73 Amateur Radio

JANUARY 1965
A Chilly 40c

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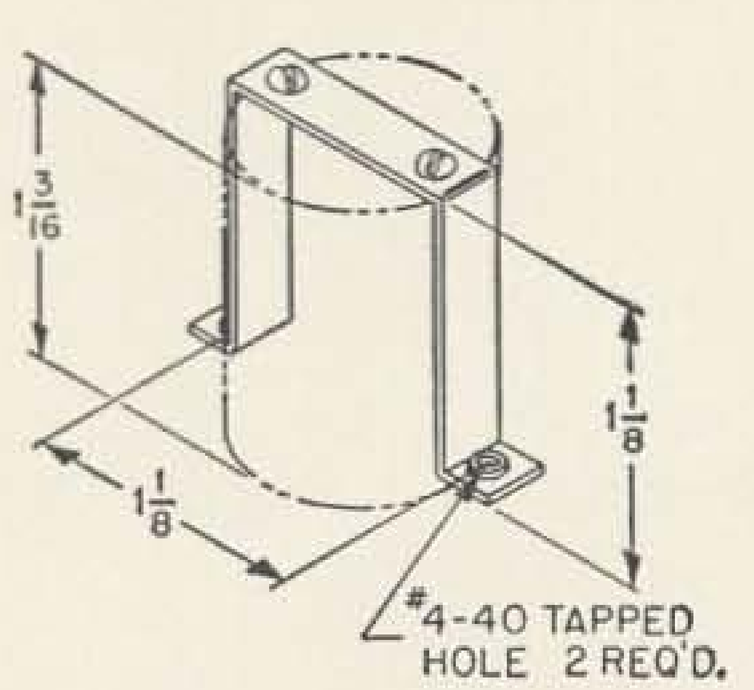

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73 Magazine

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Cover: New Hampshire type Squalo mobile. Cast: Bob Cushman (Cushcraft) on left, contained in raccoon coat; Wayne Green in middle; Alrun, genuine Arabian Stallion, the pride of 73 Farms, on the right. Squalo by Cushcraft . . . winter by New Hampshire. Picture by K2YDD.

3 Magazine is published monthly y 73, Inc., Peterborough, N. H. The phone number is 603-924-3873. Subscription rates $4.00 per year, 7.00 for two years, $10 for three ears world wide. Second class postge is paid at Peterborough, New Hampshire and at additional mailing ffices. Printed in the U.S.A. Entire ontents copyright 1964 by 73, Inc. Postmaster: please send form 3579 to 3 Magazine, Peterborough, New Hampshire. All those interesting rticles and here you are wasting our time with the small print!

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de
W2NSD/1

never say die

The FCC has, at my request, extended the deadline for your comments on Docket 1564, the one that proposes to extinctify the Conditional Class license. Here is a copy of my petition to the FCC in answer to 15640. Since the ARRL seems quite determined to have a maximum of government control of amateur radio I expect that my voice will be lost in the whistle of wind from Newington.

I see this innocuous petition as a major step toward socialism in our hobby, a step that will be difficult if not impossible to ever retrace. Readers, you either speak up now or take what happens to you quietly.

Federal Communications Commission
Washington, D. C.
Re Docket 15640

I believe that the docket, as proposed, would be detrimental to amateur radio and have the following effects:
1. The additional workload which must of necessity be born by the FCC examiners would make it necessary to increase the staff and thereby place an extra expense upon the public.
2. The increased difficulty of taking the exam at a distant examining point must necessarily reduce the number of people able to take the license exam. As a basic policy shouldn't the exam itself be the factor in deciding whether people are able to become licensed amateurs, not the difficulties set up by the government for the taking of the license exam?
There has been considerable criticism lately over the administration of the Conditional Class license, complete with ARRL requests for its elimination. If there is fault with the present system why not try to eliminate the fault? The reasons for the establishment of the Conditional Class license are as valid today as they were when it was established. It is still a great hardship to travel long distances and lose time from work in order to meet an FCC examiner.
I propose that Docket 15640 be rejected and that the present Conditional Class license continue to be administered as at present, with the amendment that the administration of the license exam be by any licensed amateur in the presence of at least two other licensed amateurs, no two from the same immediate family. Any possible problems that might arise due to friendship or favoritism should be reduced to insignificance with three witnesses. Considering the present amateur population there is no area of the country where it should be any hardship to assemble at least three licensed amateurs.
Please act favorably on this petition.

Wayne Green W2NSD/1
Peterborough, N. H.

My prayer is that you will write to the FCC, complete with the lousy 15 copies, and support my proposal to continue the Conditional Class license. The reasons for the license are all still valid. If you got an appointment for a license exam 150 miles away at 9 AM on a weekday what would you do? Would you have a license today? Isn't it tough enough to learn the code and theory without putting a completely unnecessary 300 mile hurdle in the way as well? This would virtually eliminate fellows with fixed office hours such as doctors and dentists from taking the exam. Etc.

Send me a copy of your comments too . . . please?

Just because we are licensed by the government doesn't mean that we have to be completely controlled by it. I'm working to make amateur radio as self-governing as possible . . . but I'm a loser if you don't back me up.

Dannals? Ugh!

I understand that the election for Director in the Hudson Division ended in a tie after one of the heaviest votes ever turned in. Wolfe, W2AGW, is trying to upset the old guard, Dannals W2TUK. I've talked to Wolfe a few times down through the years and have found him to be an intelligent and sincere ham. I've known Dannals quite closely for the last few years and frankly I can't think of anything much more disasterous that could happen to our hobby than to have this guy successfully bludgeon his way to the fame and power that he seems to crave.

The permitting of Dannals to run for Director of the League is another black mark on ARRL Headquarters. They certainly know this man for what he is for he has done their dirty work for them on many occasions. What have we here, another Teamster's Union?

If you are in the Hudson Division, know anyone in the Hudson Division, or even QSO anyone in the Hudson Division please ask them to vote for Wolfe . . . and while you're talking to them find out if they know anyone with a good word to say for Dannals . . . I'd like to hear one. Those that I've heard so far can't be printed. On the first ballot half of the votes were against Dannals, if the secretly counted votes were counted right. Please do what you can to get more ARRL members to vote on the second ballot . . . and to enlighten the half that almost got Dannals elected.

Tours

Several letters have come in recently asking about any future tours. Perhaps it is time I leveled with you on this.

In 1958 the Porsche Club of America de-

cided to run a group flight to Europe. I wanted to go, but couldn't get away for the trip. They easily filled a complete plane and had a lot of members on the waiting list for cancellations.

In 1959 they chartered two planes and I went along. I had a fabulous time. In 1960 I was busy starting 73 had to wave at the Porsche-Pushers on their third annual flight. In 1961 I still couldn't get away. By 1962 I decided that Virginia and I would go whether we could get away or not.

We had such a marvelous time visiting hams all through Europe that we decided that this was too good not to be shared. We started laying plans for a ham flight. I didn't expect any great problem in filling a plane since the Porsche Club had to turn members away and they had a total membership of less than 4000. With 250,000 hams to draw on it should be simple to fill one plane.

Most three week tours of Europe seemed to cost around $900. This obviously was high for the average amateur so I set about figuring how low the cost could be chopped. I added the group plane fare, the cost of good second class hotels which were clean but not opulent and bus expenses. It came to about $550, or some $80 less than the regular tourist class air fare for the same trip. This seemed to me like quite a bargain.

Virginia and I spent a lot of time working out the itinerary. We wanted to get the most travel out of the three weeks . . . to see as much as possible, yet not skim too fast. We decided on starting the tour with London, since this is one of the top tourist points of interest in Europe. Everyone should have a chance to personally visit Westminster Abbey in this life . . . actually stand in Piccadilly, and shop in the famous London stores.

Obviously Paris had to be the next stop. Then Geneva, Rome and Berlin!

The response was disappointingly light to my announcements of the trip and it was soon obvious to me that we were not going to charter a whole jet. I guess my salesmanship wasn't up to the occasion. Just 73 of us went on the trip. I suppose that I should be happy with that since, as far as I know, every other attempt to organize a ham tour has failed completely.

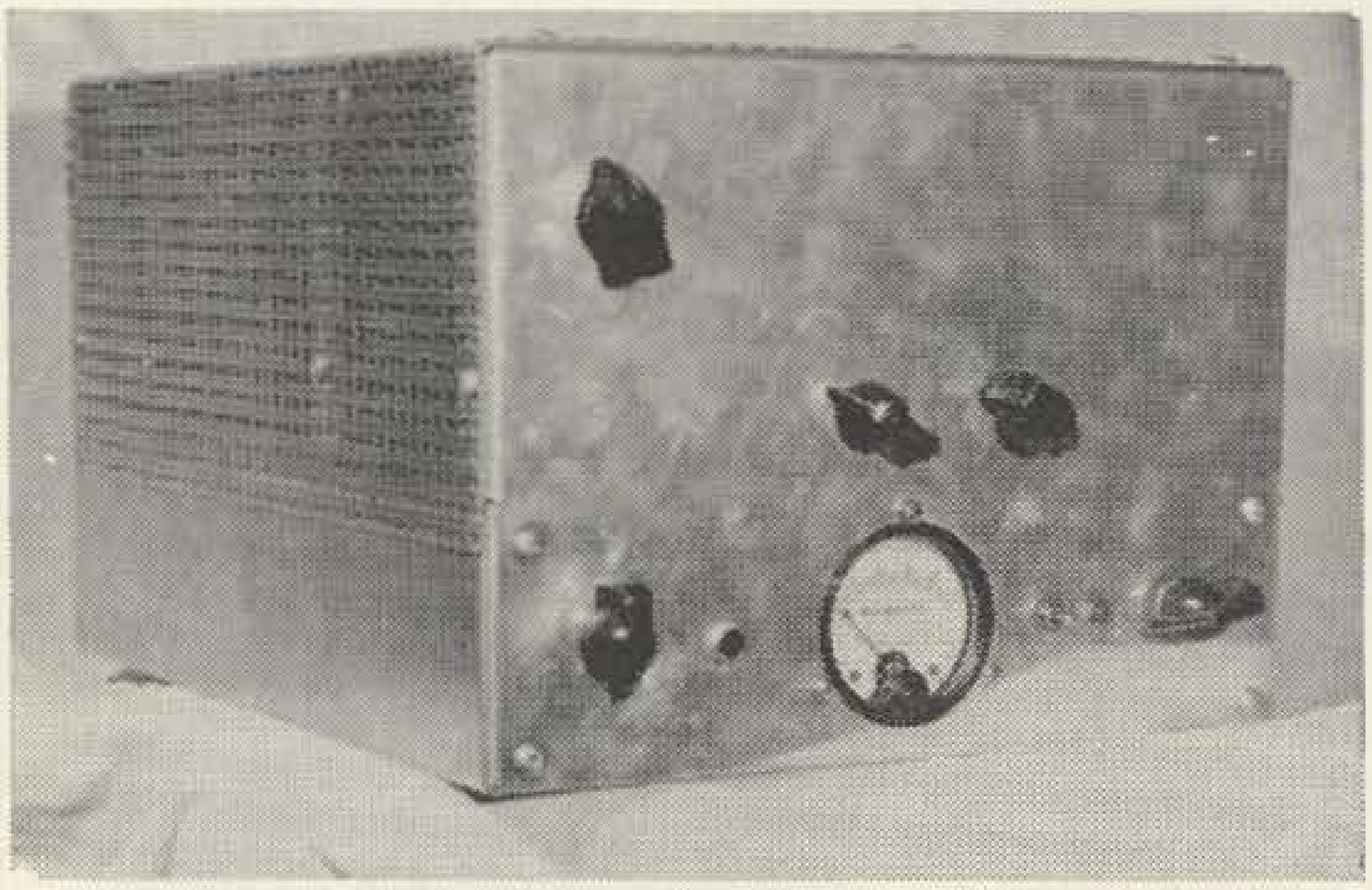
The original idea of the tour was to take everyone to the five cities and then let them be on their own until time to leave. Well, this may have been my idea, but we arrived in London and I suddenly found 72 other people sitting there waiting for me to tell them what

Turn to p. 64

120 Watts Mobile on Two Meters

This article, due to its exceptional thoroughness is being published in two parts. This month the construction is covered, next month the tuning up process is described in detail.

Jim Kyle K5JKX
Jim Speck, W5PPE
5421 N. Military
Oklahoma City, Okla.



Looking for a quick, simple way to put a hundred and twenty watts on 144 mc in your mobile at almost no expense?

If you are, then turn the page OM because that's not what this rig is. Instead, it's a top-performance rig designed for the best possible signal and the greatest operating convenience, at the lowest cost possible. While it could hardly be classed as a "beginner's project," it's not so difficult that it can't be readily duplicated.

Now, if you're still with us, let's look at how closely this little bomb has filled its design requirements. Starting at the pocketbook (of major interest to most of us) we frankly can't say just what it did cost, since both authors have well stocked junkboxes and access to all kinds of exotic hardware and shop equipment. However, if most parts were purchased new, cost probably wouldn't be over about $125.

For this, we got a stable, clear 144 mc signal of some 80 watts at the output jack, which keys as cleanly as a 160-meter rig and has no detectable spurious output. We also have a modulator featuring full clipping and filtering, with up to 25 db of clipping available and plenty of punch for 100-percent modulation. The entire package, less power supply, is enclosed in a box measuring 8 x 10 inches and 12 inches deep, complete with 12-position crystal switch for rapid QSY without fumbling.

All stages have plenty of power reserve; the driver is rated for more than 10 watts output all by itself. The modulator provides 60 watts sine-wave audio output with no trace of grid current being drawn.

Though designed as a mobile unit, and built around a Swan-transceiver power supply already installed in the car, the rig also works nicely as a home station unit. It has pulled out 10 states in just 3 months of operation from W5PPE, in conjunction with a 32-element array some 75 feet up. It competes easily with higher-powered equipment!

Before we get into the details of duplicating the rig, let's take a brief look at how it works. The driver (from oscillator up to but not including the second 6360) is essentially the ARRL beginner's 2-meter rig, with a tube substitution and some minor changes for added operating convenience. The first 6360 cathode was lifted from ground and tied through a 33-ohm resistor to the key jack. The screen circuit of the second 6360 was modified by adding a pot for drive-level control, and a 2-turn link added to its plate tank. In addition, this stage required neutralizing (not shown on the schematic).

The final is a 5894, with fixed-tuned grid circuit. This is made possible by the generous margin of drive available; the grid coil resonates with the tube input capacity at about 130 mc. Fixed bias of −90 volts (which was available in the Swan supply) was used, permitting exciter keying for emergency CW use.

The plate circuit is a balanced parallel line made of 3/16-inch pipe, with a homebrew plate bypass capacitor at the cold end. Output is taken off through a tuned link, visible in the photos; the antenna relay is built into the transmitter.

The modulator begins with a 12AX7 preamplifier for crystal or dynamic mike, though

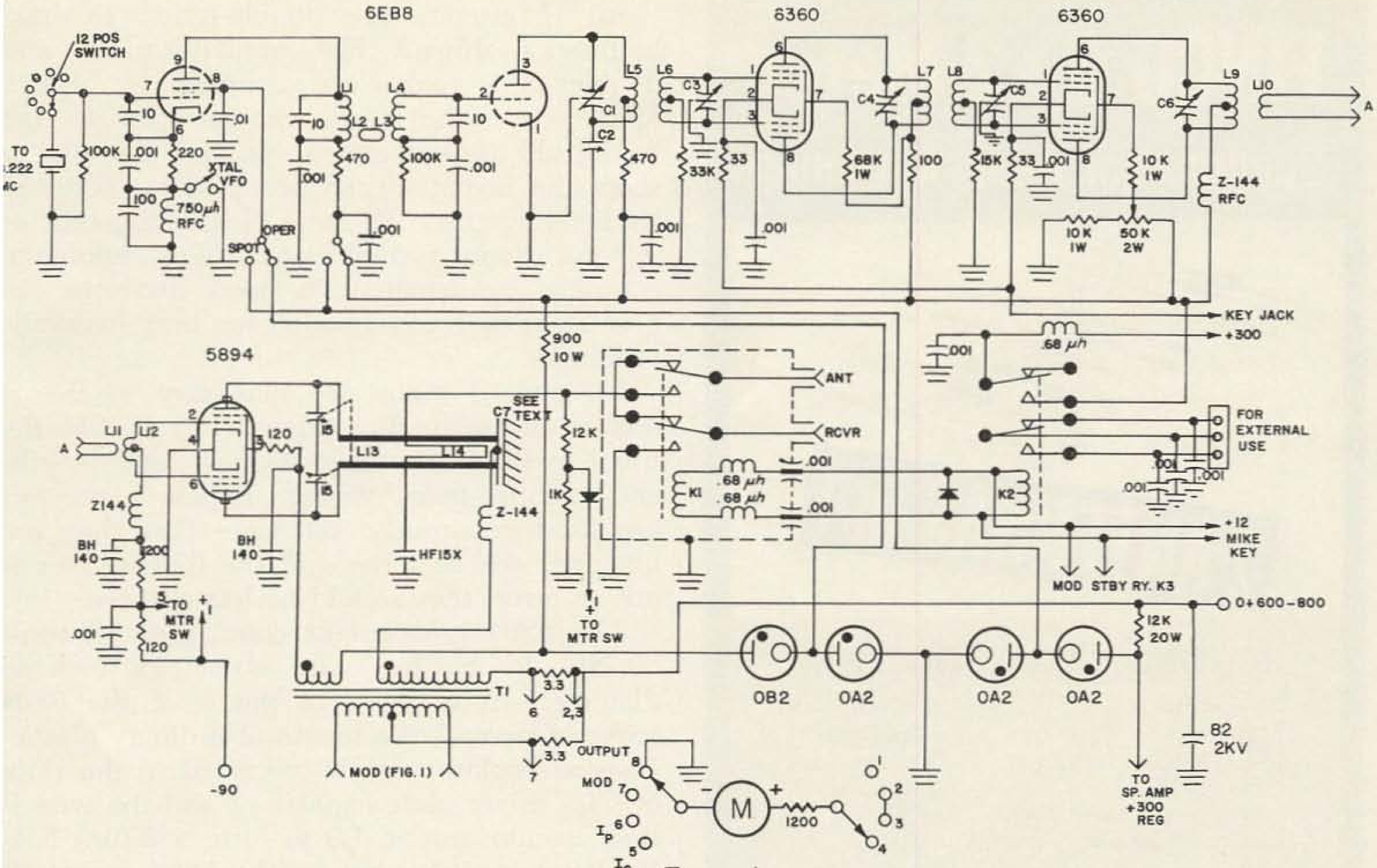


FIGURE 1

crystal is preferable. Output of the 12AX7 goes through a 12AU7 cathode follower to the clipper, after which it is filtered before being applied to a 12AU7 "cathode" phase splitter. The phase-split outputs are amplified by another 12AU7 before reaching the 807 grids. Hi-fi fans will recognize the influence of the popular Williamson amplifier here.

Fixed bias is also applied to the 807's, with a standby relay to bias them all the way off. The entire power supply to the speech amplifier and 807 screens is regulated at 300 volts by a pair of OA2's.

Metering is provided in the final grid and plate, the modulator plate, and in the output through a built-in rf voltmeter.

That's enough description for the moment; we'll get back to theory after everything is put together. Here's how we built it. Feel free to add your own ideas, but watch out for trouble if you make major changes in parts layout. A rig this compact, at this frequency, with speech and rf circuits on the same chassis, is an open invitation to rf feedback. We had a few battles with it along the way, and no problems exist with the rig as pictured.

The starting point is a commercial 10 x 12 x 3 chassis. Lay out the parts as shown on the bottom and top view photos and mark all holes. Exact locations of capacitors and transformer-mounting holes will depend, of course, upon the models of components you are using.

With all the holes marked and drilled, you can install all sockets. The 807 sockets submount on metal spacers one inch below chassis level, to allow the height of the rig to be reduced to 8 inches; they could be an inch and a half but we had no spacers that length. The 5894 socket is a Johnson unit, mounted flush from the top of the chassis.

With all sockets in place and properly oriented, filament lines can be wired. We hooked everything up for 12-volt operation since mobile use was the prime purpose. It wouldn't be too difficult to wire the rig for either 6 or 12-volt filament use by judicious series-paralleling of the few tubes with 6-volt filaments.

Next, relay K2 (the open frame unit behind the meter) should be installed and the 300-volt power wiring connected. Decoupling capacitors can go in at this point also.

With all power wiring in place, the rf section can be wired starting at the oscillator and working toward the final.

The sharp-eyed among you will see from the photos that we originally built the rig with a single crystal socket and added the switch and crystal bank later; you can do it either way but if you're putting in the crystal bank you can save the cost of one socket by coming up to the switch arm with bare wire through a ½-inch hole in the chassis. The toggle switch visible near the oscillator tube in the top-view photo is the vfo-xtal switch shown on the schematic.

All ıf circuits are double-tuned to hold harmonics down. The oscillator-plate and doubler-grid tanks are coupled by 1-turn links, while the other circuits (up to the final grid) are inductively coupled. The photos show the layout clearly; coupling is adjusted by bending the coils more closely together or moving them farther apart. The minimum coupling consistent with good drive to the next stage is recommended for best harmonic reduction.

No special pains are necessary in the rf section through the driver, except for the usual VHF precautions of short lead lengths and point-to-point wiring. Bypass capacitors are used generously, but note that they are not used on the screens of the 6360's. This is not an error; they should be left off here.

The 5894 grid circuit consists of 1½ turns of No. 12 bus-bar wire about 1¼ inch in diameter, from pin 1 to pin 5 of the 5894 socket. One end of a length of ordinary plastic-covered hookup wire is grounded to the rotor of C6 (driver plate capacitor) and the wire is then wound around L9 to form a 2-turn link. It comes straight over to the 5894 socket, is wound into a 1-turn link inside the grid coil, and grounds to the 5894 socket on the far side. The close-up photo shows the details. Though this sounds (and looks) crude, it eliminates one tuning adjustment and provides plenty of power transfer.

The 5894 tank circuit is almost completely homebrew. The lines are built of 3/16-inch pipe, spaced ⅝ inch apart and silver-soldered to a 2⅞ inch square of perforated brass stock. They are bent 90 degrees at a point 2⅝ inches from the plate, and extend a total of 7¾ inches from the plate. At the ends of the lines, ¾-inch flexible shim-stock straps connect them to Fahnestock clips, which make contact to the 5894 plate pins.

At the junction of the shim-stock straps and the lines, additional straps of shim stock are connected and run to the Bud dual-15-mmfd double-spaced plate tuning capacitor. This capacitor is mounted on 0.040-inch plastic, and is completely isolated from ground. The shaft connects to an insulated coupling which runs through the front panel to the tuning knob. Perfect balance of the lines is important; do all you can to achieve and maintain it.

The 2⅞ inch brass sheet at the other end of the lines forms the hot plate of bypass capacitor C7. The dielectric of this capacitor is 0.016-inch sheet phenolic, and it should extend at least ¼ inch beyond the brass sheet all around the edges to prevent possible dc arc-over. The brass-sheet and phenolic sandwich is clamped tight to the chassis with nylon hardware.

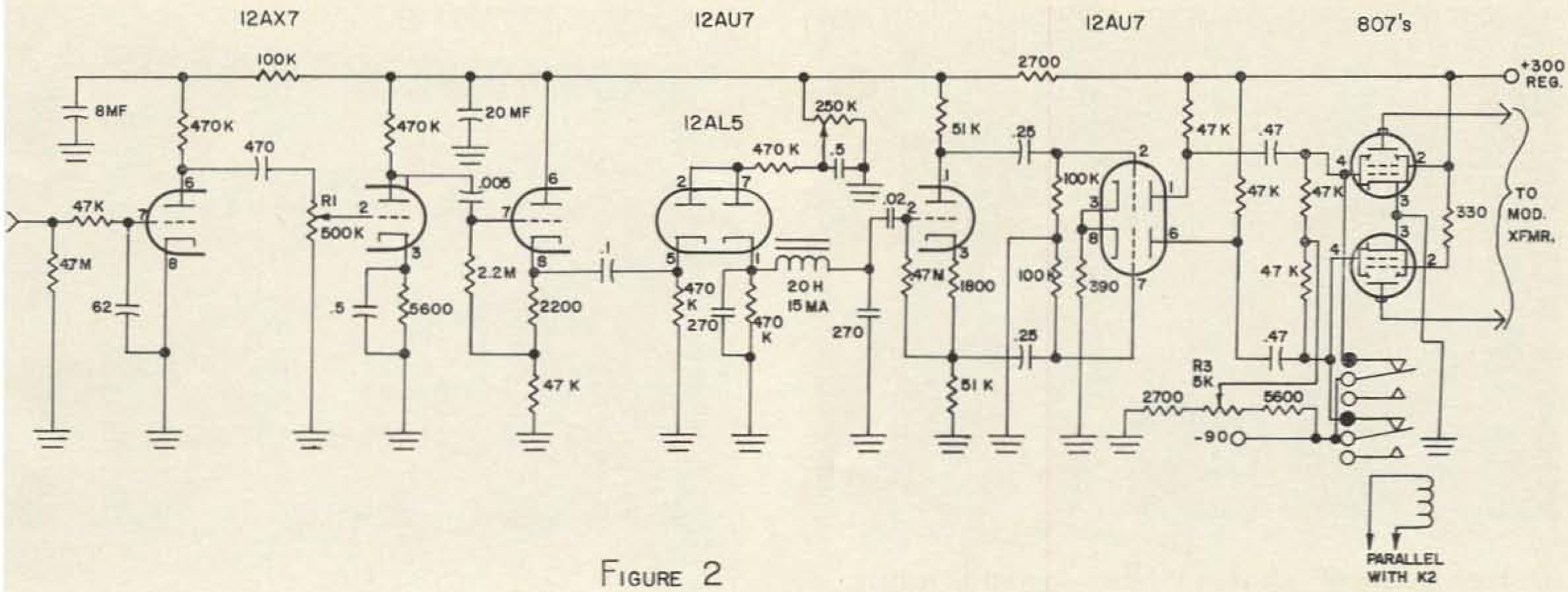


FIGURE 2

Dc connection to the 5894 plate is made through an rf choke visible in the bottom-view photo directly behind the meter switch. The lead from this choke runs through a ½-inch clearance hole in the chassis, through a 1/16-inch hole in the phenolic sheet, to the brass plate, where it is soldered. The other lead goes to the meter switch/shunt assembly.

Rf output from the 5894 tank comes from a link made of No. 12 wire which is insulated with Teflon tuning. The link is 2¼ inches above the chassis, and 2½ inches long. One end connects directly to the bottom terminal of relay K1 (inside the metal shielding box, bottom view of chassis) and runs straight through the chassis in a gum grommet until it is 2¼ inches above chassis, where it bends to be parallel to the plate line. The other end projects down 1 inch, to the stator terminal of the Hammarlund HF-15x capacitor which tunes the link. The link is entirely self-supporting.

With the rf assembly completed, the front, back, and shielding plates may be bent from sheet aluminum and drilled for the appropriate controls. The shielding plate should be as far from the 5894 lines as the lines are from the front plate, to preserve balance.

With the rf deck complete, the meter switch can be assembled following the schematic and photos and, together with the meter, put into place. Then the rf section can be checked out through the final grid circuit.

If all is well, proceed to the audio department. Though the photos make it look complex, the wiring is actually simple. The apparent complexity is caused by our striving for shortest possible leads to prevent any rf feedback, with resulting stack-up of parts atop each other.

To wire the audio, start at pin 6 of the input 12AX7 and wire through as the signal progresses. Leave off connections to back-panel controls R1 and R2 until wiring is complete. Then add connections to the controls, and the two resistors and the capacitor in the grid circuit of the input 12AX7.

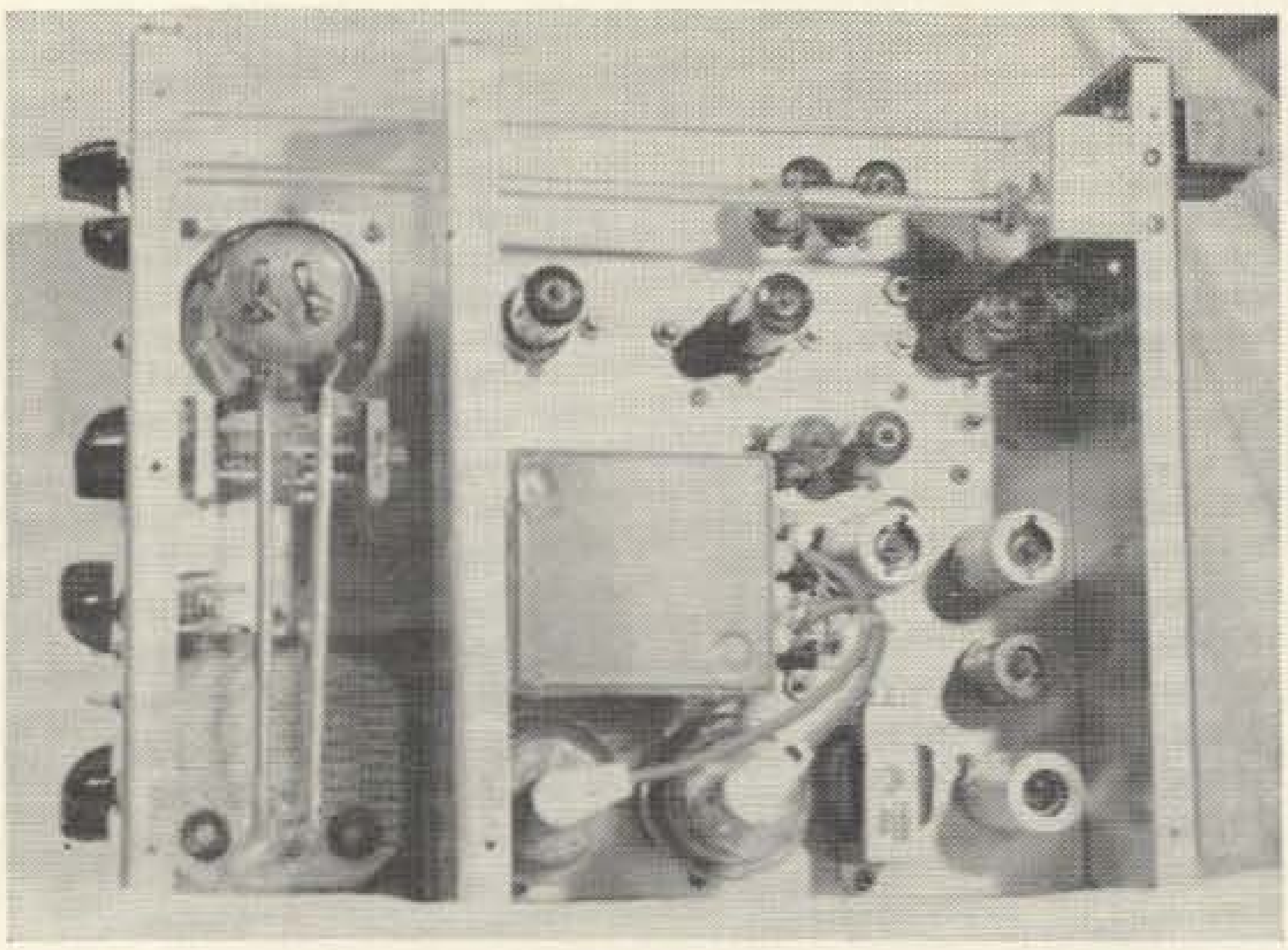
The choke in the filter circuit is a Merit type C-2985, and no substitutions are recommended here. With 270-mmfd capacitors at each end, this filter has a cutoff frequency of about 2500 cps, and substantially eliminates all clipping splatter above 5 kc or so.

The only unusual portion of the modulator is the standby relay, K3, in the 807 grid circuits. This relay applies 90 volts negative bias directly to the grids in standby, to cut off the 807's and prevent any current drain. It pulls in on "transmit," and is effectively out of the circuit.

The modulation transformer we used is a Collins Radio Co. item taken from a Collins 618S1 commercial rig, and bearing the part number 677-0537-00. It has separate secondaries for screen and plate of the final-amplifier tube, and is the smallest 90-watt mod transformer we have seen. Its impedance ratings are 5500 ohms plate-to-plate in the primary, 2000 ohms in the plate secondary, and 200 ohms for the screen winding. However, it is working at considerably higher impedance levels in this circuit.

Our transformer had a high-voltage to case short, which was "cured" by insulating the case from ground and then taking special care not to touch the critter (the shielding cage helps in this respect). You might be able to obtain a similar transformer from the surplus stores operated by Collins for their employees. If not, use a 8-henry, 50-ma choke between the 5894 screen and its regulator tubes, and a "universal" 60-watt transformer for modulation.

Visible in the photos but not shown in the schematics is the AM-CW relay which shorts out the plate winding of the modulation transformer for CW operation. This is a dpdt relay with the normally-open contacts wired to the mod-transformer plate-secondary ter-



Top view of chassis shows general parts layout. 5894 occupies compartment at left. In line from 5894 to crystal switch are 6360's and 6EB8. Two VR tubes are below crystal-switch shaft, other two are directly below them. Modulator starts with 12AX7 at lower right, with 12AL5 directly above and a 12AU7 above that. Second 12AU7 is directly to left of first one, while 807's are directly below mod transformer.

minals, and the arms connected together. One end of the coil goes to +12 volts, while the other end runs to the fone-cw switch on the back panel. This switch is a spdt with its arm grounded; in the cw position it grounds the mod-xfmr relay, and in the fone position it grounds the key-jack lead.

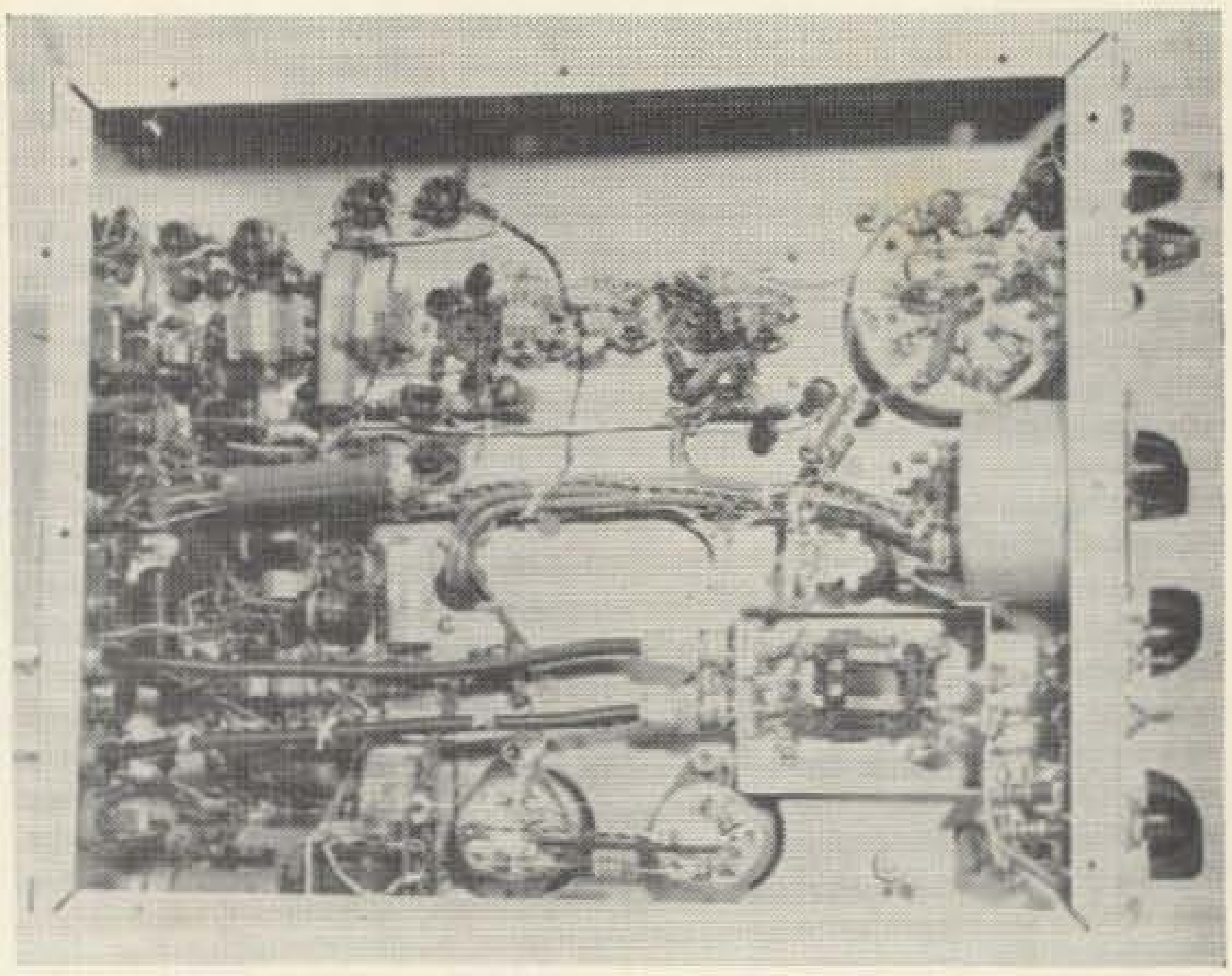
Because this relay carries modulated B+, which can reach 1600 v on positive peaks of modulation, it is also insulated from the chassis, and the shield of the tube nearest it is wrapped with fiberglas insulating tape as an added precaution.

With rf and audio wiring complete, all that remains to finish the job electrically is to install the rest of the control circuitry, the rf output meter components, and the back-panel cabling.

The major item in the control circuitry not already hooked in is the antenna relay, K1. This is an ordinary dpdt relay with a 12-vdc coil, but is enclosed in a small chassis box as shown in the bottom-view photo. We took the lid off the box for the photo so you can see what's inside.

The output link runs through a hole in the box directly to its relay terminal. Antenna and receiver connections through the box are made with coax fittings; we used BNC because we had them on hand but any other small coax fitting would do as well. The shields *must* be grounded at this point to prevent leakage, so don't just run coax through holes in the box.

The relay coil wiring is decoupled with



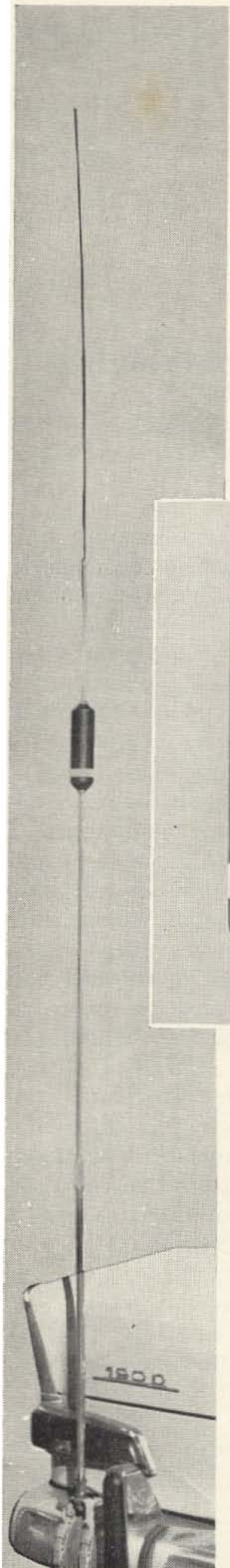
feed-thru capacitors, and .68-microhenry rf chokes between the feed-thrus and the coil itself. The feed-thrus are visible at the front of the box.

Rf voltmeter components are inside the box also, and the dc output to the meter switch also passes through a feed-thru capacitor. A silicon power diode is best for the rf voltmeter, since 80 watts on 50 ohms comes out to be a little over 60 volts, and the 1N34 series is rated for only 50 piv.

Also in the interests of diode protection, the meter switch wiring should be changed a bit from that shown in Fig. 2. The change consists of interchanging the Ig and Mod positions of the switch, so that high-voltage contacts aren't located immediately adjacent to the rf voltmeter contacts. We built it the way it's shown and arc-over between contacts has killed two diodes for us so far!

With electrical hookup complete, only one step remains before tune-up and testing. That's to install the shielding cage. It's made from Reynolds do-it-yourself stock, bent to shape and secured to the lips of the plates with No. 4 sheet-metal screws. A bottom plate, not shown, completes the shielding.

Tune-up and adjustment procedures for this rig divide into two parts, rf and audio. Experienced VHFers won't need much direction for either, but if you do find that you need help we'll have the second part of this article next month, giving you step by step tuneup instructions.



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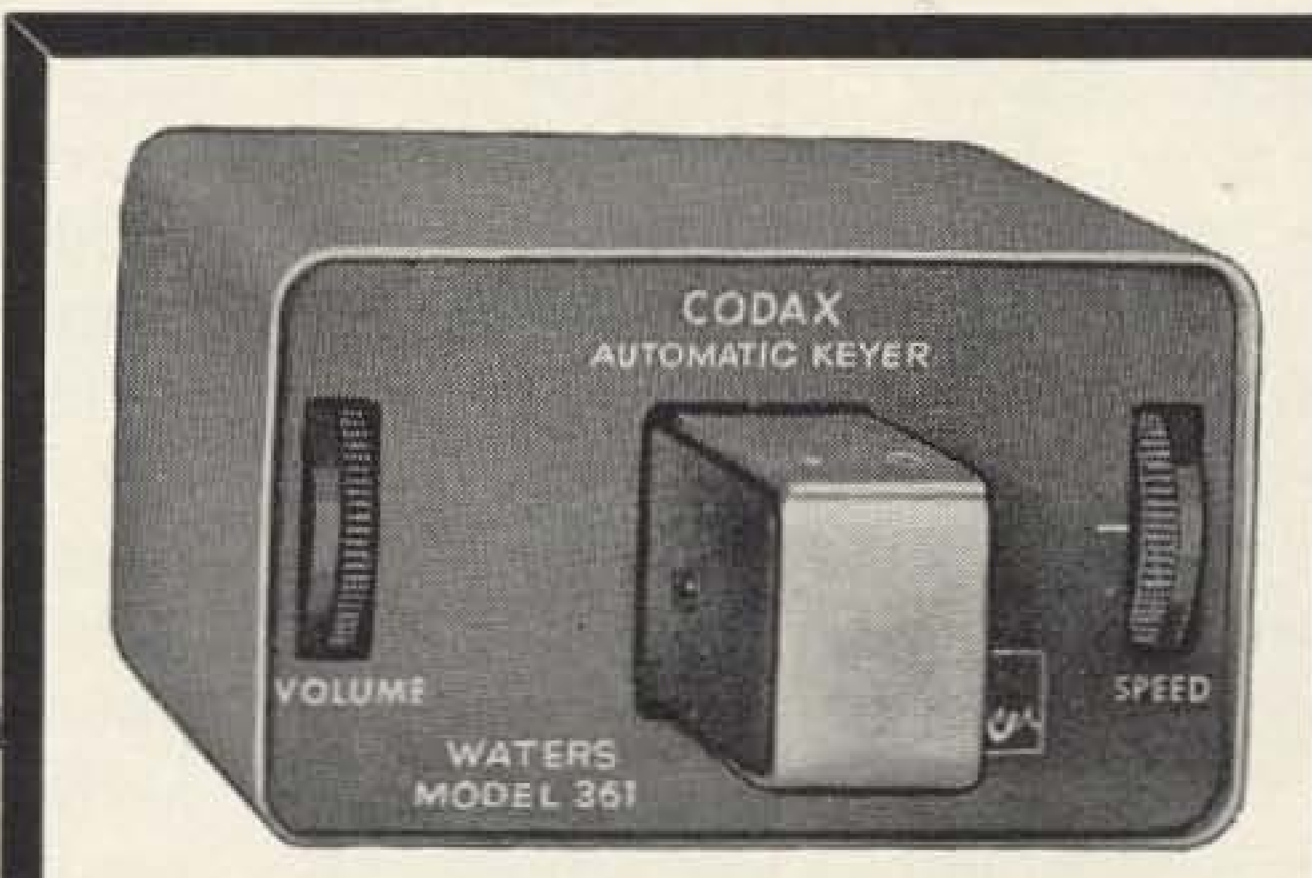

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How to build a transistor AM transmitter that works.

Leonard Geisler

AM, the Amateur and Transistors

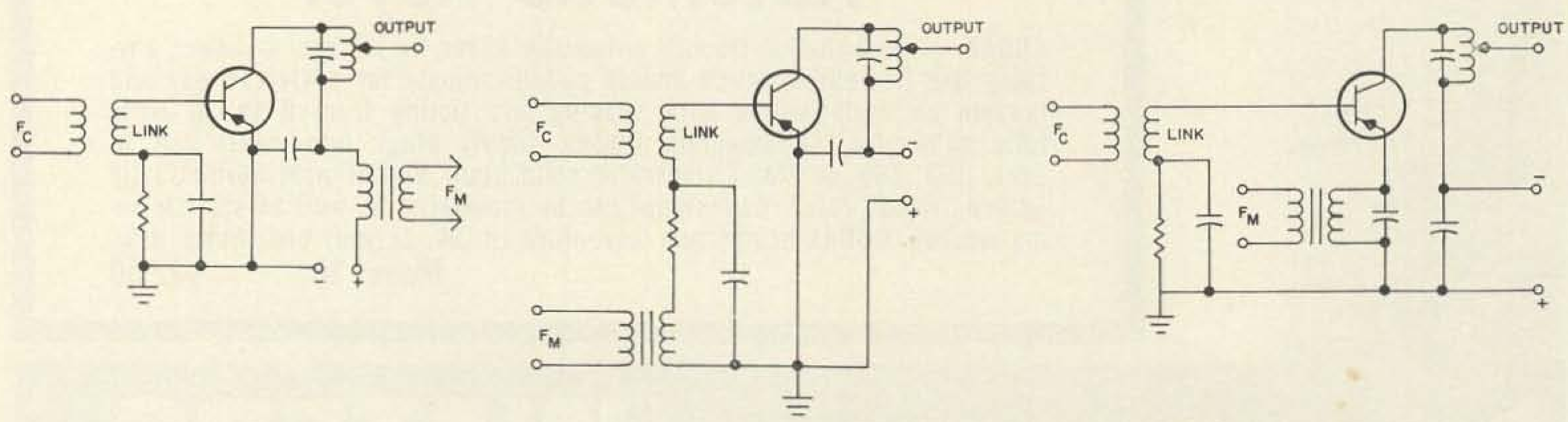
Now that transistors are plentiful and the low and medium power high frequency types are priced within reason, there is no excuse whatever for the amateur to continue working with cut and dried vacuum tube circuitry. We shall endeavor to clear away the fog of misinformation and misconception by a small amount through presenting some of our proven circuits here.

There have been several half-truths circulated in the literature about amplitude modulating transistor transmitters. It has been stated that it is a) difficult to 100% modulate a transistor final, b) driver stages must be modulated, along with the final, to obtain good overall depth of modulation, c) linear modulation of transistors is very difficult, so a) and b) are true. We shall try to dispel this gloom.

Shown in Fig. 1a through c are representative diagrams illustrating how amplitude modulation is applied to a transistor transmitter power amplifier or final. Any of the circuits will work properly, provided alignment of the final tank is done with extreme care.

When the tank is tuned for maximum CW output, it is virtually impossible to linearly modulate the transistor; a) in the foregoing paragraph is therefore true.

If we apply rf drive to the final and tune its tank while a steady tone is applied to the modulator transformer, it is possible to peak the amplifier output so that we can obtain a very large amount of rectified—or demodulated—audio across the load resistor. An oscilloscope properly connected to the modulated transistor amplifier will show a clean trapezoid pattern, indicating 100% modulation at some given af input level. However, if we measure the unmodulated carrier output of such a transmitter tuned in this fashion, we will find it far less than it is when we tune for maximum CW output. This then proves that a) above, is untrue. The true statement should read, "It is impossible, under the usual conditions associated with CW tuning of a transistor amplifier, to obtain linear or 100% modulation." With this interpretation, we can safely assume the rest of the statement is subject to further clarification, and research.



COLLECTOR MODULATION, HIGH LEVEL, HIGH Z. A.

BASE BIAS MODULATION, LOW LEVEL, MEDIUM Z. B.

EMITTER MODULATION, INTERMEDIATE LEVEL, LOW Z. C.

FIG. 1 CONVENTIONAL AM CIRCUITS.

The subterfuge of modulating the earlier stages of a transistor transmitter as recommended by some [1] is really not an elegant solution to the problem, *even though it works*. It is my firm conviction that the best solution to a problem is to avoid it in the first place. Fig. 2 illustrates a better way.[2]

Here, modulation is applied to both the emitter and collector, 180° out of phase. What happens, in effect, is that the base-emitter voltage, hence the gain of the transistor, is varied simultaneously with the increase and decrease of the collector source voltage by the modulating waveform. The modulated transistor is always kept operating in class C throughout the modulating cycle and linear—100%—modulation is easily attained.

We should mention here that by comparison, the multi-stage modulation systems mentioned in reference (1) operate with the final transistor working as a class B *non-linear* amplifier during nearly half the modulating cycle, so a high degree of inefficiency may result.

The combined emitter-collector modulator is capable of being operated at both high efficiency and high power. A transmitter of a given final dc input power using multi-stage modulation, and a comparable dc input to a combined emitter-collector modulated transmitter will show, in actual tests, that the simpler combined system is greatly superior.

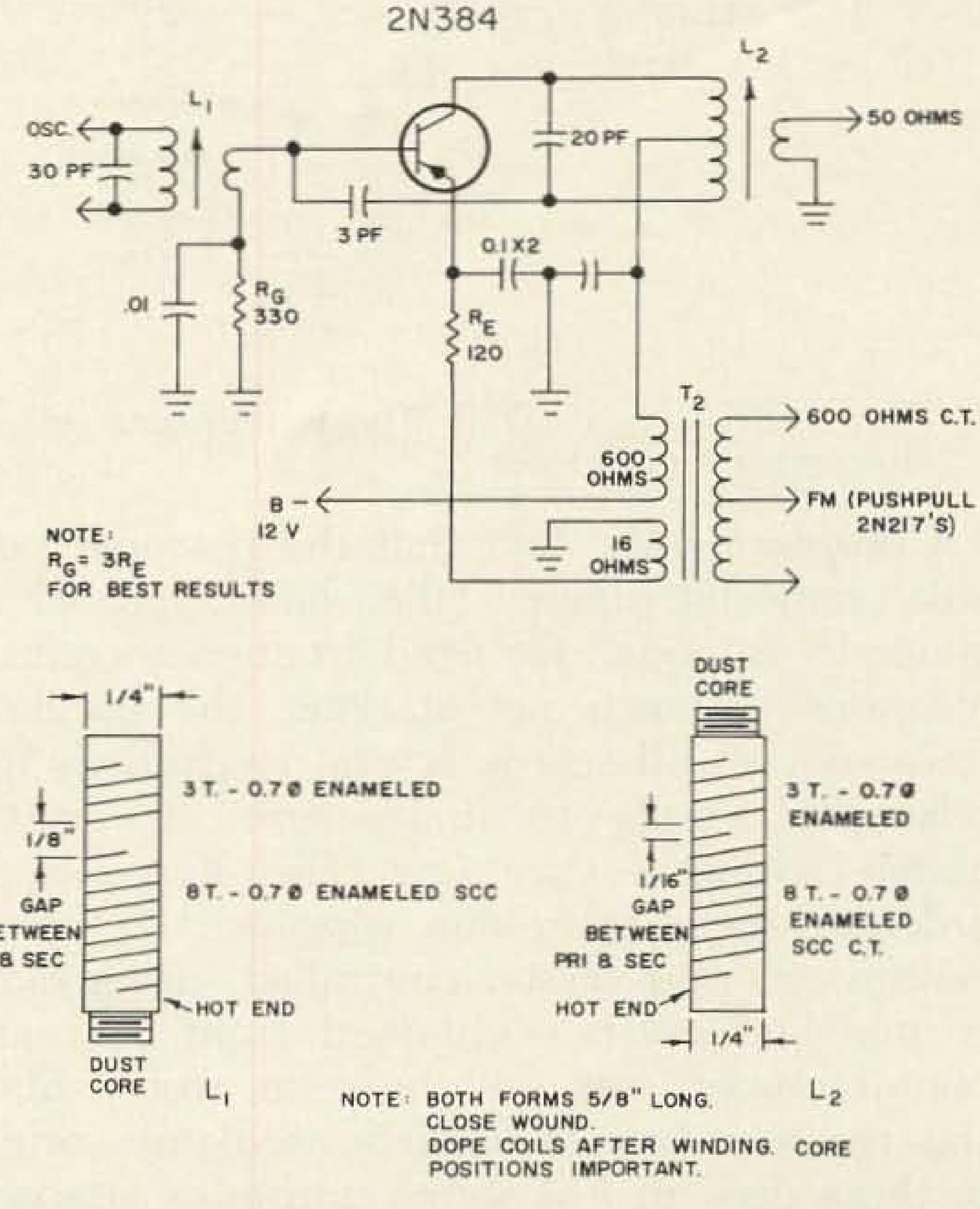


FIG. 2

Fig. 2. Combined emitter-collector circuit. Modulates linearly.

Unmodulated carrier power of the emitter-collector modulated transmitter will nearly equal full CW output. This means, with linear modulation, we are able to obtain full ICAS output from a low power transistor. In the practical circuit of Fig. 2, we show the modulator transformer as having a 600:16 Ω impedance ratio between the two secondaries. With other transistor types, it will be necessary to adjust the impedances to match the power level you intend to operate your own transistor at.

We now come to the "something-for-nothing department."

Economy of space and battery power dictate highly efficient systems must be used with the rapidly-becoming-popular types of personal portable communications gear. This means we must use the most simple, yet effective, system possible in both the transmitter and receiver. Such a system is the well known DSB transmitter with a simple locked oscillator bfo in the companion receiver for carrier reinsertion.

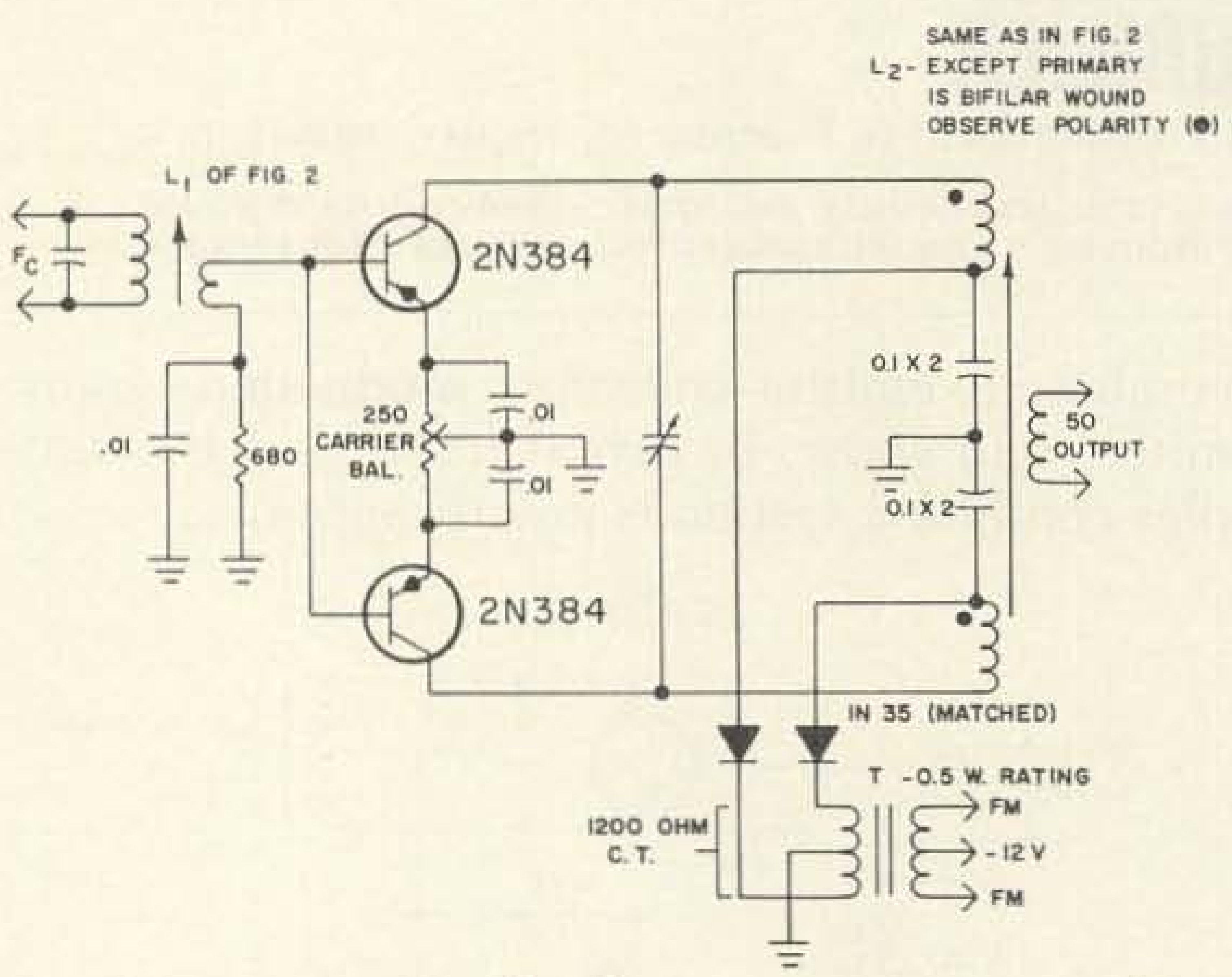


FIG. 3

Fig. 3. Brute force DSB. The louder you yell, the better you get out.

Considering the fact that the personal portable radio-telephone (the handie-talkie) is generally intended for fixed frequency communications between net stations, the oscillator frequency of all sets is crystal controlled. It is relatively simple to make sure all crystals match within a very few tens of cycles by ordering them from one supplier. If the receivers are also crystal controlled, using closely matched crystals obtained from the same manufacturer, we only have to worry about the receiver bfo. A locked oscillator, similar to those used in FM stereo multiplex adaptors, except for frequency—which should be that of the set's *if*—will generally suffice under most conditions.

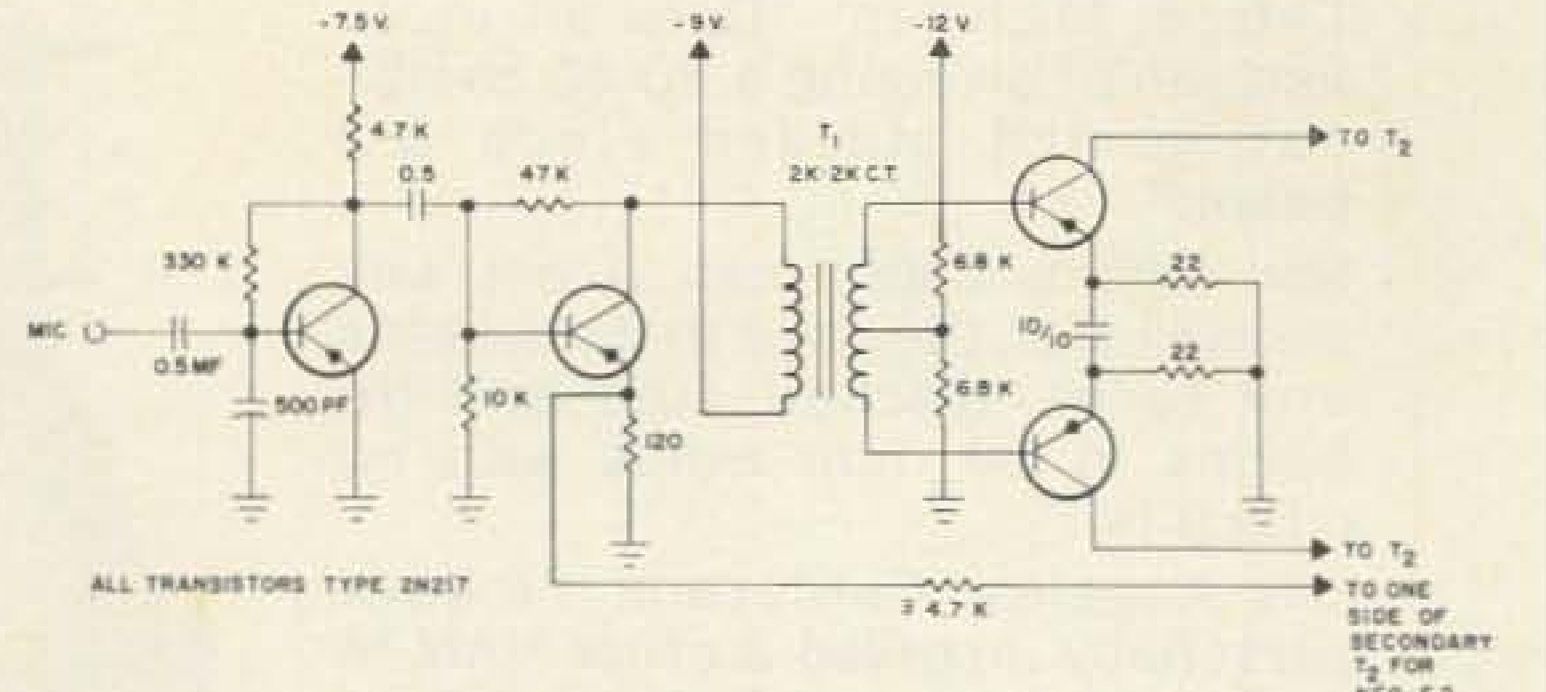


FIG 4

Fig. 4. Amplifier-Modulator.

Now that we have taken care of the "minor" details, let us continue. One highly efficient DSB transmitter final is shown in Fig. 3.

The credit for the original idea should go to John Palmer, KH6EGP. The author built the test circuit, found it worked—better than anticipated—and is passing it on to you for your information.

This circuit functions somewhat like the screen-grid DSB transmitter originally developed by an associate of Costas. There is one exception however; transistors have no screen-grids!

Rf excitation is applied in parallel to the bases of the final transistors, while their collectors are wired in push-pull. This results in carrier cancellation when no modulation is applied. Audio power is fed in push-pull to the final collectors, keying the transistors *on* alternately on each audio cycle. This generates an rf output which contains no terms of f_C or f_M, but only the upper and lower sidebands. (Any unbalance is adjusted by the 250 Ω emitter potentiometer.)

Sufficient power is available from the modulator amplifier to supply full rated dc input to the DSB generator transistors. There is no need to connect the final to the battery. By using this kind of modulator-cum-power supply, we save on primary battery power, as the final draws power only when you talk. (The louder you yell, the better you get out!) The oscillator operates while the press-to-talk button is held down, however. In order to prevent "pumping" it is recommended that a large electrolytic capacitor be shunted across the battery supply, say about 500 mfd.

It is necessary to prevent distortion in the modulator. Heavy negative feedback keeps the modulator power output stage matched to the load at all levels of speech input. The audio amplifier circuit we used is shown in Fig. 4.

. . . Geisler

1. Pacific Semiconductors Applications Notes, "Citizens Band Transmitters," by George G. Lentigerau and Joseph E. Mackey.

2. Electronic Design, Oct. 11, 1962, "Linear Modulation of Transistor Power Amplifiers," by Leonard E. Geisler.

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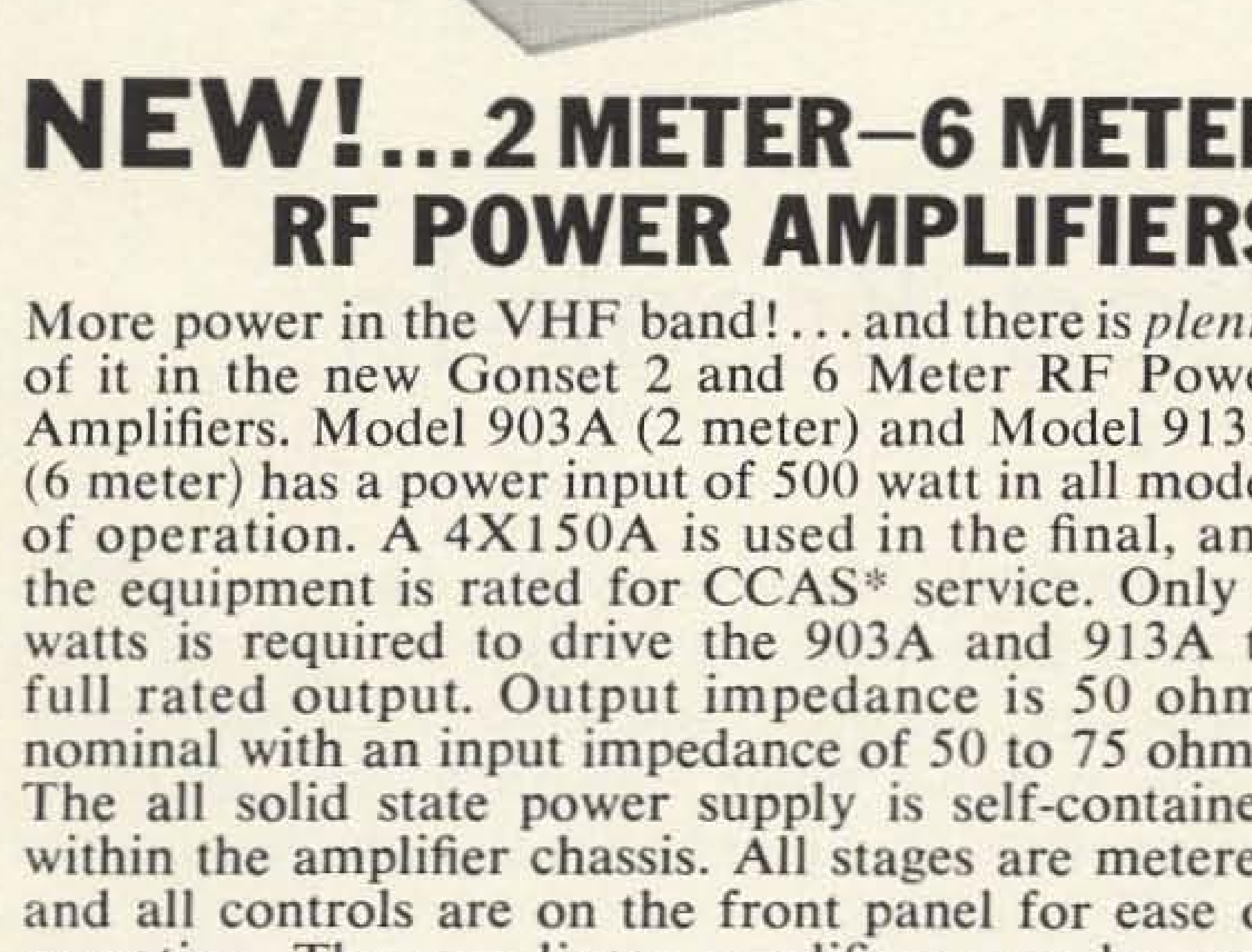

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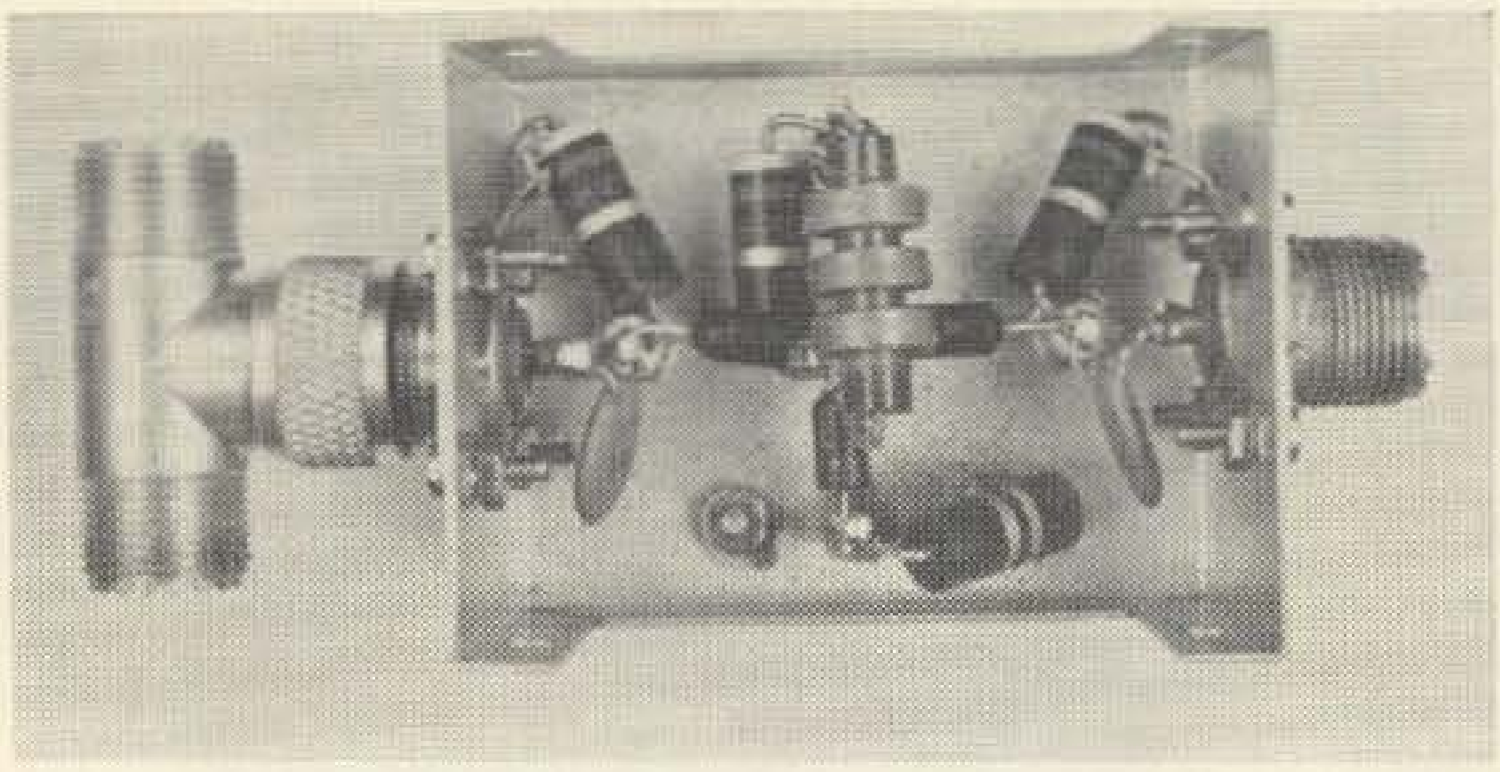

M. Hughes, VE2AUB/W5
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Fort Davis, Texas

Diode Controlled Break-In

The search for the perfect T-R switch will continue for many years to come. The coax relay is hard to beat when one considers its broad bandwidth, its 100 db isolation, and its almost zero insertion loss. However, it is ponderously slow, it is noisy, and the best ones can cost a buck per db of isolation. What we require is a switch that will operate quietly and quickly, one which has low insertion loss and which is cheap and easy to make.

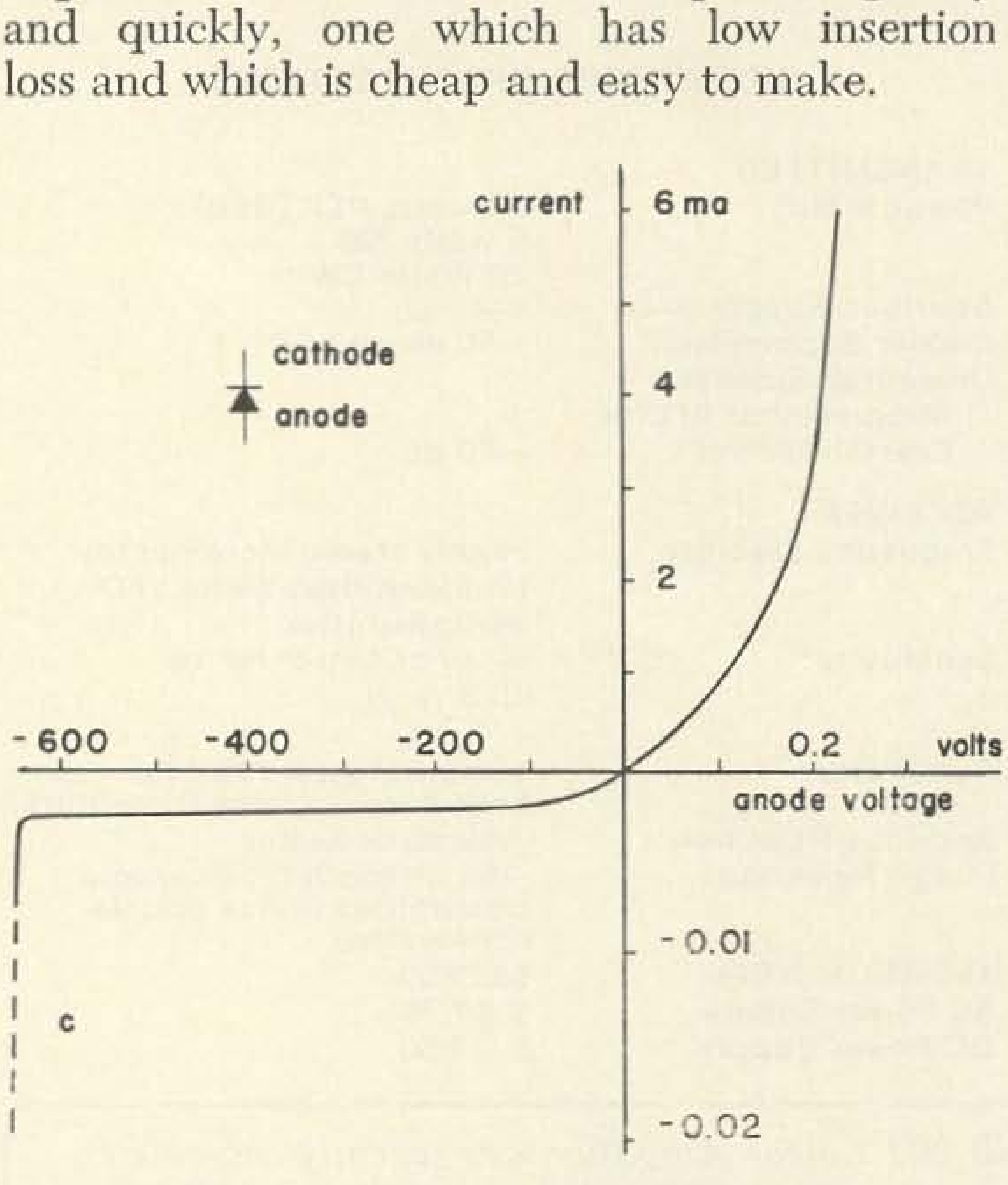

Fig. 1. Characteristics of silicon diode.

Electronic T-R switches are usually quite complex and seldom provide as much isolation as the coax relay. Some give a little gain for reception; most will degrade the receiver's performance. Some must be retuned as bands are changed. Many carry the hazard of TVI. A few are extremely tricky to adjust. The magic tee, ferrites, and coax and waveguide diode switches come into their own at UHF, but these techniques cannot easily be used in the HF bands.

The T-R switch described here will give about 80 db of isolation, less than 2 db insertion loss, and fast, silent operation; it is broadband, calls for a minimum of adjustment, and, above all, it is simple to build.

As the title tells, the active element is the diode. In fact we use the silicon diode. The characteristic (Fig. 1) shows that, depending upon the polarity of the applied voltage, the silicon diode either conducts heavily or (almost) not at all. In other words it is very much like a switch, where the switch's "handle" is replaced by the applied voltage. Whatever we do, we must be extremely careful not to operate the diode on the part 'C' of its characteristic, because the high dissipation in this so-called 'breakdown' region is destructive.

Let us investigate the silicon diode a little further. A forward biased diode (one with a positive potential applied to its anode) will conduct heavily. Under these conditions it presents a low impedance to a superimposed rf signal as well, providing the peak-to-peak amplitude of the rf is less than twice the available bias voltage. A reverse biased diode (one with a positive potential applied to its cathode) will pass hardly any current at all. It presents a very high impedance to dc. To an rf signal it will also present a high impedance, but the value of the impedance to rf will be lower than for dc. The reason for this difference is the fact that the diode possesses a certain amount of capacity, which passes the rf but blocks the dc. The impedance of a reverse biased diode therefore decreases with increasing frequency, but even at 30 mcs it will still be several thousand ohms if the bias is great enough.

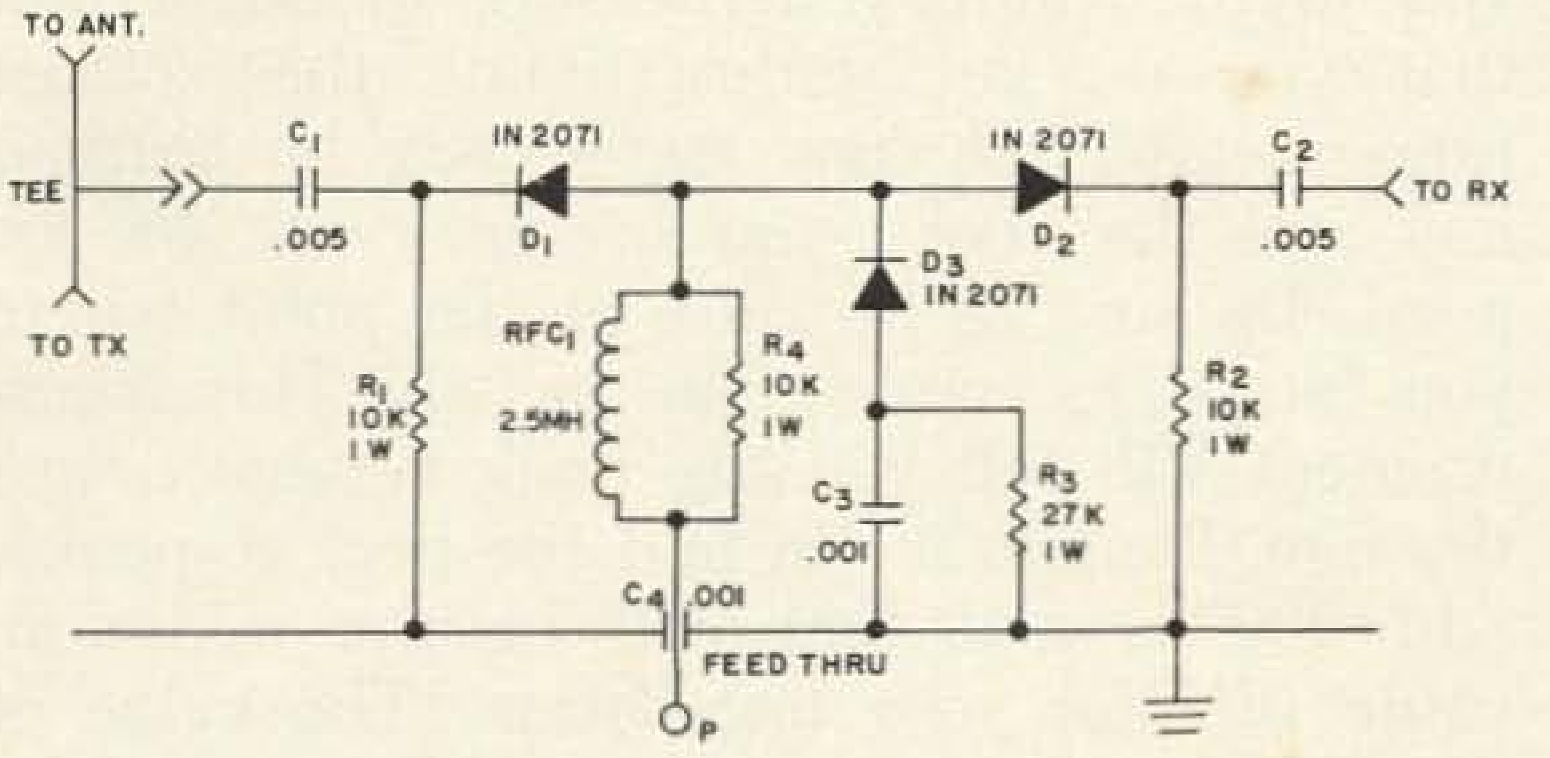

Fig. 2. T-R switch.

These ideas may now be applied to the T-R switch, the circuit of which is shown in Figure 2. The resistors form dc circuits for the bias current. They have values that are high in comparison to the impedance of the coax line, and so they do not shunt the signal excessively. The capacitors are there to block the dc and to pass the rf where necessary. Diodes D1 and D2 are biased in the same direction. D3 is biased in the opposite direction. Suppose we apply a positive potential at the point 'P'. Diodes D1 and D2 will conduct and diode D3 will be reverse biased and will not conduct. Thus diodes D1 and D2 present low impedances while D3 presents a high impedance. Under these conditions an rf signal from the antenna will be passed to the receiver with little attentuation.

Suppose now that we apply a negative voltage to the point 'P'. Diodes D1 and D2 will no longer conduct. D3 will be forward biased and will conduct. Therefore diodes D1 and D2 will present high impedances and D3, a low impedance. Rf from the antenna or from the transmitter will now be confronted by the high impedance of D1. A certain amount of the signal will leak past D1, only to be confronted by another high impedance, that from D2. A much easier path for any rf that does leak past D1 is to ground through the relatively low impedance of D3 and C3 in series. Accordingly, very little signal will now be able to reach the receiver.

Practical Considerations

It is now pertinent to decide upon the values of the components in the circuit and the voltages necessary for switching purposes. Let us first consider the operation of the device in its receiving mode. Signals will generally be quite small with voltages across the coax line seldom exceeding a few millivolts. Therefore, if the bias applied at the anodes of D1 and D2 is + 1v or more, the impedance through the unit will remain small for all signals.

During tests of the prototype, it was found that increasing the bias voltage above about + 10 volts at 'P' did not reduce the insertion loss materially. For general operation in the receiving mode, it is recommended that about + 30 volts be applied at 'P', but anywhere between + 10 and + 100 volts should prove satisfactory. From the point of view of heat, it is better to keep to the lower values of bias, since resistors R1 and R2 will be dissipating all their power in the close vicinity of the heat-sensitive diodes.

In exceptional cases, for instance, when a powerful transmitter is located nearby, cross modulation may be experienced, but an increase in the bias voltage should eliminate the problem. For a similar reason the bias supply must be well regulated, otherwise the slight change in transmission characteristics of the switch with changes of bias will modulate incoming signals, and hum will be apparent on them all.

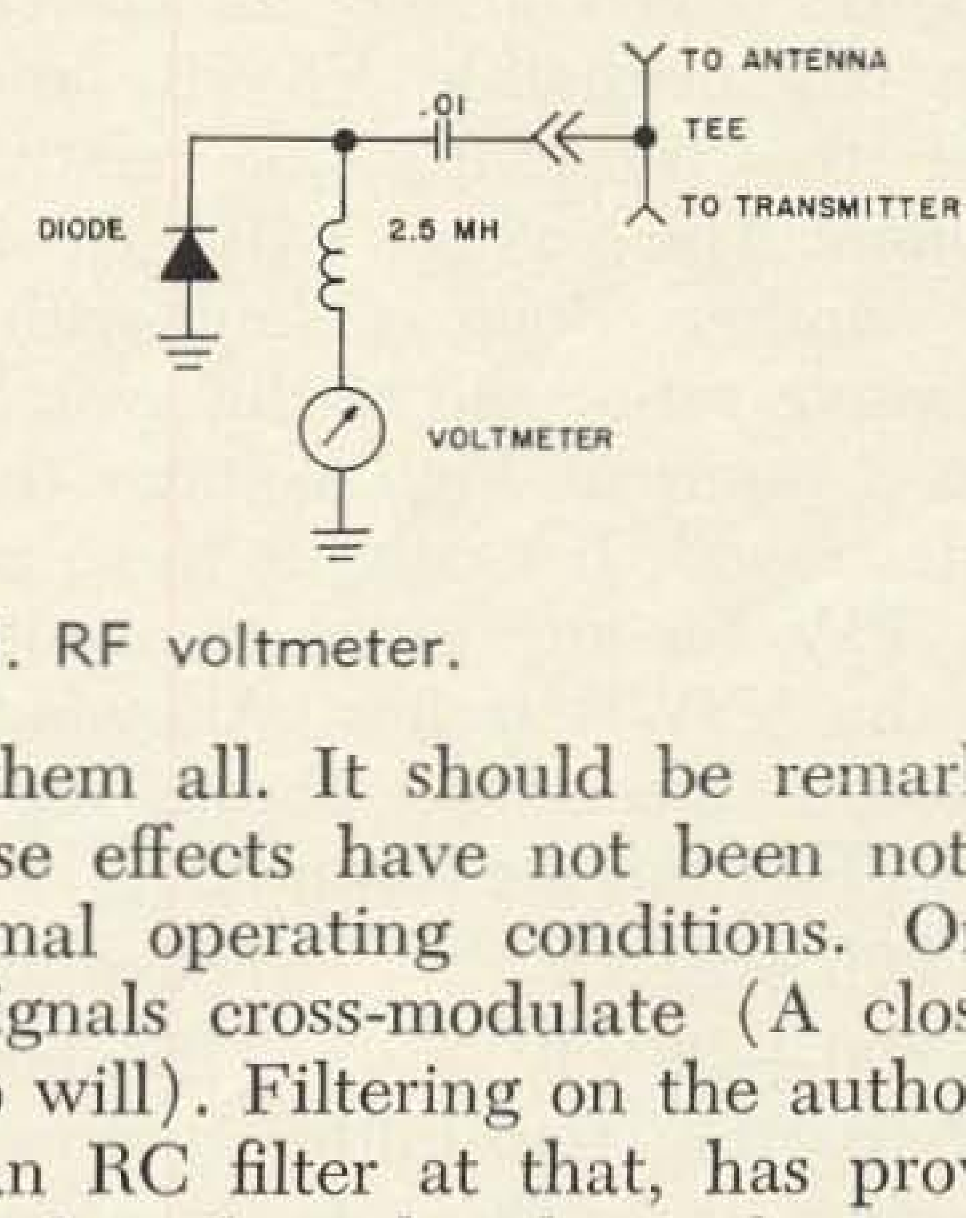

Fig. 3. RF voltmeter.

It should be remarked here that these effects have not been noticed under normal operating conditions. Only very strong signals cross-modulate (A closely coupled gdo will). Filtering on the author's transmitter, an RC filter at that, has proved adequate, and no hum has been detected during reception. However, with *no* bias the hum is severe.

Now we come to the bias requirements for the transmitting mode. It is possible to obtain the bias voltage directly from the rf output of the transmitter, but a number of disadvantages are associated with this method. TVI is one. Another is that large pulses of rf would reach the receiver at the start of each morse character, since there would be no provision for sequential keying. Also, for adequate isolation, a rather high voltage is necessary.

Tests were made with a signal generator having an output of a few volts. When a bias of - 6 volts was applied at 'P' the device had an isolation of 50 db. For increases of - 2 volts under these conditions there were increases of 1 db in the isolation. With - 120 volts applied at 'P' the attenuation reached 80 db. The available test gear was not sufficiently sensitive to measure any further increase in isolation.

We now know that the reverse voltage across the diode D1 must not be less than - 120 volts for proper isolation. Let us allow a safety factor of 30 volts, and make it our criterion that, whatever the signal from the transmitter, the voltage across D1 must be at least - 150 volts. A transmitter with an output of 100 watts will produce a peak-to-peak of 200 volts across a 50 ohm line. This peak-to-peak voltage will be centered on the bias voltage applied to D1 and will swing the voltage across D1 from 100 v greater than the bias to 100 v less than the bias at the rf rate. To meet our criterion, therefore, the bias must be at least - 250 volts in this case. To ensure that the diode is not operated in its breakdown region, its piv should be at least 350 volts. If we allow a 50 volt safety margin, then we must choose a diode with a piv of 400 volts.

The figures given above are correct if the coax line has negligible VSWR, and if the output of the transmitter is relatively free of harmonics. The voltage will vary from one place to another along a line with a high standing wave ratio, and if the switch is connected at a point of high voltage the diodes may be destroyed. It is simple to calculate the necessary PIV for any given transmitter power when the VSWR is low. Allowing for the safety margins mentioned above, we can calculate the PIV from the formula,

$$PIV = 200 + 21\sqrt{P} \qquad \text{(50 ohm line)}$$

$$PIV = 200 + 26\sqrt{P} \qquad \text{(75 ohm line)}$$

where P is the transmitter output power. Table 1 gives the value of piv necessary for a number of given output powers.

TABLE 1

DIODE PIV	P-P XMTR VOLTAGE ACROSS COAX	XMTR PWR OUT (WATTS)* 50 ohm	75 ohm	OPTIMUM BIAS VOLTS
400	200	100	66	250
600**	400**	400**	260	350**
800	600	900	600	450
1000	800	1600	1050	550

* Power values for CW.
** Author's unit uses 600 volt diodes, 350 volts bias, with a 150 watt transmitter. All other values untried.

It is quite simple to measure the voltage across the coax, however, and eliminate the possibility of destroying the switch. All that is needed is a peak reading voltmeter like that illustrated in Fig. 3. The diode and capacitor should have voltage ratings greater than the voltage expected across the line. The meter should be as sensitive as possible (absorb little power) and it should be used on its highest range for greatest accuracy. However, even a meter with a basic movement of 1000 ohms per volt will introduce only a small error. Whatever meter you use, add 10% to the value you measure to be certain that you do not underestimate the voltage present—after all your meter may be reading low and the choke you use may not be too good. Be sure to measure at the point where you intend to connect the switch. This measurement will tell you the peak voltage across the line. Double it (to find the peak-to-peak), add 200 v, and that will be the minimum value PIV for your installation. The value of bias for a given transmitter is determined by adding 150 v to the value measured by the peak reading voltmeter. A higher bias may be used providing the diode you select has a high enough PIV.

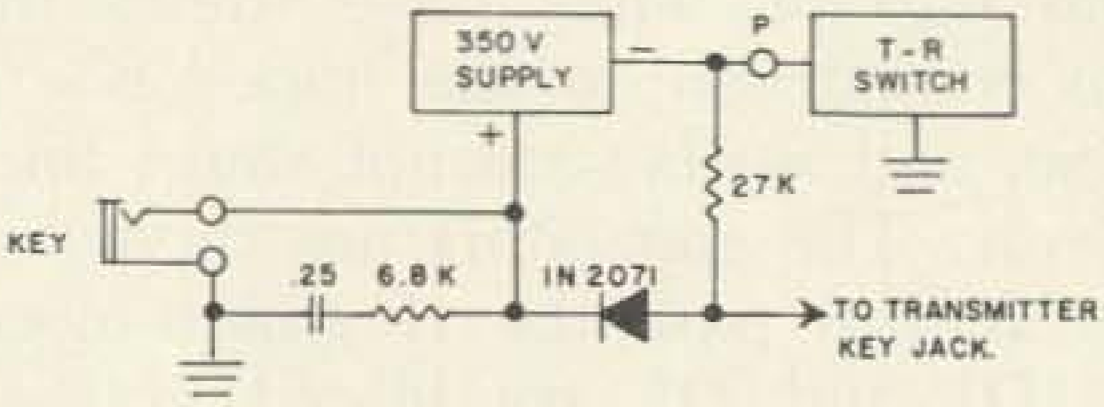

FIG.4

T-R switch hook-up.

Other components in the circuit are not so critical. D2 has to withstand the transmitting bias, and for convenience may be the same type of diode as D1. D3 has only to hold off the receiving bias and may have a lower rating than diodes D1 or D2. The capacitors should have reactances that are low compared with the line impedance, and the resistors should have values that are high compared to the line impedance. The choke should have no series resonance falling in or near a ham band, and it should present a reactance of several thousand ohms over the ranges on which it is to be used. R4 damps any tendency for ringing to occur due to the presence of the choke. Although C2 will normally have to withstand only the receiving bias, C1, C3, and C4 all must hold off the transmitting bias or the peak coax line voltage, and it may prove convenient to choose all the capacitors to stand the transmitting bias. Doing so when D2 has the same PIV as D1 might prove a useful feature, since the transmitter could be connected to either end without damage occurring. About 10 ma should flow through D3 in the transmitting mode, and one or two milliamps should flow through D1 and D2 during reception. The details giv-

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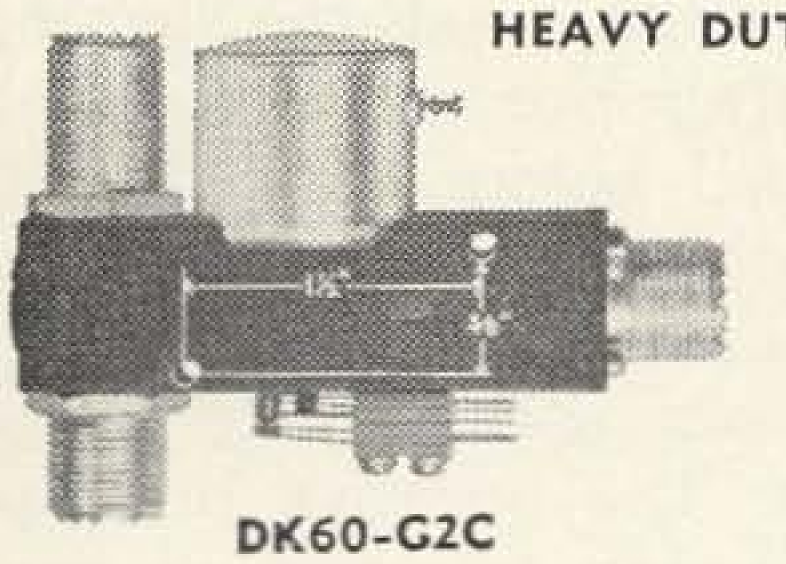

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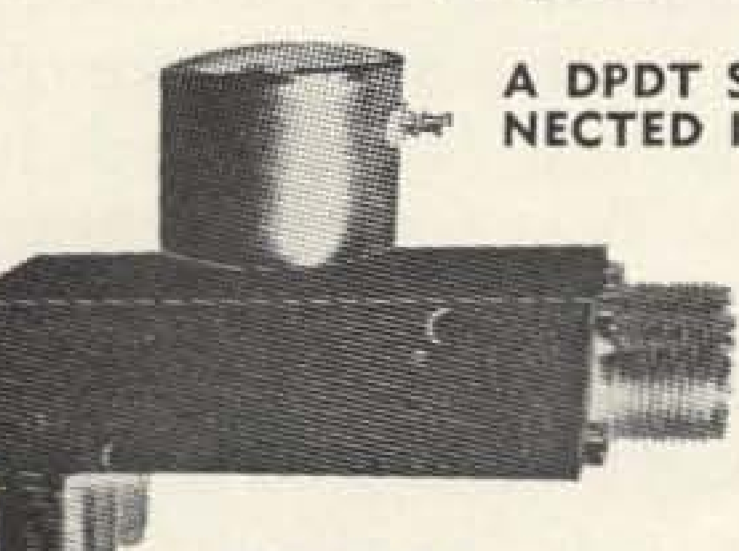

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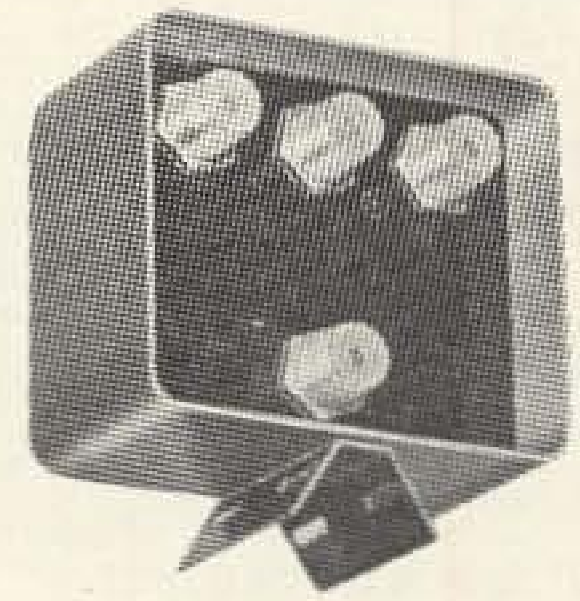

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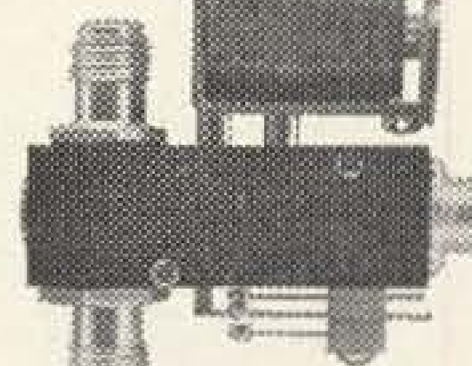

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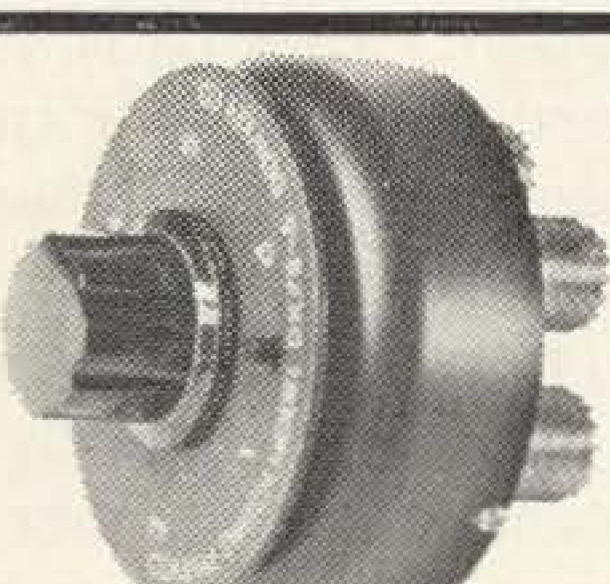

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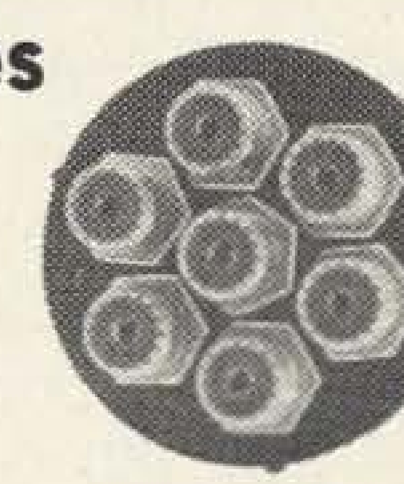

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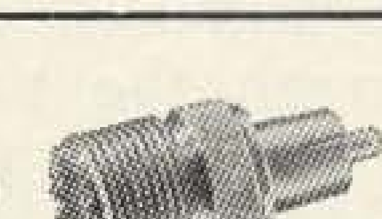
Male UHF to Male Phono Connector
$1.25 ea.



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en above should serve as guidelines for anyone who wishes to design his own switch.

Construction

The photograph shows the layout of the unit built by the author. It is housed in a 2¾ × 2⅛ × 1⅝" minibox. The heat-producing resistors are kept away from the diodes, and the imput and output circuits are arranged to minimize their mutual coupling as much as possible, thereby improving the isolation. The 2 watt resistors are not essential, and the 1 watt types specified in Fig. 2 will normally be satisfactory. However, for phone operation the dissipation of R3 should be checked to make sure that it is not being overrun.

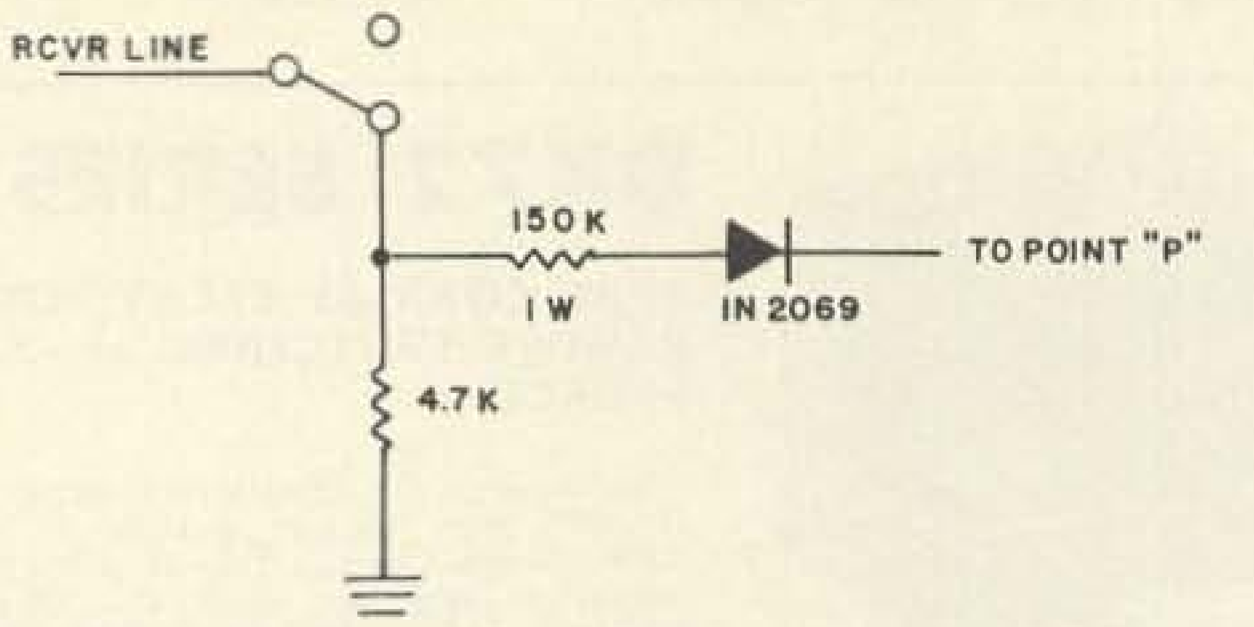


Fig. 5. AVC-MVC modification in receiver.

The diodes are supported on low capacity ceramic standoffs arranged down the center of the box. Capacitors C3 and C4 are mounted to the side. C4 is a ceramic feed-through and carries the bias current.

Control

There are many ways in which the biasing voltages can be applied. The method described below shows how another diode may be used to do some of the work.

Seventy volts appears across the contacts of the author's key when it is up. This voltage is used to bias the diodes in the receiving mode. A 27k resistor is connected in series with the 70 v line to the switch, as shown in Fig. 4. A diode is placed in series with the lead to the key with its anode towards the transmitter. A 350 volt supply, with its output floating is connected from the switch to the cathode of the diode. When the key is up, the diode is back biased by the 350 volt supply. No current is drawn through the diode; the 350 volt supply is isolated. However, current can flow from the transmitter into the t-r switch and bias it for receiving. When the key is depressed, current is drawn through the t-r, through the 350 volt supply via the key, thus biasing the t-r switch for transmitting. At the same time the back bias is removed from the diode (Fig. 4) which becomes a low impedance and the transmitter is keyed.

The CR circuit across the key contacts is there to prevent the t-r switch from returning to the receiving condition before the rf from the transmitter has had a chance to die away. The capacitor has to charge to about 200 volts before the negative bias is removed from the switch, and this takes several milliseconds. As the switch switches over to isolation in less than one millisecond, the shaping circuit in the transmitter prevents too much rf from being developed before the switch is in the transmitting mode.

A further embellishment of the circuit may be noted. Again we can use a diode to do some switching for us. The negative bias applied to the switch during transmission can, at the same time, be used to bias the rf stage of the receiver and reduce its sensitivity. The diode isolates the receiver from the + 70 volts applied to the switch during reception. Fig. 5 shows the arrangement used by the author. In the mvc position the avc/mvc switch normally grounds the avc line. The ground connection is removed and a 4.7k resistor soldered in its place. The switch side of the resistor connects to the 150k resistor and diode in series. A lead is taken from the cathode of the diode to the point 'P' of the t-r switch. In normal operation the 4.7k resistor makes no difference to the manual volume control, and, of course, it is out of circuit for avc. In other installations the value of the 150k resistor can be changed to suit individual requirements.

If *all three* diodes in the switch are reversed, a negative bias will be required for receiving, and a positive bias for transmitting. This alternative configuration may prove useful where the available voltages differ from those described above. There are very many ways in which biasing can be effected, and the reader will no doubt discover the method most easily adapted to his own needs. It is perhaps appropriate to include the circuit of a simple power supply that can be used with, say, the receiver power transformer, to supply the transmitting bias. It can also be used with a filament transformer and more filtering to provide the receiving bias. Fig. 6 shows a voltage doubler circuit that has a floating output. It can be used either for negative biasing as shown, or for positive biasing simply by reversing the connections to the output. The resistor R is adjusted to give the correct voltage at the point 'P' of the switch under operating conditions.

Conclusion

The diode T-R system described above has proved extremely reliable and effective. The arrangement switches so quickly and cleanly that only a slight click is heard at the start of each morse character. The click is presumably caused by the sudden change in the receiver's parameters as the negative bias is applied to the rf and *if* stages. The recovery to full sensitivity, which, to the ear, seems to take place instantaneously, is clean and free from clicks. During transmission the receiver gives a pure S8 monitoring signal.

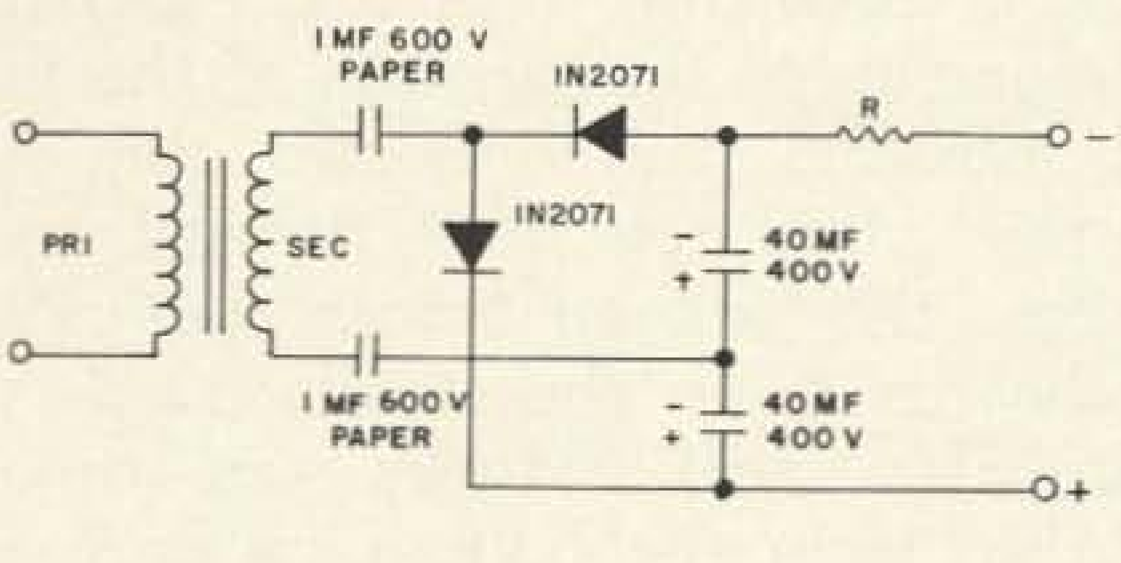


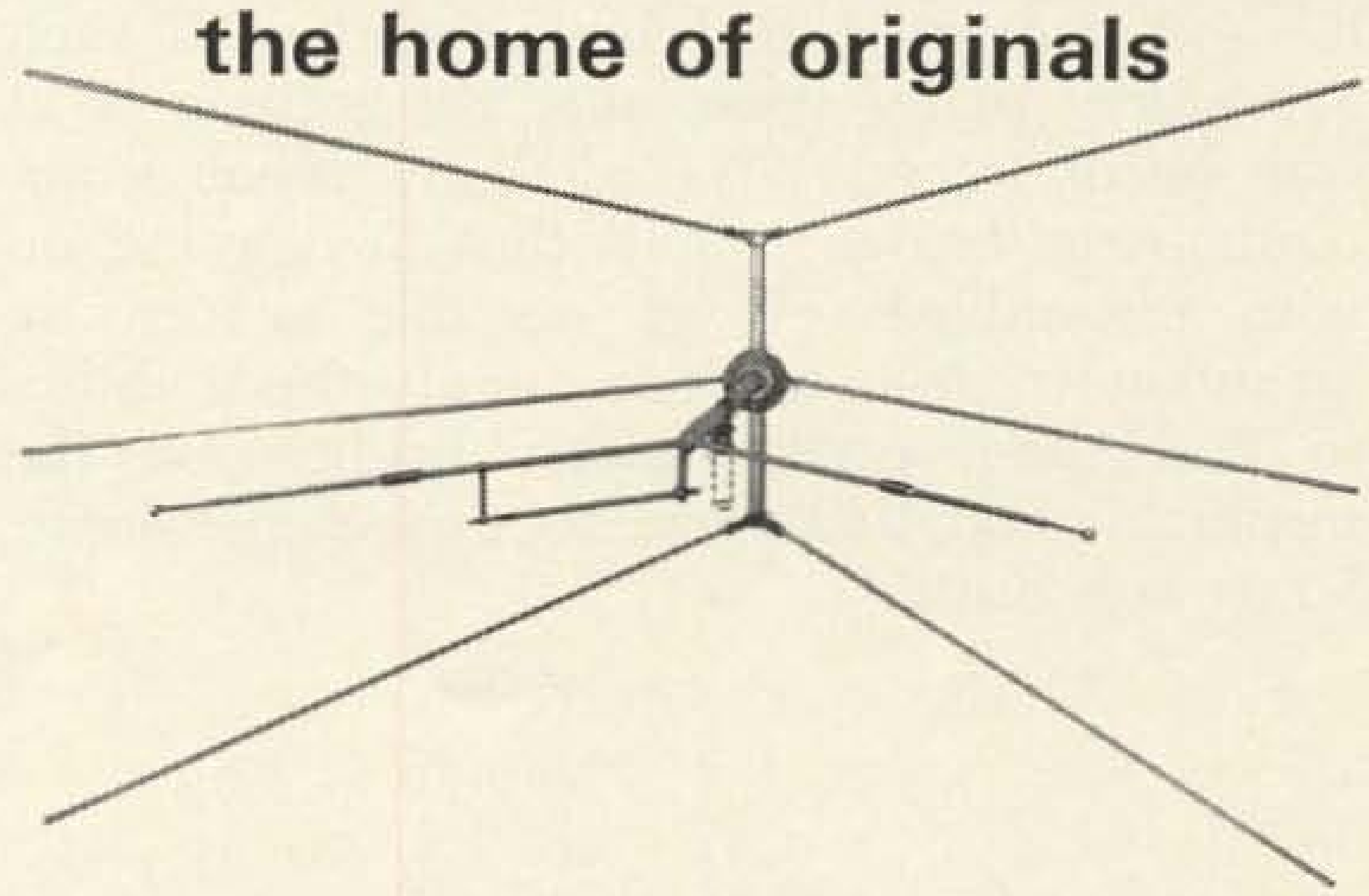
FIG. 6

Voltage doubler power supply.

Loss of sensitivity during reception is negligible. The switch's insertion loss was measured as less than 2 db over the range from 10 to 30 mcs, and there is no reason to expect any great change down at 3.5 mcs. As 2 db is substantially less than one "S" point it would remain undetectable under most circumstances. The diodes add little noise to the circuit since they are not matched to the line.

Some people may suspect that diodes at the output of a transmitter would produce nothing but TVI. As the TVI from a diode is a result of operating it over a non-linear portion of its characteristic curve, we have made certain that this does not happen. No TVI has been introduced at the author's installation, although the TV antenna is only 6 feet from the transmitting antenna and the TV station is 130 miles away.

. . . VE2AUB/W5



Capt. John L. Reinartz, USNR, Ret. K6BJ

Radio Calibration—How To Get It

This article, written shortly before his death, is the last work of one of amateur radio's most important pioneers. We are very proud that John chose 73, over all other ham magazines, to publish his articles for the last few years.

I was much taken with the article by Conway Wilson in the April '61 Issue of 73 Magazine. However, he left out the 'how to get it,' and because I had been faced with such a problem many years ago, the solving of it may be of interest. We all know what a potentiometer bridge is and that in conjunction with a standard cell we are able to measure an unknown voltage. It is merely the inability to find these potentiometer bridges on the surplus market that prevents their general use. So we substitute.

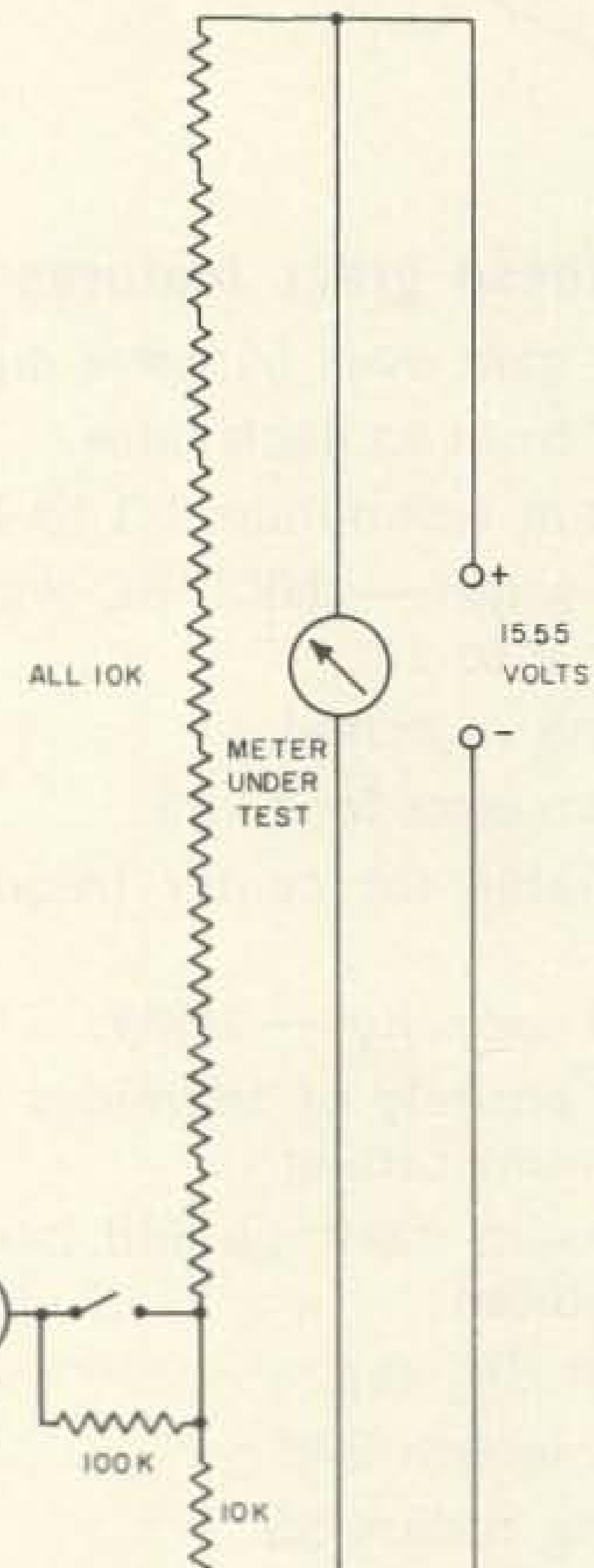


FIG 1

To refresh our memory let's look at Fig. 1. If we have ten good 10000 ohm resistors that have all been checked to 1% or better of being alike, we connect them all in series and we have a good start on a potentiometer bridge. Any voltage across the entire ten will now be the sum of the separate voltages across each one. If we had a standard cell connected from the start of the series of resistors and through a galvanometer to the junction of the first and second resistors and adjusted the voltage across the entire ten until the galvanometer read zero, the voltage across the entire ten would be ten times the standard cell voltage and probably 1.0192 times ten or 10.192 volts. Also, from the bottom up each resistor tap would give us a proportionate voltage. Consequently, if we had 100 resistors, the voltage across the stack would have to be 101.92 volts to balance the standard cell voltage across the first resistor.

Now not only don't we find such expensive potentiometer bridges on the surplus market, neither do we find standard cells there. These cost too much nor do we need them every day. Therefore a substitute is needed that will serve as well and with just about the same accuracy. So we do start with ten 10000 ohm resistors of 1 watt rating and all 0.1% accuracy if possible. If not we will be satisfied with 1% acuracy. Also we need 1 resistor of 1010 ohm value and another of 2040 ohm value. With the total combination we are going to be able to have ratios of 2, 3, 4, 5, 6, 7, 8, 9, 10, 50 and 100 to 1 of the voltage we are going to use as a standard in place of the

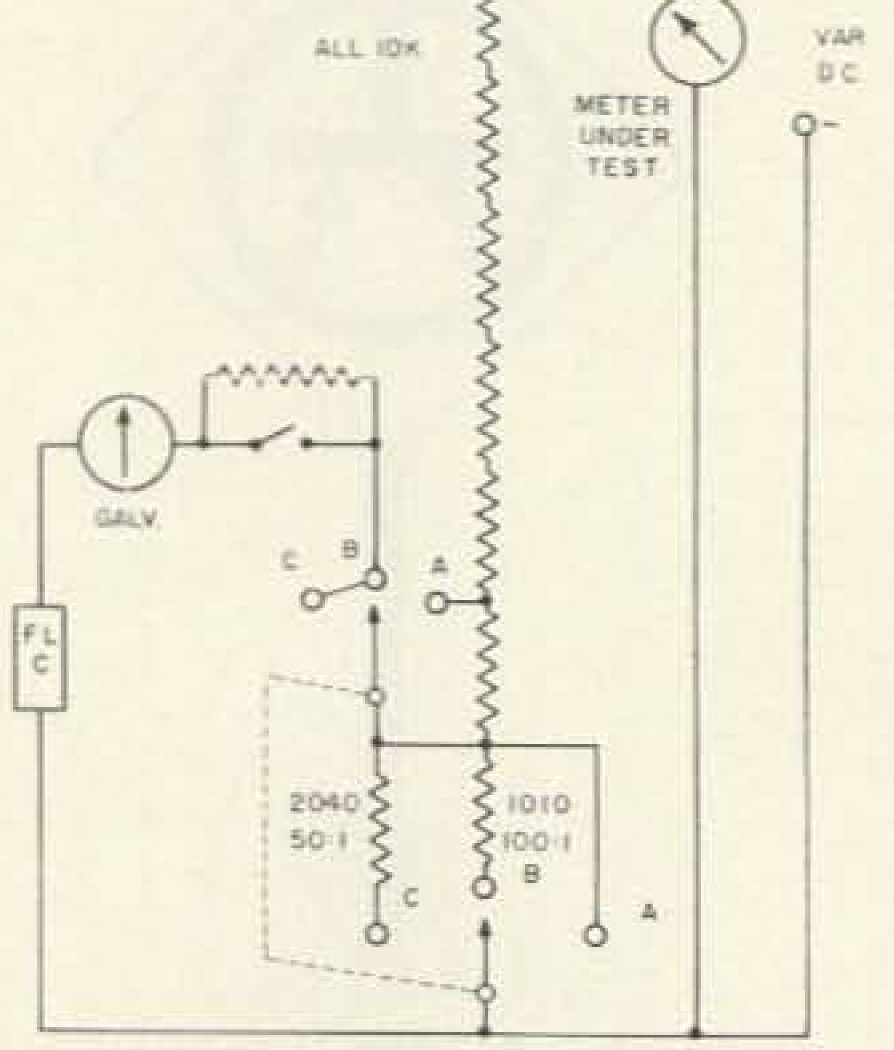


FIG 2

standard cell voltage. Our standard is going to be a flashlight cell. As far back as 1927 I learned that these cells have an open circuit voltage of 1.555 volts and since our improvised potentiometer bridge will draw no current from our flashlight cell we are assured of a constant 1.555 volts. Because I do have both the L&N potentiometer bridge and a standard cell that is certified at 1.0192 volts I have checked my 1927 observation and find that flashlight cells still have an open circuit voltage of 1.555 volts.

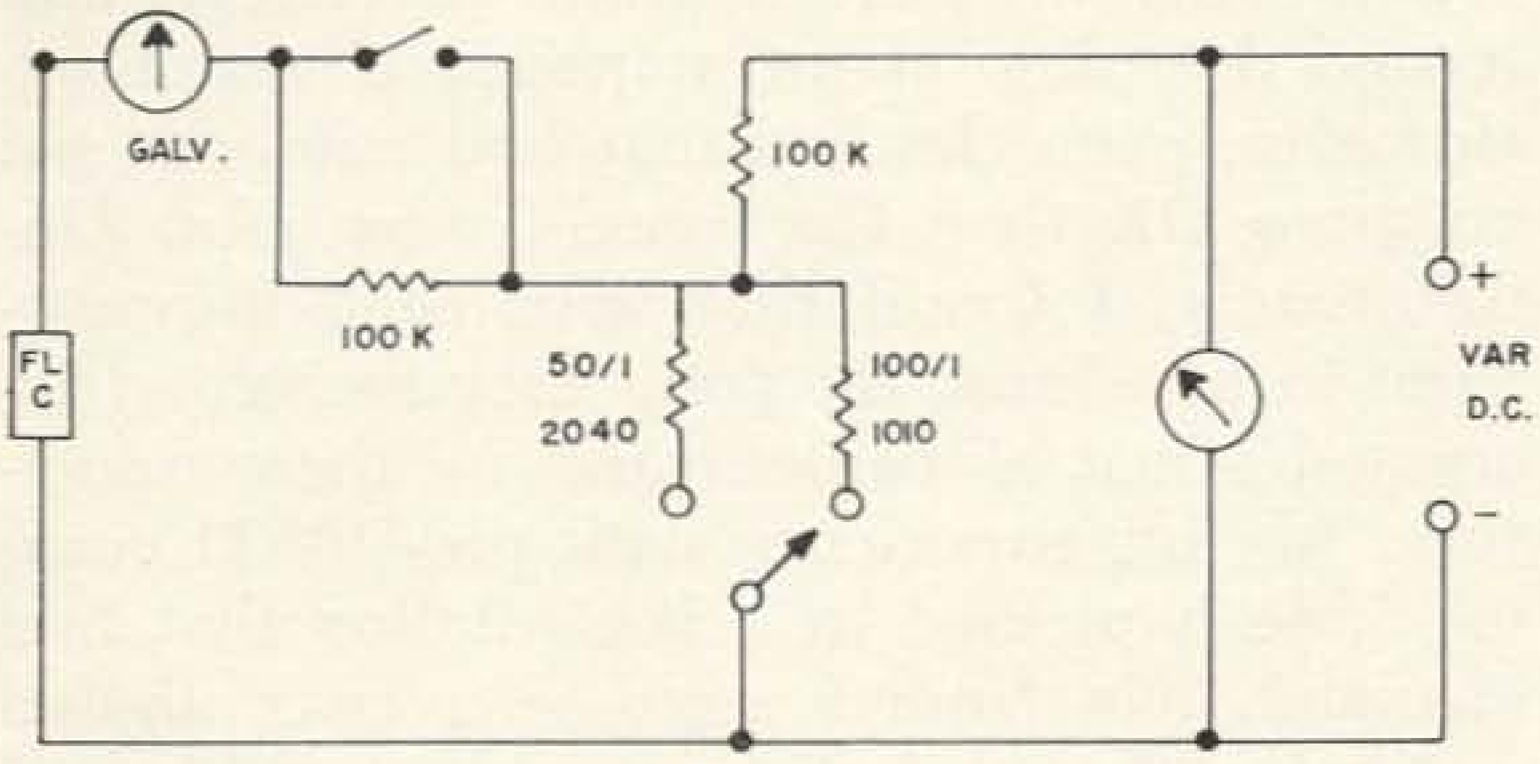


FIG. 3

Let's now look at Fig. 2. Here we have the ten 10000 ohm and the 1010 as well as the 2040 ohm resistors all connected up, together with a variable dc voltage source, a 25-0-25 microammeter, a push switch, a flashlight cell and a meter to be tested or a milliammeter to be turned into a voltmeter. The 100000 ohm resistor in series with the flashlight cell and the microameter is required to keep current through the meter within limits during changes of the variable dc voltage. When near balance has been obtained, the push switch shorts out the 100000 ohm resistor and final careful adjustment of the dc voltage is made to the point where the microameter reads zero. At this point the voltage across the voltmeter under test should read the 1.555 volts times the resistor ratio that was previously set up. The resistor stack has no bearing on the results of the test. It merely is a slight load across the dc source. Neither does the flashlight cell have any effect since it draws no current from the resistor stack.

You can do away with the resistor stack and use only 1 100000 ohm resistor and calculate the resistor to be connected at the bottom end of it and to the flashlight cell. You merely multiply the 100000 ohm resistor by the ratio you want to achieve and divide the result by the ratio less one. The difference between 100000 ohms and answer you got is the resistor needed. If 100/1 is what you wanted, the resistor value is the 1010 ohms mentioned above. The connections are as shown in Fig. 3. Now you know 'how to get it.' Have fun. . . . K6BJ

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Tuned Feeders Forever

When the writer started hamming almost thirty years ago, there were only a couple of really popular antennas. Our big favorites were the Windom ("single-wire off-center fed") and the tuned-feeder antennas—either end-fed (Zepp) or the center-fed system. A few of the boys were using exotic antennas such as the "delta-match" or some form of matched-impedance antenna using linear transformers for impedance matching. A few of the real old-timers were still using cage antennas and end-fed wires. I surveyed the situation and decided that the Zepp was my type of antenna. For several years I used tuned feeders—either the Zepp or center-fed antennas—with fairly good results. With either, I could flit around 80, 40, or 20 and load whatever rig was in use at the time without any worry as to how well the antenna was matched. The rig loaded and I got out.

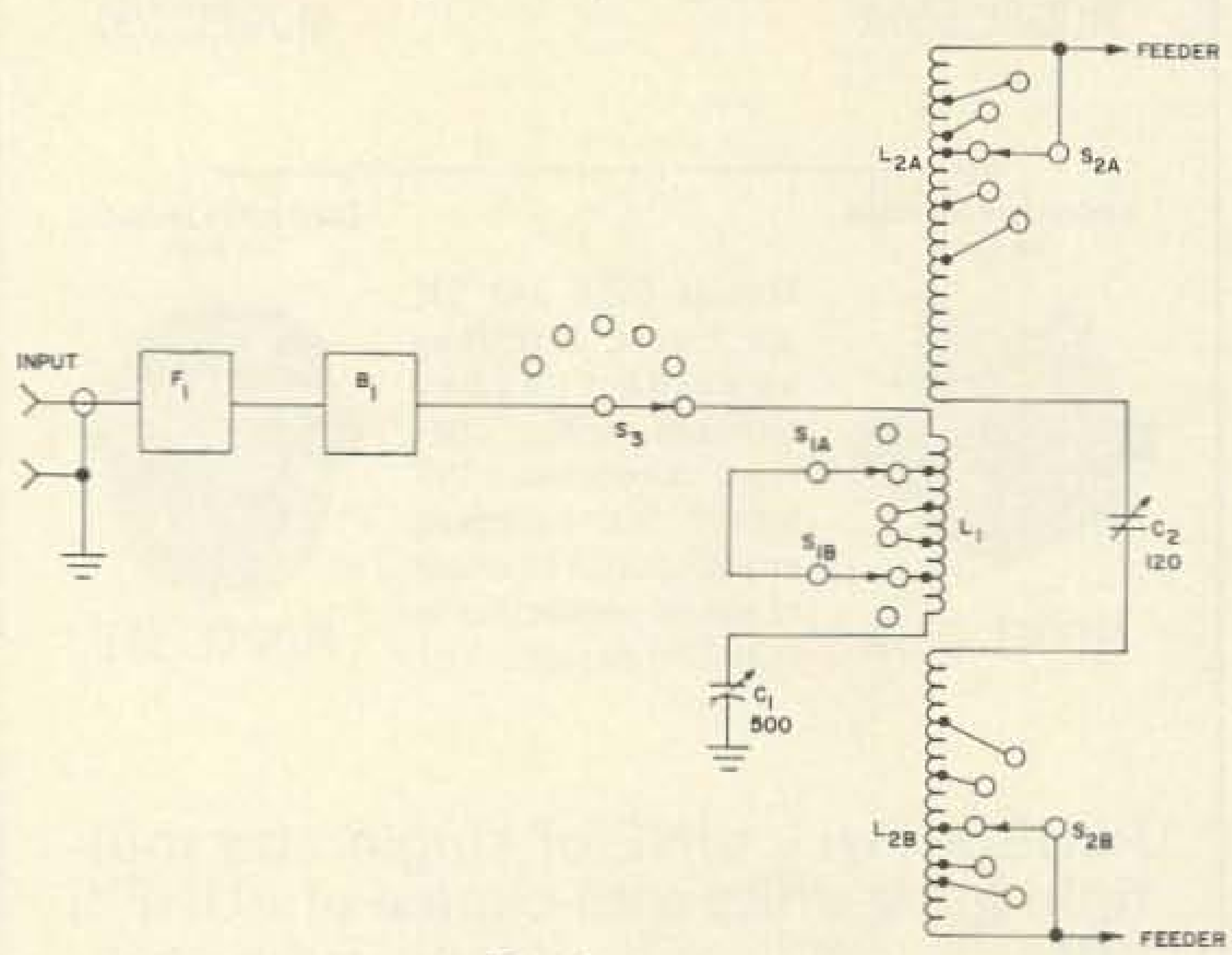


FIG. 1

F-1—Bud Low-Pass Filter.
B-1—Monimatch (See Ref. 2).
C-1—500 mmfd variable, .03-inch spacing.
C-2—120 mmfd variable, .077-inch spacing.
L_1, L_2 —Formed from one 7¾" length of B&W 3905-1 coil stock. L_1 12 turns in center, tapped at second and fourth turns from center on each side. L_2 separated by one removed turn on each side from L_1. L_2 tapped at second, fourth, eighth, fourteenth, and nineteenth turns from inside on each side.
S_1—Communications Products Co. Model 86 switch.
S_2—Communications Products Co. Model 86 switch.
S_3—BC-375 switch (See text).

Sometime in there I went to college and started learning about impedance matching. However, even the best-matched antennas got no more DX than the tuned-feeder jobs. Unfortunately, I found that with each improvement in matching, the frequency flexibility decreased. Coaxial cable came in there sometime. My big experience with pre-WWII coaxial cable happened in a B.C. station that had changed over from a cage to a coaxially-fed vertical. After the copper cable had flashed over a few times—with very expensive results—the Chief Engineer switched back to open-wire feeders. He claimed they were matched-impedance, but they looked like Zepp feeders to me. I gave up fancy feedlines and went back to tuned feeders forever—I thought.

Then World War II came along. With a little more schooling I became convinced that anyone who used tuned feeders had to be a dolt. The solid coaxial cables were introduced. When the war ended I was in Hawaii with a KW and a lot of surplus cable. I tried the coax with fair results, but found I wasn't getting out much better than other local hams who were using tuned feeders. This cast some doubts on the value of my education. However, about that time I acquired a bride who had some question about the aesthetic value of "wire ladders", and abortive experiments with rezepping were abandoned.

RG-8/U and I reached a moderately happy compromise over a number of years. I tried verticals with L-matches and inverted L-matches. In New Mexico my double-domed friends introduced me to various exotic forms of T-matches. I tried multi-wire coaxially fed dipoles and trap dipoles. Every one of those gadgets reduced my frequency flexibility and decreased my ability to switch from fone to CW frequencies to meet old friends.

In 1960 I rebelled. My inverted-Vee, multi-wire, coaxially-fed dipole was cut for 3600 kc and 7050 kc. I was unable to work old friends in the phone frequencies on those bands without operating on the antenna to the point where I could not operate in my beloved CW contests. (I had become further technically advanced and was using pi-L finals that spat with an SWR beyond 2:1.)

So, back to tuned feeders. The only decision to make was whether to use Zepp feeders or a center-fed system. Geography and sad experience with inverted Vees determined the answer. First, the wire had to be horizontal. The 75-foot tower supporting my tri-bander beam was roughly in the middle of a pathetically inadequate city lot. One friendly neighbor had an even friendlier 60-foot tree about 150 feet away. No other trees in the neighborhood would do as supports, and erection of other towers was out of the question.

The antenna became a Zepp strung from the 62-foot level of the tower to the top of the tree. Counterweights on the tower—plus rope stretch—compensate for the sway of the tree. For added insurance, the rope holding the antenna is only quarter-inch manila. It has been proven satisfactorily that this snaps before the tower does.

The next problem was determining the length of the feeders. Back in the dim past we argued about whether to use multiples of quarter-wavelengths or half-wavelengths to cut the feeders for best results. Rufus Turner settled that. He proved that the best feeder length was that which stretched from the antenna to the shack. He also proved that the length of the "flat-top" was not particularly critical.[1] I used his recommended feeder length—down the tower, across the roof, down the side of the house, in the basement window, to the antenna tuner. It looks like 90 feet or so. The flat-top was cut at 135 feet.

The next problem was how to couple the feedline to the rig in such a manner that the rig looked into an SWR of 2:1 or less. For several years, the literature has been telling us that "antenna tuners" can be used to reduce the apparent SWR seen by the rig to 1:1. This seemed improbable. I built "tuners" for both 80 and 40 with all sorts of reactance-cancelling arrangements. To my great surprise, the apparent SWR could be adjusted to 1:1 anywhere in either band. Unfortuntely, the arrangement was bulky and inconvenient for band changing. A friend had a Johnson KW Matchbox. This did everything my set-up did and did it more conveniently. My children's ravenous appetites precluded my purchasing one, so I started researching for an adequate substitute. (This is also known as reading all

[1] Rufus P. Turner, "Debunking Tuned 'Feeders' and the Exact Length' Mania," R/9, June, 1935, p. 7. (It is unfortunate that this article is not generally available. Perhaps some enterprising editor could arrange a reprint.)

the back issues of the ham magazine.) The tuner had to be bandswitching, preferably from 80 through 10; it had to be capable of handling a legal kilowatt on CW and SSB; and it had to present a reasonably resistive 50-ohm load to the final. No truly satisfactory coupler could be found. One that came fairly close was discovered.[2] It had several faults: it was not a "front-panel" bandswitching gadget; the power handling capacity was too low; and it required switching from parallel to series tuning, which seemed a needless nuisance.

After a few days of thought, the need for switching from parallel to series tuning was eliminated. If enough inductance were put in series with each leg of the line, series tuning could be used on all bands. High power components and switches could be used. So, the tuner in Fig. 1 was built. To my great surprise, it worked. Several hours were spent in getting the correct combination of taps for each band. Best efficiency will be obtained with as few turns as can be used in L_2. This will vary widely with feeder length, but the coil lengths given should permit resonance with virtually any feeder length. In my case, the full length of L_1 was used on 80, the first taps on 40 and 20, and the second taps on 15 and 10.

I subsequently put one of the single pole, six-position switches from the BC-375 in at S_3, and use it to switch to other antennas, increasing the versatility of the coupler.

The Zepp and coupler have been in use for over four years. On 80 and 40, the comparison antenna is a 63-foot vertical, beautifully matched and well-grounded. (Two days of work and 1500 feet of copper, plus assorted water pipes, fence posts, ground rods, etc.) The Zepp is 10-to-20 db better on U. S. contacts than the vertical on either band. On DX contacts, the Zepp is better than the vertical on 80 by about 3 db, but the vertical has the edge on 40 by 4-to-6 db. On 20, 15, and 10, the comparison antenna is a three-element tri-bander at 75 feet. The Zepp is about 10 db below the beam in most directions—which accords with theory—and is used frequently when conditions are good for general work, and in contests when it becomes a nuisance to swing the beam.

The tuner enables me to tune to any frequency in the 80-through-10 meter bands. An SWR of 1:1 is obtained anywhere within the bands. Bandswitching the tuner takes only a few seconds. The tuner takes the output of a 4-1000A grounded-grid linear running at 900 watts on CW and 2Kw PEP on SSB.

All in all, the Zepp with its tuner makes a satisfactory antenna setup. I would change several things if I could. If my lot were large enough, I would put up a center-fed system, as it makes for better feeder balance. (Still, a little feeder radiation doesn't hurt. The real object of antennas is radiation, and I would prefer feeder radiation to feeder absorption.) I would also use the Johnson KW Matchbox, were it not for the aforementioned appetites. I would also like to live on top of a rotating hill. In the meantime, the Zepp makes a good compromise.

. . . W5DWT

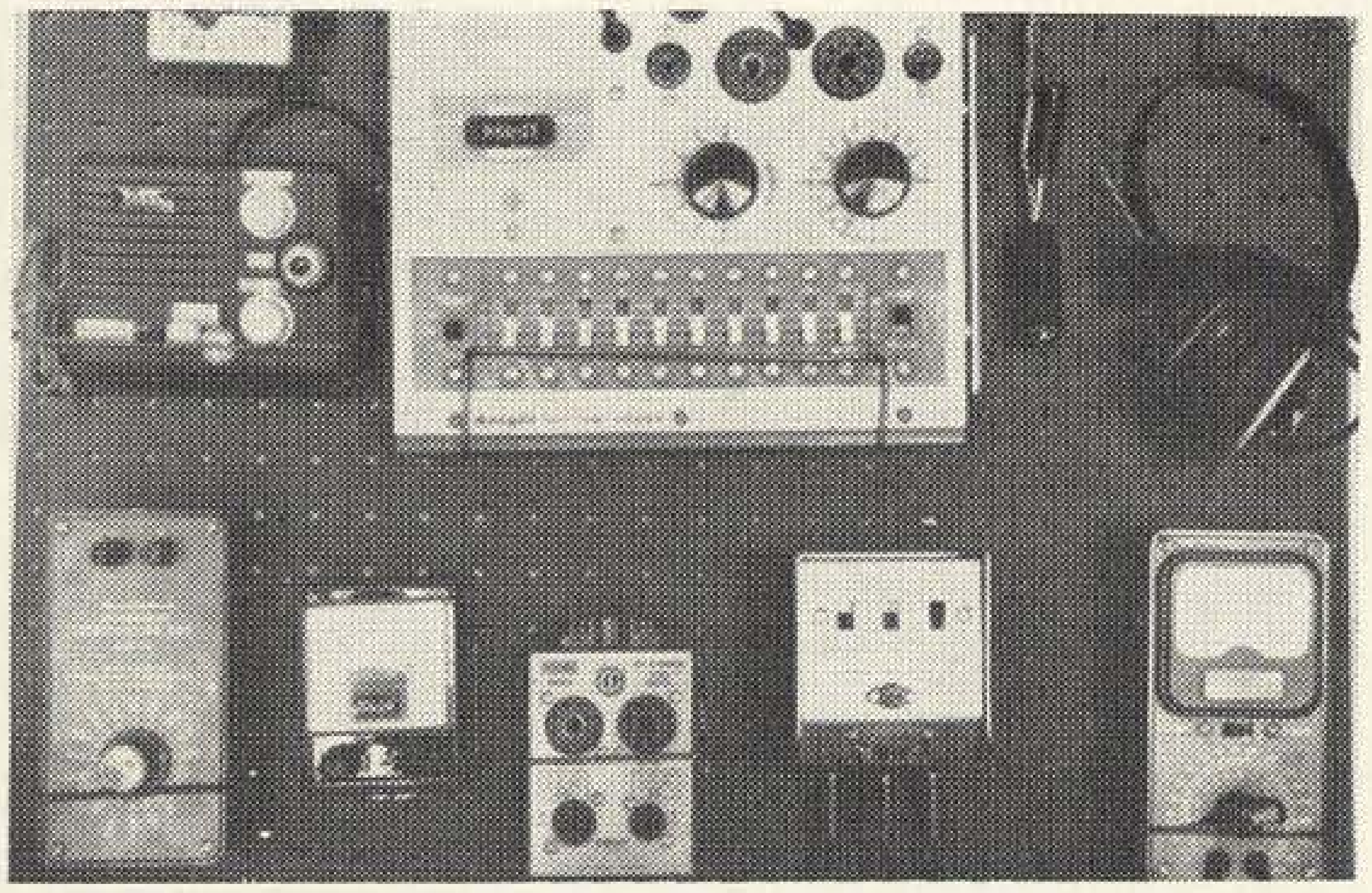
[2] The Radio Amateurs Handbook, 37th edition (1960), pp. 352-354.

Fred Blechman K6UGT

Pegboard Panacea

The use of "pegboard" in workshops and stores is certainly nothing new. It has been used for years to display small items of equipment and tools. However, the limitation on its more extensive use has been the availability of special "holders" for odd-shaped equipment; if available, the special brackets are expensive.

The home experimenter can eliminate this problem by simply using common coat hangers and a small tool!



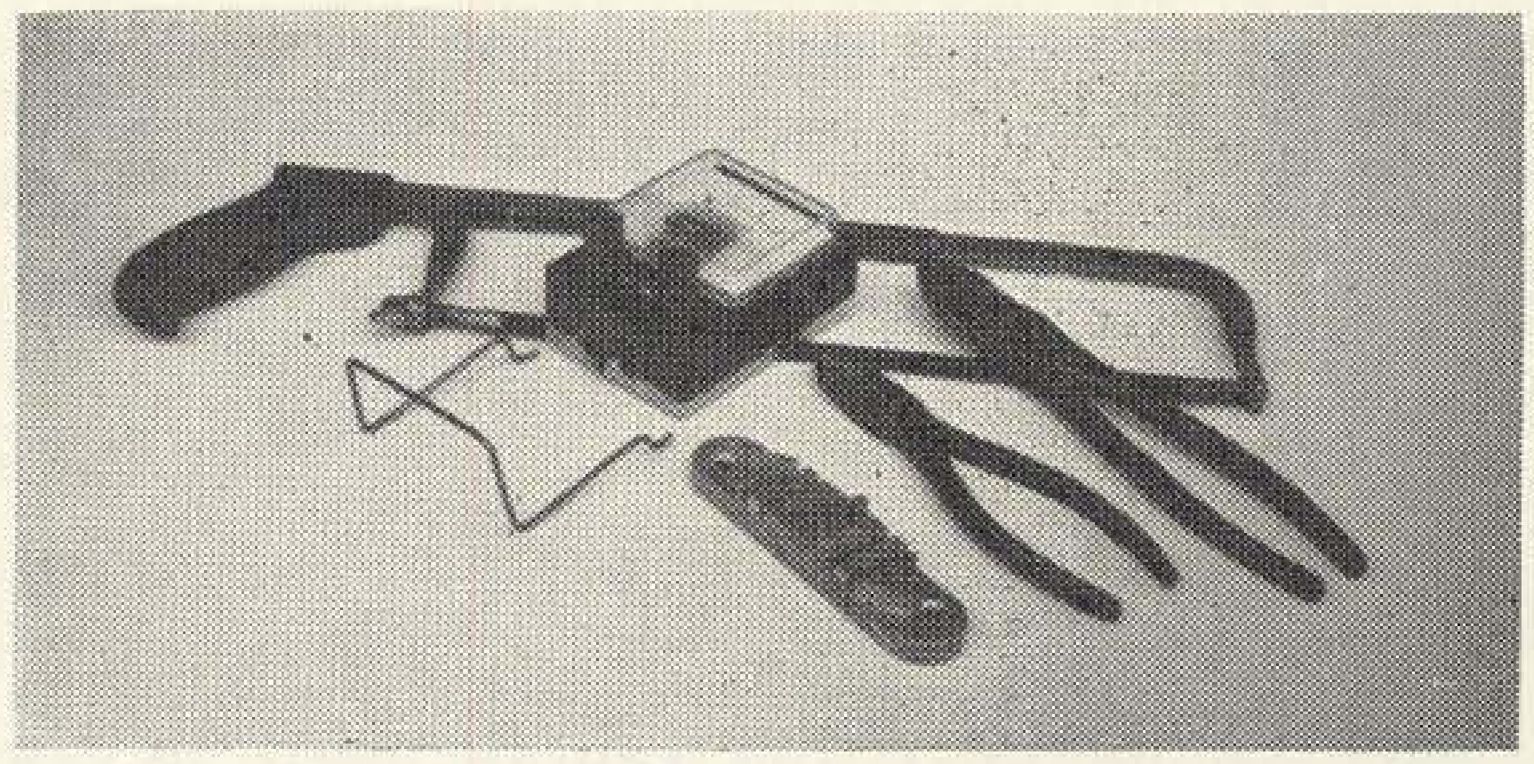
Even a small tube tester, such as the Knight "400," can be mounted out-of-the-way, yet accessible, on a pegboard. Coat hanger wire is surprisingly strong, yet easily formed and cut.

The tool, known as the "Handi-Bender", is sold by Jon-Cee Products Company, 1203 Ford Road, Cleveland, Ohio for 98c postpaid. This cast aluminum bending jig, with its slots and movable dowel pins, allows one to easily form wire into the sometimes-intricate shapes required to hold odd items of equipment to pegboard. A hacksaw or pair of diagonal cutters may be used to cut the wire at the desired points.

The coat-hanger wire is untwisted at its junction and straightened, using the slots in the Handi-Bender. One end is cut to remove the twisted portion, and a joggle is put on this end, using the dowels in the Handi-Bender.

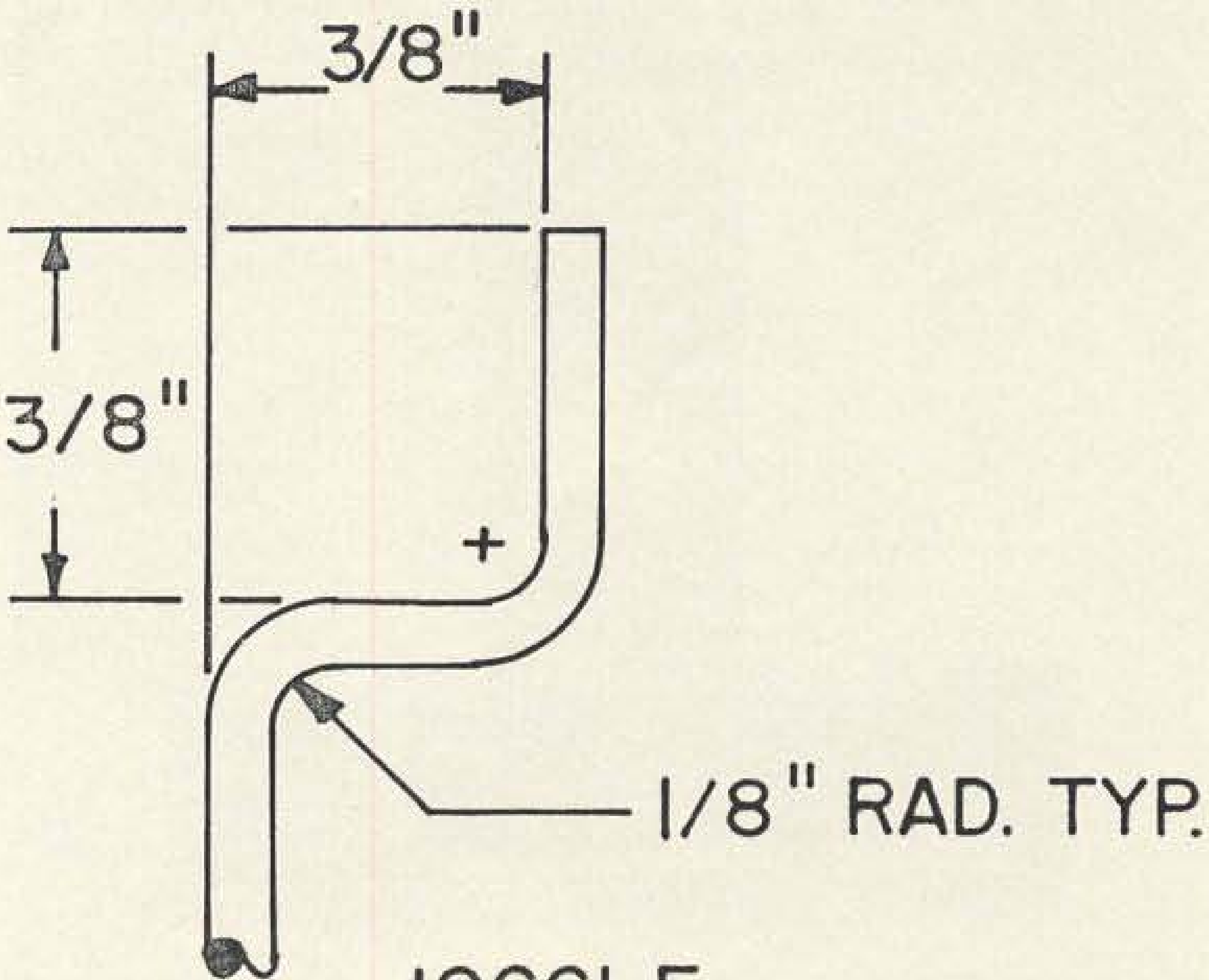
The dimensions of the joggle are not critical, but a joggle *is* required to keep the bracket from pulling out of the pegboard holes. The remainder of the bracket is then formed to accommodate the required equipment shape, ending with another joggle.

One 2 × 4 foot piece of pegboard will provide instant access to a surprising number of



The only tools needed to form the special brackets are a hacksaw and the "Handi-Bender," with an assist from pliers and diagonal cutters. The small meter is a natural for peagboard with the special coat hanger bracket shown.

small items of equipment that otherwise tend to get mislaid, and valuable bench and shelf space is saved.



JOGGLE
DIMENSIONS
(NOT TO SCALE)

The author has yet to encounter a reasonably small piece of equipment which couldn't be mounted in this manner, including a not-so-small tube tester, as shown in the photos.

. . . K6UGT

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Low Cost Grid Dipper

Here is an item that can be used by all amateurs. How many times have you wound a coil for your new transmitter, on some odd size form, and wondered just how close you were to guessing the right number of turns. With the grid dipper you can measure the resonant frequency before you solder the coil and condenser combination into your trans-

mitter permanently. A grid dipper has many uses. Among other things, it can be used to check resonant frequencies of antennas, including mobile whips. It can be used to measure relative field strength. It can be used as an emergency signal generator for communication receivers. I have even used it to align the *if* stages of my television set.

Construction: This particular grid dipper has a frequency range of 1.8 to 54.0 megacycles. It is battery powered, which makes it completely portable. It is built in a surplus tuning unit case from an RU-16 aircraft receiver. The parts are available from most junk boxes. Construction details are left pretty much to the reader as each individual will probably have some "pet" case he wants to build it in. A few suggestions are offered. Use a good calibrated dial. Use good quality bypass condensers. Ground them both to a common point, preferably on the rotor lug of the tuning condenser. Keep the leads to the coil socket short—if you intend to wind coils for 50 mc or above. The grid winding of each coil should be the top coil, with the feedback or plate winding near the base. Proper phasing of the coils is necessary to sustain oscillations. The grid and plate connections should be on opposite ends of the coil, with the ground and B plus near the center of the coils. For the 50 mc coil use a polystyrene base or mica filled base from some tube such as a 5R4 or 811. The 50 mc coil is self supporting and wound with #12 bare wire. Its feedback winding was wound with insulated wire and cemented with model airplane cement. The spare coils are stored in sockets, mounted in the cover of the tuning unit case. Any 0-500 ua or 0-1 ma meter will work. Battery leads may be soldered on if you have no battery connectors.

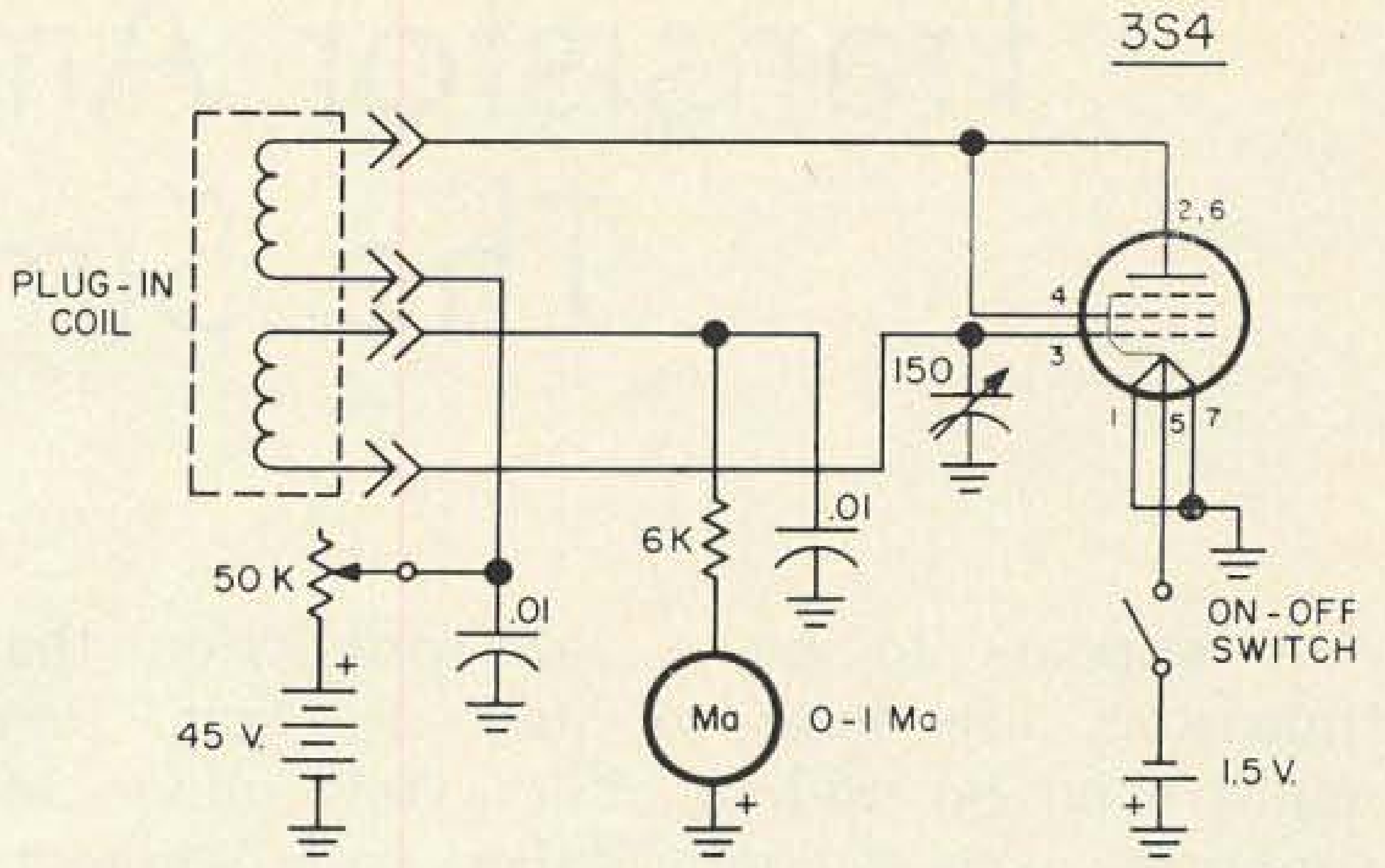
Calibration: Calibration is done by first setting your general coverage receiver to the calibration frequencies desired and then tuning the grid dipper until a beat note is heard.

I suggest that you calibrate it every 100 kc from 1.8 mc to 7.5 mc and then calibrate every 500 kc from there on, except return to 100 kc points through each ham band. I calibrated the higher bands on a Hallicrafter S-27 which covers 28 to 140 mc.

Using the Instrument: For ordinary tank coils, couple the grid dipper to the tuned circuit and turn the grid dipper dial until there is a pronounced dip in the grid current meter. This indicates resonance, and is due to the fact that some of the power from the grid dipper is being absorbed by the external tank. For the most accurate measurements, back off the grid dipper until only a perceptable dip is noticed. For high frequency slug tuned coils that utilize stray capacities to resonate them, the same method is used—but be sure that all the tubes are in their sockets. You may wish to set the grid dipper on a certain frequency and then tune the slug being measured until you notice a dip in grid current. If any coil is inaccessible due to its being behind a transformer or other shield, you can wind a one turn link around the grid dipper coil and another 2 turn link to fit over the other coil. Keep the link near the "cold" end of the coils.

Long Wire Antennas: To check resonant frequencies of long wire antennas, you can loop 3 or 4 turns of the antenna wire around the coil and tune for a dip. For extreme accuracy, check the frequency with your communication receiver, at the frequency of the dip, since attaching turns near the grid dipper coil will shift the frequency somewhat. In the case of an end fed antenna the frequency measured will be the ½ wave frequency. You can also connect the end of the antenna to a 2 turn link and ground the other side of the link. In this case the measurement will be the ¼ wave frequency. For instance, a wire 120′ long connected through a link to ground will indicate resonance at around 2 mc. Without the ground it will indicate resonance around 4 mc.

Mobile and Coaxial Feeds: Couple to the coax cable with a 2 turn link. Caution is advised when connecting to a coaxial cable.



COIL DATA

FREQ. RANGE	GRID COIL	PLATE COIL	SIZE FORM
1.8-4.3 mc	33 T #31	20 T #31	6L6 tube base
3.4-7.2 mc	17 T #19	10 T #31	6V6GT tube base
7-15 mc	7 T #19	6 T #31	6V6GT tube base
15-31 mc	3 T #19	3 T #31	6V6GT tube base
28-54 mc	5 T #12	4 T #18	3/8" diam. self-supporting

There are resonant frequencies within the cable itself, and if you start to change taps on your mobile whip and the frequency doesn't appear to be moving, you are probably checking a resonant point within the cable. For instance, a 12′ piece of RG8/U, commonly used with a mobile whip, will tune between 4.5 mc and 5.5 mc. Pruning of the loading coil will not affect this resonant point. The correct antenna frequency can be checked by holding your arm within a foot of the loading coil. A change in resonance would be noted.

Field Strength: This is done by backing off on the plate potentiometer until a minimum reading is obtained. Any signal picked up from a radiating antenna will be rectified in the grid circuit and the meter will rise to a higher value. In this manner you can also check for transmitter harmonics.

Signal Generator: To peak up the rf stages in your communication receiver, or converters, set the grid dipper several feet away and tune the receiver, with the antenna connected in a normal fashion, to obtain a maximum S-meter reading. Move the grid dipper far enough away to obtain an S4 to S7 reading. Trim the antenna and rf stages for a maximum S-meter reading.

. . . W7CJB

Transistor Amplifier Design The Simple Way

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It appears to be a safe prediction that transistors are here to stay. In fact, they might even be said to offer a few minor advantages over vacuum tubes from time to time. For example, how many times can a tube be dropped five feet to a concrete floor without damage?

But, as most amateur designers who have ventured into the semiconductor realm have discovered, transistors have one major disadvantage. It appears to be necessary to have at least six years' training in enginering and mathematics to be able to design a simple, ordinary, everyday class A amplifier using transistors!

At least, this is the impression gained when opening any transistor manual, even those directed at the hobby-level experimenters!

About the only way yet offered to sidestep this disadvantage has been the suggestion that a "test set" be built up to determine all parts values by trial and error. Use of such a test set requires an oscilloscope at least, and in addition is just too much trouble for many of us.

The reader who's been active in electronics for very long is undoubtedly familiar with at least a few of Murphy's famous Laws of Electronics; the most quoted is the First Law: "If anything can go wrong, it will." Not so widely quoted, but equally true in 99.999% of all known cases, is the Fifth Law: "If it's simple, it's wrong."

But the special case of transistor amplifier design is in that thousandth of one percent of cases when Murphy's Fifth Law fails; a simple way exists, and it's a right way.

This isn't to say that it can't be improved upon, but it will always yield a design which is as accurate as most tube-type designs taken from tube-manual data, and which cannot harm the transistor. Other simple methods exist, but they have no such built-in safety features.

Before we get into the simple technique involved, let's take a brief refresher look at the typical transistor amplifier, diagrammed in Fig. 1. As you can see, it consists basically of merely the transistor, a load resistor, and some bias-voltage sources. In the common-emitter circuit, most widely used of the three possible configurations for a number of reasons, the emitter is considered as the reference terminal of the transistor. Input signal is applied between base and emitter, and amplified output is taken off from the load resistor, which is effectively between collector and emitter since the bias supplies are assumed to have zero internal impedance to the signals.

Fig. 2 shows the original way in which the voltages were supplied. Separate batteries were used. To obtain proper transistor action, the collector must be reverse-biased with respect to the emitter, while the base-emitter junction must be forward biased. Fig. 2 shows proper battery polarity to meet these conditions for a pnp transistor; with an npn, all polarities must be reversed.

Though this was the original technique, it offers no protection at all against unavoidable variations between transistors of the same type, or even against variations of characteristics in the same transistor as temperature changes.

In addition, the two-battery requirement was unattractive. Early experimenters quickly figured out that one battery could be used by slight modification of the circuit, and the hookup shown in Fig. 3 was the result. This is still probably the most widely used transistor-amplifier circuit, but like the original circuit it provides no protection against variation of characteristics.

As a result, in such circuits Rb is usually made adjustable, and somewhere in the line-up instructions you'll find something to the effect of "Adjust base resistance as necessary to obtain proper operation." This isn't what you'd call the best in design.

Addition of two more resistors and a capacitor, as shown in Fig. 4, provides virtually complete protection against all variations, and this circuit is today the basic transistor amplifier circuit used in most commercial and military apparatus. Unfortunately, almost all the handbooks bristle with complicated mathematical formulas when they discuss proper choice of resistor values for the circuit, and as a result most of us steer clear of using it.

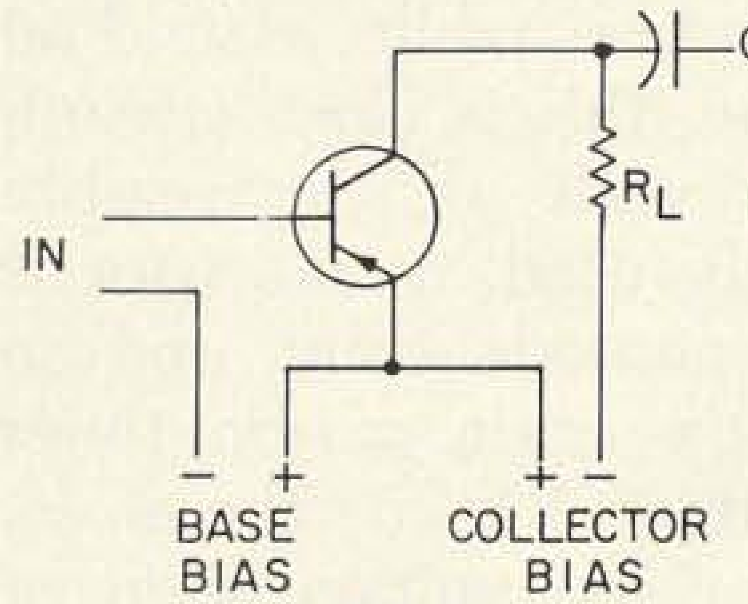

FIG. I

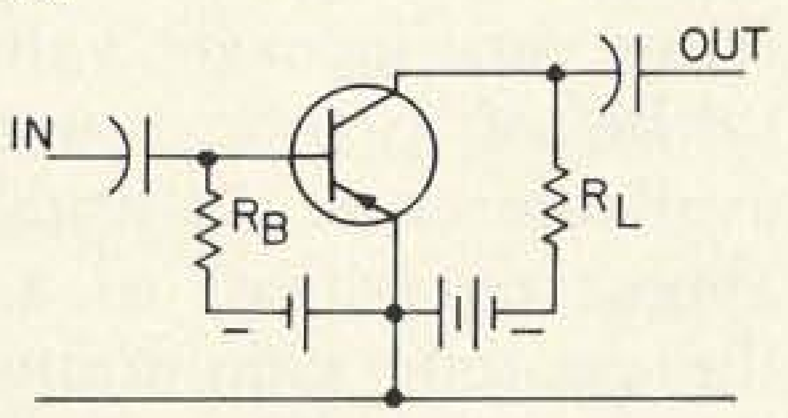

FIG. 2

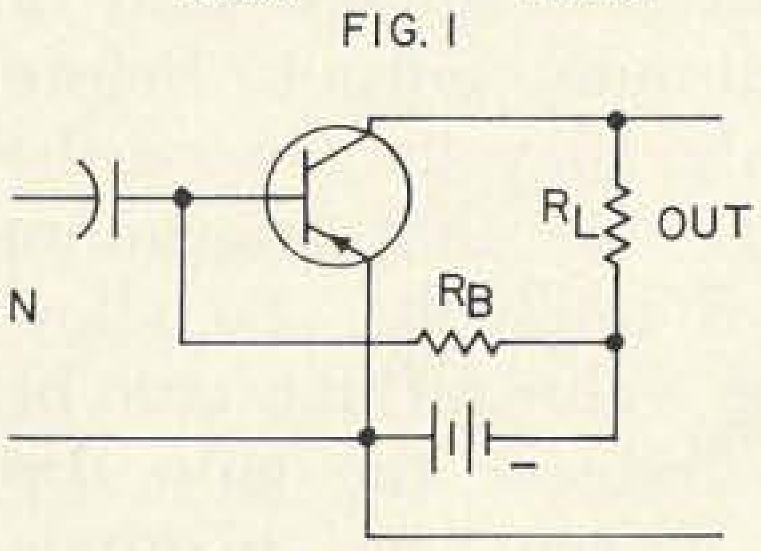

FIG. 3

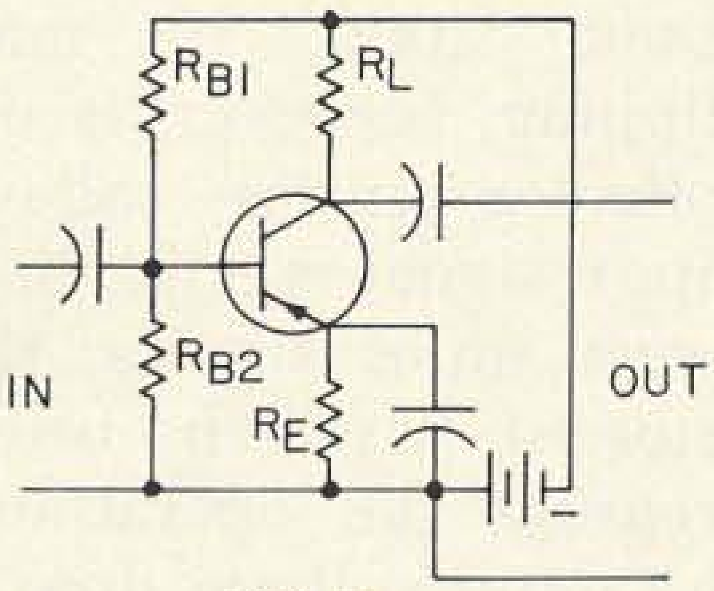

FIG. 4

The unfortunate thing is that all the complication isn't necessary unless you're designing the circuit to meet rigid commercial or military specifications. For general use, a far simpler technique yields almost identical results. While a little arithmetic is involved, most of it is nothing more than the use of Ohm's Law, and the rest isn't any more complicated.

The procedure works this way: first, pick your transistor type. Decide what supply voltage you're going to use (9-volt battery, 20-volt line, or what have you?). Pick a collector-to-emitter voltage somewhat smaller than the supply voltage, and an operating-point current which will be the final current read on a milliammeter inserted at point X in Fig. 4.

For best results, the supply voltage should be about three times the collector-to-emitter voltage to be used, but any voltage more than twice the V_{ce} is usable. Select a value for the collector load resistor, R1, so that the voltage drop across it at the operating current will be approximately equal to the drop across the transistor itself; if V_{ce} is to be 5 volts, and current is to be 1 ma, then R1 should be 5/.001 or 5K ohms.

Add the drop across R1 to the chosen V_{ce}, and subtract the total from the supply voltage. This tells you how many volts must be dropped across the emitter resistor, Re. With a 12-volt supply for our preceding example, and a 5100-ohm resistor for R1 (to use standard values), Re would be called upon to drop 1.9 volts at 1 ma, so would have to be 1900 ohms. Either 1800 or 2000 ohms would be usable.

To get the values for the base-bias divider, we apply a rule of thumb which is sufficiently accurate for all practical purposes: in a properly operating transistor amplifier using a germanium transistor, the base voltage will be ¼ volt away from the emitter voltage, and in the same direction as the collector. That is, for a pnp transistor, the base will be ¼ volt more negative than the emitter. (With silicon transistors, the figure is 7/10 volt).

This means that the base-bias voltage divider must be proportioned so that the base voltage will be ¼ volt way from the emitter voltage. In our example, the emitter resistor drops 1.9 volts, so the lower leg of the base divider, R_{b2}, would have to drop 1.9 + .25 or 2.15 volts. If we assume 1 ma of current is to flow through the divider, this would require a 2150-ohm resistor, and a 2200-ohm standard value would suffice.

The other base resistor, R_{b1}, must drop the rest of the supply voltage at the divider current; to continue the example, R_{b1} would be required to drop 9.85 volts. At 1 ma, this would be 9,850 ohms. A standard-value resistor would be either 9100 ohms or 10K.

Actually, 1 ma of divider current is far more than necessary. A value of 100 microamperes is usually more than necessary and provides ample safety margin. This allows all divider-resistor values to be increased by a factor of 10, giving us 22K and 91K or 100K as end values.

In both cases where the calculated value has fallen between two standard values, we have indicated that *either* standard value may be used. This is true because the entire circuit is highly self-regulating, and corrects for these "minor" errors rather closely.

To see how this works, let's draw up our example in Fig. 5 with the calculated values, then check back to see how the standard values affect the result.

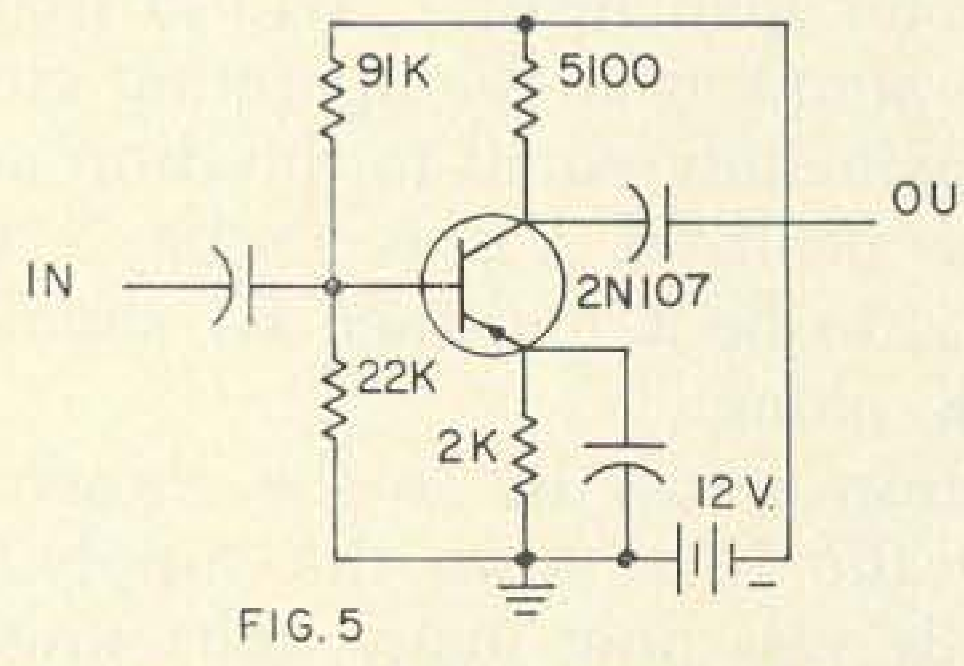

FIG. 5

With Re equal to 1800 ohms, using a 91K resistor for Rb1 gives a resulting collector current of 1.17 ma; if 100K is used at Rb1, current drops only 120 microamps to 1.05 ma. With a 2K emitter resistor, the 91K resistor in the base divider gives 1.05 ma collector current and the 100K resistor gives 0.95 ma.

Our design target was 1 ma exactly; the use of values other than the exact ones calculated has caused a maximum error of only 170 microamps in the current, and two of the combinations are only 50 microamps away from target.

Here's how to check it, so that you can use the same approach to check out your own designs: First, determine the voltage present at the midpoint of the base-bias divider. Subtract ¼ volt (or 7/10 volt for silicon) for the base-emitter drop, and the result is your emitter voltage. With emitter voltage known, the voltage across the emitter resistor is fixed. With this voltage and the value of the resistor known, current can be quickly determined by Ohm's Law, $I = E/R$.

You might notice that "beta" or the transistor's current-amplification factor does not enter into the calculations at all. This is not an oversight; a circuit designed by this approach will give virtually identical current flow regardless of the gain factors of the transistors plugged into it! This is, in itself, powerful protection against variations in characteristics. It also enables the experimenter to make direct comparisons of various models of transistors, to see which works better for his purposes.

To get an approximate idea of the gain to expect, another rule of thumb is often handy. This one says that the average gm of most transistors is about 0.4 mhos; while individual types vary in exact value, this is close enough to be of practical use with all the readily available ones. As usually used, a transistor is almost equivalent to a pentode tube, and so the pentode gain formula (gain = gm times R1) applies. The circuit of Fig. 5, therefore, could be expected to have a voltage gain of about 2,000. Its maximum output before clipping, however, is only 10 volts (twice the collector-emitter voltage) so that maximum input signal would be 5 millivolts. To allow larger input signals, the value of R1 can be reduced which in turn reduces the gain. Increasing the operating current can maintain the same voltage drop across R1 (halving the resistance while doubling the current maintains the voltage constant) which will, in turn, allow the same output voltage. Since gain has been cut in half, though, the input can now be doubled.

Following a similar approach will allow you to design a transistor amplifier for almost any application you may have in mind—and without need for any complicated math. With this ability safely in mind, you too may agree that semiconductors may be here to stay!

. . . K5JKX

Jim Kennedy K6MIO
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The Heath Cantenna is an excellent aid for ham experimenting. This simple modification extends its use to above 432 mc.

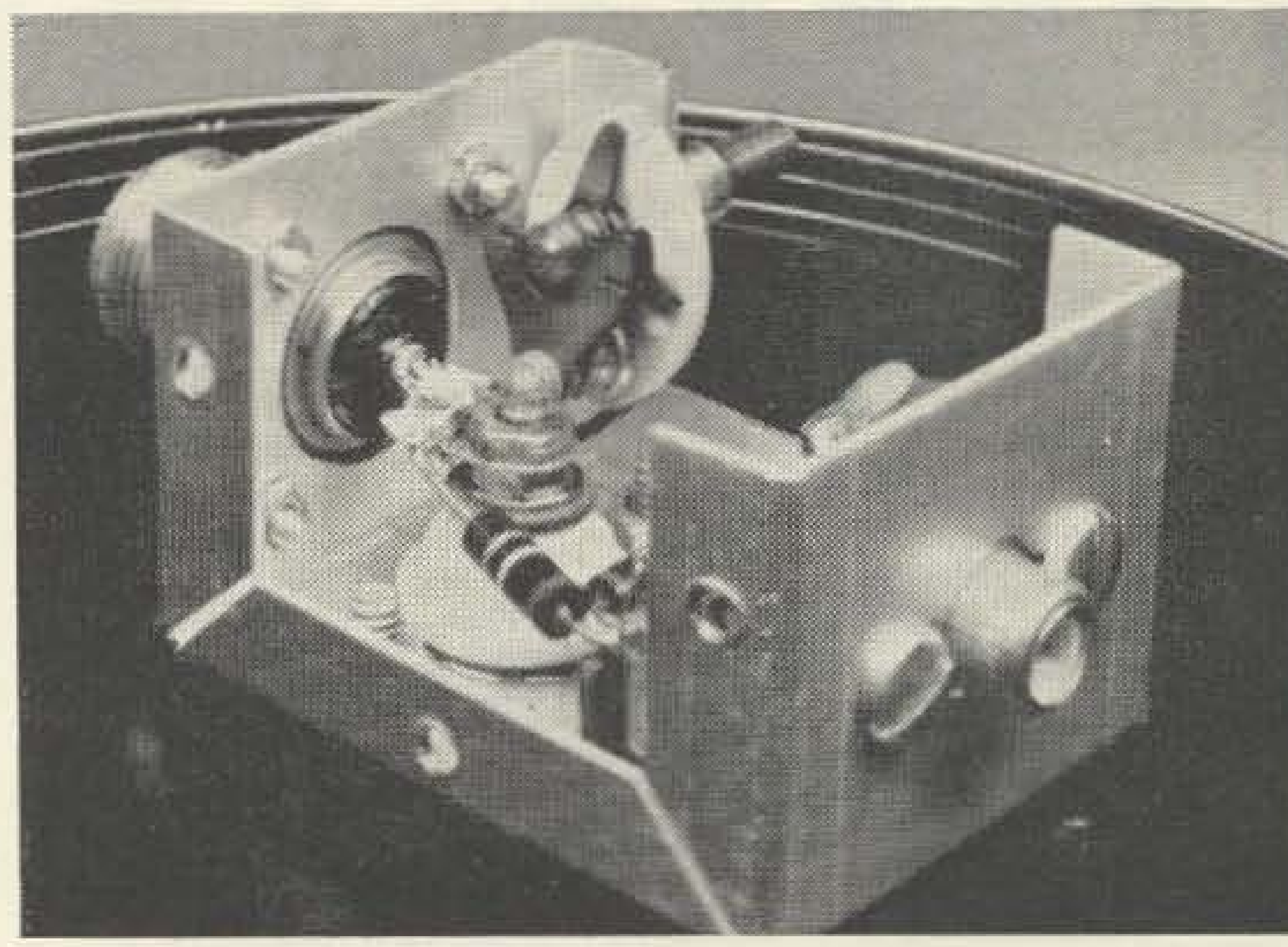

Photo Credit: Joe De Young WA6CQL

Modifying the Heath Cantenna for UHF

The first requirement for accurate rf power measurements is a flat dummy load. Likewise, very low vswr in a dummy load can be an important factor in testing high power transmitters.

Several relatively inexpensive dummy loads are currently available for 50 ohm lines. Of these, at least three are capable of handling up to a kw output.

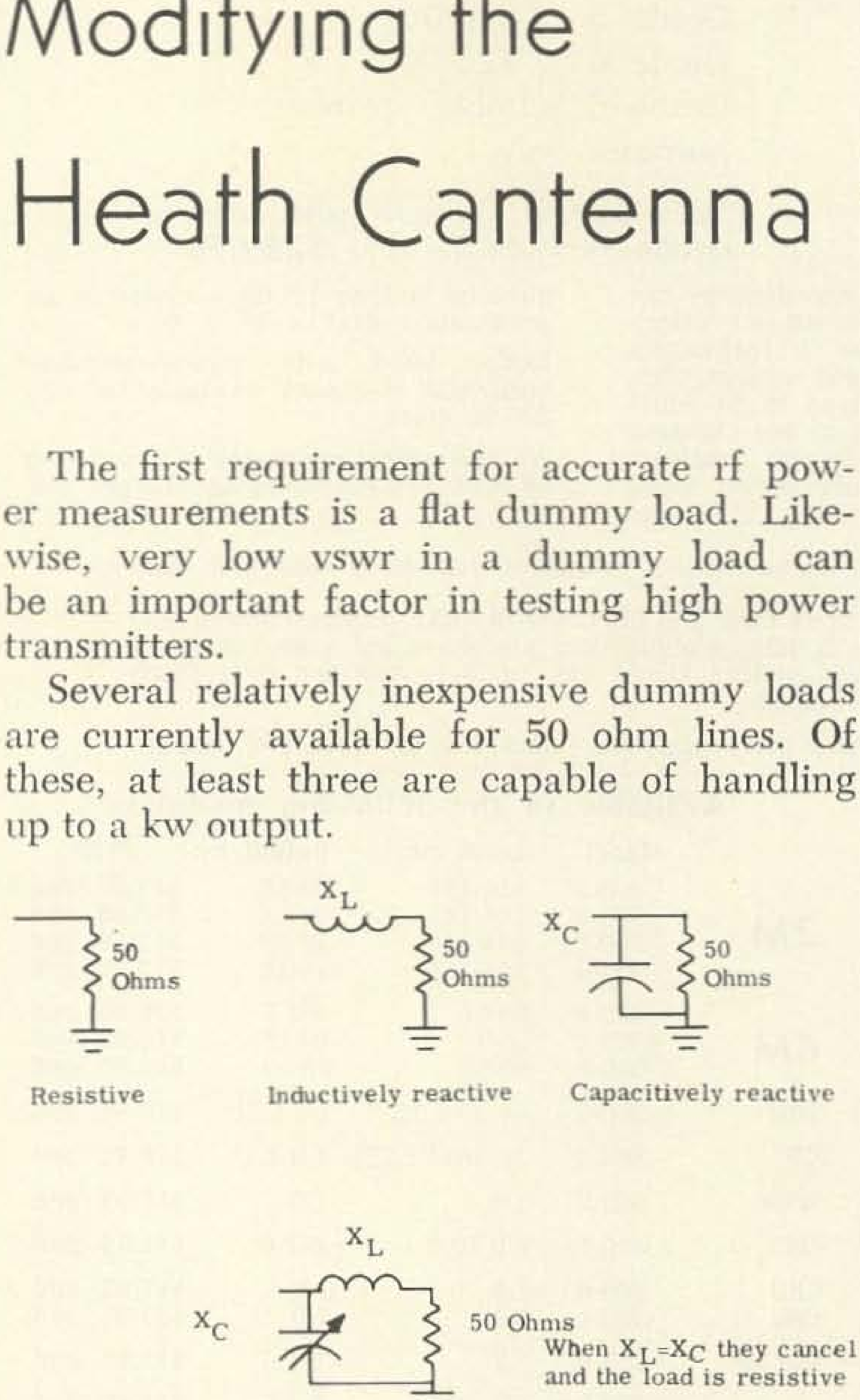

Fig. 1. A dummy load may appear resistive or reactive to rf. The Cantenna acts slightly inductive at UHF but addition of a small capacitor cancels this inductive reactance.

At high frequencies, these loads perform well and exhibit tolerable vswr. However, in the VHF and UHF frequency ranges, performance falls off due to a rising vswr.

The Heathkit Cantenna power rating is 200 watts continuous and 1000 watts for up to ten minutes. The vswr at 50 mc was measured at about 1.15/1. This is a generally acceptable level however; at 220 mc the vswr rises to 1.35/1 and at 432 mc the figure was 1.8/1.

A high power 432 rig operated into such a load might be seriously damaged if the transmission line were being operated near its ratings (an easy thing to do at 420 mc).

Mismatch in dummy loads is the result of either a resistive mismatch or a reactive component in the load.

Since the dc resistance of the load is 50 ohms the source of the standing waves at VHF is probably reactive. This reactance is generally either a shunt capacitance or a series inductance. See Fig. 1.

The source of this reactance is generally either a peculiarity of the load material itself or a lead length or dress problem. In practice, it is generally a combination of a lot of the former and some of the latter.

In theory, then, to return the load to a resistive impedance of 50 ohms, it will be necessary to cancel the reactive component by adding the proper value of either inductance or capacitance.

This generally means that load flatness becomes a frequency sensitive thing, i.e. the load is tuned or rather the reactance is tuned out. This is no more than what you had before, except that now the effect can be controlled.

In applying this theory to the Cantenna, it was found that in the 220-450 mc range, the load exhibited some series inductance. It was further found that, according to theory, a small capcitance shunted across the load could be made to cancel the inductance in the load and produce a resistive 50 ohm situation at 432 mc and hence reduce the vswr to virtually 1/1.

This was done by adding a small variable air capacitor of 5 to 7 mmfd across the input to the load to ground.

The capacitor in the photograph had just enough capacity to null the standing waves at 432 mc.

The lowest vswr at 220 was observed at maximum capacity and, though lower than before, did not produce a null, indicating that more capacity would reduce the vswr even further than the value shown in Fig. 2.

It will be noted that a slight increase in vswr is seen at 50 mc with the capacitor installed at maximum capacity. This indicates that somewhere between 220 mc and 50 mc the natural reactance of the load has changed from inductive to capacitive.

FREQUENCY	VSWR NORMAL	VSWR WITH CAPACITOR
50 Mc	1.25:1	1.35:1
220 Mc	1.43:1	1.35:1
432 Mc	1.8:1	1:1

Fig. 2. VSWR measured at various frequencies with and without added capacitor. All measurements with capacitor are with capacitor fully meshed.

The general conclusions to be drawn from all this are: if operation is desired primarily at 50 mc, and the vswr must be below those given, a small amount of inductance between the connecter and the load terminal should flatten out the load; and, if operation is desired from some undefined point below 220 mc to some equally undefined point above 432 mc, a 10-15 mmfd air variable will allow the load to be tuned to minimum vswr.

If very low vswr operation is required from 50 mc to 450 mc, a small inductance and a 10-20 mmfd air variable might both be installed and allow the load to be tuned across the entire range.

Though these last statements are, for lack of confirming experiments, somewhat conjecture, the fact of a flat load at 432 mc and an improvement at 220 mc was definitely established, and though no figures are shown, tests indicate that these modifications have little, if any, detrimental effect on operation below 30 mc.

. . . K6MIO

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I'd Like to See:

The Three-way Two-stop. This much needed mechanical device for facilitating the "three-way" QSO is a simple built-in mechanism in the main tuning dial of the communications receiver. The dial looks normal except that it has two buttons on it. When you have tuned in Joe you push the button marked "A". Then when you tune in the party of the second part, you depress button "B". That's all there is to it. Returning to Joe is easy because the dial locks and will not turn farther south. And in the other direction, you cannot overshoot either. I forgot to say that there is also a red button which releases the two pre-set locks. Even my typewriter carriage does something like this.

The Blast-off. This is simply an avc circuit which really works under rugged circumstances. Suppose you have picked up a weak signal which just *must* be rare DX, so you advance the rf gain, the better to hear it. *Crash!* The fellow down the block—the one with the Texas Kilowatt lets go with a CQ. Of course the rare DX is gone forever, but you would like to salvage your headphones, your eardrums and your poise. Why not a real *avc*?

The Double-Out. Rejection tuning is a great thing. So why do they not give us *two* of them to reject interference and noise on *both* sides of the desired signal? So simple.

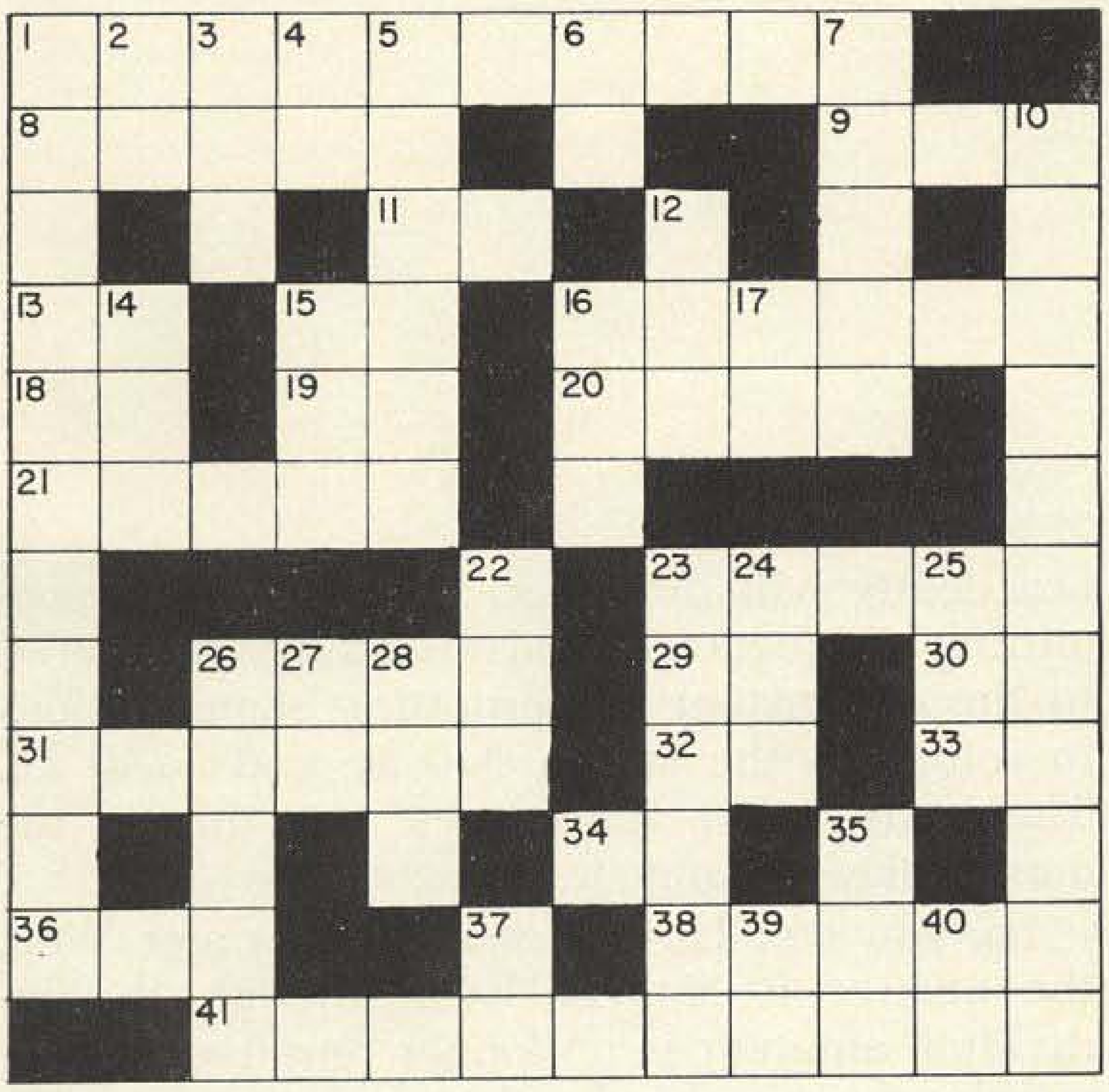
The Great Inflatable Kite. This remarkable invention is just the thing to take with you on Field Day. It rolls up and fits in a cigar box. Two large pieces of plastic sheeting, trimmed to "kite-shape" are edge-sealed together all around. Spot-ties hold the two surfaces together at suitable points. When inflated from your CO_2 cartridge (or with hydrogen!) it becomes a near-ideal airfoil. So carried away was I in flight of fancy that I almost forgot to mention that the director, reflector and driven element of shiny silver are cunningly plated on the inside surfaces of the plastic envelope. (The true exhibitionist ham will have his call letters in six-foot block letters on the under-belly.)

The Tab-Log. This modified Log Book is a great convenience to those organization hams who diligently keep an alphabetic card index of important contacts. In this case, the log book has a fold-under extension of the left-hand edges of its pages. Carbon paper is inserted of course; and the result is that when you have completed a page, you have a tear-off section which is a carbon copy of the important information on each contact—date, time, station called, etc. Of course the carbon copy is gummed, and the separate entries are perforated for tearing apart and pasting-up on the 3×5 index cards.

The Self-timed Tape Recorder. Tape recorders and accessories are being made more complex, yet more useful, by leaps and bounds. Yet the very obvious feature—a built-in start & stop timer—does not seem to appear. In our opinion, all excepting the lightest portable instruments should be so equipped. I need it to turn on and off the recording function when I am in the bowling alley (which I've never been in one of yet). Of course the aim is to engage in some purposeful eavesdropping on the bands *in absentia,* or merely to record a radio program after hitting the sack. It's obviously illegal to use such a timed recording as a shouter-outer on the bands if you're not in the shack yourself; however the on-off recording function would be very useful in many ways, such as monitoring your own mobile signal from the home station when you are on the road. On and off function switching will probably have to be power-actuated by solenoids to avoid flattening of the puck and drive discs. Come on, somebody, do something! . . . W2LLZ

Ham X-Word.

Harvey B. Rock, WA2BWQ



ACROSS

1—Power conversion device
8—type of wave
9—$\overline{SK}$
11—$4\pi^2f^2$
13—Final Amplifier
15—Defense agency
16—Antennas
18—Unit of energy
19—Transistor amplifier configuration
20—Transformer current
21—Type of silicon junction diode
23—keying fault
26—Fixed negative tube voltage
29—Argentina
30—See 13 Across
31—Function of second stage in some transmitters
32—Communication mode
33—That
34—Saint Martin
36—Descriptive of circuit containing inductance, capacitance and resistance.
38—Not neutralized; ______________scillation (2 words)
41—Type of transistor current.

DOWN

1—Scope pattern
2—Ham (abb.)
3—Address
4—Nickle (Chem.)
5—Make a connection
6—Georgia (Prefix)
7—Switching device
9—1/Q of a capacitor; ______________ factor
12—Heard
14—Avenue
15—Capacitance between collector and emitter of transistor
16—Government agencies
17—AC collector resistance of transistor
22—Please
23—Amplifier type (2 words)
24—Result of lack of filtering
25—Repeat
26—Rough spot on chassis
27—Type of transistor current
28—W4 state
35—Relay
37—RTTY part
39—Ethiopia
40—French Oceania

Answer on p. 81

Conelrad: NO!

E.B.S.: YES!!

Anthony "Tony" Curtis K3RXK
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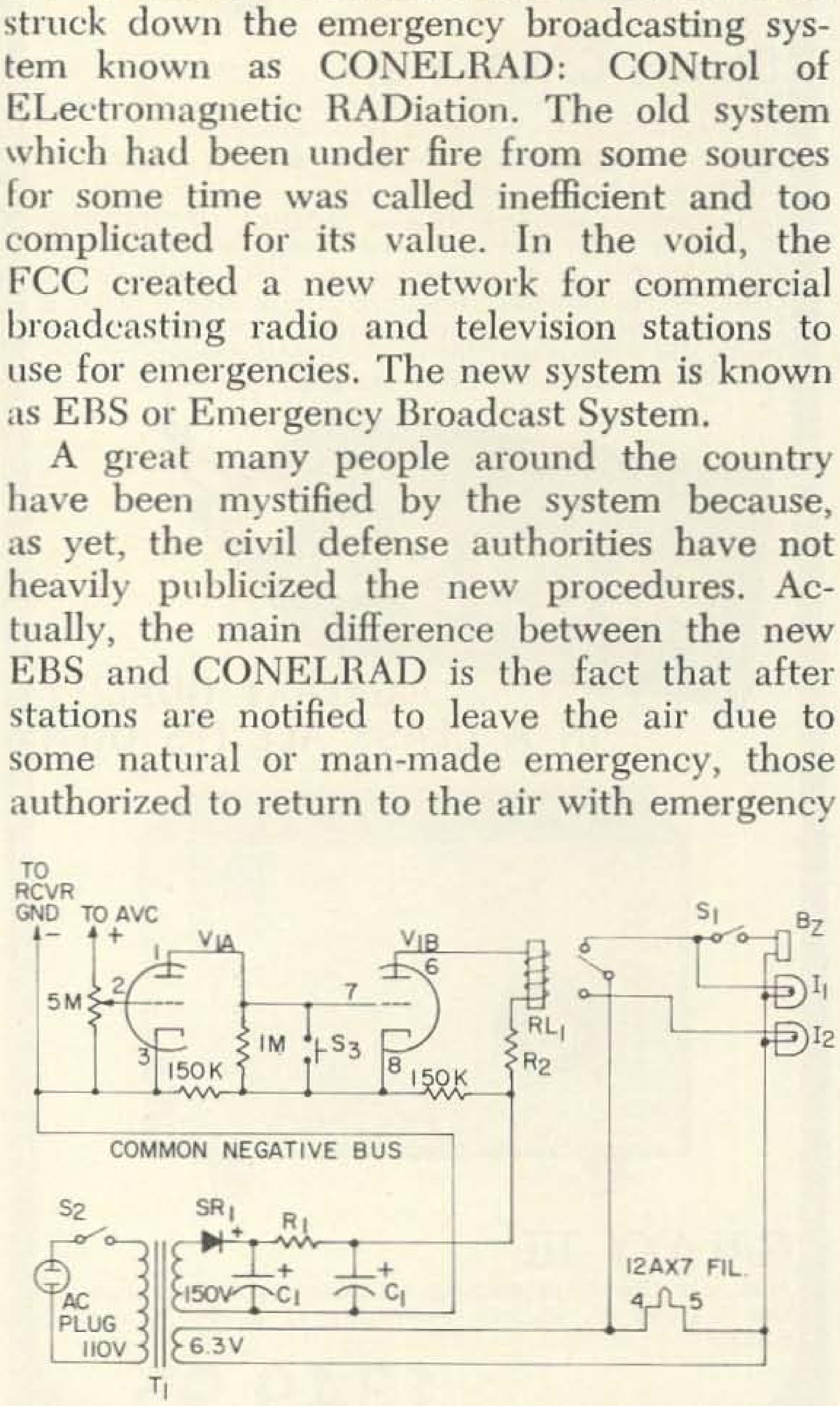
Recently, the civil defense authorities and the Federal Communications Commission struck down the emergency broadcasting system known as CONELRAD: CONtrol of ELectromagnetic RADiation. The old system which had been under fire from some sources for some time was called inefficient and too complicated for its value. In the void, the FCC created a new network for commercial broadcasting radio and television stations to use for emergencies. The new system is known as EBS or Emergency Broadcast System.

A great many people around the country have been mystified by the system because, as yet, the civil defense authorities have not heavily publicized the new procedures. Actually, the main difference between the new EBS and CONELRAD is the fact that after stations are notified to leave the air due to some natural or man-made emergency, those authorized to return to the air with emergency



T1 150 v. @ 25 ma. + 6.3 v @ A. power xfmr
S1, S2 single-pole single-throw switches
S3 pushbutton momentary contact switch
Sr1 20 ma. selenium rectifier
R11 5000 ohm coil relay
R1 1000 ohm/1 watt
R2 1000 ohm
R6 5 megohm potentiometer
C1 16 mfd. @ 250 v. double-section condensor
V1 12AX7 tube
Bz 6 v. buzzer
I 1, I2 red and green pilot lamps

broadcasts will do so on their original transmitting frequencies. This is to be compared to the old system of permitting some stations to return to the air on 640 kc and 1240 kc. There are other differences but this is the most striking change in plans.

So, you say: How does this affect me? Well, the answer is simple. Even though the individual amateur is no longer required to constantly monitor his local station for program interruptions, it is still of very great value to the ham to know just when his local station goes off the air.

If the Big War comes, we will want to be warned just as soon as we possibly can be. Some system to unobtrusively watch for such notification would be most desirable. Any sudden floods, hurricane, tornado, or other natural disaster striking your area should be acknowledged immediately. A source of immediate notification in this event would be very handy, indeed. If a system of EBS monitoring could be available inexpensively and conveniently, there would be no need for any ham to be caught unaware.

CONELRAD operation experience by manufacturers, electricians and broadcast station engineers has contributed greatly to the art of emergency notification signal pickup. Many systems have been devised which are highly successful. This article will describe one simple system which is minor in cost of construction and cost of operation. Construction time is slight and operation of the unit is not a headache to those persons who have to bear the unit daily.

The unit is powered by its own internal power source or it can rob power from the host BC rcvr which supplies avc voltage. A single dual-triode 12AX7 is used to interpret the broadcast signal (or lack of signal) and to trigger the alarm relay at the time when the station goes off the air. Switch S3 is a reset button which returns the unit to its ready-to-go position of operation.

The alarm system is fired by the relay and the alarm itself can be anything from an electronic tone to a light bulb. Each person can custom design the unit for his own setup. I chose to use a small 6 volt buzzer and red-glow pilot lamp for alarm, with a green-glow lamp used to indicate that the unit is on and in the ready-to-go position. Using an SPDT relay allows a system similar to this, but you might choose to use the simpler and cheaper SPST relay, which would permit an indication only at alert time.

Whether your host receiver has 6 or 12 volts available for filaments, you can still use the 12AX7 tube.

A great many transistor radio sets are in use today, causing many of the older tube sets to be left here or there to collect dust. Any old set capable of supplying the necessary avc, would be suitable and could certainly be most easily found and obtained.

So, even though CONELRAD is out, EBS is in and we should all take it upon ourselves to make some definite arrangement to use this excellent emergency warning system. It may seem like a bother now, but if WW III comes you will be most happy to have all the extra seconds of the fifteen minute warning you can get!

. . . K3RXK

The what, why and how of ALC. Make your signal seem up to 20 db stronger.

Jim Kyle K5JKX
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Automatic Load Control for SSB

One of the most useful, though least discussed, operating aids for the sidebander is the device known as "automatic load control." An ALC-equipped transmitter cannot flat-top, is unable to produce splatter unless woefully mistuned, and in addition will be some 6 to 20 db louder at the other end of the line—and yet the standard ham handbooks, all together, devote less than half a page to the idea.

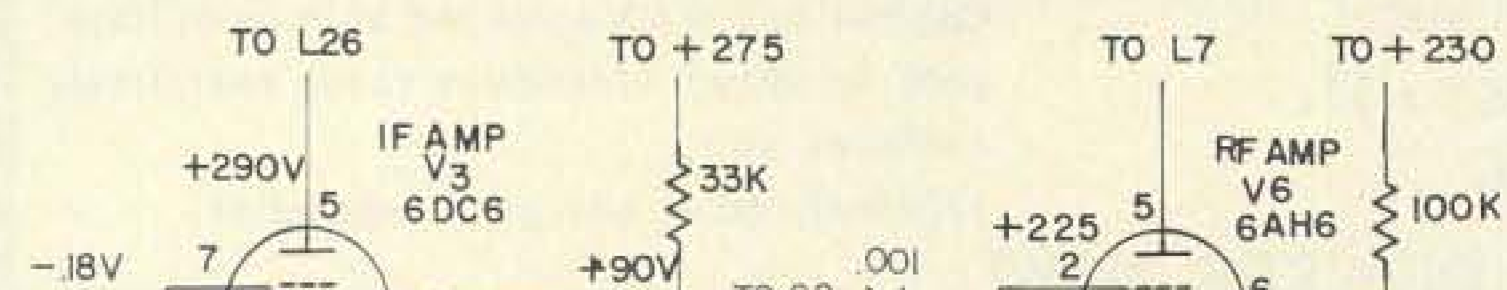


Fig. 2 ALC circuitry of Collins 32S-1

This might be comprehensible were ALC a difficult idea or if it were complicated to add to an existing rig. But the fact of the matter is that ALC can be added to any transmitter in which the final operates Class AB1 in a matter of minutes, with junkbox parts.

If you're among the gang using a 100-watt-range exciter followed by a big linear, you can make the ALC work with both. Alternatively, you can put the ALC in only the exciter, then swamp it down so that it cannot overdrive the linear. You'll still have the same advantages.

Before we get into the "how" of ALC though, let's take a look at what it is and how it works.

The "what" is simple. It's a fully automatic system which "rides the gain" on your exciter's drivers so that the final is never overdriven. Accomplishing this simple end does away with most types of SSB distortion. In addition, you can then crank the audio gain way on up, since the peaks will never be able to overdrive the output, and you now have the equivalent of an audio compressor. This raises the average-to-peak power ratio of the voice, just as the land-line folks do with compandors or the AM gang with speech clippers, and increases the "loudness" of your signal at the other end of the circuit.

The "how" is equally simple but at this stage several alternative approaches are available. The first one tried consisted of a gadget to pick off a little of the outgoing energy at the antenna connector, rectify it to get negative-going dc, and apply this dc (after filter-

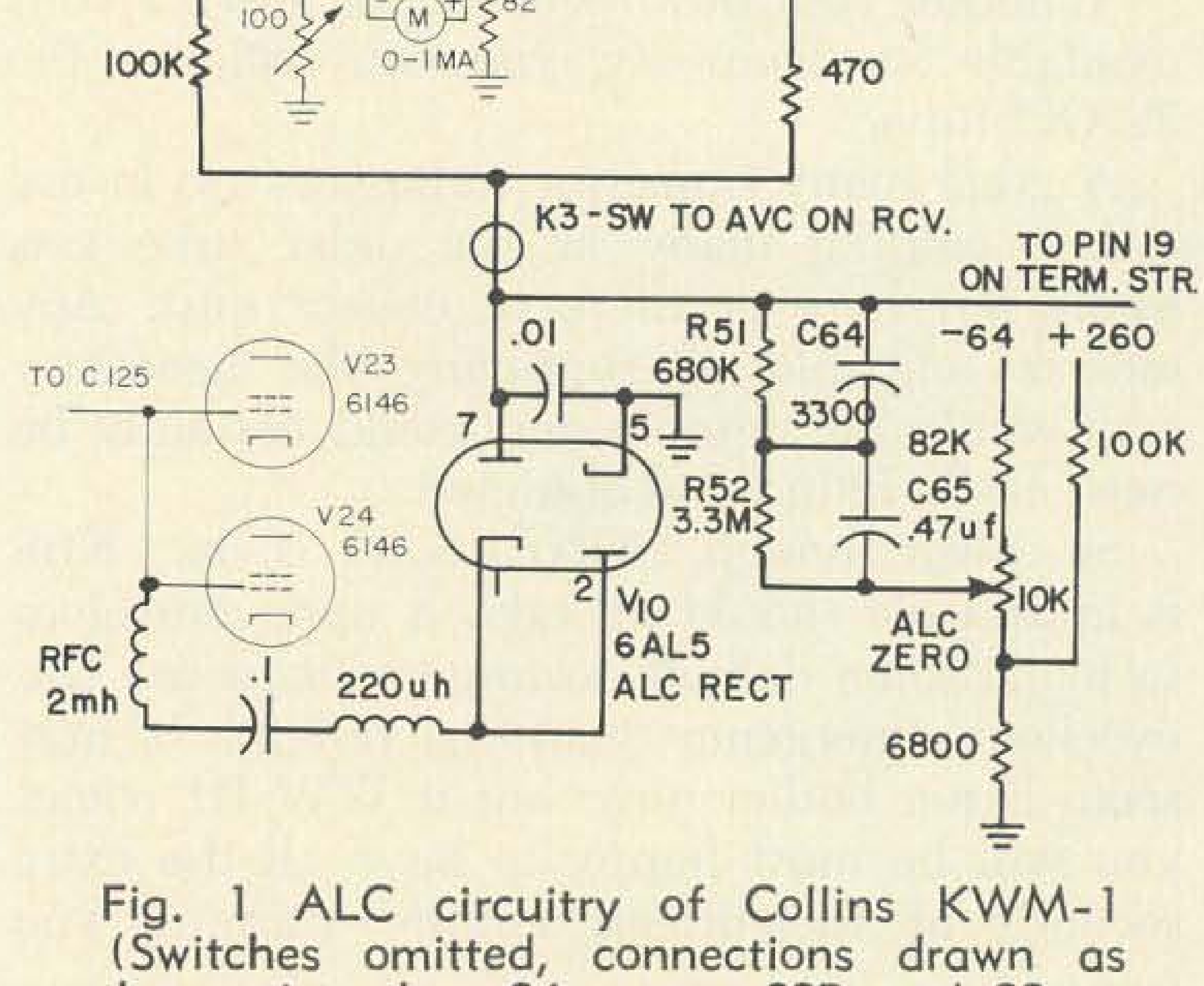


Fig. 1 ALC circuitry of Collins KWM-1 (Switches omitted, connections drawn as they exist when S4 set to SSB and S2 to ALC, unit in transmitting condition.)

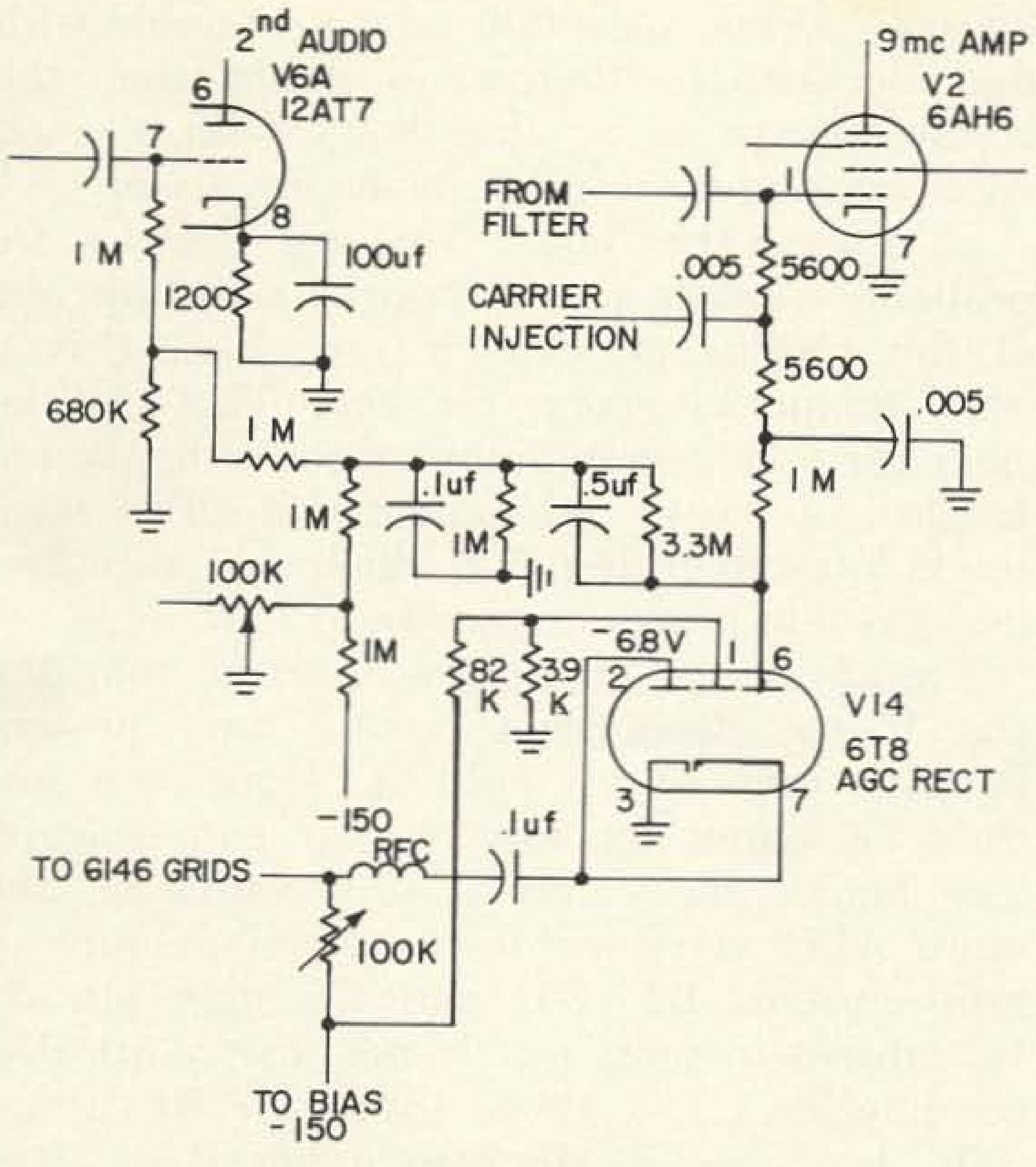


Fig. 3 Johnson Invader ALC circuits (simplified, switching omitted)

ing out the af hash) to a low-level driver stage just as avc is applied in a receiver to cut back the gain.

To make this system work, it's necessary to put some delay bias on the rectifier so that the final can develop full rated output before the ALC starts to cut down gain. This complicates things a bit, and in addition the gain reduction is slower than most of us would like.

However, it's used by Hammarlund the HX-50, and appears to work nicely there.

But the fellows at Collins came up with a much simpler idea which applies to all Class AB1 finals. They remembered that the grid-leak AM detector of earlier days was simply a diode detector made up of the grid and cathode of a tube, direct-coupled to an amplifier (the same tube). The essential part of this memory was that grid and cathode form a detector.

They do the same thing in an over-driven AB1 linear. The detected signal shows up on the grid-bias line as hash at audio frequency.

If you just insert a reasonably high impedance (to audio) in grid-return line, then pick off the audio through an rf choke to eliminate the rf and a series capacitor to get rid of the dc, you can then rectify the hash to get a control voltage.

This voltage will be completely absent until the final is driven into grid current. The instant grid current begins to flow, however, the control voltage appears. When properly applied to driver stages, the effect is to keep the tube operating right at the grid-current point all of the time. This does no harm, and assures you of maximum power out.

Fig. 1 shows how it's done on the KWM-1, with the ALC circuitry presented in bold lines. V10, a 6AL5, rectifies the hash, while R51, R52, C64, and C65 form a combination filtering and hang-time circuit. The two capacitors charge up instantly when control voltage appears, but take nearly 1½ seconds to discharge, so that the ALC voltage follows the average level but is never lower than any occasional peak.

The sole earlier description of this circuit incorrectly refers to V10 as a voltage doubler. While it does look like a voltage doubler as used here, it is not. The 0.1-mfd input coupling capacitor never returns back to ground directly, so the charge on it is not used in getting the ALC voltage. The diode of pins 2 and 5 is a shunt rectifier, while that of pins 1 and 7 is a "hang" diode which prevents the rectifier or source resistance from affecting the time-constant network.

In the KWM-1, the control voltage is applied to *if* amplifier V3, and to rf amplifier V4, both 6DC6's. Each gets the same amount of ALC. The lead to pin 19 of the terminal strip is for applying external ALC from a separate linear, while the ALC-zero circuit is for zeroing of the meter (a modified S-meter circuit).

The circuit used in the 32S-1 is similar but not identical. In this one, the rf amplifier is a 6AH6 rather than a 6DC6, and it gets a larger share of the ALC voltage. However, the 6DC6 does most of the controlling and the rf amplifier's main contribution is protection against instantaneous high-energy peaks.

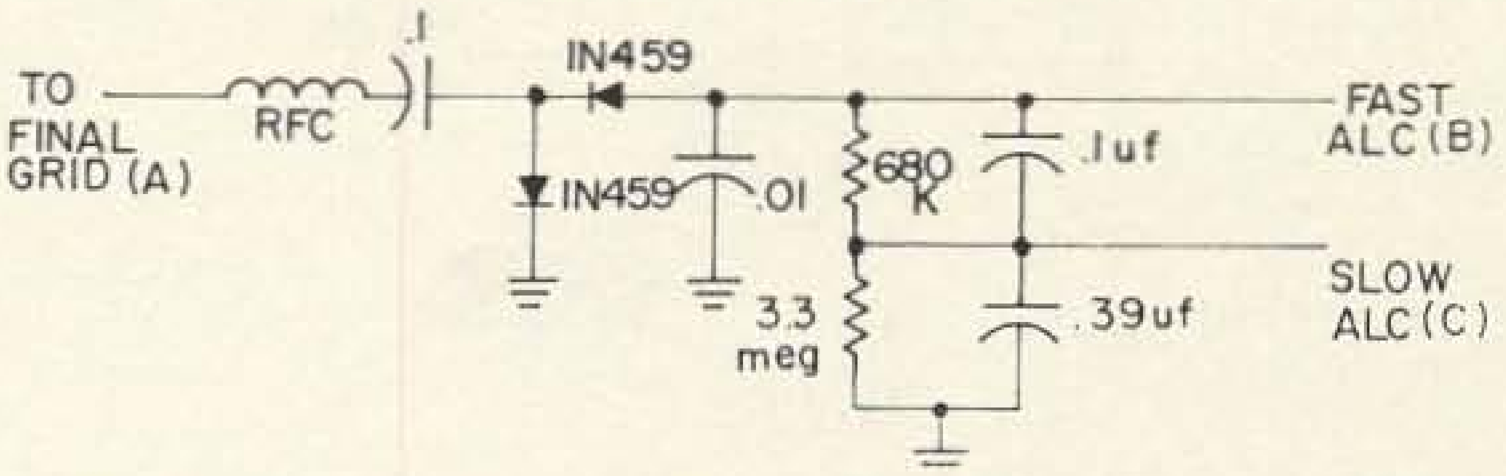


Fig. 4 ALC adapter for any AB1 final

We didn't redraw the KWM-2 circuit since it is so similar to that of the 32S1.

When used with the 30S-1 linear, ALC voltage is developed in the linear rather than the exciter. The grid return is made through an audio transformer, and the hash to be rectified is taken from the secondary of this transformer. No time-constant networks are employed, since they are in the circuit of the exciter at all times.

When using one of these exciters with the 30S-1, the ALC output of the linear is jumpered to the external ALC terminal of the exciter, and the exciter is tuned so that its own ALC never gets a chance to operate (very light drive). Then the linear's ALC will act to keep the final fully driven as much of the time as possible.

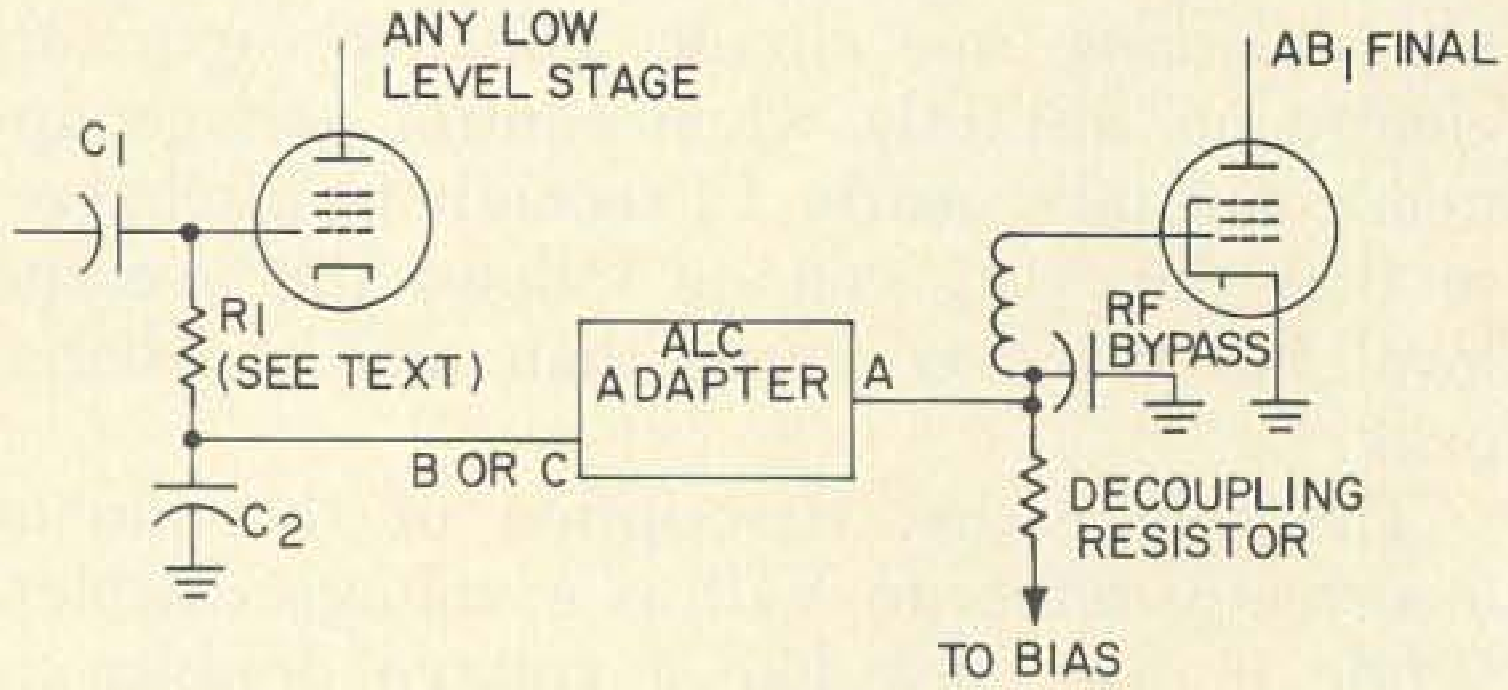


Fig. 5 Hookup of ALC adapter

Hammarlund and Collins aren't the only manufacturers using ALC. Johnson includes it in the Invader, and the circuit is shown here. It is similar to the Collins approach, except for the "clamping" voltage applied through pin 1 of the 6T8. This voltage prevents the ALC line from ever going more negative than about −7 volts. This is necessary, since the Invader controls the second audio stage as well as its 9-mc amplifier. ALC voltage on the 12AT7 must be kept to less than a couple of volts.

Heath includes a simple and effective ALC circuit in the HX-20, while Hallicrafters uses what they call AALC (amplified automatic load control) in the SR-150.

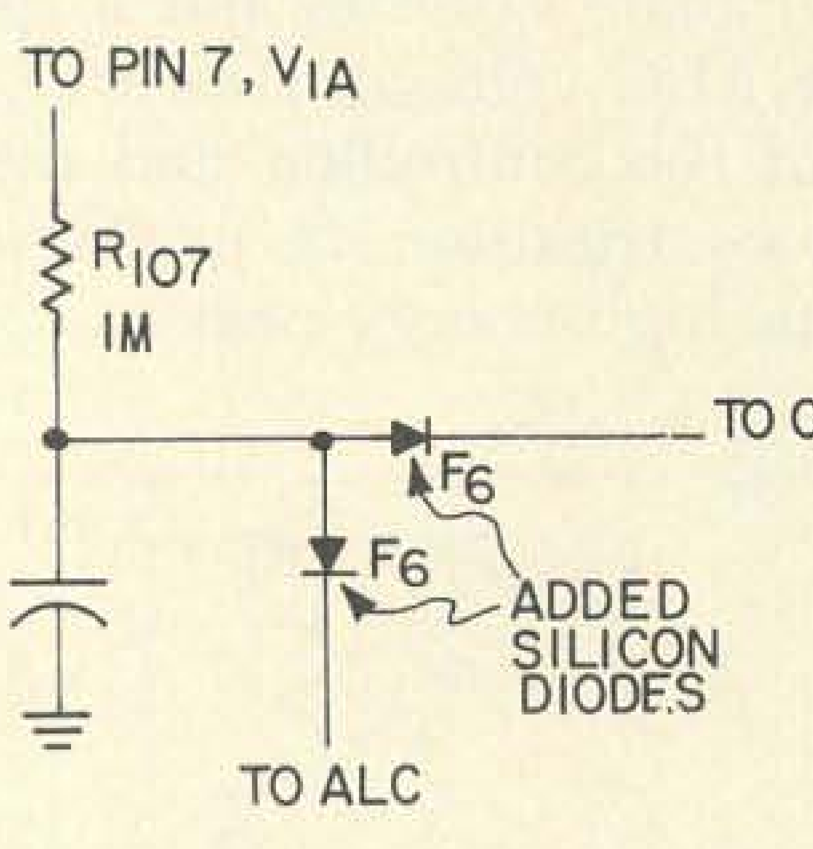


Fig. 6 HT-37 modification

The Hallicrafters circuit simply puts a triode amplifier between the grid-pickoff point and the diode rectifier, to give a more positive cutoff. They use half of a 6EA8, with a plate load resistor of 47K ohms and an unbypassed cathode resistor of 1000 ohms. The remainder of the circuit is "standard".

Along about now, some of you should be noticing that for the ALC to operate, the final grid *must* be drawing a small amount of current. Otherwise, there's no ALC voltage.

Worry not. Collins says that this minute amount of grid current actually helps improve linearity. While we might tend to quibble with that declaration, there's no doubt that the 30 microamps or so that flows with a good ALC working doesn't do anyone any harm.

So now to the "how." You real sharpies are probably already at the bench, adapting one of the Collins circuits. If not, Fig. 4 is a ready-adapted version for you. This can be assembled in five minutes or so with a mere handful of parts, and in fact will all fit on a single 5-terminal tie point which can be tucked into any odd corner of your rig.

Fig. 5 shows how to connect it into the rig. If the decoupling resistor isn't present in your grid return, add it. Don't use less than 5K ohms, for this is your gain control. The higher the value of this resistance, the more ALC you'll get for a given amount of grid current. R1, C1, and C2 may already be present in your rig. If not, use a .01 disc ceramic for C1, a 100K ½-watt for R1, and a .001 disc for C2. Hook to either B or C as you prefer. You'll probably want to try it both ways to see which works best for your own voice and equipment.

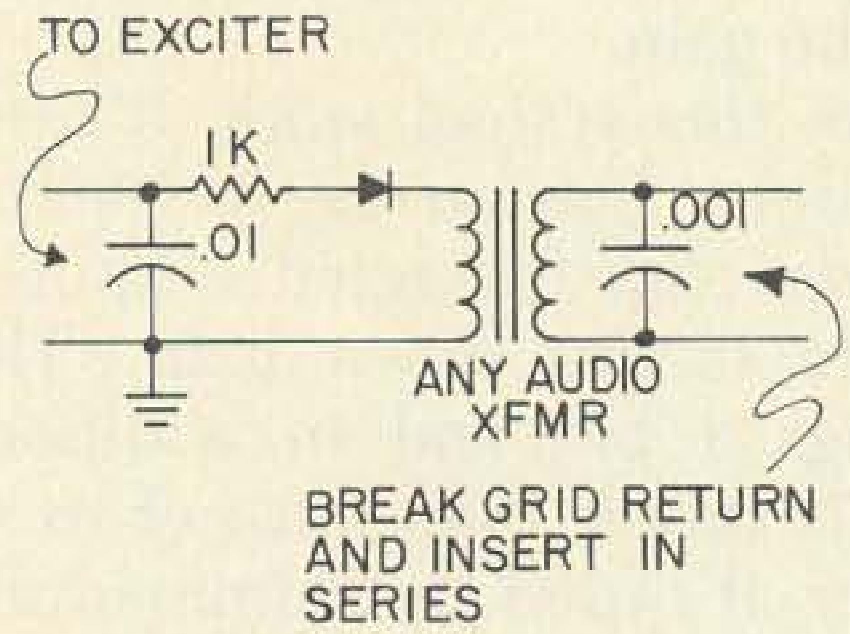


Fig. 7 ALC for any AB1 outboard linear

Picking the low-level stage to control should be little problem. In the Swan transceivers, the 6CB6 *if* stage is a natural. This requires only lifting the ground end of the 470-ohm resistor in its grid, and bypassing it. In the HT-32, connection can be made to pin 1 of V5. The HT-37 requires a bit more effort; details are shown in Fig. 6.

If you are running with a linear, the simple adapter of Fig. 4 may not quite fill the bill unless exciter output is swamped down so that maximum exciter output just barely drives the linear to saturation. However, the version shown in Fig. 7 will handle virtually any AB1 amplifier. This is an adaptation of the 30S-1 arrangement.

For the popular "four-811's" Class B linears, these simple circuits won't quite do it. One which should, based on the design used in the Collins 30L-1, appears in Fig. 8. Unlike the other circuits shown here, this particular one hasn't been performance tested and may possibly have a hidden bug or two. The time-con-

stant network is omitted deliberately, since it's assumed that the exciter will have its own ALC adapter installed for those occasions on which you want to use it barefoot.

The only thing to be careful of when installing the ALC adapters is not to foul up the rf circuits. Keep the lead from the grid-pickoff point to the rf choke as short as possible. Aside from this, almost nothing is critical.

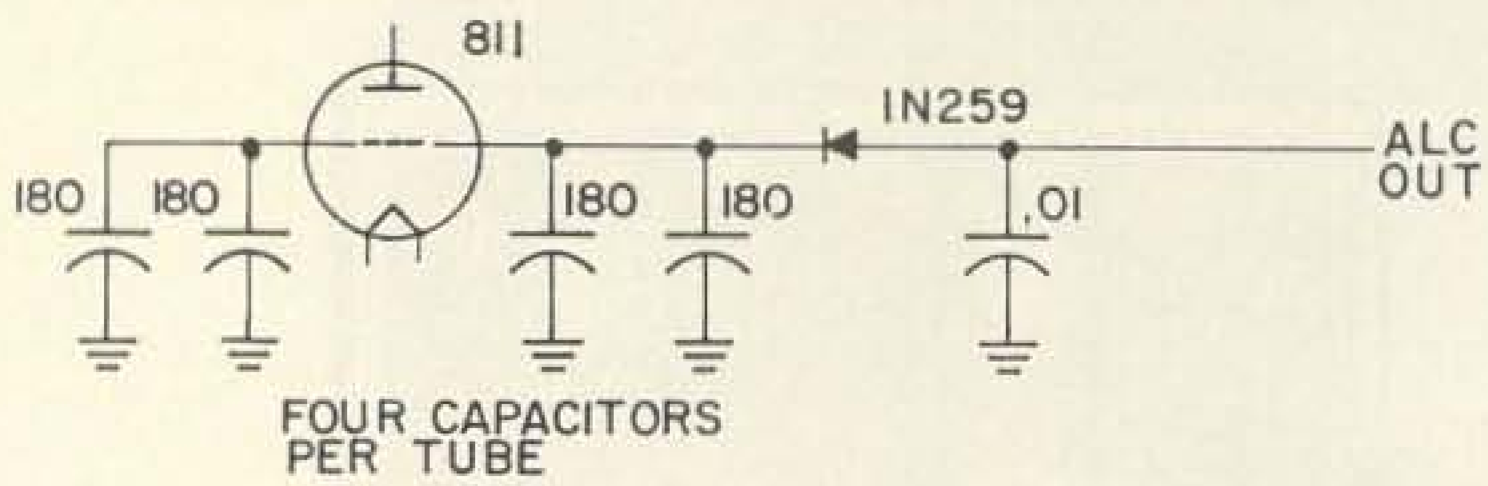


Fig. 8 Class B system

A few rigs may give you trouble in "tune-up" position after ALC is installed, since grid current developed during tune up procedures will try to swamp itself out through the ALC. This can be overcome by grounding the ALC line during "tune" operations, with a spare contact on the function switch of the rig or with an external switch or relay. The hookup appears in Fig. 9.

After installation of ALC, the rig will tune and operate as before. The only difference is that plate current will never rise higher than some value determined by the final tube and its operating conditions.

The mike gain knob now acts as a "compression" control. If left in its original setting, you will have approximately the same talk-power output as before and the only difference will be that you now have automatic splatter protection. However, if you twist the mike gain higher the talkpower will come right on up, and no splatter will be introduced. The signal will remain clean, regardless of mike gain control setting, until driver stages overload, and with commercial equipment of good design this just won't happen.

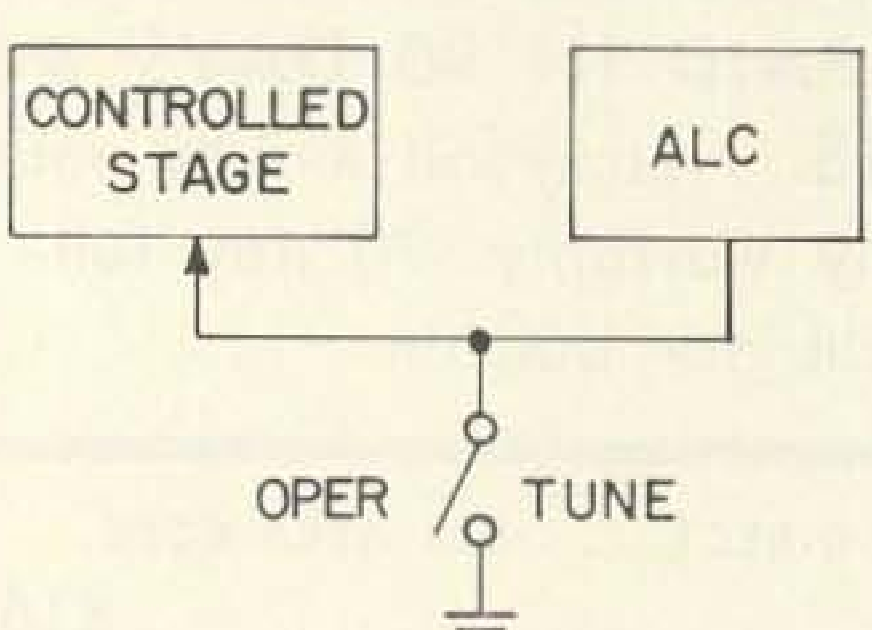


Fig. 9 Tune/oper switch

To determine if the ALC is actually doing anything, you can rig up a meter circuit following the leads given in Figs. 1 and 2, or you can measure ALC voltage directly with the metering circuit shown in Fig. 10. Zero reading on the meter indicates that the ALC is not in action. The greater the compression being provided, the higher the meter will read. If you like, you can calibrate the meter in decibels with the aid of an adjustable-output audio oscillator by first setting the oscillator so that the needle just barely lifts off zero, then doubling the oscillator output. The resulting needle position will indicate 6 db of compression. Doubling output again will provide the 12-db point. In-between calibrations should be more or less linear, since ALC voltage is a logarithmic function of signal input.

If you use the circuit of Fig. 10 and an 0-1 ma meter, you can adjust meter sensitivity with R2 so that it reads 0.3 ma at the 6-db-compression point and then read approximate db of compression directly from the scale, simply multiplying by 20. Thus a reading of 0.5 ma would be 10 db of compression.

In general, it's best to use from 6 to 10 db of compression for all-around purposes and save the rest for really digging deep after that elusive DX. With a single controlled stage, the useful range of control will be about 20 db, and with two controlled stages you can get twice as much. However, extreme compression leads to forms of audio distortion, as well as making all background noises seem to be just as loud as your voice.

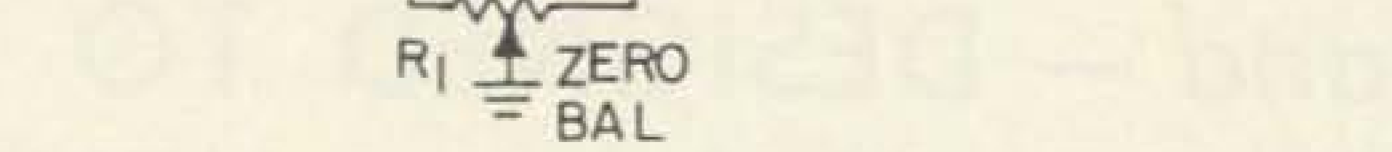


Fig. 10 ALC meter circuit

Normally, with articles such as this, we like to run a list of references for the fellows interested in additional homework. The list is short this time, though, since almost nothing has been written on ALC. Only three previous items could be found; one is in CQ's SSB column for April, 1961 (page 75), one is in Collins Radio's book "Fundamentals of Single Side Band" which is now out of print, and the lst is in W6SAI's huge Radio Handbook. So don't waste time reading any more; unbutton the bottom plate of the rig and get that ALC installed! You'll have a lot more fun, and so will the rest of the fellows on the band.

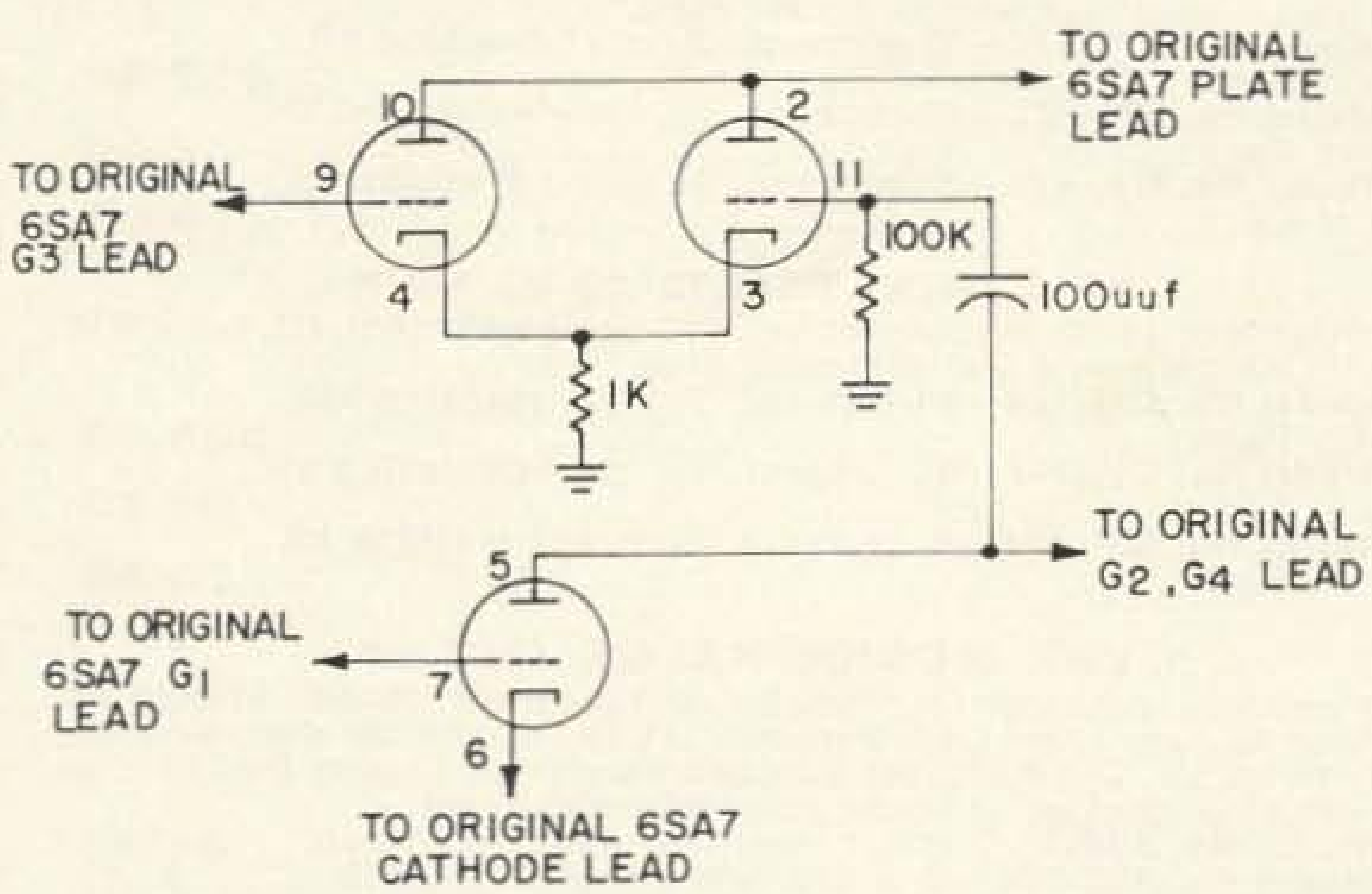
. . . K5JKX

John Reed K9ITR
RR2,
Pekin, Illinois

Front End Hint

The purpose of this article is not to sell you on the Like New Mixer, but to offer a few pointers concerning its use in receivers (such as my SX99) that use the old 6SA7 noise generator as a self-excited converter. Usually there is no room to mount a separate tube for the oscillator, and did you ever try to mount a 12AT7 in a 6SA7 hole? It can be done, but it is no snap. I ran into this when planning to change my SX99. Here is my solution to it.

The 6D10 Compactron is a three triode tube, with the same characteristics as the 12AT7. As an added attraction, you can remove the old octal socket and the new 12 pin socket will fit the same hole.



6D10 Mixer.

On the SX99, the leads are plenty long, so no splicing is needed. The whole job takes only a few minutes. Before you start I suggest you buy a Photofact. You will need it when you find that your receiver alignment has gone south.

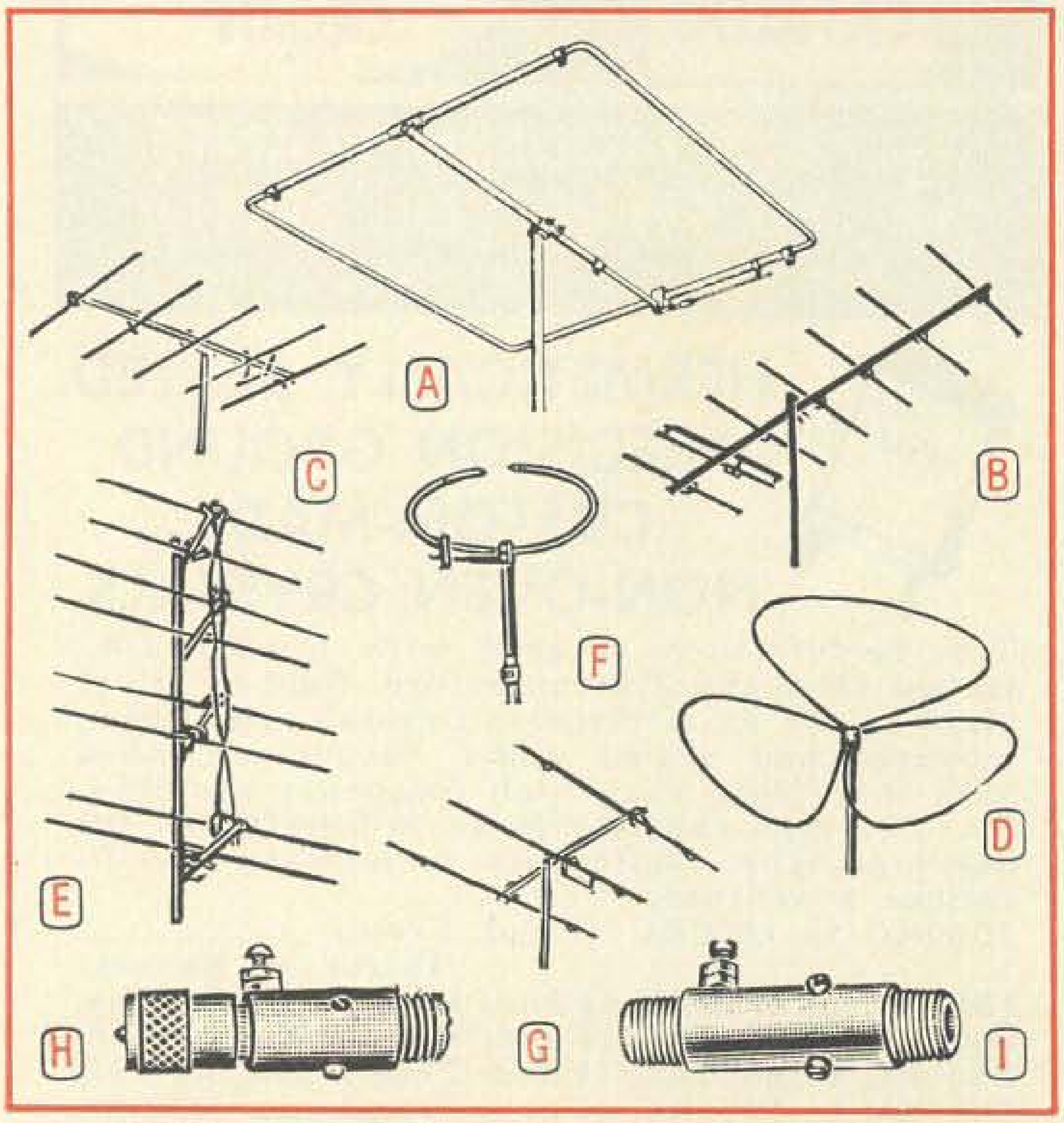
Fig. 1 shows the circuit I used. Although it differs from others published in 73, it works as expected and requires no changes to the original wiring. The results are amazing. Noise is no longer a problem.

If you are reluctant to deface your receiver, it would only take a few minutes to replace the 6SA7 and return to your original noise level.

With my new mixer, my xtal converters, and my Jim Kyle phase shift filter, I'll see you on 7015.73, and good listening.

. . . K9ITR

Cush Craft AMATEUR COMMUNICATION ANTENNAS



MOBILE AND FIXED "SQUALO" (FIG. A)

Half-wave, horizontally polarized, omnidirectional antenna with full size in compact dimensions. Low Q for broad band coverage and direct 52-ohm Reddi Match feed for ideal net control, monitoring or general ham coverage. Designed for mast or tower mounting; also with rubber cups for car top mount.

Model No. ASQ-6—6-meter, 30" square. Net Each.....$12.50
Model No. ASQ-10—10-meter, 50" square. Net Each... 19.50
Model No. ASQ-11—11-meter, 50" square. Net Each... 19.50
Model No. ASQ-15—15-meter, 65" square. Net Each... 23.50
Model No. ASQ-20—20-meter, 100" square. Net Each.. 29.50
Model No. ASQ-40—40-meter, 192" square. Net Each.. 66.50

VHF/UHF YAGI BEAMS (FIG. B)

The standard of comparison in VHF communications. Boom, 1" dia. aluminum tubing, preassembled 3/16" dia. elements. Pre-tuned, direct 52- or 72-ohm Reddi Match coaxial feed with average 11 db gain, 7-element; 13 db gain, 11-element. May be ordered for 200- or 300-ohm feed.

Model A144-11—11-element, 2-meter; 12-ft. boom. Net..$12.75
Model A144-7—7-element, 2-meter; 8-ft. boom. Net Ea... 8.85
Model A220-11—11-element, 1¼-meter; 8½-ft. boom.... 9.95
Model A430-11—11-element, ¾-meter; 5-ft. boom. Net.. 7.75

3-, 5-, 6-, 10-ELEMENT 6 METER BEAMS (FIG. C)

Rugged, full size, with proven performance. Aluminum booms, 1¼" and 1½" dia.; elements ¾" with preassembled direct 52- or 72-ohm Reddi Match coaxial feed. Easy assembly with marked parts.

Model A50-3—3-element; 7.5 db forward gain; 6-ft. boom. Net Each.....$13.95
Model A50-5—5-element; 9.5 db forward gain; 12-ft. boom. Net Each.....$19.50
Model A50-6—6-element; 11.5 db forward gain; 20-ft. boom. Net Each.....$32.50
Model A50-10—10-element, 13 db forward gain, 24-ft. boom. Net Each.....$49.50

COAXIAL STACKING KITS (NOT ILLUS.)

Stacking doubles effective radiated power, provides 3 db gain over single beam, low radiation angle and greater capture area. Complete with RG-59/U cable and mounting hardware.

Model A41-SK—16 db forward gain with Model A430-11. Net Each.....$4.95
Model A21-SK—16 db forward gain with Model A220-11. Net Each.....$4.95
Model A17-SK—14 db forward gain with Model A144-7. Net Each.....$4.95
Model A11-SK—16 db forward gain with Model A144-11. Net Each.....$4.95
Model A53-SK—10.5 db forward gain with Model A50-3. Net Each.....$4.95
Model A55-SK—12.5 db forward gain with Model A50-5. Net Each.....$4.95
Model A56-SK—14.5 db forward gain with Model A50-6. Net Each.....$6.95
Model A51-SK—16 db forward gain with Model A50-10. Net Each.....$6.95
Model VPK—Vertical polarization kit for use with dual stacked VHF yagis. Net Each.....$7.50

VHF/UHF QUAD STACK ARRAYS (FIG. B)

Extremely high forward gain, large capture area. Complete with four antennas, stacking frames, phrasing bars, Q sections and all hardware. Forward gain 28-element model, −17 db; 44-element, 19 db. Standard Quad 52 ohms; may be ordered for 450, 300 or 200 ohms.

Model A144-11Q—44-element, 2-meter. Net Each.....$76.00
Model A144-7Q—28-element, 2-meter. Net Each..... 62.50
Model A220-11Q—44-element, 1¼-meter. Net Each... 54.50
Model A430-11Q—44-element, ¾-meter. Net Each.... 43.00

VHF TWIST (NOT ILLUSTRATED)

For satellite tracking, back scatter, moonbounce, combination base to mobile and point-to-point communications. Twenty-element yagi provides horizontal or vertical, left or right circular polarization by phasing dipoles. Reddi Match for 52-ohm direct feed. Cut to frequency within 130–150 Mc range. Boom 12-ft. long.

Model No. A144-20T—20-element. Net Each.....$24.50

MOBILE AND FIXED VHF/UHF BIG WHEEL (FIG. D)

Horizontally polarized, omnidirectional gain antenna features low-Q, large capture area, ease of matching and improved band width. Single-wheel gain, 5 db over halo; stacked, 8 db.

Model ABW-144—2-meter; 47" dia.; weight 4 lbs. Net..$10.95
Model ABW-220—1¼-meter; 29" dia.; wt. 3 lbs. Net.... 9.95
Model ABW-420—¾-meter; 17" dia.; wt. 3 lbs. Net..... 8.95

BIG WHEEL STACKING KITS

Model ABW-12S—2-bay, 2-meter. Net Each.....$ 3.95
Model ABW-22S—2-bay, 1¼-meter. Net Each..... 3.95
Model ABW-42S—2-bay, ¾-meter. Net Each..... 3.95
Model ABW-14S—4-bay, 2-meter. Net Each..... 11.75
Model ABW-24S—4-bay, 1¼-meter. Net Each..... 11.75
Model ABW-44S—4-bay, ¾-meter. Net Each..... 11.75

VHF COLINEAR ARRAYS (FIG. E)

Lightweight, mechanically balanced VHF antenna systems. Extremely high power gain, major front lobe, low SWR, and broad band coverage; low angle of radiation and large capture area for excellent receiving and transmitting characteristics.

16 ELEMENT ANTENNAS 13.2 DB GAIN

Model No. CL-116—2 meter, 16-element, collinear. Net $16.00
Model No. CL-216—1¼ meter, 16-element, collinear. Net 12.85
Model No. CL-416—¾ meter, 16-element, collinear. Net. 9.85
Model No. CL-MS—Universal matching stub matches 300-ohm 16 element antennas to 200, 52, or 72-ohm feed lines. Net $4.75

32 ELEMENT ARRAYS 17 DB GAIN

Order two 16-element antennas and one 32-element kit, complete with all hardware and matching stub.

Model No. CK-132—32-element, 2 meter stacking kit. Net Each.....$32.50
Model No. CK-232—32-element, 1¼ meter stacking kit. Net Each..... 32.50
Model No. CK-432—32-element, ¾ meter stacking kit. Net Each..... 19.95

64 ELEMENT ARRAYS 20 DB GAIN

Order four 16-element antennas and one 64-element kit, complete with all hardware and matching stub.

Model No. CK-164—64-element, 2 meter stacking kit. Net Each.....$69.50
Model No. CK-264—64-element, 1¼ meter stacking kit. Net Each..... 59.50
Model No. CK-464—64-element, ¾ meter stacking kit. Net Each..... 29.95

VHF MOBILE HALOS (FIG. F)

Aluminum construction; machined hardware; Reddi Match for 52 or 72-ohm direct feed. 2 meter, 144 to 148 Mc, 14" dia.; 6-meter, 48 to 56 Mc, 26" dia. Dual halo two bands one 52-ohm feed line, no switching, tuning, or traps, complete with mast.

Model No. AM-2—2 meter, without mast. Net Each....$4.95
Model No. AM-2M—2 meter, with mast. Net Each..... 8.70
Model No. AM-22—2 meter, stacked. Complete incl. mast. Net Each.....$14.95
Model No. AM-6—6 meter, without mast. Net Each... 8.75
Model No. AM-6M—6 meter, with mast. Net Each.... 12.50
Model No. AM-26—Dual halo 2 and 6 meter, with mast. Net Each..... 17.45

Note: All Cush Craft VHF/UHF yagis and Colinear arrays are designed for either horizontal or vertical polarization. Most types listed are available cut to frequency, on order, for commercial services. Add $7.50 to net prices for cutting.

FULL SIZE SINGLE BAND BEAMS (FIG. G)

Lightweight, rust proof aluminum construction. Factory pretuned and adjusted, direct 52-ohm Reddi Match feed for 1:1 SWR, average 8.5 db gain, will handle maximum legal power.

Model No. A28-3—3-element, 10 meter, boom 10'. Net $28.50
Model No. A28-4—4-element, 10 meter, boom 18'. Net. 42.50
Model No. A21-3—3-element, 15 meter, boom 12'. Net. 32.50
Model No. A14-3—3-element, 20 meter, boom 20'. Net. 62.50

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The **only** coaxial cable lightning arrester designed to eliminate heavy static charge build-up to protect valuable radio equipment; in many cases eliminates noise problems; fits any standard coaxial cable. Power handling capacity 1 kW fully modulated. Will not affect SWR or performance to 500 Mc. It will not create insertion loss. U.S. PATENT NO. 2,922,913.

Model No. LAC-1 (Fig. H)—One male, one female type 83 connectors. Net Each.....$3.95
Model No. LAC-2 (Fig. I)—Double female type 83 connectors. Net Each.....$4.45
Model No. LAC-2N (Fig. I)—Double female type N connectors. Net Each.....$5.95

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SQUALO

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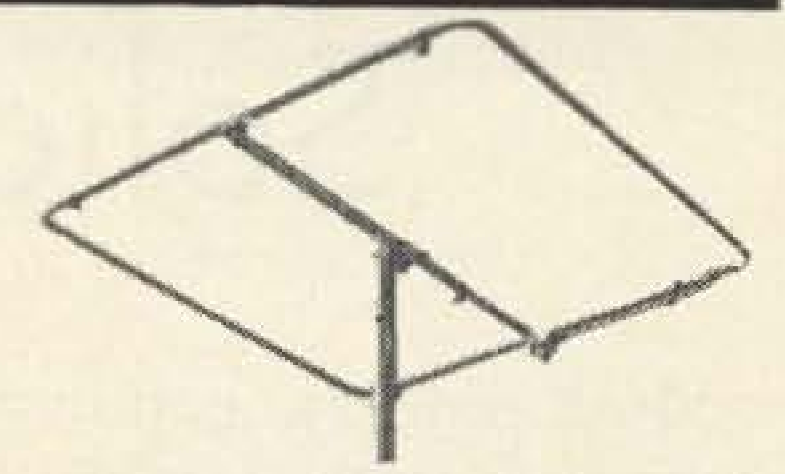
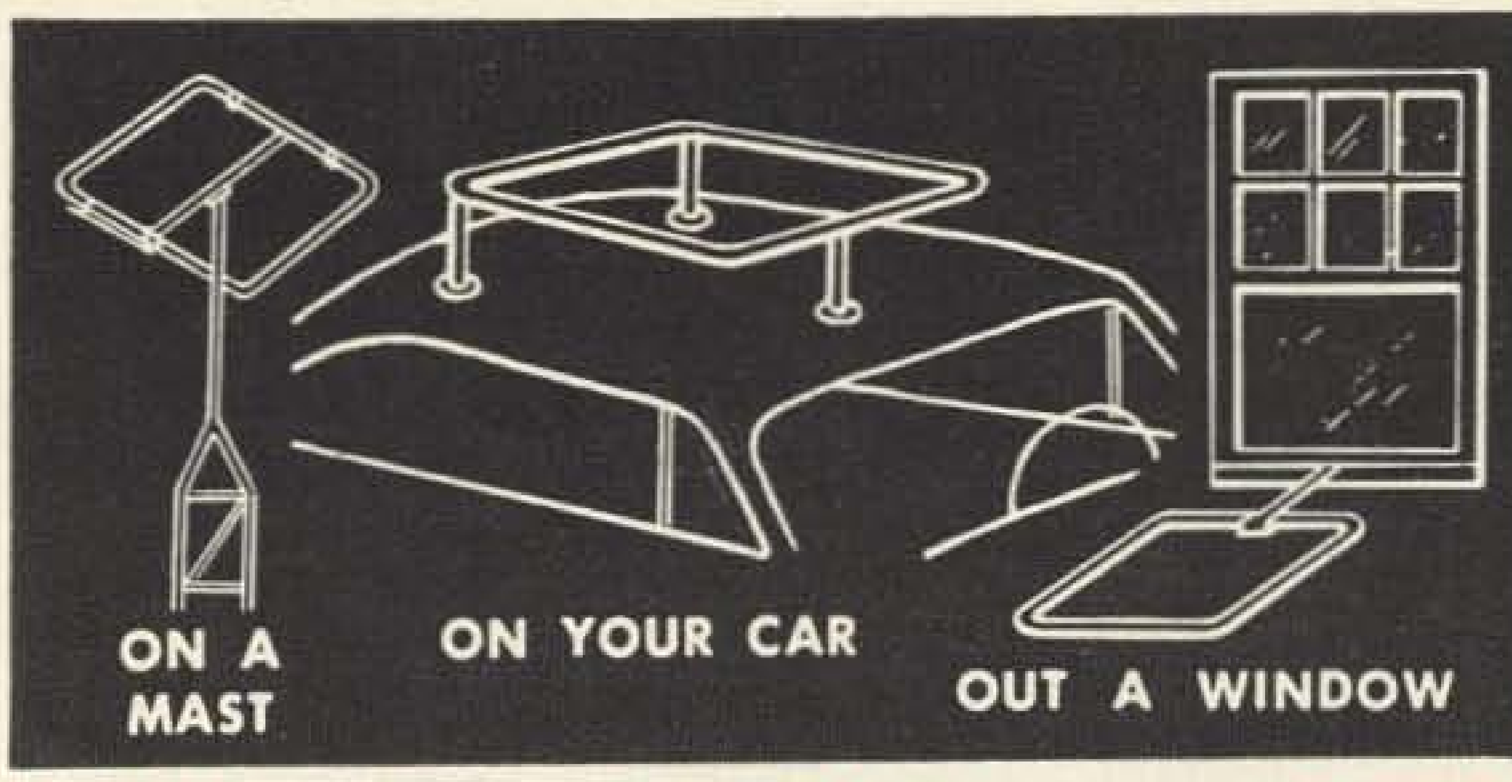


SQUALO is a full half wave, horizontally polarized, omni-directional antenna. Outstanding all around performance is achieved through a 360° pattern with no deep nulls. The square shape allows full electrical length in compact dimensions. Direct 52 ohm Reddi Match feed provides ease of tuning and broad band coverage.

The 6 meter Squalos are completely universal for mounting anywhere. They are packaged with rubber suction cups for car top mounting and a horizontal center support for mast or tower mounting. The 10—15—20 and 40 meter Squalos are designed for mast or tower mounting. Squalo is ideal for net control, monitoring, or general coverage.



MODEL NUMBER	DESCRIPTION	NET PRICE
ASQ-6	6 Meter 30" square	$12.50
ASQ-10	10 Meter 50" square	19.50
CSQ-11	11 Meter 50" square	19.50
ASQ-15	15 Meter 65" square	23.50
ASQ-20	20 Meter 100" square	29.50
ASQ-40	40 Meter 192" square	66.50

SQUALO TREE

Design a complete multi band antenna system to meet your own requirements. Squalos can be mounted one above the other or above existing beams on a single mast. The Squalo tree is a horizontally polarized, omnidirectional system in any combination of the 6 through 40 meter amateur bands. The Squalo tree takes a minimum amount of space, and does not require extra radials, ground wires, or rotators common to most multi band systems.

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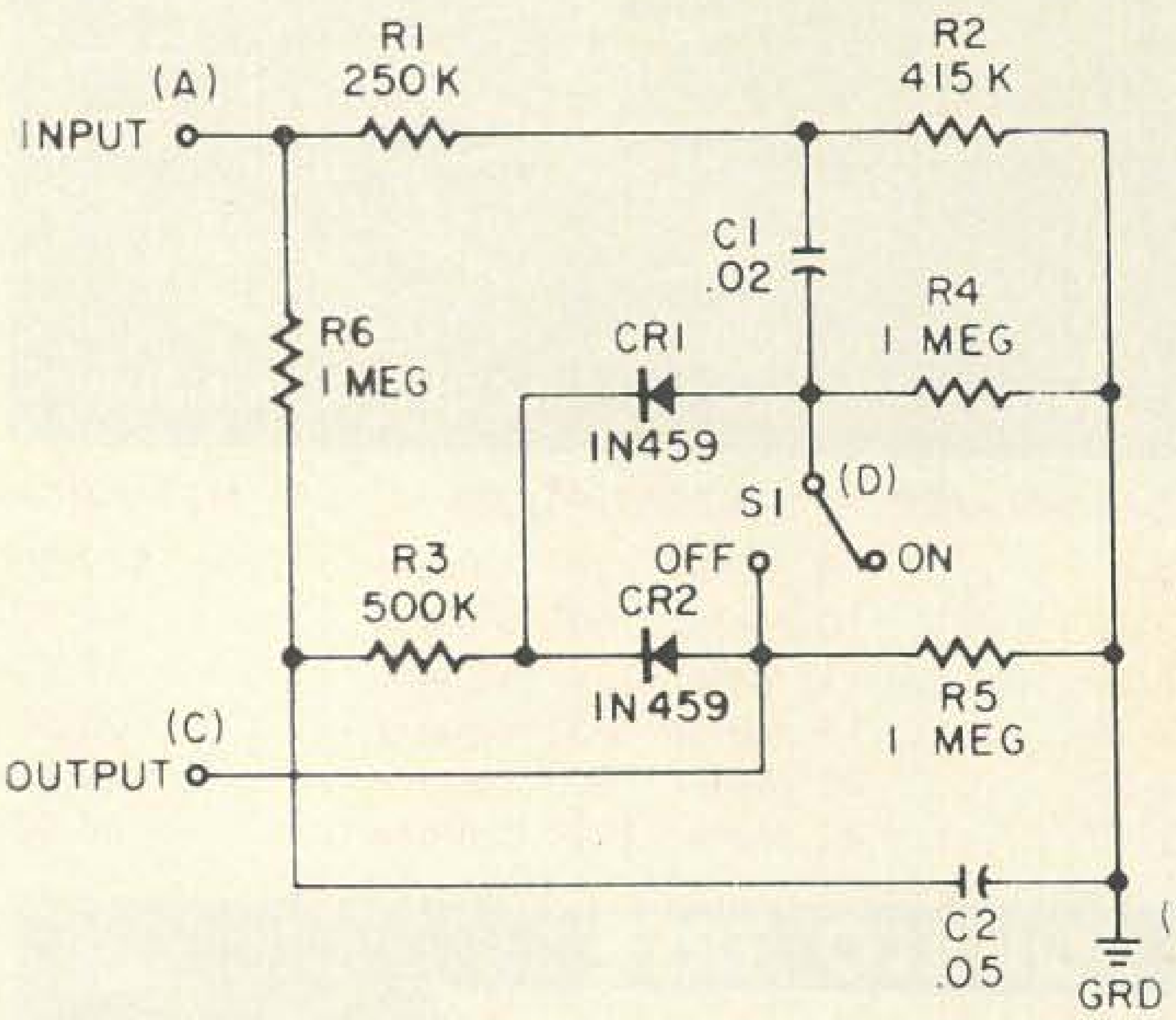
Solid State Noise Clipper

Most modern communications receivers are equipped with factory-installed noise-limiting devices; but either impulse-noise problems are becoming more severe or the "stock" noise limiters are becoming less effective. When an acute noise problem arises—as when first encountering the notoriously noisy mobile conditions of six-meter operation—and the built-in automatic noise limiter seems inadequate in its clipping depth, most hams spend some time on research. In the quest for easy and practical methods of impulse-type interference rejection, a mobile operator may be surprised to see the volumes that have been written on the suppression of noise at the source.



Unfortunately, source-type or "active" noise control can be a formidable task. The prospect of thorough bypassing, grounding, and shielding is often too involved to consider. But simply because the "passive" noise rejection of the built-in noise limiter doesn't always prove satisfactory, it is by no means proof positive that one need take "active" measures. The majority of commercially made communications receivers employ half-wave noise clipper circuits. That is, the positive audio half-cycle is clipped while the negative half-cycle remains unchanged. This allows a substantially undistorted audio output with a reasonable degree of impulse noise chopping. While this is generally acceptable, the more severe noise problems demand full-wave control.

While most hams are aware of the shortcomings of the conventional ANL circuits, few want to alter the appearance or circuitry of their "store-bought" rigs through modification or the addition of a home-brew accessory. An active amateur may have a transmitter under the dash panel of his automobile, plus a receiver or converter, and maybe even a power supply. The inclusion of another circuit would mean another black box—which is generally taboo with the xyl's.

So the limiter described here might just be the perfect answer to those "incurable" mobile interference problems. It effectively provides full-wave noise limiting and can be built into a unit small enough to mount in the actual receiver (under the chassis). And there is no need to change the receiver's physical configuration or electronic circuitry. Inclusion of the solid-state clipper into a receiver involves only soldering at three (or possibly four) points, and the disconnection of one wire (where a noise limiter already exists). This is no more effort than the soldering of a transistor into a circuit.

Theory of Operation

The limiter as described here was designed by Dick Hughes (W6CCD) of Pomona. He started with a standard circuit which employed a vacuum tube type dual diode, then substituted semiconductors in place of the tube. The inherent incompatibility of the original components with semiconductors necessitated other changes. The result is shown in the diagram. In this circuit, highly effective clipping with very low distortion is accomplished by clipping only on the positive signal pulses. The negative pulses are reduced in amplitude to a value approximating the clipped positive pulse. This gives a relatively noise-free output sine wave whose characteristics are essentially the same as those of a clean signal from the detector.

Actual clipping level is determined by capacitor C2. The higher the value, the greater will be the amount of signal clipped from the positive audio pulse, and the greater will be the amplitude of the negative cycle. The voltage difference between the unclipped negative half-cycle at C1 and the unclipped reduced-amplitude negative half-cycle at C2 determines the level, or amplitude, of the signal at the output.

Experimentation has shown a value of .05 microfarad to be optimum for conditions of serious noise in receivers with a bandwidth of 2 or 3 kc. In broader receivers, the noise could be clipped closer with little increase in signal distortion. In highly selective receivers, however, with a bandwidth of 1 kc or less, the value of C2 might be raised slightly to assure distortion-free performance while still providing adequate impulse-type noise limiting functions.

The circuit is adaptable to any vacuum tube circuit and to hybrid circuits employing vacuum tubes in the audio preamplification stages. The filter is installed in series with the audio line between the detector and the grid of the first audio amplifier.

To summarize: the distortion is average, while the audio dampening characteristics are a considerable improvement over a conventional half-wave noise clipper. The effective clipping action under conditions of severe noise is dramatically distinct.

Construction

The following parts are required for the noise limiter:

R1–250K
R2–415K
R3–500K
R4–1 meg
R5–1 meg
R6–1 meg
C1–.02
C2–.05
D1–1N459
D2–1N459
S1–SPST

The resistors may be ¼ watt, if obtainable (a necessity where extreme miniaturization is required). The switch is not required, and may be omitted in installations where the circuit will be on at all times. The diodes may be replaced by either 1N457 or 1N458 as long as both diodes are the same. The only difference in these diodes is the peak inverse voltage rating, which will not be exceeded in any case. There is nothing critical in the selection of diodes for the noise eliminator. Any conventional diode with an extremely high back resistance and relatively low forward resistance will suffice. The diodes must be able to conduct under normal conditions without decreasing amplitude and to offer a nearly infinite resistance to pulses in the nonconducting state. All values shown are plus or minus ten per cent. The circuit point marked A is the audio input. B is floating ground or ground. C is the audio output. If there is already a noise limiter in the circuit, and it is not desirable to remove it or utilize the switch in the new circuit, simply disconnect the existing limiter from the audio input and prevent it from coming into contact with other wires. This will disable the existing noise limiter. Tie new limiter point A to the same contact point. Tie audio output C to audio-output point of existing limiter (the existing limiter may remain tied in at this point). If an on/off switch is to be used, the switch will connect between C and D. These two leads should be shielded to prevent pickup of noise and hum. When C and D are shorted (switch closed) the noise limiter is off.

Miniaturization Considerations

If care is exercised to keep all leads as short as possible, the noise clipper can be potted into a unit of less than one cubic inch. There is no need for hookup wire, either. Solder the elements as closely as possible, then save the excess leads from all components. These can be used as external leads from the clipper after hermetically sealing the miniature package. Once the noise clipper has been fabricated, choose the four longest leads saved from the original parts. Solder these to points A, B, C, and D so they all extend from the unit in the same direction. Code them in such a way that you can remember which lead goes where after the circuit is sealed. (One effective system is to cut lead A the shortest, with B, C, and D progressively longer.)

Potting

A very inexpensive method of packaging miniature circuits is to use ordinary epoxy glue. A "professional" looking potting job can be obtained by forming the epoxy glue over the components. Before sealing the unit, however, remember to test the circuit for proper operation. Once the circuit is sealed with the epoxy glue, there can be no trouble shooting or component adjustments in the noise clipper.

Another effective method of packaging is through the use of ordinary wood putty or "Plastic Wood".

Wood sealers work and shape well and dry fast. The major disadvantage here is that the consistency of wood sealers does not allow "dipping" of the circuit to provide isolation between leads. If wood sealer is used, the completed circuit should first be dipped into a "liquid tape" insulating compound—available at most electronics outlets. The liquid tape insulates all exposed conducting surfaces and allows the unit to be tightly compressed during the packaging process.

. . . K6MVH

We Need Your Help

You can help ham radio as well as us by encouraging friends to subscribe to 73 or giving a gift subscription or two. The more hams that read 73 the more that may take an interest in the preservation of our hobby . . . the more that may be intrigued by the large number of construction articles and start building.

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Ed Sagatis WA2DJU
Amperex Electronic Corporation
230 Duffy Avenue
Hicksville, L. I., N. Y.

Take Full Advantage of Your Halo

For six meter mobile operation the halo antenna provides distinct performance advantages over whip type antennas. Included among these advantages are: higher gain; horizontal polarization to coincide with the base station; relative insensitivity to noise pick-up.

The halo antenna, with its high Q, possesses an undesirable narrow bandwidth characteristic. Therefore if you desire to QSY while obtaining optimum performance it is necessary to retune the halo antenna in order to present a 50 ohm load to the transmitter.

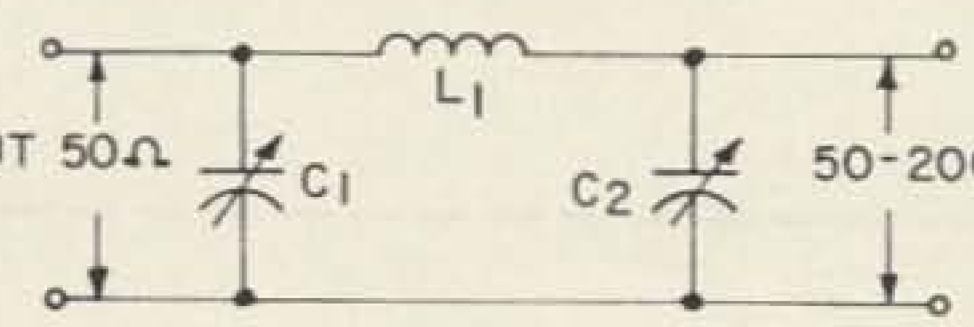

FIG. 1

PARTS LIST
C_1 ARCO #463
C_2 ARCO #464
L_1 3-1/2 TURNS #16, 7/16" DIAMETER, 3/8" WINDING LENGTH

The majority of six meter transceivers use pi networks to transfer power from the final amplifier to the load. Unfortunately, many pi networks have a limited impedance matching range of 2:1 which generally causes a mismatch between the antenna and the amplifier.

Using the results of a recently published paper, "The Design of π Networks," by Mssrs. H. Kaylie and R. Bosselaers of the Amperex Electronic Corporation[1] Applications Laboratories, the mismatch disadvantages can be overcome. The matching network of Figure 1 is the familiar pi which has been designed using this technique and will provide up to a 4:1 match from 50 ohms to 200 ohms.

There are several advantages to the design of Figure 1. Among these are:

1. It requires tuning of one element instead of the usual two.

2. It offers suppression of harmonic frequencies.

3. It has a relatively high loaded Q of 6.

The network can easily be constructed inside a minibox with appropriate connectors placed at each end. The values of the reactive components of the network for 6-meter operation are as follows:

C_1 = 110 mmfd max.
L = 0.18 μh
C_2 = 220 mmfd max.

Adjusting Procedure
(Refer to Figure 2)

The procedure for adjusting the pi network is:

1. Without the π network connected, setup the equipment as indicated in Figure 2. Use the 50 ohm load. Tune and load the transmitter for maximum forard and minimum reflected power as indicated on the bridge.

2. Insert the pi netork and replace the 50 ohm load with the 200 ohm load adjust C_1 and C_2 to obtain the same bridge readings as step 1.

3. Replace the 20 0ohm load with the 50 ohm load and adjust C_2 for readings identical to step 2.

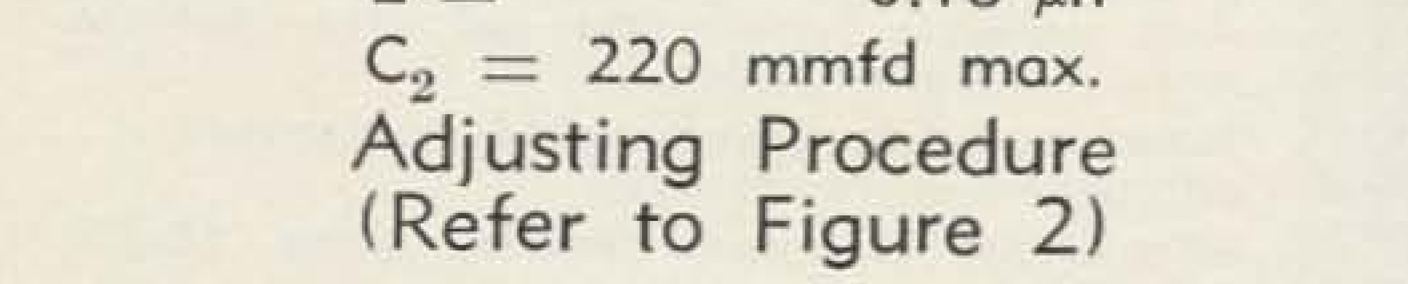

FIG. 2

The pi network is properly adjusted when the readings of step 1, 2 and 3 are identical. When this is accomplished, the network is ready for use and should be installed between the transmitter and the antenna.

When changing frequency, it will only be necessary to adjust C_2, and the final amplifier's plate tuning control.

The addition of this pi network to a halo antenna will provide a low vswr over a greater frequency range. This will result in a greater percentage of the final stage output power being delivered to the antenna.

Acknowledgement

The author wishes to thank Mr. H. Kaylie for his helpful suggestions. . . . WA2DJU

John Kline K9UTN
209 N. Dunlop
Viroqua, Wisconsin

Is Your Investment Protected?

The radio amateur has, as an investment in equipment, values ranging anywhere from $300.00 to $3,000.00, according to his operations and desires. In the accumulation of these values the thought of protecting that investment is often forgotten. Most people feel that their household contents insurance will protect them. This is true, with the exception, however, that many times increased values brought about by addition of equipment and the slow and gradual build up of equipment is overlooked. It is too late at the time of a fire or a windstorm to have your insurance increased. You must make plans for protecting that investment ahead of time.

Basically, two things are involved in thinking about protecting your investment. First, you must think of your values. When you are thinking of your values be realistic and consider the real value of your equipment. (Not the value that you tell your XYL that you have invested). Secondly, think of the perils involved. Most losses to radio equipment and accessories are caused by fire, windstorm and electrical damage. After considering these two items, insure to protect your investment.

Radio equipment and accessories are termed as "contents". The term contents in an insurance policy is very broad, covering "household and personal property usual to or incidental to the occupancy of the dwelling." (Ham equipment is usually primary to occupancy). It also covers property which you are purchasing on the installment plan, thereby protecting your supplier, and it protects equipment for which you may be liable. Coverage exists while contents are on the insured's premises. Premises includes the dwelling, the yard, etc. Therefore it covers property in garages and other outbuildings on the premises (This would include a separate shack which might be built for the purpose of seeking seclusion from local QRM from the family). An additional 10% of the insurance that has been placed upon the contents applies while away from the premises while anywhere in the continental United States, Alaska, Canada and Newfoundland. Therefore, this extension unquestionably covers property while in transit.

There are, in most states, four forms of insurance which can cover the exposures. They are as follows, with variations.

1. Standard Contents Form
2. Homeowner's Policy
3. Personal Property Floater
4. Specific Marine Type Coverage

We will discuss each form separately, discussing mainly the perils of fire, wind and electrical damage.

Standard Contents Form

The standard contents form normally is written to cover direct loss or damage by fire, lightning and extended coverage. Extended coverage is a broad extension to the fire policy covering windstorm, hail, explosion, riot, aircraft damage, vehicle damage and smoke damage. Most states exclude damage done to outside radio antennas, television antennas and towers, unless they are so named in the policy. In other words, you must insure them separately. This exclusion is most of the time written to apply only against wind and hail.

The modern insurance policy covers "consequential damage". This would be damage done to equipment while it was removed from the premises endangered by the perils.

For instance, a fireman might drop your KWM2 while taking it out of the basement to protect it; therefore, it would be insured against the dropping, although the fire policy in the standard form does not cover collision. It would also cover water damage done to the equipment while water was being played upon the house to fight the fire. Lightning damage done to the equipment is covered. However, in some states there is a code by the fire underwriting people whereby antennas and lead-in wires must pass through certain sizes of openings and must be held a certain distance away from the house. This

should be checked in your locality. Under the standard fire policy and extended coverage policy, electrical damage covered under the electrical apparatus clause provides that only the ensuing fire damage is covered if there is an artificial electrical injury or disturbance to electrical appliances, devices or wiring. There is written what is known as broad form extended coverage which does cover electrical injury or disturbances. However, in 1962, an addition restricted this electrical injury in that it eliminates all tubes, as well as transistors and similar electronic components. This was done, basically, to prevent fire insurance policies from becoming a "maintenance policy".

Homeowner's Policies

The modern trend in insurance writing is to the package policy. One of the package policies is called a Homeowner's Policy. It encloses under one policy form a coverage for the dwelling, contents, theft of contents, and your comprehensive personal liability. (Don't laugh at the personal liability part, your antenna may fall on another house and you would have a lawsuit on your hands, thereby being protected by the Homeowner's). The perils covered are basically the same as the standard dwelling and contents policies with some broadening. The added incentive is that it also includes theft, which could become quite important in the case of radio equipment. The fire coverage is basic and is as stated in the discussion on the standard fire policy.

In most states, the windstorm clause covers radio and television antennas without a separate endorsement. This is where it becomes beneficial to purchase a Homeowner's Policy. There are, under some policies, a deductible applying to that type of loss. It is permissable in some states to exclude the deductible by additional premium.

Electrical damage is covered under most of these forms, in that it covers sudden and accidental injury to electrical appliances, devices, fixtures and wiring (except TV picture tubes) from currents artificially generated. To the writer's knowledge, the recent 1962 restriction does not apply to Homeowner's policies. Check your policy.

The most important additional coverage afforded by a Homeowner's Policy is the theft coverage. It covers all of your contents at home to the limits of contents coverage written. And while away from home it covers up to the limits of at least $1,000.00. This would include equipment while in your car. The main thing to remember is that there is a normal exclusion on the Homeowner's Policy, excluding theft from the automobile while unattended and while in a public throughfare. (If somebody is going to hock your KWM2, be sure your car is parked in a private driveway or that you have the car locked so that there would be evidence of entry). You must remember that mysterious disappearance is not considered theft under most policies but under some policies can be included at an additional premium. Under most forms a deductible applies to all losses outside the realm of ordinary fire and extended coverage insurance.

Last but not least, under the Homwowner's Policy, your personal liability is covered. This could become important, as I stated, in case an antenna might fall on some property or somebody. (Unfortunately, it does not cover TVI complaints).

Personal Property Floater

The personal property floater is, in the terms of an insurance man, an "All Risk" policy. Many times this policy is written with a $50.00 mandatory deductible applying to all losses except normal losses from fire and extended coverage.

It covers all the losses named above, including theft. As a matter of fact, the perils which are covered are not named. It merely states in the declarations of the policy that it covers *all risk of damage* to your personal property except those which are excluded, and that is usually wear and tear, water damage caused by backing up of sewers, and damage done to equipment while repairing or reworking. This is the advantage of this policy. It does cover physical damage to the equipment of some types of which we don't even think about. For instance, you might leave your yard sprinkler on with your window open and the equipment may become water soaked. This would be collectable under the personal property floater.

Under this policy, mysterious disappearance is covered. If you come home and your beautiful KWM2 is missing, without any evidence of entry, you have coverage. As a matter of fact, to be ridiculous, if you drop your transmitter in the pond while transporting it from your car to the picnic table, there is coverage.

The electrical damage clause on this policy is limited to the point that it only covers damage done to equipment by the ensuing fire. Lightning is not classed as electrical damage, but arcing is.

Under the personal property floater TV or transmitting towers are considered real estate and, therefore, are not covered under the contents policy and so should be covered in the dwelling policy. The confusing fact about it is that the radio antennas themselves, such as a two meter antenna or a six meter antenna, are covered under the contents portion of the personal property floater.

Specific Marine Type Coverage

There is available a specific policy written covering transmitting and receiving equipment as well as radio and television towers, either of a permanent or mobile nature.

This policy insures against all risk of loss or damage much the same as the personal property floater does. The conclusions to be drawn for the radio equipment marine policy is that it specifically includes either on a blanket basis or a named basis, all radio equipment and accessories. The advantage being here that you will then be sure that you have all your values covered. Also under this, the antennas are covered if named.

Conclusion

The point in fact is that in order to protect your investment you must be sure of your values. Be sure to consult your local insurance agent about the terms of your policy. Above all, be sure to insure your investment.

. . . K9UTN

K5JKX—Our controversial author.

Dear Wayne:

I just finished reading through the September issue of "73" and was quite interested in the article "More On the 6DQ5" by K5JKX. I believe I have another interesting little bit of information that can be added to this that will only help to verify his information.

Recently, I purchased a used Swan SW-240 rig from a chap that had (apparently) had a bit of trouble with it. After I fiddled around with it, checked tubes and so on, I decided that I'd better call on the Swan people down at Oceanside for a little assistance as I couldn't get the little monster to fire up "the way the book seze." A phone call and a nice shoreline drive down to Oceanside introduced me and my XYL (K6OAO) to some of the most cordial and friendly amateur radio gear manufacturers that I have met in over 17 years of hamming! ! ! The Customer Service Rep met us and listened to my problem with the SW-240 and tucking it under his arm, he started for the door leading back into the "secret chambers" of the organization. K6OAO and I were just getting ready to spend the usual "hours" sitting in the waiting room when this C. S. Rep. said, "come on with me, you wanna see what's going on with your rig don't you? ! ? ! ?" Stunned, we followed him back to the customer service test bench . . .

To shorten the story, one of the first things that he did after removing the cabinet was to remove the "Belch Fire 240" 6DQ5 and throw it into the "good for TV servicing only" box. Having just checked the tube the evening before and knowing that it was a **real hot bottle**, I naturally became a bit concerned . . . Seeing my obvious displeasure, he advised me that the **ONLY** 6DQ5 that they could count on for completely satisfactory service was the one made by RCA . . . Replacing "my" 6DQ5, he took the time to completely realign the transmitter complete to neutralization on 20 Meters. With that he showed us the neutralization on 40 and 75 Meters. The final was running completely wild! He neutralized it for 40 Meters and it was out on 75 and 20 Meters. Down on 75 Meters, that 6DQ5 retained a mind of its own! ! Reneutralizing on 20 Meters, he showed us our power output with a wattmeter.

Then, replacing our 6DQ5 with a new RCA bottle, he reneutralized the final and it was good on all 3 bands! He then showed us the power output with the wattmeter . . . That was enough for us . . . He also gave us a considerable number of little pointers in loading and operating the SW-240 that have helped a great deal in its operation here at the home station. Since we've had the rig back home, it has operated like a brand new machine . . .

Being a Federal employee, I am not associated with RCA in any way and Swan is not "pushing" RCA tubes but this demonstration at the factory has certainly caused me to "eye ball" the same tube but by different manufacturers with a critical eye when replacing any tubes in our amateur gear . . . **There is a difference in performance** . . .

With the number of Swan rigs in use now, I feel that this information is of value to every Swan owner who uses the 6DQ5 in the final amplifier. For all I know, this information may also apply to other 6DQ5 rigs . . . I just wanted you and "73" readers to know that K5JKX's article has very definite merit and isn't just something to fill-up more pages of a monthly magazine.

You publish a dern nice magazine.

E. L. Hollis, W6ZGZ

Dear Mr. Green:

With reference to article, Class D Amplifier, May 1964 issue of your magazine by Mr. Jim Kyle, I respectfully suggest a severe caution to any of your readers who are inspired to build an audio amplifier with 99 percent efficiency. Albeit this pulse coding technique is very ingenious and not without many promising applications it by no means allows for such a high efficiency. Out of curiosity I have worked out the mathematical power spectrum for this type of signal and determined the relative power that will be present in the audio region of the signal, and the relative power that will be present in the rest of its spectrum. The maximum percent of the total power present in the audio region can not exceed 62.5 percent. Thus assuming that the transistor is operating at 100 percent efficiency one still looses 37.5 percent at least of ones power in the transformer or low pass filter. None-the-less, one can scarcely assume the transistor to operate that efficiently. The saturation resistance of the transistor may vary up from fractions of an ohm to as much as ten or more ohms. Unless the transistor is matched to an appriately high impedance, the transistor will dissipate a significantly high percentage of the power at the output terminals.

Finally a word about frequency response. Analysis of the frequency spectrum of the class D signal shows that the audio appears as the "zero order" component of the square wave sampling frequency. The fundamental and each overtone of the square wave carrier becomes frequency modulated by the signal and gives rise to side bands that can overlap the audio spectrum itself. The choice of a five to one ratio between the highest frequency of the audio and the square wave carrier frequency is about minimum. Also about five overtones are about minimum for reproducing a good square wave, so that all together one needs a transistor that can handle frequencies about twenty-five times those one wishes to amplify. All this is for a gain of 12.5 percent over the maximum possible efficiency of a class B amplifier.

Karl A. Stetson
Graduate Research Assistant
University of Michigan

Dear Wayne:

Care to get a little power supply discussion going? I was intrigued by the supply in W6NKZ's linear amplifier article in the December issue. It is a full-wave "tripler" first described in a staff article in 73, June 1961. [Ed. note: by Jim Kyle K5JKX]

Clark is right that "tripler is a slight misnomer"; it is a full-wave *doubler*. The extra two diode legs of the bridge don't do anything because they are always back-biased. This probably accounts for the observation in the staff article that "most reference books fail to mention its existence and no commercial design using the circuit could be located."

The idle diode legs are the ones shunting the filter capacitors. This figures. It's hard to imagine how a diode bypassed with a husky electrolytic could see any ac to do anything with, isn't it? The rest of the circuit is the full-wave doubler of Fig. 8 of the staff article. The doubler keeps each capacitor leg charged to something near the peak ac voltage, and this holds the idle diodes always back biased.

Shamefully lacking courage of conviction, I built one and tried it. With a transformer providing 22 vac rms (something I could get my fingers into) and 120 mfd capacitors, the output voltage was about 60 volts no load and 50 volts dc with 125 ma load. Removing the idle diodes had no effect at all.

The full-wave doubler provides a no-load output voltage of 2.83 times the ac rms input voltage, and the way things usually work out in practical circuits the loaded output voltage runs around 2.2 to 2.4 times the input rms voltage.

My guess is that Clark used the full secondary of a transformer providing about 350 vac rms each side of center-tap. Such a transformer would give abt 400 vdc in a capacitor-input TV-set full-wave rectifier, but using the full secondary (700 vac rms) in a doubler would give 1980 vdc unloaded and 1540 to 1680 vdc loaded. Just about what Clark measured.

So it looks like Clark has eight spare diodes he can put back on the shelf. How about it? Is the circuit drawn wrong in the staff article and there's a slight rearrangement that works?

Larry Clayton W4LDB

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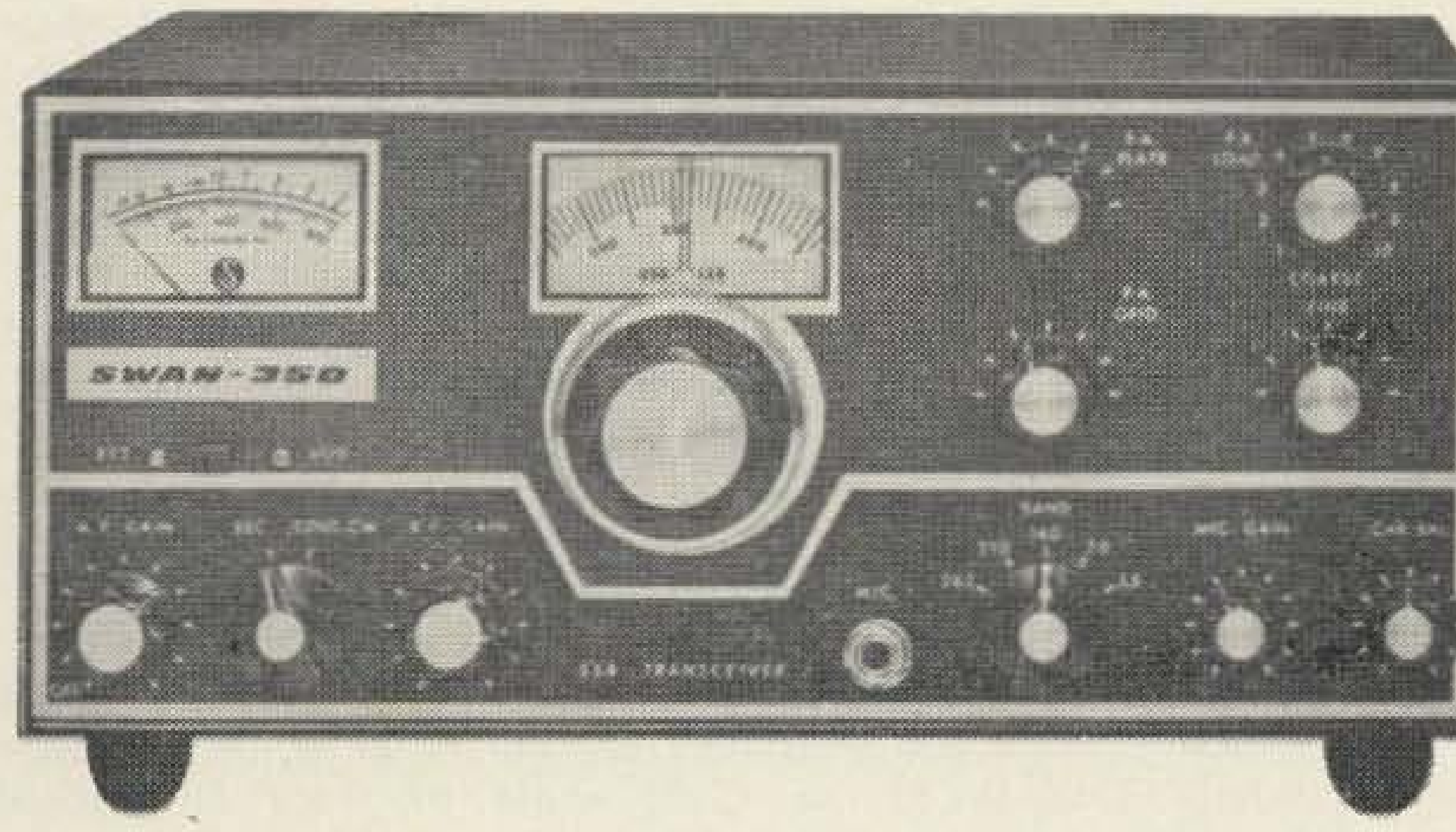

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Letters

Dear Wayne,

You wrote in a recent article that you were using a six meter 16 element colinear beam. I have been unable to find any information on a beam of this type. I would deem it a favor if you would advise me where you purchased this beam.

A. Cutler WA2ONB

Well, A, Cushcraft just happened to have one of these things lying around their storeroom when I visited one day. I called them for you to find out if they had made any more and found that they will make, on order, a similar beam, one with 24 elements, a combination colinear and yagi beam. I'm using these types on two meters and find them terrific. The price on the 24 element job is $125. My order is in for one; I don't want to chance your being any louder than me.

Dear Wayne:

I just received a copy of Washington Amateur Radio News (not requested) and on page 3 there is an article about the ARRL requesting a commemorative stamp for amateur radio.

This letter is to inform you that they didn't know about the stamp until the president of the Teaneck, N.J. Police Athletic League Stamp Club wrote to them and asked their permission to use the call letters W1AW on the cache envelope to be issued by the P.A.L. Stamp Club in conjunction with the P.A.L. Radio Club, WB2NUW, the first P.A.L. radio club.

The ARRL ignored the letter and capitalized on it. The stamp will soon be issued and the cached envelopes will be sponsored by the Institute of Amateur Radio. Please print this letter and let anyone try to dispute it.

Raymond Vath, WB2FYB
IoAR #85

Dear Wayne:

I would like to recommend to you and any reader who has some background in science at the college level that a subscription to "The Journal of Irreproducible Results" is well worth the dollar it costs for a year (three issues). It is available from Dr. George Scherr, Consolidated Laboratories Inc, Box 234, Chicago Heights, Illinois. The articles in the Journal are so funny it hurts.

As far as K2US . . . first of all, a ham station on the second floor may impress the hams who make contact with it, but the general public isn't going to know it exists. When I pointed this out to Mr. Dannals at the HARC Convention in New York, he said (in his usual "polite" manner) that the station was to publicize the Fair among hams! What about the general public? Isn't there some reason (like TVI maybe) for showing people that hams aren't all a bunch of morons who botch up their TV reception? Isn't there the idea of getting people interested in ham radio as a hobby? No, the purpose is to let other hams know that the World's Fair has a ham station.

Operating? Forget it. Dave Popkin WA2CCF was there and certified that my license was valid on the opening day of the Fair. I filled out an operator's application sheet and that was that. I never heard a word from them. I called the station twice and was told both times by the station manager that I would hear from them in a few days. I heard nothing. Bah.

Norm Goldman, WA2JIS

Dear Sir,

Reference to your cover on the December issue of 73. Either the Eskimo is far from home or the penguins are. Eskimos are from the arctic and penquins from the antarctic.

Ernest Harris W1PZU
Manchester, N. H.

73 spares no expense to bring you attractive covers.

Dear Wayne:

I have been prompted to answer your editorial in the current issue of 73, concerning the history of your career through several ham magazines and the present venture.

First of all, let me say, that I believe 73 is the finest ham magazine available. Your technical articles are well-done and easy to understand. I would like to see, however, a roundup of FCC actions every month, similar to that in magazine "Q." I subscribe to the Newington rag mainly to keep up with allocations, and various changes in regulations. If you could publish these, it would be very helpful.

Next, I know how you feel, and I must agree with much of what you say. However, I feel you are in danger of trapping yourself in a position of being opposed to ARRL just for the sake of opposition, even though you may not feel that way, entirely. Those of us who are rebels in this world, always have a hard time staying out of trouble. We all basically feel antagonistic towards the "establishment." So, even if they win the battles, the fact that you are a dissenting voice is so important, that it should be heard at greater volume.

As you do, I am beginning to feel that ham radio is in danger of extinction, not from too many Technicians and Novices, but from a lack of interest in preserving it by the hams themselves. Most amateurs, unfortunately, are not too well read outside their field. Most are poor at self-expression (witness the pointless QSO's and the characters you meet at hamfests) and most are unwilling to be counted.

I have decided, after some deliberation, to send you 10 bucks and join your IoAR. I don't know if I'll be wasting it or not, but at least I'll be supporting a good IDEA.

Keep up the good work, but in my opinion, you should now be getting more POSITIVE with solutions of your own.

Joel Rose W3AFY
Pittsburgh, Pa.

Dear Sir:

Will you please provide me with the correct name and address of the department in charge of the meeting to be held at Geneva in the near future.

The writer has made an honest attempt to lead an honest and honorable life for quite a spell and honestly believes that he worked what we used to call "Wireless" prior to the advent of the so called ARRL but at this late date is finding it difficult to get anything more substantial than evasive or wise crack answers out of the so called headquarters. Perhaps, there is another way around.

When the writer asks civil questions in a civil manner he thinks he is entitled to an honest straight forward answer and not what Headquarters seem to refer to as a "Formulated Answer." Anyhow think it is worth a try.

A. Lee Chamberlin. WØCZ
Des Moines, Iowa

The conference is managed by the International Telecommunications Union in Geneva, but this is an impersonal agency, similar to the U. N. About the only people who can answer questions are those who have attended ITU conferences such as John Huntoon, George Jacobs W3ASK and myself.

Dear Wayne:

Please confirm or deny ugly rumor by ARRL member that you are no longer buying construction articles on spark gap transmitters until 1968 due to large stock on hand.

Ralph Loackard, K6GOQ

A quick look at the transistorized quench-gap rig by W. Coward K2PMM on page 137 of this issue should dispell this irresponsible rumor. 73 is always in the market for state-of-the-art spark rigs. Watch for a beautiful varactor silicon-controlled mulched-gap spark rig coming soon.

(W2NSD—from p. 4)

to do next. I was a tour director. And that is what I did for the whole trip . . . directed. I never got to see the sights or do much shopping anywhere for I was too busy keeping the tickets straightened out, finding baggage, arranging for busses, getting hamfests put on, etc. I'm not complaining for I enjoyed it and I wouldn't mind doing it all again.

Not that the occasion will ever present itself again I suspect, for the response to my proposed Scandanavian tour was even less than the European tour, with most of those wanting to go being the people that made the European trek with me. It seems that it is just possible that the great bulk of the hams that might go on a tour went on my tour . . . perhaps there are only 73 of us interested in it . . . out of 250,000. Hmmm.

I'll make a deal with you. If I get letters from at least 150 of you saying that you are definitely interested in a three week European tour for September 1965 I'll start the ball rolling. I want a complete jet this time though. The price will have to be a little higher than last time since I found that there were dozens of extras that I had to take care of such as airport taxes at most airports, hamfests (I picked up the entire tab for dinner for our group plus a goodly number of London hams, etc.), sightseeing in East Berlin and West Berlin, busses to and from the airports in all cities, busses to hamfests, and on and on and on. Figure on $650 per person for the three weeks, all expenses paid except lunches and dinners. This will coincide with the 1965 International Amateur Radio Convention in Geneva, by the way.

Anybody want to go?

K6BX

A letter from Clif is always an event. They are pretty much like his news bulletins . . . and if you haven't been reading them then you've been missing an emotional experience. Clif whips himself up into full blown indignation at the gosh-awful things that are going on in ham radio these days. He gets up a good head of steam, but you know, he is usually right in there with his facts to back up his carrying on. I haven't seen anyone yet that has been able to call him a liar.

Except possibly some yellowing ham magazine that recently brought out a thin anemic little dollar issue with some boy trying to do a hatchet job on BX in it.

So, anyway, there's this letter from K6BX. Clif suggests that we take a peek in the CB magazines and see what is happening there. He points out that there is a major move to make a home for the poor downtrodden ham-type CB'ers on the top end of our two meter band. He wonders why ARRL has kept so quiet about this in QST and why CQ is supporting this move through their CB magazine S9.

This seems normal to me. The ARRL has recently petitioned the FCC to prevent any further use of the top two megacycles of two meters by hams in their rebuttal of RM-399. If they were planning to move the CB'ers into that band this suddenly makes sense. Many of us were flabbergasted when they opposed 399, never thinking of this development. This also fits in with the hushed-up proposal that ARRL President Hoover reportedly made at the Disneyland convention when he was first elected wherein he suggested that the top two megacycles of six meters be given over to the CB in order to keep them from trying to get ten meters from us. Are we being sold down the river from within?

Visiting Ops

Though I try pretty hard to keep up on the twists and turns the FCC takes in making and interpreting rules for us, they came up with a new one the other day. The FCC had always interpreted their rules to mean that specific equipment was licensed with call letters, not the operators. They even went as far as to request licensed wives to use their husbands call when using his equipment, etc. Now apparently all that has been changed. It would now seem that the operator should use his own call on any equipment that he is controlling. This certainly will cause great difficulties come Field Day and during any other multi-op contests.

Here is exactly what I received from Mr. Waple, the FCC Secretary: "In reply to your recent letter, you are advised that if your individually licensed amateur radio station is operated by another amateur operator while you are not in actual control of the station, your station call sign may not be used. 'Control,' for this purpose, contemplates the ability to both monitor the station's operations and to terminate operation immediately for any impropriety or malfunction."

You can see that it is obvious from this that multi-operator stations are a thing of the past and should any such operation be attempted in upcoming contests they will have to be disqualified for failure to comply with FCC regulations.

Also it is contrary to the FCC interpretation of their rules for anyone but Ed Handy, the licensee of W1AW, to operate W1AW using that call. Every other operator must use his own call unless Ed is right there in control. It will be interesting to see if the League continues to operate W1AW in violation of the FCC regulations.

This should put an end to K2US and other special events stations where the licensee custodian cannot be always present. Each operator will henceforward have to use his own call.

I'm a troublemaker.

Xerox?

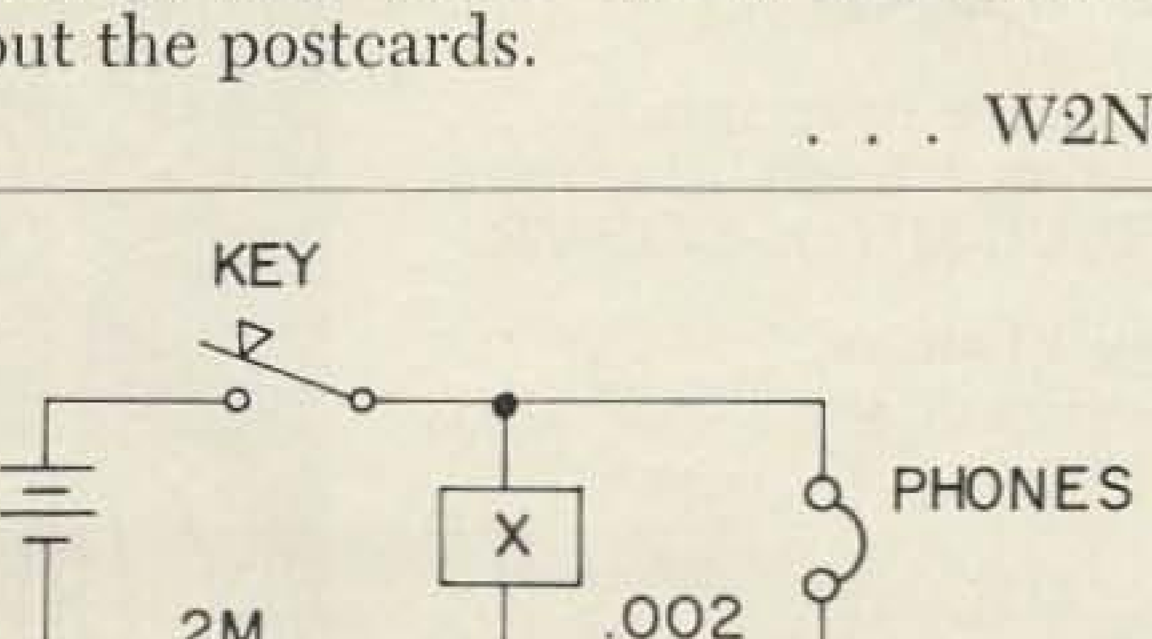
Perhaps you've seen the television commercial with the big contraption sitting in a darkened room . . . the light snaps on and this cute chick swings in, flips a knob for the number of copies she wants, puts the letter to be copied in and walks out a minute later (or less) with 23 copies of the letter. I think they said it was a couple cents a copy.

My reaction to this was, "Hmmm, that should be in the FCC offices so we wouldn't have to send in 15 copies of everything." Quite a few fellows have grumbled about this severely limiting requirement for filing comments on dockets.

There are, of course, two sides to the requirement. There is no question but that it eliminates a lot of useless junk from ending up in the docket files. There is no purpose to having hundreds of postcards on file, each saying that they are opposed or are in favor of a docket. The FCC is interested in the reasons for your position, not the position itself. They are supposed to make their decisions based on all of the factors involved and it is up to the amateurs to make sure that the Commissioners have all of the facts.

On the other hand, anything that limits the ability of the FCC to get the facts needed to make the best decision can only work to the detriment of amateur radio. Perhaps it is time for the FCC to invest in an automatic copier? Even if we had to include a dollar copying fee it would be well worth while. This would also filter out the postcards.

. . . W2NSD/1



What component or circuit would you put at "X" to end up with a code practice oscillator? Ans. p. 81.

Frederick Durham K1VDX
E. Swanzey, N. H.

RDZ Receiver

While trying to find a cheap way to effectively receive 220 mc and 435 mc signals, I learned of the RDZ Receiver, a National product which tunes from 200 to 400 mc, which is now available in surplus. Although the 60 cycle model is a good buy—anything that weighs about a hundred pounds and has 22 tubes is tempting—the receiver is also available in a 400 cycle model at just over half the price of the 60 cycle model.

The conversion to 60 cycles is so simple that it is worth doing to save the money. The following conversion takes less than two hours to put the set into operation.

The power supply section is converted first. Connect a power cord to pins A and C of the power input plug. Remove the bottom plate of the power supply section. Remove and discard the 400 cycle filament transformer, the accompanying potentiometer, and the associated wiring to the power transformer and to pins *one* and *two* of E-302. In the unit converted, the 60 cycle power line in and the 12 volt power line out enter under the feed through terminal board to the rf section, rather than as shown in the schematic. Leave these as is. There should now be no wires connected to pins 1, 2, 3, and 5 of the terminal board E-302. Solder the red wire clipped and folded under the resistor board to the top center 0.1 capacitor lug (as seen from the bottom of the set). This completes the power supply section conversion.

Next, remove the bottom plate from the af if section. Remove the pair of wires from pins 1 and 2 of E-202 and connect one of these to ground at the adjacent resistor board. Connect the other to 6.3 heater voltage at any one of the sockets in the rear tube row. For an external speaker, connect a 500 ohm line to voice coil transformer to pins A and C of the audio output plug; connect speaker to the secondary of the transformer.

Finally, the autotune must be modified or disconnected. Three variations are possible. To use the autotune and crystals, replace the 400 cycle motor with a similar 60 cycle motor (Eastern Air Devices, 100th hp. made for Collins). After replacing the motor, remove wires from lugs 15 and 16 of the autotune strip on the top rear of the autotune (blue and white). Then trim added wire (red and black) from the red and yellow pair coming from E-203. Connect the remaining yellow wire to 15, the black to 16 of the autotune strip. Finally, cut out and discard the two pairs of wires (blue and white, red and black) previously disconnected.

For manual tuning with crystals, leave the wiring as it is and do not turn on the autotune; use the receiver manual tuning in conjunction with the input meter to peak the set for each frequency tuned.

For variable tuning, any small 4.5 to 7 mc oscillator may be plugged into one of the crystal sockets and peaked for each frequency with the manual tuning control.

. . . K1VDX

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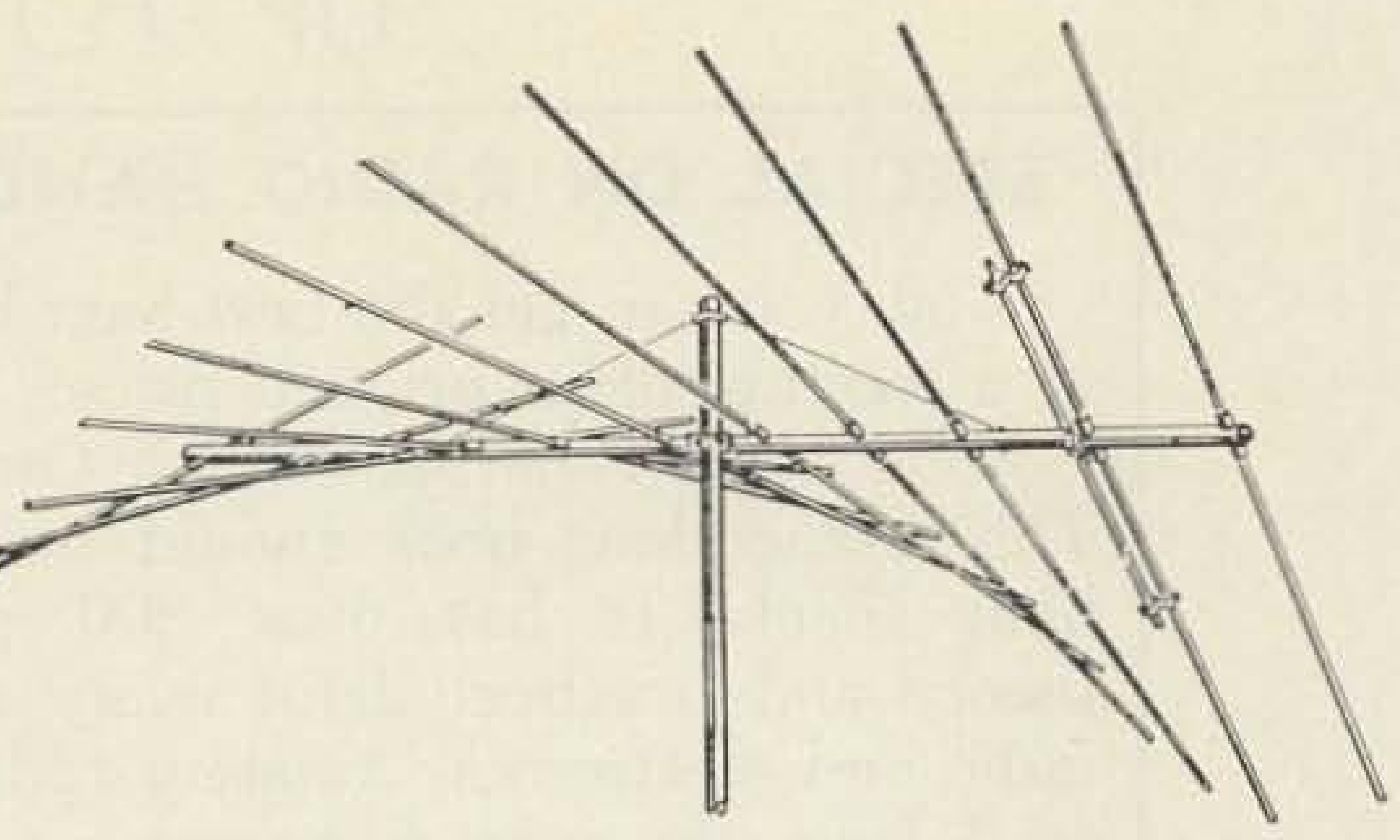
So We Bought a Spiralray—



Joe Marshall, WA4EPY

—the midget model with 27 ft. boom, that is. The big brothers have booms some 36 and 47 feet long respectively.

The Spiralray is a mighty odd looking beast. It looks like a big Yagi that has been through a tornado. The elements make a 90 degree twist between the reflector and the last director.

The theory is that the Spiralray transmits a circularly polarized signal, similar to a helix. Like a helix it attains maximum gain when the antenna at the other end is also a Spiralray. In the case of the 27 ft. model, the claimed gain under this condition is 16.5 db. The gain is about 1 db less when working either a horizontally or vertically polarized signal. This offers no great advantage in my area since most six meter hams here use horizontal antennas. Even the mobiles favor halos over whips.

However, only the short-range, obviously line-of-sight stations actually deliver a signal at the receiving end that is polarized the same way that it is transmitted. If the signal is reflected or deflected either by the ground, a ridge or an ionized layer in space, the polarization shifts. So that, what started out as a horizontally polarized signal may end up at the receiving location with vertical polarization or something in between.

Furthermore, the shift in polarization is not always a constant one. Over any interval of time the polarization may shift many times through the 90 degree angle between vertical and horizontal. An antenna with fixed polarization suffers considerable loss as the incoming signal departs from its own polarization. Thus a horizontal antenna may be as much as 20 db or more down for a vertically polarized signal and vice-versa. The actual field strength of an incoming signal may be fairly constant, but the shifting polariaztion produces a large variation in the voltage developed across the antenna. This accounts for a good deal, if not most, of the QSB on long ground-wave and skip reception. Therefore, the Spiralray, with equal sensitivity to any polarization, should in theory produce better results than a Long John with the same gain, but for only one mode of polarization.

This was particularly attractive to me because few signals arrive here by a direct path. Though my elevation is 1700 feet, it is surrounded in every direction by ridges 200 to 1000 ft. higher. Thus I experience a shift in polarization on almost all signals, so you can see that an antenna which is relatively insensitive to differences in polarization would be just what the doctor ordered.

The Spiralray arrived in a surprisingly small package—about 10 ft. long, 5 inches square and weighing only 27 lbs. Like all Telrex antennas, it was well made. The radiating element is tubular, the others are solid aluminum about ⅜ inches in diameter. The boom comes in three section which fit snugly together and are anchored with bolts. The holes for the elements are drilled with great precision, which must be quite a manufacturing trick.

The instructions are on the blue-print and drawings. The elements come cut for 50 mc and should be cut a total of 1 inch for each ½mc increase in center frequency. The elements slide smoothly and snugly into the holes on the booms. Obviously the smart thing to do is to assemble it in three sections. It takes some time to get the elements precisely centered since this is a tapering type Yagi and each element is a different length.

To match the feed while the antenna was within reach I assembled the beam on a 10 ft. mast. To keep the long boom from drooping there are two wire struts supported about 4 ft. above the boom on the mast and going out some 6 or 7 feet to appropriate points on the boom. The struts were easy to adjust at this point since, with the tower on the ground, the boom was only some 6 ft off the ground.

The Spiralray comes with a balun to match 50 ohm coax. I set the T match by ruler to the indicated points and hooked up the balun and through 50 ft. of coax fed it 200 watts of rf. A Knight SWR bridge indicated an SWR of 1.5 at 50.9 mc and dropped below 1.2 all the way down to 49.98. Connecting odd lengths of coax to the line did not affect the SWR.

Results

The SWR remained low despite several nearby trees after it was raised.

The reports from stations within 50 to 75 miles, with presumably minimum polarization shift, give me gains of about 6 db over the 5 element antenna I had used previously, and this corresponded to the receiving gain. This figures since the Spiralray has a claimed gain of about 4 db over the 5 element, and the improvement in SWR could easily account for another 2 or 3 db.

The Spiralray does produce a really dramatic improvement over the horizontal antenna when working stations with vertical antennas. I can work mobiles with whips far beyond my previous range, and often when they are completely inaudible to nearby stations using horizontal antennas. I have worked mobile Sixers loaded into whips, in motion, as far as 70 airline miles. The mobile flutter is very markedly reduced.

The Spiralray has a very useful beam pattern. Although the front lobe is broad—about 35 degrees—so you don't need a surveyor's transit to be sure of getting into a given place. On the other hand, it has a very sharp null at about 90 degrees—something more than 40 db, and enough to take even a very strong signal right down into the noise. The flatness of the front lobe makes it often possible to null out QRM without reducing the signal strength of the desired station significantly, by changing the antenna direction to a few degrees. The null is sharp enough to measure direction within a few degrees.

The front-to-back ratio is 28 db with small minor lobes at about 45 degrees.

There is a definite improvement in the depth of fading of long ground-wave signals. Paths which formerly gave as little as 25% readability over a 5 to 10 minute contact now provide well over 75%.

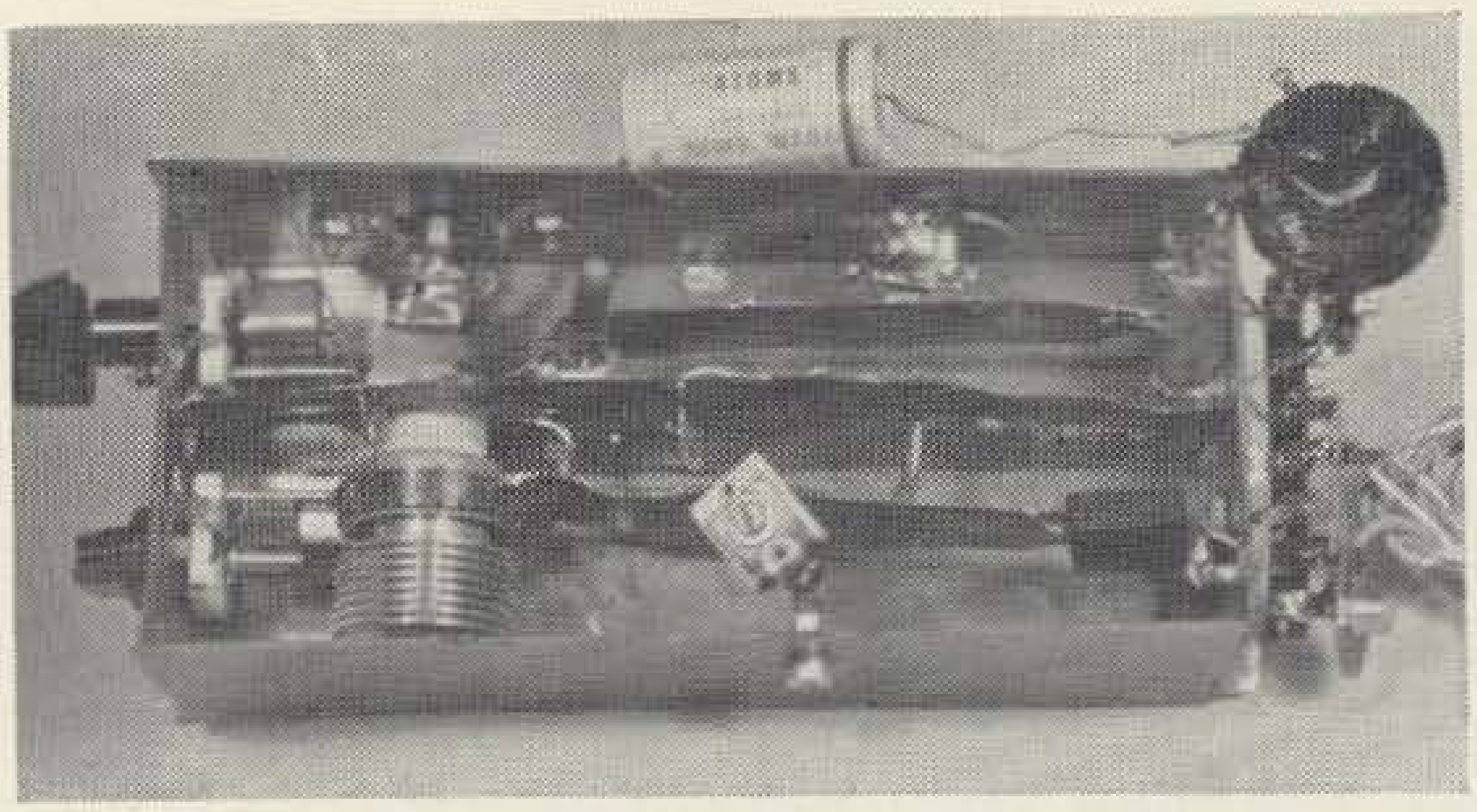
I have worked only one other station using a Spiralray, W4VIW in Greeneville, S. C., 150 airline miles and several mountain ranges away. He feeds his Spiralray with a Zeus. While I have worked this path quite consistently in the past, no station down there ever delivered a signal in excess of an S5 or 6. W4VIW peaks as high as 10 db over 9 and with a surprisingly constant signal. He reports similarly. To cap it off, he is just barely readable to other stations in my area which previously had reports over this path comparable to mine.

It is difficult to assess skip performance of antennas since there is so much freakishness involved in the whole business of skip communication. However, that is what we noted during openings: The combination of our 200 watts of rf and the Spiralway gave us "top-signal-on-the-band" reports repeatedly. We practically never had to make more than one brief CQ or call for a specific station. We enjoyed a "first-in-last-out" position in our area in virtually every opening. For example, we heard and worked VP7CX some 15 minutes before anyone else in this area heard him and we were the only station he was reading for an equal period. We were the first to hear and the only station in this area to work VP5BB on Turks Island one day, and K4PGL/VP9 one evening during a period of very erratic shifting skip. We worked stations in Maine, New Brunswick and Nova Scotia another day in brief openings when the band was seemingly dead. Finally, it does appear that the QSB on reception of skip signals is considerably reduced.

All in all, the Spiralray does the job it claims and has improved our station capabilities considerably. We can recommend it wholeheartedly to any serious VHF worker.

. . . WA4EPY

There has been tremendous interest in the VHF linears in September 73. This article will give you more insight into AM linears for VHF.

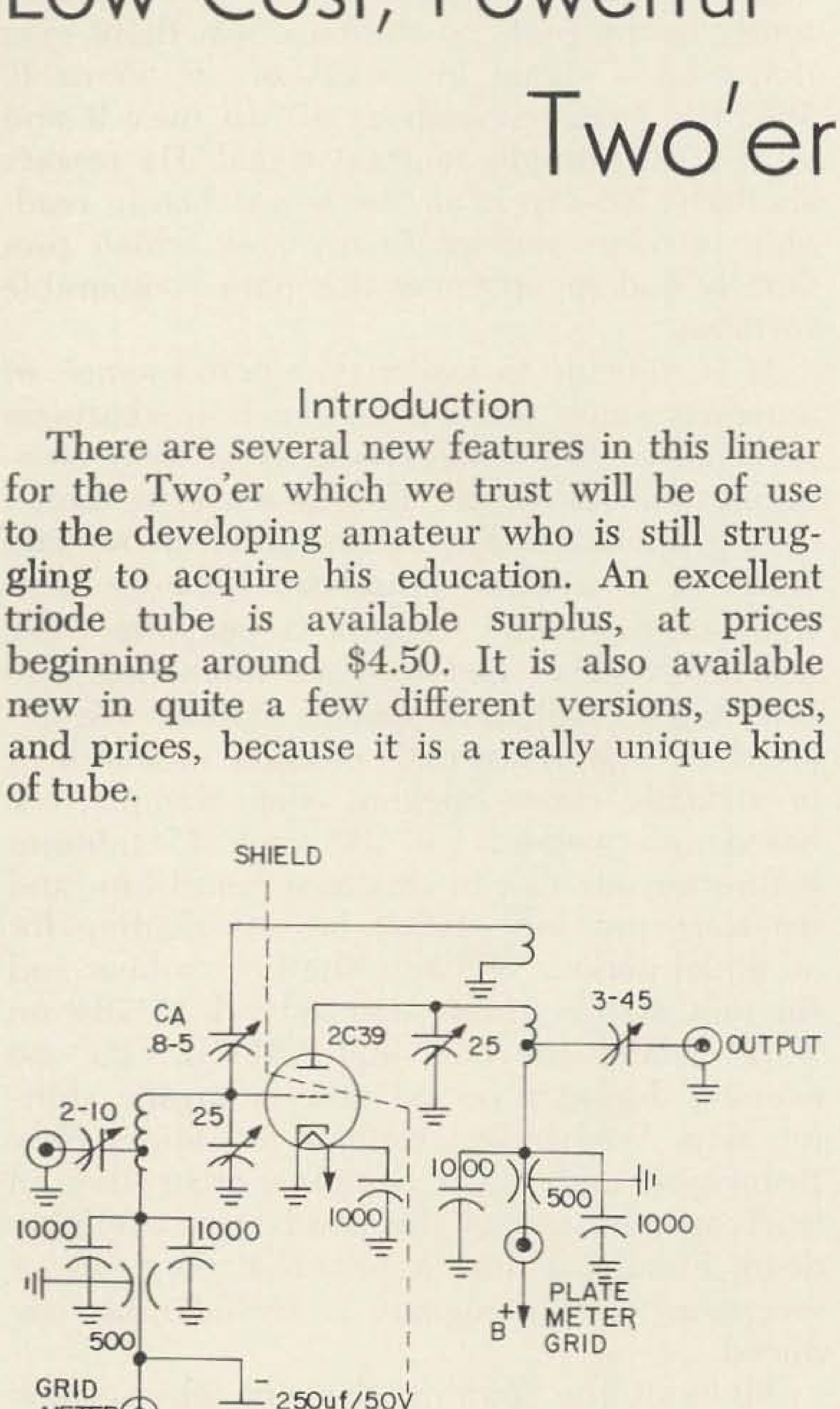


Low Cost, Powerful Two'er Linear

Bill Hoisington K1CLL
Peterborough, N. H.

Introduction

There are several new features in this linear for the Two'er which we trust will be of use to the developing amateur who is still struggling to acquire his education. An excellent triode tube is available surplus, at prices beginning around $4.50. It is also available new in quite a few different versions, specs, and prices, because it is a really unique kind of tube.



After getting this tube, all you need is some copper-clad bakelite, a few small capacitors, phono or UHF jacks to suit your cable connectors, and a home-brew power supply, as from an old TV set. You do not have to modify the Two'er in any way. Just plug the Two'er rf output cable into the rf input jack of the linear, using the microphone and modulator of the Two'er. Plenty of details follow.

VHF Neutralization

This is quite a subject. We are going to take a good look, so get hold of a glass of your favorite fruit juice and settle down.

Plenty of excellent reference material for hf neutralization is available but the handbook writers begin to hedge as soon as they go up past 30 megacycles. They are also on relatively easy ground with the $20 double-pentodes for VHF, but when it comes to something inexpensive, simple to build, and powerful, where are they?

My first experience with the reality of VHF neutralization came with the 815 double pentode in 1940, a mere 24 years ago. This was to all intents and purposes two 6L6's with plate caps, and a handy octal socket. "TNT" circuits were quite the thing then on 2½ meters. That was a tuned plate, tuned grid, modulated oscillator. Worked fine with triodes. With the two pentodes in the 815 envelope, weak oscillation. Why? Without going into too much theory at that time I experimented with MOPA, (master-oscillator, power-amplifier) neutralization, and the 815 as an oscillator. I soon found out by trying various values of neutralizing capacitors that the natural internal grid-plate capacity of the 815 was just enough to cause weak oscillations, but not enough for much rf output as an oscillator. By adding neutralizing capacity, the usual push pull cross over type from one plate to the other grid, the tube could be neutralized and would run fine as an amplifier. Then, by increasing the Cn's, a good oscillator could be obtained. Don't forget, those were the days of the modulated oscillator.

So we find ourselves today with practically nothing about triode neutralizing for VHF in the amateur handbooks. This in spite of the fact that there is a 100 watt triode with a transconductance of 24,000 micromhos with full ratings to 2500 megacycles, that you can buy for as low as $4.50 surplus.

What does the old reliable RCA handbook have to say? No help there either.

Plenty of dope on how to neutralize an amplifier that is already built, and a few words on neutralization in general, triodes and pentodes, but nothing on VHF. What gives? Are some people that determined to sell $20 pentodes to lads who just cannot lay out that kind of dough?

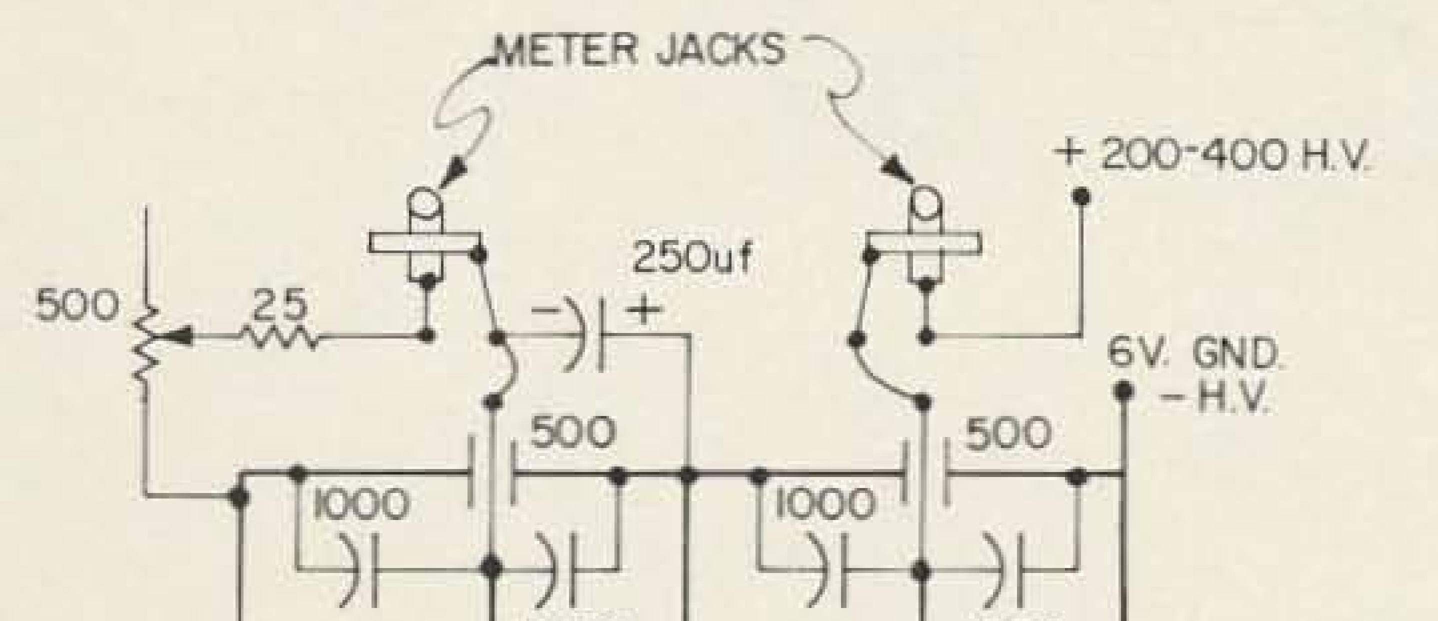


Fig. 1. 144 mc linear amplifier.

Let's look in Bill Orr's VHF Handbook. Plenty of real good dope in there on lots of VHF problems. A good 3½ pages entitled "Analysis of neutralizing circuits". Starts right in with a tetrode tube. No mention of triodes there. Further along in the book under "The grounded-grid rf amplifier" we find "One of the undesirable characteristics of the conventional triode rf amplifier is that the stage must be neutralized to prevent self-oscillation". "As the frequency of operation is raised the stage becomes increasingly difficult to neutralize . . .". Then there are several paragraphs on the advantages of the grounded grid amplifier. No diagrams are shown of a simple grounded cathode VHF neutralized triode stage.

One more handbook: "VHF for the Radio Amateur", by Frank C. Jones. At least on page 5 there is a picture of my favorite, the 2C39, among other UHF tubes. He starts right in on whole circuits for transmitters, beginning at 50 megacycles. (Incidentally, I think a great deal of this book as far as it goes.) He carries 144 mc into a pair of 4CX250B's, tetrodes, which is fine, but way out of the price range at present. At 432 megacycles he gets to the 2C39 tube and says ". . . it will function effectively if driven hard by the exciter." This is in a grounded grid circuit, and is just one of the disadvantages of the grounded grid. He makes no mention of any neutralization, relying on the "grid-separation" circuit to keep out self-oscillation. Which is ok but does not allow small drive power, as from a Two'er.

Well, so much for VHF neutralization in the amateur type handbooks. Now where do we go?

The 2C39 Tube

I have talked about this rugged (I haven't burned one out yet and still haven't installed a blower), low cost surplus, 100 watt capability (*with* blower!) tube and how it works on 432 mc with easy-to-build series tuned trough lines, etc. Now let's see what this tube is like. It is the first tube in the "RCA Transmitting Tubes" technical book series. That's just a numbering accident, but makes it easy to find. "May be used to 2500 mc at full input", this book says. That should cover 2 meters all right! Then we see on the third line "Transconductance equals 24,000." Going back to the ARRL "Radio Amateurs Handbook" for the definition of transconductance, we find "The best all-around indication of the effectiveness of a tube as an amplifier is its grid-plate transconductance." "Transcoductance is the change in plate current divided by the change in grid voltage that causes that plate current change" with fixed plate voltage. The transconductance of some comparative tubes follows: 2E26, 3500; 832, 3500; 807, 6000; 6146, 7000; 829, 8500; 6969, 10500; 6CL6, 11000; 417A, 24000; 6897 (2C39 type) 24800. The only tube that is in amateur use I know of that has a greater transconductance is the 416B gold-plated triode, a special receiving or low-power transmitter tube, at some 30,000 to 40,000. (when new!)

Bear carefully in mind though, that a 2C39 must be used in a *grounded cathode grid drive* circuit in order to use that Gm of 24,000.

Connections

The next thing special about the 2C39 is the connections. No pins, no leads. Just *surfaces!* While cylindrical cavities are fine and a real must around 1296 and up, you can get along ok on 2 meters with properly used trough lines. Using a one inch strap for the grid and plate conductors (one for each) or lines, you can cut out a semi-circle in the end of the strap, see Fig. 4, and get a large area connection right onto the plate and also the grid, through, of course, the flexible ring connectors with fingers which are also large area.

What does this do for you? As an example I quote again from F.C. Jones Handbook, "The 6146 is not too efficient at 144 mc." "This tube has to be neutralized by series tuning the screen grid lead inductance . . ." His circuit shows a 4 turn plate coil with series tuning, as in a half wave circuit. now look at the 2C39 circuit in Fig. 1. Parallel tuning, high Q, and how is it tuned? With a 25 mmfd capacitor between plate and ground. And what does it do? At half power capability (50 watts) it lights a 25 watt bulb to full brilliance, when driven by, of all things, a standard unmodified Two'er!

It appears that almost any of the 2C39 "family" works fine on 2 meters. I have used 2C39, 2C39A and B, glass or ceramic, the 3CX100A5, the 2C39WA, and the 3X100-A11. In fact, there are probably even more of them I don't know about!

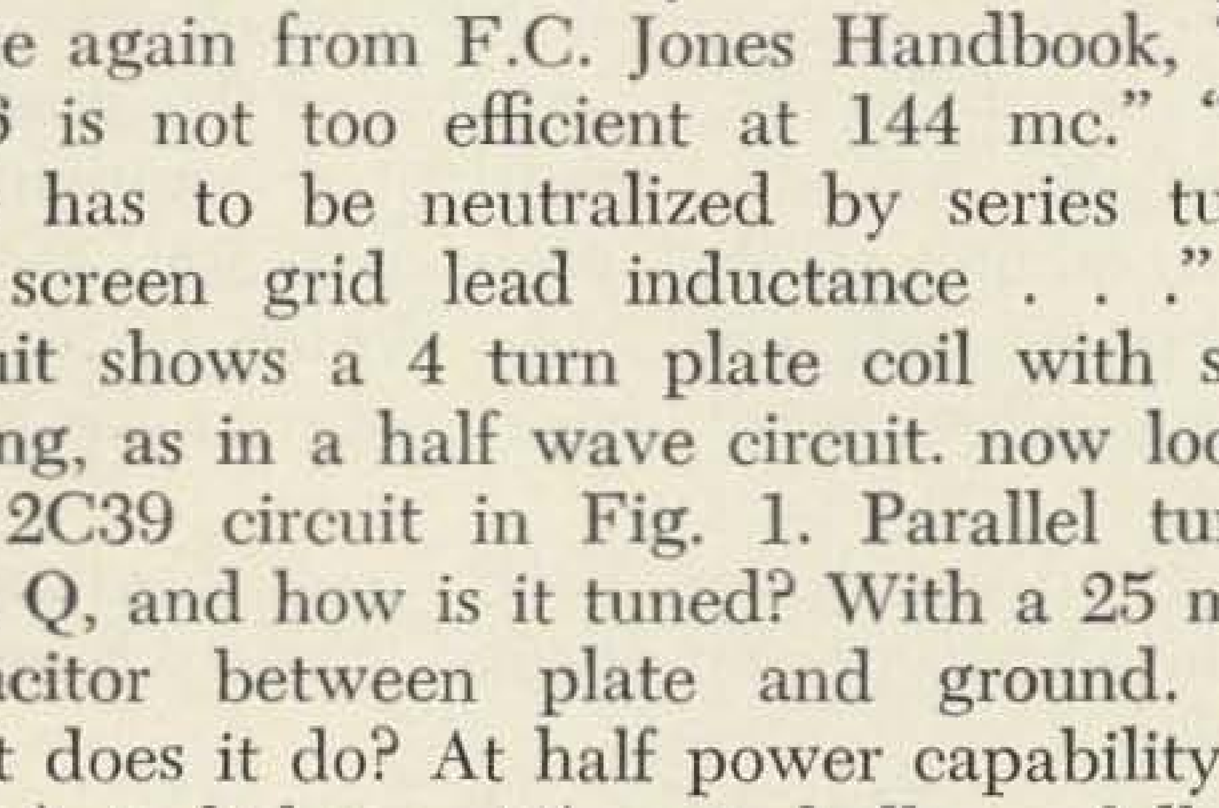


Fig. 1b. Box detail. All copper clad bakelite inside.

Believe It Or Not Dept

B.I.O.N., today, after many years of VHF and UHF and even microwaves, we VHF-UHF amateurs do not have the proper tubes to work with! As you can see from Fig. 1, the grid and the cathode have to "go through each other" to get where they belong. Admittedly, the 2C39 was not designed for grounded grid service. But what else have we got that will do the same job at anything like the price?

I like pentodes too, but not at $20 for the budding young VHF-UHF lad. He's still got to build his power supply. At least with this rig he can step up from a Two'er to 30-40 watts. More with a blower.

Circuit Detail

Basically there are two trough lines: one grid line and one plate line, with a common ground wall in between. This wall has two holes in it, one for the tube, the other for the neutralizing circuit. Electrons flow from the grid to the plate through the first (inside the tube of course), and reversed phase electromagnetic energy (*not* electrons) comes back to the grid through the second hole.

FIG. 2

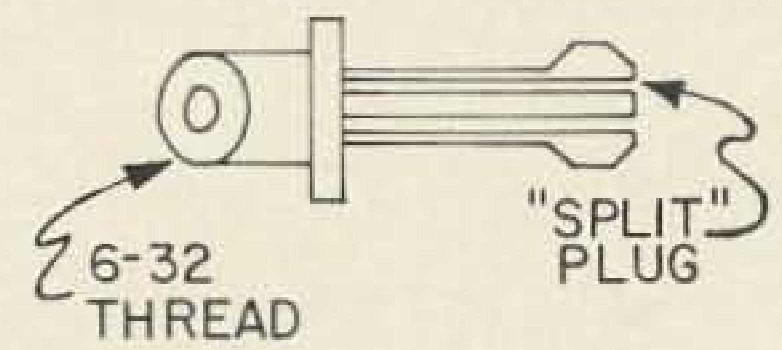


FIG. 3

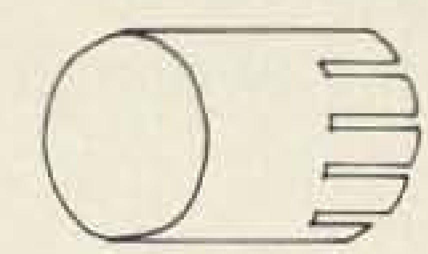


FIG. 4

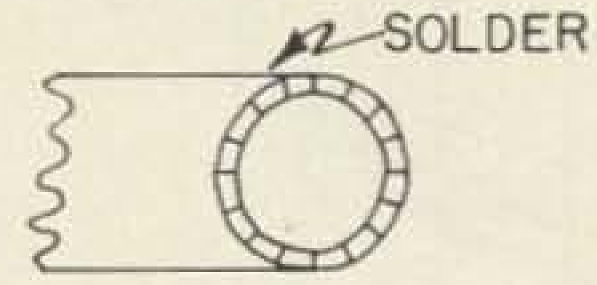


FIG. 5

Fig. 2. Filament plug.
Fig. 3. Cathode ring connector. These fingers turn in onto the cathode.
Fig. 4. Side view of grid connector ring and tube end of grid line.
Fig. 5. Plate ring connector. These fingers turn back on the plate ring.

Tube connections may be made with surplus rings, fingers, straps, or "sockets". See Figs. 2 to 5.

The 6 volt filament "plug" in the small end of the tube can be bolted to an insulating plate of bakelite which in turn is bolted to the wall of the cavity. This will hold the tube in place pretty well. Figs. 2, 3, 4, and 5 show some rough details of the connectors that I used. These are obtainable from the Instrument Specialties Co., Little Falls, N.J.

The whole rig appears to be a "natural" for rf grounding. A bypass on the 6 volt connector made no difference to the operation. I put it in anyway. Inductors. Using one inch copper strap creates a high Q for several reasons. First, there is plenty of copper surface for the electromagnetic momentum to work on, and second, this copper is "in line" and protected from radiation by the trough line. Granted a cylindrical cavity where all rf paths are equal length, with 100% shielding, is better, but the effort is not justified on 2 meters. Look what you're getting as is! The Q is so high now that large capacitors in parallel can be used to tune to 144 megacycles. High C is of course a standard way of getting rid of parasitics, harmonics, etc., but generally not possible on VHF. It is possible here though, and does a good job. It also makes available low impedance input and output circuits for 50 ohm cables.

The one inch strap lines are grounded for rf at the far end of the trough lines with feed-through capacitors. I didn't have a high enough value so had to add on more discs. Again, not critical. Just don't bypass modulation out of the plate line. That is, in case you wanted to have more fun and use a high-level modulator on the tube later on. As a linear of course, there is no modulation across those bypasses. This is a downright unique feature of this amplifier, it is really uncritical throughout. You can do almost anything to it and it still keeps on working. I even had a contact the other night with no B plus on the plate line, just audio, but that's another story.

The tuning capacitors are Hammarlund 25 mmfd units. They have an additional grounding strap soldered to the rotor spider. It is possible that with a blower and 600 volts, the plate tuning capacitor should have a bigger spacing. We'll check this unit out for the full 100 watts and perhaps a high level modulator to go with it later. Right now it does very fb as a linear.

Neutralizing

If a line (piece of heavy wire in this case) is introduced into the plate tank circuit, grounded at the plate end and open at the other end, it should pick up and produce energy out of phase with the plate voltage on the tube. It does! This out of phase voltage is sent through the common wall to the neutralizing capacitor Cn which is just about the rated grid-plate capacity of 2 mmfd. That is, the Cn is about .8 to 4 mmfd, and the setting used looks like 2 mmfd. To set this neutralizing capacitor, plug a tuned rf power detector into the plate circuit output jack with the 2C39 filament turned on and plate voltage off, with the Two'er feeding rf (all of its ¾ watt) into the grid circuit. The neutralizing null setting is immediately evident and effective. Remove the detector and plug in a 15 to 25 watt bulb, turn on the plate voltage, 200 to 400 volts, and tune up. With the circuit dimensions as shown you may get some self oscillation but only when you tune the plate circuit near 200 mc. When it's all tuned up and loaded even this disappears. After neutralization as per above, grid current does not vary at all, not even one black lines worth, when the plate is tuned through 144 mc. What more do you want?

Blower

For higher power, if desired, some small holes in the far (cold) end of the plate trough line with a small blower attached and a piece of plastic or cardboard over the top of the trough line should allow plenty of cooling. In fact, the air could be sent through the grid trough line at the same time. Some would circulate anyway through the tube hole.

Operation as a Linear AM Amplifier

Here is where this little powerhouse shines. As a rugged low-cost, non-critical triode, in a highly efficient amplifier, it allows very easy tune up. In fact it should work immediately. It did for me. Granted an AM linear is quoted as being "not quite" so efficient as a class C amplifier but what does this difference amount to anyway? RCA transmitting tube handbook says "The efficiency varies from approximately 33 per cent for an *unmodulated* carrier (who needs one) to 66 per cent for a fully modulated carrier." You want more than 66% efficiency on 2 meters? It will cost you a little more in money, time, and effort.

Furthermore let's say you use a converted old TV power supply. I found a half dozen of these you know where! If you're that fussy, go to the local TV repair and sales shop with a few dollars in your pocket. But why pay money for them?

New Gimmick Dept

We claim a first here (until someone shows up with a copy of Sleeper's Radio, 1932, with one in). This is the use of grid rectified bias for a linear. The simple gimmick is a large, really large capacitor, of several hundred mfd (not mmfd) across the grid resistor. This provides the "stiff" bias recommended for use with linear service, and needed. Without it you get downward modulation. With it you can get upward modulation and the difference in audio is quite noticeable. I checked many times, here, and on the air, between battery bias, (ideal) and the one shown in Fig. 1, and so far no one has been able to detect any difference.

Incidentally the 2C39 grid is so designed that no protective bias is needed in case of excitation failure (such as the Two'er stopping operation). Be careful of this with other tubes. Some, like the 811 types, are so designed that they take very little mils when not biased.

Other tubes will run away and that's that. So in this circuit the cathode is grounded both for rf and for dc. Without bias of any kind, the 2C39 takes about 90 miles at 400 volts on the plate. With 500 to 600 it may need a little protective bias.

Cable Matching

With the circuit as shown, matching between the Two'er and the linear amplifier is pretty good. You may have to retune the Two'er plate output circuit, in combination with C1 and C2 for maximum grid mils. I found around 20 to 30 grid mils, with a maximum of 40 without any grid resistor. Do not run the amplifier that way. After preliminary tune-up, recheck the neutralization. Do this also after final plate tuning. In fact, do it several times. Gradually all adjustments, Two'er tank, C1, C2, C3, C4, and Cn will come into line. This is recommended in the handbooks incidentally. It is also the natural way to do it.

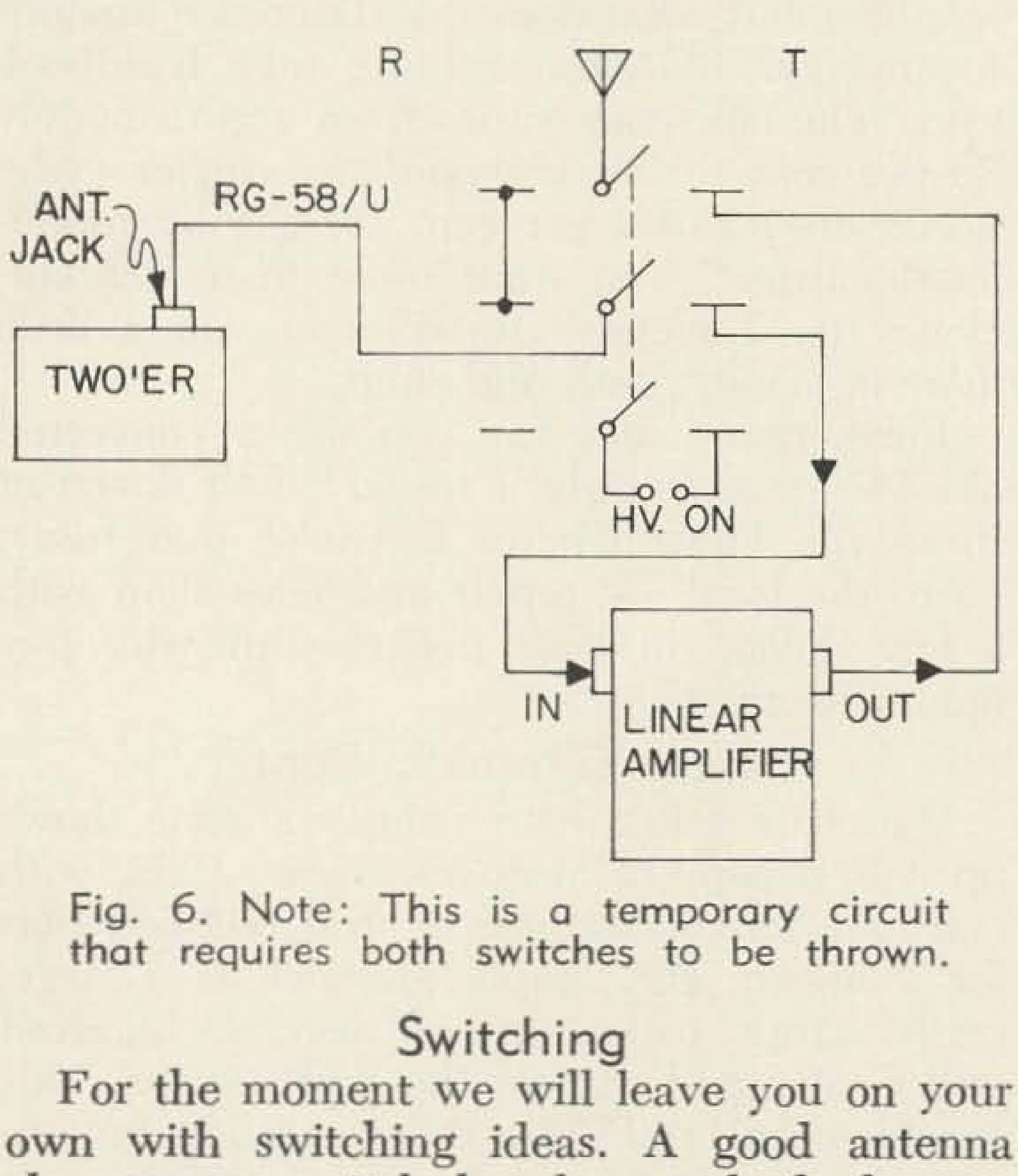


Fig. 6. Note: This is a temporary circuit that requires both switches to be thrown.

Switching

For the moment we will leave you on your own with switching ideas. A good antenna change-over switch has been rebuilt for use on 432 mc and works good there, so it has to work good on 2 meters. An ordinary porcelain wafer switch was taken apart and a "ground plane" of copper-clad bakelite installed very close to the back of the wafer. RG-58/U cable is cut close and installed on this ground plane also. A simple possible diagram of send-receive switching is shown in Fig. 6. This is with 2 switches to throw. A more automatic job (one switch to throw) would put a sensitive relay ($1.95 Radio Lafayette) in, or on, the Two'er, controlling an exterior relay on the amplifier.

On The Air Tests

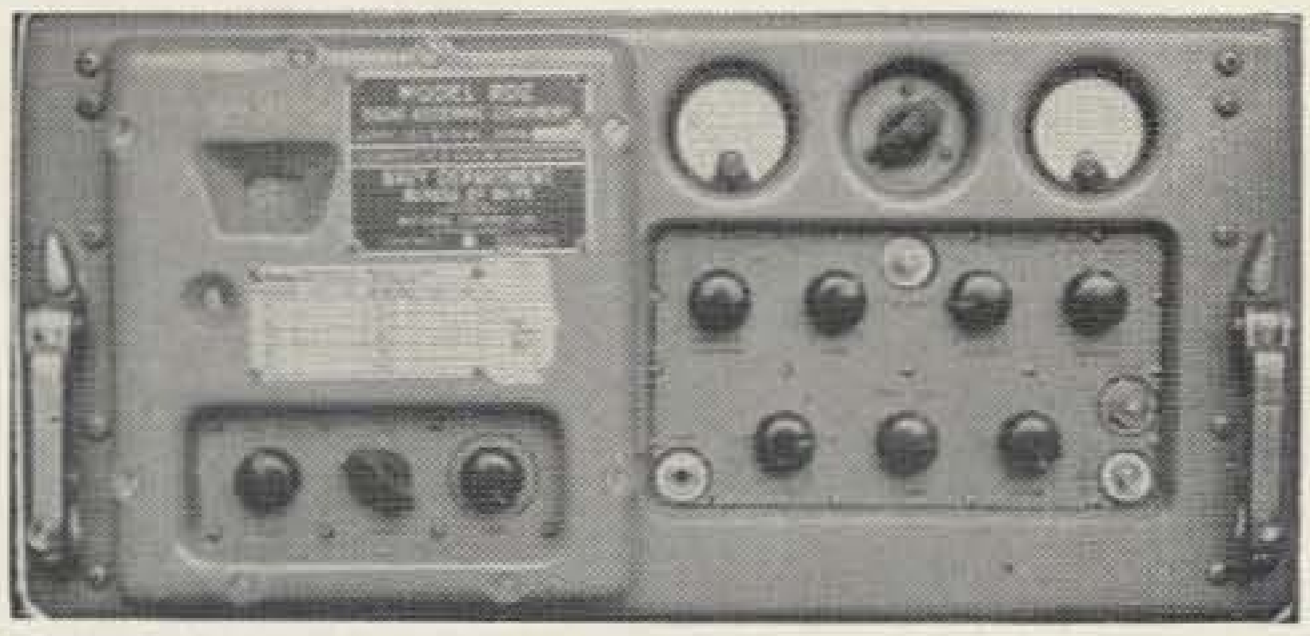
On the bench with tuned diode detector, transistor audio amplifier, and "Hi-Fi" padded earphones it sounded good. It sounded even better than the Two'er driving it! There could be sound reasons for this possibility, but at least the modulation of the Two'ers is plenty intelligible as is, as far as voice goes. With still no modification of any kind to the original Two'er kit, built by someone else, and putting out at the most ¾ of a watt, I plugged it into the rf input phono jack of the linear amplifier. Into the output jack went my favorite test antenna, the little 2 over 2 four element, the same one I use mobile on the car. It barely clears the roof top of the house here, in fact, does not clear a chimney top mainly because I have a 14 element 432 mc beam on top. Ground level here is only 100 feet above sea level. So, thinking "what have I got to lose", I called a CQ. By 8:30 pm had worked six stations with plenty of carrier, stability, and modulation checks, particularly the last. Varying both the bias and the plate voltage while on the air did not affect the modulation adversely. Evidently that easy method of obtaining linear bias works fb. In one test an S unit was gained on the distant receiver (31 miles) by going from 80 mils at 400 volts to 100 mils at 500 volts, 50 watts. So what if S meters aren't always exactly db power meters? Sounds good to hear it anyway.

On the subject of power, not yet having a blower on the 2C39, and feeling the hot air coming up from it into my face as I manipulated the various switches on the bench, I ran it most of the time at about 30 watts input and about 15 watts out. With exception of one or two step ups to 50 watts just for fun for a minute or so. For all I know the 2C39 might take the 25 watts dissipation without a blower continuously, but I love those tubes and only have about seven of them on hand here right now. Am getting real interested in putting a blower and 100 watts on it! Still driven by that Two'er!

Modulation reports were good: "Could not tell it apart from a Two'er"; "Quality is tremendous"; "Modulation real nice sounding. Very interested in how you connect it to the Two'er".

. . . K1CLL

There is an error in the schematic of the linear on page 8 in the September 73. The negative terminal of the 250 mfd grid capacitor should be connected to the junction of the 40 K resistor and the grid inductance.



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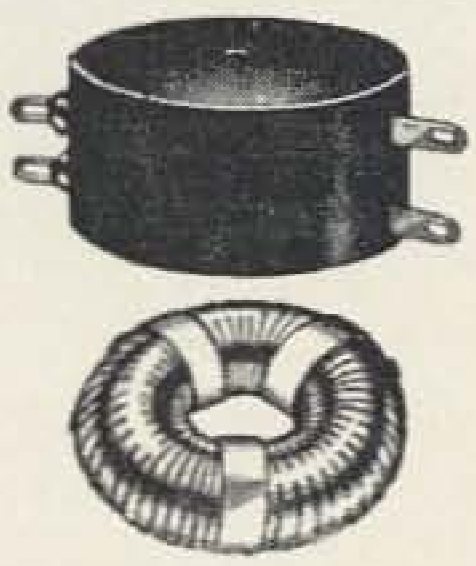

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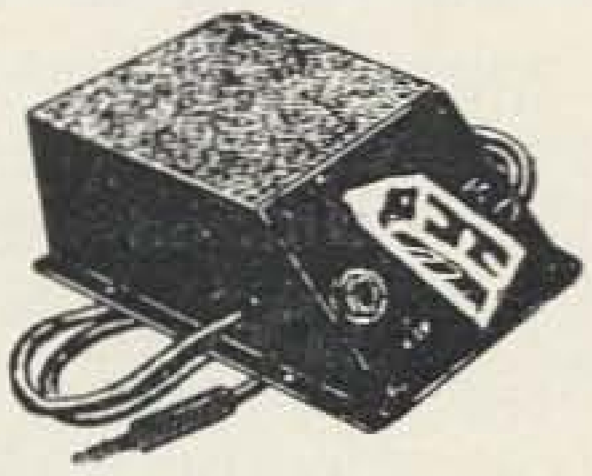
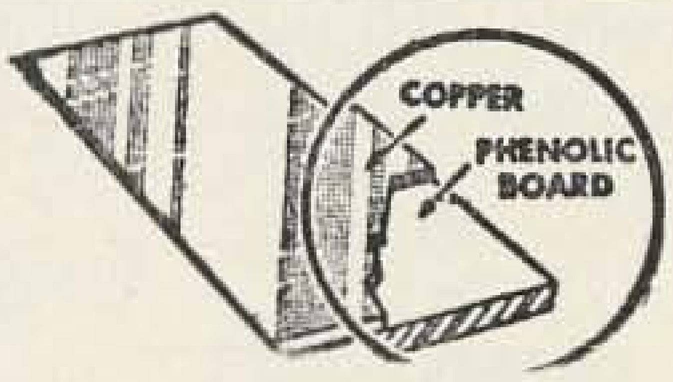
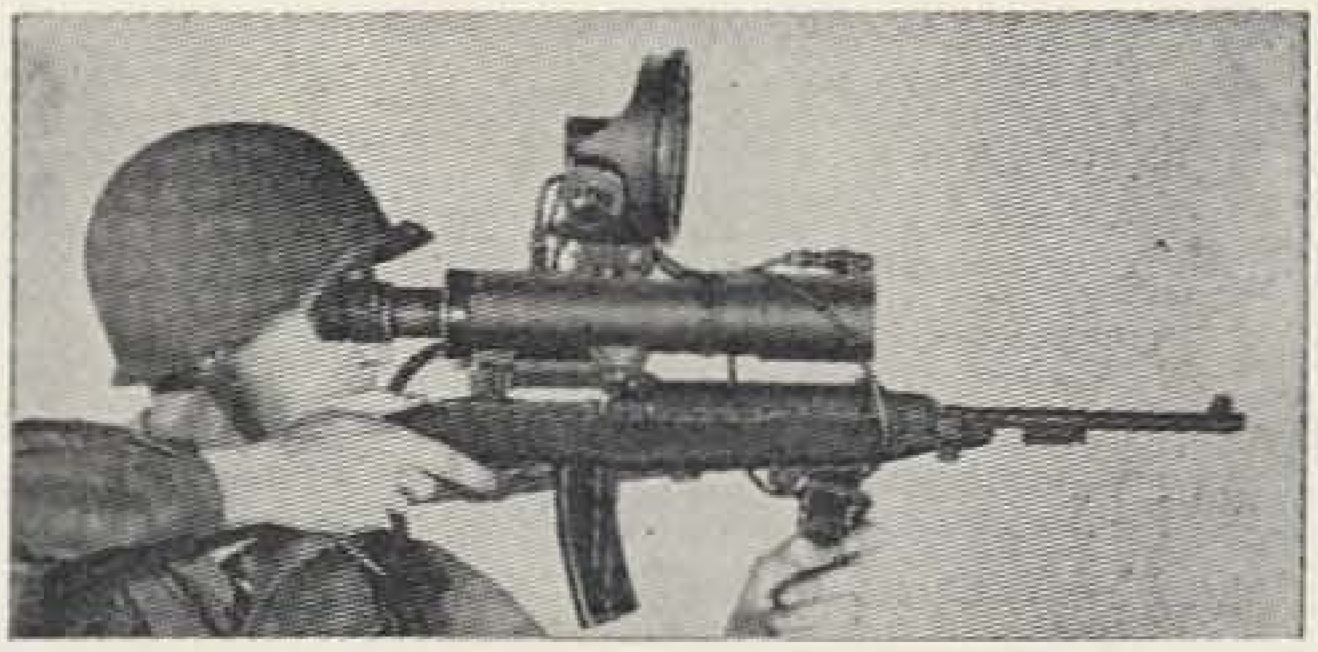


CIRCUIT BOARD
(as used in 73)
Copper one side.
Approx 4 x 10 **8/$1.00**





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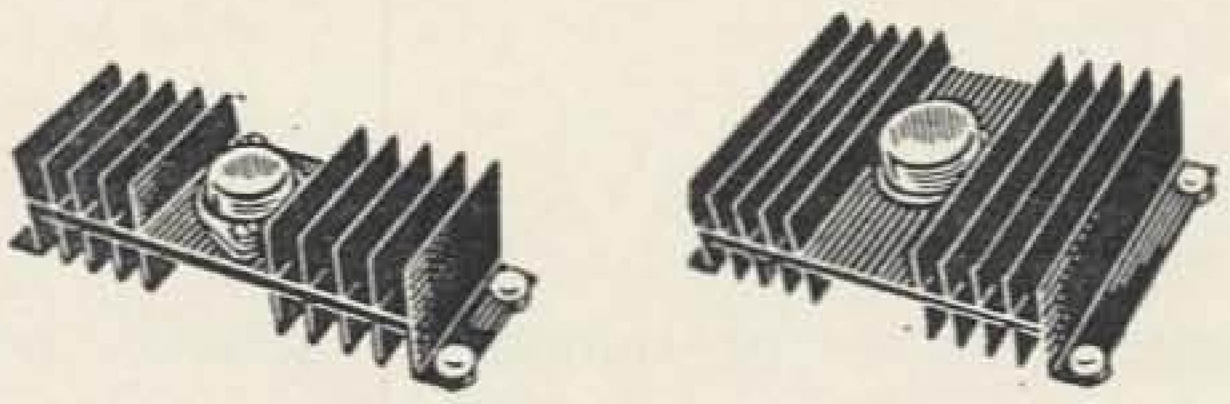

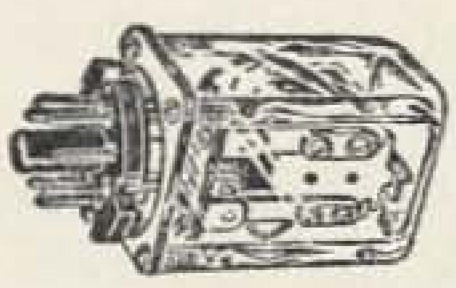

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RG 8A/U	100 ft.	**$9.00**
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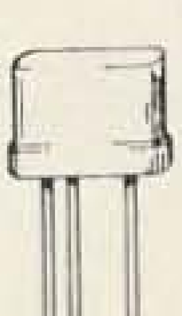

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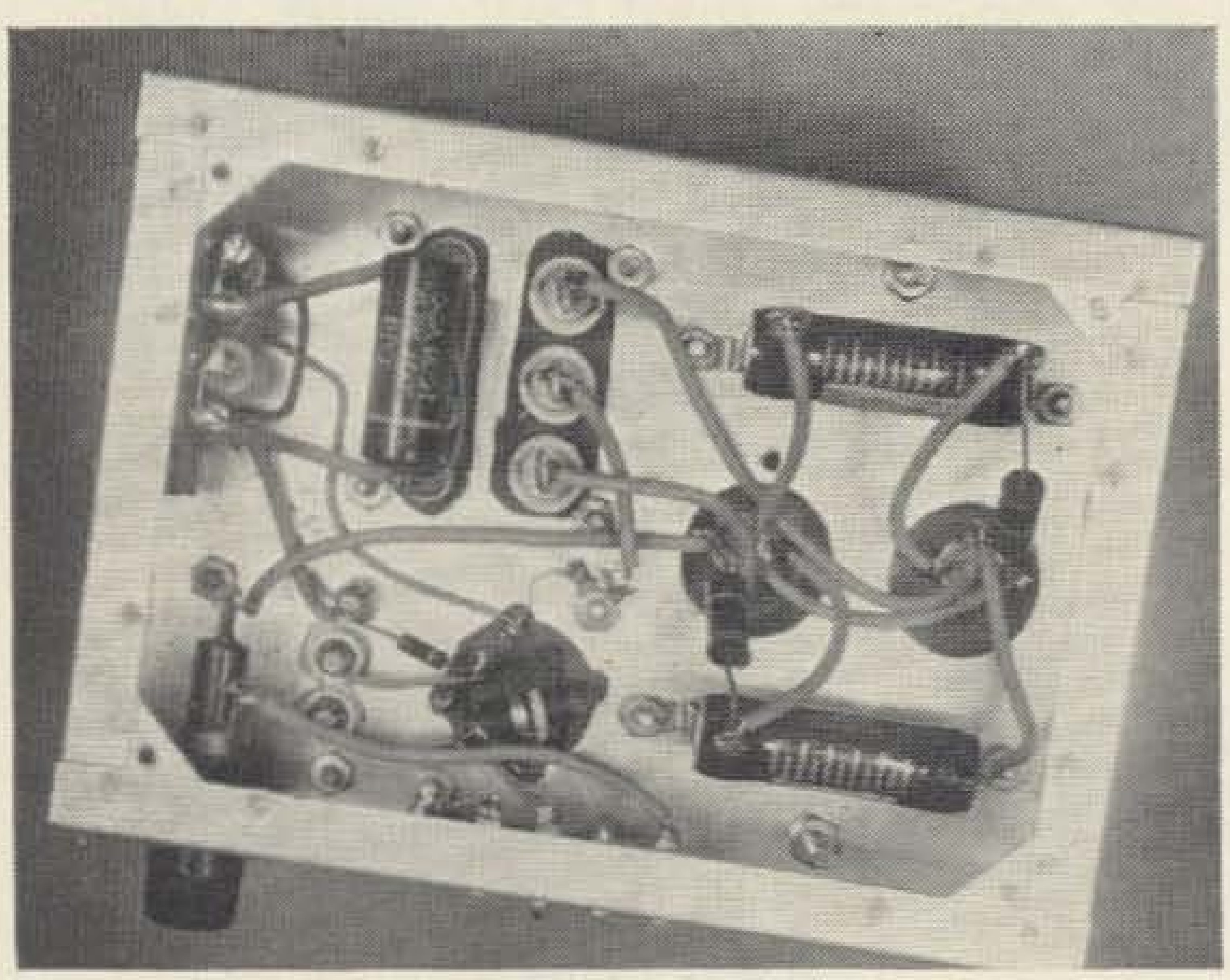
A large number of magazine articles have appeared in recent years on how to design and construct dc to dc converters working from a 12 volt source. Most of these articles have a statement in them somewhere to the effect: 'Of course the supply will work on 6 volts input, but the output voltage will be halved'. If you happen to own an automobile with a six volt battery, or otherwise have to work from a 6 vdc source, these words are not exactly what you have been waiting to read. Furthermore, the output *power* is usually less than half of the 12 volt value when the supply is operated on 6 volts.



I had just such a problem in locating a suitable design for my mobile rig power supply. My car is of foreign make and uses a six volt battery. I was not able to find an appropriate design, so I set about concocting the one shown in the photographs and schematically in Fig. 1.

Fig. 2 shows the pertinent data on this supply. Note that for maximum efficiency, the supply should be loaded heavily to 40 watts. Heavy loading and maximum efficiency go hand in hand for all dc to dc converters. When the output load exceeds 150 ma, output ceases entirely. When the output load exceeds 140 ma, the converter becomes a cranky starter under load. The practical maximum

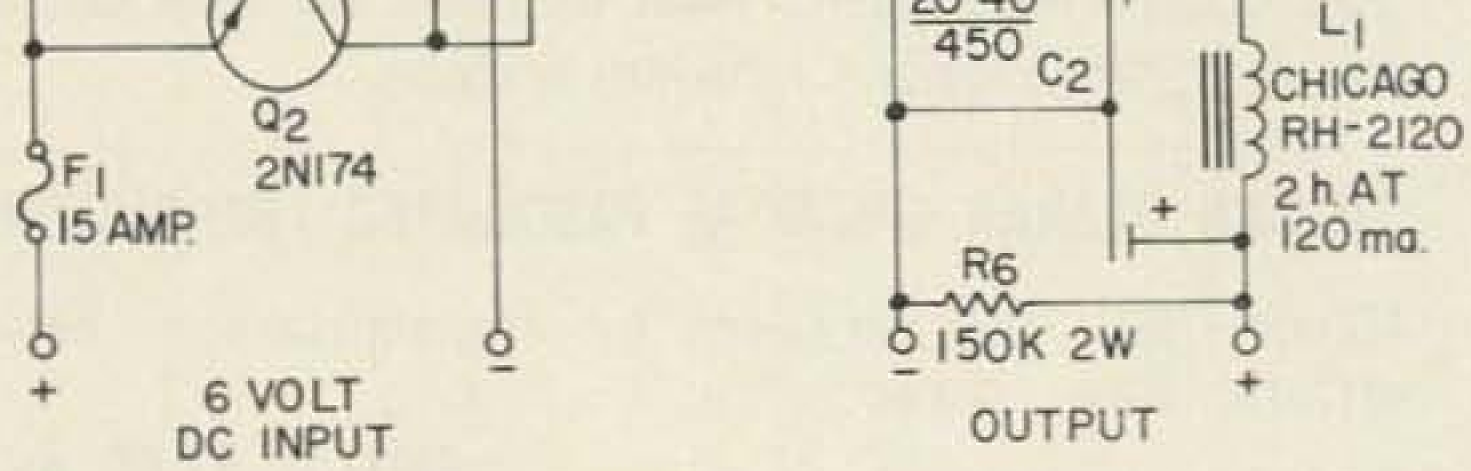


FIG. 1

BILL OF MATERIALS

Q1, Q2	— 2N174 or 2N1358
T1	— Chicago FH-25 2.5 VCT @ 6.6 Amps to 115-230 V
L1	— Chicago RH-2120 2 Hy @ 120 Ma.
R1, R2	— 10 ohms @ 2 Watts
R3, R4	— 10 ohms @ 25 Watts
R5	— 10 ohms @ ½ Watt
R6	— 150K @ 2 Watts
C1	— 0.007 mfd. @ 1600 V
C2	— 20-40 MFD @ 450WVDC
F1	— 15 Amp SloBlo FUSE
D1-D4	— 1N540 or equiv.
Heat Sink	— VEMALINE 6071-4BB or DELTA NC-421
Chassis	— 5 x 7 x 2 Aluminum

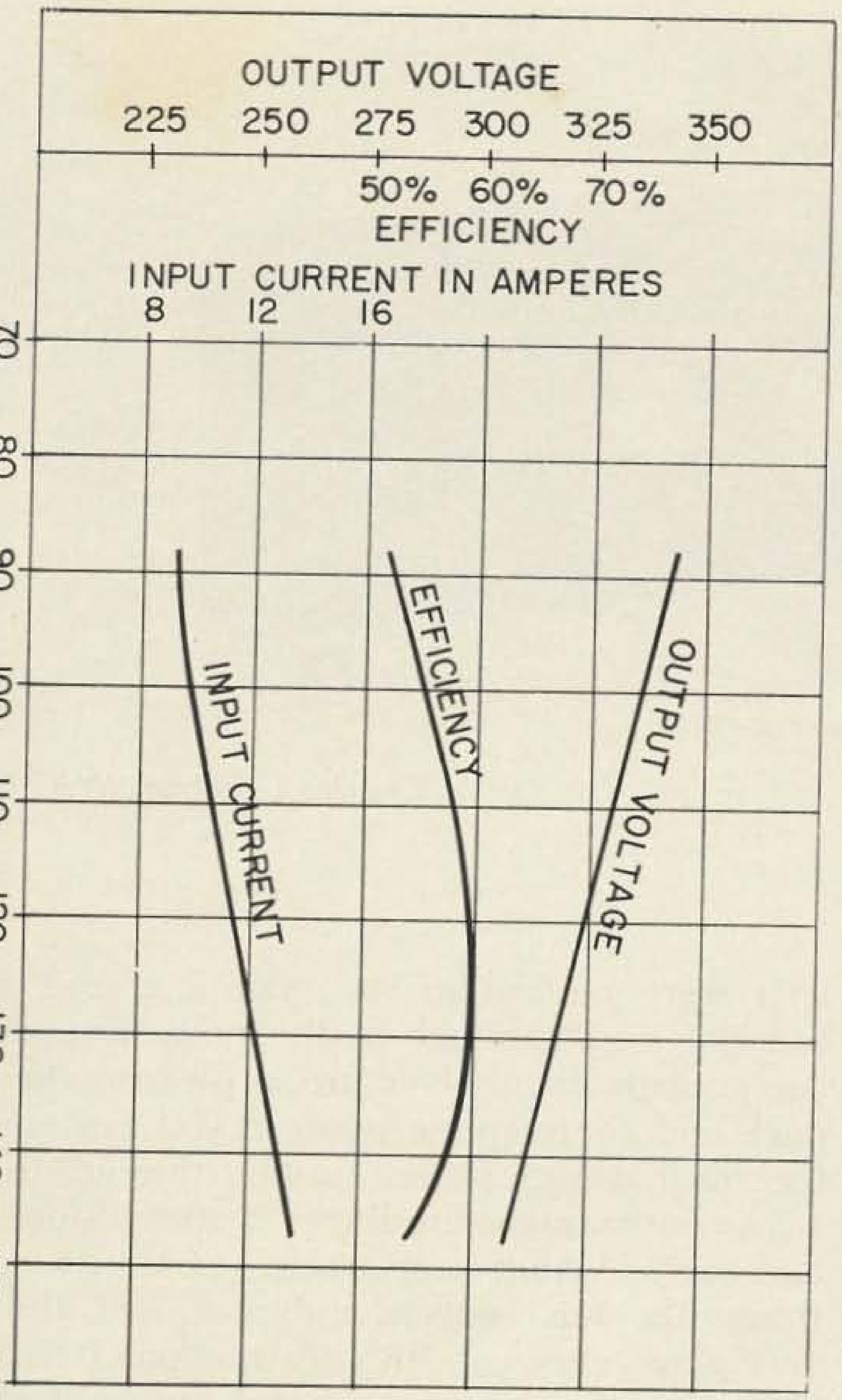


FIG. 2

load should be considered to be 130 ma. It is entirely probable that the use of another type of transformer will change these basic characteristics somewhat.

The transformer I used is rather expensive and frankly, any 2.5 volt at 5 ampere center-tapped filament transformer would probably be alright to use. Because of the type of steel in these transformers and the primary inductance (about 5 mhy), the frequency of oscillation ranges from 70 to 100 cps.

Use No. 14 gauge stranded wire for hook up to avoid excess voltage drops. Use a good heat sink to keep the temperature of the transistors to a respectable value. Do not depend on the $5 \times 7 \times 2$ inch chassis to provide a suitable sink . . . it won't. With the heat sink specified, the transistors never get more than warm to the touch.

Mount the components and, in fact, the supply itself where there is some air circulation.

Unlike the authors of 12 volt converter articles, I will close by saying; of course this supply can be connected to 12 vdc, but it will cook the wax right out of the transformer.

. . . W3UWV

A test report:

The Heath SB-200

Charles Leedham WA2TDH

There comes a time in every ham's life when the siren call of power is heard, pegging the meter and coming in Q5. It has been beckoning to me, lo these long years, but I had always managed to resist it. Going along with the theory that good signals can be got out with low power, tinkering, and a dash of cunning, I have put in my QRP apprenticeship. I have tuned lines, wrapped baluns, trimmed elements, tapped loads, climbed towers. I have put up beams, ground planes, coaxials, quads, dipoles, long-wires, inverted V's, inverted V beams, and just about every other kind of antenna that will conceivably fit on an apartment house roof.

Even operating from one of the world's rottenest locations—midtown Manhattan—I have managed to put out a respectable signal, getting just about as much oomph as could reasonably be gotten out of a given small input. But when the real test came, getting through in the clutch to the good DX or holding up through the QRM for a phone patch, it was never quite enough. Know the feeling? Ever have your little peashooter trampled to death by the hob-nailed boots of a kilowatt just when you were about to snag that little S2 DX station? The high-power bug was nibbling, and finally it bit, and hard, when the ads first appeared for the Heath SB-200, an incredible KW on CW and 1200 PEP on SSB, and all for only $200. It was just too much to resist.

From the beginning, the SB-200 is an impressive little package. Two packages, rather, because the massive transformer is mailed in a separate small box of its own—presumably because it is so heavy it would smash other components, however well packed, to flinders if it were packed in the main box and that box got joggled much in the post. The major components themselves are a pleasure to unpack and contemplate because you can almost feel all that high power surging through them.

In construction, the linear is straightforward and easy, I didn't keep track, but it was something like ten or twelve hours, and this of very slow, very careful construction. I had no desire to run an unsuccessful smoke test at 2,400 volts, and so checked and rechecked every step. The only point I found that requires any watching at all is the fact that a small coax cavity and driver element (for the SWR bridge) are installed inside the back apron towards the end, and after a number of wires have been laid in the same general area. If you've ignored the manual's earlier instructions about routing those wires, you might have considerable trouble getting the cavity in place. It is a minor point, and if you follow the manual carefully, won't bother you at all.

The power supply section is a breeze. Sixteen silicon diodes, six filter capacitors, plus equalizing and bleeder resistors all slip into a circuit board, leaving nothing much else to do in the power section but put in that husky transformer and hook a few leads to the rest of the unit.

The rest of it goes right along smoothly. Then at the end, there are exactly two resistance checks to make before putting the linear into operation. Heath has prudently avoided any voltage checks, confining itself to repeated warnings throughout the manual on the lethal potentialities of 2.4 kilovolts, and supplying nice red Danger stickers to be put here and there. If you've never handled high

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BC-221 1000 Kc Crystal Brand New **$8.95**
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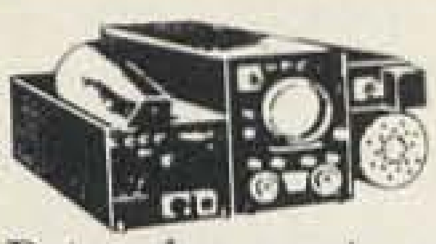

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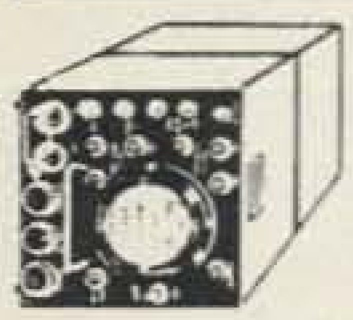
Like New. P.U.R.
We carry a complete line of replacement parts and accessories for above.

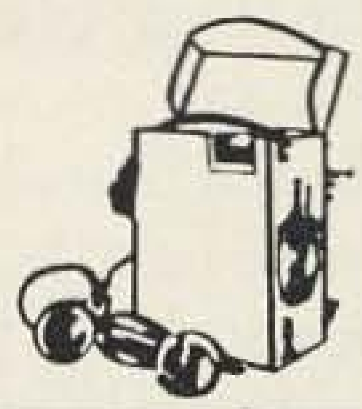


APN-12 3-INCH SCOPE

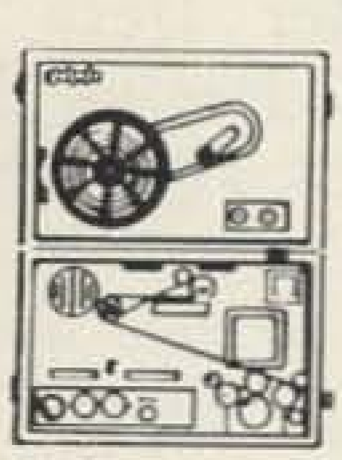
Has vertical and horizontal sweep with focus and intensity controls, coaxial antenna changeover motor. Complete with 11 tubes and 3JP1 CR Tube. For 115 V. 400 cycle AC and 24 V DC. Circuit diagram included. LIKE NEW. $14.95

EE-8 FIELD PHONES

Checked out, perfect working order. Complete with all parts. Excellent Condition.
LIKE NEW! Each **$14.50**



TG-34A CODE KEYER



Self-contained automatic unit, reproduces code practice signals recorded on paper tape. By use of built-in speaker, provides code-practice signals to one or more persons at speeds from 5 to 25 WPM.

Like New, Tested **$29.50**

Set of 15 Reels, Army Code Practice Lessons, BRAND NEW, original packing P.U.R.

AN/APR-4Y FM & AM RADIO RECEIVER

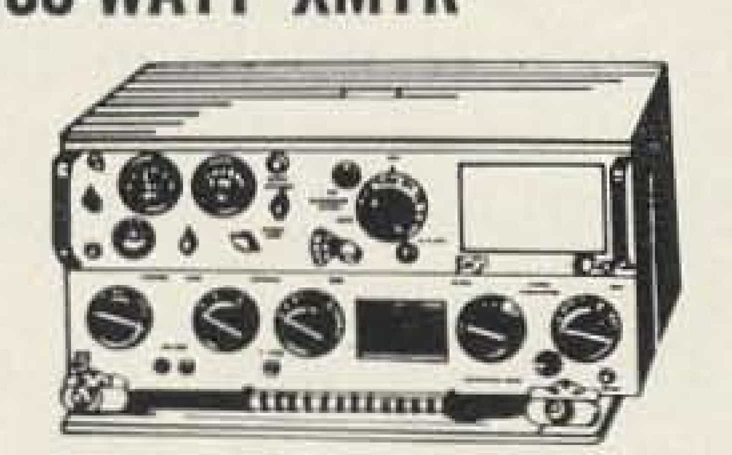
High precision lab instrument, suitable for monitoring and measuring frequency and relative signal strength of signals from 38 to 4000 Mc., in 5 tuning unit ranges. For 110 V 60 cycle AC operation, built-in power supply.
LIKE NEW, SPECIAL **$79.50**

TN-16, TN-17, TN-18, TN-19 and TN-54.
Tuning Units for above in stock...... P.U.R.

AN/ART-13 100-WATT XMTR

11 CHANNELS
200-1500 Kc
2 to 18.1 Mc

$79.50 EXC. USED



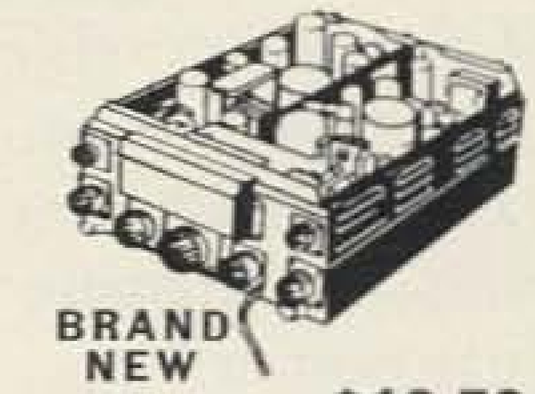
complete with Tubes

Famous Collins Autotune Aircraft Transmitter. AM, CW, MCW. Quick change to any of ten preset channels or manual tuning. Speech amplifier/clipper uses carbon or magnetic mike. Highly stable, highly accurate VFO. Built in Xtal controlled calibrator. PP811s modulate 813 in final up to 90% class "B." A Real "HOT" Ham buy at our low price!
AN/ART-13 XMTR, as above. In LIKE NEW condition, with all tubes and crystal **$89.50**

0-16 Low Freq. Osc. Coil for ART-13 .... **7.95**
24V Dynamotor for ART-13 .... **11.95**
We carry a complete line of spare parts for above.

FAMOUS BC-645 TRANSCEIVER
15 Tubes 435 to 500 MC

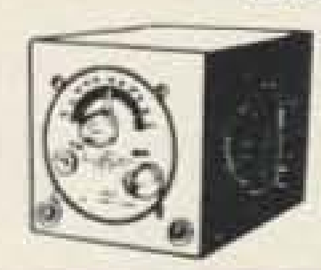
Can be modified for 2-way communication, voice or code, on ham band 420-450 mc. citizens radio 460-470 mc. fixed and mobile 450-460 mc. televisoon experimental 470-500 mc. 15 tubes (tubes alone worth more than sale price!); 4—7F7, 4—7H7, 2—7E6, 2—6F6, 2—955 and 1—WE-316A. Now covers 460 to 490 mc. Brand new BC-645 with tubes, less power supply in factory carton.
Shipping weight 25 lbs. **SPECIAL!** **$19.50**



PE-101C Dynamotor. 12/24V input $7.95
UHF Antenna Assembly 2.45
Complete Set of 10 Plugs 5.50
Control Box 2.25

SPECIAL "PACKAGE" OFFER:
BC-645 Transceiver, Dynamotor and all accessories above. COMPLETE, BRAND NEW,
While Stocks Last **$29.50**

BC1206-C BEACON RECEIVER



195 to 420 Kc. made by Setchel - Carlson. Works on 24-28 volts D.C. 135 Kc. IF. Complete with 5 tubes. Size 4" x 4" x 6". Wt. 4 lbs.
LIKE NEW **$10.95**
USED, less tubes **$4.95**

ARC-3 RECEIVER!

Complete with All tubes Exc. Used **$21.50**
Like NEW **$33.50**
Crystal-controlled 17-tube superhet, tunes from 100 to 156 MC., AM., on any 8 preselected channels. 28-volt DC power input. Tubes: 1-9002, 6-6AKS, 1-12SH7, 3-12SG7, 1-9001, 1-12H6, 2-12SN7, 1-12SL7, 1-12A6.
110 V A.C. Power Supply Kit for above **15.00**
Factory Wired and Tested **19.95**

ARC-R TRANSMITTER

Companion unit for above tunes 100 to 156 MC on any 8 preselected channels. 9 tubes, crystal controlled, provides tone and voice modulation. 28V DC Power input. Complete with all Tubes: 3-6V6, 2-832A, 1-12SH7, 1-6J5, 2-6L6. Exc. Used .... **Only $18.95**
Like new condition $28.50
ARC-3 PUSHBUTTON CONTROL BOX $5.95

SCR-274 COMMAND EQUIPMENT

ALL COMPLETE WITH TUBES

Type Description	Used	Like New	BRAND NEW
BC-453 Receiver 190-550 Kc.	**$14.95**	**$18.95**	**P.U.R.**
BC-454 Receiver 3-6 Mc.	**$15.95**	**$19.50**	**P.U.R.**
BC-455 Receiver 6-9 Mc.	**$13.95**	**$19.50**	**P.U.R.**

BC946 Receiver 550-1500 Kc Complete with all tubes, Brand New, in original packing .... **P.U.R.**
1.5 to 3 MC Receiver Brand New .... **P.U.R.**

110 Volt AC Power Supply Kit for all 274-N and ARC-5 Receivers. Complete with metal case, instructions **$8.95**
Factory wired, tested, ready to operate **$12.50**

SPLINED TUNING KNOB for 274-N and ARC-5 RECEIVERS. Fits BC-453, BC-454 and others.
Only **49c**

2.1 to 3 Mc Transmitter, Brand New **$12.95**
BC-457 TRANSMITTER—4-5.3 Mc. complete with all tubes and crystal, BRAND NEW **$10.75**
Like New **$7.95**
BC-458 **TRANSMITTER**—5.3 to 7 Mc. Complete with all tubes and crystal.
BRAND NEW **$12.95**
Like New **$7.95**
BC-696 TRANSMITTER 3-4 Mc Complete with All Tubes & Crystal. Like New **$11.95**
BC-456 Modulator .... **USED 3.45 NEW 5.95**
ALL ACCESSORIES AVAILABLE FOR ABOVE

MICROPHONES Checked Out, Perfect
T-17 Carbon Hand Mike,
Exc. Used **$4.45** .... Brand New **$7.95**
RS-38 Navy Type Carbon Hand Mike,
Exc. Used **$3.95** .... Like New **$5.75**

SCHEMATIC DIAGRAMS For most equipment on this page, each 65c

Please include 25% Deposit with order—Balance C.O.D., or Remittance in Full. 50c Handling Charge on all orders under $5.00. All shipments F.O.B. Our Warehouse, N.Y.C. All Merchandise subject to Prior Sale and Price Change.

G & G RADIO SUPPLY CO.

Telephone: CO 7-4605
75-G Leonard St. New York 13, N. Y.

voltages before, this is no time to start—and in any case you won't have to, because the thing works flawlessly. Screw on the top plate of the heavy shielding, drop the hinged top of the cabinet into place, hook it up to your exciter, and you're in business. No tuning of coils, no fussing, no neutralizing, no nothing. Just power.

In circuitry, the SB-200 is only a little more complicated than an electric light. The signal from the exciter comes in through pre-tuned input coils for each band (80 through 10) and is applied straight to the cathodes of the two paralleled power tubes running in grounded grid configuration. These are either 572-B's or T-160-L's. It matters not at all which tube you get, for they are identical tubes except for name.

Input of the SB-200 is a full, round kilowatt on CW and 1,200 watts on sideband. Input drive required to reach full output is 100 watts, easily available from most current exciters, and naturally enough supplied by Heath's companion transmitter/exciter, the SB-400. input impedance is 52 ohms, and the input itself is so broad-band that no tuning is required there. Output is 50 to 75 pi-network, and Heath strongly recommends not working into an SWR of more than 2:1. You can talk on SSB from now until next week, pausing only for breath, and not overheat anything, and hold the key down for up to five minutes, so no fear of blowing something if it takes you a little long to get tuned up. Especially since tuning is a matter of five to ten seconds once you know which knob is which.

There are three hook-ups to the exciter—ALC from linear to exciter, the rf cable, and one for carrying a grounded condition to the linear relay when your exciter relay closes on transmit. The fourth hook-up is to the wall, and you can take either 120 or 240 volts to make the SB-200 work. The primary of the power transformer is split, and a simple change of bridging connections inside the linear allows you to change your power source if you want to—and the connections are made to screw terminals, not soldered, thus making power changes almost instant. Peak power draw is 16 amps at 120 volts, 8 at 240. I've got the thing hooked up to 240 volts from an air-conditioner outlet near the operating bench, figuring that 16 amps on the single 120-volt line in the room would be a bit much, considering the fact that everything else (transmitter, receiver, lights and such are already quite enough. What will happen come summer I'm not at all sure. The line cord comes with a three-prong grounding plug, plus an adapter for a normal wall plug if your house or apartment isn't equipped with grounding sockets. But be sure you use the grounding connection of that adapter, onto the screw of the socket! That kind of voltage is nothing to have around ungrounded. Or, if like me, you plan to plug it into a 240-volt source, make sure you have a proper plug on hand for that socket. Most if not all air-conditioner and other 240-volt sockets take completely different types of plugs, so get one when you put in your SB-200 order, or start looking for one. Then just clip off the plug supplied with the line cord, wire on your new plug (CAREFULLY!) and you're in business.

The linear, incidentally, is not fused but has two button-resettable circuit breakers and the buttons are accessible at the top, after lifting the piano hinged top of the cabinet and respectfully observing the big DANGER label on the shielding. Whether the breakers work or not I couldn't say, as nothing has ever popped—which is quite a good recommendation for the linear. But I imagine they do. There is also very little apparent heat from the two big tubes. They are fan-cooled, and the fan moves the heat out very smoothly, so that a hand held over the top of the cabinet feels hardly anything. Still, heed Heath's cautions about putting it in a well-ventilated area.

Actual operation is totally painless. First, you peak up your exciter using the relative power setting of the linear's meter. Here, incidentally, somebody at Benton Harbor has been doing some good thinking. The meter reads relative power of the exciter when the linear is switched off, and then of the linear when it is on. Also, more thinking—there is an SWR setting for the meter which reads the SWR of the exciter, linear off, or the SWR of the whole affair. With the exciter tuned, it needs only to touch up the tuning and loading of the SB-200, and you're ready to put out those lovely big watts. Switching from exciter to linear is almost instantaneous. Shove the big rocker switch on the front panel and the instant-heating tubes start boosting your signal within two or three seconds. And that's all there is to it.

Operation with this tabletop powerhouse is pure pleasure. I have always stayed pretty much out of the pile-ups in the past, knowing full well that the power boys would beat me out almost every time, and I've settled for working the DX that I happened to hear first and early. But once the SB-200 was in place I couldn't resist the temptation. Within the first few hours of operating, I walked happily nto three good struggles for some interesting DX, and came away with the contact. Heh neh. Of course, some of the low cunning necessarily developed in the years of trying to get through with low power helped, but it was he pure brute power of the kilowatt that urned the trick. Things look a great deal different from behind a kilowatt. Cross my heart, 'm not going to trample my way into any nore pile-ups, but better you should get an SB-200 just in self defense in case I weaken.

The SB-200, I think, is going to be one of the very hottest items Heath ever came up with, and they have a long history of some very good stuff. I haven't had a moment's trouble rom it, from the first time I hit the switch. The output is clean, and on-the-air reports from ome very critical people have been universally excellent as to quality. And no TVI, either, o far as I know. And the price! Any time you can buy yourself one thousands watts for $200—that's all of 20c per watt—that is the ime to break open the piggy bank. I hear hat orders for the SB-200 are piling up like utumn leaves out there in Benton Harbor, so better get yours in quick. Very highly recommended.

. . . WA2TDH

Solution to Ham X-Word

T	R	A	N	S	D	U	C	E	R		
R	A	D	I	O		F			E	N	D
A		R		L	C		H		L		I
P	A		C	D		A	R	R	A	Y	S
E	V		C	E		E	D	D	Y		S
Z	E	N	E	R		C					I
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		S	A	T	U	R	A	T	I	O	N

Answer to question on p. 65: NE-2

E. Robson 5Z4ERR
P.O. Box 30077
Nairobi, Kenya

How To Fish For DX

You don't have to be a rich man to go fishing for fish or DX. The urchin is often the one who gets home with the biggest trout, caught with a worm on a bent pin.

I can rightly claim to know most of the DX boys and whilst many of the past and present honor roll experts have superb equipment now, they certainly did not to begin with and like any hobby you gradually improve and accumulate your equipment.

I joined the Phone Honor Roll in April 1948 and like W1FH and W2BXA I'm still in it and during this time have discussed "Fishing for DX" with all types including the top ten and would like to pass on this collected information and advice to those who delight in collecting new countries.

Many of my friends were hams who came to Kenya for a three year tour—worked 100 countries or more and then went on to Uganda or Tanganyika or the West Indies to work a succession of new "100" DX Certificates. Total value of equipment carried usually valued at $300! But like all hobbies, if you can afford good equipment—buy it.

To get into the Honor Rolls—you require certain essential equipment admittedly—such as

1. A first class, properly calibrated receiver—stable and sensitive.

2. A good monoband beam or quad—at least three elements for 14 megs.

3. An ssb Transmitter 150 watt PEP.

Further down the list—whether you make or buy them, come

1. A PA to follow the above Tx.

2. Antenna rotators and indicators and more antennas.

3. SWR Bridge with Input/Output meter, FS meter, etc. are all fun to build and useful.

4. If you have a permanent location a tower is well worth making or buying. Get a minimum height of forty feet and a steel 2″ mast through the top will add on ten feet. Your tower will last longer than you, and requires no upkeep and is easier to climb.

5. A workshop bench and tools.

To the above desirable things which help so much and which help you to see at a glance if your 'power' is going out and in which direction I would add a really comfortable chair and operating bench.

Whether you buy or build it is queer how one guy buys a good Rx and uses any old antenna and another does the opposite.

Even lesser ills such as an uncomfortable chair, a table too high or low, poor lighting, contribute to tiring a chap, so do too many switches, just out of reach.

Having got your equipment up to the best standard you can or will afford, comes the question of how to use it.

Check that the antenna system is all bolted down well and all joints and connections weatherproofed and before you leave it, borrow a SW bridge and get the antennae impedance matched up to the Tx. Then unless you have a really modern Rx it will pay you to match the Rx up to the 52 ohm feeder. My old 75A1 was miles off 52 ohms.

Now you are ready—with a good setup but there is a certain amount of thought and know how, rules, habits, customs and methods which are worth studying.

In the front end of your call book you will find a list of countries with plus or minus GMT.

It is labelled:

"Standard Time throughout the World".

Most of us don't know it is even there. You are looking for some country, fine, you can spend your evenings or week-end afternoons searching but it is no good looking for a country at 3 a.m. *his time*. It is his time that matters and you must arrange to look for him in the evenings—his evening time, not yours. On Saturdays and Sundays look for him in the afternoon and mornings but *his* afternoon time. Study his habits and if you know somebody who worked him collect the times GMT when he was active.

You then get a pattern with perhaps a most active time of 1900 GMT on Fridays or Saturdays. Begin to look for him a little before and you have also got his usual frequency, so listen and try and get in quickly before the kilowatts get busy. You have got 10 minutes or if lucky 20 minutes at the most before the frequency gets swamped. If you are lucky and have two receivers put your ground plane on one and use *if* for casual searching. You may miss a weak DX station if your quad or

SELECTRONICS

420 MC TRANSCEIVERS

The same as one we sold for $34.95 except the vibrators, 5894A, cables and mike are missing. Most of the small tubes are included. These units are excellent for stripping and using the tripler-amplifier chassis to get on 420 mc with about 2-3 watts drive on 2 meters. Type 829B tubes may be substituted for the 5894 at reduced output. Cat. #S-7129. Price $9.95

5894A TUBES

Price .... $7.95 ea. or 2/$15.00

MOBILE MIKE

Shure Dynamic high impedance push to talk with 5' coiled cord & 4 pin Amphenol Mike Connector.
Price: $2.95
P.M. Speaker in 5½" Round Metal Case 6—8 Ohms.
V.C. MIKE & SPEAKER combination. .... Price: $3.50

MODEL WR-36A

Produces black and white dots, color rainbow pattern, and a 3.58 mc subcarrier for alignment and adjustment of color receivers. Has RF output for insertion of signal into receiver antenna terminals and video output.
In excellent condition. Shpg. Wt., 30 lbs.
Cat. No. S-6998A $24.95

NAVY SUPERSONIC SELECTOR UNIT

Here is an excellent unit for you radio control bugs. Consists of a 10 channel selector using 12SH7 amplifiers and adjustable tuned circuits at the following frequencies: 20, 27.5, 35, 42.5, 50, 57.5, 72.5, 87.5, 102.5, 117.5 cys. Also contains 10 SPST 3300 ohm telephone type relay and 10 12SH7 tubes. Case size 11" H x 12¾" W x 6¾" D.
Shpg. Wt., 30 lbs.
Cat. No. S-6394 .... $6.95

COMPUTER — BRAND NEW

Contains the following parts: 1 dynamotor input 27V. .75 amps. DC. Output 285 V. at .075 amps. DC. 3 tubes and 1 ballacast, 88 IRC precision wire wound resistors, 1% accuracy, 5 relays, 2 oil filled caps. 6 x 600 VDC.
A wealth of parts for the price.
Shpg. Wt., 30 lbs.
Cat. No. S-6308 .... $4.95

WEATHER-PROOFED CONTROL BOX

Type CAY-23381 of model TDE 2 radio equipment. Contains the following parts:
- Small, jeweled, bayonet-type pilot light with one 12 V bulb.
- Toggle switch.
2 - Standard phone jacks, ¼".
- Dual control mike jack.

Shpg. Wt., 4 lbs.
Cat. No. S-6303 .... each $1.50

REMOTE CONTROL AMPLIFIER

Brand new. Type CAY-23304A, Power req'd 117 VAC-DC 37 Watts.
Audio power output 1.3 Watts 600 Ohms 250-350 cycles + 2 DVB.
Excellent for use at intercom master station or small paging system.
Contains telephone type mike & earphone.
New, with spare parts $12.95
New, less spare parts 10.95

All prices are F.O.B. our warehouse Philadelphia, Pa.

All merchandise accurate as to description to the best of our knowledge.

Your purchase money refunded if not satisfied.

Minimum order — $3.00

SELECTRONICS

DO IT YOURSELF

K.W. Silicon Rectifier assembly kit—consisting of diodes and resistor capacitor network. Full assembly instructions included. Can be used in either full wave center tap or full wave bridge configuration—up to 3500 volts at 1 amp. $19.95
Higher power kits or custom built units available on request.

BRUTE POWER SOLID STATE SUPPLY KIT

Husky mil. spec. transformer—choke combination to supply HI & LOW Voltage at plenty of current for any of the modern 150-300 Watt P.E.P. Transceivers or Exciters.
At full rated current (300 mils or better) regulation better than 10%. Full instuctions and schematic included.
PRICE: $19.95.

TUBE REPLACEMENTS

DIRECT PLUG IN REPLACEMENT. NO RE-WIRING NECESSARY. At least 60 V more B+ and current capabilities up to 1 amp. D.C. for item #SA.

Replace the following tube types #5Y3, 5U4, 5Y3G, 5Y3GT, 5V4, 5V4GT, 5AU4, 5T4, 5W4, 5Z4, 5AW4, 5V3, 5AS4, 5AX4, 5AZ4.
PRICE: $1.95. ITEM #SA

STUD MOUNT SILICON TYPE 1032

All 5 amps.

200-400 V	price	39c ea.
400-600 V	price	49c ea.
700 V	price	69c ea.
800 V	price	84c ea.
1000 V	price	$1.99 ea.

FILAMENT TRANSFORMERS

Pri: 115 or 230 v. 60 cy. Sec: 6.3 v.c.t. at 6.5a. Cat. #S-7119. Price $1.00

TOP HAT TYPE SILICON RECTIFIER UNITS

(1 amp.) @ 1 MA max. leakage.

100-200 PIV	price 11c ea.
200-400 PIV	price 14c ea.
400-600 PIV	price 24c ea.
600 PIV	price 34c ea.
700 PIV	price 36c ea.
800 PIV	price 38c ea.
1000 PIV	price 49c ea.

FIRING SOLENOID

MK 21 model 1.
115 V 60 cycle 1.5 amp 1¼" Throw
Shpg. Wt., 20 lbs.
Cat. No. S-6724 .... $4.95

FIRING SOLENOID

115 V 60 cycle 1.5 amp 1¼" throw.
Shpg. Wt., 20 lbs.
Cat. No. S-6723 .... $3.95

ELECTROFAX SIGNA GUARD

BRAND NEW—made for banks for encoding savings accounts passbooks. A GADGETEERS DELIGHT.
Partial list of parts:
Dual High Voltage Power Supply using H. V. SELENIUM rectifiers approx. 2000 V.D.C., timing motors, rack and pinion drive system, 2 projection lamps and sockets, objective eye piece lens, fibre optics, cam timer, pilot lights, relays etc.
All this in a betutiful NEW sloping aluminum cabinet.
Shpt. wt. 50# .... Price: $14.95

1206 S. Napa Street
Philadelphia, Pa.
HO 8-7891 — HO 8-4645

beam is a good one and highly directional. When you have found the station, turn your beam onto him and "blast him" as they say. Both Rx must be coupled up to mute and to short out at the antenna terminals.

When you find him, you may find he is working on 14150 and listening on 14270 upwards. Put your beam and Tx and Rx onto 14270 and the other Rx on the ground plane onto his frequency and listen to him talking to find out when to call him. Soon you will catch the station talking to him and vfo onto that station or if very crowded—just off frequency—a few kcs only.

By keeping an eye on both him and the station he is working you can move in quick with split second timing. Slip in your own call sign quickly—once or perhaps twice, talk quickly and clearly. The split second timing is important, most of these expedition hams are very good operators and appreciate good timing and short calls and know their own call signs quite well—it's your call sign they want. During a QSO at a "change-over-to-you" it is quite legitimate to slip in your call—short and quick—and if he says "stand-by" just wait and he will always, nearly always, call you in.

I have been at "both ends" VQ1, VQ3, VQ4, VQ9, giving ssb for the first time in some cases and speak from experience. The U.S.A. hams and the U.K. boys were the best operators—listen to Honor Roll gang for tip-top know-how and slick operating. You never hear them calling long and loud or persisting in calling when they are not sure if the DX is talking or not. They don't hog the frequency and yet they always get their man—in and out quickly to make way for the next man. After getting him, move right off the frequency at least 10 kcs up or down and if you are likely to be called by someone, say as you finish 73's and "moving down 10 kcs".

Bad operating is a pain in the neck and slows up everything. Don't ask the guy for his QRA—you'll hear him give it sooner or later and you can get it from someone else and don't tell him all the details of your shack —get off his frequency and keep it short if there is a queue waiting.

Very often, slipping in quick calls, you will be heard by other stations who will mention it to the DX station as they sign off and you may get a direct call and that's fine, but you may miss the tip-off to get ready with *only one* Rx.

Getting quickly off the mark and getting in quickly is essential. You can say "he will be on the whole week". "I'll look for him later" and you may be right and work him easily when the heat is off but my motto is work him as soon as possible, generator trouble, loss of voice, failure of equipment, have often terminated or handicapped expeditions.

Your manners? Tut! Tut! Listen to the topliners. Most are polite and a pleasure to listen to—very few lids or hogs among these chaps and someone usually puts them in their place if they get too excited and hog the frequency.

It is no good calling the station until you can really hear him. Sometimes the strain and excitement gets the better of the DX hunter and we occasionally hear "I think you came back to me OM—you are 3 & 3—lots of QRM" etc., meantime the DX is talking to someone else. These imaginary QSO's are rather stupid even if they are genuine errors.

Wait and listen or try later on when the band is more open to the DX area.

You will find others keen on DX and you can subscribe to various clubs who air-mail out a weekly bulletin of DX.

As soon as hams know you are collecting countries they will drop in on the frequency to discuss DX with you. You can keep up-to-date and on the alert by listening to many people like PY2CK, 4X4DK, TI2HP, W4ECI, MP4BCC, MP4BBW, who are keen on DX and sponsor DX in some cases. I get most of my help and news from my rivals and I try and give them as much news and help as I can—it's good fun but take it easy and live and let live. Take your holidays and go travelling with the family and work in the DX the best you can without penalizing your family and friends and in case you don't know it—yourself in the long run.

On QSL's—if you are in a hurry send an addressed envelope with enough coupons for air mail postage. You can put U.S.A. stamps on self addressed envelopes if the DX station has a U.S.A. QSL manager. Buying stamps is much cheaper than buying 6 or 7 coupons which is necessary for 1st class air mail in many countries.

If you are a foreign country like me you can, when corresponding, economize by writing and using aerogramme forms at six pence and tacking a 25 cents U.S.A. air mail stamp inside for return postage and perhaps a small gummed self addressed slip which makes it easier for the QSL manager. Always quote your QSO's in GMT. I shall always remember Dick KV4AA giving me hell about it and saying "I ought to know better". How right he was. Checking up thousands of QSL's for Danny would drive you nuts if all QSL's used their local times.

I cannot close this message without allusion to Gus. I hope for the sake of posterity someone has taped 30 minutes of Gus working the pile up on CW and SSB. Some magazine should rent out a tape to all those about to embark on DX expeditions on how to handle a pile up.

To listen to Gus operating is to listen at the feet of a master of DX operating. I shall always remember him saying, "Ok, Ok, Ok, chaps all stations up-ten—all stations up-ten".

The heavy metal brigade moved up ten and called long and loud and I heard Gus mutter "that will take care of the lids" and he proceeded to pick off stations at 3 a minute anywhere except ten up. Work it out. I was trying to work Gus but I collapsed in laughter as soon as I worked it out.

If you are a bit DX yourself you must learn to control the pile ups, right from the start and keep a firm grip. It's kinder and quicker and is appreciated by the good operators.

If you are at say VQ9 for a spell you will get perhaps 500 calls on your tail within minutes.

Just say "W1's only, between 14270-80" and then W2's and so on. They will be delighted and quietly wait their turn (most of them). The only ones to grumble will be the W9 and WØ especially if the band weakens, in which case only work a dozen of each. Don't give your QRA name, Rig, etc., except occasionally —let them listen and find out. You can work at peak openings, three a minute on SSB if you cut out the trimmings—treat it like a contest.

I know it's a chore and lots of people don't like rubber stamp QSO's but there are plenty who do and are grateful for a new country and 20 seconds of your time. To the persistent rag chewer just say "can't stop 'scuse me' " and go ahead with the next one. I have never heard Gus get ruffled or cross—always even tempered and smooth and efficient but he controls the band like an astronaut. Comparisons are odious but I must also mention WØMLY Dick, Danny, Angus, and other experienced astronauts—it's the only word for them! Dick, Angus and Gus have broken into a QSO, apologized for the interruption "just wanted to give you a new country, Robby, hope you don't mind" and then literally disappeared under a welter of QRM, but only for a moment. They wait and they dictate their terms to the mob and are in control in a few minutes. That last method of working a new country—being called by one—is of course the best way of all, why don't you try it!

The old hands who may have read so far will I'm sure, be agreed on these DX problems and the beginner may learn a few things but there are still several things we can do to help.

1. Listen before you call CQ and rag chew, and keep away, when rag chewing, from DX activity and the popular DX sections of the band.

2. 14100 to 14130 is virtually ssb plus ssb DX. Don't rag chew just there, move up to 14160 and 14200. The am boys are fading out but respect the die hards. There is a core of them between 14130 and 14160.

3. On 14200 and 14250 a lot of U.S.A. am hams are still found—let them alone and don't go down there on ssb too often—just yet.

4. 14300 and area is still quite a DX spot and so is 14270. Why not contact your pal and move up 14330 say. You'll notice I don't mention other bands on which these problems don't arise often and have solved themselves but 14 megs is a precious band and needs care to keep it so.

5. When you cross-talk, across town or state why not move onto 28, 21, or 7 or 3.5 megs or VHF, whichever suits and keep off 14 megs.

6. Some U.S.A. DX Clubs have "VHF call links" to swap DX news and information. That is smart and thoughtful, and they help each other to net DX fish. . . . 5Z4ERR

New Products

HQ-145AX

Hammarlund has announced a new version of their very popular HQ-145A, the general coverage 540 kc-30 mc receiver with calibrated electrical bandspread on 80-40-20-15-10 meters, dual conversion above 10 mc, six position crystal filter, slot filter, etc. The new "X" model gives a choice of 11 crystal controlled channels selectable from the front panel for any frequency in the receiver's tuning range. This will certainly be of interest to amateurs who are interested in such fixed channels as MARS, CAP, WWV, CHU, and regular nets. Price $349. Info? Write Hammarlund, Mars Hill, N. C.


New Path Signal Generators

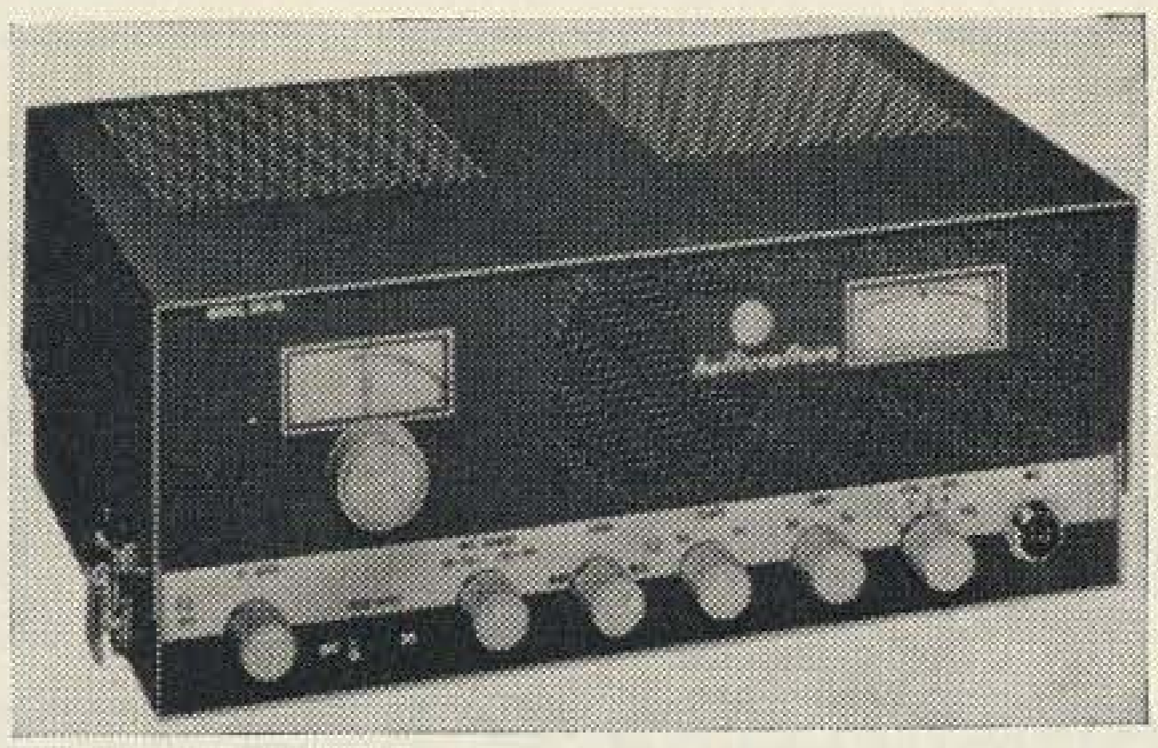
Any one who works with electronics knows how necessary signal generators are. Path products have announced two very nice generators made by the famous Nombrex company of England that will cover the test and experimenting needs of virtually all hams (not to mention labs, service technicians, field engineers and hobbyists). Both are light, compact, durable and stable. Both operate from common 9 volt batteries and are in handsome steel cases with aluminum panels. They are wired, tested and calibrated at the factory, yet sell for no more than tube type generators. The prices include test leads, instructions and battery. Service is provided under the guarantee of Path Products. Be sure to notice the wide coverage of both generators. For information, write to Path Products Corp., 55 Halley Street, Yonkers, N. Y.

Model #27 All Transistor Wide Range RF Signal Generator

Price – $36.25
Range – 150 kc to 350 mc, continuous tuning.
Accuracy–better than 2%.
Modulation – 30% from internal 400 CPS osc.
Outputs – 1) RF: 0.05 volts into 75 ohm load.
2) AF: 1 volt, 400 CPS, sine wave.
Frequency stability – less than 0.2% max. frequency shift due to changes in load; less than 0.4% with battery at 7.5 volts.
Dimensions – 6⅝" x 4⅝" x 2⅝".
Weight – less than 2 pounds.
Controls – tuning, range, off-RF-modulation-AF, RF attenuator, RF out, AF out.

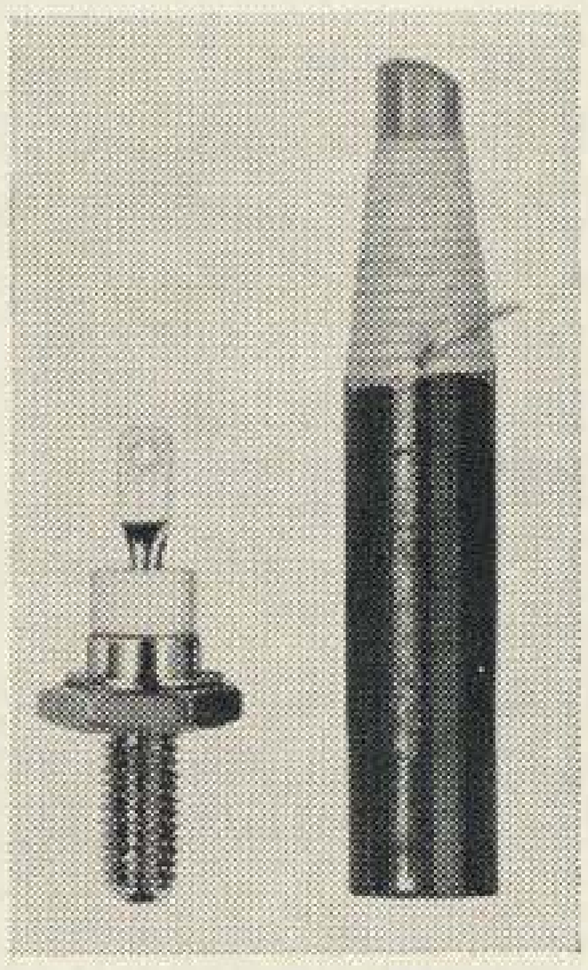
Model #63 All-Transistor Audio Signal Generator

Price – $59.25
Range – 10 cps to 100,000 cps in 4 bands.
Outputs – 1) sine wave.
2) triggered square wave.
Accuracy – within 5%, not affected by battery voltage.
Output level – 1 volt p-p ± 1 db; automatic thermal control.
Attenuators – 3 position step attenuator, continuous variable attenuator calibrated in mv; accurate within 3% of output voltage.
Dimensions – 6⅝" x 4⅝" x 2⅝".
Weight – less than 2 pounds.
Controls – frequency, sine-square wave, range, step attenuator, mv attenuator, output jacks.



VHF Transceivers

Hallicrafters has announced the SR-42 for two meters and the SR-46 for six meters. They both have nuvistor front ends, superhet receivers with dual conversion and a crystal controlled second oscillator, automatic noise limiters, S-meters, and push-to-talk. Both are powered by a combination 115 vac and 12 vdc supply. Both are reasonably priced at $189.95. Further info is available from Hallicrafters, Chicago, Ill. 60624.



New Amperex Varactor

The Amperex H4A varactor with a cut-off frequency of 60 Gc (60,000 mc), offers high power handling capabilities due to its high breakdown voltage of 175 volts and low series resistance. As a frequency tripler the H4A can deliver 25 watts into a 50 ohm load at 144 mc with an efficiency of 60% and 13 watts at 432 mc with an efficiency of 50%. The price is half that of a 5894 or 2C39 and no socket, external power or modulator is required. See October 73 for more information on these fabulous varactors.

Application Report #S-121 "Frequency Multipliers with Varactor Diodes" is available to designers. This report covers theoretical considerations of doublers and higher multipliers and as with all of the excellent Amperex reports, also discusses a number of practical circuits with circuit diagrams, graphs and photos of layouts.

More information can be obtained from Amperex Semiconductor and Receiving Tube Division, Providence Pike, Slatersville, R. I.

YEAR END CLEARANCE SALE

SPECIAL

Linear Amplifier, 1 KW P.E.P. (commercial rating) 2-30 Mc., continuous tuning, in floor type rack cabinet. Local only, cannot ship. Original cost near $2000.00. Our price ... **$495.00**

ANT. COUPLER, CU-362/FRT, 1 KW, 2-30 mc., continuous tuning, 50 ohm coax to balanced line ... **75.00**

MISC. XMITTERS & RECEIVERS

Polycomm, model II, Citizen band transceiver	**59.00**
Starcaster, Citizen band transceiver	**35.00**
Pierce-Simpson, Citizen band transceiver	**59.00**
Polycomm type N, Citizen band, Brand new	**139.00**
Lettine, model #240 or #246 Xmitt. ... each	**39.00**
TBS, 60-80 MC., 100 watts, 6 Mtr.	**24.00**
Mark II, B-29 Xmitter, with 12 V. supply	**29.00**
Sonar, SRT-120, Xmitter	**59.00**
Heath D-35, for 6 meters only	**29.00**
TCS transmitter or receiver	**19.00**
GF-11 or 12 Xmitter, with 3 coil sets	**9.00**
Wilcox F-3 transmitter	**9.00**
MAR, 2 meter portable	**24.00**
Arc. 5, 5.3-7 Xmitter, new	**9.00**
BC 620, FM Xmitter-Receiver, 20-27.9 mc.	**19.00**
Arc. 5, Xmitter for 2 meters	**14.00**
Modulator, RCA MI. No. 22565, 345-485 watts	**49.00**
BC 611, Army Handy-Talky	**25.00**
Tecraft 2 meter converter & 110 V. supply	**24.00**
Sonar CFC, 80-40 Mtr. Exciter & VFO	**19.00**
BC 342, Receiver, less power supply	**40.00**
RBS-RBM, 2-20 mc. Receiver, 110 V. supply	**39.00**
BC 433, Radio Compass Receiver	**15.00**
APR-4, High Frequency Receiver	**49.00**
Military type HRO Receiver, with 3 coil sets	**45.00**
RAK and RAL Receivers	**39.00**
APR-1 Tuning UNITS	**9.00**
MN-26, Radio Compass Receiver	**15.00**
Navy RU type Receiver, with 3 coil sets	**9.00**
Teletype, 11 tube Receiver, with 110 V. supply by Press Wireless	**15.00**
ARKAY short-wave Receiver Kit, 53-18 MC	**15.00**
RDZ, 200-400 MC Receiver, with Ant.-like new	**49.00**
FM-AM - Stereo 80 watt receiver, Crosby R-80 factory close-outs, orig. cost. **$375.00**, our price	**175.00**

MISCELLANEOUS

Brush Development Co. #0A1 Recording amplifier	**$12.00**
Signal Generator I-72-J, 100 KC-32 MC	**10.00**
RT-12/ARC-Z, Transmitter only	**12.00**
Keyer, TG-10-F code	**15.00**
Lettine, Antenna Tuner, new	**18.00**
Amplifier, G.E. 6 tube 25 watt	**12.00**
TG-34 Keyer—for code practice	**19.00**
Norelco #100, portable tape recorder, new	**35.00**
Lafayette RK-133, portable tape recorder, new	**18.00**
Sperry #810, Wattmeter, 200 ohm operation	**15.00**
Kay, Megger Pipper	**10.00**
Variac G.R. 7.5 Amp. 400 cycle, new	**4.50**
Teletype, models 14 & 15 Printers, keyboards, carriage assemblies, motors, covers, etc. What do you need? FIG-H-7000-165	
MAR, Automatic tuning unit with plug-in crystal oven	**9.00**
Coax Cable RG-11/U, 72 ohm, 100 ft.	**7.50**
Geiger Counter, RCA, less geiger tube & batteries	**5.95**
Geiger Counter, same as above, but less meter	**2.95**
Frequency Meter, Navy LM type, new but incomplete, less tubes, Xtal, Cond., Case	**7.00**
Aircraft Torpedo Camera, type 1	**19.00**
QJB, Echo ranging equipment—new in crates, write for details	

POWER SUPPLIES

PE-103, 6-12 V., 500 V.-160 ma.	**$ 8.00**
RA-87, Teletype, 115 V. DC, 115 V. AC	**9.00**
Leece-Neville, heavy duty 6 v. supply	**18.00**
TCS Supply for Xmitter & Receiver, 12 V., 440V.-200 ma., 220 V.-100 ma.	**9.00**
Ameco PS-3, 600 V.-300 ma., 300 V.-100 ma., 12 V. 3 Amp. or 6 V.-4 Amp.	**28.00**
P.E.-219, Battery Charger, 6-12-24 V., new	**12.00**
RA-142, Regulated 30 V. & Regulated 180 V.	**24.00**
Canadian RCA, 10-D/3501 power supply, 500 V.-400 ma., 420 V.-240 ma., 180 V.-240 ma., 180 V.-60 ma., also 12 V. Brand new in crates. Approx. 100 lbs.	**39.00**
Lambda PS-33 supply, regulated 100-200 V. DC-300 ma., 6 V. CT-5 Amp. Reg. & Unreg.	**39.00**

OIL CONDENSERS

8-8-8 mfd.	—	500 V.	**$1.50**
8-8 mfd.	—	600 V.	**1.25**
10 mfd.	—	600 V.	**1.00**
4 mfd.	—	1000 V.	**.75**
.4 mfd.	—	5000 V.	**1.50**
4 mfd.	—	600 V.	**.75**
4-4-4-2-1 mfd.	—	600 V.	**1.50**

ELECTROLYTIC CONDENSERS

9000 mfd.	—	12 V.	**$1.00**
6000 mfd.	—	10 V.	**1.00**
5000 mfd.	—	50 V.	**2.00**
4000 mfd.	—	18 V.	**1.50**
400 mfd.	—	25 V.	**.75**

Minimum order $5.00.

Avoid delay, enclose sufficient postage, excess will be refunded.

Give second & third choice if possible in case first choice is sold out.

Ordering Information:

All items are F.O.B. Hempstead.

25% required with COD orders.

All merchandise guaranteed to be as represented.

ALGERADIO ELECTRONICS CO.

PHONE AREA CODE 516 IV-9-0808
37 GREENWICH ST., HEMPSTEAD, N. Y.

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CAVEAT EMPTOR?

We've had so many requests from 73 readers for a want ad section that we're starting one—against our better judgment. After all, we're dreadfully overworked now and are bound to have even more of a headache handling all those tiny ads. But you say you want it, so please follow these instructions when you submit ads:

- ★ Price—$2 for non-commercial ads; $5 for business ventures. No display ads or agency discount. Include your check with order.
- ★ Type copy on standard size paper. Phrase and punctuate exactly as you wish it to appear. No all-capital ads. Include your signature with order.
- ★ We can only accept ads related to ham radio. 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 and an SASE, we can maintain a reply box for you.
- ★ We cannot check into each advertiser, so Caveat Emptor . . .

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"TAB" FOR THE BEST KITS!

Each "TAB" Kit Contains The Finest Selection!!!

- Kit 35 Precision Resistors
- Kit 75 Resistors 1/2/1&2W
- Kit 12 Electrolytic Cond's.
- Kit 65 Tubular Condensers
- Kit 500 Lugs & Eyelets
- Kit 10 Bathtub Oil Cond's.
- Kit 5 lbs. Surprise Package
- Kit 10 Transmit Mica Cond's.
- Kit 8 Phone/Patch Xfmrs
- Kit 10 Insltd Tuning Tools
- Kit 6 "SunCells" Battys
- Kit 10 Sub-Min Tubes
- Kit 12 Alligator Clips Asstd
- Kit (6) Tube Clamps Asstd
- Kit (32) Transistors PNP & NPN
- Kit (12) 2Amp Stud Rectifiers
- Kit 75 Mica Condensers
- Kit 10 Crystal Diodes
- Kit 200ft Hook Up Wire
- Kit 4 Rolls, 500ft/ea. Assorted Color
- Kit 5 FT243 Xtal Holders
- Kit 10 Xtal Osc. Blanks
- Kit 4 Asstd Rectifiers
- Kit 100 Self/Tap Screws
- Kit Adj Wire Striper & Cut
- Kit Hi Gain Xtal Mike
- Kit 2 pair SO239 & PL59
- Kit 12 Binding Posts Asstd
- Kit (3) TO36/50Watt Untested
- Kit (50) TOPHAT 3/4A/Diodes Untested
- Kit (12) TO3/3A Transistors Untested
- Kit (4) PF/PressFit 18Amp Studs

Order Ten (10) Kits—We Ship Eleven

One Each Above Kit Only. Each Kit 99c

DC 3½"/Meter/RD/800Ma $4 @, 2/$7
DC 2½" Meter/RD/100Ma $3 @
DC 2½" Meter/RD/30VDC $3 @, 2/$5
AC 3½" Meter/RD/130VOC $5 @, 2/$9
DC 4" Meter/RD/1Ma/$5 @, 2/$9

Mica Condsr .006 @ 2500V 4/$1
Snooperscope Tube 2" $5 @, 2/$9
Mini-Fan 6 or 12Vac/60Cys $2 @, 3/$5
4X150 Ceramic Loktal $1.25 @, 2/$2
Line Filter 200Amp/130VAC $18 @
Line Filter 50Amp/250VAC $10 @

Battery Charger 6&12V Charges up to 5Amp "Approved" Heavy Duty Design with Klixon Circuit Breaker. Operates 220 or 110VAC @ 50 or 60 Cys $8

866A Xfmr 2.5V/10A/10Kv/Insl $4 @, 2/$6
Ballentine #300 AC/Lab Mtr. $54
W.E. Choke 4Hy/0.5A/27ohms $4 @, 2/$7
"VARIACS" L/N 0-135v/7.5A $15
"VARIACS" L/N 0-135v/3A $10
TWO 866A's & Fil. Xfmr. $6

SILICON TUBE REPLACEMENTS

0Z4 UNIVERSAL $1.75 @, 2/$3
5U4 1120Rms/1600Inv $3 @, 2/$5
5R4 1900Rms/2800Inv $9 @, 2/$15
866 5Kv/Rms - 10.4Kv Inv $11 @, 2/$20

Transformers All Inpt 115v/60Cys 1100 VCT @ 250Ma, 6V/8A/5V/3A $6, 2/$10
778VCT @ 200Ma, 5V/3A, 6V/5A $4 @, 3/$10
20VAC Taps/4, 8, 12, 16, 20V/4A $4 @, 3/$10
32VCT/1A or 2X16V at 1A each $3 @, 2/$5

Line Filter 4.5A @ 115VAC 4 for $1
Line Filter 5A @ 125VAC 2 for $1
Converter Filter 400 Ma @ 28VDC 4 for $1
Converter Filter Inpt/3A @ 30VDC 4 for $1
2.5MH PiWound Choke/National 5 for $1

"VOLT-TAB" 600Watt Speed Control & Light Dimmer, 115VAC $4.50 @, 2 for $8

UNTESTED "SCR" Up to 25 Amps 6 for $2
Glass Diodes 1N34, 48, 60, 64 20 for $1

"SCR" SILICON CONTROLLED RECTIFIERS!

PRV	7A	16A	PRV	7A	16A
25	.60	1.00	260	2.70	3.00
50	1.00	1.35	300	3.00	3.45
100	1.60	2.15	400	3.75	3.90
150	1.95	2.45	500	4.75	4.80
200	2.20	2.80	600	5.45	5.65

"TAB" THAT'S A BUY

"TAB" Tubes Factory Tested, Inspctd. Six Months Guaranteed! No Rejects! Boxed! GOVT & MFGRS Surplus! new & Used

0A2	.89	6BZ7	1.25	43	.75
0A3	.80	6C4	.45	45	Q
0B2	.65	6C5	.69	50L6	.69
0C3	.70	6C6	1.08	RK59	1.39
0D3	.50	6C8	1.08	RK60	1.17
0Z4	.79	We Trade!		HY69	2.20
1A7	.90	6CB6	.89	75	.81
1B3	.99	6CD6	1.49	HY75	5.00
1L4	.82	6CF6	.85	83V	.95
1R4	5/$1	6CL6	1.40		
We Swap Tubes! What Do/U Have?					
1R5	.78	6CB6	.89	1PR60A	37.50
1S4	.78	6CG8	1.12	4-124A	27.50
1S5	.68	6CM6	.79	4X150G	15.00
1T4	.85	6CS6	.70	4X250B	41.00
1T5	.95	6CU6	1.29	4-400A	41.75
1U4	6/$1	6D6	.99	4E27A	39.00
1U5	.75	6E5	.79	250TL	19.45
1X2	.99	6F4	2.49	307A	2/$1
2C39A	Q	6F5	.63	316A	Q
2C40	5.50	6F6	.99	VR92	5/$1
Send 25c for Catalog!					
2C43	6.50	6F7	.99	388A	3/$1
2C51	2.00	6F8	1.39	350A	2.45
2D21	.65	6H6	.59	350B	1.75
2E22	Q	6J4	1.72	371B	.95
2E24	Q	6J5	.59	6146	3.90
2E25	2.50	6J6	.59	416B	16.00
2E26	Q	6J7	.99	450TH	43.00
2E30	Q	6J8	1.39	450TL	43.00
2E35	1.60	6K6	.59	460	11.50
2K25	9.75	6K7	.79		
All Tubes Stocked at Low Prices!					
2K26	34.00	6K8	.99	703A	Q
2K28	30.00	6L6	1.19	707B	3.50
2V3	2/$1	6SN7	.72	715C	10.90
2X2	.48	6T8	.98	717A	5/$1
3A4	.70	6V6GT	.90	723AB	5.00
3A5	1.00	6X5	.49	725A	2.75
3AP1	Q	12AT6	.59	803	3.50
3BP1	Q	12AT7	.89	804	8.85
3C24	3.50	12AU6	.63	805	6.00
3D23	3.95	12AU7	.69	We Trade!	
We Buy!		We Sell!			
3E29	6.00	12AX7	.79	807	1.10 5/$5.
3Q4	.68	12AY7	1.29		
3Q5	.86	12B4	.95		
4-65A	13.50	12BA6	.65		
4-125A	27.50	12BA7	.99	811	Q
4-250A	34.00	12BD6	.59	811A	Q
4X150A	Q	12BE6	.59	812	Q
4X250	36.00	12BH6	.79	813	9.95
4X500	Q	12BH7	.99	815	1.75
5AP1	2.95	12BY7	1.00	826	Q
Wanted Test Sets and Equipment					
5BP1	Q	12BZ7	.99	828	9.00
5BP4	7.95	12H6	.75	829B	8.00
5CP1	Q	12J5	.69	832A	6.00
5CP7	9.00	12J7	.69	833A	36.00
5R4	1.00	12J8	1.35	837	Q
5T4	.90	12K8	.89	866A	2.25
5U4	.99	12SA7	.69	954	Q
5V4	.89	12SC7	.89	955	3/$1
5Y3	.60	12SF5	.69	957	3/$1
5Z3	.89	12SG7	.89	958A	2/$1
Send 25c for Catalog!					
15GP22	89.00	12SH7	.89	991	5/$1
6A7	1.00	12SJ7	.75	1614	2.75
6A8	.99	12SK7	.75	1619	5/$1
6AB4	.59	12SL7	.79	1620	2.00
6AC7	.72	12SN7	.69	1626	3/$1
6AG5	.65	12SQ7	.69	1626	5/$1
6AG7	.75	12SR7	.69	1629	4/$1
6AK5	.69	15E	1.19	1050	1.25
6AL5	.55	15R	4/$1	5517	1.25
6AQ5	.66	FG17	Q	5608	3.95
Top $$$ for 304TL, 811A, 812A, 813					
6AR6	1.95	19T8	1.16	5618	3.25
6AS7	3.49	24G	Q	5651	1.35
6AT6	2/$1	25A6	1.19	5654	1.20
6AU6	.79	25A7	2.19	5656	4.25
6B8	1.35	25C5	.81	5663	1.15
6BA6	.59	25L6	.72	5670	.90
6BE6	.59	25T	4.00	5686	1.75
6BG6	1.49	25Z5	.72	5687	1.15
6BH6	.79	25Z6	.75	5691	4.70
6BJ6	.72	26A7	3.69	5725	1.95
Top $$$ Paid for XMTTR Tubes!					
6BK7	.99	FG27	8.28	5732	2.00
6BL7	1.35	HV27	19.39	5736	85.00
6BN4	.69	28D7	.89	5749	1.95
6BN6	1.08	FG33	15.00	5750	2.75
6BN7	1.99	EL34	3.49	5751	1.25
6BQ6	1.19	35A5	.69	5814	1.20
6BQ7	.99	35L6	.59	5879	1.20
6BX7	1.11	35T	4.49	5894	12.00
6BY5	1.19	35Z5	1.25	No See—	
6BZ6	.91	RK39	2.99	Write!	

"TAB" * SILICON 750MA DIODES

NEWEST TYPE! LOW LEAKAGE

Piv/Rms	Piv/Rms	Piv/Rms	Piv/Rms
50/35 .05	100/70 .09	200/140 .12	300/210 .14
400/280 .15	500/350 .19	600/420 .23	700/490 .27
800/560 .35	900/630 .45	1000/700 .65	1100/770 .75

GTD ALL TESTS AC/DC & LOAD!

1700 Piv/1200 Rms @ 750 Ma/$1.20 @. 10/$10
Same 1100 Piv/770 Rms 75c @, 16/$11
3 Kv/2100 Rms @ 200 Ma/$1.80 @, 6/$10
6 Kv/4200 Rms @ 200 Ma $4 @, 3 for $10

"TAB" * TRANSISTORS * SCR's * DIODES!!

GTD! FACTORY TESTED — FULL LEADS.

PNP 100Watt/15 Amp HiPower TO36 Case! 2N441, 442. 277. 278. DS501 up to 50 Volts/ VCBO $1.25 @, 5 for $5. 2N278, 443, 174 up to 80V $3 @, 2 for $5.
PNP 30 Watt, 2N155, 156, 235, 242, 254, 255, 256, 257, 301, 392, 35c @, 4 for $1.
PNP 2N670/300Mw 35c @, 4 for $1
PNP 2N671/1Watt 50c @, 3 for $1
PNP 25W/TO 2N538, 539, 540, 2 for $1
2N1038 6/$1, 1039 4/$1, 1040 $1
PNP/TO5 SIGNAL up to 350Mw 25c @, 6 for $1
NPN/TO5 SIGNAL IF, RF, OSC 25c @, 6 for $1
Silicon PNP/TO5 & TO18 Case 25c @, 5 for $1
2N1046/$1.40 @, 3/$4. 2N1907/$2 @. 4/$6
Power Heat Sink Finned Equal to 100 Sq" Surface $1 @, 6 for $5
TO36, TO3, TO10 Mica Mtg Pckg 30c @, 4/$1
Diode Power Stud Mica Mtg Pckg 30c @, 4/$1
ZENERS up to 1Watt 6 to 200v 70c @, 3/$2
ZENERS up to 10Watt 6 to 150v $1.45 @, 4/$5
ZENERS 1Watt/5% Tolerance $1.25 @, 3/$3
ZENERS 10Watt/5% Tolerance $2 @, 3/$5
ZENER Kit Asstd up to 10w 3 for $1
STABISTORS up to 1watt 5 for $1

TRANSISTORS—TOO MANY! NO CAN TEST!

Untested Pwr Diamonds/TO3 10 for $1
Untested TO36 up to 100Watts 3 for $1
Untested TO5/SIGNAL/sistors, 20 for $1
Untested Power Diodes up to 35 Amp 4 for $1
Untested Pwr Studs up to 12Amp 12 for $1

D.C. Power Supply 115v/60 to 800 Cys. Output 330 : Tap 165V up to 150Ma, Cased—Size—SPECIAL $5 @, 2 for $9

SILICON POWER DIODES * STUDS P.F. *

DC AMP	50Piv 35Rms	100Piv 70Rms	150Piv 105Rms	200Piv 140Rms
3	.08	.14	.17	.24
12	.30	.55	.70	.85
18*	.20	.30	.50	.75
35	.70	1.00	1.50	2.00
100	1.65	2.05	2.50	3.15
240	3.75	4.75	5.75	8.75

DC AMP	300Piv 210Rms	400Piv 280Rms	500Piv 350Rms	600Piv 420Rms
3	.29	.30	.40	.48
12	1.00	1.35	1.45	1.70
18*	1.00	1.50	Query	Query
35	2.15	2.45	2.75	3.33
100	3.75	4.60	5.50	8.00
240	11.70	17.10	23.94	29.70

*P.F. PRESS-FIT AUTOMOTIVE TYPE!

18 Amp Press Fit up to 200Piv 4/$1
2 to 3 Amp Studs up to 600Piv 6/$1
35 Amp Studs 150 to 200Piv 5 for $5

We Buy, Sell & Trade

SEND 25c FOR CATALOG

"TAB" Terms Min Order $3 FOB New York. 10 Day Gtd. Our 18th Year.

111NJ Liberty St., N.Y. 6, N.Y. Re 2-6245

Propagation Chart

EASTERN UNITED STATES TO:

GMT -	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7	7	7	7	7	3	3	3#	7#	14	14	14
ARGENTINA	7*	7#	7#	7	7	7	14	14	14	21	21	14
AUSTRALIA	14	7#	7#	7#	7	7	7	14	14	14	14	14
CANAL ZONE	7	7	7	7	7	7	7	14	14	14	14	14
ENGLAND	7	7	3	3	3	7	14	14	14	14	7#	7
HAWAII	14	7#	7	7	7	7	7	7#	14	14*	21	21
INDIA	7	7	7#	3#	3#	7#	14	14	7#	7#	7#	7
JAPAN	7*	7#	7#	7	3*	3*	7	7	7#	7#	7#	14
MEXICO	7	7	7	7	7	7	7	14	14	14*	14	14
PHILIPPINES	7*	7#	7#	7#	7#	7	3	7	7#	7#	7#	7
PUERTO RICO	7	7	7	7	7	7	7*	14	14	14	14	14
SOUTH AFRICA	7	7	7	7#	7#	7#	14	21	21	14	14	7*
U. S. S. R.	7	3*	3	3	7	7#	7*	14	7*	7#	7#	7
WEST COAST	14	7	7	7	7	7	7	14	14	21	21	14

CENTRAL UNITED STATES TO:

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

WESTERN UNITED STATES TO:

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

Very difficult circuit this hour.

* Next higher frequency may be useful this hour.

Good: 3-5, 8-10, 12-16, 21, 22, 24-31
Fair: 1, 2, 6, 11, 17, 19, 23
Poor: 7, 18, 20
Es: 4, 8, 15, 16, 26

J. H. Nelson

LEO SAYS: BUY DIRECT AND *SAVE BIG* ON THESE *WRL HAM EXCLUSIVES*

Leo I. Meyerson
WØGFQ

NEW

WVG MARK II ALL BAND VERTICAL ANTENNA

Low cost — self-supporting 10 - 80 meter antenna. Tunes 3.5 — 30 Mc with manual tap adjustment. Feed with 52 ohm coax. Quick installation. Amazing efficiency for DX or local contacts. Used as portable antenna also.

$15.95
Postpaid
Continental USA

MECHANICAL SPECS:
Overall ht. — 18′. Tubing diameter — 1 1/4″ to 7/16″. Max. unguyed wind survival — 50 mph. — Mtg. bracket for 1⅝″ mast. Wt. 5 lbs.

ELECTRICAL SPECS:
Maximum power: 1000 watts AM or CW — 2 KW PEP. Omnidirectional. Vertical polarized.

TECH-CEIVER 6A

Low cost, compact, 6 meter transceiver

Stable superhet receiver. 5 watt transmitter, featuring PTT, using std. (Ft 243) 8 Mc range xtals, non-critical coils, plate modulation, power and modulation indicators, 10 tube performance. Step-by-step manual included. Wt. 9 lbs. 115 VAC Power supply (kit) — **15.95.**

only $39.95 kit

- **5 Watt input**
- **Sensitivity — better than 1 UV**
- **Selective — 20KC @ 6DB points**
- **49-54 Mc coverage**

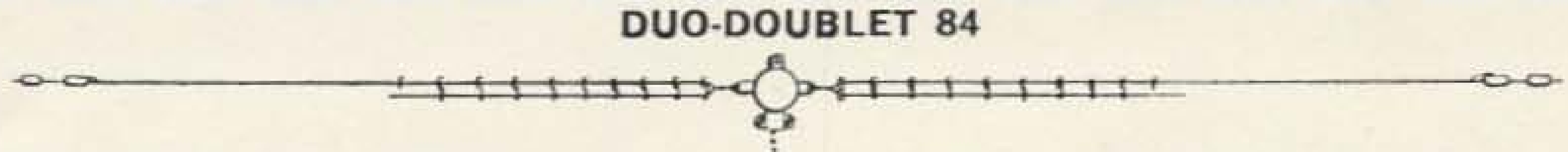
PSA-63 POWER SUPPLY

Universal Power Supply: Powers most AM rigs up to 100 watts, SSB units — up to 200 watts, PEP. Silicon rectifiers provide both 300 VDC & 600 VDC @ 300 Ma., ICAS (210 watts total), plus 6 VAC @ 10A or 12 VAC @ 5A, plus 95 VAC @ 10 Ma. Size 11¼″ x 4¾″ x 6″. Wt. 15 lbs. Kit — **24.95,** Wired — **39.95.** Opt'l cabinet — **4.95.**

only $24.95 kit

- **Use with 30-200 watt XMTRS—XCVRS**
- **Dual voltage B + Fil. power-bias**
- **Customized units available—Extra**

DUO-DOUBLET 84



NEW 80-40 meter diapole using proven parallel diapole principle to resonate on both bands. Requires only one 52 ohm feed line (coax not supplied). Kit includes wire, insulators, center connector & full instructions. Complete formula supplied & quick graph chart for easy adjustment. May be used on **15 meters also.** SWR: Better than 2:1 at resonance — 80/40. Max. length — 123 ft.; 140 ft. for lowest CW range. Easy to install. Wt. 4½ lbs. Shipped Parcel Post.

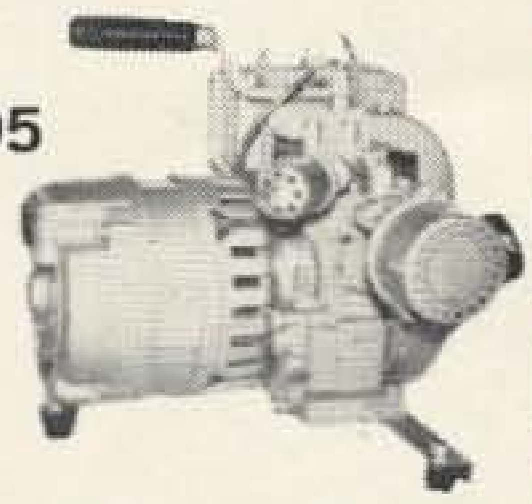
80-40 Meter Diapole
One Feed line

$7.95

NEW

WRL'S 12R GENERATOR

$149.95



Shielded ignition. 1250 Watts, 115 VAC, 60 cy., 77 lbs.
(FOB Milwaukee, Wisconsin)

SS-3 "Q" MULTIPLIER

- **Notch and peak**
- **Self Powered**
- **One simple receiver connection**

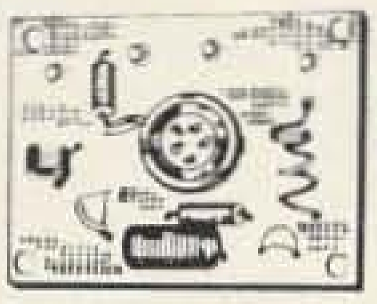
Int'l 115 VAC P.S. Plugs into Collins 75S-1, KWM-2 & others. Use with receivers having 455KC-IF: AC or DC powered. Adj. selectivity: 300 cy. to 10 KC. Sharp rejection (50DB) null for hetrodynes. 6¼″ x 4¼″ x 4¾″.

$15.95
kit

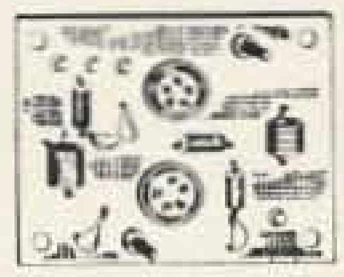
ANTENNA TUNER MM-100

$10.95
kit

Specifically designed to match end-fed long wire which is ½ wave, or multiples thereof, to 50 ohm transmitters. Panel lamp indicator. For inputs up to 150 watts SSB, 100 watts CW, 75 watts AM. 4 x 5 x 4 steel case. Reduces TV1.



$4.98 **$6.37**



WRL NUVISTOR PREAMP PRINTED CIRCUITS

PA50-2 Stage preamplifier for 6 meters. Use 2 RCA 6CW4 nuvistors. Highest grade glass epoxy board. Assembled and pre-aligned for 50 ohm input-output. Requires 60-120 VDC @ 10 MA. & 6.3 VAC
Size 2¾″ x 2¼″. Wired **$6.37**
PA-144 Same as above except only 1 6CW4 nuvistor & for 2 meters. Wired **$4.98** (less 6CW4 tubes).

WRL

WORLD RADIO LABORATORIES, INC.
3415 West Broadway
Council Bluffs, Iowa 51504

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six pack

National offers six of the world's finest receivers to meet *your* particular requirement.

Receiver number one provides greater amateur band performance and features than any amateur receiver ever built. ■ Receiver number two has the widest frequency range (from 5 Kc to 30 Mc) of any general coverage communications receiver ever built for lab or commercial application. ■ Receiver number three is *completely* solid-state for high reliability, versatility and portability. It operates from 12/24 V.D.C. or 115/230 V.A.C. This receiver draws less current than a couple of dial lamps (when its dial lamps are switched off), and provides instant-on operation. ■ Receiver number four incorporates specific features for high selectivity and has a six-pole filter to provide built-in steep-skirted 500 cps, 2.5 Kc, 5.0 Kc, and 8 Kc bandwidths with *passband tuning* for CW and SSB. Also *AGC threshold control* to knock out background QRM. Also a 50 db notch filter. ■ Receiver number five has a phase-locked frequency synthesizer to replace conventional high frequency oscillator crystals for superior stability and over-all calibration. ■ Receiver number six offers frequency meter performance with 1 Kc dial calibration and accuracy over its entire tuning range, 24 feet of bandspread per megacycle, and 10 Kc per turn tuning rate.

Each of these receivers is called the HRO-500. National's new HRO-500, at $1295, is the finest *total* receiver you can buy . . . at any price. Interested in trying out National's new sixpack? See your National dealer for an opener.

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