the cathode, plate and grid of the vacuum tube. It might seem logical to use vacuum tube terminology for FET's and at least one pioneer manufacturer is doing this, but recent companies have failed to follow suit and it appears that the newer terminology is more widely used.

Basically, the field effect transistor consists of a bar of semiconductor material with two contacts, the source and the drain, at either end as illustrated schematically in **Fig. 1.** Two semiconductor junctions built into the middle of the bar are connected in parallel to serve as the gate; the space between the gates is called the channel. Field effect transistors are classified as N- or P-channel devices, depending upon the electrical properties of the semiconductor material used in the channel.

The operation of the FET is really quite simple and straight forward. In normal use it is biased as shown in **Fig. 2** with the source grounded and the gate in the zero or reversed biased condition, (i.e., for the P-channel device, the gate voltage is zero or positive and the drain negative). When the gate is reverse biased, a depletion region forms around each of the gate elements. The term depletion means simply that the region is void of current carriers (electrons or holes). In the P-channel FET, the gates are constructed from N-type material and a positive bias voltage is applied.

When the gate junctions are formed during the manufacturing process, electrons from the N material cross the junction and recombine with holes on the P side. This exchange of electrons creates an electrostatic field across the junction with the positive charges residing on the N side and the negative charges on the P side of the junction. This field is known as the barrier potential. When an external bias is polarized such that the N-type material is more positive than the P-type, the holes and electrons move further away from the junctions, thereby increasing the width of the depletion region.

Going back to basic electricity for a moment, you will remember that the electrical resistance of any material is directly proportional to its area. This should be intuitively evident if we consider that smaller areas have a smaller number of current carrying electrons and hence higher resistivity. The basic operating mechanism of the FET is based upon the fact that resistance is a function of area.

Consider the schematic illustration in **Fig. 2**; in **2A**, where the gate bias voltage is zero, the depletion region lies very close to the gate elements and the channel is fully opened. However, as the gate bias is increased, the depletion region extends further and further into the channel (**2B**), restricting current flow by effectively increasing the resistivity. As the gate bias is further increased, the depletion regions come together as shown in **Fig. 2C** and the channel is "pinched off." The level of bias required for this to happen is referred to as the pinchoff voltage (V_P).

In a nutshell then, the operation of the field effect transistor consists of modulating the flow of current in a semiconductor channel by establishing depletion regions at each side. As these regions increase, they diminish the effective cross-section area of the channel, thereby increasing its resistance. The characteristic wedge shape of the depletion region is due to the fact that the reverse bias on the P-N junction is greatest at the drain end of the transistor.

From this discussion, it would seem that the

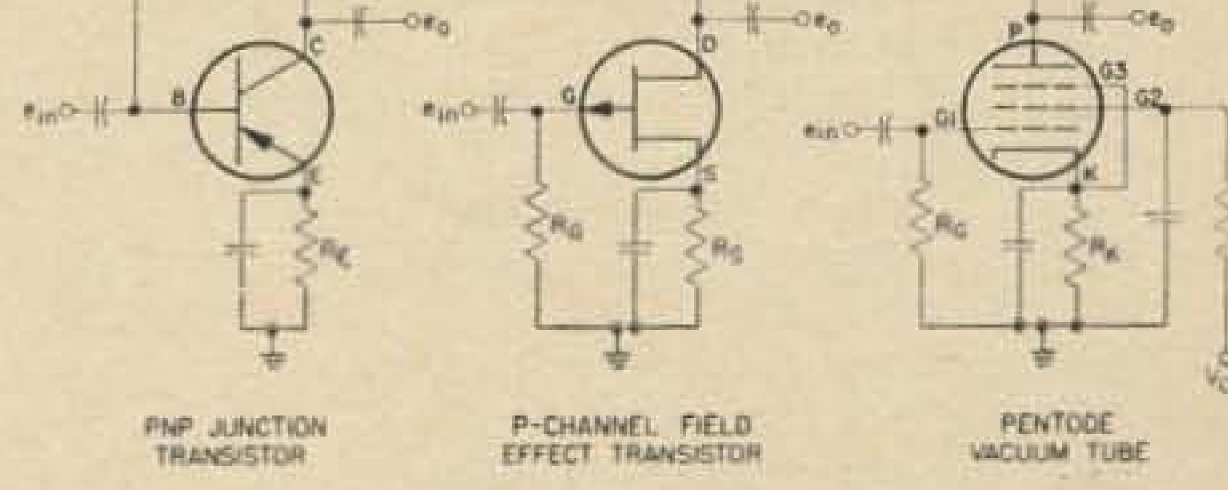

Fig. 4. Comparison of junction transistor, FET and pentode tube.

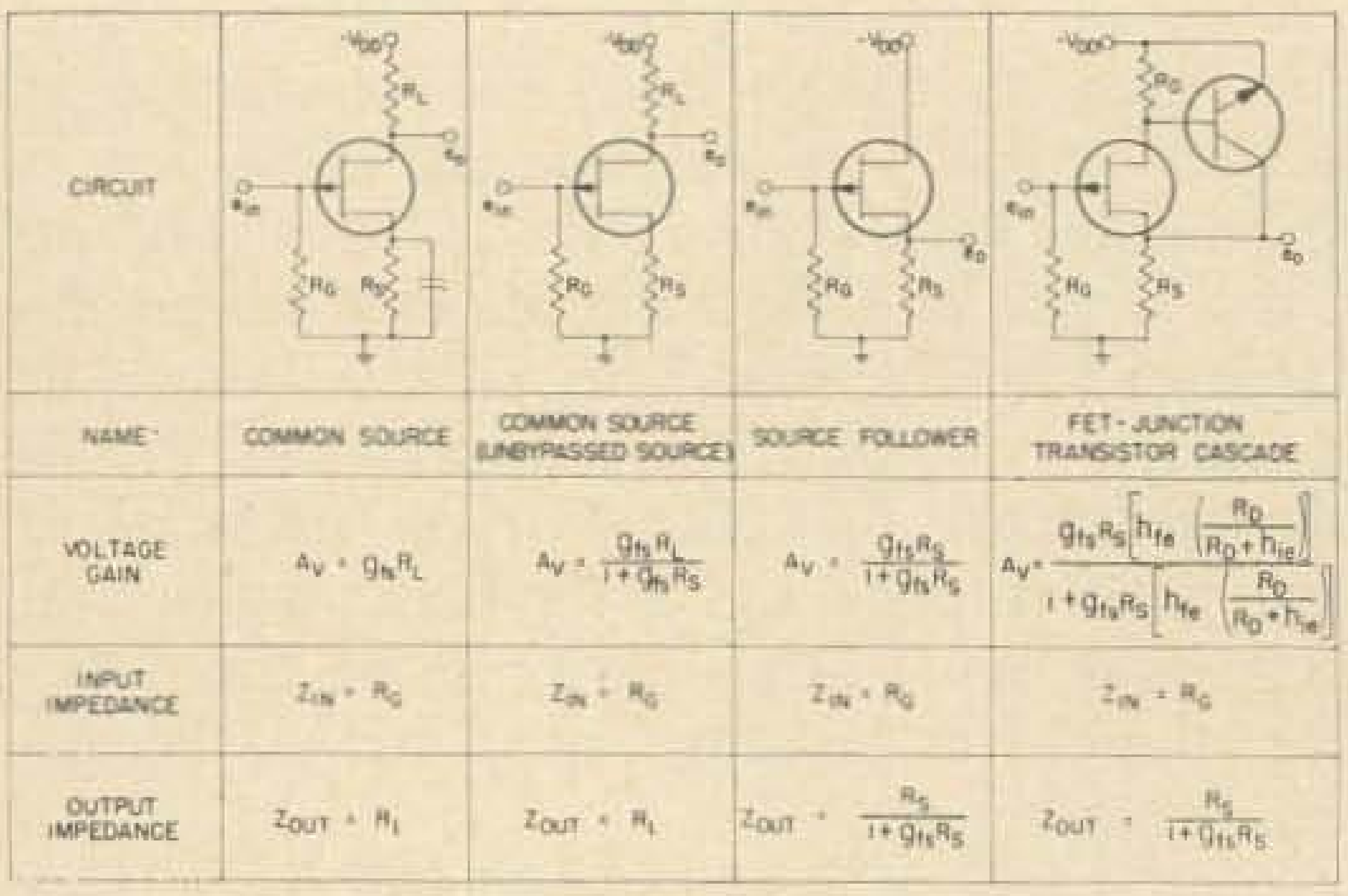

Fig. 5. Basic FET amplifier circuits.

external bias required to bring the two depletion regions together would be capable of reducing the drain current to the characteristic reverse current of the P-N junction. However, this complete pinchoff condition never occurs; in practice, the drain current approaches some irreducible minimum greater than the diode reverse current.

If the gate bias voltage is held at zero and the drain voltage is increased, the area of the depletion region will similarly enlarge and when the drain voltage is about equal to the pinchoff voltage, the channel is effectively pinched off and exhibits extremely high resistance values. If the drain voltage is increased beyond this point, there is no significant change in the current. This property is especially useful in current limiting applications and is a current anology of the voltage limiting zener diode. As the drain voltage is further increased, the electric field increases until "breakdown" occurs. Beyond this point the current between the drain and the gate increases very rapidly and the device may be permanently damaged.

At small values of current, the channel between the drain and the source acts like a linear resistor, but as the current increases, the portion of the channel near the gate junctions becomes significantly negative with respect to the source. Note in **Fig. 3** that the relatively constant slope at low voltages becomes less linear with increasing applied voltage. The point at pinchoff corresponds approximately to the voltage at the "knee" of the curve. Above the pinchoff voltage the drain current saturates and increases very little for further increases in voltage.

The symbol used for the field effect transistor has only three terminals as shown in **Fig. 4**, but its electrical behavior is more similar to the pentode tube than the triode. It should be noted that the symbol in itself does not differentiate between the source and the drain; this must be done by adding the letters S and D. Actually many devices are symmetrical and the source and drain may be interchanged, but the parameters may not necessarily have the same values in the reverse connection unless so guaranteed by the manufacturer.

Although the operating mechanism of this device is very interesting and provides some insight to what may be expected in use, more specific information is required before actual circuit application may be made. The most informative method of doing this is to plot the effect of gate voltage on the drain current (I_D) as shown in **Fig. 3.** Here the drain characteristics of the FET comprise two regions; the pinchoff region which is called the pentode region and the non-pinchoff or saturation region which is sometimes called the triode or ohmic region.

The most important of the field effect transistor's operating parameters are listed in **Table 1** along with their approximate vacuum tube equivalents. Normally only those parameters designated by an asterisk are included on the data sheet however, and are sufficient for nearly all applications. The forward transadmittance (g_{fs}) is measured in much the same way as the transconductance of the vacuum tube; that is

$$g_{fs} = \frac{\Delta I_D}{\Delta V_G} \text{ with } V_D \text{ held constant}$$

Table I

FET Operating Parameters

FET Parameter	*Description*	*Vacuum Tube Equivalent*
BV_{GDO}	Drain to source breakdown voltage with the gate open-circuited	—
BV_{DSS}	Drain to source breakdown voltage with the gate short-circuited	—
$*BV_{GDS}$	Gate to drain breakdown voltage with the drain short-circuited	—
BV_{GSS}	Gate to channel breakdown voltage with the drain and source shorted	—
C_{rb}	Feedback capacitance from drain to gate. Also designated C_{gd}	C_{gp}
C_{GS}	Gate to source capacitance	C_{gk}
$*C_{is}$	Short-circuit input capacitance	C_i
$*g_{fs}$	Forward transadmittance. Also designated g_m and Y_{fs}	g_m
g_o	Output conductance. Reciprocal of output resistance R_o	—
$*I_{DSS}$	Zero bias drain current. Also designated I_o and $I_{D(on)}$	—
$*I_{GSS}$	Gate to source cutoff current	—
R_{in}	Input resistance	R_{in}
R_o	Output resistance	R_o
V_{DS}	Voltage from drain to source	—
V_{GS}	Voltage from gate to source	—
$*V_P$	Gate to source pinchoff voltage	—
Y_{fs}	Forward transadmittance, see g_{fs}	g_m
Y_{os}	Output admittance. Complex reciprocal of output resistance R_o	—

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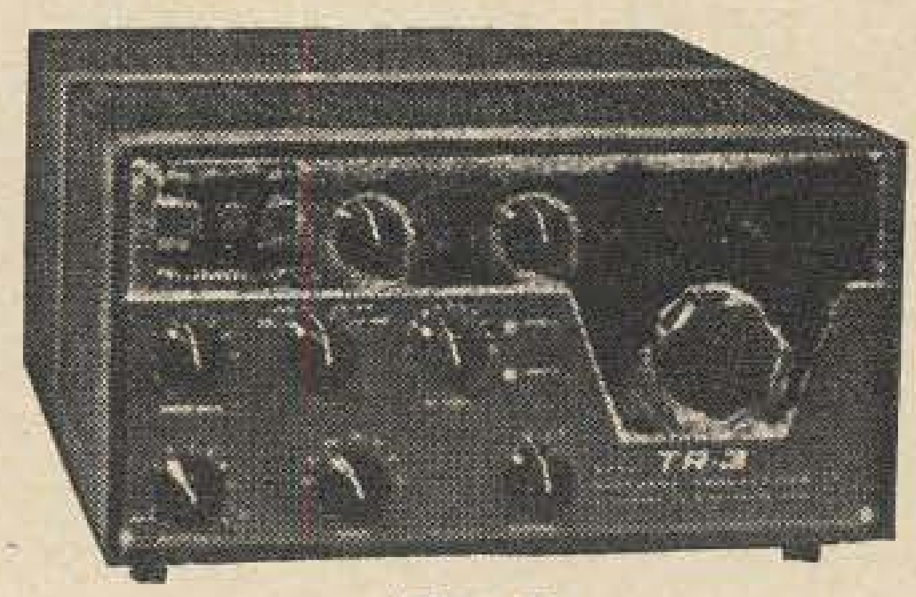

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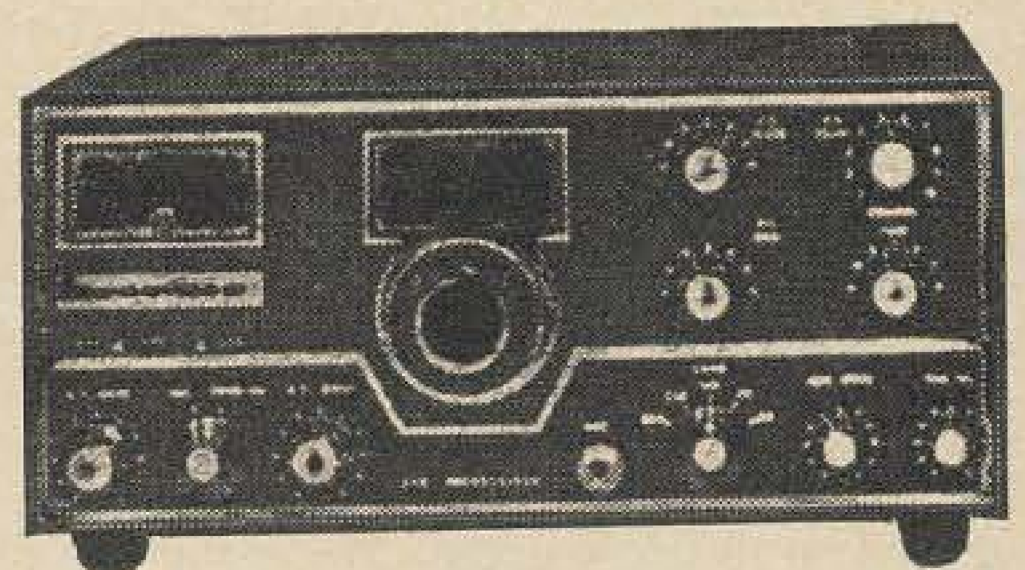

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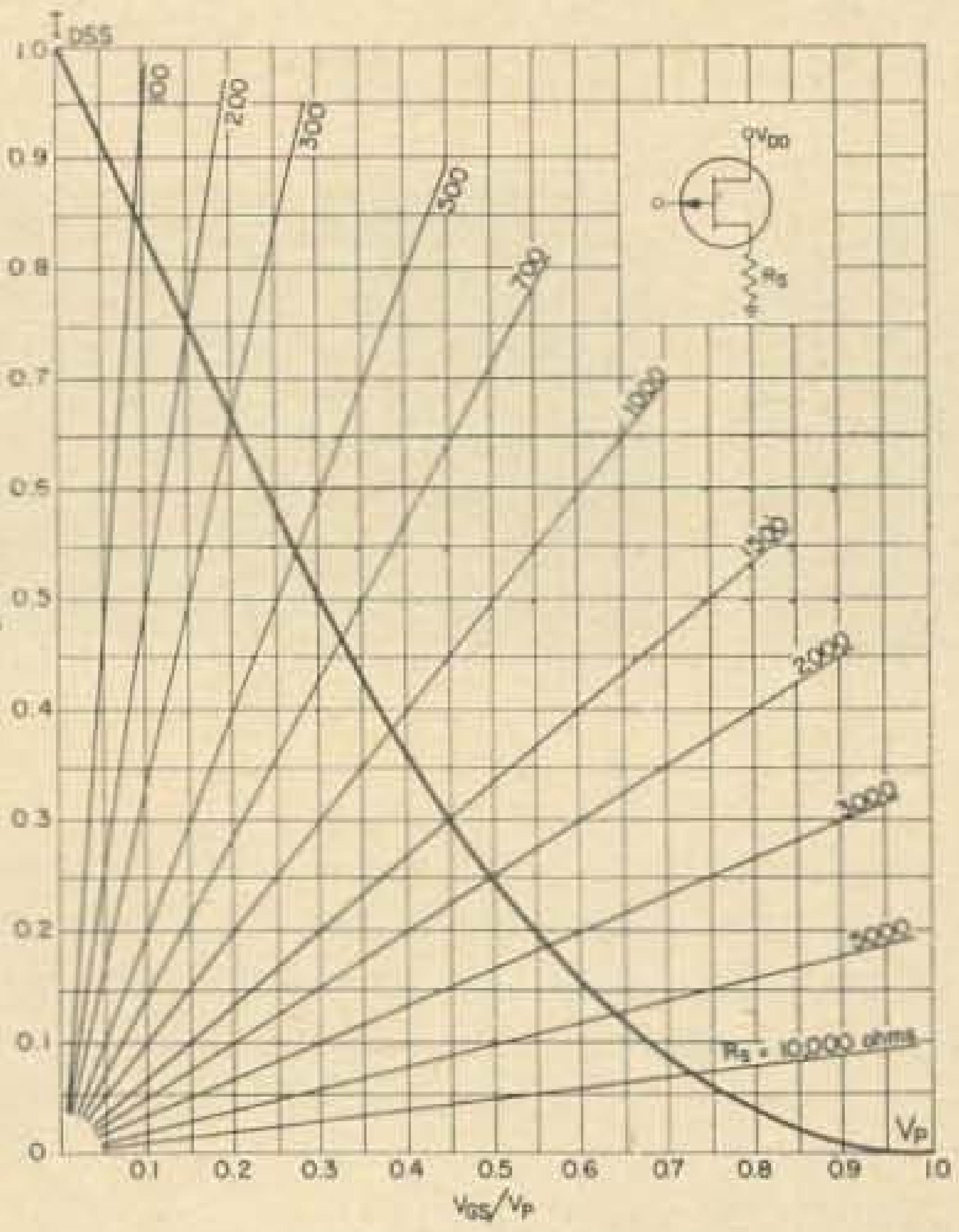

Fig. 6. Normalized FET transfer curve.

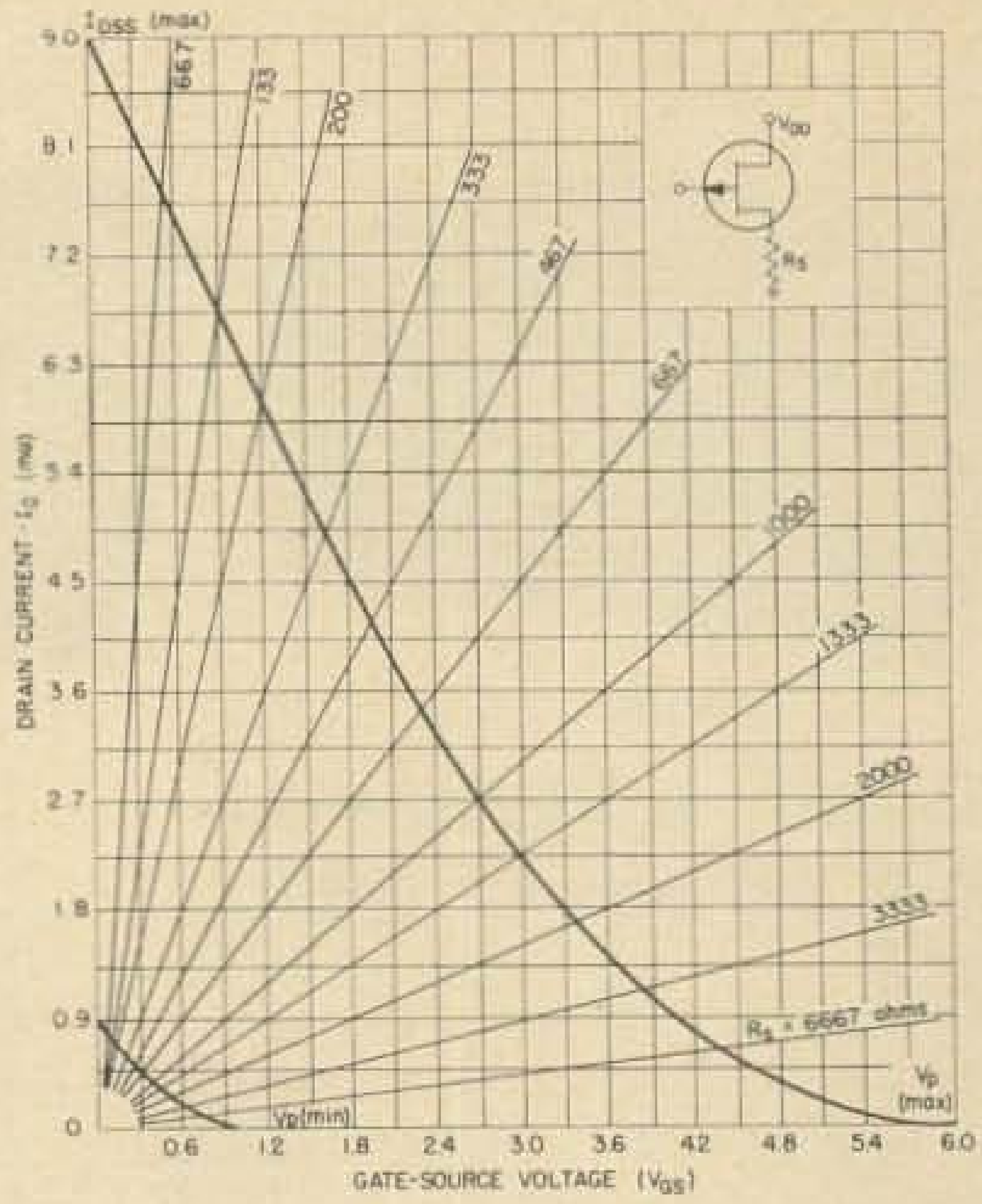

Fig. 7. U-112 transfer characteristics.

where g_{fs} is the ratio of the change in drain current to the change in gate voltage. This parameter is given in micromhos and is very useful in designing circuits.

The output impedance of the FET is the ratio of the change in drain voltage to the change in drain current with the gate voltage held constant. Mathematically:

$$R_o = \frac{\Delta I_D}{\Delta V_D} \text{ with } V_G \text{ held constant}$$

Since the drain current exhibits negligible change in the pinchoff region, even for rather large excursions of the drain voltage, the output resistance is essentially infinite under normal operating conditions.

In as much as the gate is normally reverse biased, the resistance at the input to the field effect transistor consists of a reverse biased diode junction and is typically on the order of several hundred megohms.

When the field effect transistor is used as an amplifier, it is usually used in one of the basic amplifier configurations illustrated in **Fig. 5.** The simple common-source circuit is the most popular however and will probably see the most use in amateur applications. The amplifier with the unbypassed source resistor is useful in some cases as an impedance transformer, but the voltage gain is very low because of the negative feedback across the source resistor. The source-follower is equivalent to the cathode- or emitter-follower and is used for the same purposes.

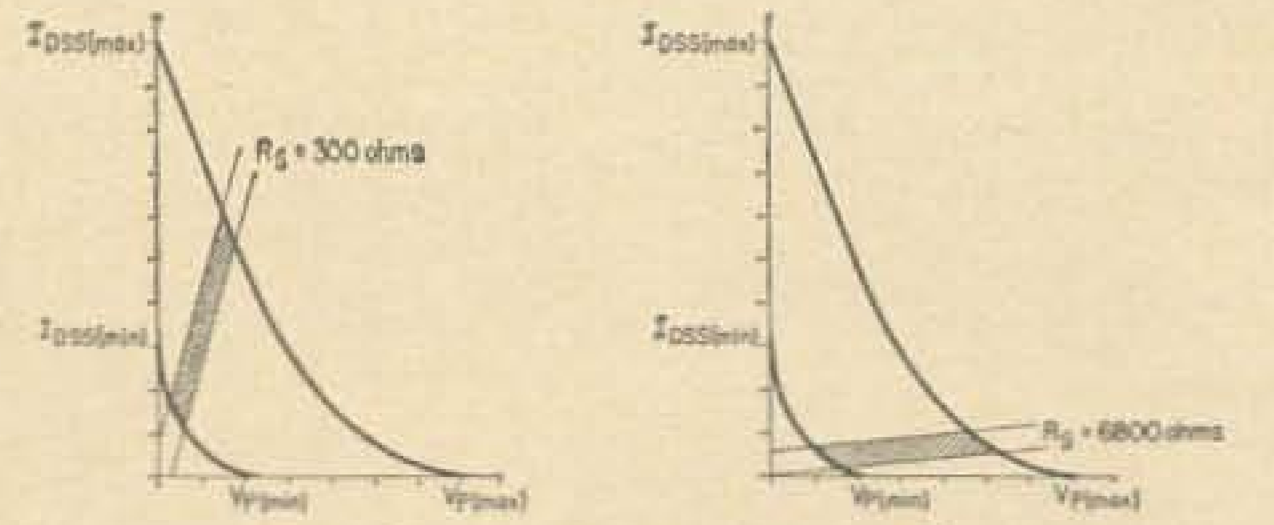

Fig. 8. Effect of source resistor on FET bias point.

Of particular interest is the cascade circuit using a field effect device in conjunction with a conventional transistor. This circuit is especially useful for coupling a very high impedance driving source to a low impedance load.

The values given in **Fig. 5** for voltage gain (A_v), and input and output resistance are not 100% accurate, but are very close approximations which are useful in selecting circuits and transistors for different uses.

Irrespective of the characteristic gate voltage versus drain current curves (**Fig. 3**), the transfer characteristics of the FET is probably the most useful tool available for amplifier design. FET's manufactured by the diffusion process (nearly all of the types currently available) exhibit a transfer characteristic in the shape of a parabola as shown in **Fig. 6.** Regardless of the type, any field effect transistor may be force fitted to this curve by using the published values of pinchoff voltage (V_P) and the zero bias drain current (I_{DSS}). Since the curve plotted in **Fig. 6** is "normalized," it may be applied to any FET by the proper use of ratios.

To apply this curve to a particular transistor, the published values for V_P and I_{DSS} are noted on the chart at the 1.0 points respectively on the horizontal and vertical axis. Then the values for the other points along each axis are calculated by simple ratios. For instance, if the published value of pinchoff voltage is 6 volts, this would be plotted on the normal-

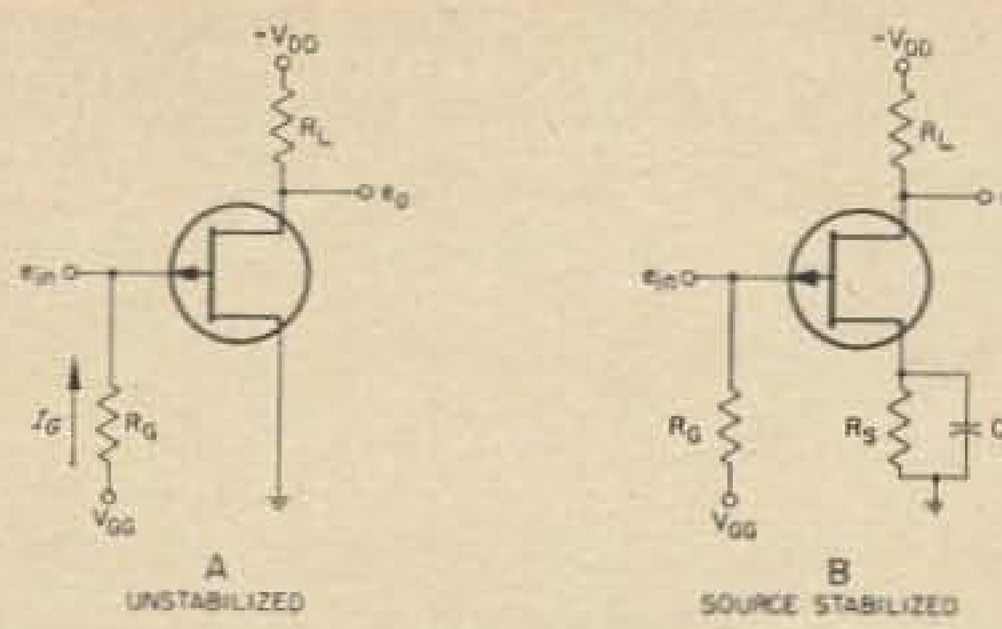

Fig. 9. Biasing FET amplifier stages.

ized V_{GS} axis at the 1.0 mark corresponding to V_P. Then the 0.9 mark on this axis corresponds to 5.4 volts (0.9 x 6 volts), 0.8 to 4.8 volts, 0.7 to 4.2, etc. The values of drain current along the vertical axis are determined by the ratio of normalized points to the published value of I_{DSS}.

The d-c load lines plotted in **Fig. 6** for various values of source resistor R_S are also in normalized form and must be converted for compatibility with the actual values plotted on the I_D and V_{GS} axis. This is accomplished by multiplying the normalized value of R_S by the ratio V_P/I_{DSS}. For example, if the published value for V_P and I_{DSS} are 6 volts and 9 milliamps respectively, the required factor would be $V_P/I_{DSS} = 6$ volts/9 ma $= 0.667$, and the normalized 1000 ohm source resistor would have an actual value of 667 ohms. Using this approach, the complete transfer characteristic of the Siliconix U-112 field effect transistor was plotted in **Fig. 7** using the published values for V_P and I_{DSS} along with the converted R_S bias lines.

The easiest way to use this normalized transfer characteristic chart is to use a clear plastic overlay and a grease pencil. In this way the chart may be used many times without damage.

It should be noted that actually two transfer curves are plotted in **Fig. 7**; the "main" curve for the maximum published parameters while the other curve corresponds to the minimum parameters. It is very difficult to control the operating parameters of the FET during manufacture (that's why they cost so much) and usually there is a rather wide variation between the minimum and maximum parameter values. This is pretty obvious from the curves plotted in **Fig. 7**; all U-112 field effect transistors will fall somewhere between these two curves.

When designing an FET amplifier circuit, it is helpful to plot both the minimum and maximum transfer curves; when this is done it becomes graphically evident which values of source resistance are most desirable. In the

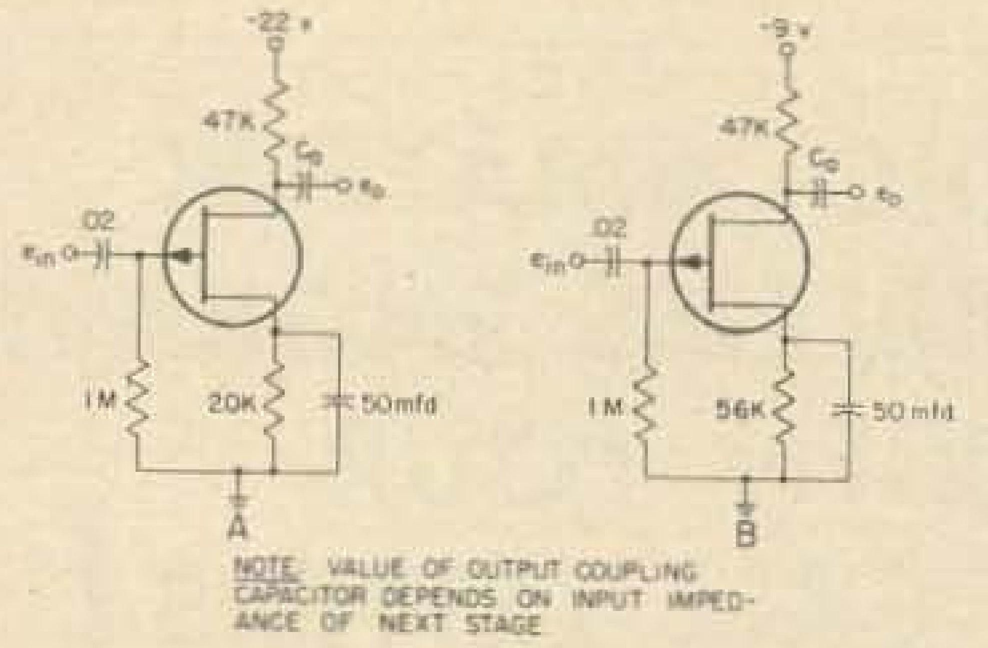

Fig. 10. FET audio amplifiers.

case of the U-112, a value of 667 ohms would place the quiescent operating point in the approximate center of the transfer curve. At first glance it might appear desirable to use this source resistor, but this is not necessarily so. Since the drain current with a 667 ohm source resistor could possibly vary from 450 microamps to 3.5 milliamps and still be within the minimum and maximum parameters of the FET depicted in **Fig. 7**, selection of a load resistance and voltage supply that would satisfy every FET of the same type would be nearly impossible. Consider **Fig. 8** where the effect of two different source resistors is plotted. In **8A** the 300 ohm resistor provides a worse condition than one that places operation in the center of the curve. The shaded area takes into account the 10% tolerance of standard resistors so operation could be at any point in this area. On the other hand, the 6800 ohm resistor in **8B** is nearly parallel to the horizontal axis, so variations between transistors have a minimum effect on drain current. Selection of load resistors and power supplies would therefore be infinitely easier with the 6800 ohm source resistor.

In addition to parameter variations, biasing at the input must be carefully considered. To obtain reasonably stable operation, a d-c path must be provided from the gate to the source. At room temperature, the gate current may be as low as four billionths of an ampere (4 nanoamperes), and the value of the gate resistor will be on the order of several megohms. However, as the ambient temperature increases, so does gate current and without adequate stabilization, this change in gate current will seriously effect the operation of the amplifier.

The simplest type of FET amplifier is illustrated in **Fig. 9A.** The voltage at the gate is simply the gate voltage supply (V_{GG}) minus the voltage drop through the gate resistor. Assuming a 10 megohm resistor at R_G, a supply voltage of 0.5 volts and gate current (I_G) of 4 nanoamps at room temperature, the voltage at the gate is

$$V_G = V_{GG} - (R_G I_G) = 0.5 - 0.04 = 0.46 \text{ volts}$$

However, if the temperature increases significantly, it would not be entirely unlikely for the gate current to increase by a factor of ten to 40 nanoamperes. In this case the voltage at the gate would be

$$V_G = V_{GG} - (R_G I_G) = 0.5 - 0.4 = 0.1 \text{ volts}$$

This is a considerable change in gate bias which would drastically effect the voltage gain of the circuit. In some applications it might be tolerable, but usually more stable operation is desirable.

In the circuit in **Fig. 9B**, bias stabilization is obtained by negative feedback due to the voltage drop across the source resistor. This is the same type of feedback provided by the emitter resistor in conventional transistor circuitry or the cathode resistor in tubes.

Because of the stringent requirements on field effect transistor biasing and the wide variations in operating parameters of devices currently available, amplifier design is somewhat of a problem. There are two distinct paths which may be taken; that of selecting a large value source resistor which provides a bias line parallel to the horizontal axis of the transfer characteristic and making the circuit "play" in true experimenter fashion, or go through a more rigorous mathematical approach that will get you close to the desired result before you even warm up the soldering iron. Although the approach you take will depend entirely upon your own desires, hopefully the result will be the same.

In the "experimenter" approach, a source resistor is chosen as previously noted and other circuit components are plugged in as seems appropriate. If you are familiar with vacuum tube circuits, the gate resistor and load resistor are chosen in just about the same way, with the load resistor chosen for voltage gain and the gate resistor for input impedance. Then a voltage compatible with all the voltage drops in the resistors is applied. If the completed circuit doesn't work properly, the source and drain resistors are juggled back and forth

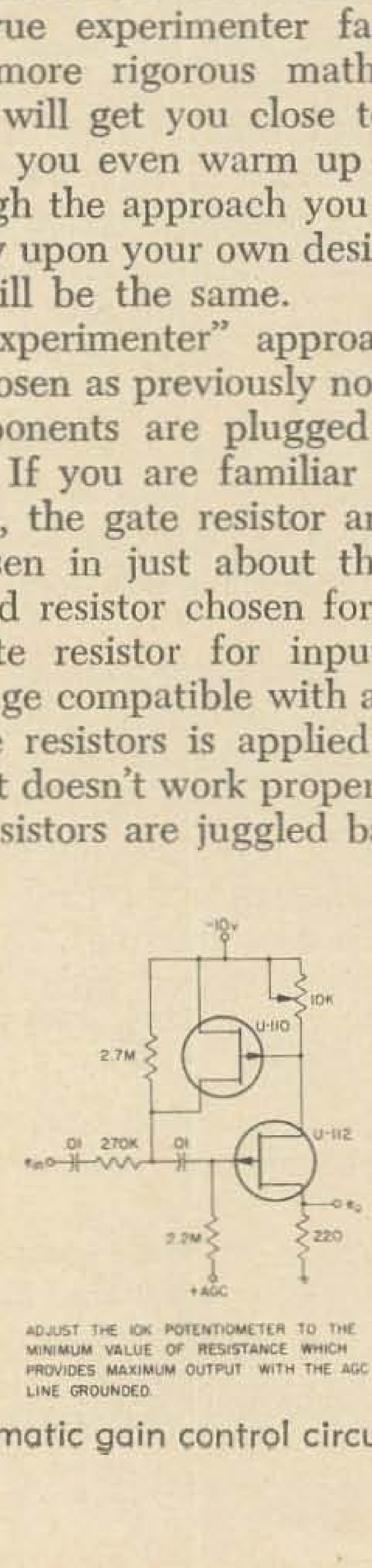

Fig. 11. Automatic gain control circuit.

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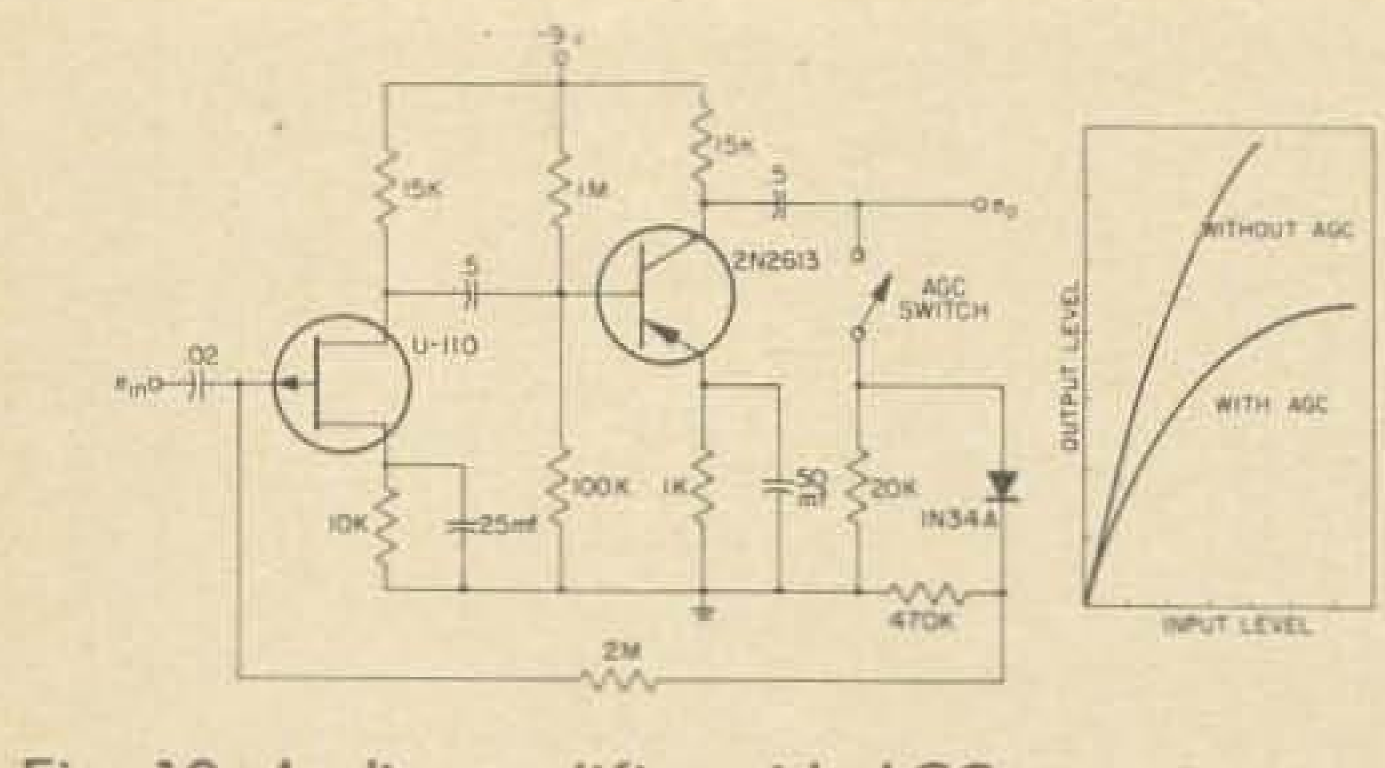

Fig. 12. Audio amplifier with AGC.

until desired operation is obtained. Actually in practice this can be done in less time than it takes to write about it. There is only one thing that must be considered before applying voltage to a FET circuit designed in this way; that is to insure that the voltage across the transistor does not exceed its breakdown voltage. The simplest solution here is to use a voltage supply with a maximum voltage somewhat less than the specified breakdown voltage of the device being used.

The best way to illustrate the use of the mathematical approach is to design a simple audio amplifier using the U-112 field effect transistor. Suppose that the requirements for the amplifier are

Supply Voltage (V_{DD}) 22 volts
A-C Load Resistance (Z_L) 20000 ohms
Minimum Output Signal ($V_{pk\ min}$) 2 volts p-p

The drain resistor may often be chosen arbitrarily, particularly when no output resistance requirement is made of the amplifier. It is common practice in transistor circuitry to use a value about twice the a-c load so in this case 47 kilohms will do. The equivalent a-c resistance of the 47 K drain resistor and the 20 K load resistane is their parallel equivalent of 14,000 ohms. The quiescent drain current may then be calculated from

$$I_{DQ} = \frac{\text{output signal (min)}}{\text{AC load impedance}} =$$

$$\frac{2\text{ v p-p}}{14\text{ K ohms}} = 0.143\text{ ma}$$

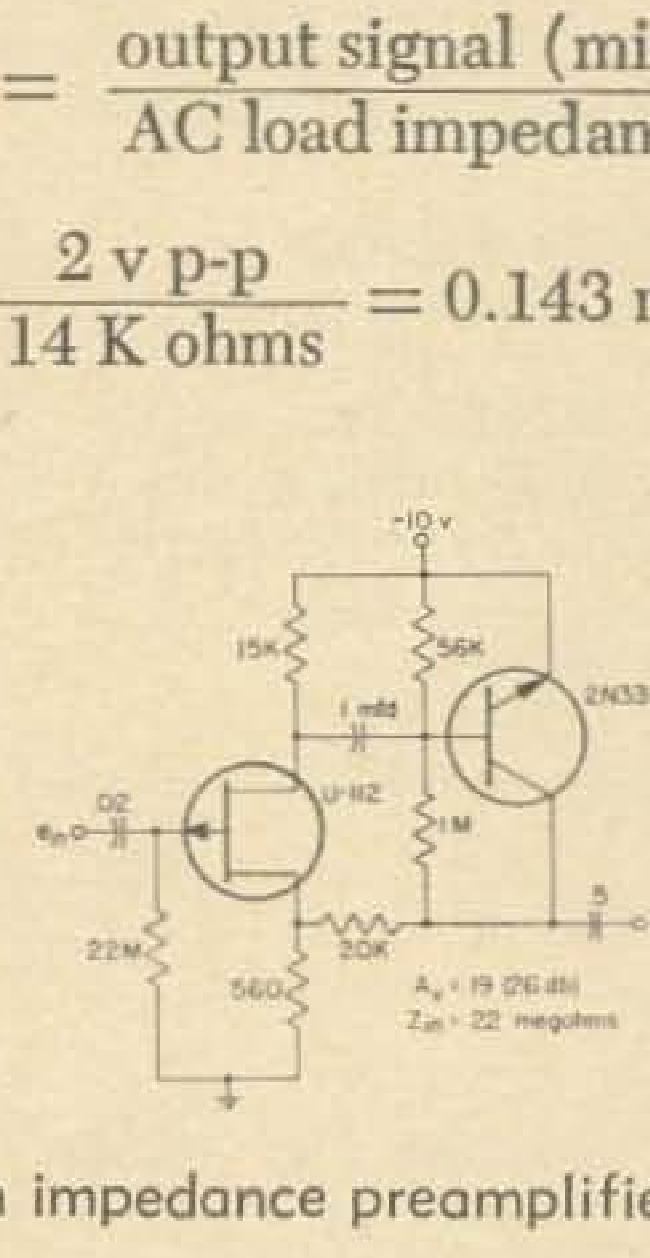

Fig. 13. High impedance preamplifier.

To prevent the transistor from operating near cut-off, about 50% should be added to this value; that is, $I_{DQ} = 0.214$ ma. The next step is to find the lowest value of source resistor that will satisfy the quiescent drain current requirements and breakdown voltage limitations and still keep the circuit operating in the linear pentode region. For the U-112, 6 volts across the transistor (V_{GS}) will ensure operation in this region. The minimum value of source resistor may be found from

$$R_S = \frac{V_{DD} - V_{GS} - I_{DQ}R_D}{I_{DQ}} =$$

$$\frac{22 - 6 - 10}{0.2\text{ ma}} = 20\text{ K ohms}$$

This is the minimum value of source resistance that should be used in the circuit under the intended operating conditions. A larger value could be used, but anything smaller than 20 K will be likely to place operation in the cutoff region, resulting in distortion of the output signal.

The value of the gate resistor may be chosen somewhat arbitrarily but from a mathematical point of view, there is a maximum limit on the value of this resistor dictated by the zero bias gate current (I_{GSS}). At room temperature, I_{GSS} for the U-112 field effect transistor is specified to be 4 nanoamperes, and the maximum gate resistance is given by

$$R_G = \frac{R_S\ (I_{DQ} + I_{GSS})}{I_{GSS}} =$$

$$\frac{20K\ (0.213\text{ ma} + 4\text{ na})}{4\text{ na}} = 42.6\text{ megohm}$$

This is the maximum limit on the gate resistor, but any smaller value may be used if desired. In this amplifier a one megohm input impedance will be more than sufficient so a 1 megohm resistor will be used.

The completed audio amplifier is illustrated in **Fig. 10A.** The coupling and bypass capacitors for field effect circuits are chosen in just about the same way as for vacuum tubes, so we won't discuss them here. The circuit in **10B** is a similar amplifier designed by the "experimenter" approach for use with nine volt batteries. Note that the only difference between the two circuits is the value of the source resistor. Bench tests on both these units showed that the only significant difference between them was the greater dynamic range of the circuit with the 22 volt supply. This is because with the 22 volt supply, a greater voltage exists between the drain and the source of the transistor, and it takes a much larger signal to drive it into cutoff.

Although it is impossible to cover all the applications of this versatile device in one article, some of the more obvious and straightforward applications are shown in **Fig. 11** through **15**. Besides the rf applications which are limited to about 10 megacycles or so with inexpensive FET's, the AGC amplifiers are particularly interesting. The operation of these circuits is based upon the fact that the transadmittance varies with different values of gate bias. In the AGC circuit illustrated in **Fig. 12**, two stages are employed to obtain sufficient voltage to control the gain of the first stage. The output voltage is rectified and fed back to the gate of the FET.

Two field effect transistors are used in the 60 db AGC circuit shown in **Fig. 11**. Here the positive control voltage is obtained from an external source. The variable resistor is adjusted to a minimum value such that the output voltage is greatest when the AGC voltage is zero.

The high input impedance amplifier in **Fig. 13** exhibits a voltage gain of 26 db and an input impedance of 22 megohms; the output resistance is on the order of 16 kilohms. This circuit makes an excellent high impedance microphone preamp for driving transistor circuitry. Operation of this particular circuit changes very little with voltage supplies from nine to about fourteen volts; it would be particularly well suited for mobile operation. Although the schematic shows a minus ten volt supply, the circuit will operate just as well with the −10 volt terminal grounded and the grounded end tied to a positive voltage supply.

The rf oscillator circuits illustrated in **Figs. 14** and **15** are field effect transistor adaptations of standard vacuum tube circuits and illustrate the circuit similarity between the two different devices. The variable oscillators in **Fig. 15** are especially noteworthy because they bring up the possibilities of VFO's, "gate" dip oscillators and the like. In both of these applications the FET version is considerably more simple than their junction transistor counterparts.

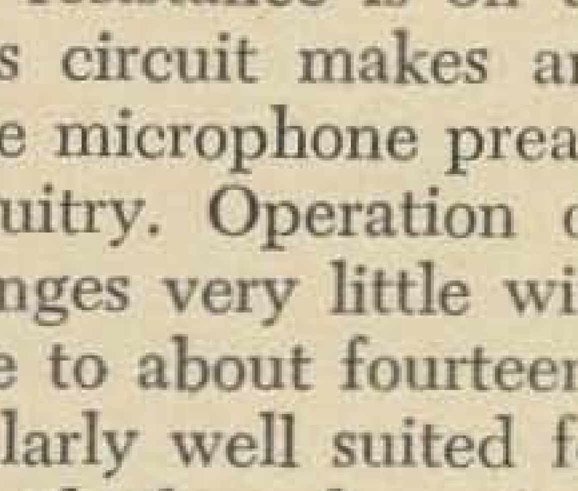

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Fig. 14. Crystal oscillator.

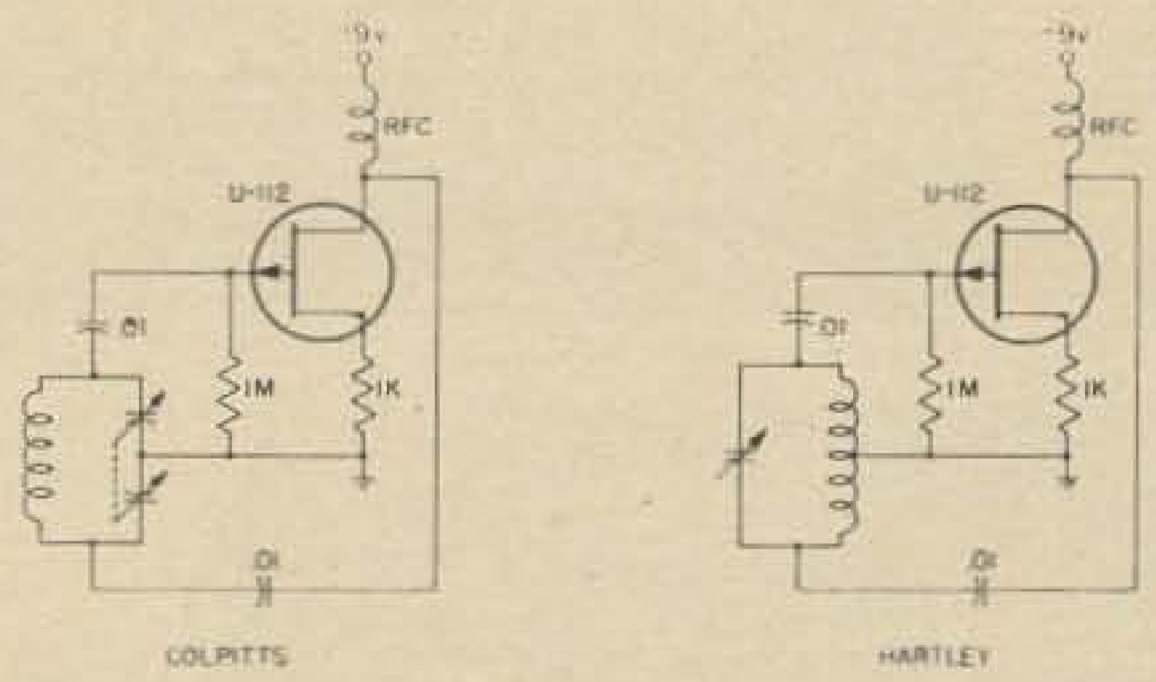

Fig. 15. FET oscillators.

At the present time selection of field effect transistor for a given application is pretty much dictated by how much you are willing to pay. However, for a given voltage supply, voltage amplification is inversely proportional to the pinchoff voltage. Therefore, devices with low pinchoff voltages are usually more desirable. The frequency response of the FET is dependent upon the amount of capacity at the input to the device, so small capacitances are a necessity for high-frequency applications.

There are only a few field effect transistors currently on the market which will appeal to the amateur fraternity. Foremost among these are the U-110 and U-112 transistors offered by Siliconix*. Until December 31, 1965, Siliconix has a special package deal for amateurs and experimenters that includes a U-110 for one dollar, a U-112 for two dollars or the pair for $2.75 plus local sales tax if you are a resident of California. The package includes application data and some sample circuits. After the first of the year the price of the U-110 and U-112 will return to their normal prices of $5.25 and $4.55 respectively.

Other devices of interest are the Texas Instruments 2N3819 and 2N3820 at $3.75 and the Siliconix U-146 ($3.25) and U-147 ($2.95). These are a far cry from the one dollar variety though and the Siliconix deal is especially enticing. A technological breakthrough may bring the price of the FET down tomorrow, but more likely it will be four or five years before the 50¢ FET is a reality. However, that is no reason not to try them now. After using them a few times, their advantages become immediately apparent. With the FET, nearly any vacuum tube circuit may be transistorized by simply changing the value of the cathode (source) resistor and lowering the voltage supply. So don't procrastinate, get on the FET bandwagon now.

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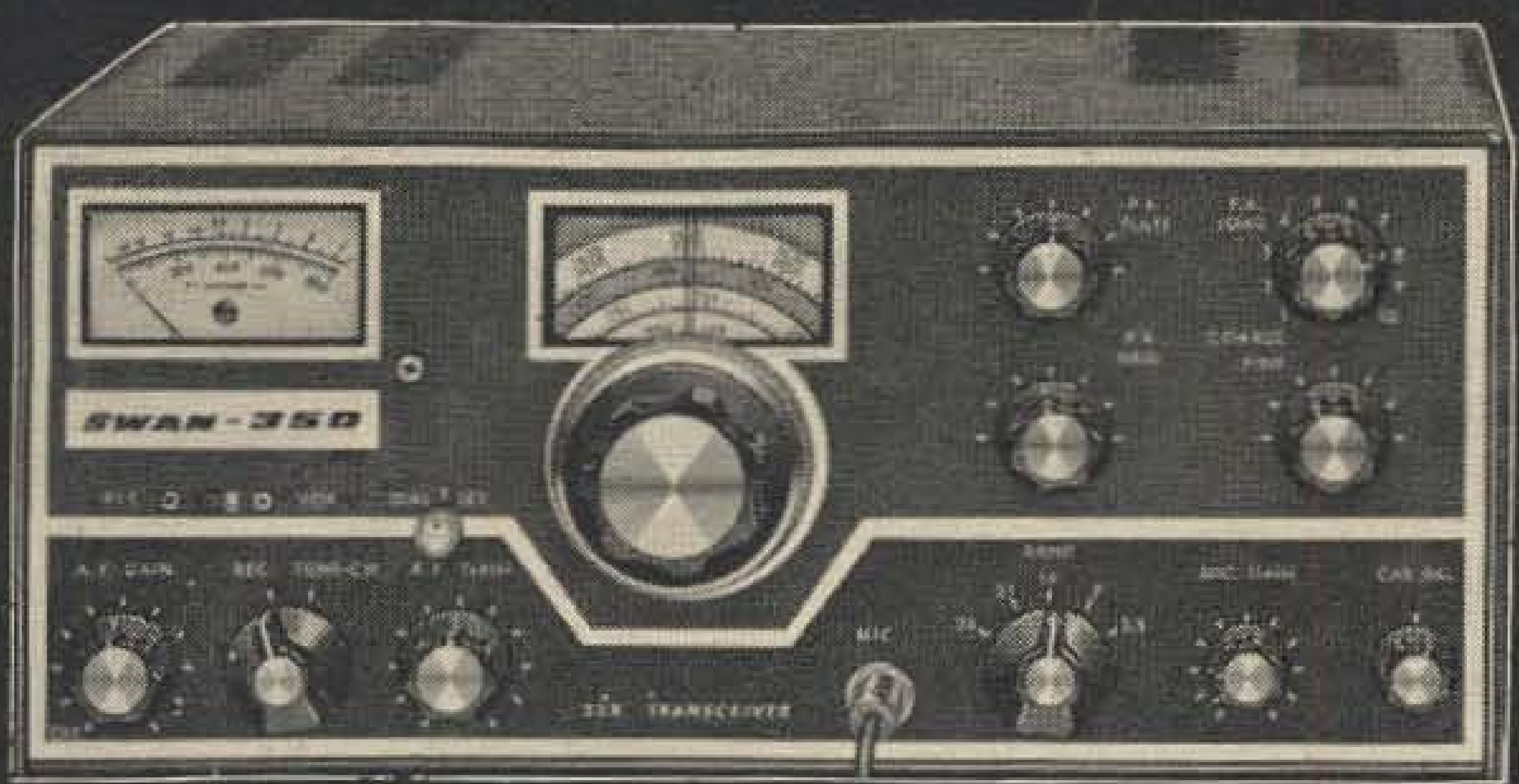

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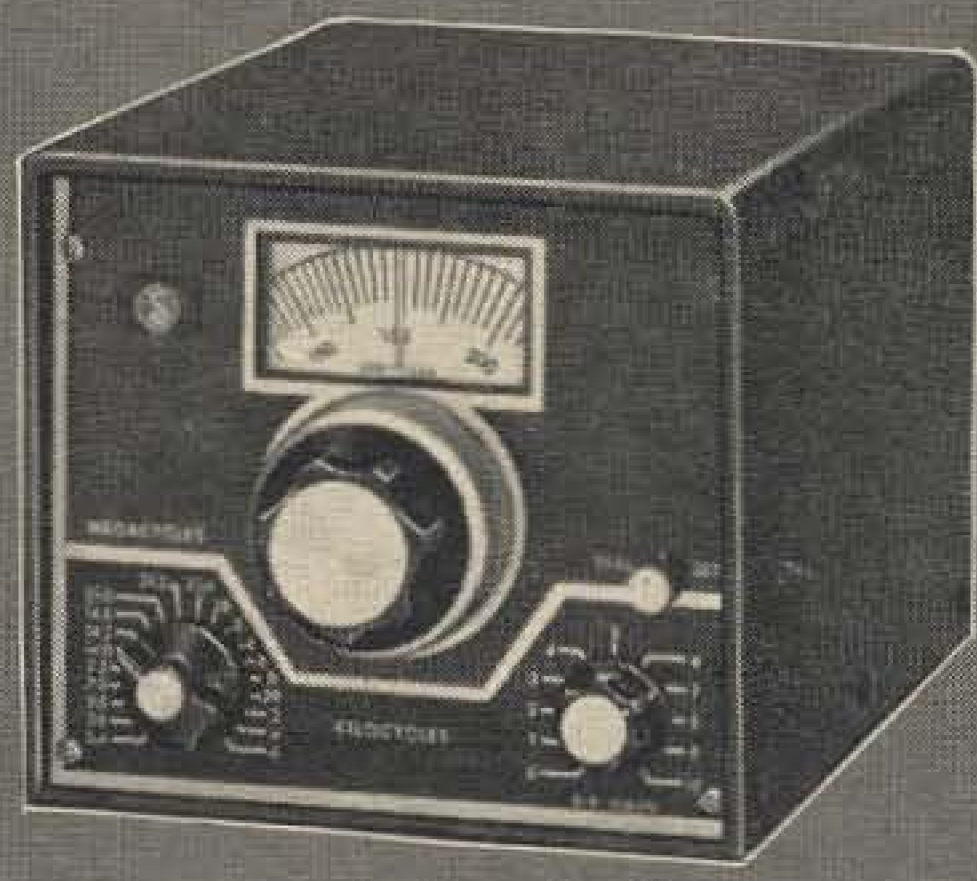

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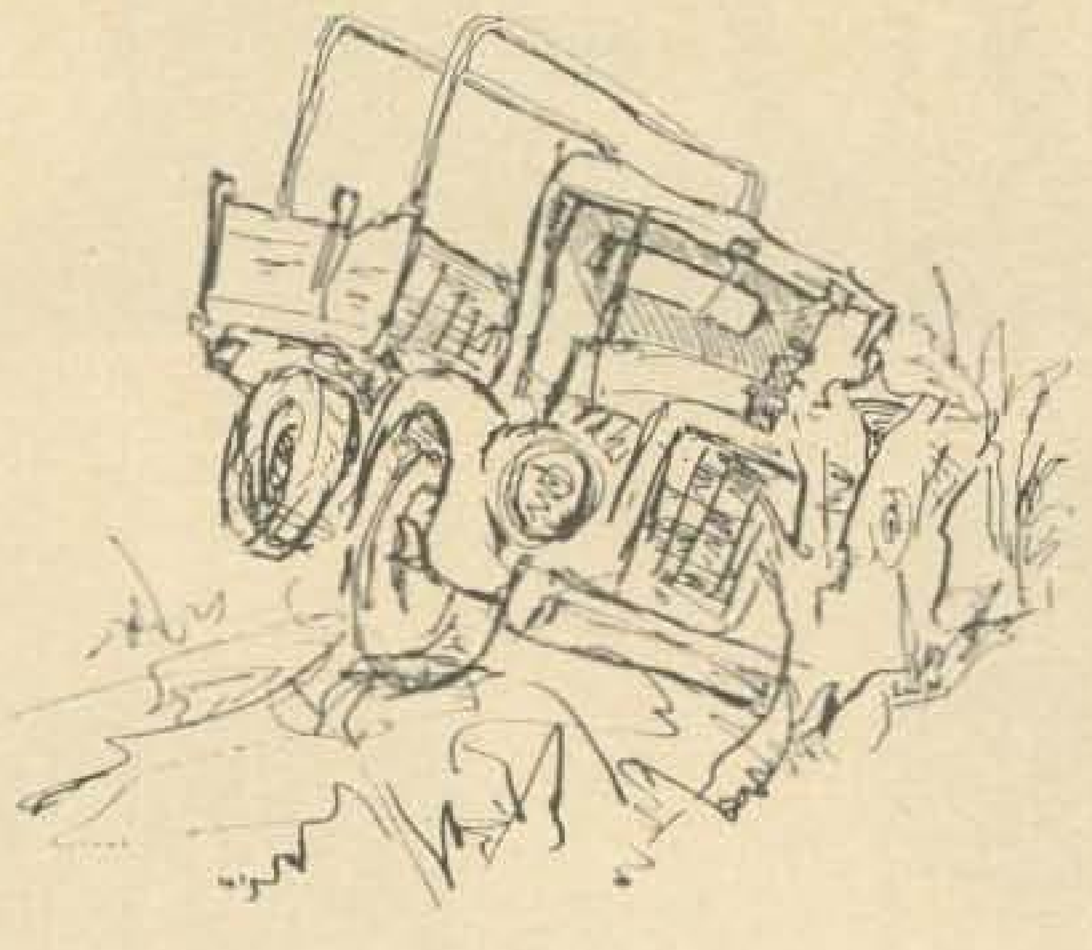

A Doll for Serifina

Ken Cole W7IDF
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Vashon, Wash.

The road from the docks to the Luzon village of Santa Marta was slick with mud, and in a drainage ditch a burned-out, rusting Japanese truck raised an eloquent frame against the fading sky.

In two minutes the jeep would pull up in front of Delgado's Bar, and under Victor's room. There, only a few years before, a boy of sixteen had found pleasure in sending to a stranger in America messages that, week by week, wove into a bond of friendship the pattern of his family, his village and his dreams.

Later, with the addition of Jiro Ohtsuka, those schedules brought closer together Santa Marta, Seattle and Yokohama, and they endured until shortly before the outbreak of war

In the last uneasy months of peace, I left school to go to sea on American Mail Line freighters that called at Yokohama, Shanghai, Hong Kong and Manila, and returned by the same route. Rarely did we spend more than two nights in port, but the schedule gave me an opportunity to visit with Jiro twice each trip, and occasionally we added an overnight run from Manila to the ore docks at Santa Marta. Victor Delgado would be waiting at the foot of the gangway.

With each visit I learned a little more of Victor's history. His mother had died when he was seven or eight, and shortly afterward his father had left him and his younger sister in the care of an aunt and spent five years making a modest stake in Stateside canneries. In 1937 the elder Delgado returned to Santa Marta to open a small bar and restaurant and raise his children. The hard years in an America struggling to climb out of a depression had been a gainful exchange; when Pedro walked down the steerage gangway at Manila he brought home with him an unyielding loyalty to the United States, a resolute optimism and, it must be added, an outsize appetite for salami. Soon enough the misfortunes of war would test all of these.

Now, recalling better times when I had arrived at the village with a salami for Pedro, radio parts for Victor, and a Japanese doll from Jiro for Serafina, I lacked the nerve to ask my driver for a rundown on the wartime fate of Santa Marta. In Yokohama the news had been good—Jiro had survived four years of service and was working as an interpreter for the occupation forces at Yokosuka. But here, in view of Pedro's independence, history of residence in the States, and his predictable opinion of the Co-Prosperity Sphere, I wondered if ultimately the Delgado family had not found itself trying conclusions with the Japanese army.

Victor was coming out of the restaurant just as we drove up, and he recognized me immediately. Even in the exuberance of our meeting we looked closely into each other's face—a war had taken away the years since last we met. In the shadows I could not see too clearly, but once inside my pleasure was mixed with a sadness I could not hide. The thin, expressive face I remembered as untroubled, always smiling, now was older and lined. A scar marked one arm, and I noticed that Victor limped.

He read my thoughts, "Yes, we had some difficult times here, and much fighting in the last days. But our family was fortunate; we are all alive. Now we only look ahead and try to forget the past. My father is in Manila arranging supplies for the village, and Serafina is in school." He laughed, "Look—American coffee for you! We have a dozen of your soldiers staying here and they give us their food to cook for them. 'Help yourself,' the sergeant told me, 'there will be plenty.' "

We were sitting in the small dining room. The floor was concrete covered with fibre mats. Along the front and one side were windows with shutters but no glass, on the other side a doorway opening on an outside staircase, and to the rear a passageway lead-ing through the kitchen to a small courtyard. On the second floor were four bedrooms and above them a rusting iron roof. The beat of rain drummed from the metal sheets and I remembered it had rained like this every time I had been there. The shutters were open but the wide eaves sheltered the windows from the downpour. While Victor was bringing the coffee I counted seven small lizards on the walls and ceiling. Bright-eyed motionless creatures a finger in length. Official flycatchers.

I was curious to hear Victor's experiences for I already knew he had been involved in liaison on this part of the coast between holdout groups in the hills and agents landed from submarines. So far he had volunteered nothing and I didn't feel like probing painful memories. When he came back to the table we sat in silence for some minutes.

There was something I wanted to know, but I was uncertain about how to begin, so I asked Victor for news of Serafina.

"She is fine! A year ago she was very sick with fever and bad food but now she is well, and growing up so quick! You would not know her. Tomorrow my father will see her at the convent school."

In other days there had been a very gaudy jukebox in the dining room. A record by the Argentine, Pedro Vargas, had been Serafina's favorite, and I would give her a handful of silver to see her toddle across the floor. She could barely reach the coin slot then.

"What happened to the jukebox?"

"Oh, we used the parts in our radio equipment." Victor was thoughtful for a moment, then he said, "But let me tell you about Serafina—she saved us all, and in a way it was because of you."

Victor told me that just before Luzon was liberated the Japanese became concerned about an increase in guerrilla activity in the hills east of Santa Marta. Through bad luck and negligence, bearings were taken on clandestine signals by counter-intelligence direction-finders. The Japanese were determined to find the communication link, and one afternoon three trucks drew up in front of Delgado's place. Soldiers surrounded the building and machine guns on the trucks were uncovered and trained on the second floor windows.

Victor thought the end had come. Earlier in the day a warning had leaked through to the village—not an uncommon occurrence, for these investigative actions were not characterized by tight security. However, this weakness was of little aid to the quarry, for light aircraft patrolled the selected zone at low level and any movement could be spotted quickly.

While the village waited, a lieutenant wearing on his left arm the Kempei band took a sergeant and a squad into the restaurant. The officer ignored the Delgados and ordered the non-com to take four men and search the second floor. While the party thumped around overhead the rest of the men covered the rear court and the officer waited in the kitchen. When the second floor was cleared the soldiers came down and were put to work checking the kitchen and dining room, walls, floors and ceilings. Nothing was overlooked and nothing was found.

The lieutenant stared impassively at Pedro Delgado for an unnerving minute. "We know you speak English and we know you have a forbidden wireless set here. Show me where it is!"

"No! There is nothing! Look everywhere—you will find there is nothing." Delgado's voice was firm, but he was shaking a bit inside.

Suddenly a soldier came running from the kitchen passage. In one hand he held a shovel, and before he could speak the officer brushed by him headed for the courtyard. Prodded by rifle butts the Delgados followed. Soldiers were examining the ground, and the lieutenant was scraping the surface with one boot as if to emphasize the obvious fact that the packed earth had recently been swept. He turned to Pedro.

"Where did you bury the wireless?"

"There is no wireless!"

The sergeant told one of his men to find a bucket of water, and when it was brought he carefully sluiced it across the ground, beginning at one wall and working toward the center of the court. Where the fifth bucketful hit the earth the water soaked in swiftly, and without waiting for an order the soldier who had found the shovel began to dig. Pedro, Serafina and Victor were ordered to stand against the wall and the atmosphere became very unfriendly. Victor reached carefully for Serafina's hand.

The hole was only a foot or so deep when the shovel hit something. One of the soldiers dropped to his knees and scrabbled in the loose dirt. Then there was a moment of stillness and Victor heard what sounded like a snicker. The lieutenant leaned over the hole and was handed a broken box and a badly mangled doll. Serafina began quietly to cry.

The situation had to make sense, and Delgado tried. "Sir, it is my daughter's. The doll was run over by a truck."

Silence.

The officer's incredulity was plain. He ex-

amined the doll thoroughly and paid no attention to Pedro, who continued. "The doll was much loved by my daughter, and she was very ill with fever. When it was destroyed she said we would have to give it proper burial. A child's wish . . ." He shrugged, imploring agreement, "A harmless sentimentality. I could not refuse."

The lieutenant turned his attention from the doll to the girl. In her face were the signs of illness and malnutrition, pathetic confirmation of that much of her father's story. The tearful eyes were fixed on the tiny grave. Noting this, Pedro felt a bead of perspiration trickle down his back and he forced himself to smile at her.

Abruptly, and without a word, the lieutenant handed the doll to Serafina. Turning to the soldier who had been digging he gave a command. The shovel dropped beside the hole and the soldier followed the officer through the building to the street.

With an unsteady hand Pedro pulled Serafina to him and they all listened while the trucks roared and rattled out of Santa Marta.

Victor paused in his account, and when his thoughts returned to the present he held one hand a foot above the table. "If they had dug that much further they would have found the transmitter." Then he added, "And grenades. There had been so little time to find a hiding place. We relied on a trick, and prayers."

"It's hard to imagine the ground ever being dry here," I said.

Victor nodded, "Bad luck."

I wouldn't call it that, I thought, and held my cup out for a refill.

His eyes were grave as his thoughts turned again to the past. "Your being here makes me think of our friend Jiro," he said. "I wonder what happened to him? I'm so sorry we never met."

I was glad to hear that. "Well, Victor," I said, putting on the table a small box I had brought from Japan for Serafina, "You did."

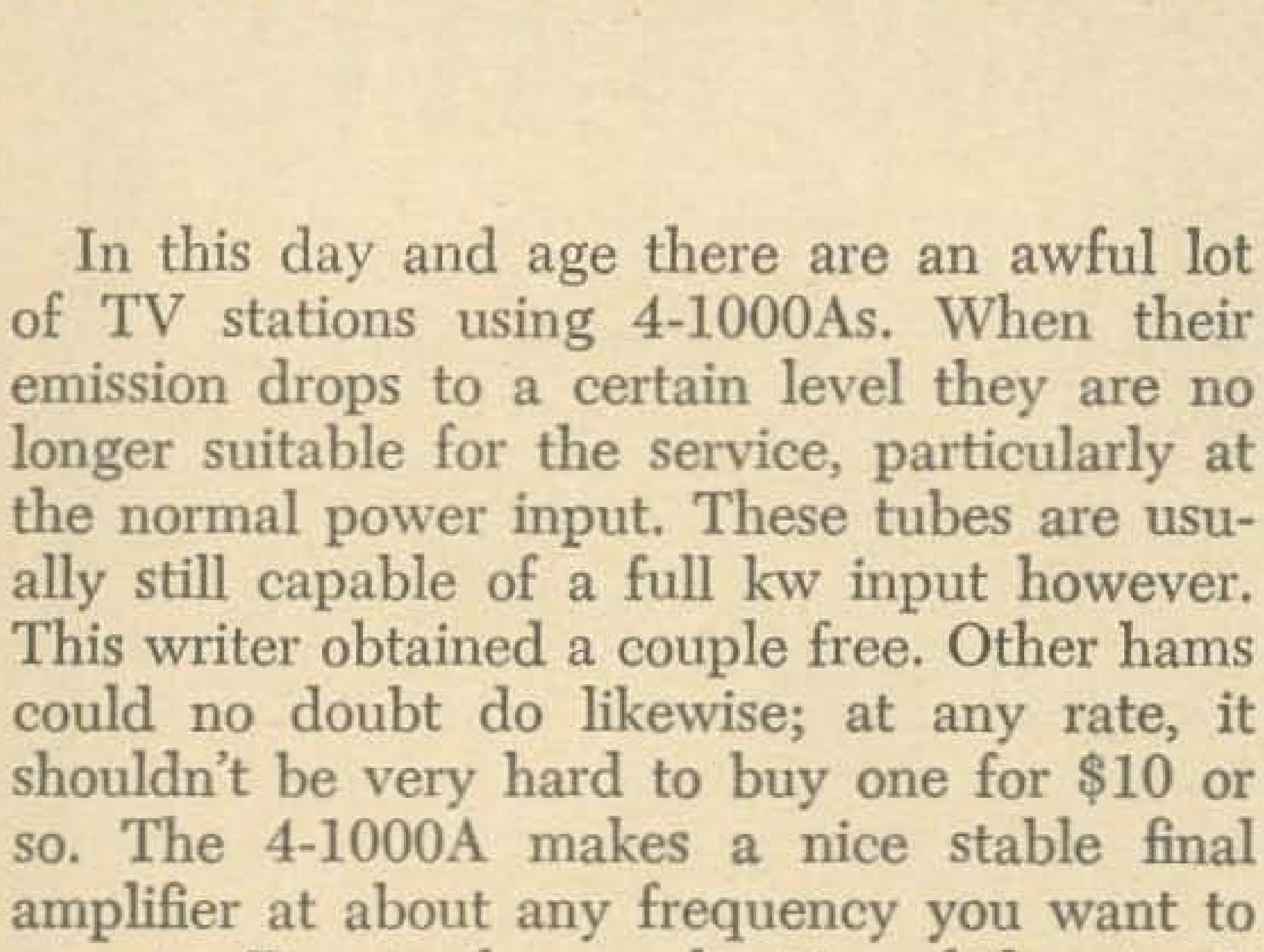
. . . W7IDF

R. E. Baird W7CSD
3740 Summers Lane
Klamath Falls, Oregon

4-1000's are cheap;
Their sockets are expensive.
So—

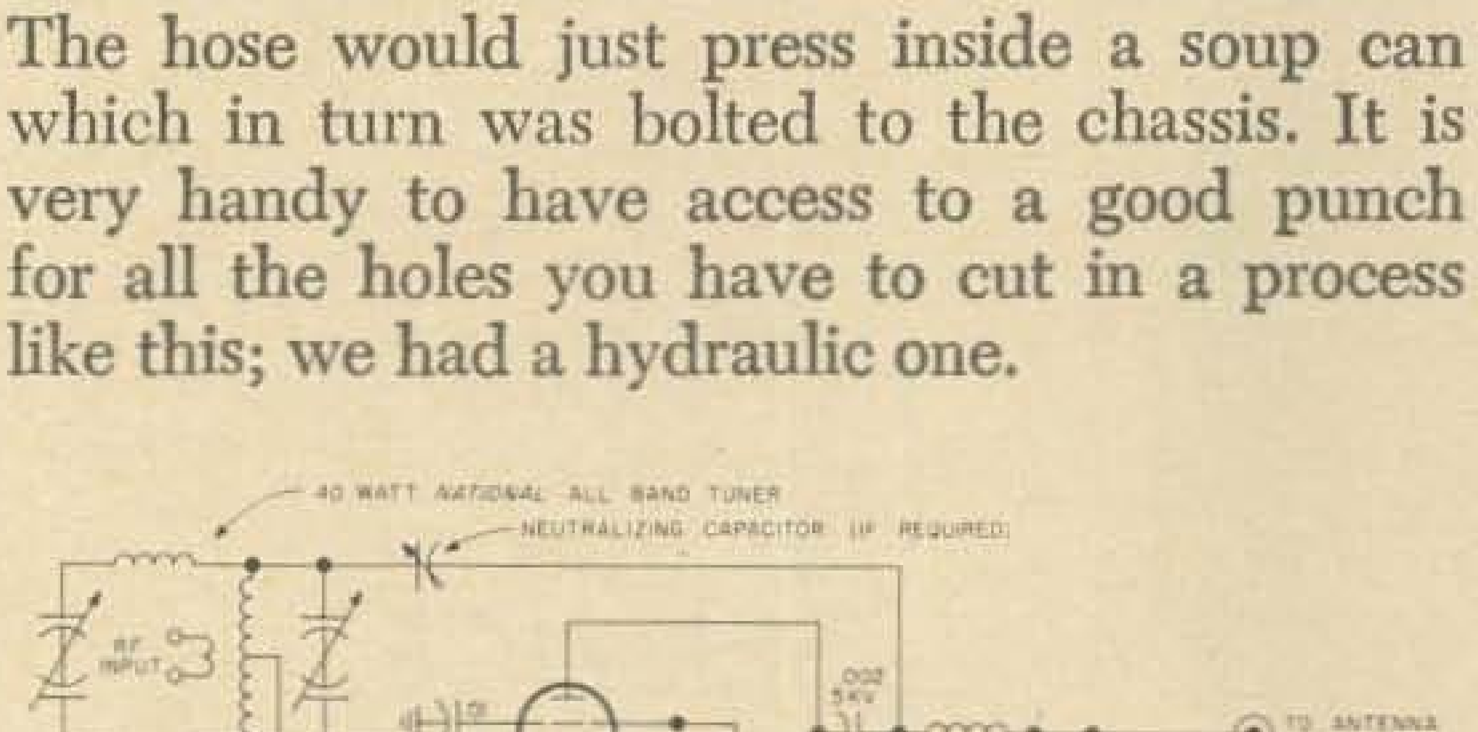
Build Your Own 4-1000A Socket

In this day and age there are an awful lot of TV stations using 4-1000As. When their emission drops to a certain level they are no longer suitable for the service, particularly at the normal power input. These tubes are usually still capable of a full kw input however. This writer obtained a couple free. Other hams could no doubt do likewise; at any rate, it shouldn't be very hard to buy one for $10 or so. The 4-1000A makes a nice stable final amplifier at about any frequency you want to operate. Due to the peculiarities of the circuit we built, neutralization was not even necessary. At 50 mc or 144 mc some attention would have to be paid to this problem, no doubt.



The basic problem in trying to build a cheap kw using a tube of this kind is the tube socket and air system. You also need a husky filament transformer, but rewinding a secondary on some existing one is relatively simple. We took what used to be a 12 volt transformer rated at 250 watts, wound on some number 10 wire, and wound up with 8 volts on the 4-1000A. This seems about right for a tired 7.5 volt filament. But the air system is something different. To begin with, the standard 5 prong socket costs a small fortune. Then to get satisfactory circulation you need a chimney around the tube. And any way you look at it you do have to have a blower.

Solution: We had a double ended blower on hand. A single ended one would do equally well. This we connected through short sections of rubber hose to holes in the chassis. The hose would just press inside a soup can which in turn was bolted to the chassis. It is very handy to have access to a good punch for all the holes you have to cut in a process like this; we had a hydraulic one.



4-1000A AMPLIFIER

For screen grid and grid prongs we cannibalized an old 304TL socket. With the ring part removed, the fitting fits very snugly. Screw-on clamps (like hose clamps) were used for the filament connections. The tube itself is held upright by a ring clamp that has four feet bent out on it and bolted to the chassis. A glass chimney was not available but it was discovered that a #10 tin can is about the right size; so one end was removed and a hole the same as the one in chassis was punched in the other. The bolts in the ring clamp, on the tube, go through this #10 can, the feet on the ring, and the chassis and thus secure the whole assembly. A second #10 can underwent an operation with the tin snips and hole punch, and by serrating the lower portion, it was possible to press fit it into the first can and form the desired chimney. This does of course increase the plate to ground capacity, and very little tank capacity is needed on 15 meters. The cooling system seems quite adequate and except for the blower, costs nothing but labor. The illustration shows the procedure.

Circuit: The circuit diagram is included but is pretty straight forward. The chassis was a box that was on hand and lends itself well to a sub-chassis grid and filament circuit. The grid circuit is a National 40 watt all band tuner which happened to be on hand from previous equipment. The final tank coil is old fashioned for reasons of economy and space. You have to change it. A neutralizing capacitor is included using "grid" neutralizing. The geometry of this construction called for less capacity than was present with this capacitor completely removed to get perfect neutralization. So we had to take it out. The amplifier is perfectly stable for all frequencies from 21 mc down. Ten meters was never tried. At low frequencies it is necessary to add externally to the loading capacitor. The output terminals are binding posts with built in banana jacks. They are spaced so that a standard mica capacitor, with banana plugs screwed in, will just fit.

Use: The amplifier is used at W7CSD mostly on 21 mc NBFM with about 400 watts input. (We don't have a 3000 volt supply.) It would work at a full kw as a linear either for AM or SSB. A 6146 will drive it very nicely. The lack of a shielded cabinet may cause some eyebrow raising. At the W7CSD location there is only one TV station and it is on Channel 2. All others are received on a cable system; hence TVI is no problem. We have some herring bone on the TV whose antenna is less than 15 feet from the transmitting antenna when the transmitter is on 20. No trouble on 15 or lower frequencies.

Assuming you have an appropriate kw power supply gathering dust, this is a real cheap way to get a high power final on the air.

. . . W7CSD

Roy Pafenburg W4WKM

Simple Surplus Salvage

Twenty years ago, at the peak of the war effort, the twin sister of Rosie the Riveter dipped a socket drive set screw in the strongest cement then known to man. She then drove it home, using a 12" "T" handled wrench and all the awe inspiring strength of her 200 pound frame. Her partner on the production line then stepped forward and, after inserting a tiny taper pin, drove it out of sight with the aid of a 20 pound sledge. After a liberal application of MFP varnish, this fragile item of electronic equipment was started off to the war. However, it never arrived and after reposing in many warehouses for all those weary years, you finally buy it from Surplus Sam.

Now you drool over all those fancy gears, couplings and other components you plan to incorporate into your new, super de luxe final. Out come the tools and you go to work. You insert a wrench in a set screw and apply pressure but nothing happens. You apply a bit more pressure and the wrench suddenly develops a 90° twist. Undaunted, you grab a pair of gas pliers and really heave. There is a slight click and the wrench turns freely in the broken screw head. Twenty minutes and much work later, you have the mutilated screw loose. Now to drive the taper pin out. Ten minutes, a broken punch, many bent nails and three cracked ceramic insulators later you hold the now multilated and utterly worthless coupling in your hand. You give up the project, turn off the lights and, once again, swear off surplus for good.

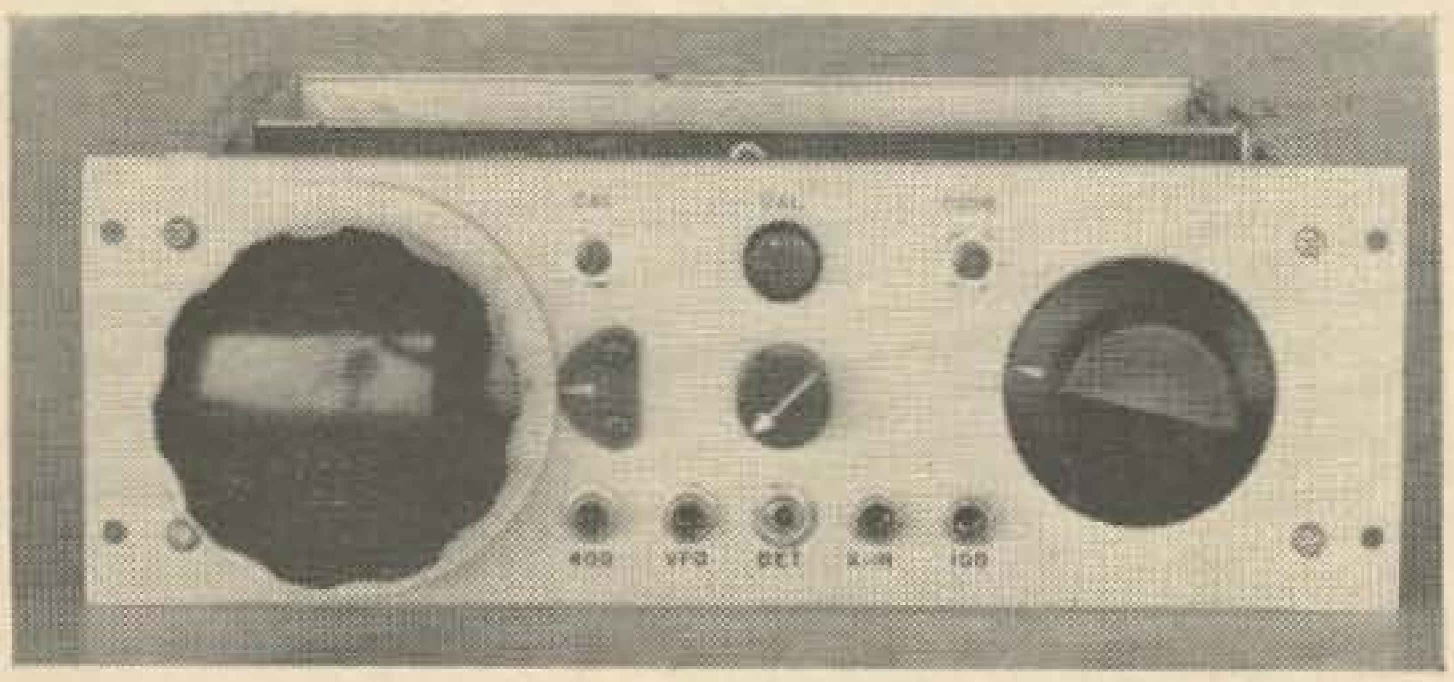
If the above sounds familiar, join the club. All who have worked with surplus military equipment have experienced this frustration. There is, however, an easy way out. Simply fire up the soldering iron before you go to work. When the iron is good and hot, insert the wrench in the set screw and apply moderate pressure. Now, bring the hot iron in contact with the hub of the coupling or other mechanical component and wait a moment. As the hub heats up it expands from around the setscrew and the screw turns out easily.

Now, let the hub cool off and turn your attention to the taper pin. Carefully examine both ends of the pin and turn the coupling so the small diameter end of the pin is toward you. Once more, apply the hot soldering iron to the hub. Let it heat for about 30 seconds and then, using a small drift punch (or even a rusty nail) tap lightly on the pin. The pin will drop out as if hexed.

The coupling, gear or what have you should now slide freely off the shaft. If not, do not be alarmed. Simply heat the hub again and tap lightly. The hub should slide off easily.

Try this technique; it works wonders. Only one precaution is in order. Use the heat treatment *before* you chew up the screw and round off the wrench with the brute force method!

. . . W4WKM



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An Audio Frequency Standard

The instrument to be described will measure or generate frequencies from 100 cps to 6 kc with an accuracy of a *few cycles,* and will generate harmonic markers of 100 and 400 cps with an accuracy of better than .03%. An instrument of this accuracy is particularly useful for calibrating other oscillators; measuring mark, space and shift frequencies in RTTY work; measuring inductance, capacity and Q by the resonant frequency method; and plotting the response curves of sharp audio filters.

Fig. 1 shows the block diagram and Fig. 2 the method of operation. A beat-frequency oscillator operates from 100 cps to 6 kc. The "F" dial (main tuning) is calibrated every 100 cps over this range. A second dial "δf" (vernier tuning) lowers the output frequency by up to 100 cps. An accurate fork standard establishes bench marks every 100 cps throughout the frequency range.

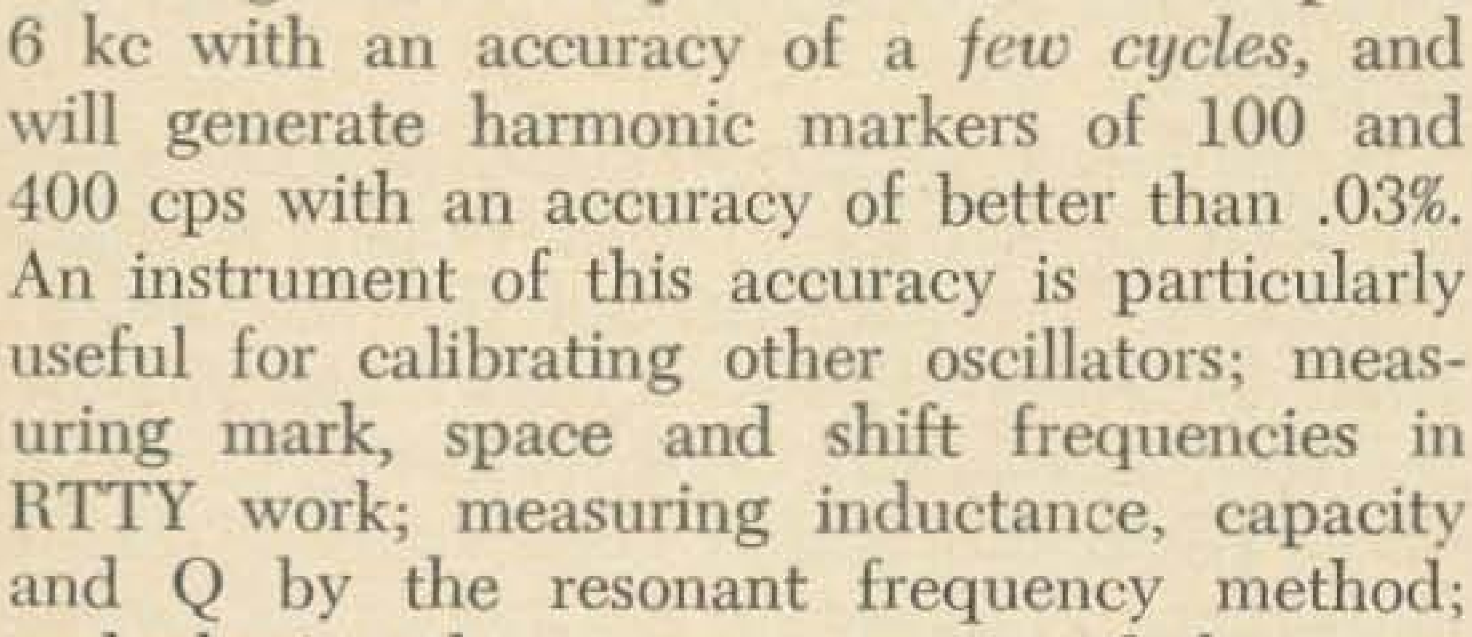


Fig. 1. Block diagram of the Audio Frequency Standard.

Suppose an unknown frequency (2170 cps) is to be measured. Fig. 2 shows the relations between the unknown, the bfo and the 100 cps markers. The bfo is first set *exactly* on the unknown frequency by zero beating. The "F" dial now reads between 2.1 kc and 2.2 kc. The switch (Fig. 1) is now thrown connecting the mixer to the 100 cps standard. The "δF" dial now drops the bfo to the next lower 100 cps harmonic (2.1 kc). The "δF" calibration says that the bfo was dropped 70 cps to reach 2.1 kc, so the unknown must be 2100 cps plus 70 cps or 2.170 kc. The unknown is always the sum of the "F" and "δF" dials. The entire procedure takes only a few seconds.

Since the 2.1 kc frequency is exact, the only sources of error are δF dial inaccuracy, inexact zero beating, and bfo drift during measurement. With a little practice the error should not exceed five cycles at the most. By measuring the harmonics of low frequency signals, this error may be decreased even further!

The complete circuit is shown in Fig. 3. Q_1 and Q_2 are stable beat oscillators operating at about 450 kc. L_1 and L_2 are the windings of 4.5 mc *if* transformers. The fixed tuning condensers C_1-C_2-C_{46}-C_5 must be made up of silver micas for stability, since even a very small percentage drift at 450 kc results in a very large drift in the beat frequency. The short term drift rate in the audio beat can

be held to about one cycle per minute. Of the many transistor types tested, the Philco 2N588 gave the best voltage and temperature stability, but almost any rf type will work in the circuit.

The oscillators must have good electrical isolation or they will lock together at low frequencies. C_8 must be connected with short leads to the common -6v line near the coil terminals. With proper isolation outputs of less than 20 cps will be obtained before locking.

Q_3 mixes the 450 kc oscillators giving a 0-6kc beat in the collector circuit. This bfo output feeds the second mixer, Q_4

Q_6 is a 400 cycle fork oscillator. The fork is rated accurate to better than .01%. Since the recommended (vacuum tube) circuit is not used, the accuracy may be lowered, but even .03% would be only 1.8 cps off at 6kc!

The output of Q_6 is a sharp pulse, ideal for triggering the unijunction divider. The pulse is clipped at 6.8 volts by D_2. This standardized pulse is available at an output jack, and is also used to calibrate the bfo at 400 cps when S_1 (cal bfo) is pressed.

The unijunction 100 cps oscillator, Q_5, is synchronized by the 400 cps fork. The 100 cps signal is available at an output jack. Its very sharp pulse provides harmonics every 100 cycles throughout the audio spectrum (Fig. 2). When S_2 is pressed, the bfo is combined with this frequency "comb" in mixer Q_4 to give accurate zero beats with the bfo every multiple of 100 cps.

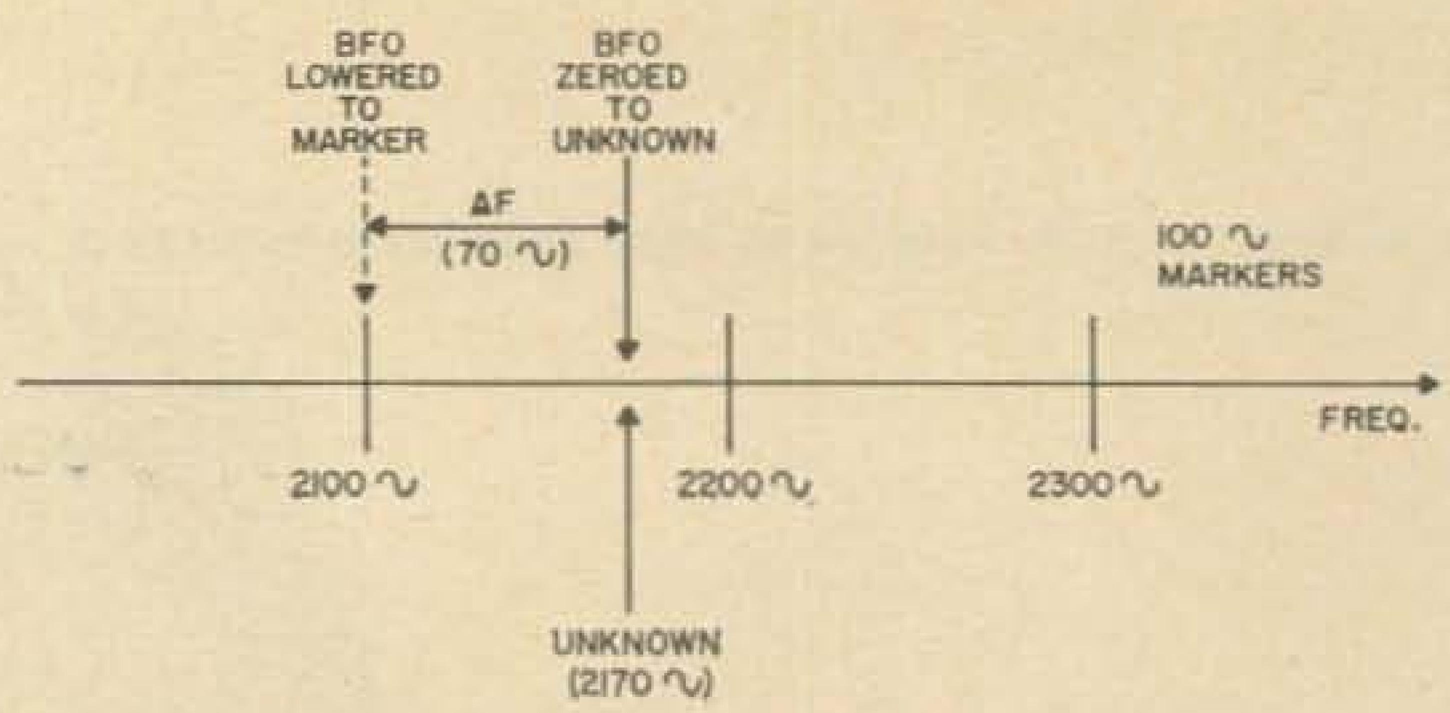


Fig. 2. Frequency relationships in measuring an unknown.

Note that the output of mixer Q_4 does not contain the usual low-pass filter. The audible frequencies present (bfo or unknown) are heard as well as any near zero beats. The very low beat frequency, which usually cannot be heard by ear, modulates the higher audible notes present, causing them to "wow-wow-wow." An exact zero beat can be easily established since we are listening, not to the sub-audible beat, but to its effect on a higher tone. The need for this higher audible tone sets the lower limit of the instrument to about 100 cps.

Calibration

It is important that the bfo not drift during initial calibration. Place the instrument away from drafts and hot equipment, and let it warm up for several minutes. Set C_9 at minimum capacity, set C_{10} at half capacity, and set C_{11} at maximum capacity. Now adjust the slugs of L_1 and L_2 for a strong zero beat in headphones or in an amplifier plugged

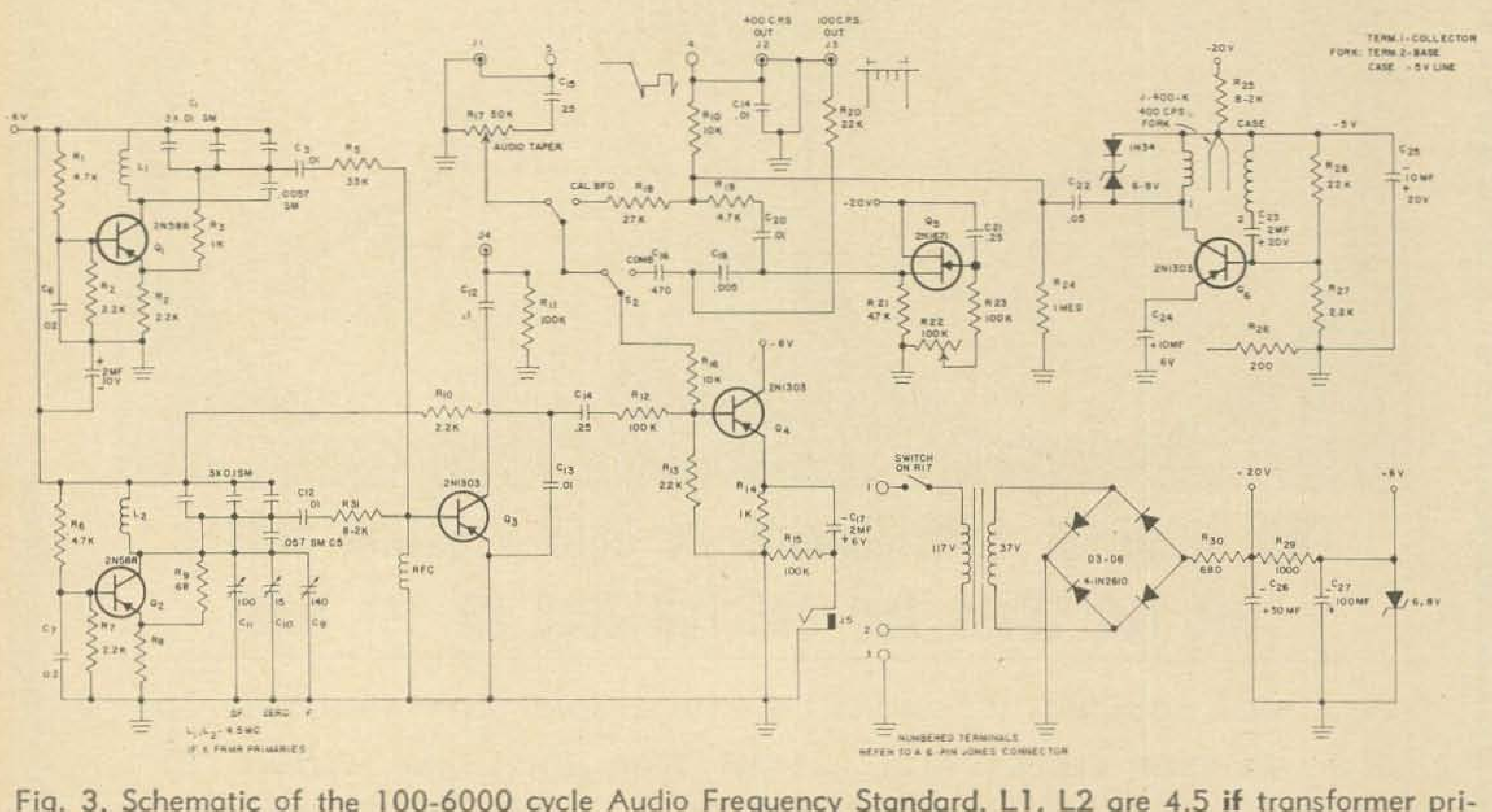


Fig. 3. Schematic of the 100-6000 cycle Audio Frequency Standard. L1, L2 are 4.5 if transformer primaries. Remove internal capacitors. T1 is a miniature 37 v transformer (available from author for $1.) The fork is a Philamon J-400-K. C5 should be .0057 and the three .1's above it .01's.

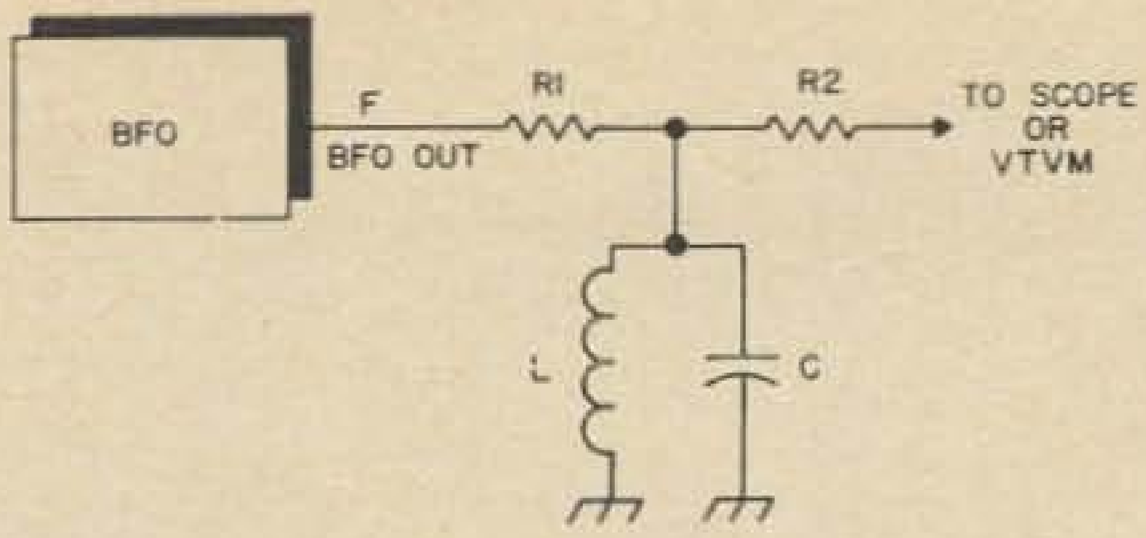


Fig. 4. Measuring L, C, Q.

into J_5. If a beat cannot be obtained, pad C_2 or C_5 until a tone is heard, and adjust the slugs for zero beat while tapping the coils to insure mechanical stability. The "F" dial (C_9) should now cover a range of about 6kc, with a good constant sine wave at J_4. The ampiltude may be adjusted for maximum output without distortion by changing R_5.

About 30 seconds after turn-on the fork should be heard softly humming. Connect a cope to J_3 and adjust R_{22} for a stable 100 cycle output, indicated by a strong Q_5 pulse on top of each fourth 400 cycle pulse. If Q_5 will not synchronize, change C_{29} as necessary.

Press S_2 and rotate C_9. Faint zero beats should be heard every 100 cycles. With C_9 set on one of the markers, C_{11} should be able to drop the frequency to the next lower marker, that is, C_{11} should have a 100 cycle tuning range. For best linearity, center this range so that C_{11} need not be operated too near either full or minimum capacity. Mark the two zero beat points on the "δF" dial *very carefully.* With mechanical dividers divide the scale into 5-cycle increments beginning with "O" at the higher capacity end.

Return C_{11} to the zero mark. Set C_9 to minimum capacity and reset L_1 for zero beat if necessary. Slowly turn the "F" dial to higher frequencies, with S_2 depressed, and mark the dial at each 100 cycle beat point. Return occasionally to the first 100 cps mark and rezero with c_{10} if necessary. A particularly strong beat will be obtained at 400 cycles by

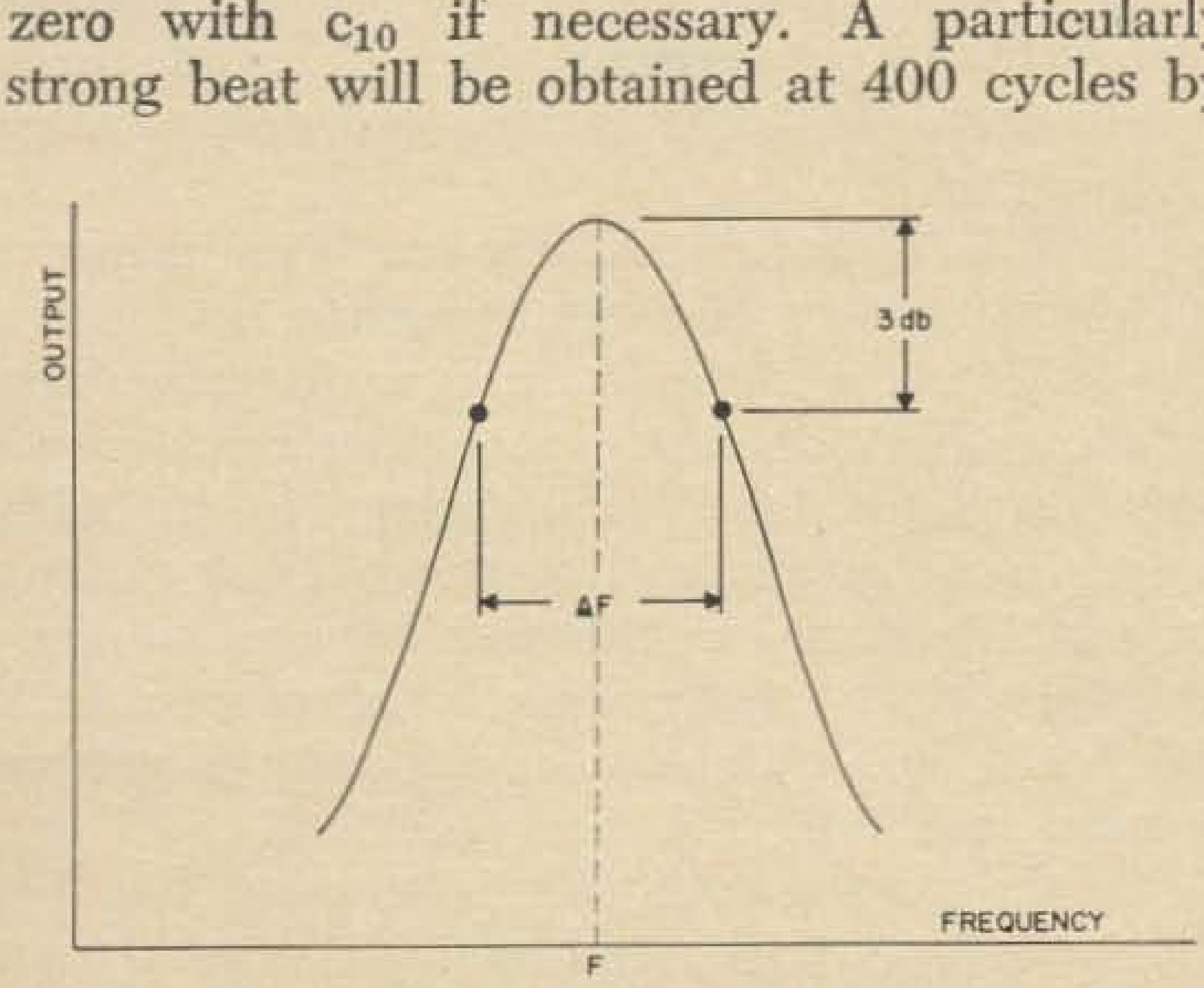


Fig. 5. Q calculation by the bandwidth method. $Q=F/\Delta F$

pressing S_1. Mark this point in red as it is a bfo calibration point.

Measuring an Unknown frequency

Turn R_{17} for minimum level with S_3 turned on. Set the "δF" dial to zero and set the "F" dial to the 400 cycle calibration mark. Press S_1 and set C_{10} for zero beat. Release S_1, advance R_{17} and with the "F" dial zero beat the unknown. Be sure you don't zero on a harmonic of one of the tones by audibly comparing the tone at zero beat with R_{17} at minimum (bfo tone) and at maximum (unknown tone).

With the "F" dial *accurately* zeroed to the unknown, push S_2 and quickly advance the "δF" dial to zero beat with the next lower 100 cycle marker. The unknown is now the next lower "F" dial reading plus the "δF" dial reading. Note that the exact calibration or reading of the "F" dial is unimportant, it just establishes which 100 cycle harmonic is being used as a reference for the "δF" dial.

Frequencies above 6kc can be measured by beating a harmonic of the bfo if the approximate frequency is known. The percentage accuracy is not changed, but the inaccuracy in cycles increases in proportion to the harmonic number. Likewise, frequencies below 3kc may be measured more accurately by setting the "F" dial on the second (or higher) harmonic. Now the inaccuracy in cycles is decreased by the harmonic number.

Setting an exact frequency

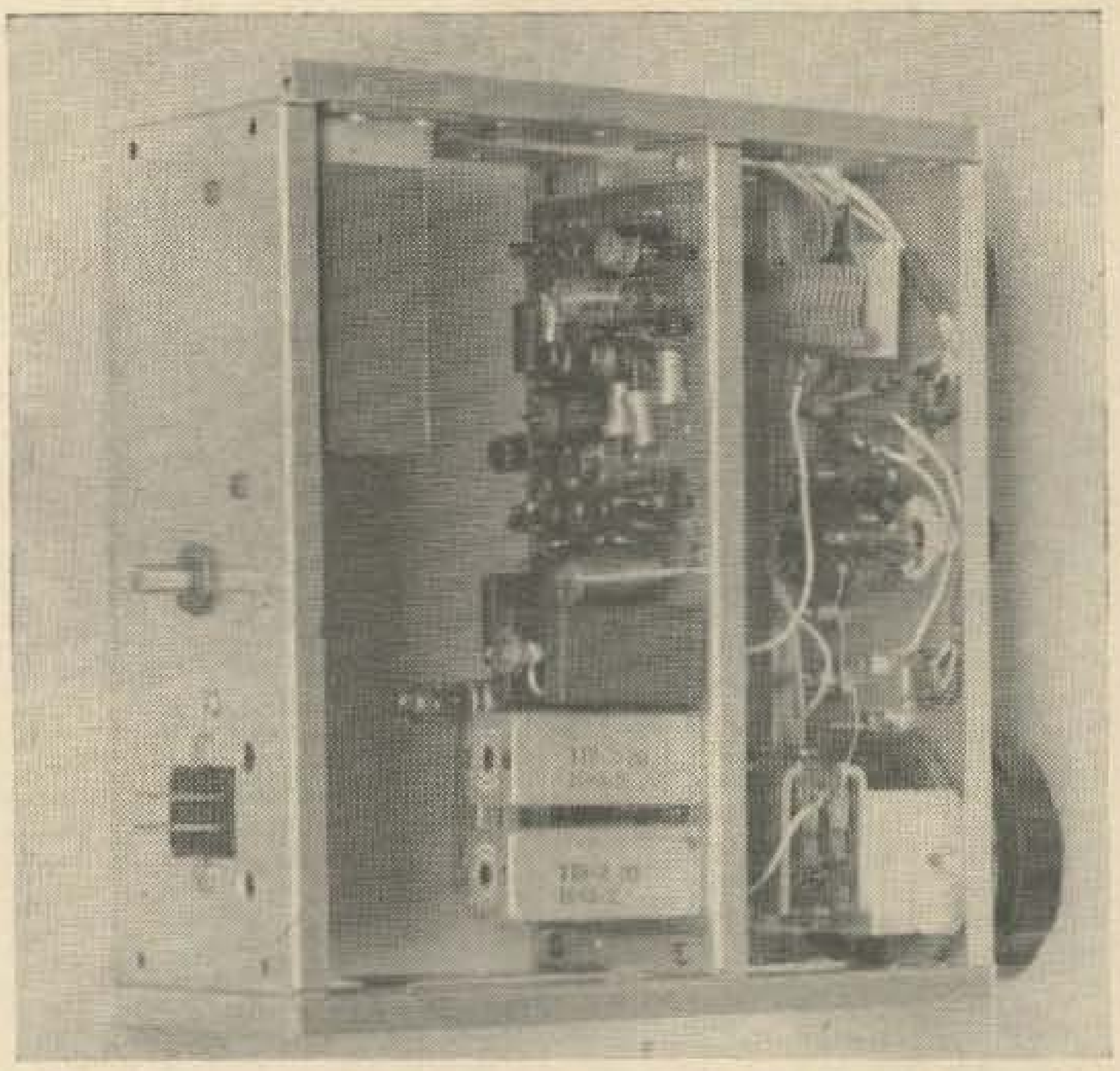
Suppose you want to generate an accurate 2125 cps signal. Set the "δF" dial to zero and calibrate the "F" dial at 400 cps. Push S_2 and zero beat the "F" dial at the next higher mark (2200 cps). Now drop the frequency 75 cps with the "δF" dial. The output is now $2200\text{-}75 = 2125$ cps. When located away from heated equipment, the oscillator drift will be about 1 cycle per minute.

Uses of the standard

Now that you have decided not to build this standard, let's see what you will be missing. There are several unique measurements that can be made with an accurate oscillator.

L-C measurement

Providing the circuit Q is fairly high, very accurate measurements of L and C can be made by determining the resonance of an L-C circuit. Fig. 4 is set up using an accurately known inductance to measure capacity, and vice-versa. Resonance is indicated by a peak in the output on a scope or ac VTVM. Values are calculated by $F = \frac{1}{2\pi\sqrt{LC}}$



Side view of the Audio Frequency Standard. The fork is in the upper left corner. Notice that most of the wiring is on a printed circuit board, though other methods of construction may be used.

Q measurement

The Q of an L-C circuit is easily measured by the bandwidth method. The setup is shown in Figs. 4 & 5. The 3 db down frequencies are measured and the Q figured from $Q = F/\delta f$. The total circuit loading (R_1 in parallel with R_2) must be high compared to $2\pi FLQ$ for accurate results. If a low-loss condenser is used (mica or polystyrene) the Q will be essentially that of the inductance.

Filter measurement

Very sharp audio filters, such as used in RTTY, may be easily plotted because of the high accuracy and good setability of this oscillator. The output impedance is 2.2k, which must be corrected to the proper input impedance of the filter. An ac VTVM connected to the filter output will enable an excellent frequency plot to be made. Usually the "δF" is not needed, the "F" dial being set to each 100 cycle marker and output readings plotted.

In RTTY work it is necessary to measure small differences of large numbers (0-850 cps out of 3kc), a basically inaccurate procedure. Finding the mark and space frequencies with this oscillator, and subtracting, is probably much more accurate than the normal zeroing of one frequency in the receiver and measuring the shift directly. The latter procedure is not too accurate due to the difficulty of getting a good zero beat with most receivers.

In the past month this instrument has become indispensable, and worth its small cost several times over in just the tuning up of RTTY filters. . . . K8ERV

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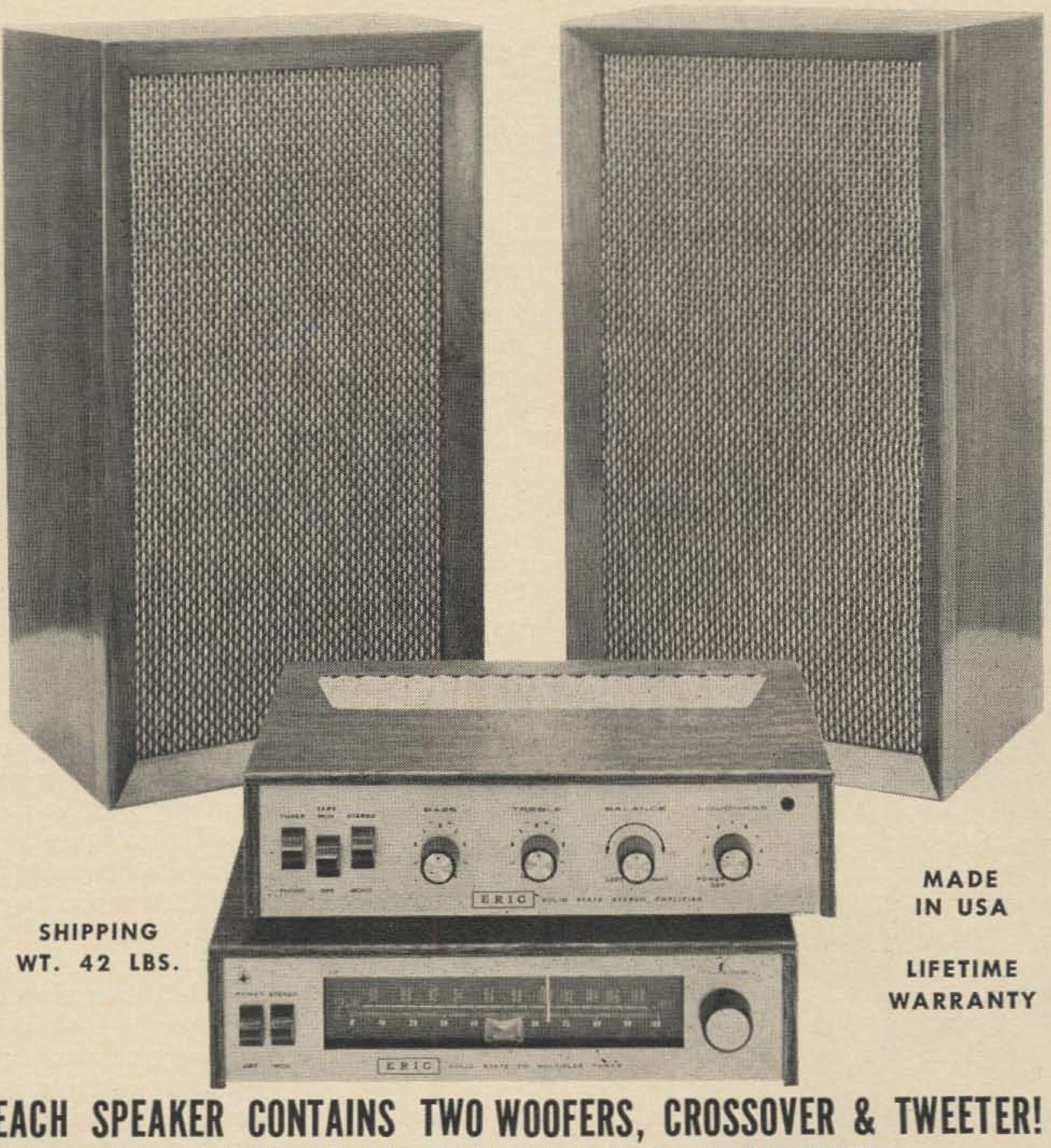

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A Bumper Mount for "Impossible" Cars

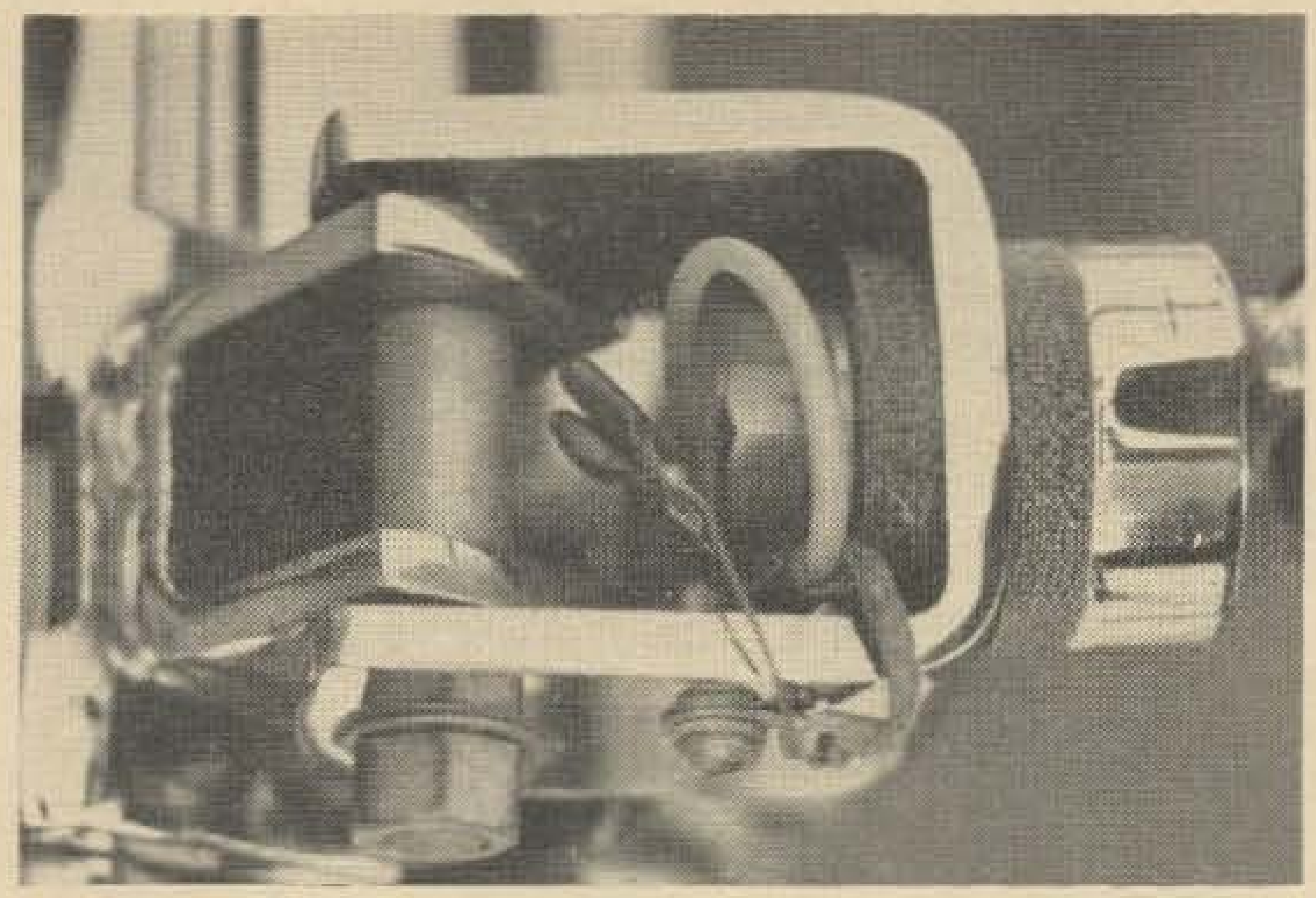
After driving an older car equipped with a body mount for your mobile antenna, you have bought a new (or newer) car. Now what to do about an antenna mount? You don't want to put any holes in the body of the new car, at least not until it's paid for, and the bumper of the new car is too close to the body to permit the use of a conventional bumper mount. The bumper may even underhang the body. Certainly the base of your whip would touch the rear edge of the trunk lid or the tail lights. So where do you go from here?

The hybrid bumper mount installed on the author's Duesenberg showing sufficient clearance even for cars where the rear deck overhangs the bumper.

If you kept the body mount from your old car, you have the problem halfway solved. All that remains is to purchase a good double-chain bumper mount, one with an inverted U-shaped bracket on which a whip is normally mounted. These two mounts are then combined to make a hybrid bumper mount which will give you plenty of clearance between your antenna and the car body.

To assemble this hybrid bumper mount, it is first necessary to remove the U-shaped bracket from the rest of the bumper mount for a while. This is done by removing a cross bolt and a spacer which prevents the legs of the U-shaped bracket from being drawn together when the cross bolt is tightened. In the middle of the U-shaped bracket there will be a pair of fiber washers with a bolt passing through them into a small hexagonal metal fitting which would normally receive the base of an antenna. Remove the metal fitting, the bolt, and the two fiber washers from the U-shaped bracket. Set the fiber washers and the U-shaped bracket aside; they will be used later.

Remove the big fiber disc from your old



Construction details of the hybrid mount. The two parallel capacitors are for impedance matching.

body mount. You should have remaining the two halves of the body mount, with the body-mounting half having a long screw protruding from it.

Now replace the two fiber washers on the U-shaped bracket, and insert the long screw of the body mount through them. If the long screw is a little larger in diameter than the holes in the washers, the holes can be enlarged with a drill or a rat-tail file. Be careful not to remove any more fiber material than necessary. Place a large solder lug on the end of the long screw and start a nut on the screw. Position the body mount and the U-shaped bracket as shown in the photo, and tighten the nut with a socket wrench.

Replace the U-shaped bracket on the rest of the bumper mount, and tighten the cross bolt finger tight.

Install the hybrid bumper mount in a convenient place on your rear bumper. Push the U-shaped bracket over so that it lies in the horizontal plane, and tighten the cross bolt so that the U-shaped bracket cannot move. Then adjust the joint between halves of the body mount so that the part which receives the base of the antenna will hold the antenna erect.

When you figure out a way to bring your coax out of the car body to the hybrid bumper mount, connect the center conductor to the solder lug on the long screw of the body mount, and ground the shield braid to the U-shaped bracket. Some bumper mounts already have a small screw tapped into the side of the U-shaped bracket for this purpose. If yours does not have such a screw, you can easily install one.

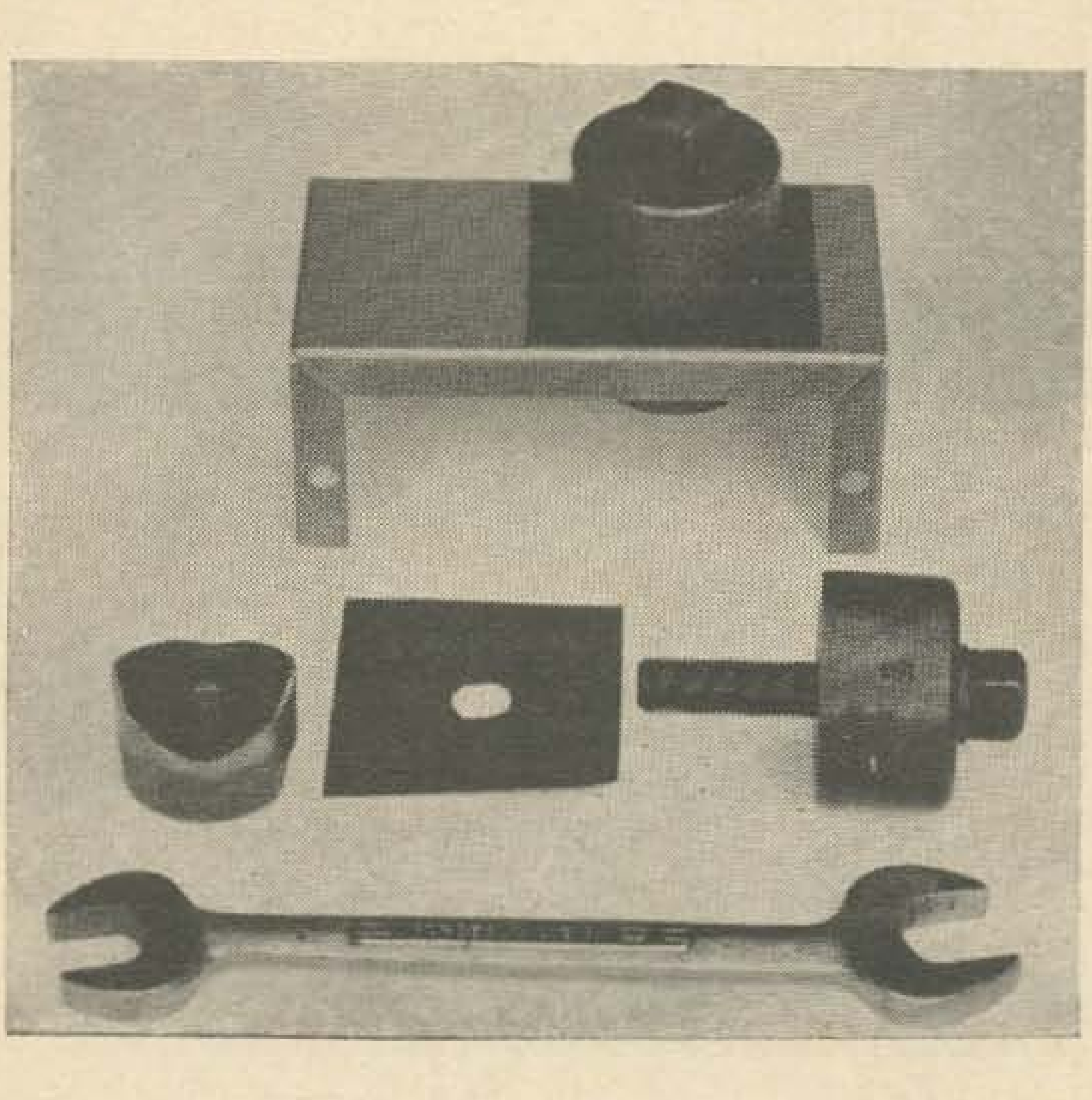
This hybrid bumper mount has been in use for over 7000 miles and has given very good service. If you have a new car, why not give this hybrid mount a try before cutting into that nice paint job?

. . . W7SMC

Roy Pafenberg W4WKM

Socket Punch Chassis Protection

Many commercially available chassis assemblies and cases are of light aluminum construction and finished in hammertone gray lacquer. Since no primer coat is used, this finish is very susceptible to flaking and chipping. Even when care is exercised, the finish is usually damaged during the construction of a project using these units.



The photograph shows the answer to one common cause of finish damage. When knockout socket punches are used, the pressure of the punch will often cause flaking of the lacquer. Simply insert a washer of cardstock or heavy paper between the punch and the chassis surface. This gasket will protect the finish, even if the punch turns as the screw is tightened.

Another common cause of finish damage is the square used to lay-out the chassis. To avoid this damage, simply apply a strip of cellophane tape to the underside of the rule and the butt surfaces of the square. After construction is completed and decals are applied, a coat of clear spray lacquer will protect both the decals and the original finish. *Warning* apply a very thin coat or the spray lacquer will dissolve both the decals and the original finish!

. . . W4WKM

Photo By: Morgan S. Gassman, Jr.

QUEMENT

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"DE" How Come?

I wonder how many of our present-day hams have thought about why they use "D E" before signing their calls when using Code?

"D E" was part of the 1912 International Radio Agreement. Since it has now been used for more than 50 years, it probably is taken for granted and used without a passing thought by all except the real old timers!

Before 1913 we just made the call letters of the wanted station several times, then the call letters of the calling station—no DE in between. For example, instead of calling say NPH NPH NPH de W6LM—we would send NPH NPH W6LM GA. The "GA" stood for "go ahead" as there also then was no "K" invitation to transmit!

I am certain the procedure explained above was simply a carry-over from the Morse land telegraph lines and stations. All instruments on a land telegraph line were in series; so, when a called station replied to a calling station, the operator just opened the circuit (with a lever provided for that purpose, on the side of the key) and answered back. Of course the calling station knew the moment the circuit was opened and reply started; so there was no need of any character or signal between the call letters of the 2 stations. The same procedure was used on wireless work until the 1912 regulations included the use of "DE."

. . . W6LM

John Carroll K6HKB

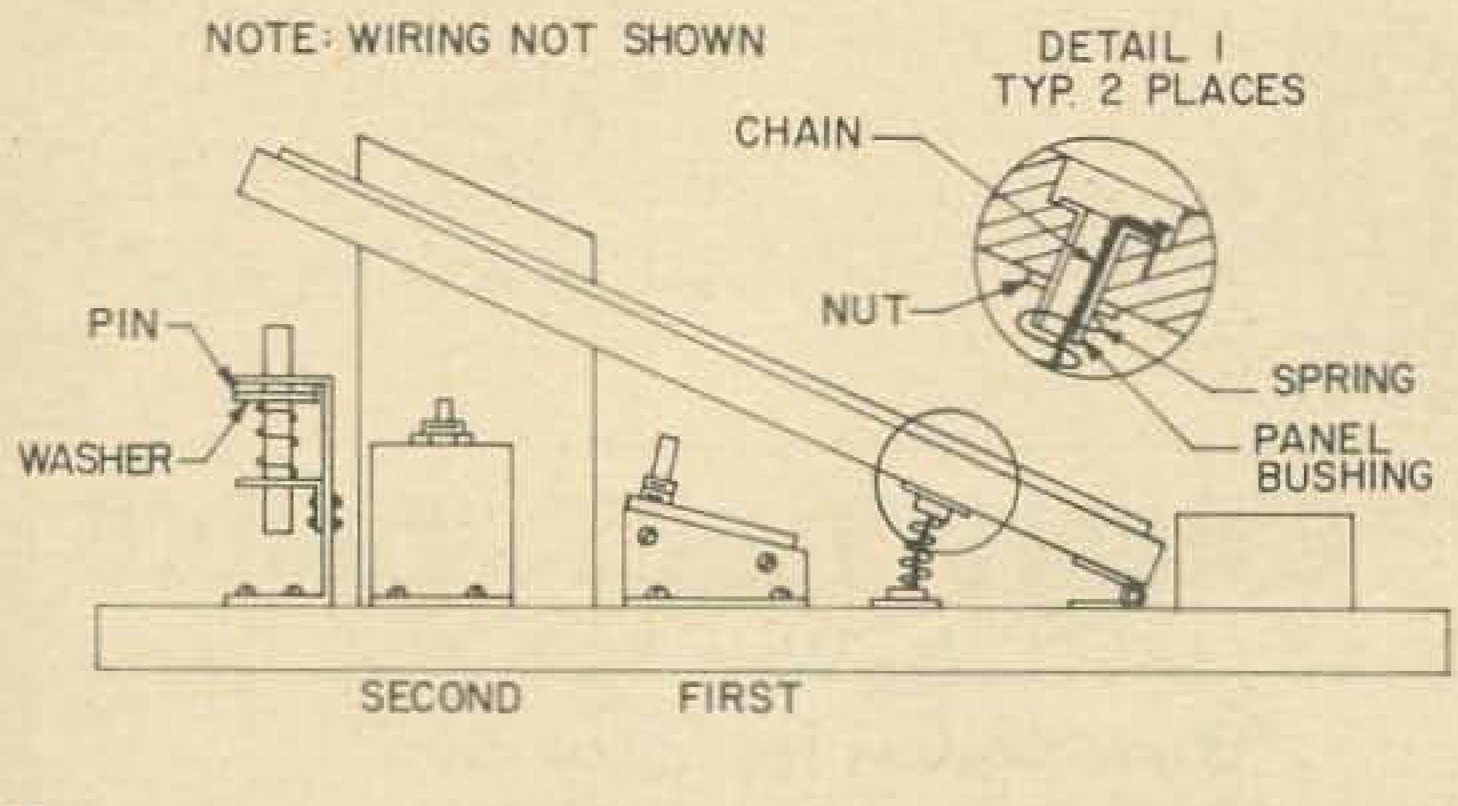
A Double Action Foot Switch

Foot switches to put the rig on the air aren't new, but they are usually the push-to-transmit, release-to-receive type. I decided to build one with the option of lock-on, so that I could have push-release action for short transmissions without the fatigue of holding the pedal down for long periods, and still have no-hands operation in both cases.

Referring to the drawing, the pedal is hinged to the base and provided with a return spring just stiff enough to raise the pedal. A chain limits the resting height as shown in Detail 1. The spring should be soft enough to go down easily when stepped on.

The two switches under the pedal are wired in parallel. The first switch is a momentary type, a microswitch with an overtravel plunger in my unit. This one provides the push-to-transmit action. The second switch is a push-on, push-off switch. It provides the lock-on feature. I used a common appliance switch.

The spring assembly under the toe of the pedal is made extra stiff, and the pedal



reaches it after the first switch and before the second one. Resting a foot on the pedal triggers the first switch only, giving push-release action. Stepping down hard triggers the second switch, which stays on after the foot is removed. A second stomp shuts it off again.

It's a good idea to put a heel rest behind the pedal, because the foot slides back otherwise. The foot rest next to the pedal is handy between transmissions.

As for construction and exact mechanical scheme, it's as far from critical as anything in radio ever gets. The dimensions and the shapes of the brackets just have to be laid out according to what's in the junk box. The base can be anything big enough to stay put; mine is a ½ × 7 × 10 piece of scrap plywood. I used an automobile gas pedal, but a piece of plywood covered with stair tread might be more comfortable. The heel rest is a piece of 1 × 2 tacked to the base, and the foot rest is a wedge-shaped piece cut from 2 × 4.

A couple of things are important. The pedal should still be tilted back 10° or 15° at the bottom of its travel, because it's hard on the ankle to reach down any farther than that. Also, there should be room to adjust the switches to get the sequence right.

I've been using mine for four months, and the only trouble I've had came from a worn-out vacuum cleaner switch I shouldn't have used in the first place.

. . . K6HKB

Gus Browning W4BPD

Gus: Part VIII

In the last chapter I was in Athens, Greece staying with SV1AB, George. We talked about the possibilities of a trip to Mount Athos. Socrates SV1AE was also interested in a trip there and both of them and a number of other hams had tried but permission was never given to anyone, nor was anyone even encouraged to keep trying. First, there is problem No. 1—getting permission from the Greek government, and problem No. 2—getting permission from the high church officials in Mount Athos. Getting permission from either, even to this day, seems absolutely impossible. The same goes with the Sovereign Order of the Knights of Malta in Rome. This has been tried, I understand, by a number of people, and so far it's still there awaiting the right one to get the right key to open it to the DX World as virgin DX territory. I would give my right eyeball to be the fellow who operates from these two spots, the only two spots in the whole world still left for a W1FH to work.

I felt, as I departed from Athens, that I had known George a long time. He is a very sincere fellow, and of course I hope some day to visit him and Socrates again and get to know both of them better.

The trip to Beirut, Lebanon was uneventful. No customs trouble at all there, since I was having my radio equipment shipped to Nairobi by I1AB of Milan. I was met at the airport in Beirut by Rundy and Fred—OD5CT and OD5AF. Rundy took me to his very elegant air-conditioned apartment and was introduced to his refrigerator with all those Cokes in it. Rundy's wife is from North Carolina, and boy I sure had some very fine southern cooking while there! I even operated OD5CT a number of times. I was getting the "feel" of DX now; the "W" boys were not loud like they were in Europe. The old bands were changing and so were the local QRM stations heard.

The population of Beirut seemed to be about three fourths Arabic and the rest Western. Hotels can be had for any price that you want to pay. Beirut is a sort of free port, so things can be bought there a lot more reasonably than any other place in that area except Aden. For a ham, Beirut seems to me to be a very good spot. All Africa is south of them; Europe is not too far away for good QSO's all day long. The Middle East is their next door neighbor; Asia proper is not too far away either. And of course the "WK" stations with their KW's and beams can be worked easily. I suppose their hard-to-work area is the Pacific Islands. But, all considered, OD5 land seems to be situated in a good spot, although living there is very expensive, Rundy told me. This is true especially if you want to buy USA products. I understand if you are a good "trader" that it's quite easy to make good money in Beirut. Everyone there looked quite prosperous, and business was like a beehive in every place that I visited. Even at the bazaars business was rushing like mad all day long and well into the night.

After about 4 or 5 days there staying with Rundy, we departed for Cairo, Egypt. The flight we went on arrived at about 10 o'clock at the Cairo Airport. When you get over Egypt you will know it by the desert down below you as far as the eye can see—it's one big mass of yellow sand from horizon to horizon. Then the plane landed and the door was opened; we knew we were in Egypt by the hot air. The airport at Cairo is out on the desert and the approach is sand in all directions. Rundy came with me to Cairo, to stay a few days for business. He insisted that I stay with him at the Nile Hilton, a real fancy hotel with real fancy prices; the whole thing is airconditioned and there is no suffering there on account of the heat, as long as you are inside the hotel. We went out to some of those Egyptian cafes and had some of the oddest food I had ever eaten. Then one night we went to one of the night clubs. That was the thing! Arabic music, singing, and real "belly dancing."

After about 3 days or so, Rundy had to return to Beirut. After he departed I decided it was time to hunt up the fellow that Mahmud —SU1MS—had written that Arabic note to. I could not stand that rate staying at the Nile-Hilton so I made a phone call to the number that Mahmud had written. Immediately Mahmud's friend, Mohammed Atef, was around to the hotel to see me. He had a chauffeur driven red Chevrolet convertible and the top was down. He insisted that I come around and stay with him (this was what I wanted all along).

Mohammed owned a nice apartment building, I guess about 6 or 7 stories high. On top of the building was a penthouse consisting of three rooms. He went in with me and said, "Gus, this is yours as long as you stay in Cairo." Out of the bedroom window I could see the Pyramids of Giza in the distance, all three of them. I said to myself, "This is it." He told me if I wanted anything just to pull the tassel that was at the head of my bed. He departed and told me to lie down and take a rest. Immediately after he left I decided to try out that tassel. I pulled it and in a few moments a young servant appeared and said, "Yes, master?" I said, "Get me a cold Coca Cola." He bowed and departed and in about 5 minutes was back with a good cold one. Now this was living! About 12:30 my lunch was brought up to me by the same little servant. This boy was about 12 years old and, I understand, was one of the children from a farm family. After lunch I decided to try the tassel pull business again. When the servant said "Yes, master," I said, "Bring me a good cold Pepsi Cola"—pronto, it was on hand. I said, Gus, you are a lucky dog; all this service, plenty of cold drinks, 3 private rooms, and a car left at your disposal also.

Walking around Cairo, I saw lots of those veiled ladies and I was warned not to attempt to take a picture of them or my camera might get smashed and maybe I might even get smashed. I went to a number of those big mosques in Cairo. You see people praying on their prayer rugs, all facing the east—Mecca. This takes place 5 times each day, early in the morning, again about 10, then about 12 noon, again about 3, and again about 6. These mosques have gone modern with a bang—everyone of them seem to have a big P.A. system where the head man calls the people to prayer with his mournful singsong. To me it sounded very sad.

The first morning at Atef's I went downstairs to the chauffeur and told him I wanted to go to the pyramids. Off we went. The pyramids of Giza (those are the 3 big ones, that you always see in movies) are about 15 miles away, a good road all the way. When I first arrived at their base I was impressed with their tremendous size, and then I looked at those large stones that they are made of; and when I thought that they were made a few thousand years ago, I really wondered how they ever did this without any modern machinery—all done with just the simplest tools. It does look almost impossible, but there they are.

I had a few meals with Mohammed in his apartment below; he was living with his mother and family there. But one odd thing: I never did see any females there. It seems they are kept separate from the males. You soon get used to the fact that when you go to someone's home, you don't expect to see their wife, or any of their sisters; nothing but their father and brothers. This is their way of life.

One night someone knocked on my door and when I opened it, there stood one of the prettiest young ladies I have ever seen. She was about 14 years old and a picture of real beauty, with the typical Egyptian face. I said "Come in." She introduced herself as Atef's sister. I said, "Where is your veil?" She said, "I am a modern Egyptian and will never wear one of those old-fashioned veils." When I returned to Cairo 3 years later, I noticed there were a lot less veils on the ladies. This young lady spoke very good English and we had a long talk. She wanted to know all about America, and I told her what I could. To this day, I don't think Atef knows that his sister visited me when I was there.

While in Cairo I met SU1IC – Abrihim Charmy, a very nice fellow who is not on the air anymore. It seems that he received a notice from the licensing authorities to bring in his license. It was cancelled on the spot with no explanation whatsoever. They also came to his home and cut all the cables between his power pack and rig and it was all sealed up with sealing wax and an official seal placed on it. I asked him why. He said he had no idea why this was done. I guess in this sort of dictatorial country, they don't have to explain anything to you. When it's done, it's done—Amen! You fellows in real free countries don't know how lucky you are. In lots of countries they don't have to explain anything to anyone. If you do too much complaining you might even end up in prison. You just keep your mouth shut and take what they dish out. Boy, how lucky we Americans are—and many people don't know it. We take everything for granted and seldom think of how things are in the rest of the world.

After staying in my little penthouse in Cairo for 14 days, time arrived for me to depart for Nairobi. Atef was very disappointed that I had to leave. He invited me to return and spend a few months with him upon my return trip. I can truthfully say my stay in Egypt was most enjoyable. I really was "living" there: plenty of good food, auto trips, private rooms, and ALL FREE! What else could I have had?

The first place the plane stopped on the way to Nairobi was Khartoum, in the Sudan. I wanted to stay there for 3 or 4 days to take some pictures. The plane landed about 10 at night, and brother, when they opened the door, the hot-air blast scorched me. It was HOT and how! You know me; the way I travel is—never make any reservations at any time. Well, this is one time I should have made advance hotel reservations for an air-conditioned room! Since I had not, I ended up hunting all over Khartoum for one; none could be found so I had to accept a regular hotel room, one with two of those large, slow-turning ceiling fans in it. I took a shower, had dinner, took a shower, wrote some in my diary, took a shower, read a newspaper and took a shower, and without bothering to put on any clothes at all, lay down on just the bed sheets, both ceiling fans in high gear, and tried my very best to go to sleep. Sweat poured off me like a dog. I just lay there sweating it out until about 2:30, when it finally cooled down to about 100 degrees and I went to sleep. I was up at 7 the next day, and it was already hot. I could not see anything at all in Khartoum to take any pictures of; there just was not anything that looked interesting enough for me to use my film on. My plans were to stay there for 3 or 4 days, but with the weather so doggoned hot and nothing of interest to look at or visit, I decided Khartoum was not for me. Immediately I departed from there for Addis Ababa, Ethiopia.

Between Khartoum and Addis Ababa I saw some of the roughest country I have ever seen anywhere; plenty of big mountains and lakes. At one place during this flight I saw three lakes, each one a different color; one was blue, one green and one yellow. I took a color picture of this from the air, and as usual it did not turn out so good.

The airport at Addis Ababa was practically brand new, very beautiful and large. I spent one night in Addis Ababa, walking and taking a few pictures around the Palace and a few street scenes. The weather there was very nice, the elevation being something over 1 mile.

Away I went on to Nairobi, Kenya—lion country I call it. The first night there I spent in a downtown hotel. I called up Leny VQ4AQ (now 5Z4GT) and he came by and took me to his home where I met his niece XYL Lillette and his daughter Gertie. We had a wonderful eye-ball QSO. I operated VQ4GT for a number of QSO's. George VQ4AQ and Robbie VQ4ERR came out to visit us and a very fine time was had by all. After spending one night with Leny, I found out that I had slept in Gertie's room and she had slept on the couch in the living room. I decided that I did not want to impose on them, and after talking to George, I was invited to come and stay at his house a few nights while we were QRX for the WØ boys to show up from Kansas City. I found that George was a real down-to-earth fellow and would do anything for a fellow ham; the same went for his FBXYL. They really made me feel welcome in their home. George drove me all around Nairobi, even a few trips out to the Game preserve that is just outside the city limits of Nairobi. There were plenty of lions, elephants, rhinos, zebras and antelopes roaming around. They would even walk up to the car to look us over. Of course up went the windows when they approached!

The Kansas City boys arrived a few days after I did, Lee WØAIW stayed with Robbie, and the others (Mike WØMAF, and Mac WØUQV) stayed at a downtown hotel. Now, these fellows really came prepared for a DXpedition with nearly a ton of radio equipment, power plant, antennas, spare parts etc. My equipment that was supposed to have been air freighted to me from Milan by I1AB some 20 days before my arrival had never arrived, so I was lucky that Lee and the boys had brought plenty of gear with them.

After spending a few days in Nairobi checking over everything and doing a little sightseeing it was time to depart for Mombassa. Away we went down to the railway station with all that radio gear. Lee and Mike shared one compartment and Mac and I the other. Those compartments were crammed to the brim with boxes, and I for one could understand why the ticket clerk said we had by far too much luggage to be taken "free." We could hardly move around in our compartments.

Upon arriving in Mombassa, we checked into a hotel. Mombassa is right smack on the seacoast so you get the benefit of all the loss of altitude by the temperature rise. If you want to sleep when you are in Mombassa, you get an air-conditioned hotel room or you suffer. Mombassa is a typical seaport city, with all the big warehouses and docks. You see people there from all parts of the world. You see Arabian ships from Aden, Saudi Arabia, Muscat and the Persian Gulf ports. There are many Indian bazaar type of shops that sell everything under the sun. Then there are the native open air markets all over the town, selling many different things; carvings, bamboo products, carved ivory objects. There is meat hanging up on hooks covered with flies, dried fish, fresh fish—boy what a smell!

We were to board our ship for the Seychelles the next day. After lunch we all went up to our rooms and took a short nap in the nice cool air from the air-conditioner. After the nap, Mike decided to take a walk. He was back in about an hour and I asked him what he saw of interest while out looking around. He told me about seeing all those pretty wood carvings the natives were selling. This interested me and I went out to take a look-see myself. Every place I slowed down, they jumped me trying to sell me something. At one place they started showing me their wares and just for the heck of it I started haggling over the prices. They would offer me something for, let's say 30 shillings, then I would say I will give you 3 shillings, then they would say how about 20 shillings. I would say, 5 is my top price, and then they would say they cannot sell for less than 15 shillings as that was the cost price. I would then say my top price is 7 shillings. They would say that they were going to lose money but I could have it for 12 shillings. I would say no, no, no. Here's 10 shillings. I would have the money in my hand while saying this and if they hesitated I would start walking off. They would let me walk about 25 feet, then would say OK, we will sell it to you, then would wrap up the item in a piece of newspaper and hand it to me. Well, those carvings were beautiful, the prices were cheap (after haggling for a while), and I ended up with a good sized box of carvings before I got back to the hotel. I had spent a total of about $10.00.

When I arrived back at the hotel with the box full of carvings, I dumped them on my bed, and when Mike saw them he asked me how much they cost. When I told him $10 he said, "Gus, when we get back from the Seychelles, I want you to buy me a whole big batch of them at the same price you paid for these." That little story will be told later on.

We got up early the next morning and away to the docks and boarding the ship—The Kampala—a nice sized boat and spotless. After everything was placed in our cabin, we strolled around the boat and after a short while anchor was lifted, the big 77 cycle whistle was tooted, and away we were!

Now remember this was the very first time in my entire life that I had ever been on a boat, except one little row boat in the Edisto River near Orangeburg, S.C., and the little 10 foot sail boat I used to sail around Lake Fairview when I lived down in Florida many years ago. To me every minute of the trip to the Seychelles was real adventure. Once or twice I felt the first signs of a little butterfly in my stomach—then I would say to myself, "Look here, Gus, you just can't be seasick, you are here for a DXpedition. This is the one and only trip to the Seychelles you will ever have, you cannot afford to get sick now." Then I suppose I would talk myself out of getting seasick. This system has always seemed to work for me.

After the ship was at sea, out of sight of land, we decided to see what the chances of a little /MM was. The ship was pretty fair sized, about long enough for a full wave 160 meter antenna and broad enough for at least a ½ wave 160 meter antenna. I knew that the antennas they used for their wireless would certainly be long enough for us to use. Lee had made this trip to the Seychelles before and had become acquainted with the wireless operator and had approached him previously regarding some /MM work. Up we went to the wireless room and after drinking a cup of tea and some talk it was decided that /MM was all OK. We brought up our gear, had to make up a makeshift antenna tuner to match the long wire antenna they had on the ship—good old Lee had brought along a little junk box full of condensers, coils etc. We were on the air as WØAIW/MM. All the world seemed to be QRX for us and we had a ball all the way over to the Seychelles operating /MM. I remember I was at the key when the Seychelles were first sighted—about 5 am—and I gave the boys a running account of its appearance to me. When you first see the island, Mahé, all you see is a mountain top sticking out of the sea, with a few hazy clouds floating above it. I guess a good description of Mahé is to just say it's a ridge of mountains about 35 miles long that sprung up out of the sea ages ago with beaches on each side of it. People live all over the island but it's more thickly settled around Port Victoria, the only port in the island. There are a number of much smaller islands around Mahé. The ship could not pull up to the docks on account of the shallow water so it anchored out in the bay about one mile from the landing docks and many of the small island boats met the ship. One of these took us ashore. I landed and walked right into their customs. They asked, "Do you have anything to declare," and I said, "No." They thanked me and I was at the Seychelles—VQ9 land.

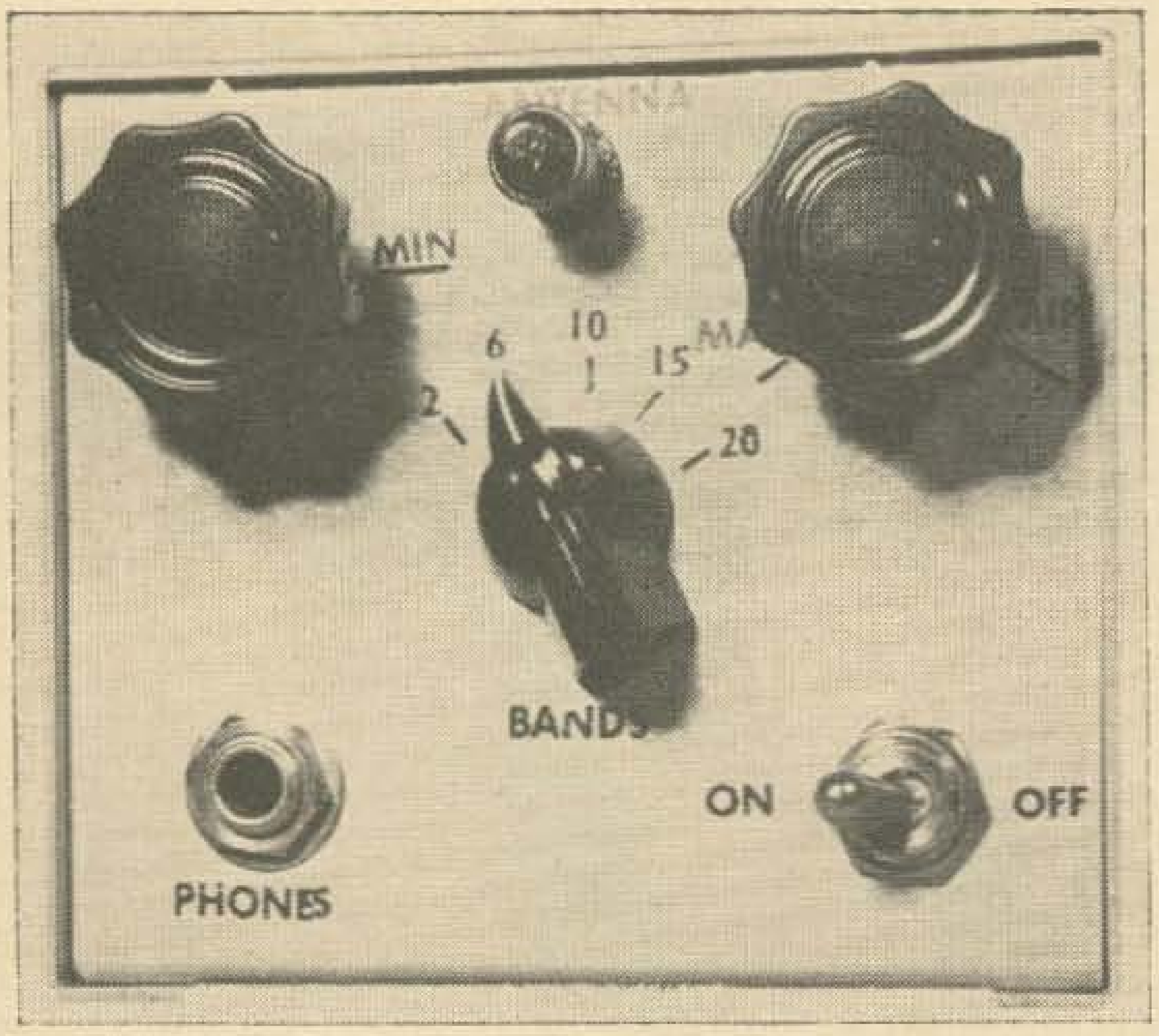
When you land at the Seychelles you notice that there seems to be lots more females on the island than there are males. Someone told me the population is something like 7 to 1, or maybe it's 9 to 1. Now this does make life there a little bit more interesting. Young men who are tired of a drab unromantic life in the USA (or any other country), you go to the Seychelles. I was once telling ole Bill W7PHO about things there and he said if he ever went there he would take a 5 gallon bottle of Geritol with him! Well, I told him that sounded like a very good idea. In case any of you are interested (as near as I can remember, at least) it costs about $80.00 for a one way trip, by boat from Mombassa, Kenya to the YL's—I mean Seychelles. But make your reservations early because there are a lot of VU2's going on a one way trip from Africa, so the boat is usually sold out well in advance. My second trip there I had to fly to Bombay and go there by the long path, because of this "hold out" business. There is a ship about once every month from Mombassa and from Bombay. Hotel rates are FB, it cost me $22.00 per week, room and board and any other service I wanted. More about this when I come to my second trip there a few years later.

We were met at the docks by Anton Schwartz who runs a small exclusive sort of hotel on the island; he had his station wagon and we loaded everything up. We met Harvey Brain VQ9HB and gave his boat the once over—and Mike said "OH No" when he saw the boat, I said, "Well it looks good to me!" I don't remember if Mac and Lee had anything to say—but I could see they were thinking!

Upon arriving at Tony's place, the first thing was up with the antenna—a vertical in the very top of an 80 foot coconut tree. I cannot say that conditions were good or bad during our stay there, I suppose they were just average. I do know that four people are too many to operate ONE transmitter. My rig never had arrived from Milan, so we were stuck with ONE rig and had to make the best out of it.

Next Issue—away for Aleglea Island, Who got sea-sick, and lots more!

. . . Gus



Howard Pyle W7OE
3434-74th Ave., S.E.
Mercer Island, Wash.

Two through Twenty FSM

Have you noticed how few of the many magazine construction articles and handbook descriptions of field-strength meters have pretty much side-stepped the higher frequency amateur band applications of this most desirable station accessory? I have for I recently had occasion to turn out a piece of gear like this and I pretty thoroughly searched available sources for suitable data, which was sadly lacking. I finally ran across a catalog page from Shurite Meters of New Haven, Conn., which seemed to present the basic answers.

These people, not too long ago commenced production of a 0-1 DC milliammeter modified especially for field strength applications and is known as their stock number 8903Z field strength meter selling for $3.95. While adaptable of course to use in any frequency band with appropriate circuitry, apparently they realized the lack of construction information covering the higher frequency applications. Accordingly they designed a circuit around this meter with emphasis on VHF usage . . . 2 through 20 meters. This was just what I wanted so I procured the meter and went to work using their recommended circuit and constants. It turned out beautifully and performs splendidly. Probably by using a couple more coils and two additional positions on the band switch, just as satisfactory results could be carried right on through the 40 and 80 meter bands as well.

I used a small LMB aluminum meter cabinet with a hole for a 2" meter; any equivalent cabinet can of course be used. With a small enclosure such as this (4"x4") the meter occupies the face of the cabinet and all controls are on the rear. Using a somewhat larger housing both the meter and the control knobs can be placed on a front panel if you prefer.

Rather than wind up the three coils I found that the J. W. Miller Company RF chokes with minor modifications were admirably suited for a compact job. One each of their catalog numbers 4606, 4588 and 4580 were required to cover the three frequency spreads from 2 through 20 meters. The #4606 coil should have five turns carefully removed, to cover the 10-20 meter bands; remove three turns from #4588 for six meters and two turns

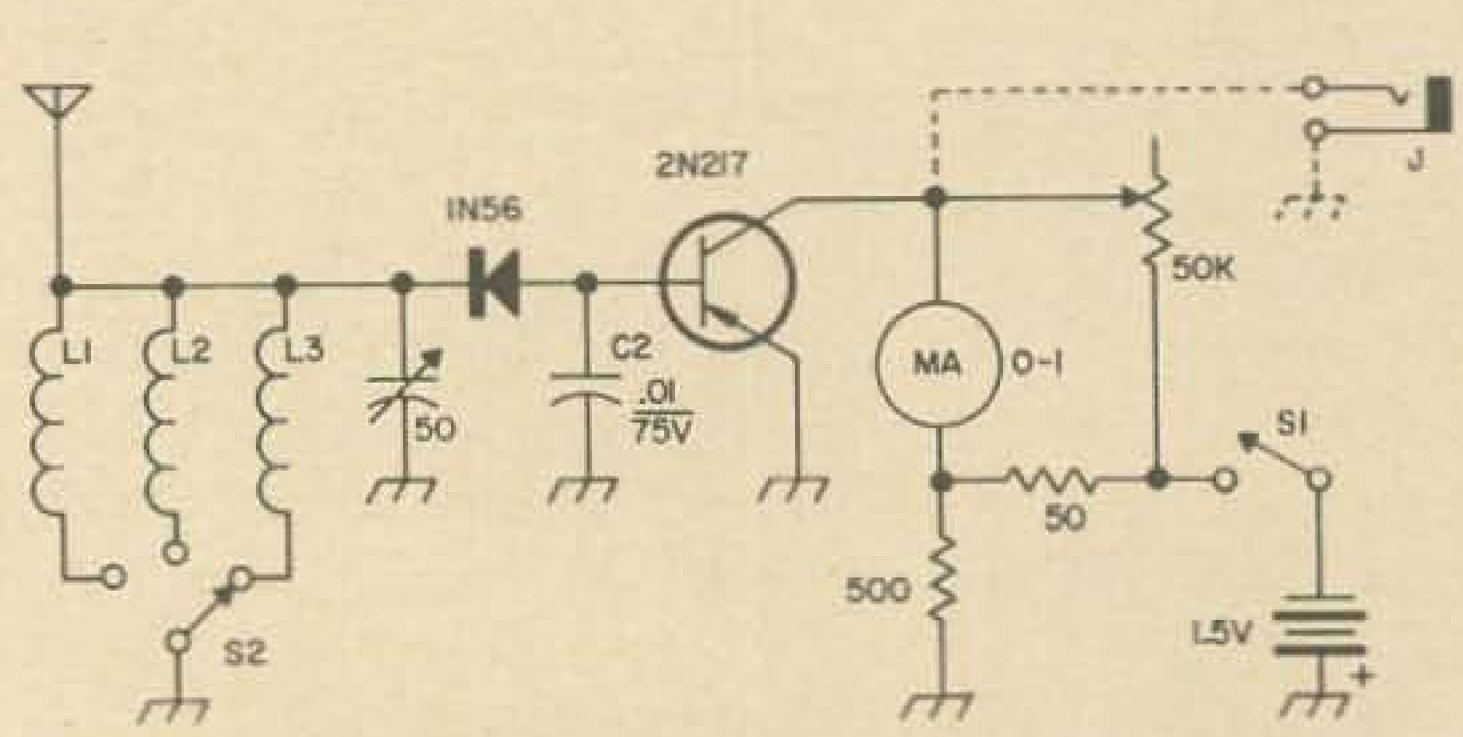
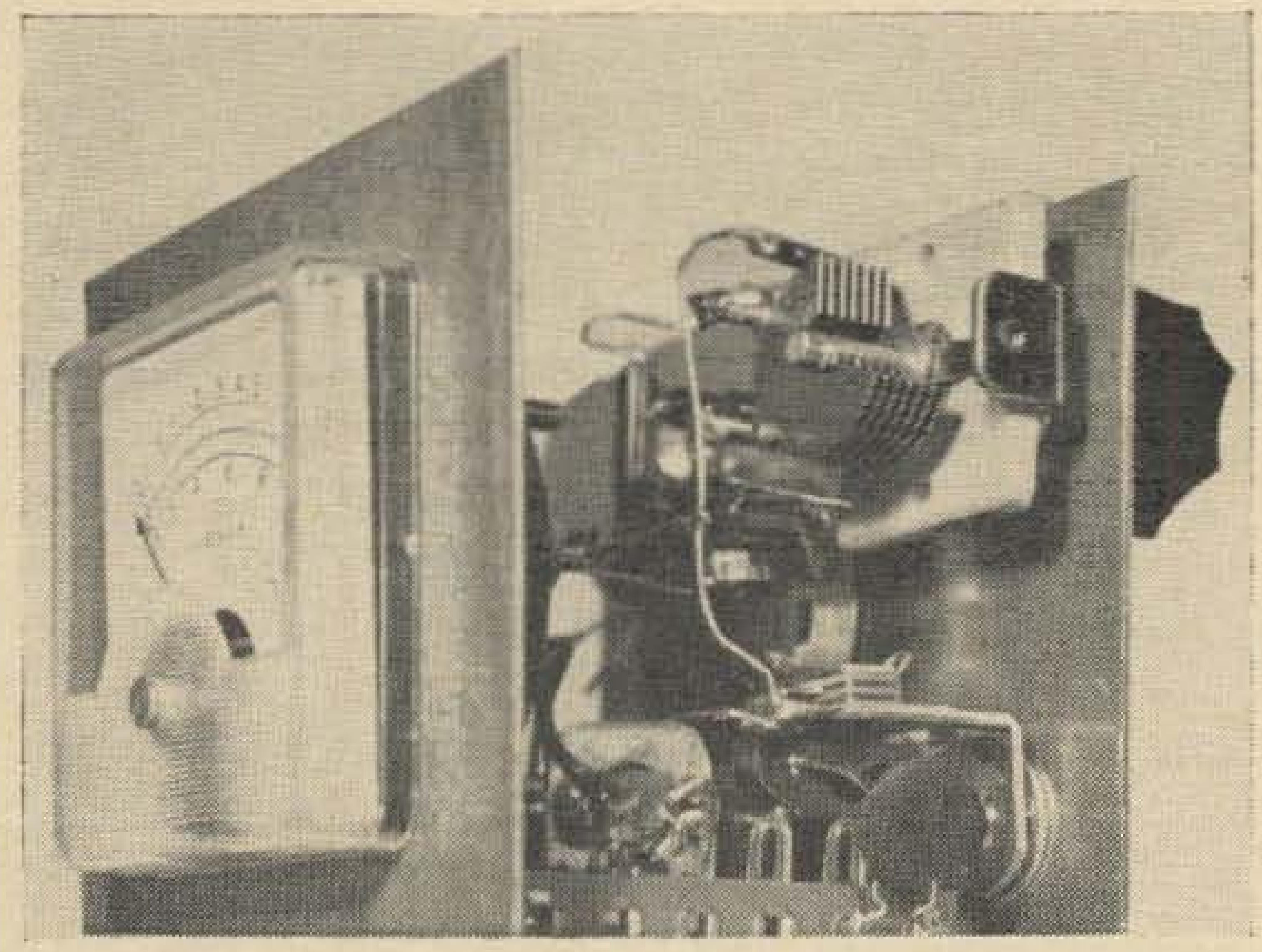


Fig. 1. The bandswitching, transistorized field strength meter for two through twenty meters.



Side view of the FSM.

from the #4580 coil to handle 2 meters. These can all be resonated with a 50 pf midget variable tuning capacitor; a Hammarlund HF-50 or the equivalent is excellent. Any of the small multi-point selector switches can be used for band switching. A JBT lever switch type SS-14-ILS will handle the job or, if you prefer a rotary switch you can use a Mallory type 3215J as I did, leaving two positions unused. (I might want to add a couple of coils and try 40 and 80 later!).

Resistors R-1 and R-2 shown in the schematic, need be only ½ watt. A single flashlight cell will serve for the battery although I chose a 1.4 volt mercury transistor battery to conserve space. Other items shown on the schematic are obvious and all parts are readily available from most electronic parts distributors as well as from the electronic mail order houses.

Build this little F/S meter and know what your VHF outputs are doing. If you want to check your modulation quality, a phone jack may be added as shown, making this little gadget really versatile.

. . . W7OE

Jim Kyle K5JKX

Improve Your Scope

Shielded leads should always be used with an oscilloscope when you're checking high-impedance circuits, since the unshielded variety can easily pick up 60-cycle ac fields which exist in every building wired for power. Yet most inexpensive scopes have no convenient method for attaching shielded leads and maintaining the shielding intact all the way up to the scope itself.

Several writers have suggested replacing the original vertical-input terminals with some type of coax connector or fitting to remedy the situation, but most of these approaches have involved reaming out the connector hole on the front panel or other changes which hurt both the appearance and resale value of the instrument. In addition, most common coax fittings are a bit cumbersome to connect or disconnect.

On the writer's Heath Model OL-11, the problem was solved simply and quickly by the use of a length of Rg-58-A, a UG-88/U BNC fitting on the end of the coax, and a UG-657/U BNC pressurized receptacle at the scope. The UG-657/U is the unusual part of this modification. It mounts in exactly the same hole left when the 5-way connector provided by Heath is removed, with no reaming, drilling, or other troubles.

Since the BNC is a spring-loaded bayonet type fitting, it is actually quicker to connect or disconnect than even conventional test leads. For this reason it is used in much laboratory-type equipment. Appearance of the scope is improved, if anything. Take a look at the photo and judge for yourself.

And if you're thinking, "Gee, that's nice, but it sure must cost," then stop worrying. The 1964 Newark catalog lists the UG-88/U cable fitting at 87¢, and the UG-657/U at $1.30. Thus for just over $2 you can have all the convenience of a lab-type instrument!

P. S.—It works just as well with VTVM's, etc. All the gear here is being converted over to this system, to minimize the number of test leads hanging around the bench!

. . . K5JKX

Ralph Hanna W8QUR

Varactors

A dandy device that came into being with other solid state items is the varactor. This is just what the name implies—a variable capacitor. They are variable by putting a negative voltage on them. Capacitance range is from a few pica farads to several hundred. The present units have the same size and appearance as any other diode such as the 1N295. They are finding very wide use in many applications such as: Remote tuned radio receiver, remote tuned VFO, automatic frequency control in FM receivers, frequency modulators, audio frequency amplifiers, a parametric R-F amplifier at microwave frequencies and as frequency multipliers.

The first practical voltage variable capacitors were two plate devices with a high dielectric layer such as barium titanate. These units would not handle much power, were quite critical to temperature change, and would tend to fatigue when cycled, as with a sweep circuit. These disadvantages slowed the use of this type and tended to discourage use of them even as they became very reliable as they are today.

The modern voltage variable capacitor is a specially processed, tiny P-N junction diode and looks like one. The life is infinite and most of the previous disadvantages have been overcome. The price is quite reasonable. These newer units go under a variety of names depending on the manufacturer. Raytheon has the Varactor, RCA and Bendix also use Varactor, while Crystalonics uses Varactron and Pacific calls them Varicaps.

Hughes has done about as much as anyone and has a line of high "Q" units that range in price from $1.80 to $3.80. Of course, like other semi-conductors, you could pay well over $100 for one.

If you are interested in seeing circuits of actual production items, take a look at the Collins 75S3 receiver where one is used with a potentiometer to control the variable BFO and rock steady it is. Motorola and Heath both use one in the automatic frequency control circuit of their FM sets, and eliminate one tube and the associated circuitry.

. . . W8QUR

Ronald L. Ives

Success with Decals

Decal labels are standard on much commercial, and some amateur, radio equipment. Decals to fill almost any imaginable need are now available from several manufacturers. Application of decals is relatively simple, and results should be good if the manufacturer's instructions are followed carefully. Unhappily, this is not always the case. Trouble is frequently experienced with decals that won't stick, that crinkle, or that peel off a few weeks after application.

Refusal of decals to stick properly to the panel is usually caused by greasiness of the surface. This trouble is most serious with crackle and similar finishes, in which the depressions in the coating collect oil or grease. Water will not wet a greasy surface, so the decal will not stick to it.

Surface grease can be removed from panels easily by use of either carbon tetrachloride or benzene (lighter fluid). Apply this with a cotton swab, rubbing the surface gently at the time. Let it dry before applying the decal. Be sure that the workroom is adequately ventilated—benzene is mildly toxic, carbon tetrachloride is very toxic. Where the panel greasiness is extreme, flood with the solvent, and remove the excess (in which the grease is dissolved) with a blotter.

Decal adhesion is also expedited if the water in which the decal is soaked to loosen the paper backing contains a trace of alcohol, a few drops of almost any detergent, or even a trace of soap.

After the decal is in the desired location on the panel, initial drying can be speeded by removing excess water with a lintless blotter (photographic white blotter is ideal). In damp environments only, final drying can be speeded by use of a hair dryer, at low heat. Do not use a heat gun, as this may crinkle the decal hopelessly, or even blister the panel finish.

Decals are commonly bonded to the panel by dissolving the transparent backing. This is commonly done with lacquer thinner, although one manufacturer (Tekni-Cals) supplies a special solvent for the purpose. As lacquer thinners vary considerably in their properties, this is a step in the right direction. In place of lacquer thinner, a less active solvent is recommended. Rubber cement thinner works very well here, and is both less volatile and less toxic than most lacquer thinners. With this relatively gentle solvent, dry decals will not tend to crinkle, and the panel finish is not likely to be stained or damaged. This same rubber cement thinner is also a good degreaser for panel surfaces. Although flammable (do not spill it on the soldering iron), its fumes are not violently toxic, so that you can use it all day, with reasonably good ventilation, without getting a splitting headache.

Tendency of decals to wear away after a time can be reduced by giving them a protective coating of clear lacquer. Let the decal dry in place for a reasonable time, such as 24 hours, then give it a thin coat of clear Krylon, or a thin coat of clear fingernail polish (such as colorless Cutex). Let this dry hard before handling. This protective coat can be renewed periodically if necessary.

. . . Ives

Fred Blechman K6UGT

The Proxy Patch

"CQ, CQ, CQ Miami, Florida, or vicinity. K6UGT, King Six Ugly Grumpy and Tired, Canoga Park, California, looking for any station within a hundred miles of Miami, Florida. K6UGT tuning for a call. Come in Florida!"

"K6UGT, K6UGT, K6UGT. This is WA4-FVD, in Marathon, Florida. Can I help you? K6UGT, WA4FVD standing by."

"WA4FVD, K6UGT. Thanks for the call. You're booming into Southern California this morning. Handle here is Fred, running a DX-40, plate modulated. How far is Marathon from Miami? I'd like to make a phone call to my mother in Hallandale, just north of Miami. WA4FVD, K6UGT. Go ahead."

"K6UGT, this is WA4FVD. You're 20 over 9, Fred. Handle here is Ron. Golly, I'm pretty far south of Miami—about 100 miles. Can I make a collect call for you? Break."

"Yes, Ron, please do. Only I don't want to run up my mother's phone bill, so let's make this a 'proxy-patch'. Do you know what I mean, Ron? Break."

"Proxy-patch? Never heard of it. You mean phone patch? Go ahead."

"No, Ron. A proxy-patch is something most guys don't realize is available. It's not a piece of equipment—it's a method. This situation is a perfect example. You are able and willing to make the collect call, but I don't want the charges put on their bill; however, I'm perfectly willing to have the charges put on *my* phone bill! So do this, Ron. Dial 'Operator' and tell her you want to call Miami collect, but you want it charged to a California telephone number. My mother's name is Dee, her number is 305-923-5774; my number, to which all charges should be billed, is 212-346-7024 in Canoga Park, California. The operator will probably call me here to verify that I'll accept the charges. Got that, Ron? WA4FVD, K6UGT standing by."

"K6UGT, WA4FVD. Wow, Fred, that sounds wild. It's a new one on me. Let's give it a try. Hang on while I dial the Operator . . ."

Well, dear reader, contact was made in less than a minute! I've tried this several times, and it doesn't shake up the operators at all. Apparently it is an accepted procedure, though unknown to most people. For cross-country amateur radio telephone calls it's just great! No longer do you have to hit the location you're seeking on the nose. If you're calling a friend and don't want him stuck with the collect charges from a nearby (but not local) ham, have the station place the call through the operator and charge it to *your* phone. Similarly, if you hear a station calling an area toll-distance from you, suggest that you place a proxy-patch collect call charged to *his* phone. The toll charges, of course, are computed only between the parties actually on the phone. Don't get worried if the charge acceptance isn't made at the time of the call—if the lines are busy, the operator will verify sometime later.

Proxy-patching should increase the use of selective, purposeful calls on the ham bands . . . and will also make the phone companies a little richer from the tolls on calls that might not otherwise be placed!

. . . K6UGT

Ronald Ives

Diode Center Taps

Some years before most of us were born, an unknown genius found that a single-ended coil could be made to drive a push pull circuit (rather inefficiently) by use of a resistive center tap, as in Fig. 1. Drive applied to the load (here shown as a tube grid) was slightly less than half of the full coil voltage if the load drew no current, and very much less than half of the coil voltage if current was drawn.

If our load is designed for class B operation, so that only one half cycle is used by each half of the load, the same single-ended coil can be center-tapped by means of a pair of diodes, as in Fig. 2, applying substantially the full coil voltage, during the pertinent half cycle, to the load. Because of the high conductance of modern diodes, current drawn by the load has little effect on the applied voltage, and the diode center tap does not act as a "Q killer", so that this method can be used with peaked and tuned circuits.

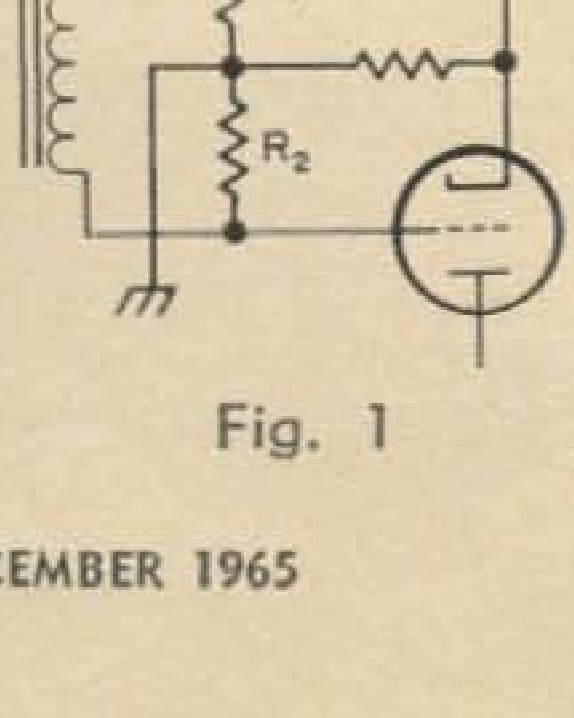


Fig. 1

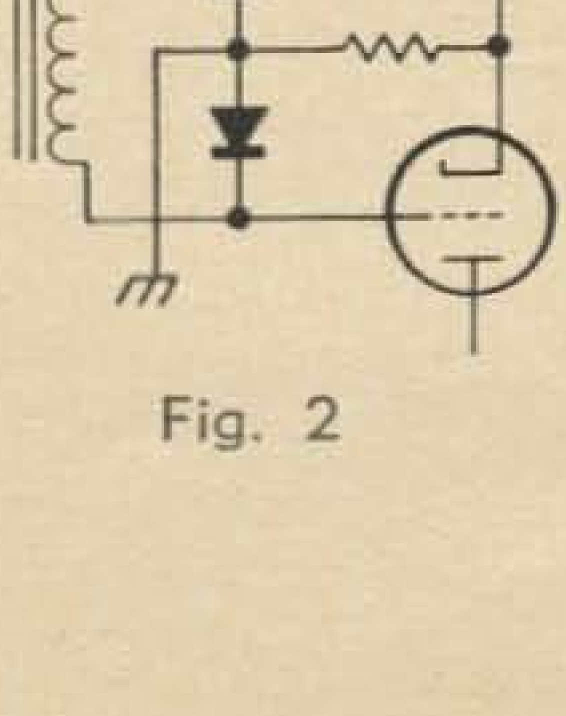


Fig. 2

This substantial immunity to current drain makes this type of center tap ideal for use with transistor circuits, as in Fig. 3. Here, also, the diode center tap prevents the negative half wave from putting too great a reverse bias on the base of the transistor, a "sticky" problem with some center-tapped transformers and some silicon transistors.

By replacing the conventional diodes with Zener diodes, the forward drive can be limited to the Zener rating of the diodes, as in Fig. 4, so that the transistor base is protected against over-volting in both directions.

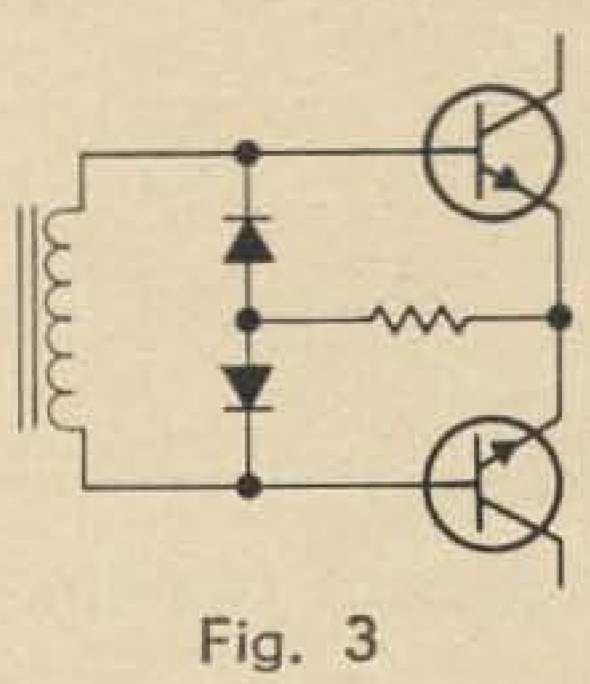


Fig. 3

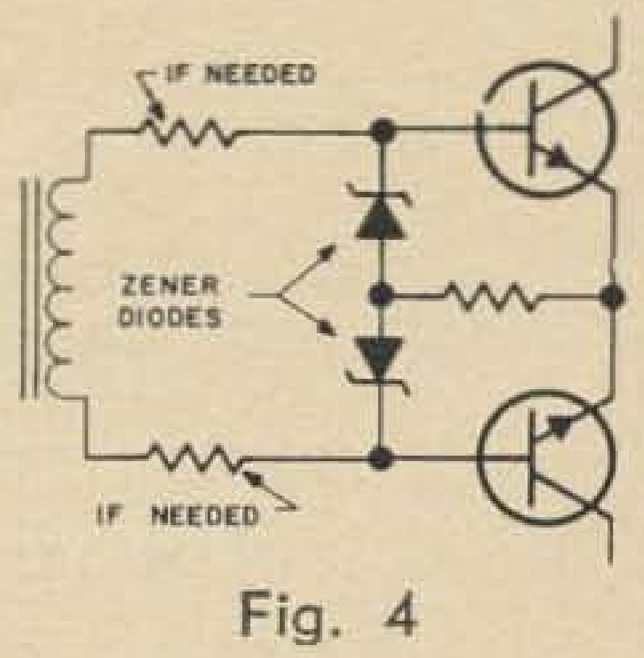


Fig. 4

All of these diode center taps seem to work as well in practice as they do on paper, and the Zener center tap (Fig. 4) has some very definite possibilities as a volume compressor, in addition to its merits as a transistor base protector.

. . . Ives

HI FELLOWS

A special opportunity to help make our new opening as festive an occasion for my many New England Ham friends is possible. The Hammarlund Company have provided me with a particularly good deal on 60 pieces of the HQ-105 transceiver. This in reality is an HQ-100A receiver and a 2-tube transmitter.

HQ105TR

540KC-30MC

$169.95

EXPRESS PREPAID IN CONTINENTAL USA

Each unit is factory fresh, having been received on October 26th, in original, sealed cartons, complete with instruction manuals, and bears the 100% warranty of both the factory and my own service department. The receiver is very well built, has that solid feel, is velvet-like in its tuning, and has the combination of controls which provides the operator with flexibility and convenience to meet his normal short wave or Ham requirements. The HQ-105 (HQ-100A) covers the range of 540 KC to 30 MC in 4 bands with calibrated band spread for 80, 40, 20, 15, and 10. You can easily judge your frequency to within 5 KC on 80 meters for example and within 10 KC on 15. The audio frequency output of this receiver is somewhat unusual in that it employs variable negative feedback so arranged that on weak signals additional selectivity is provided in the audio circuit —in other words, slightly more signal to noise ratio. Another advantage of this negative feedback is the virtual elimination of speaker "hangover." This receiver does have a beat frequency oscillator, completely variable, plus or minus 3 KC. It employs modern components and a total of 10 tubes as well as the transmitting section which uses the 6CX8 as the overtone oscillator RF amplifier. The sensitivity of the receiver is such that 1.75 microvolts produces a 10 to 1 signal to noise ratio. The HQ-105 has a Q multiplier which is very effective in providing variable selectivity especially with today's crowded bands. The S meter is calibrated up to 40 over S-9 in 6DB steps. The noise limiter is the series type which muffles against spark plug type impulse noise.

If you have a friend who wants to break into Ham radio or is interested in good short wave reception at a modest price here is the best opportunity I know of to get a high quality American made product at a reasonable price.

The transmitting portion is of course suitable, and was intended, for CB, but it might likewise be used with an appropriate crystal for operation on the 10-meter amateur band. Obviously the normal CB limit of 5 watts input can be increased for Ham purposes slightly, and this should enable many of you to work crosstown on 10 on local nets, or with luck and a good antenna to work across the pond.

I will sell to the first 60 customers this normal $219.50 item for $169.95 express prepaid to your door. This is even less than the regular price on the HQ-100A itself. Trade-ins accepted of course.

3500 additional square feet of merchandising space is now available for the display of all amateur products and normal accessories, conveniently located in central Massachusetts. Even if you can't use this attractive value yourself, why not stop in and see our facilities and try out the gear of your choice.

HERBERT W. GORDON CO.

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Harvey Pierce WØOPA

Added Utility for the HO-13

The Heathkit HO-13 Ham Scan panoramic adaptor is a very handy piece of equipment for the ham station, but it seemed a shame that such a nice 'scope should serve no useful purpose while transmitting. Examination of the circuit showed one of the vertical deflection plates was used only for positioning the trace. Not only that, but it was unbypassed, isolated by a 47K resistor! Why not feed some transmitter rf to this plate as was done in my Simplescope?

But the vertical trace sould have to be disabled, to avoid the stray receiver pickup interfering with the transmitter pattern. A further study of the diagram showed the most likely way to do this would be to open the cathode circuit of V4, the 6EW6 last *if* tube.

The adaptation to a transmitter monitor was easy and inexpensive. Two phono jacks were added to the rear panel and labeled CONTROL and ANTENNA. At the socket of V4 the 68 ohm cathode resistor (R41) and the .01 mf capacitor (C40) were ungrounded and their ground leads separated. The capacitor was regrounded and the resistor lead was connected to the control jack by a length of shielded wire. Things are crowded around V4, be careful to avoid shorts.

One lead of a 100 pf ceramic capcitor was soldered to pin 9 of the 3RP1 CRT socket (the one with the 47K resistor connected to it). The other lead was run through the grommet with the other wires and connected to the antenna jack.

A cord and phono plug connect the control jack with a set of relay contacts that are normally closed when receiving and open when transmitting. A shorted plug can be provided for this jack to restore the Ham Scan to normal operation. Any antenna, probe, or rf pickup that will produce a ¾ inch wide pattern of transmitter rf can be plugged into the antenna jack.

The sweep frequency of the Ham Scan is so low that the audio frequency waves are too crowded for really accurate analysis, but modulation percentage, hum, noise, and feedback are easily seen. The band scanner action is unchanged. While this adaption is for am primarily, it will also give useful wave-shape information for ssb and even cw.

If you did too good a job, per original directions, of wiring R41 and C40 together, it might be easier to replace them than separate them. Also, mounting the phono jacks on the rear panel is easier if the astigmatism control is unfastened and moved aside temporarily.

Why not make your HO-13 do double duty? It isn't hard to have a transmitter monitor too.

. . . WØOPA

Stanley Zuchora W8QKU

Pauper's Portable Power Pack

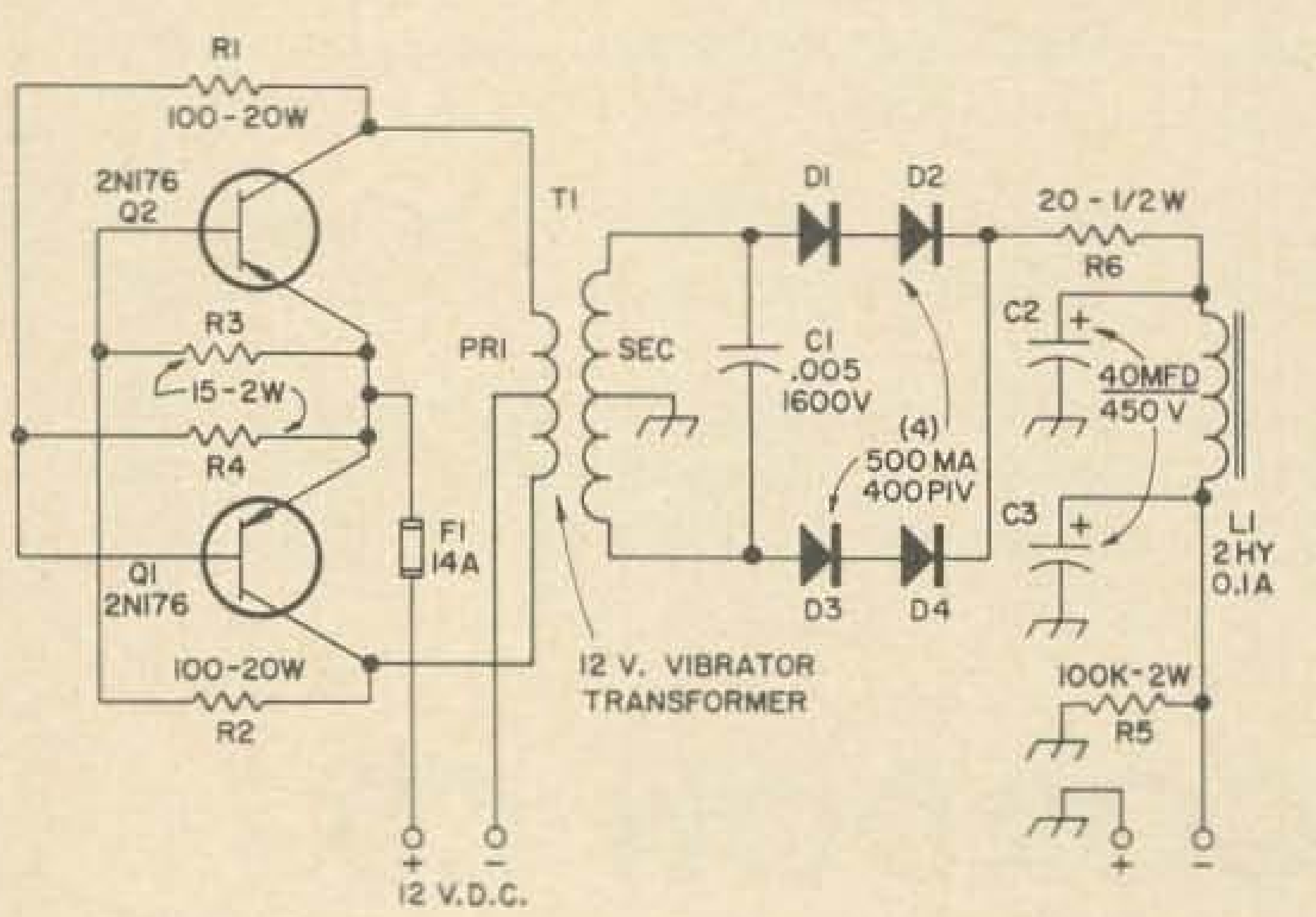


Fig. 1. Schematic of the Pauper's Portable Power Pack.

I suppose that we've all needed a small mobile power supply at some time or another. I decided to build one and checked prices. Ouch. The special power transformers and power transistors looked a bit too steep for me, so I reluctantly decided to by-pass the project for a while. Then I had an idea and started experimenting. The result was this simple project that uses a discarded 12 volt vibrator transformer from an old car radio and some cheap transistors from Poly-Paks (two for a dollar.) Other PNP transistors that have been used with good results are the 2N234A, 2N256, 2N441, 2N442 and many others. Since the supply is low power, there is no need for a fancy heat sink. Just mount the transistors on the case about three inches apart and use insulating kits or mica washers under them. The transistors switch (oscillate) at about 100 to 120 cycles, perfect for this type of supply. Don't overload the transistors. I've built a number of these supplies and they've all been useful and have stood up well.

. . . W8QKU

George Hunt W4NUT

The Super HX 20

After some revamping of the Heath HX-20, I have been able to get a full 115 watts of rf into the antenna. For those of you interested here is the easy conversion.

Parts Needed

1 blower, Burstine-Applebee catalog number 4A83	$ 6.99
1 ceramic loctal socket from "TAB" N.Y.C.	.50
1 Octal male plug	.70
2-200 ohm 2 watt resistors, carbon	.36
14 inches #18 plastic covered wire	
1 .01 mfd discap small	.15
1 .001 mfd discap small	.15
1 4X150 or 4CX250 Surplus Bill Slep Co	8.00
	$16.85

Assuming you have the HX-20 built and working, before removing from the cabinet, carefully determine the center of the 6146, this is from the top, and is best done with a toothpick carefully inserted through the vent holes, mark the center thus found on the top of the cabinet. This will be the blower position and is the only alteration to the cabinet of the HX-20. Remove unit from case, remove the 6146 and plate cap. Turn HX-20 over and find resistor R75 (100 ohm ½ watt) remove and replace with the two 200 ohm 2 watters (parallel for 100 ohms 4 watts). Lift wire at junction of R81 and R82, string a new piece of #18 plastic covered connecting pin 5 of PL (unused pin on male power plug back of unit) and the other end connect to the wire end lifted from junction R81, 82. This will be your final screen supply from external power supply. Now, by using the male octal plug and the ceramic loctal socket, and by wiring these together an adapter for 4X150 to 6146 will be made. By following these steps you will come up with a bug free unit. You will note built in rf eliminators. Keep the leads short and direct. Connect as follows.

Loctal Socket		Octal Plug (male)
Pin. 1	connect to	Pin. 3
2		2
3		2
4		4
6		6
7		7
8		1
Center		5
1 .01 mfd		1
7 .001 mfd		6

By compressing this assembly down to 1¼″ overall height (base to top excluding pins) and then filling with "epoxy" putty and shaping, and holding the 1¼ inch height, when the 4X150 is added, the added overall height equals the height of a 6146 this is important. At the point marked on the outside cabinet cut a 1¼ inch hole and mount the blower. If your center is right the blower will be directly over and within ½ inch of the 4X150 radiators. Slip a 4-40 × 1¼″ bolt through the radiator, use a solder lug on the top and a nut on the bottom to hold in place, this will be the plate connection. Solder the plate lead to lug after 4X150 and adapter are in place. Insulate the partition nearest the tube; plain insulating tape will do. This will prevent accidental grounding of tube. Assemble and put back into cabinet. The power supply should be able to furnish 1000-1200 volts at 250 ma, 300 volts regulated to pin 5 of P1, screen supply, 110 ac for blower and you are ready to tune exactly as you did for the 6146. You will be able to load to 240 ma and get 115 watts out with approximately 250 watts in.

To go back to mobile operation just remove 4X150, insert 6146 and operate with your mobile power supply. Do not use the 4X150 without the blower. Worried about that hole? Don't. A new case can be bought from Heath for about $4.50. Or you can use a snap in plug to fill it in. . . . W4NUT

Murray Baird W6LWE
1231 Tenth St.,
Manhattan Beach, Calif.

The Full Wave Tripler Myth

Recently the need arose for a good husky voltage tripler power supply—one that would deliver power to a pair of television sweep tubes operating as a linear amplifier. In reviewing the learned writings of the various authorities the article in June 1961 issue of "73" came under scrutiny. Gad, how I would like that day to live over! Included in the article was a "Full Wave Tripler" circuit claiming all sorts of advantages over the conventional half-wave lashup. For those miserable souls who had their Sept. 1961 issue thrown out with that stock of newspapers lying around the house, the circuit is reproduced in Fig. 1. If you're smart you will immediately clip it out and throw it away. It's as phony as the proverbial four-foot yardstick.

To get back to the sad story, I pondered the glib explanation of how the thing worked both as a bridge rectifier and a full-wave doubler, the voltages thus produced adding to supply triple output. It seemed the perfect answer, so ignoring the small voice of common sense, it was breadboarded and fired up. Instead of the expected 450 volts, a disappointing 300 volts appeared. Check the circuit, the diodes, the capacitors, still only 300 volts. One whole evening wasted monkeying with the thing, plus half the night pondering the unhappy situation. I re-read the blasted article a half dozen times on the assumption that old "never-say-die" Green must have slipped it in as a joke. But no, he sounds serious and you get the idea that it's really supposed to work.

The next step was a fast letter to the editor. The not-so-fast reply was to the effect that there was no mistake—it was supposed to triple—and out of umpteen thousand readers I was the only one with the temerity to question the authenticity of it all.

More pondering. It looked as though I was worse off than at the beginning. I still needed a good husky voltage tripler and now I had to prove that 73 Magazine had slipped its trolley for once. After dissecting their ill-begotten circuit to see what actually happens during each half-cycle of input voltage it came out looking like Fig. 2.

In Fig. 2A input terminal 1 is positive, terminal 2 is negative. The current path is through diode D1, through capacitor C1, and finally through the 5 ohm resistor to the positive terminal. The current charges C1 to about 150 volts. Notice that no current flows through diode D4 since no potential difference exists across it. In other words, capacitor C2 is not charged during this half-cycle, only C1.

On the alternate half-cycle things are reversed. Current flows through C2 and D2, while D3 sits idly by. C2 charges to about 150 volts and the D-C output is the addition

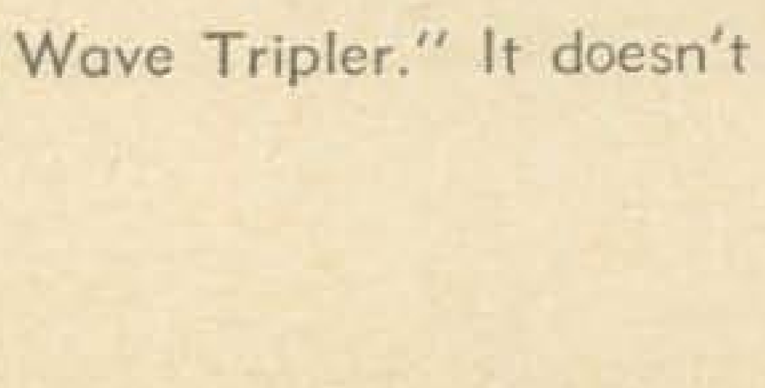


Fig. 1. "Full Wave Tripler." It doesn't work.

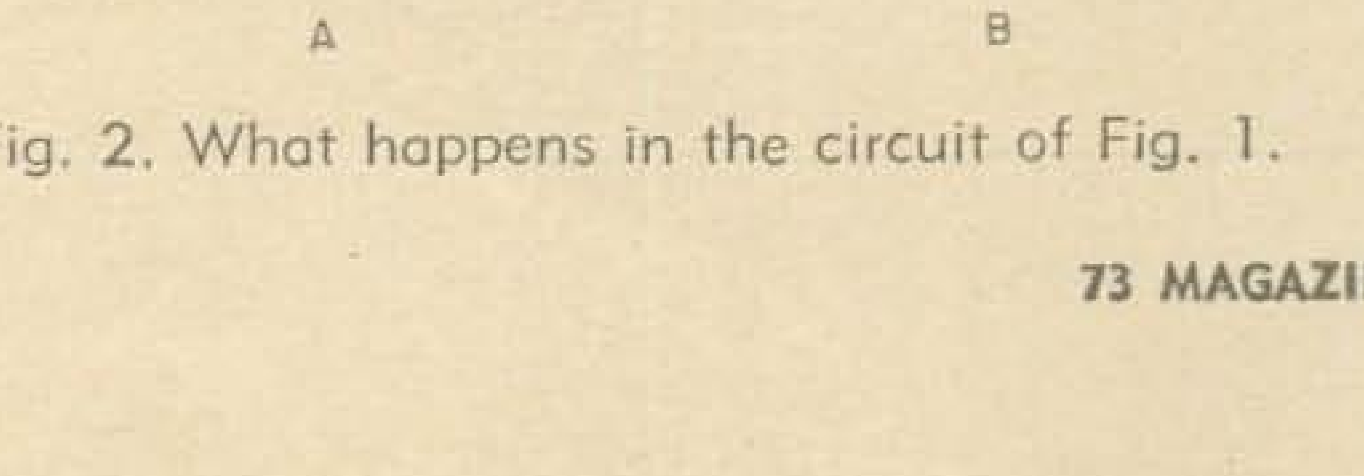


Fig. 2. What happens in the circuit of Fig. 1.

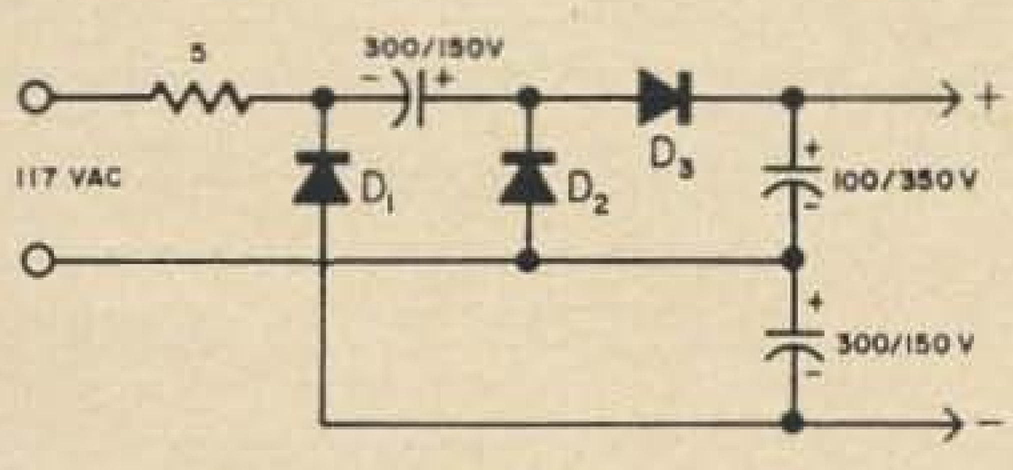


Fig. 3. Good tripler circuit.

of the charges on C1 and C2, around 300 volts. Removing D3 and D4 from the circuit neither helps or hurts matters; they were just sitting there doing nothing in the first place. So much for the full-wave tripler myth.

Actually the article was a good thing; it stimulated some thought on the subject. A couple of hours doodling produced the circuit in Fig. 3. If we are thinking in terms of full and half-wave triplers, I guess this one would be called a ¾ wave tripler. During one half cycle C1 and C3 charge; C2 charges during the alternate half cycle. It represents a substantial improvement over the conventional half-wave device. Since none of the capacitors are charged to the full output voltage, a higher capacity, lower voltage capacitor can be used, thus improving the regulation while still maintaining the same overall size. There is both 60 and 120 cycle ripple present in the output but they tend to cancel so that overall ripple voltage is substantially lower. In all fairness, it has the same drawback as all the full-wave types—both sides of the 117 volt a-c line are floating with respect to the rectified output.

With the values shown in figure 3, output voltage under load comes out as:

No load	520 volts
100 MA	490 volts
135 MA	480 volts
220 MA	460 volts

. . . W6LWE

John S. Campbell WA6RCY

How to Get "Tight"

During the construction of my latest linear amplifier attempt, I had occasion to require an electrically "tight" compartment that also was air "tight."

I was using a 4-400A with a tuned grid and did not have the wherewithall to purchase the fancy Eimac Air Socket, so I got a 5 pin septar socket and proceeded to utilize a separate chassis for the necessary aforementioned compartment. Although I had scrounged some finger stock from a piece of surplus, it didn't seal the pressure off.

Then I remembered that a while back, I had done some printed circuit work and had a bottle of *General Cement's* "Copper Print" kicking around the shack. The stuff comes in liquid form and is easily brushed on. It dries in about an hour to a highly conductive coating that will seal little cracks and openings, found in most manufactured chassis. By sealing these openings, the compartment is also physically sealed. (Don't forget to secure the compartment with screws, or rivets, the stuff isn't epoxy glue!)

With reasonable proximity of mating surfaces, a compartment may hold 25-40 psi (depending upon volume) and be electrically "tight," using the copper print. For VHF work, the silver print would be better, though quite a bit more expensive than the copper and it might not make any significant difference.

. . . WA6RCY

Ronald Lumachi WB2CQM

Systematic Antenna Tuning

Antenna tuning reduces itself to the adjustment of such variable factors as gamma match, director-reflector length and spacing. Each adjustment in a parasitic array not only affects the variable being adjusted, but as a consequence materially alters the reflected electrical characteristics of the companion units. Obviously a detailed schedule of adjustments should be adopted. To satisfy this need, and in order to relieve the burden of at least one variable, the tuning of the antenna should be accomplished using the radiating system in its receiving capacity. Consequently, it was assumed, although arguable, that an antenna tuned for maximum gain should provide the most efficient radiation. Employing this method eliminates constant transmitter retuning with each change in the antenna.

A typical arrangement for tuning would include the erection of an exciting dipole cut to the exact half-wave at a desired frequency. The half-wave antenna should be "fed" by a low power transmitter (10-50 watts) and placed as near the antenna as possible. This will insure that radiation will not be sampled from an overly long coupling line. The height of the exciting array should be placed a reasonable distance from ground potential and the parasitic array raised to a level horizontal with the exciting antenna. A spacing of at least two wavelengths should be maintained to prevent interaction from stray fields.

A VTVM of high input impedance should be coupled to the antenna through a short length of co-ax line. The meter can be strapped to the mast and relative changes viewed as adjustments are made. A high ohms-per-volt ratio unit is necessary and somewhat superior to a sensitive field intensity meter because of the minimum loading characteristics on the circuit being measured. The meter does not require any calibration since relative power maximum deflection is the norm.

With the antenna immersed in a fixed field of radiation, the driven element is the first variable adjusted. In the event a matching unit is employed, it can be simultaneously adjusted with the electrical length of the driven element for maximum meter deflection. Adjustment should then proceed to the director element nearest the driven element, again striving for maximum rf pickup. In the event the array has additional directors, altering should proceed outward from the reference (driven element) until the aggregate nets a maximum indication of induced voltage. Rotation of the array 180 degrees from the exciting source will allow reflector change for a minimum meter deflection. Additional fine-tuning will usually increase the relative sensitivity of the system.

Though this is not by any means the last word in scientific beam tuning, it will undoubtedly give you better results than you could possibly expect with a hastily erected beam tuned just by manufacturers measurements. Beams react to their environment and no two are placed in exactly the same circumstances, which means that you'll get improvement if you tune it up. Tune.

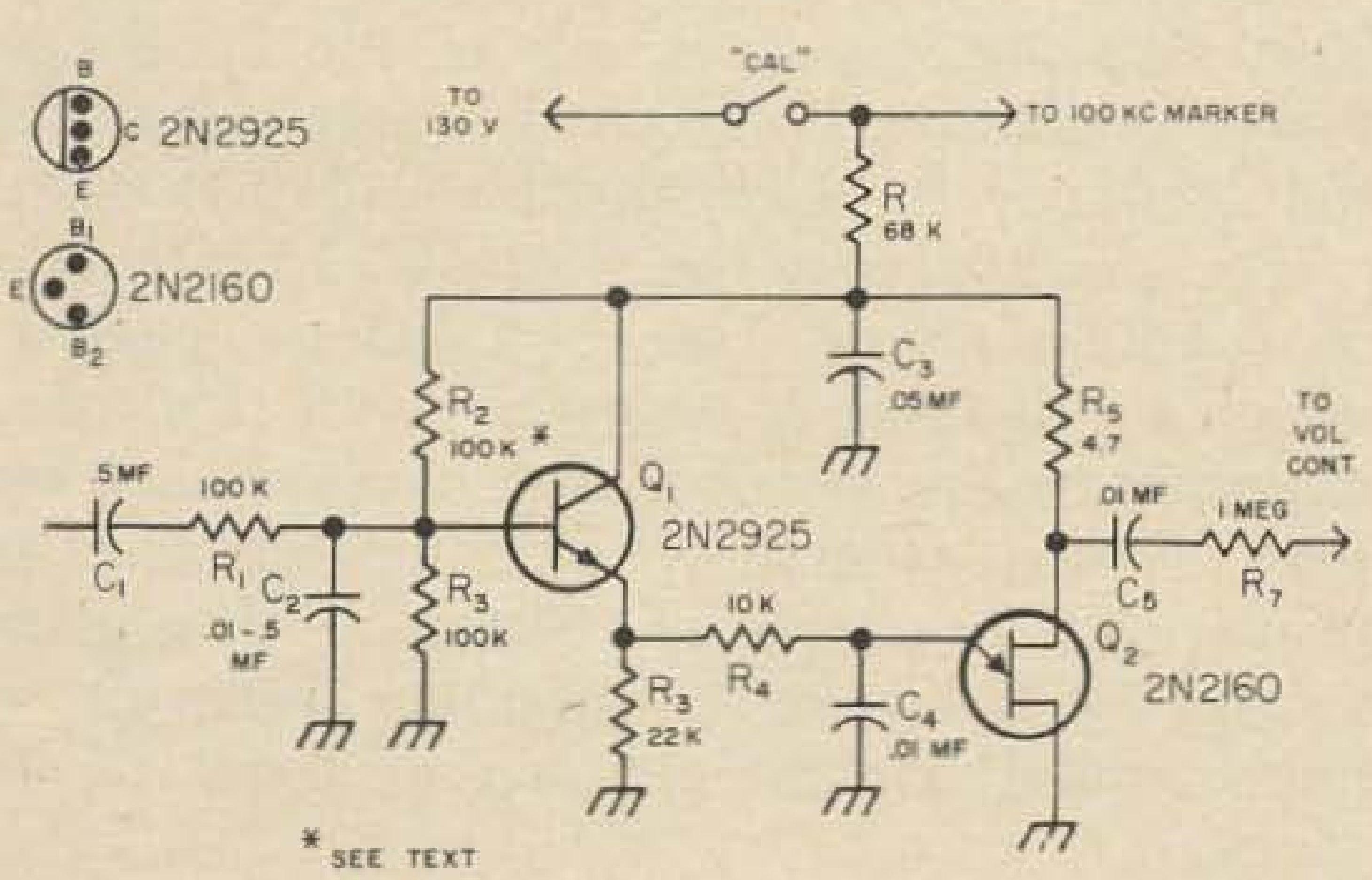
. . . WB2CQM

Tom Lamb K8ERV

The Zerobeater

Most modern receivers have a 100 kc standard. Most modern receivers have poor low-frequency response. Most modern ears are even worse. These make accurate zero beating nearly impossible. The Zerobeater comes to the rescue!

The Zerobeater is an audio oscillator whose pitch is varied by the sub-audible frequencies near zero beat. It's slowly wavering note is quite easy to hear and permits very accurate zeroing between any two frequencies you want to compare. It was designed for the Drake 2A, but should work with any receiver.



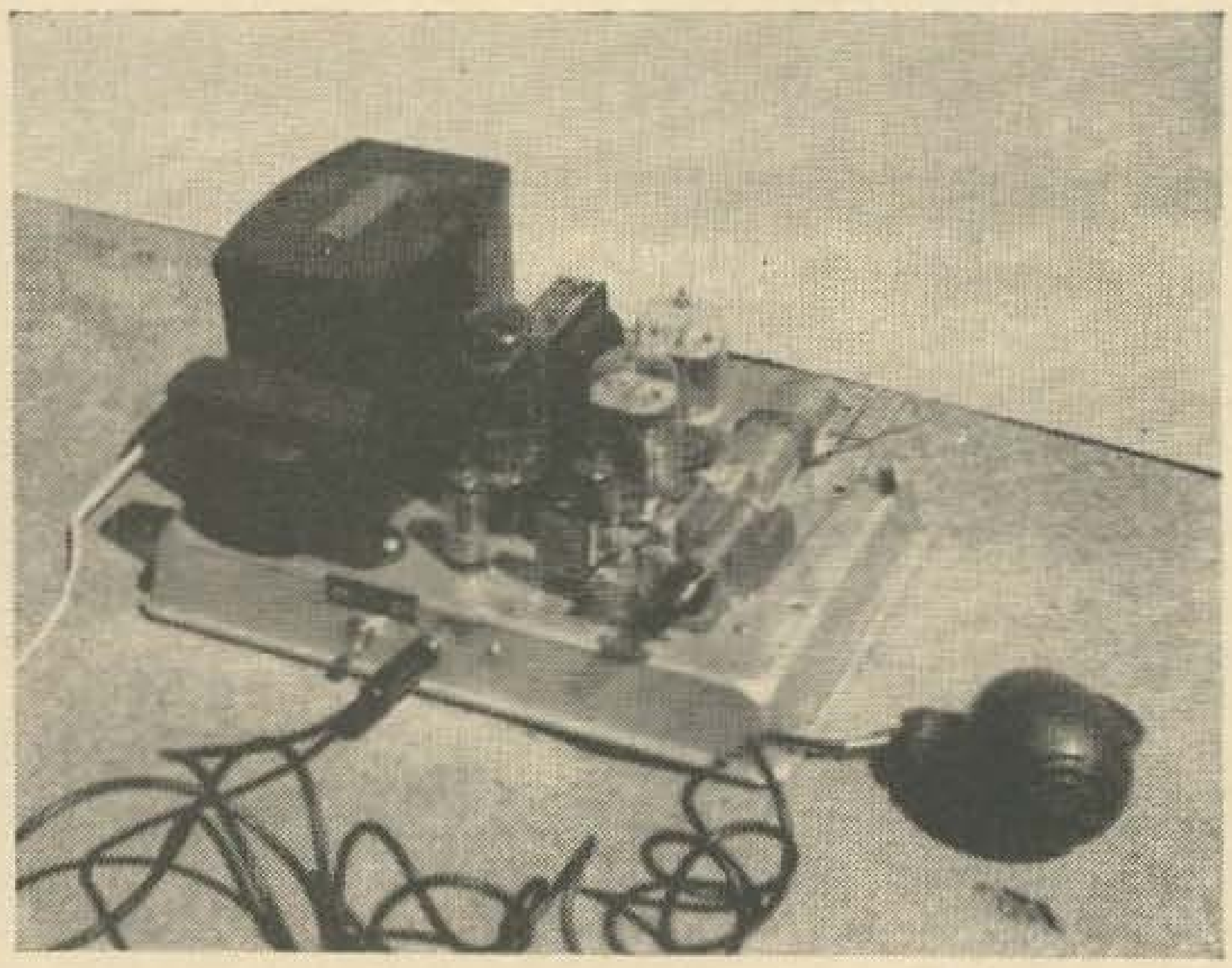
Q2 is a unijunction relaxation oscillator which generates a convenient "carrier" tone. The frequency depends on the voltage at the base of Q1. R2 is selected to give about a 1kc note with no input, and will vary with your particular 2N2160.

The input is connected to the plate of the product detector to pick up the sub-audible beat notes. These are coupled through C1 which is large enough to pass frequencies below 1 cps. C2 prevents pitch variation for beats above about 20 cycles for smoother operation, but can be reduced to a carrier filter of .01 for economy if desired.

The "Cal" switch is convenient to turn the device on in the Drake. To operate, turn on the calibrator, the product detector, the BFO, and the Zerobeater. Approach one of the check points. As your beat note becomes too low to hear, you will hear the Zerobeater pitch wavering, and can follow it to exact zero beat.

This precise beating system is quite a help when setting the marker or other frequencies against WWV, or when making accurate measurements with a 10kc marker.

. . . K8ERV



R. E. Baird W7CSD
3740 Summers Lane
Klamath Falls, Oregon

A Low Power Standby Transmitter

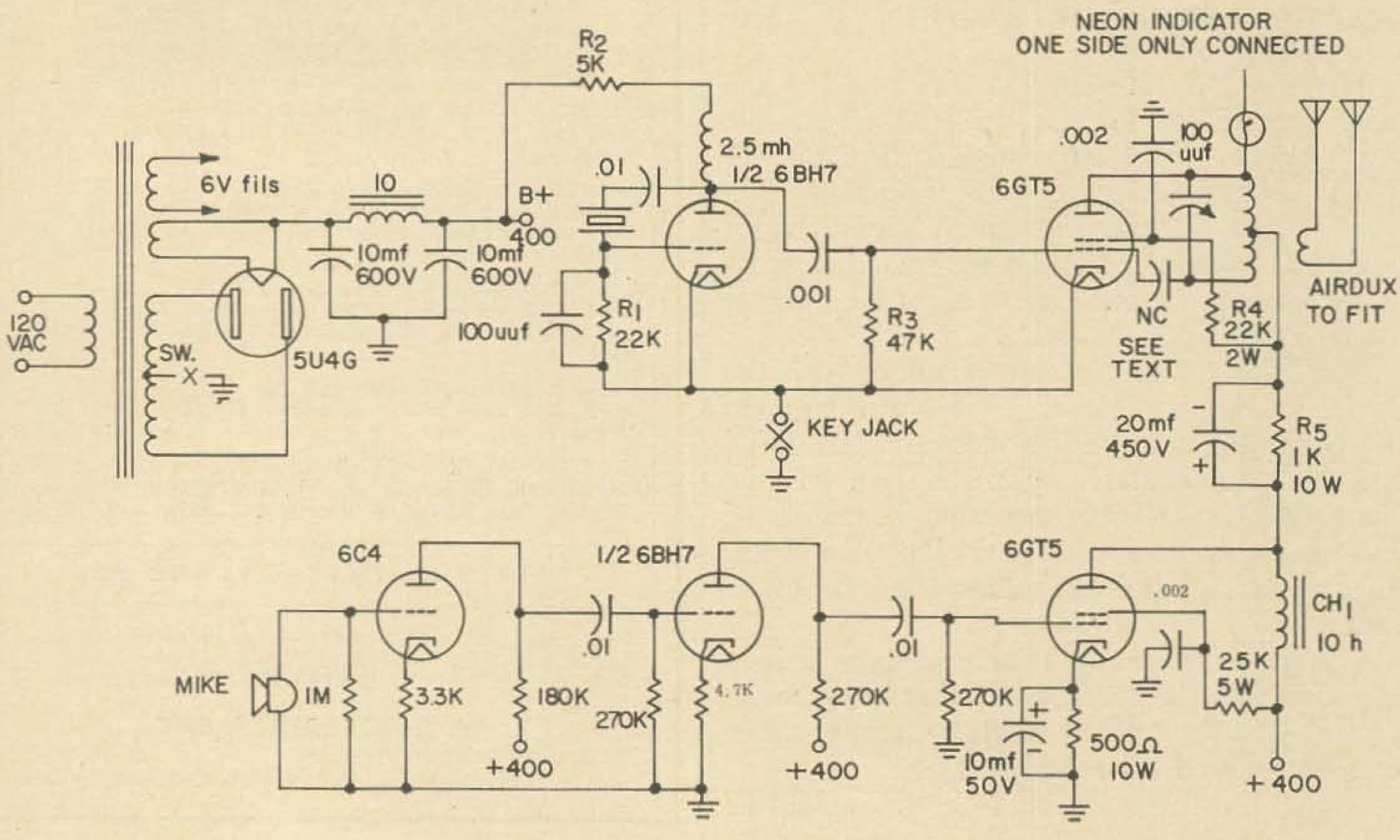
It's always nice to have a small rig that will go on the air at a moment's notice if the big rig conks out, or if you want to make major changes and still have something that will get on the air in the meantime.

We started out to see what the Novar 6GT5 would do, and evolved the following. The chassis is a 49c aluminum cake tin which we pretty well jamb packed. The power supply is a standard 400 vdc at about 200 ma built on one end. The on-off switch merely turns the "B" supply on and off ahead of the filter.

In order to conserve space and circuitry the oscillator is a Pierce which works equally well on both 40 and 80 meters (with the right crystal in the socket). It was found that by placing the 100 mmfd capacitor across R_1 the rf output of the oscillator is about doubled. This does not appear in any of the handbook Pierce oscillators. R_2 drops the plate voltage of the oscillator to between 250 and 300 volts.

The amplifier uses the Novar 6GT5 tube in a conventional circuit. The neutralizing capacitor, which by the way is necessary with this tube, is simply two pieces of plastic covered hook-up wire twisted together until neutralizing is proper (just a couple of twists). With a plate voltage of 300 volts the amplifier leads into a link coupled doublet antenna to about 65 or 70 ma.

The Heising modulator consists of a second 6GT5 operating at 400 volts and about 80 ma. This seems like too much for the rated plate dissipation, but no sign of color was observed.



It will modulate the rf amplifier right out to 100% on both peaks. The speech driver is the other half of the 6BH7 oscillator tube and the first stage is a 6C4. This arrangement with the mike used was just about right without any volume control. If a weaker mike were used, the cathode resistors on the first two stages of speech could be by-passed to bring the gain up. There is a key jack on the rear of the chassis for CW purposes. The modulator is left connected when on CW just to act as a load on the power supply when the key is up. Additional power could be obtained by installing a switch to short out the Heising resistor R_5 when on CW. This might be desirable if the transmitter is for novice use or if much CW operation is expected on the part of a General license holder.

Operation: Many hams would take a dim view of a 20 watt phone rig; however, if it is well modulated it will get out surprisingly well. From the W7CSD location we have worked everything from San Diego to Vancouver, B. C. in one afternoon on 40 meter phone with 100% QSOs for the most part. People don't understand how 20 watts can get out so well. It's mainly because they haven't tried.

. . . W7CSD

Paul Stecher

A Note on the 73¢ Noise Clipper

This efficient circuit, described on page 36 of the June 1962 issue of 73 Magazine, works best when feeding into a high impedance sound reproducer, such as crystal headphones. For this purpose it can be built right into the phone plug. Unlike the TNS or other noise limiters, it works on SSB, DSB, NFM or what have you, as well as on AM, since the clipping occurs in the audio stage and is not dependent upon AGC or carrier action.

As is, our audio clipper will not work effectively with a speaker because of the low impedance of the voice coil winding. If you want to use this clipper with a speaker, do not throw away the miniature autotransformer you find in the box of the surplus MC-385. Connect this impedance-matching transformer between clipper and speaker, and the clipping action becomes apparent at once. There is no noticeable insertion loss. If you do not have an MC-385, you can use to advantage the surplus headphone-impedance-matching transformer C-410 which is part of the CD-604 cord and plug assembly. If you do not know which way is the low impedance end of the transformer, measure the dc resistance at each pair of terminals, using an ohmmeter. The low ohm terminal pair goes to the speaker. For this particular type of transformer, the dc resistance multiplied by 1.5 gives the approximate impedance at 1,000 cycles.

I am using this clipper on my 75S3 with most gratifying results. The clipper is connected to the antivox terminals (a 500 ohm audio output) and the C-410 is connected between clipper and speaker. When connected in this manner, the speaker is not muted when the headphones are connected to the receiver through the regular phone jack. In this case no separate clipper is needed for the phones, since the noise limiting action is extended throughout the audio circuit of the receiver.

Try this useful device. What can you lose? A few cents and an hour of constructive building. We don't build enough anymore, and you know it. Besides, you will not interefer with the wiring and circuitry of your precious receiver. In a New York apartment house, this gadget far outperforms the Collins 136B-2 noise blanker. Using the TAB silicon diodes specified in the original article, I experienced no degeneration at the audio frequencies and no mushiness, as is the case when the TNS limiter is advanced to a similar clipping level where the big elevator sparks produce but a gentle plop.

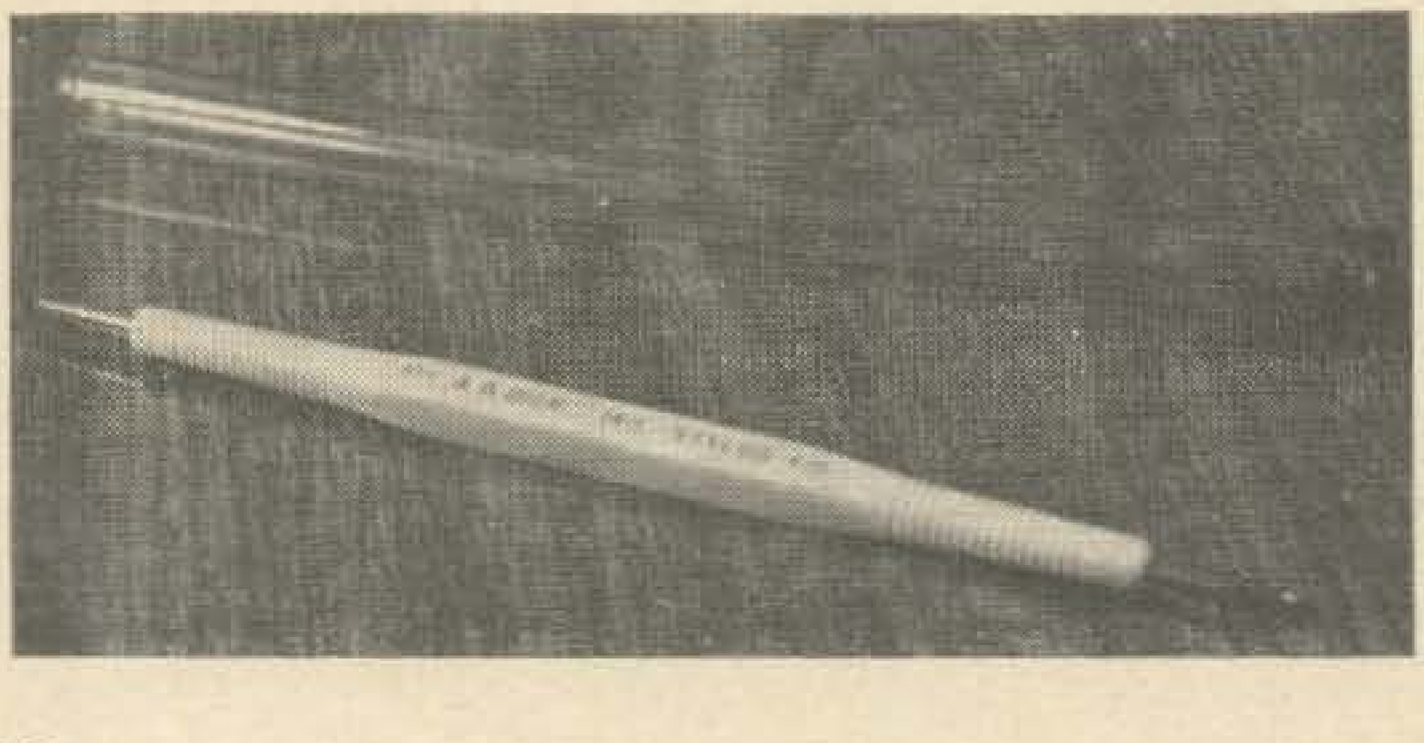
. . . Stecher

William C. Lewis WØCGO

Another Gimmick

Once you start to construct your own equipment it doesn't take long until you begin to collect a strange assortment of what you call your favorite tools. These are the gimmicks that are just right for that tough job in the far dark corner of that crowded chassis. The latest addition to my toolbox in this category is one which I borrowed from my secretary.

At this point the YL and XYL readers probably think that I'll admit to the use of a hairpin, but not a chance. The "tool" in question is a stylus commonly used for making diagrams on mimeograph stencils. I imagine that there are other manufacturers of these things, but the one I use is made by the A. B. Dick Co. #1411.



This stylus had a plastic shank and plated steel tips on either end. These tips are bent at a perfect angle for circuit work. One tip is larger than the other which is a handy feature when space is a problem. Magnetizing the tips will allow you to carry small items of hardware into far corners of a crowded chassis and the plating keeps the tip from becoming an integral part of a soldered connection.

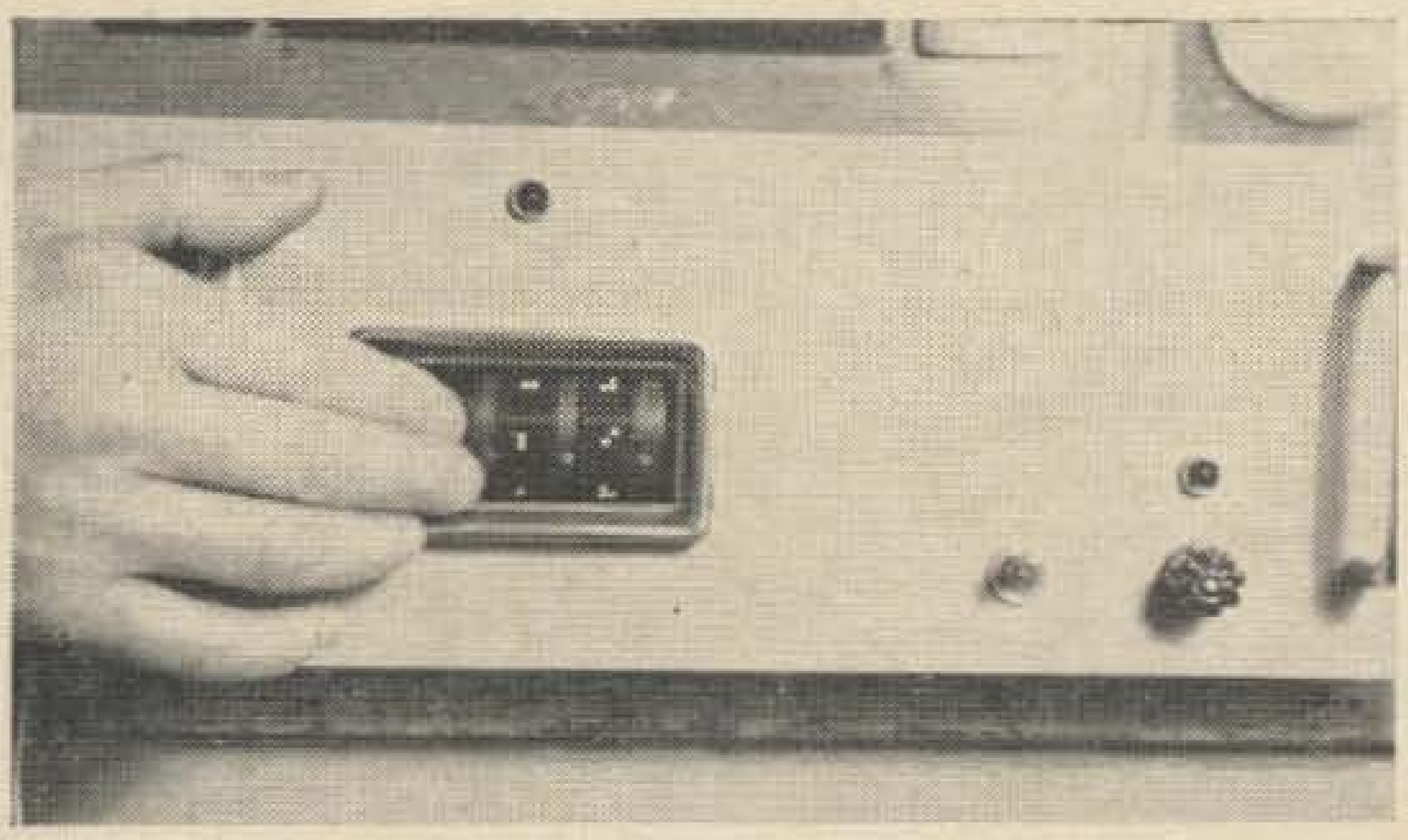
There are a variety of tip configurations available in this type of stylus, some more practical for electronic work than others. Although this aid is a little more expensive than the average soldering aid, the discriminating amateur who builds his own gear will find it a finer and more versatile tool than the average soldering aid.

. . . WØCGQ

"Tut" Tuttle WA6LUM

Metering with Braille

Blindness has not been an obstacle in the electronic career of Buddy Alvernaz W6DMN-AF6DMN. Buddy, an active Ham for many years, is continually "improving the breed". His interests range through the RTTY, FM, VHF and Hi-fi Audio. He has several patents to his credit. One of the main stumbling blocks to the totally blind technician is the problem of accurately reading meters. As a professional musician, Buddy has an extremely well developed sense of pitch, and for some years has used a transistorized audio tone comparison type meter with good accuracy.



Recently, with the assistance of Paul Barton W6JAT-AF6JAT, Buddy has developed a Braille meter that he is using with great success. This meter, a Hycon 615AR, was obtained through the Air Force Mars Program, in which AF6DMN has been active for several years. The instrument is a display type, involving motor driven drums. The conversion involved removing the glass bezel over the numerical display and applying appropriate Braille Symbols. The Braille Symbols were embossed on Dymo Tapewriter tape, using a Braille Writing Machine, and they stand out beautifully on the plastic tape. They were carefully located to correspond exactly with the original numbers. As Buddy is extremely competent in Braille he has no difficulty in reading the meter with absolute accuracy, and it is in constant use.

. . . WA6LUM

Ralph Hanna W8QUR

Pi Networks

The pi network has derived its name from its appearance in a schematic diagram which is quite similar to the symbol for pi that is used in mathematic computation relating to the circle and sphere.

This network is a very versatile thing, being used for high pass filters, low pass filters, antenna couplers, output circuits on transmitters and input from other stages in both transmitters and receivers.

One of the most common pi sections is one that many of us do not recognize as a low pass filter. This is the condenser input, choke and condenser that is used in most power supplies. In this case, the low frequency we want to pass is the pure DC and the unwanted portion is the 60 cycle and 120 cycle ripple.

The high pass filter used on TV sets is a multisection pi filter and so is the low pass filter used in the antenna lead of a transmitter to eliminate TVI. The difference between the two is that one has condensers in the run and coils in the legs. The other one is just the opposite. How can you remember which one is high pass or which one is low pass? In the previous paragraph the power supply was cited as an example of a low pass filter. This is one filter all of us know about and know that the condensers go from the high side to ground and the choke or resistor is in the run. Therefore, it is evident that the condensers are in the legs on a low pass filter and in the run on a high pass filter.

The most popular of all pi networks is the output circuit of a transmitter. This method has many advantages; the most important one is that the output of almost any transmitter can be matched to almost any antenna. This does not mean that because there is a good match that you will get out real good; it goes without saying that a resonant antenna is the very best. Another advantage is the reduction of harmonics, but don't let this give you a feeling of false security because the point of maximum harmonic suppression is not always the point of maximum loading. If in doubt always tune a bit to the higher capacity side of the point of maximum output. Tune the receiver to a harmonic and watch the "S" meter as you tune.

The big disadvantage of this system is the low efficiency. It is not possible to run more than 50% efficiency and it tends to be more like 30%. Other methods of feeding the antenna will result in efficiencies of as high as 65% to 70%. . . . W8QUR

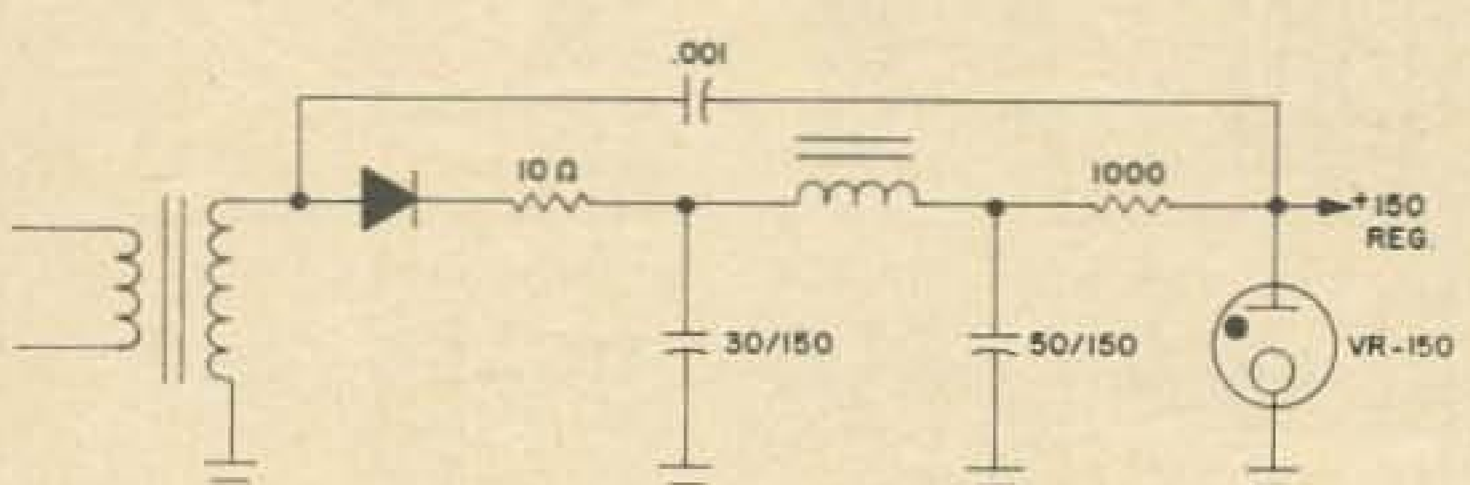
Jim Kyle K5JKX

Keeping a VR Tube Lit

The ordinary half-wave rectifier circuit, operating from either a TV booster transformer or a reversed filament transformer, is one of the most popular ways of providing approximately 150 volts for powering small station accessories.

However, such a simple supply offers some problems when you want to regulate the supply with a VR tube, because the supply itself often provides very little more than 150 volts, and can't keep a VR-150 lit under any sort of load at all.

One additional 15-cent component, though, will solve the problem neatly. It's a low-value capacitor (anything from .001 to .01 mfd, depending on what's available) from the top of the VR tube to the hot side of the transformer.



The capacitor couples the ac from the transformer directly to the tube, but the low value of the capacitor keeps ac current flow low. On peaks, the instantaneous ac voltage exceeds 160 volts, which is plenty to keep the tube lit. At the same time, the VR tube itself has such a low impedance to ac that no hum or ripple appears across the output.

Thus the instantaneous voltage across the VR tube can rise to 160 every 1/60 of a second, so if the tube goes out due to too much voltage drop in its dropping resistor it will be relit 1/60 of a second later—or as soon as the overload is removed.

This trick has been used to regulate a 155-volt supply to 150, dropping only 5 volts in the regulating resistor, with no ill effects.

. . . K5JKX

Clean That Bug

To keep that bug or straight key in good working shape, its keying contacts should be kept clean. Relay cleaning tape, type K. S. 6528 is available from Hope Webbing Co., Inc. New York, Providence. R. I. and Chicago, Ill. or can be gotten from electrical and electronics places that deal with relays and Teletype.

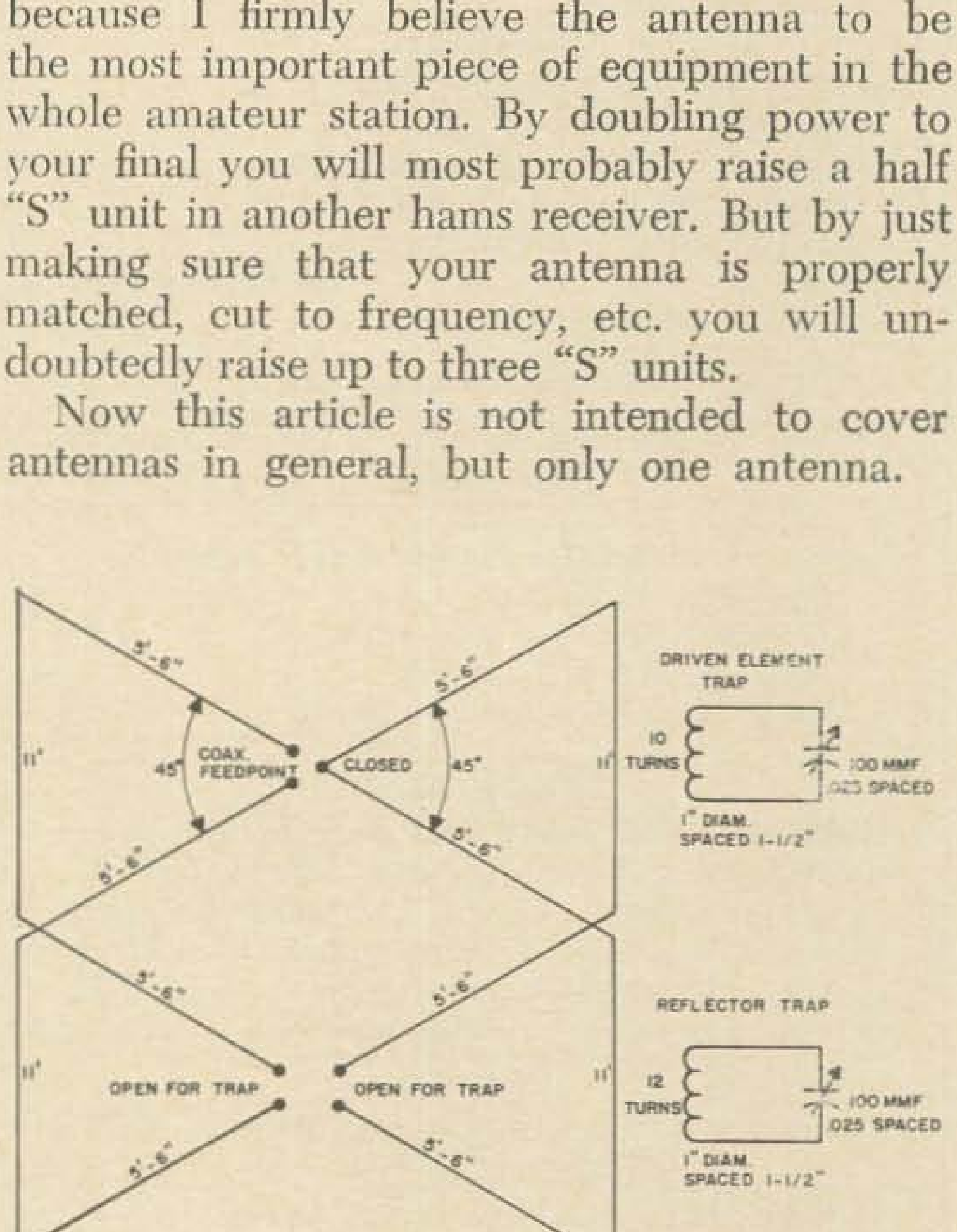
Every so often a clean tape is run between the keying contacts with the keying contacts closed once the tape is put between the contacts. Pulling on the tape will really clean those dirty contacts. Pull again with another clean tape if the first one gets dirty to make sure the contacts are good and clean. This takes about half a minute. A package of relay cleaning tape will last for years and of course the tape comes in handily for cleaning contacts on RTTY keyboards, TD's relays and so on. . . . K4GRY

Ben Bresler ZS3NZ
P.O. Box 486
Otjiwarongo, South West Africa

The Three-in-one Birdcage Beam Antenna

I have been building, testing, trying and what not most all kinds of antennas, simply because I firmly believe the antenna to be the most important piece of equipment in the whole amateur station. By doubling power to your final you will most probably raise a half "S" unit in another hams receiver. But by just making sure that your antenna is properly matched, cut to frequency, etc. you will undoubtedly raise up to three "S" units.

Now this article is not intended to cover antennas in general, but only one antenna.



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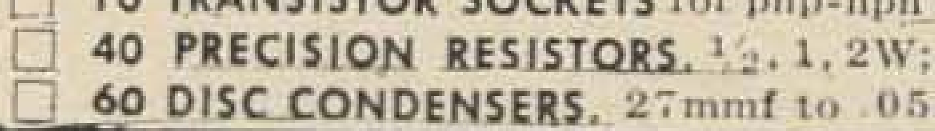

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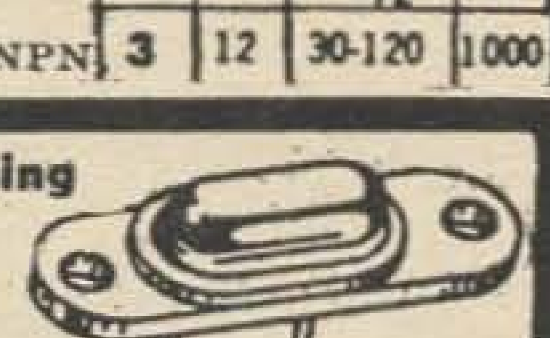

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How to get on three bands at low cost where space is restricted is what I would like to call OM Bird G4ZU's bird cage antenna. This antenna is by now well known to most hams so I will not go into the theory of the 10 db claim by OM Bird. I have not heard of the antenna being described as a tri-bander before so I hope this will be of some use to build it yourself ham fraternity.

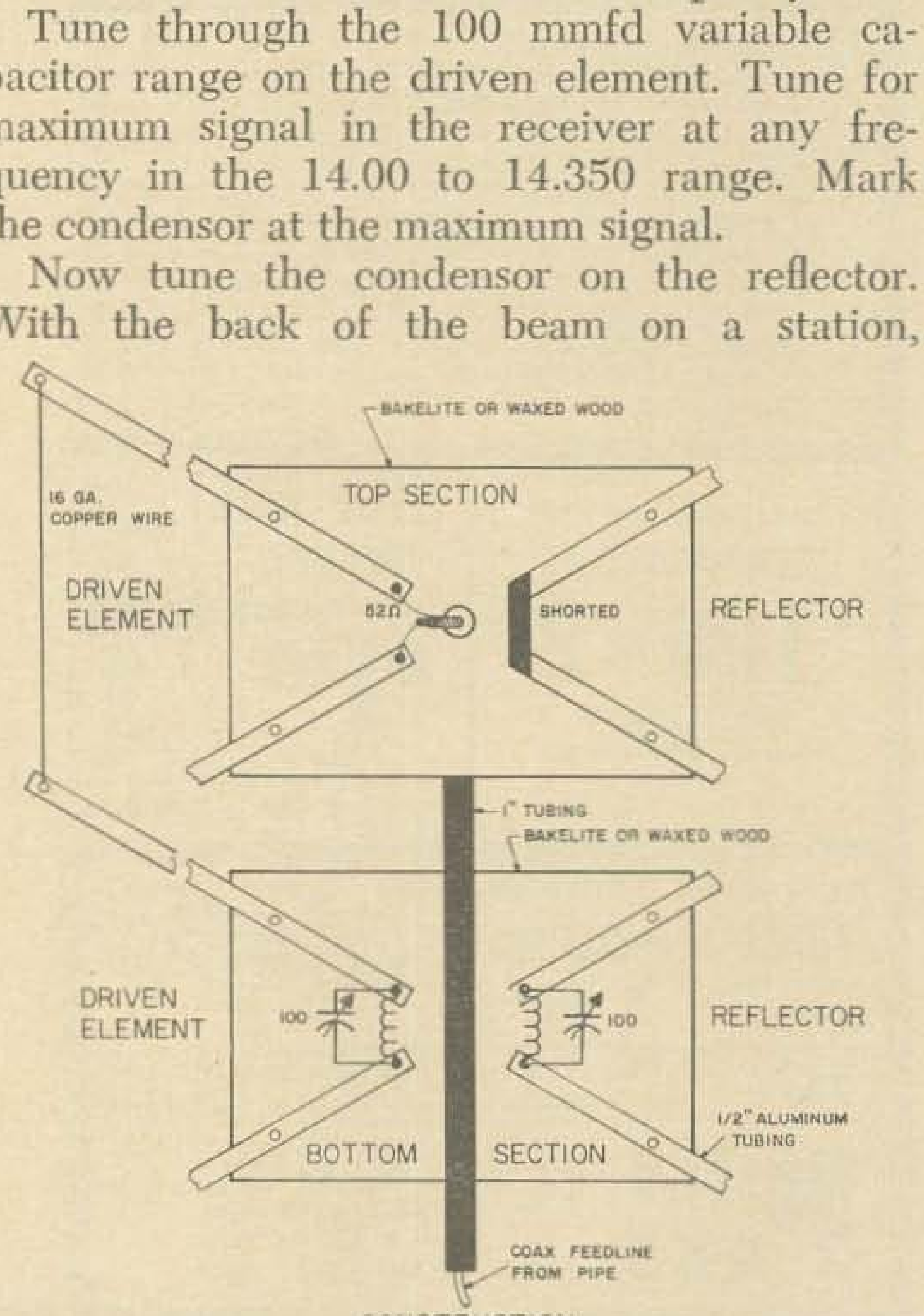
I started off by building the 15 metre bird cage described and like most fellows who have built bird cage antennas found that the measurements are too short. This did not stop me and I loaded the driven element and reflector with stubs. Reports on 15 meters was very, to say in the least, satisfactory. That was in 1962. This year the 15 metre band became a very dead band. So where to now? 20? Yes, 20 metres was decided on and the three in one antenna was born.

I did not want to take down the 15 m bird cage. I converted the bird cage so that it will be easy to go back to 15 metres any time.

The stubs were replaced with coils. Condensors (variable) were added across the coils. With the condensors placed at minimum capacity the coils were pruned to resonate the driven element at 21.200 mc. The reflector coil was cut for minimum signal off the back of the beam. This was done with the variable condensors in circuit at minimum capacity.

Tune through the 100 mmfd variable capacitor range on the driven element. Tune for maximum signal in the receiver at any frequency in the 14.00 to 14.350 range. Mark the condensor at the maximum signal.

Now tune the condensor on the reflector. With the back of the beam on a station,



CONSTRUCTION

tune for minimum signal. This will be found to be very sharp and slow tuning through the range is advised. With these settings for twenty the bird cage is also resonant on ten. Don't believe me? Take readings with a grid dipper.

It was not my aim to resonate the antenna on 10 metres, and I was quite surprised to find that it worked very well on ten compared to a four element 10 metre beam. As it is now you have a 20 & 10 metre beam. By running up the mast or switching arrangement the capacitors are nulled. And you are on 15 metres.

Reports have been very satisfactory on all three bands on phone with 40 watts input to the Tx final on AM & SSB.

It is advised that for higher power the coils and condensors are made larger to cope with the rf power.

The 52 ohm coax feedline is run through the pipe mast and is connected at the top of the antenna, so that all tuned circuits will be mounted at the bottom.

This antenna is well worth the low cost, time and space saving. The antenna is mounted on a ten foot tower placed on top of the roof (house).

. . . ZS3NZ

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

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

1. DATE OF FILING: September 10, 1965
2. TITLE OF PUBLICATION: 73
3. FREQUENCY OF ISSUE: Twelve times per year
4. LOCATION OF KNOWN OFFICE OF PUBLICATION *(Street, city, county, state, zip code)*: 73 Pine street, Peterborough, Hillsboro, New Hampshire 03458
5. LOCATION OF THE HEADQUARTERS OR GENERAL BUSINESS OFFICES OF THE PUBLISHERS *(Not printers)*: Peterborough, New Hampshire
6. NAMES AND ADDRESSES OF PUBLISHER, EDITOR, AND MANAGING EDITOR

PUBLISHER *(Name and address)*: Wayne Green, Peterborough, N.H.

EDITOR *(Name and address)*: Wayne Green, Peterborough, N.H.

MANAGING EDITOR *(Name and address)*: none

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

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

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

NAME	ADDRESS
none	

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

10. THIS ITEM MUST BE COMPLETED FOR ALL PUBLICATIONS EXCEPT THOSE WHICH DO NOT CARRY ADVERTISING OTHER THAN THE PUBLISHER'S OWN AND WHICH ARE NAMED IN SECTIONS 132.231, 132.232, AND 132.233, POSTAL MANUAL *(Sections 4355a, 4355b, and 4356 of Title 39, United States Code)*

	AVERAGE NO. COPIES EACH ISSUE DURING PRECEDING 12 MONTHS	SINGLE ISSUE NEAREST TO FILING DATE
A. TOTAL NO. COPIES PRINTED *(Net Press Run)*	44,597	46,000
B. PAID CIRCULATION 1. SALES THROUGH DEALERS AND CARRIERS, STREET VENDORS AND COUNTER SALES		
2. MAIL SUBSCRIPTIONS	42,652	44,370
C. TOTAL PAID CIRCULATION	42,652	44,370
D. FREE DISTRIBUTION *(including samples)* BY MAIL, CARRIER OR OTHER MEANS	150	150
E. TOTAL DISTRIBUTION *(Sum of C and D)*	42,802	44,520
F. OFFICE USE, LEFT-OVER, UNACCOUNTED, SPOILED AFTER PRINTING	1,795	1,480
G. TOTAL *(Sum of E & F—should equal net press run shown in A)*	44,597	46,000

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

POD Form 3526 Jan. 1963

(Continued from page 4)

Buyer beware

A reader wrote in recently to complain that he had been badly stung by a 73 advertiser. I explained to him that I had cancelled the ads for this company a year and a half ago when they first started giving trouble. I try to keep in touch with what is happening and I think you'll find that 73 is by far the most careful of the companies it permits to advertise in its pages. With but few exceptions all of the reputable companies are advertising in 73.

DX-200 and DX-300

In this day and age when an active amateur can work one hundred countries in a few days and two hundred without severe effort, something more than DXCC is desirable. The Radio Club of Venezuela has come up with certificates for 200 and 300 countries. For full information on these certificates you might drop a letter to Comision De DX, P. O. Box 2285, Caracas, Venezuela.

Shucks, it only took me two weeks on twenty sideband with the little time I have available to knock off my first one hundred. I'm up to 150 now. If I could only get a bit more time for operating . . .

Contest?

While many of us are enjoying several of our bands, there are others who have settled rather permanently on just one band. I'd like to see some articles pointing up the joys of operating on our different bands written by experienced ops. Tell you what . . . we'll pay $50 each for articles that we accept for publication on "My Favorite Band."

ARRL Elections

Those of you who do not read the minutes of the yearly Directors meetings may not have much of an idea about which directors are interested in helping ham radio and which are there for the prestige of the office. Without going into excruciating detail, let me encapsulate it:

Moss and Spencer have shown time and time again that they are working for amateur radio. Indications are that HQ in Newington will leave no stone unturned to get these fellows out . . . they ask questions about those mysterious expenditures. On the other hand, if you vote for Crossley, Cartwright, Engwicht or Denniston you deserve every thing that happens to you. Perhaps you like head-bobbing yes men?

Rotary award

ROAR, Rotarians of Amateur Radio, have a DX rag chewing award that might interest you. You have to have 100 international contacts, each lasting at least 15 minutes on phone or 30 minutes on CW, to get the award. For full info on this free award drop a line to W4RLS, Box 26, Russellville, Alabama 35653.

Still looking

We're still looking for an advertising salesman for 73. This is a difficult job for it requires a background as a ham and as a salesman. The salary is good, consisting of a fixed salary plus a generous commission. The work is demanding . . . a good salesman should never permit a customer to say no. Peterborough is great for living. If you are interested please let me know about your ham background and details of your sales training and experience.

. . . *Wayne*

advised by my lawyers that
don't you ever proofread y
are a bunch of crooks and
Letters
th... for
have no other recourse but
should be tarred and feath

Friend of the Wayfarers:

Although a newcomer to your subscription rolls may I add my "Amens" to your editorials and policy.

Wandering in a daze in the electronic forest, I find little that I can understand in *QST*. But I have been able to get a great deal out of *73*. Almost every month I find something I would like to build. I can understand what it's all about and usually fits my purse.

Keep up the good work.

Ed Staffan WA8AOD
Midland, Ohio

Dear Wayne:

Congratulations on producing such a good magazine every month: I've seen about eight ham magazines and *73* is way ahead—I guess it's probably the best available! None of this "who worked—who" DX columns and splitting up articles like Brand X does! Sure, they have about one good article a month but at a buck a toss, it's too much. Congratulations to Jim Kyle on his article on screen modulation. Keep *73* like it is!

Peter Chadwick G3RZP
Chelmsford, England

P.S. How do you stop people pinching your copy of *73* before you've read it yourself? That doesn't happen with a Brand X!

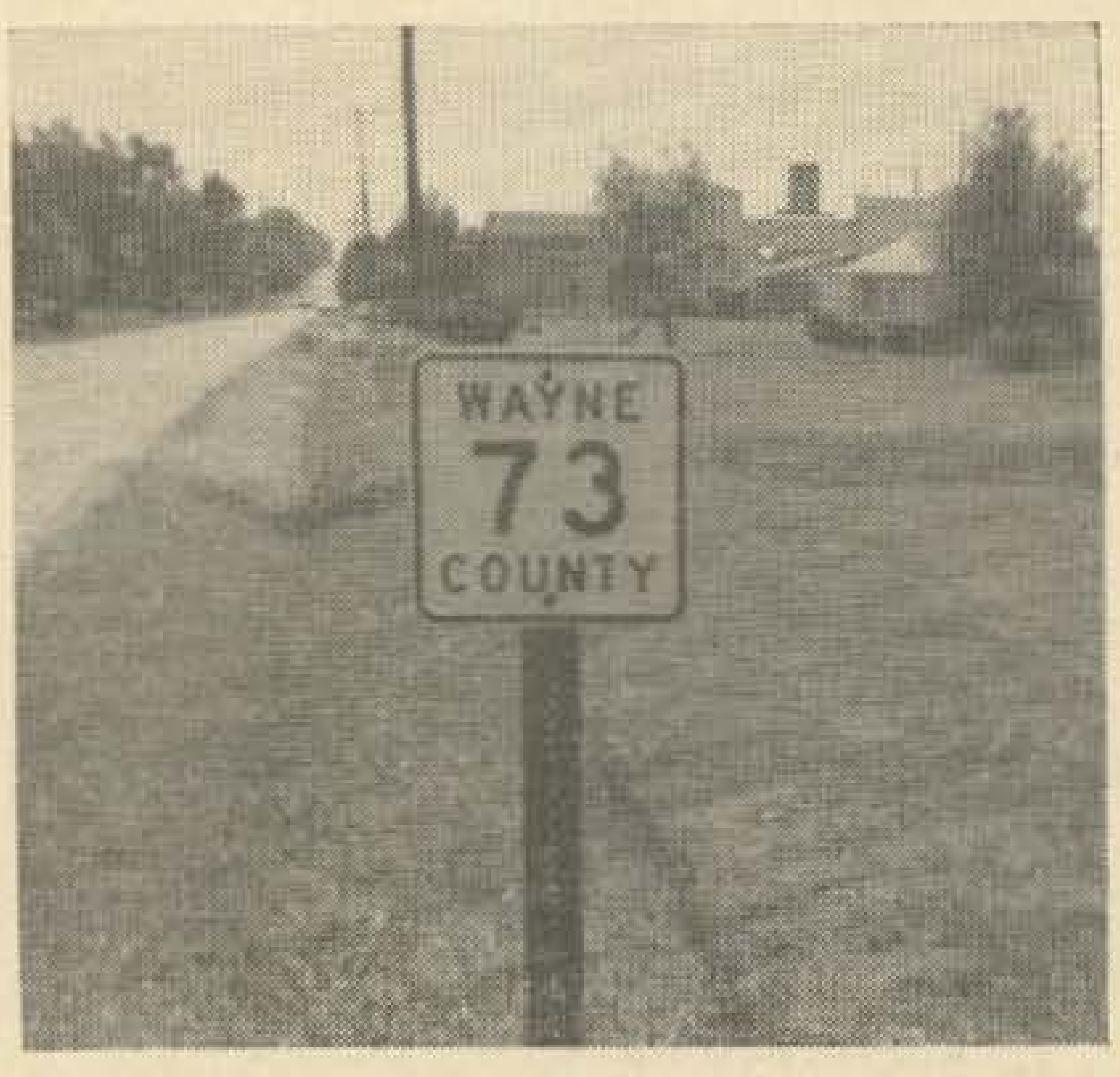
Dear Wayne:

Ham radio is my hobby and I pursue it for the enjoyment it brings me. The other night I had a nasty shock when I called a Florida station on 14,240 kc. His answer was rude and arrogant. He stated that he was operating an AM station and that he would not talk to sideband stations below 14,250 kc, however if I chose to get out of his part of the band he would have a short contact with me.

Wayne, who has allocated exclusive frequencies to the few remaining dinosaurs on our twenty meter band? They've had a good ten years to modernize so by now we know that most of the kilowatt AM'ers just don't want to get along.

After that experience I took a few hours to listen to these fellows. Listen yourself to one of the most sickening displays you will find in our hobby. They gather in small groups to tell each other how much they hate sideband. Let's form a posse and get these mentally retarded children off our bands.

An Old Timer



Dear Wayne:

While driving through Ohio last June, I came across the sign in the picture. Thought you might be interested in it.

Stan Rohrer W9FQN

Dear Sirs:

Enclosed is my subscription to *73*, I don't mind telling you that I have been a member of the ARRL for many, many years, but I'm not going to be a member much longer believe me.

I don't know what these people are trying to prove but I can tell you one thing unless we wake up ham radio is going to be a thing of the past.

I was on the air when it was questionable whether a license was needed or not because there were no broadcasting stations other than a few Naval stations. At that time I was in my teens.

Fact is that I watched and kept up with radio from its infancy. I have built my equipment and tried to keep it up to the knowledge of the day. To me this is a hobby. Sometimes I take it pretty seriously, other times I may not be on the air for months.

The ARRL now decides that I'm not smart enough to hold a license that will permit me the privileges that I've enjoyed all these years unless I up my code speed and technical knowledge. Fortunately this wouldn't be very hard for me except I would have to lose a day or more of work, travel 50 or 60 miles to take the exam and pay an additional fee for the exam for what reason. I'm not an engineer. My work has nothing to do with this hobby.

In my mind it's all too clear the ARRL has sold us out before. They have lost a portion of our frequencies time and again. I think this is a prelude to selling us out again.

I think we need another organization to restrain their efforts, and I think this could be easily accomplished. After all, they only represent about ¼ of the amateur body and many hams like myself are dropping out everyday.

Yes, count me in, and I hope you get many more members so that you may voice our opinion and it will be heard. Please excuse the writing as I'm in a hurry, but I just had to tell how some of us feel about upgrading the amateur.

Philip DeMarco W8OSX
Richmond, Ohio

Dear Wayne:

Just a short note accompanying renewal to *73* to assure you the delay was due to a time element, and not a reflection on your editorial policy. Although I don't always agree with you (who does 100%?) I've enjoyed and often benefited from the additional viewpoints presented. It is encouraging to see emphasis placed on constructive attempts to improve the technical competence of those engaged in this pastime of ours; an emphasis I feel is talked about but with sparse action taken by others in the field.

Keep up the good work and if we try hard enough, we may shake ARRL out of the 19th century. Maybe even help them discover *radio telephone* as a mode of operation.

Thomas J. Barker K6MDG
Costa Mesa, California

Wayne Green editor, etc.:

Keep those ridiculous business reply cards from between the pages of 73. You use the same type of binding as does Playboy, and the cards ruin the advantages which this binding affords.

John Boyd WAØAYP
Brookings, South Dakota

Is there absolutely no pleasing you? Here I go to all the trouble to make sure that the reply card was put in the centerfold of the magazine with but one staple holding it so you could pull it right out and send it in with no harm to your magazine and still *you complain. Good grief. Look John, you like all those articles in 73, right? And you know that no amount of subscriptions can pay for the publication of our magazine. The advertisers are the ones that are buying you the magazine . . . don't forget it. They will continue to buy your magazine for you as long as you pay good attention to their ads in 73. I'm returning the card . . . please fill it out and send it in to Newtronics and stop trying to sabotage us. By the way, 73 has the expensive saddle-stitched binding like Playboy, the New Yorker and other expensive magazines because it makes the magazine so much easier to read . . . and to lay out on the workbench when you are building. We could probably save quite a bundle if we went to the hard-to-hold-open economy type binding. We could save a lot more if we used the cheap grade of paper used by the other two magazines . . . compare the paper some time and note that 73 is using a much heavier, whiter paper.*

Dear Wayne:

Judging from the volume of correspondence on Der Kleiner Keyer Sept. 73, it may be well to advise the readers of several minor technical corrections.

The 5.8k one half watt resistors which may be seen in the photograph and on the component board layout, Fig. 10, are missing from the schematic. These two resistors should be connected in series with each leg of the dual 15k speed control potentiometer as shown below. By having these resistors in the circuit, the minimum resistance of the RC speed control circuit is held to 5.8k. This prevents the maximum speed from exceeding 50 wpm, which speed would not be useful for most hams, HI!

In addition, the 150k resistors in the filter circuit, in the power supply, should be changed to 150 ohms.

It is gratifying to know how many fellows have built this keyer. Many different plans have been used for the monitor oscillator. One which seems to work very well and allows the minimum load on the power supply is that shown near the back of the latest RCA Transistor Handbook (Page 375). A little ingenuity and experimentation will show the constructor how to connect it in with the keyer.

E. L. Klein W4BRS
Huntsville, Alabama

Dear Wayne:

Do you sell names of your subscribers to sucker list users? One amgazine did, using their own stencil so there was no question. I feel they have no right to sell my name to sucker lists just because I subscribe to their publication.

A. S. Johnson K7VQI
Tucson, Arizona

The magazine has the legal right to sell your name. I personally think it is unethical to do this and have never done this with our mailing list, though we could make quite a few fast bucks that way. By the way, if you spell your name just a little differently for each magazine you subscribe to you can find out right away who is selling you out. I only know of one ham magazine that goes in for this practice.

Dear Wayne:

You may be interested to know that I take a dim view of the ARRL and its magazines. To further prove this, I was thumbing through the July 1947 issue of *QST* when suddenly a rash appeared on my face, arms and stomach. This is the honest truth. My doctor said I was allergic to the ink on the pages. I must say that when a magazine "by and for amateurs" gives you a rash, then chances are that it's not worth reading. Keep up the good work in *73!*

Ivan Payne VE3FSQ
Toronto, Ontario

Dear Wayne:

The article by W5VOH on soldering connectors to coaxial cables is a dandy ("The Lowly Coax Fitting," October).

However, the photos make it appear that soldering is being performed on a high-pile carpet.

Take my advice: If you even suspect that your XYL may feel that solder blobs on her favorite carpet don't blend with the decor—move the whole operation to the workbench.

I followed W5VOH's instructions—on the workbench. Results? (without a carpet?)—Excellent.

Stephen Grossman W2YGA
New York, New York

Sirs:

The article by W5VOH on the lowly coax fitting in the October 1965 issue of *73* is very good and the pictures excellent, but one small change will make it much better.

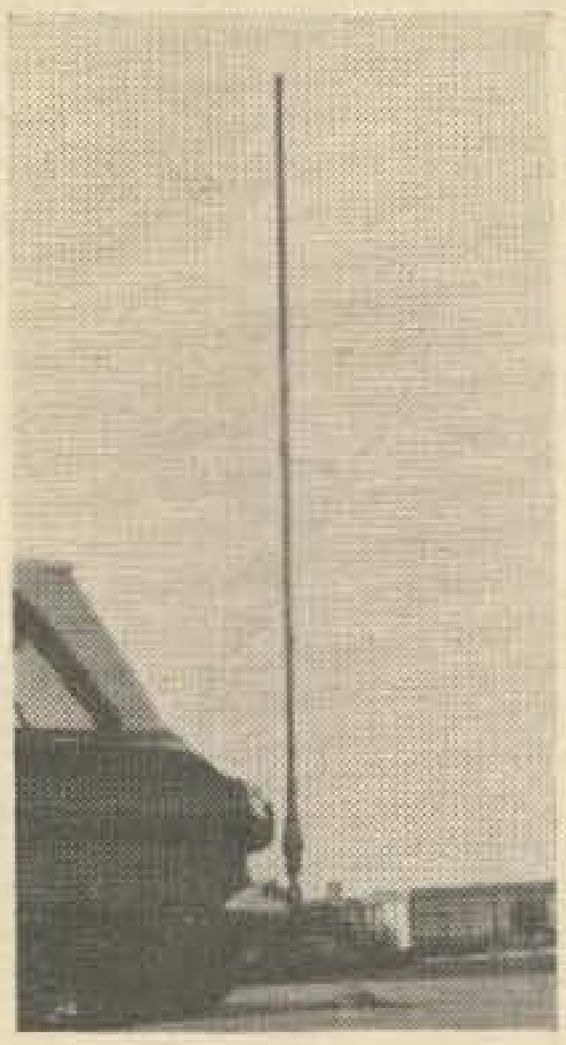
In step No. 1, the cut should be made ⅜ inch from the end of the fitting toward the threads.

Follow W5VOH's step 2-3-4-5.

In step No. 6, the connector is then screwed onto the outer covering about 3 turns. A very slight amount of moisture on the outer covering will help here. This will bring the braid into view for soldering and will provide a good weathertight seal. Then, of course, a coating of Pli-O-Bond will insure that no moisture will get inside the fitting. Hope that you can print this soon, before there are a lot of wet coax connectors around.

Thomas Kolvek WA9CIO
Roselle, Illinois

NEW PRODUCTS



High Power Mobile Antenna

Running high power mobile—or thinking about it? Mark Products has a new line of heavy duty Heliwhips for 40 through 10 that can handle 1000 watts of rf. They're a perfect match for the growing high power of the transceivers. Numbers are the KW-40, 20, 15 and 10 and they're $17.50 each from Mark distributors. For more information, write Mark Products, 5439 W. Fargo, Skokie, Illinois 60076.

Invertronics Inverters

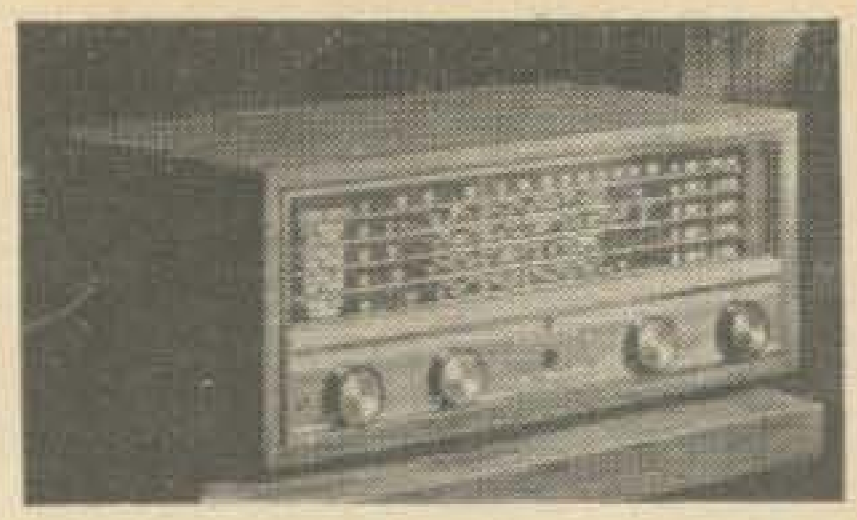
If you need a special-purpose (or regular) inverter, you ought to check with Invertronics. Their clever catalog contains all sorts of interesting ones. They've got one for 6 to 12 volts, 12 volt positive ground to 12 volt negative ground, 12 volt to 28 volt (use that surplus without modification), 12 volt to 120 AC 60 cycle and 400 cycle, and 12 volt to 250, 350 or 450 volts. Inverters are rated at 150 to 300 watts. If you're the builder—cheapskate type, they sell the transformers, too. Everything is reasonably priced. Invertronics, P.O. Box 342, Pine Brook, N.J. 07058.

CC Crystal Filter

Many hams who have wanted to build an SSB receiver, transmitter or transceiver have been discouraged by the high cost of most crystal filters, even though high frequency filters have a lot of advantages to offer over mechanical filters. And most hams are very hesitant to try to build their own since they require etching, grinding, critical adjustments, etc. Now you don't need to worry about that any more. CC Electronics is making high quality crystal filters similar to those in popular SSB transceivers for only $17.50. Their center frequency is 3 mc, the bandwidth is 2.9 kc at 3 db and the shape factor, 50/3 db, is 2.8:1. Ultimate attenuation is 55 db and insertion loss is only 2 db, while passband ripple is 1 db maximum. Input and output impedances are 3.9 k. The filter comes in a small hermetically sealed package with suggested schematic. For more information—or to order a filter—write CC Electronics, 12017 West 92, Lenexa, Kansas.

Electro-Voice Mikes

These new E-V base station mikes have a lot to offer. The cases are two pounds of solid die cast metal finished in attractive communications gray. They have a choice of locations for the DPDT telephone type leaf switch so that you can use touch-to-talk or push-to-talk. And you can choose PTT or vox at the end of the cable without digging into the mike. It comes in two models: The 619 ($28.50 ham net) in Hi-Z dynamic and features a response of 70 to 10,000 cycles at −57 lb output. The 719 ($16.50) is ceramic and has a response of 80 to 8000 cps at −56 db. See them at your distributor or write Lynea Dalrymple at E-V, 635 Cecil Street, Buchanan, Michigan.

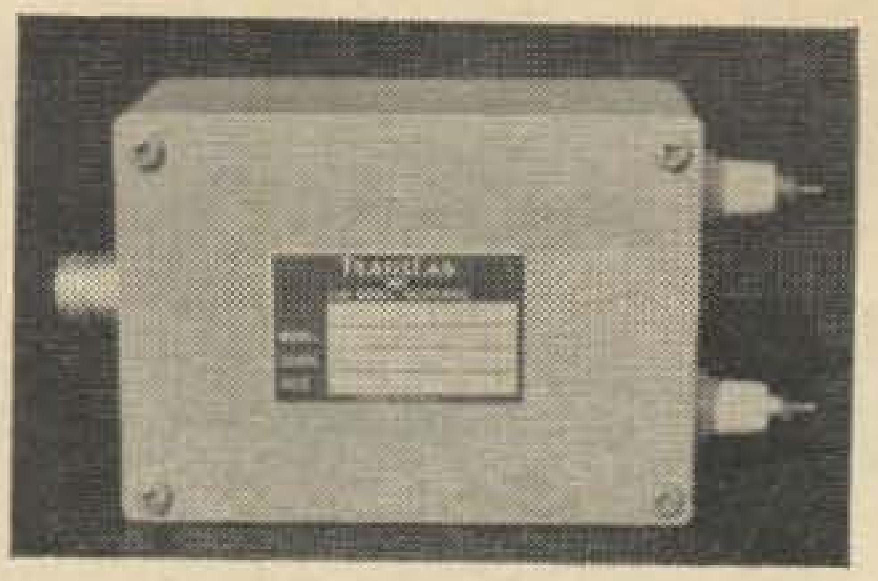


SWL Receiver from Hallicrafters

The new Hallicrafters S-200 Legionnaire looks awful nice for the SWL and others who want to be able to listen to foreign SW broadcasts without worrying about the critical tuning of most SW receivers. It covers the very popular 49, 31, 25 and 19 meter bands as well as the regular broadcast band. Since these bands have most of the foreign broadcasters, and are spread out on the S-200 you can tune the world as easily as the local broadcast stations. The S-200 is in an attractive walnut wood-grain steel cabinet so you can leave it in the living room if you'd like. More information from Mr. Bernard Golbus, Hallicrafters Co., 5th and Kostner Avenues, Chicago, Illinois 60624.

Datamark

Datak is now making their very useful rub-on lettering in inexpensive packs in a wide range of subjects. Each pack is $1.95 and typical sets are for "amateur radio," "audio, TV and hi fi," "experimenter, home and intercom," "industrial and test equipment," etc., as well as complete alphabets and number sets in various sizes. All sets are available in black or white and the alphabets also come in gold. You can get them at your distributor or from Datak, 63-71st Street, Guttenberg, N.J.



Translab Broadband Balun

The new Translab Ferrite Balun exhibits nearly perfect SWR characteristics across the HF bands from 2 to 30 mc. It's even good on 6! Power rating is 2 kw PEP and the balun is available in two models: 1:1 for 50 ohm balanced to 50 ohm unbalanced and 4:1 for 50 to 200 ohms or 75 to 300 ohms. It's completely sealed and even uses a type N connector for the coax connection since UHF ones aren't weatherproof or constant impedance. Price is $19.95 and complete data is available from Translab, Inc., 4754 Federal Blvd., San Diego, California 92102.

40 Meters on the HW-3

Mark Products has brought out a new 40 meter element for their popular HW-3 Triband mobile antenna. It screws into the top of the HW-3 giving a choice of three bands from 40 to 10 for mobile use without any mechanical or electrical switching. The basic HW-3 is $19.50 and the HW-3/40 element is $7.95. More information from Joseph Schroeder, Mark Products, 5439 W. Fargo Ave., Skokie, Illinois 60076.

Do It Yourself (Almost) QLS's

An interesting idea from the Roland Company. You send them 50¢, they send you a kit for designing your own QSL's. The kit includes various alphabets, decorations, report forms, samples, etc. Then they'll print up your own custom cards for you. Roland Company, Dept. 73, 1270 Avenue of the Americas, New York, N.Y. 10020.

73 Books

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

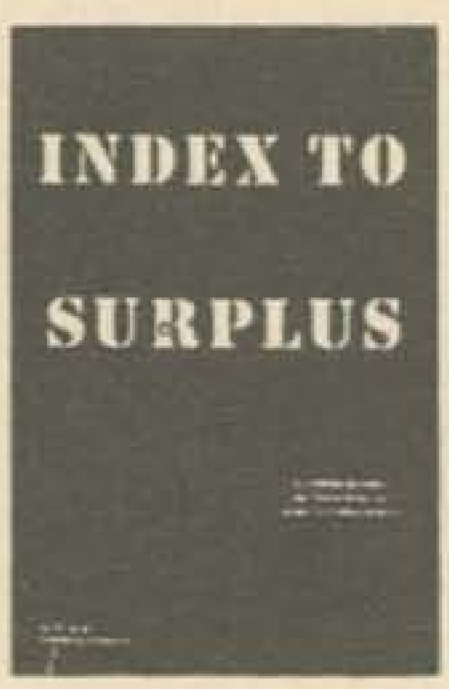
SIMPLIFIED MATH FOR THE HAMSHACK—K8LFI.—This is the simplest and easiest to fathom explanation of Ohm's Law, squares, roots, powers, frequency/meters, logs, slide rules, etc. If our schools ever got wind of this amazing method of understanding basic math our kids would have a lot less trouble. **50¢**

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

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

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

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



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

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

73 Magazine
Peterborough, N.H. 03458

Caveat Emptor?

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

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

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

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

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

WRL BLUE BOOK PRICES save money on quality used gear. Take 10% off without trades. G76-$179.00; Sidewinder 2 m-$299.00; 62S1-$650.00; 32V1-$149.00; Apache-$149.00; Valiant-$199.00; HT-37-$269.00; SB-400-299.00; Invader 200-$285.00; 200V-$499.00; HT-41-$229.00; Loudenboomer-$299.00; Pro 600JX-$199.00; SX101A-$219.00; SS1R-$545.00; HO-10-$55.00 and hundreds more. Free list: Leo WØGFQ, Box 919, Council Bluffs, Iowa.

AUDIO Q5ER Filter cuts off above 3300 cycles. 500 ohms, 20 watts, UTC new surplus 2/$5. AC line filters 3A WECO 2/$1. Tone filters 2685 cycles, 70 cy wide Burnell 2/$5. L-C Electronics, Box O, Freeland, Michigan.

WANTED: Military or commercial surplus . . . airborne, ground and testsets. Try the BIG BOYS, then write or call us collect AREA 703-560-5480 and give us YOUR price . . . We pay cash and freight. Dun and Bradstreet rated . . . RITCO, POB 156, Annandale, Virginia.

COLLINS KW-1 DELUXE TRANSMITTER. 1000 watts AM or CW. Would make fine SSB linear. $1400 or make offer. George F. Norton, W4EEE, Georgia University Station, Athens, Ga.

HEATH HW-32 20 meter transceiver with HP-13 power supply, calibrator, mike, speaker, new warranty, $140. W2NTZ, R. Stevens, 3048 Wilson Avenue, Bronx, N.Y. 10469

BUILDERS—A 4-1000A, class B, grounded grid final. Complete drawings with two 8 x 10 photographs, detail schematic diagram and specifications. Easy to construct; cost under $300. Price $7.50. Bill Brown WØSYK, 28 Marine Lane, Hazelwood, Mo.

SALE TO RAISE TUITION: National NCX-3 ($225). NCXA ($75). Heath Sixer ($40) and 6/12 vdc ($40). All excellent. Tony Curtis, P.O. Box 102, Center Hall, Pennsylvania.

QSL, SWL, WPE CARDS. Sample catalog 10¢. 12 pt Kromkote cards, some originals. Nicholas and Son Printery, P.O. Box 11184, Phoenix, Arizona 85017.

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

PLATE TRANSFORMERS 690 v at 450 ma. No CT, perfect for bridge or doubler supplies. 117 vac primary. $3.95 plus postage. Wt. 19 lb. A.R.C. Sales, P.O. Box 12, Worthington, Ohio.

SONAR 20M SSB/CW transceiver with matching AC power supply. Covers entire band with 300 watts PEP input. $155, Steve Weirich, 1407 Linden Blvd., Brooklyn 12, N.Y.

SPECIAL FILAMENT TRANSFORMER for 4-400A and 4-1000A, etc. 120 volt, 60 cycle primary. Two secondaries: 7.6 v @ 21 amp and 5.1 v @ 13 amp. Unused and sealed. $4.50 plus postage. Wt. 14 lb. A.R.C. Sales, P.O. Box 12, Worthington, Ohio.

COLLINS 75S-3B, 32S-3, 516F-2 AC supply. Late serial number. Less than 5 hours time. $1200 firm. Perfect. Send MO or certified check. TH6-DX beam in carton, new $100. W. E. Lyons, Sr., 4200 Lorna Place, Las Vegas, Nevada.

COLLINS KWM 2. New one. Serial 13846-Trade for S Line, etc. Also new TR-4, $495. Want TX-4 or T-4 Reciter. Also have 15 ft. runabout boat rig. Trade for ham gear. WA4LXX, 251 Collier Ave., Nashville, Tenn. 37211.

CRYSTAL FILTERS. 3.0 mc center frequency, 2.8 kc bw at 3 db. 7.8 kc bw at 50 db. Loss 1 db, 3.9 kc termination. 1-9/16 L x 1$\frac{3}{8}$ W x 1$\frac{3}{4}$ H. $17.50. CC Electronics, 12017 W. 92 St. Lenexa, Kansas.

COLLINS S-LINE 32S3, 75S3B, 516F-2 AC power supply. All less than one year old, like new. Lot price $1000. WA4LUN, Box 238, Troutman, N.C. Phone 528-5246.

HAMMARLUND HQ 110A, Communicator two meters, Health Sixer, send stamp for list of extra gear, some VHF, all good. W8FZ, 4328 State, Saginaw, Michigan 48603.

COLLINS S-LINE for sale: 75S-1, 32S-1, 516F2 and 30L-1 bought in 1965. Asking $1300 or sell separately. WB2FFK, 288 Fourth Avenue, East Orange, N.J. 07017.

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

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

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

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

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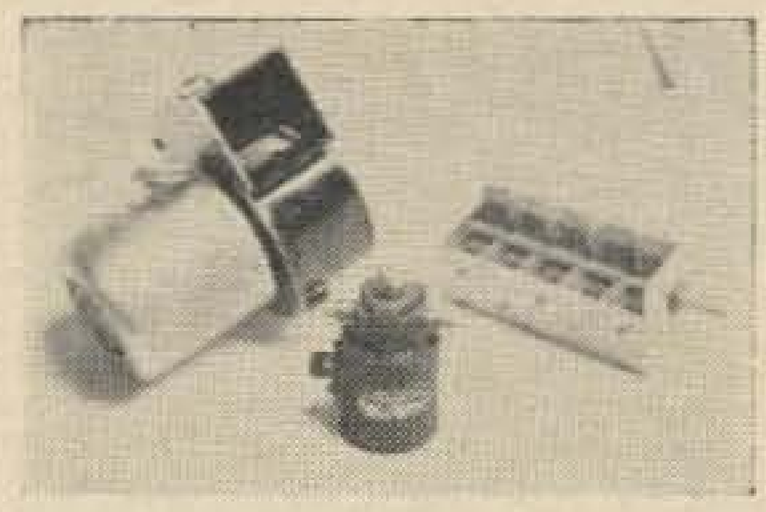
CORAL CLIFF HOTEL

Curacao, Netherlands Antilles

Eastern Air Devices centrifugal blower, 110 CFM, 110 volts 60 cy., model B3A-3C. Max. diam. 6", length 6$\frac{1}{2}$". Shpg. Wt. 10 lbs. With 4 mf. capacitor. Brand new, **$10.00.**

5-section Variable Capacitor, 400 pf. per section, 2000 pf total, makes fine loading capacitor for that linear. Will load a kilowatt into coax line. 6"x3$\frac{1}{2}$"x2$\frac{3}{4}$". $\frac{3}{8}$" diam. shaft. 4 lbs. New, **$2.00.**



Coaxial Switch, SPDT, electrically operated by 28 volt dc solenoid. Fine for selecting between two antennas. Solenoid draws current only when changing. Has type "N" coax connectors, 52 ohms. Approx. 2$\frac{1}{4}$" diam. x 4$\frac{1}{2}$" long. Shpg. wt. 3 lbs. Used, exc. cond. **$2.50.**

ARC-1 transceiver, for conversion to 2-meters. 25 watts input, AM plate-modulated, 832A in final. Superhet receiver. Xtal controlled, 10 channels. With all 28 tubes, conversion info & schematic, less channel xtals and dynamotor. 50 lbs. Used, good. **$19.00.**

28 volt dynamotor for ARC-1 12 lbs. **$2.00.**

115 volt power supply for ARC-1. Supplies plate and filament voltage. Will not operate autotune. Kit with chassis, transformer, diodes, and all parts. 10 lbs. **$19.95.**

Please add sufficient postage.

Send for our catalog of surplus electronics.

JEFF-TRONICS

4791 Memphis Ave. Cleveland, Ohio 44109

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

TV CAMERAS. Model 400 complete with good vidicon and lens. Used as demonstrators. Only $200 FOB Vanguard Labs, 196-23 Jamaica Ave., Hollis, N.Y. 11423.

NOVICE CRYSTALS. 80-40 M $1.05 each. Others 75¢. Free list. Nat Stinnette W4AYV, Umatilla, Fla. 32784.

COMPLETE HAM STATION: Halicrafters SX-110 receiver; Heathkit DX-40 transmitter and a 20' vertical antenna. Like-new conditior $140.00. Telephone in New York 377-3451.

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

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

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

GLOBAL WRIST WATCHES. Feature 24 hour world time conversion. Free brochure. Mention 73. Nordlund, 7635 West Irving Park, Chicago, Illinois 60634.

PROTECT LOW NOISE RECEIVERS. Solid state and tube front ends can be damaged or destroyed by transmitter leakage. Prevent this with broadband receiver protectors. Two models: RP-1 for 80 through 6 meters, and RP-2 for 6 through ¾ meters. Details in brochures RP-1 and RP-2. Radiation Devices Company, P.O. Box 8450, Baltimore, Md. 21234.

TUNAVERTERS! Transistor 6-1 tuning calibrated converters for AM-CW-SSB! Half a mobile station $19.95-$24.95! Sensitive, selective, tunable BFO! Marine, amateur, SW bands! Herbert Salch and Co., Woodsboro, Texas.

SBE 33 with mobile bracket $225; SB1LA 1000W linear $175; Gonset Communicator III with pre-amp, 10 crystals $175; Excellent condition, K7UFD, P.O. Box 212, Sparks, Nevada.

ELMAC AF68 station, PMR8 receiver, 12/120 volt supply. Like new $300 ppd. Will include big junk box if you pay postage. Write first. Leo Boisvert W1HIE, Exeter Road, Newmarket, N.H.

HONOLULU HAMS! Have gone transceiver operation. Have Heath SB-400 factory checked $275. Globe Champion 350 for $75. Glad to demonstrate. Local only. KH6EWA Waikiki.

FOR SALE: R23/ARC 190-550 kc receivers good operating with tubes, $15.50. Also R445/ARN30 tunable late type command receivers 108-132 mc. Same power set up as command sets. Good operating, $25.00. RITCO, POB 156, Annadale, Va.

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Want to buy, find out or sell? Caveat Emptor? will do it for you. 73's want ads are cheapest at only $2 for 25 words non-commercial, and you know they're the most effective since 73 is read by the active, money-spending hams.

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A few hints: Type copy. We aren't responsible for errors caused by illegibility. Don't abbreviate; you pay for words, not space. Include your full name and address as well as call; not all hams have a Callbook. Since we capitalize and bold face the first few words, make them important and attract attention. Don't put "For Sale" in the ad; everyone knows that's what it's for if it doesn't say otherwise.

Here's my ad:

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Send to Caveat Emptor

73 Magazine, Peterborough, N.H. 03458

R390A RECEIVER excellent condition with manual. $600, J. Larson, 330 N. Saltair Avenue, Los Angeles, California 90049. Phone 213-472-1786.

LITTLE FELLER SSB phasing reactor. See page 100 in October 73. Same used in original article, $1.25 ppd. Radio-Tronics, 50-15 Weeks Lane, Flushing, N.Y. 11365.

COMPLETE SHACK: Clegg Zeus $375, Interceptor $250, Bandit 2000A $300. Excellent condition. WA9EMB, 5721 N. 57th Street, Milwaukee, Wisconsin 53218.

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

INDEX TO ADVERTISERS

Propagation Chart

December 1965

J. H. Nelson

EASTERN UNITED STATES TO:

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

CENTRAL UNITED STATES TO:

ALASKA	14	14	7	7	7	7	7	7	14	14	14	14
ARGENTINA	14	14	7#	7	7	7#	14	14	14	21	21*	21
AUSTRALIA	14	14	7#	7#	7	7	7	7*	7	7#	14	14
CANAL ZONE	14	7	7	7	7	7	14	14	14	14*	21	21
ENGLAND	7#	7	7	7	7	7#	14	14	14	14	14	7*
HAWAII	14	14	7*	7#	7	7	7	7#	14	14	14	14
INDIA	7	7#	7#	7#	7#	7#	7#	14	14	14	7*	7
JAPAN	14	14	7#	7#	7#	7	7	7	7	7#	14	14
MEXICO	14	7	7	7	7	3*	7	14	14	14	14	14
PHILIPPINES	14	14	7#	7#	7#	7#	7	14	14	7	7#	14
PUERTO RICO	14	7	7	7	7	7	14	14	14	14	14*	14
SOUTH AFRICA	7	7	7	7#	7#	7#	14	14	14	14	14	14
U. S. S. R.	7	7	7	7	7	7#	14	14	14	14	7#	7#

WESTERN UNITED STATES TO:

ALASKA	14	14	7*	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14	7#	7	7	7	7#	14	14	21	21	21*
AUSTRALIA	21*	21*	14	7#	7	7	7	7	7	7#	14	21
CANAL ZONE	14	14	7	7	7	7	7	14	14	14	21	21*
ENGLAND	7#	7	7	7	7	7#	7#	14	14	14	14	7#
HAWAII	21	21	14	7	7	7	7	7	14	14	14	14*
INDIA	14	14	14	7#	7#	7#	7#	7#	14	14	7	7
JAPAN	14	14	14	7#	7#	7	7	7	7	7#	14	14
MEXICO	14	14	7	7	7	7	3*	7	14	14	14	14
PHILIPPINES	14	14	14	14	7#	7#	7	7	14	7	7#	14
PUERTO RICO	14	14	7	7	7	7	7#	14	14	14	14	14
SOUTH AFRICA	7#	7	7	7#	7#	7#	7#	14	14	14	14	14
U. S. S. R.	7#	7	7	7	7	7#	7#	7#	14	14	7#	7#
EAST COAST	14	14	7	7	7	7	7	14	14	14	14	14

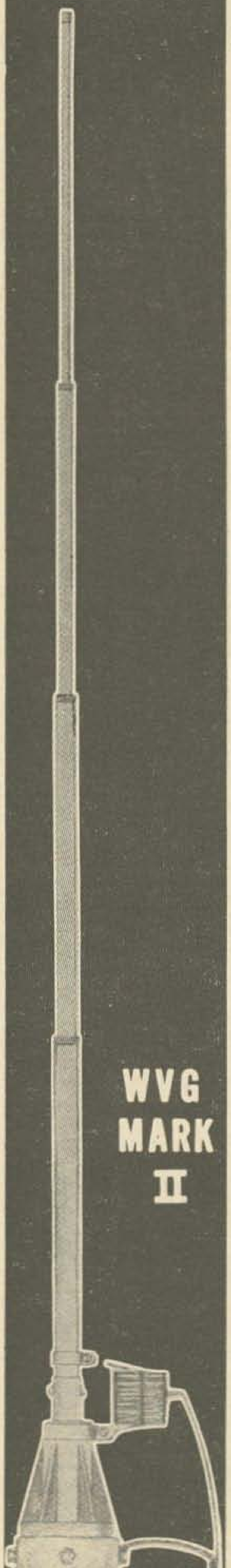
Very difficult circuit this hour.
* Next higher frequency may be useful this hour.

Good: 1, 6, 7, 8, 12-15, 21, 22, 24-26, 28-31

Fair: 3-5, 9, 10, 16, 20, 23

Poor: 2, 11, 17-19, 27

VHF DX: 8, 9, 29, 30



New

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ALL BAND VERTICAL

WRL

WVG MARK II

New low cost vertical antenna which can be tuned to any amateur band 10–80 meters by simple adjustment of feed point on matching base inductor. Efficient radiator on 10, 15, 20, 40, 75 and 80 meters. Designed to be fed with 52 ohm coaxial cable.

Conveniently used when installed on a short 1-5/8" mast driven into the ground. Simple additional grounding wire completes the installation. Roof top or tower installation. Single band operation ideal for installations of this type. Amazing efficiency for DX or local contacts. Installed in minutes and can be used as a portable antenna.

Mechanical Specifications: Overall height — 18′ Assembled (5′ Knocked down) Tubing diameter — 1¼" to 7/16". Maximum Wind Unguyed Survival — 50 MPH. Matching Inductor — Air Wound Coil 3½" dia. Mounting bracket designed for 1-5/8" mast. Steel parts irridite treated to Mils Specs. Base Insulator material — Fiberglas impregnated styrene.

Electrical Specifications: Multi-band operation — 10–80 meters. Manual tap on matching inductor. Feed with 52–75 ohm line (unbalanced). Maximum power — 1000 watts AM or CW-2KW PEP. Omni-directional. Vertically Polarized.

WRL WORLD RADIO LABORATORIES
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Council Bluffs, Iowa

☐ Check enclosed. ☐ Ship one WVG MK. II @ $15.95 Postpaid.

Name__________
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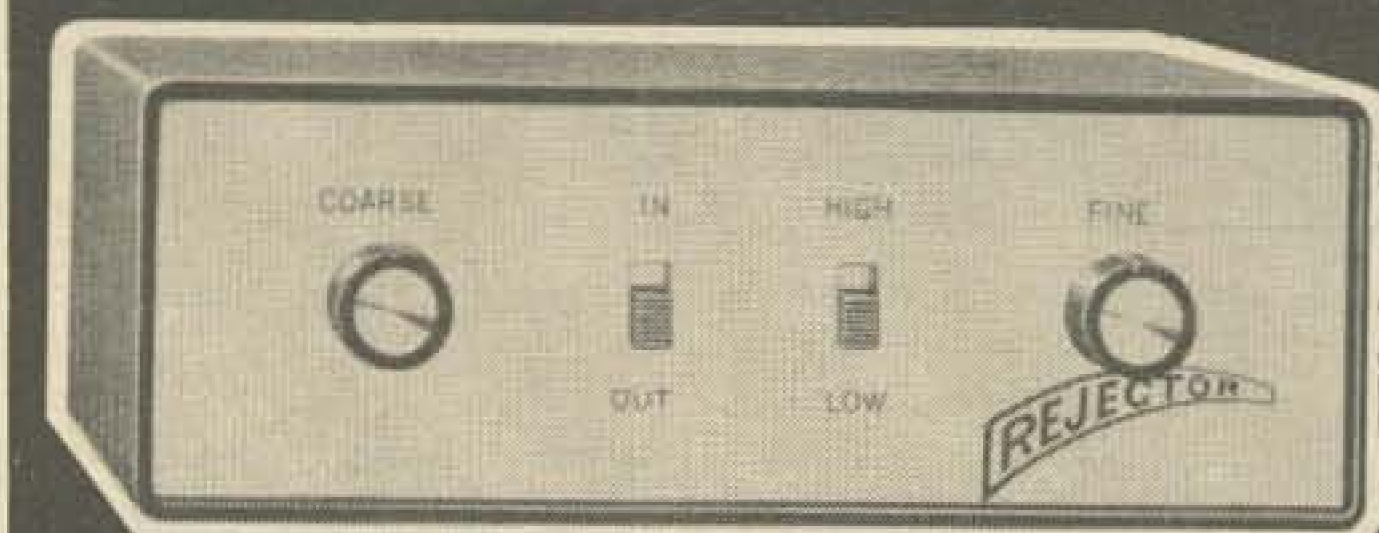
NOW! IMPROVE YOUR RECEIVER—TRANSCEIVER RECEPTION



"REJECTOR" *TUNABLE* NOTCH FILTER*

ONLY $34.95

*Patent applied for

THE REJECTOR TUNABLE NOTCH FILTER WILL GREATLY IMPROVE RECEPTION ON ANY RECEIVER OR TRANSCEIVER—HAM/CB/SW.

■ No insertion loss. ■ Audio filter with tunable range 300 to 4000 cycles. ■ Fully transistorized. ■ Ideal for CW-RTTY-SSB-AM-SWL. ■ Simply connects between receiver or transceiver audio output and P.M. speaker. Apply 12V. ac/dc (½A) Size—7½" x5⅜"x 2½". Opt'l AC Supply—**$6.95.**

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☐ Rejector Notch Filter—$34.95.
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