AMATEUR RADIO

73

May 1962

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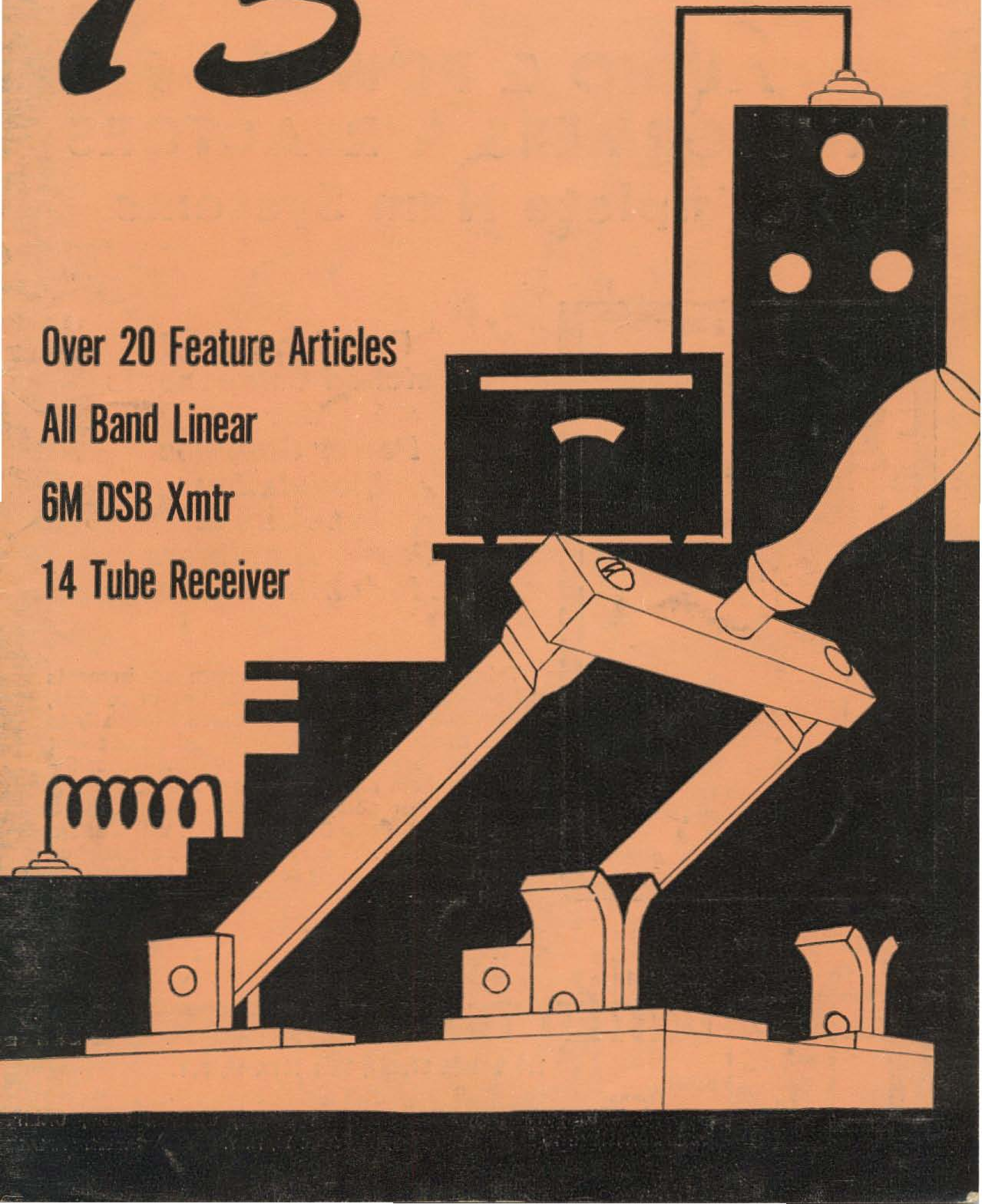

Over 20 Feature Articles

All Band Linear

6M DSB Xmtr

14 Tube Receiver

73 Magazine

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. . . de W2NSD

. . . never say die

Awards

A letter from OH2YV got me to mulling over the part that Certificates and Awards play in our hobby. Somehow I had never really thought about this before. Like many other fixtures of life I just accepted them as being there. Now I've begun to realize how much these things actually dominate ham radio.

What would operating be like if there were no awards? Would it then be possible for a DX station to get on the air and have a half hour contact with us without being hounded by hundreds of DX-hunters, all driven by their DXCC listing? Would not the now familiar snappy 30 second DX QSO be a thing of the past without the pressure of these awards? Might not DX operators assume identities instead of just being call letters to us if we had an opportunity to talk to them about anything other than their QSL and our QTH? Maybe not. Maybe we would keep on trying to work more and more DX stations even without the monthly ARRL treadmill of newly invented countries.

Since there is absolutely nothing that can be done about this to change it or to rescue those operators who have turned their whole lives over to staying high on the "list" perhaps I would do better to peck at the fringes of the problem. The Certificates Industry has gotten way beyond the ridiculous now with over a thousand being available. Almost every day I get in a sample certificate from a club or group of operators, adding to the toppling pile. Is there anything we can do to bail ourselves out from under this growing mountain?

One solution is to take up arms against this thing and fight it at its source. You can lean (through the mail) on the amateur publications and make them stop giving free publicity to these awards. This will quickly stunt the present runaway growth of this nuisance. Perhaps we should form a Certificate Haters Club (CHC) and have our own Certificate?

Perhaps I am too reactionary. Maybe we should just try to clean house a bit and settle down with a dozen good internationally acceptable awards to go after? It may be that I will stir up a hornet's nest with this attack on so fundamental a part of our hobby. I know that hundreds of operators are all hung up on awards and are certain to be pretty emotional when something so dear to their heart is treated like this. Should such a sentiment develop I believe I am ready for it. I have for some time been working on a fabulous award to be made available by 73 Magazine. This award is one of such scope as to placate the most irate certificate hunter. Aha, I think I've got you trapped . . . you want to know more about the Award To End All Awards. Let me tell you about it.

A few months ago I read with incredulity about a newly proposed award which would encertificate people on the basis of the number of counties they contacted. My first reaction was that this must be a joke. Then, when it was obvious that this preposterous thing was being seriously proposed I felt sure that everyone would just give it the horse-laugh and it would die a natural death. Alas, I did not reckon with the effectiveness of modern advertising, which was able to whip a shuffling sort of life into even such a Frankenstein as this. My sporting instinct was aroused. I would concoct an award so unbelievable that no amount of advertising would be able to get anyone to take it seriously.

This one would be an award to dwarf my previous successes in the certification field which reached such minor pinacles as the resurrection of the WAZ award, which I saved from premature extinction in 1955, the almost forgotten TT-100 for RTTY'ers who contacted 100 other RTTY stations, the still going (I think) sideband country awards for SSB-50, SSB-75, SSB-100, etc., etc. Possibly my best effort to enslave the certificate seekers was the WPX award, complete with its own record booklet, a nice little money-maker. With this background, how could I fail to come up with a new winner?

The new award would have to be one which would be accessable to every licensed amateur. It would have to be one which would have many facets to suit the varied operating interests which go to make up ham radio. It would have

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to be universal and not discriminate against anyone on the basis of color, creed, or lack of intelligence. It would have to take into consideration that QSL's are almost impossible to depend on for confirmation. And still, with all of these seeming limitations, this must be an award of heroic proportions.

I hope you haven't sold me short. I have devised an award which is awe inspiring in its scope and which overcomes all of the previously mentioned limitations. It also satisfies several obvious but unmentioned prerequisites such as requiring a record booklet which we can sell at an enormous profit and having a nominal charge for the certificates which may eventually support the whole magazine and allow us to give 73 away free to all winners for life. Details on this magnificent award will be announced in an early issue of 73, in the meanwhile I suggest that you get on all bands and contact as many stations as you can, making each contact a minimum of 30 minutes (GMT) long. Neatness counts.

The Old Man

Perhaps I am just too inculcated with ARRL lore, but I bridle every time I see someone trying to call himself The Old Man. This title should, I think, be reserved in perpetuity for Hiram Percy Maxim, the founder and long time leader of ARRL. I, for one, would welcome an occasional reprint of some of Maxim's old editorials. He was an excellent writer and I doubt if the years have weakened his messages much. Those of you with library cards can look up his wonderful book "A Genius in the Family." This, to me, is one of the all-time greats in humorous writing. Is anyone with me for keeping ham radio with just one OLD MAN? Or am I out here all alone on the high end of twenty with the band closed?

Technician

Volume 1, Number 2 (the first I've seen) of The Technician came in the other day unheralded. This is a nicely done bulletin and is interesting to read. The price is $2 per year and it comes out monthly. Write to The Technician, Box 465, Billings, Montana. The motto of the bulletin seems to be, "I'm proud to be a Technician."

May Last Year

Though we were still running only 64 pages last year, we made up for the shortage of paper (due to a lowness of advertising) by running quite a lineup of good articles. We still have a few copies of this choice issue available at 50c per.

The most popular article in the issue was the extremely simple sideband exciter by W2NQS. This one uses a pair of the 7360 tubes and almost everything is built on a couple of vector type sockets. W8VVD's article on his

(Turn to page 92)

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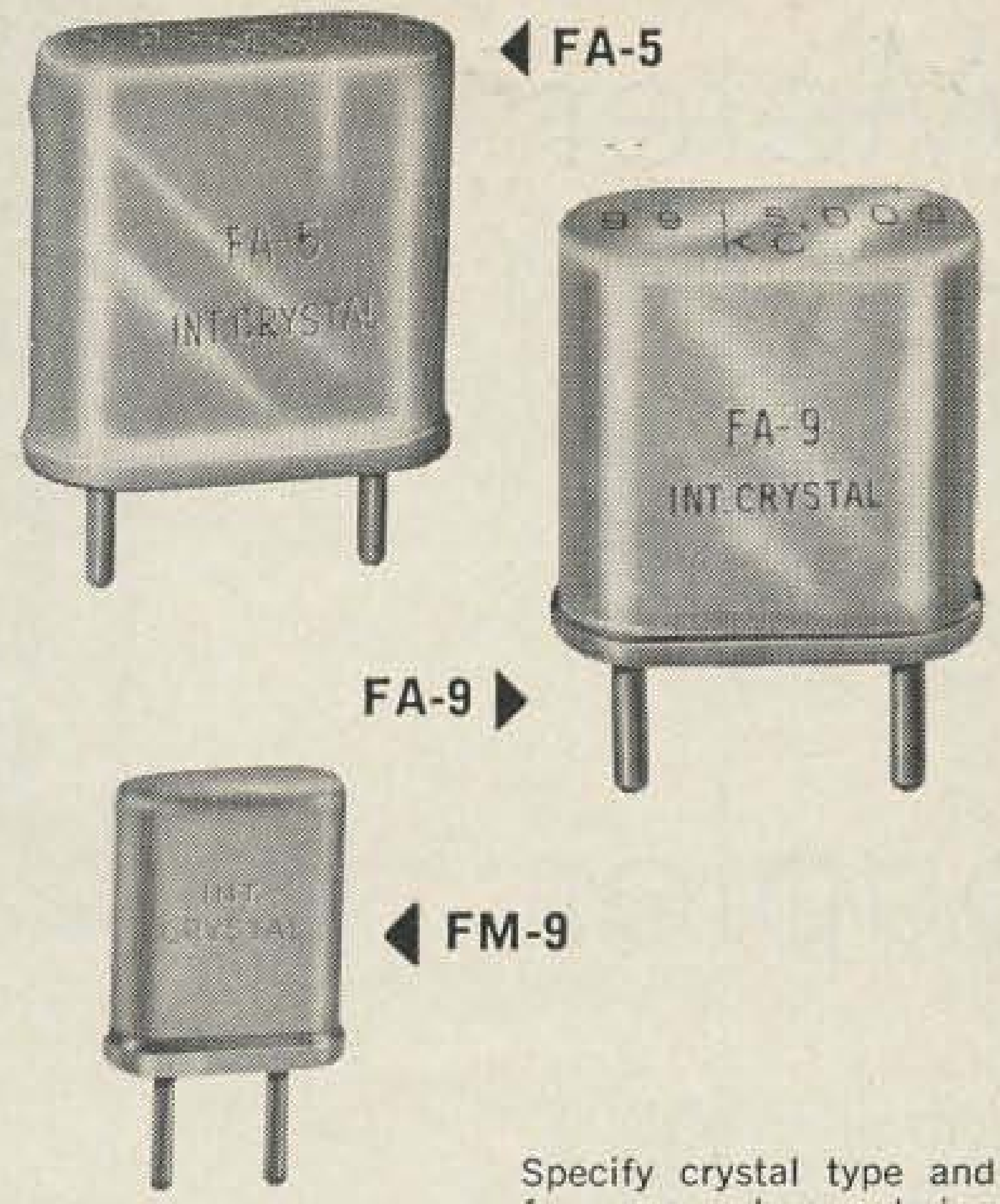

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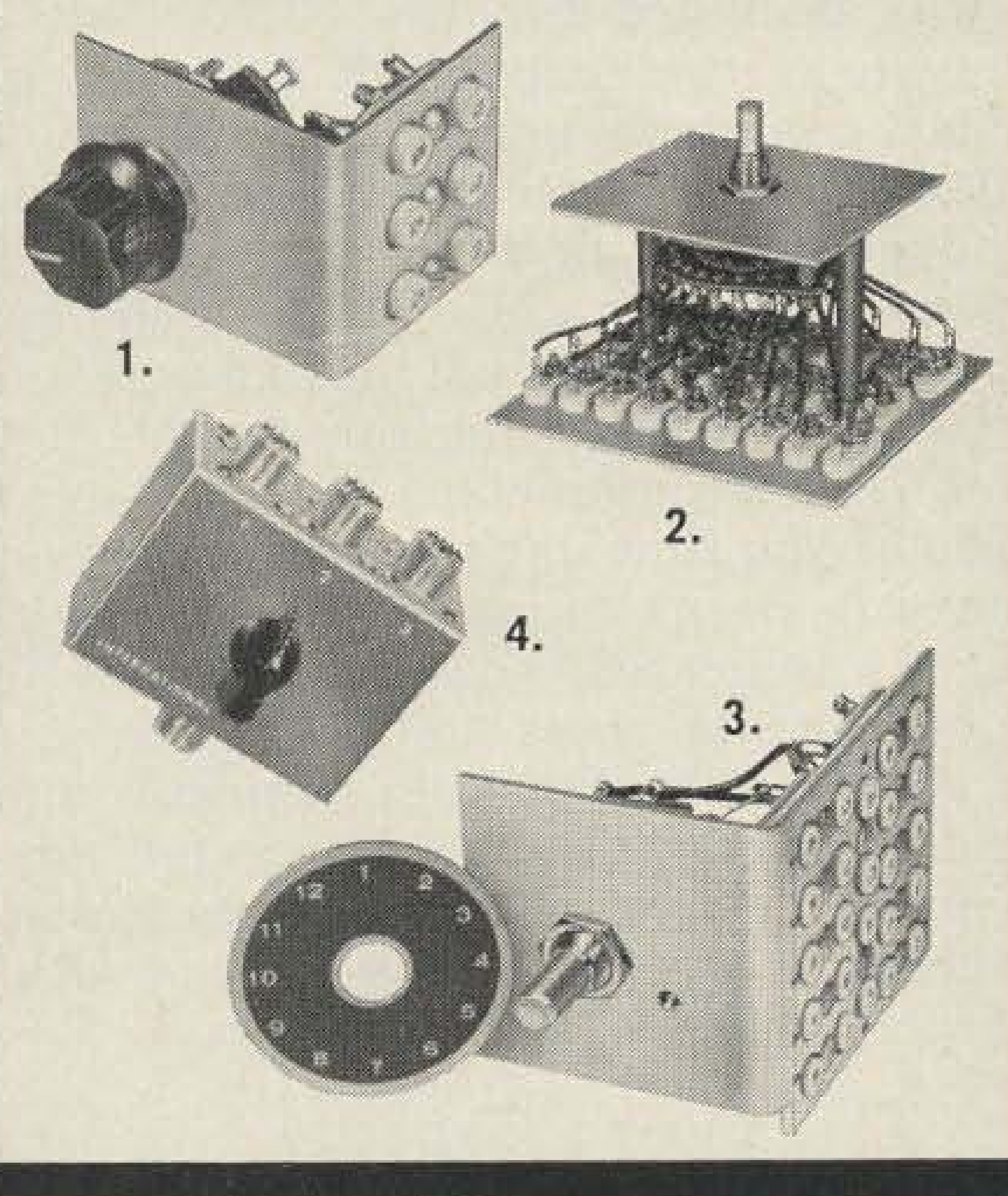

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2 Meter Tank and Coupler

Photo showing the "Echo" 144 meter transmitter using this High Q Power Amplifier.

John Wonsowicz W9DUT
4227 North Oriole Avenue
Chicago 34, Illinois

All pictures taken by Howie Trieb KN9EBP.

THE tank circuit about to be described is not new. It was used by the author on 112 mc more than 15 years ago. However, the merits of this tank warrants the re-use of this design in the higher frequency spectrum, even above the two meter range.

As shown in the photo and drawings, the tank was designed for the 832-A, but other tubes such as the surplus 3E29 or its equivalent 829B can make use of this design by cutting down the tuning capacity and shortening the inductor. The unit is easy to build, requires no soldering, and can be made in L C ratios to meet individual designs. Q of this circuit is very high; being comparable to tuned lines of 7/16" in diameter.

Those of you that like to make Chinese copies will have to resort to modifying the tuning capacitor as indicated. Others, who like to roll their own, from start to finish, can use the basic idea for further development and improvement of such circuits. Space for this tank is no problem since the aluminum horse shoe can be bent to various configurations with little sacrifice in efficiency.

Tuning Capacitor

The capacitor used, which by the way is the only one suitable for this design, is a Hammarlund MCD-35-SX double spaced dual stator variable capacitor. It is a straight line capacity model with maximum capacity of 31 mmfd. This capacitor can be used, and was used without modification in a 144 mc transmitter with a smaller horse shoe tank but for best L C ratio and ultimate efficiency it should be modified by removing plates which is quite simple. Using a small metal coping saw or a hacksaw blade cut away the two outside plates of each stator, then using a fine file smooth out the solder burrs on the shaft and file off all rough edges around the cuts. The capacitor is now duplicated.

Inductor

The horse shoe inductor is made of 1/16 inch aluminum plate cut to dimensions, as shown on the drawing. Follow the dimensions closely; however, the finished project doesn't have to be exact since the above mentioned capacitor enables some overlap of the 144 mc band at both ends. When the inductor is cut out and the saw marks are filed smooth, use a fine texture of steel wool for polishing and rounding all sharp corners and edges. Due to surface currents in VHF region, known as the skin effect, it is worth the effort to do this bit of extra work for the sake of higher efficiency. Of course if you want the ultimate, the inductor could be made of sheet copper and then silver plated; but for the average ham the aluminum tank is quite satisfactory.

When the inductor is finished, slide it under the stator plates by loosening the four screws on the bottom of the ceramic base. Before tightening the screws, cut two ribbons ½ inch wide out of aluminum foil, or copper ribbon, to dimensions indicated on the drawing and insert them under the stator plates at the opposite end of the horse shoe tank; then tighten the screws, making it a complete assembly as shown on the photo. Before you set aside this unit be sure to elevate the front and back bearing plates of the tuning capacitor by removing the screws and inserting shims under each of the same thickness as the inductor. Otherwise the minimum capacity of this unit will be too high and reaching the high end of two meters may be impossible.

Plate Caps

For the tube pin connection, a piece of ½ inch round aluminum stock is cut ⅜ inch long and a No. 53 drill used to drill a hole in the center to accommodate the plate pins of the 832A. Through the side of the ⅜ inch piece a 6-32 tapped hole is made in the approximate center for securing it tightly to the plate pins. On top of this ⅜ inch piece, another ½ inch diameter disc ⅛ inch thick is secured to the ⅜ inch piece by 2-56 screws located 120 degrees apart. Between these two discs the ½ inch wide ribbon leading from the tuning capacitor is placed and tightened. In this fashion uniformity is carried right through.

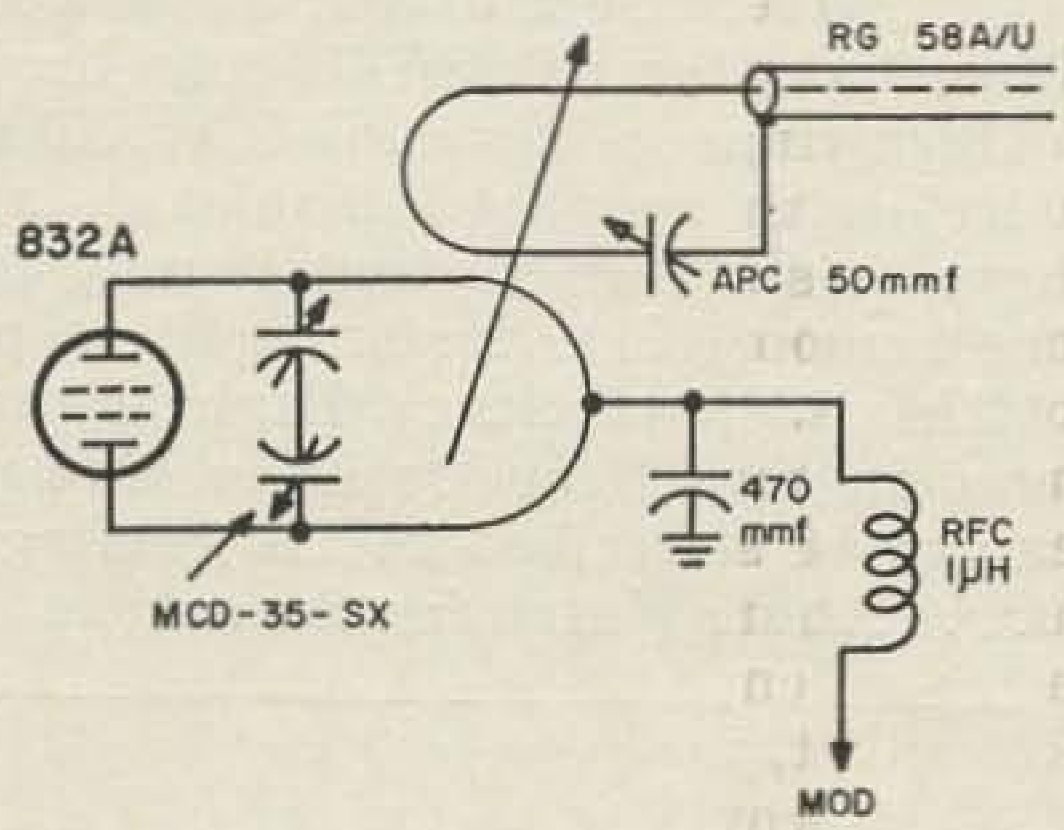
The assembled unit can be mounted by several methods to suit individual arrangement.

Antenna Coupler

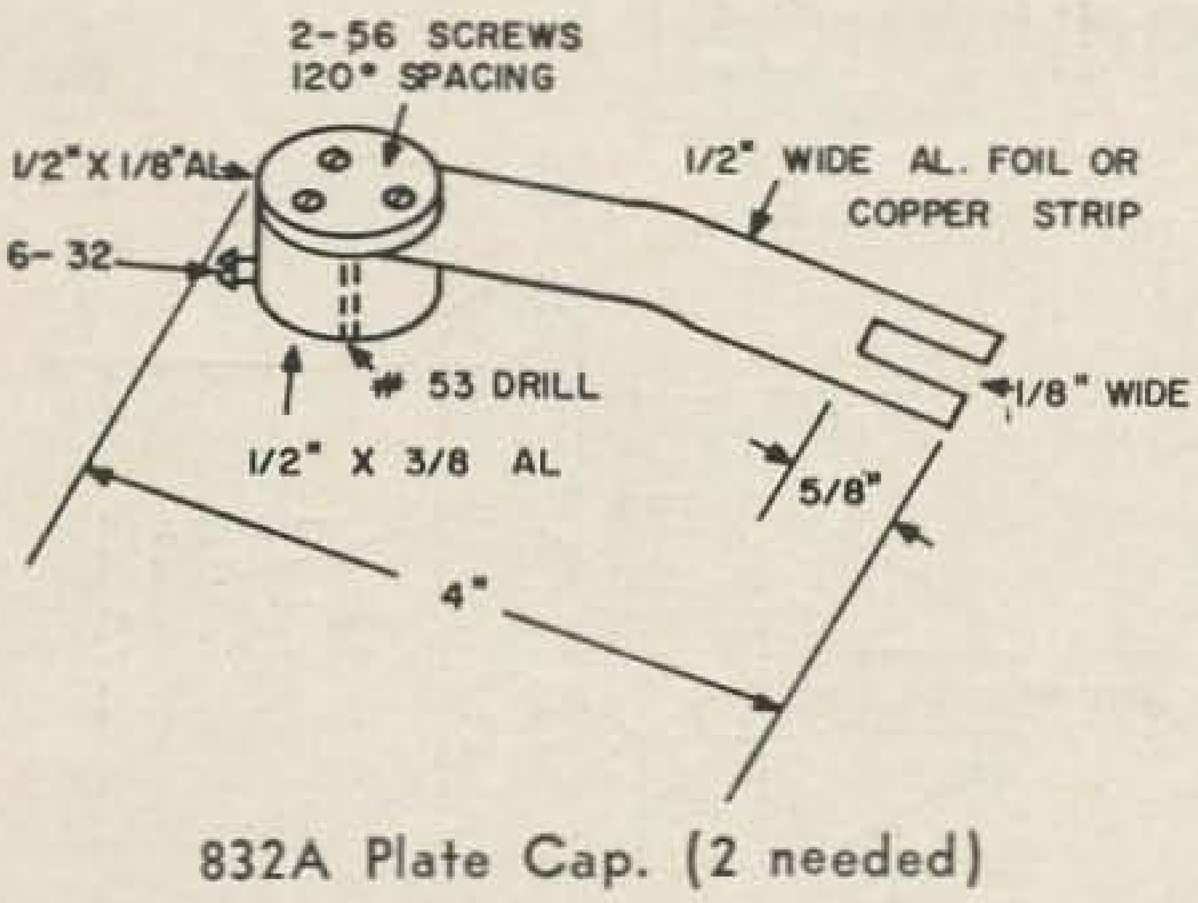
One of the most awkward pieces on VHF transmitters is the pick-up loop. There are numerous ways of arranging components, but they all seem to be awkward in doing the job. Several attempts were tried to simplify this gadget and the one herewith shown seemed to be ideal. It was built as a separate package with all components nicely grouped, as shown on the photo.

Construction

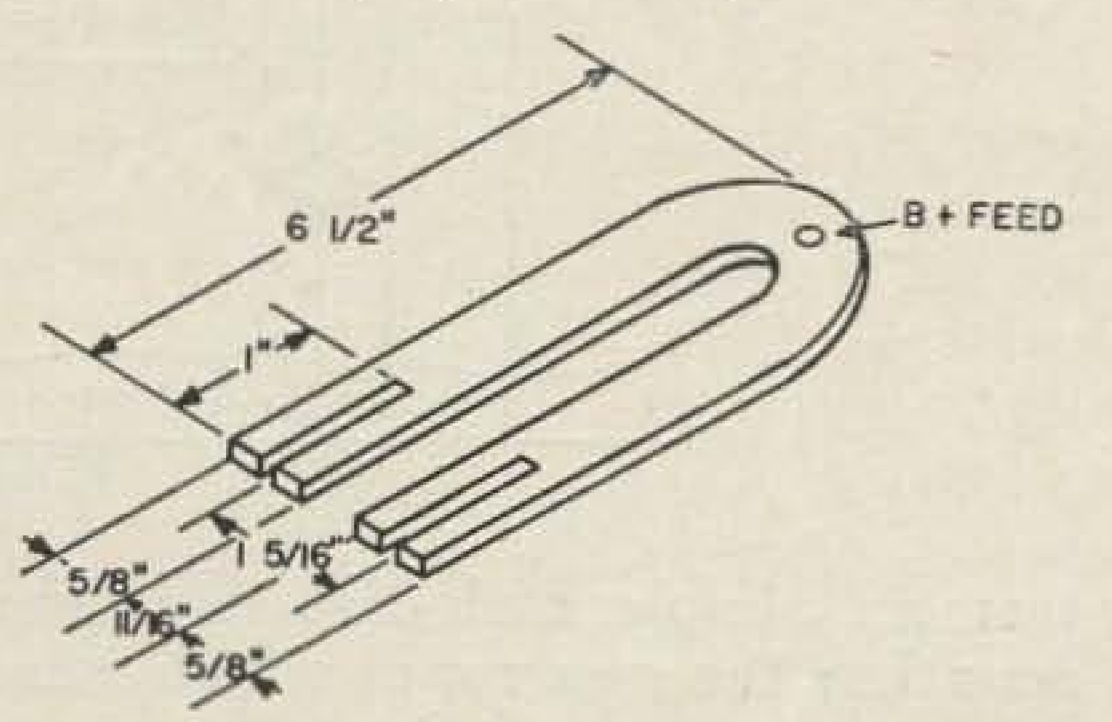
The main part of the pick-up loop is the



Tank Circuit Schem.



832A Plate Cap. (2 needed)



144 MC. High Q Tank

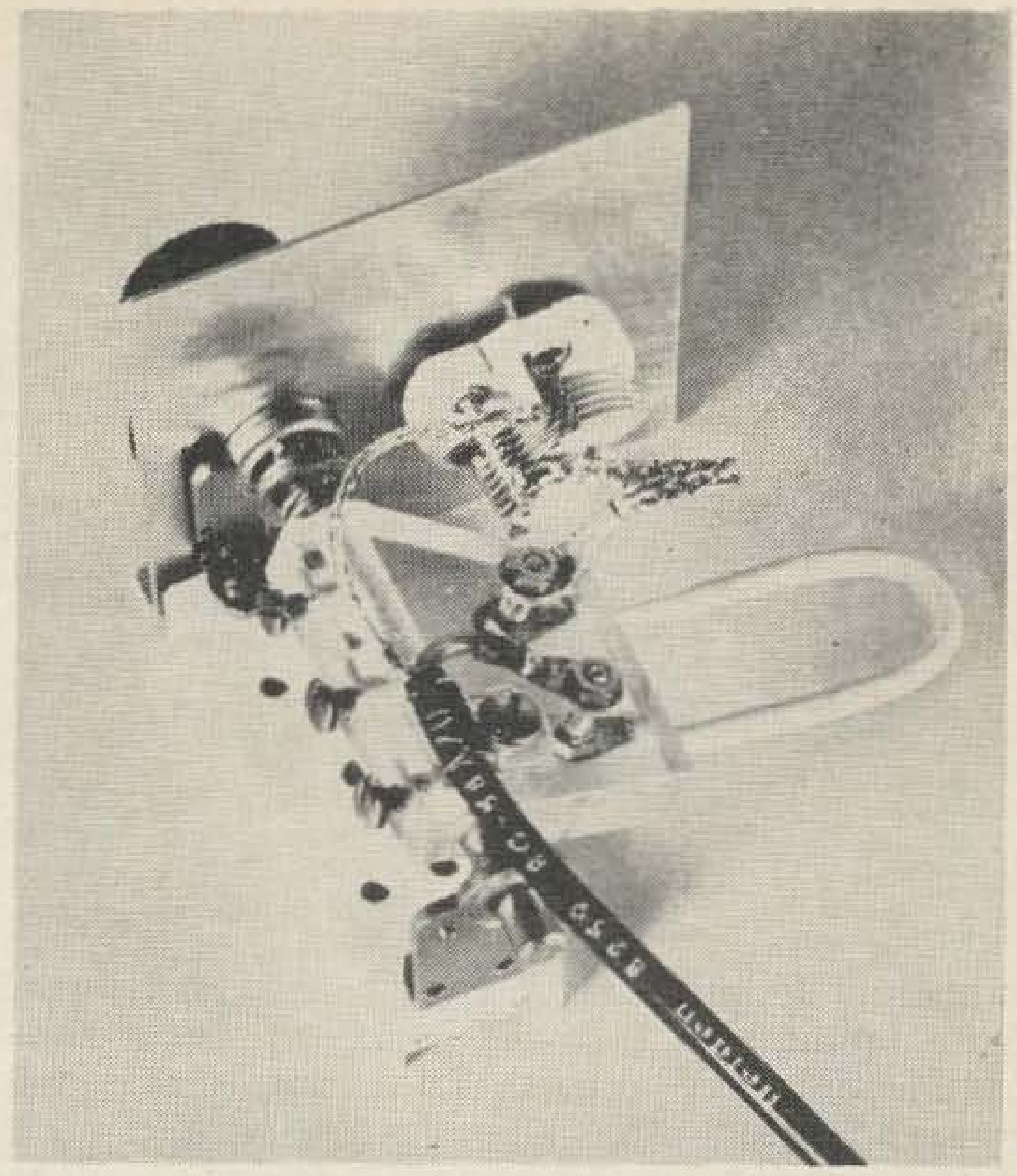


Photo showing the antenna coupler as a complete module. The coax braid can be seen soldered to the rotor tab of the APC capacitor. The center conductor of the coax is fastened to one side of the hair pin.

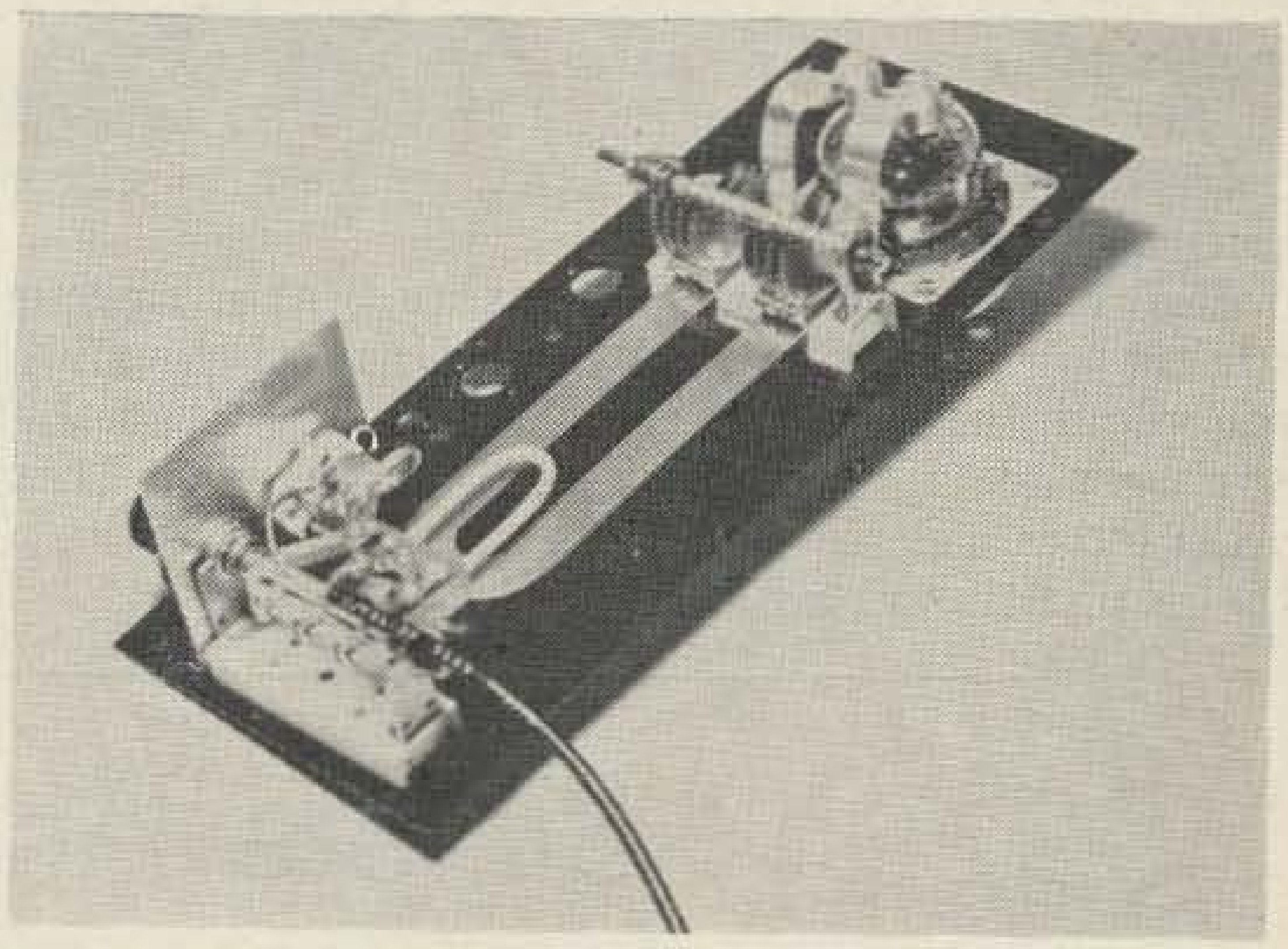


Photo showing compted high efficiency, High Q VHF Power Amplifier.

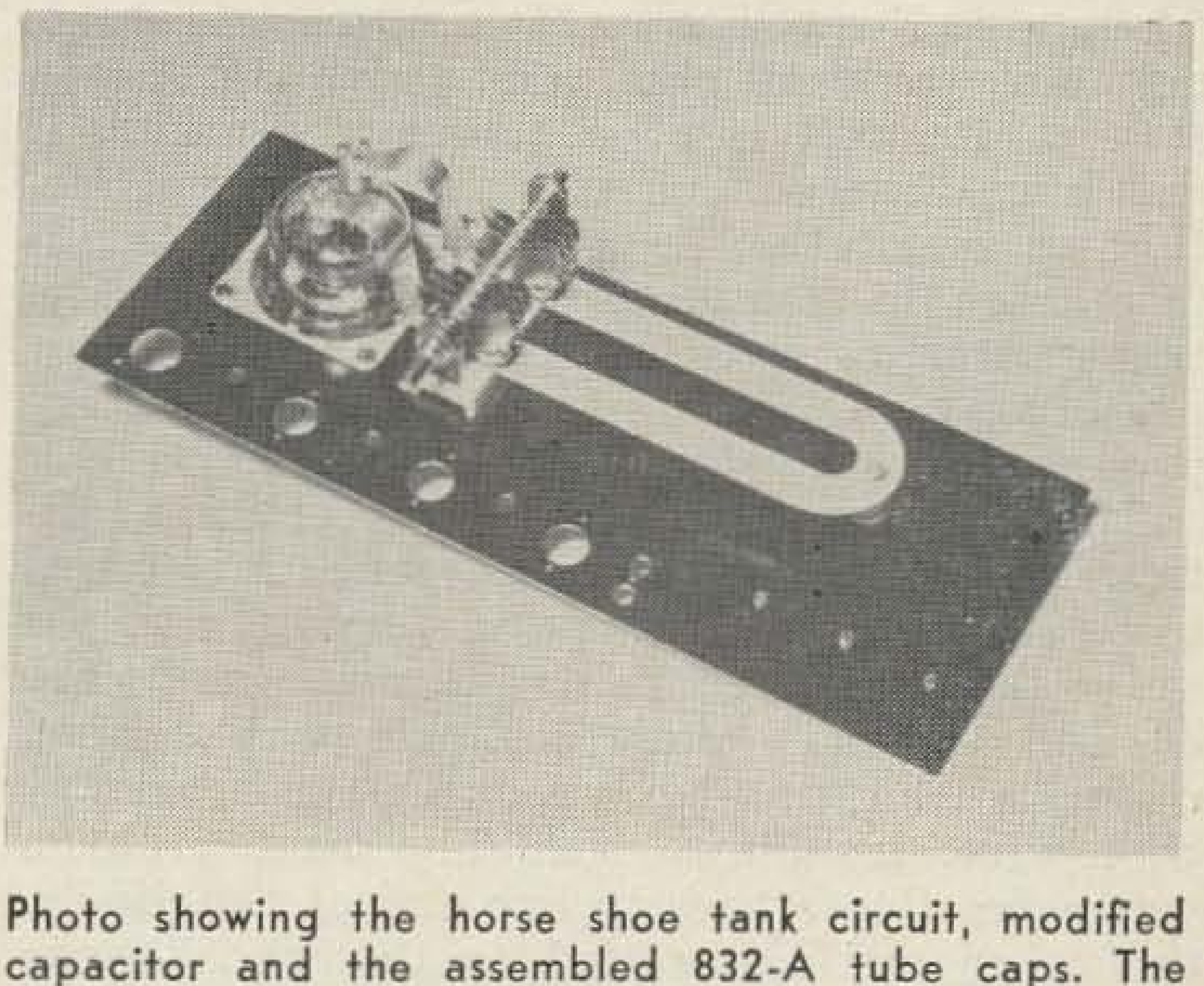
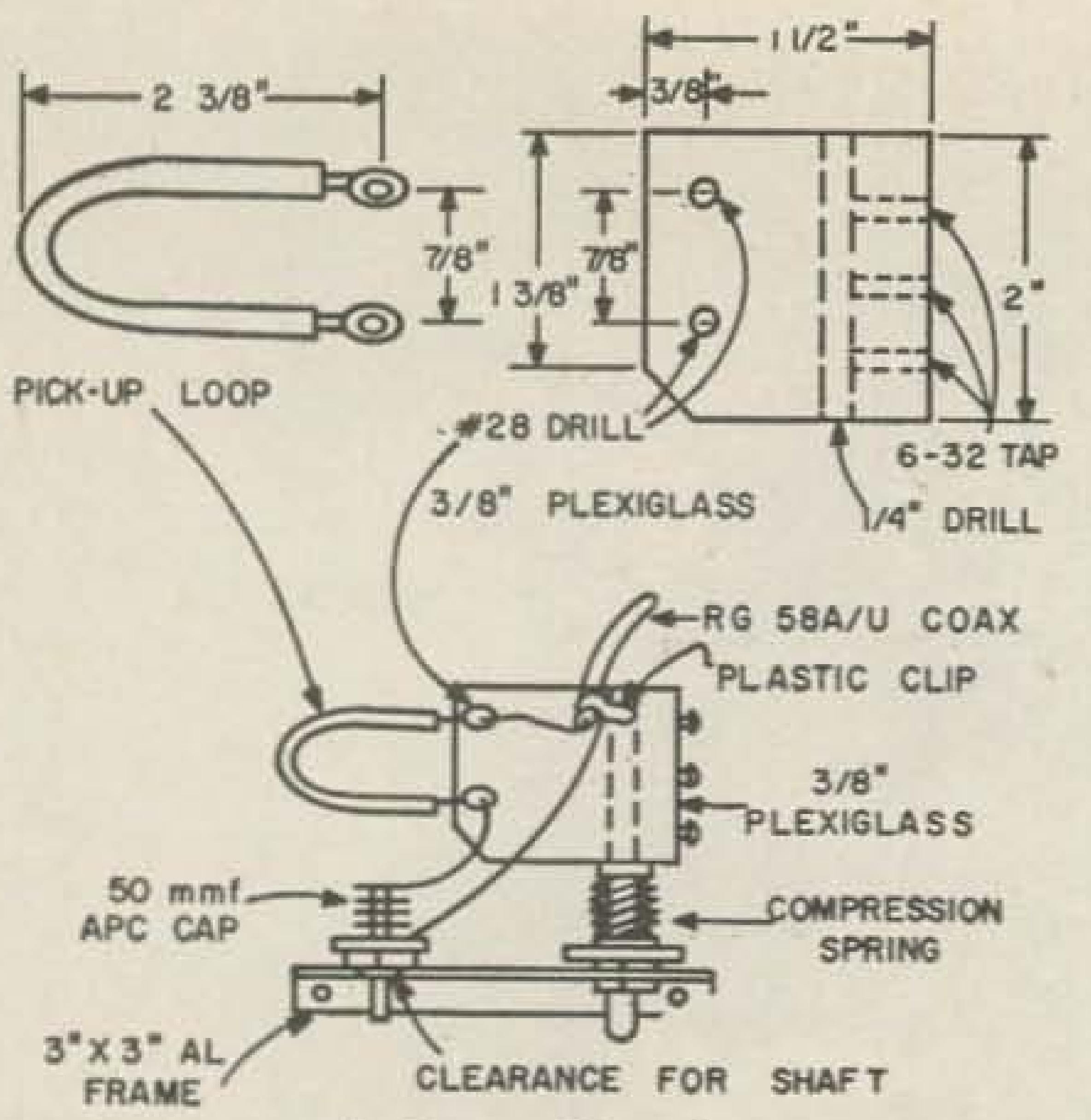


Photo showing the horse shoe tank circuit, modified capacitor and the assembled 832-A tube caps. The chassis painted black is for picture use only.



Antenna Coupler

capacitor frame, in this case borrowed from a Hammarlund MCD-35-SX capacitor, but a compatible unit can be used. The stator plates are removed, the rotor plates are stripped and shaft rounded by removing all solder. A piece of ⅜ inch plexiglass 2x1½ inches is cut as shown, and holes drilled for securing the pick-up loop and the RG58A/U coax cable. A ¼ inch hole is drilled lengthwise through the 2 inch section for the shaft. This hole is drilled ⅜ inches from one end and three 6-32 tapped holes are provided for tightening the plexiglass to the shaft.

Before assembling these parts, put a strong spring against the front bearing, then slide the plexiglass on the shaft, press against the spring and tighten the side 6-32 screws. This adds extra friction and allows the pick-up loop to be positioned solidly.

A piece of 1/16 inch aluminum measuring 3 x 3 inches with a ½ inch flange on the bottom is drilled to accommodate the hairloop frame bearing, and on the same line 1⅜ inches to the left, drill three holes to accommodate a Hammarlund APC type 50 mmfd capacitor with a ¼ inch shaft. These capacitors can be purchased at surplus stores. If in doubt about capacity buy one with many plates and cut it down to have a total of 13 or 14 plates. Mount this capacitor on the 3 x 3 inch plate but make sure that the shaft does not come in contact with the mounting plate. The reason behind this is that one point ground should be used to carry the rf and that ground is the shield of the coax cable, as shown on the schematic. This capacitor is used as fine loading adjustment and should be tuned in conjunction with the pick-up loop, to tune out the reactive component of the antenna system. In extending the shaft for panel control, use a insulated coupler.

The RG58A/U coax cable is tightly secured to the plexiglass by a plastic clip, as shown, and the inner conductor is fed through a brass screw to one side of the loop. The other side of the loop is fastened to the screw on the bottom of the plexiglass which projects through and fastens to the ¼ inch copper braid that is soldered to the stator of the APC capacitor. The rotor contact of this capacitor is soldered directly to the RG58A/U coax braid.

Pick up loop is made of No. 10 or 12 copper wire, with spaghetti insulated, and the ends have solder lugs so that it may be formed on the bench before fastening it in place.

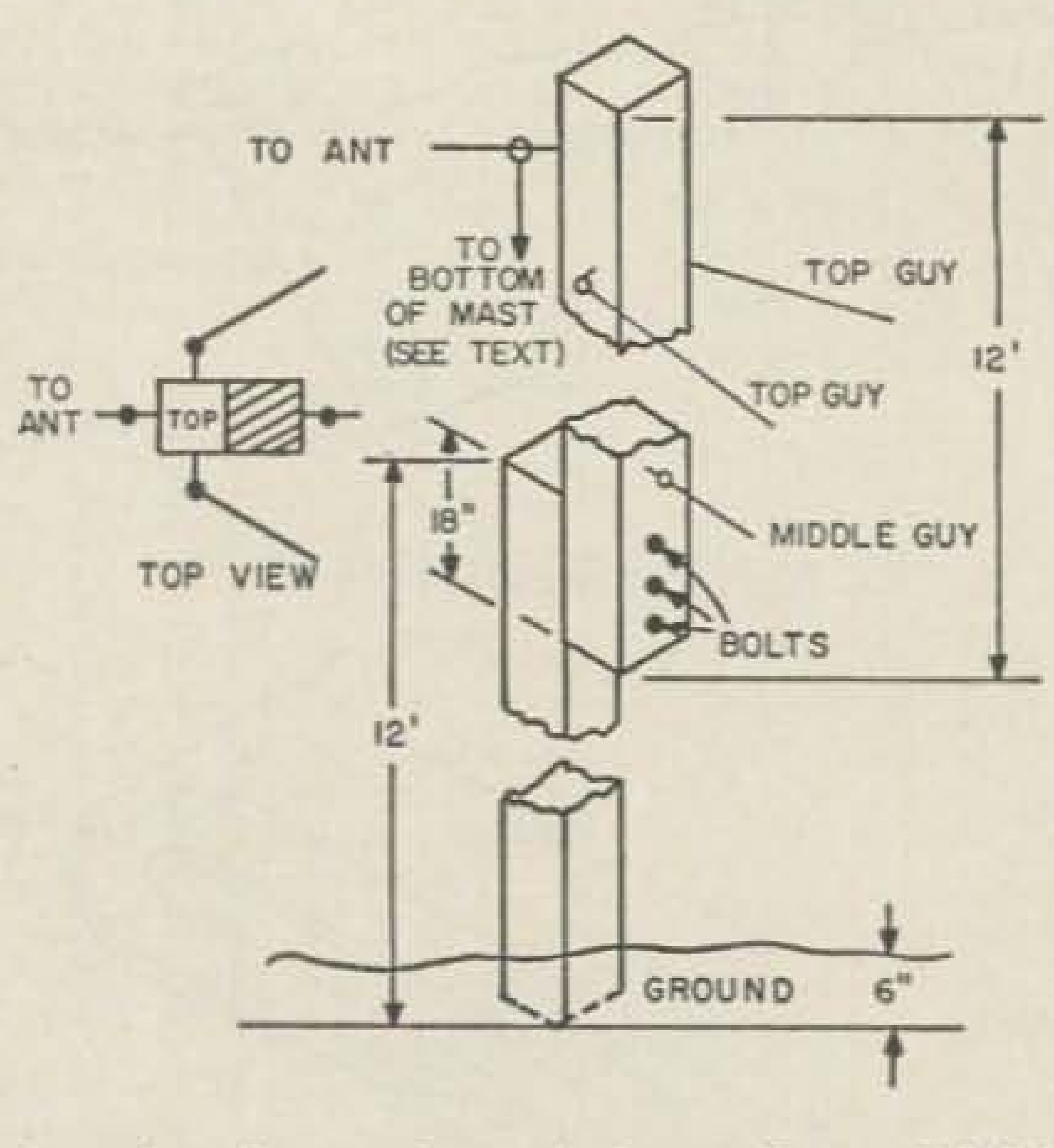
This high efficiency High Q tank circuit is used in the "Echo De Luxe" 144 mc transmitter to be described in the coming issue of 73 .... Watch for the article ... W9DUT

Simple Antenna Mast

Jim Cannaliato K3LTB/5

RECENTLY I moved from Baltimore, Maryland to Roswell, New Mexico and, of course, my ham gear went right along with me. As my stay in Roswell is of a temporary nature I was immediately faced with the problem of setting up my station in such a way as to facilitate its rapid disassembly on short notice. The transmitter, receiver and associated equipment presented no difficulties in this department. My problem was the skyhook.

The antenna set up had to have certain qualities. Besides being reasonably effective it had to be simple, inexpensive and very easy to put up or take down. Since my favorite bands are 40 and 15, the standard dipole was decided upon and the junk-box produced the necessary #14 wire, insulators, etc. The next problem was a mast to attach to one end of the dipole, the other end being tied to the roof of the house. The solution to the problem was ex-



tremely simple and cost less than $4.00, not counting the guy ropes which were already on hand.

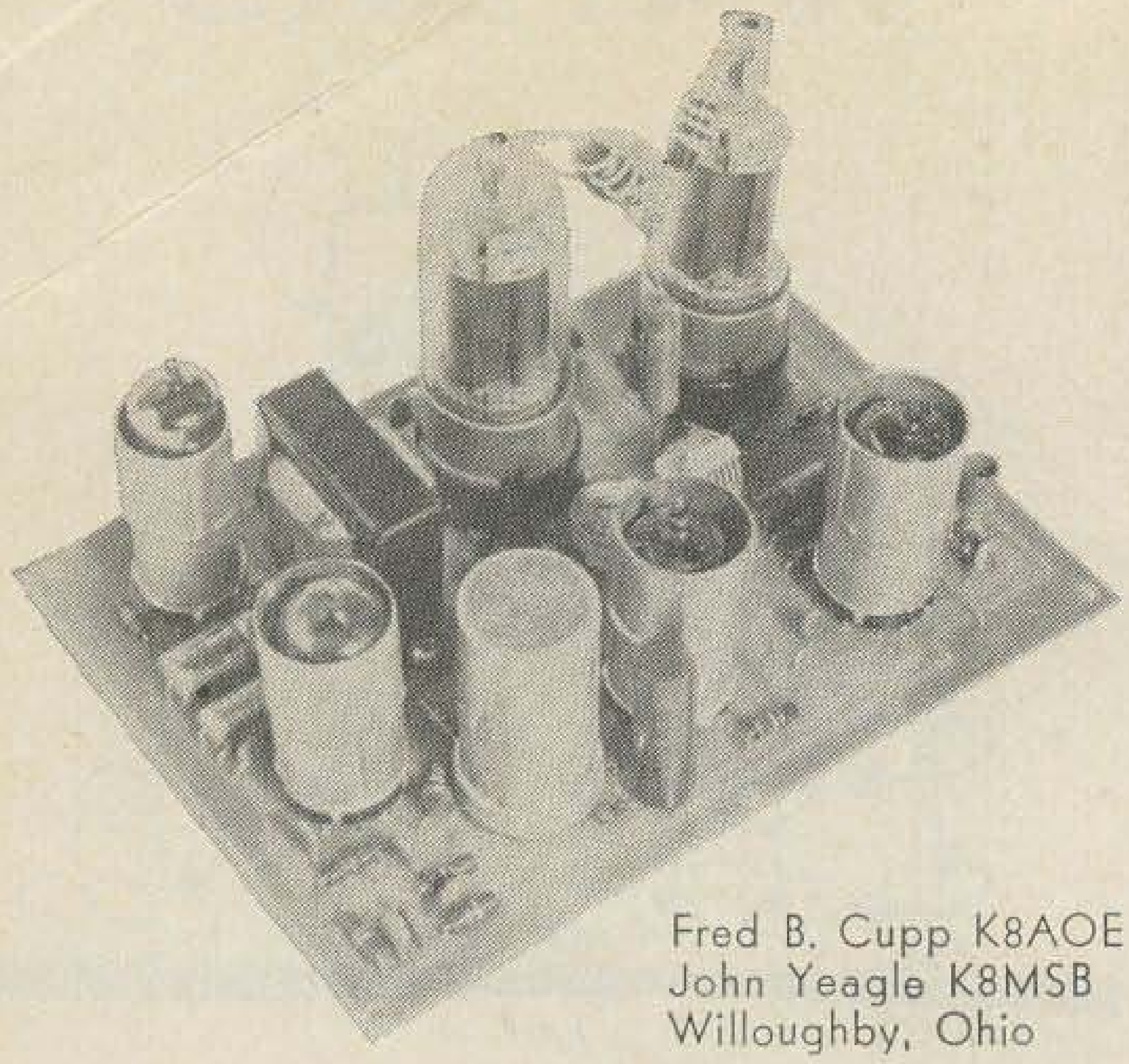
Two sections of 2 x 2-inch poles, each 12-feet long, three 4½-inch bolts with nuts and four eye-hooks were purchased. Overlapping the two poles 18-inches, three holes were drilled and the bolts inserted and tightened down. Three eye-hooks were attached at the top and the fourth at the junction in the middle.

A 6-inch hole was dug and the guy ropes attached. On the end of the antenna a long rope was tied. This rope was pulled through the middle eye-hook at the top and is long enough so that it will rest on the ground after the mast is raised. This makes it possible to lower the antenna after the mast is up.

I then grabbed the XYL and coaxed her into lending a hand steadying the mast while it was raised and the guys tied down. The antenna was pulled up completing the entire operation in less than five minutes.

The ease of disassembly and simplicity of the mast was proven when we moved across town recently. Surprisingly enough the entire assembly turned out to be very sturdy and has held up much better than anticipated. I am now toying around with the idea of adding a ten meter ground plane to the system by simply running some #14 up the side of the mast, using the radials as extra guys.

Naturally this mast is not the answer to the needs of the permanent QTH. It probably won't last more than a couple of years and from an electrical standpoint it obviously is not the ideal half-wavelength above ground. However it is quite adequate for those of you who find yourselves moving around quite a bit (servicemen, etc.) or for Field Day and may prove helpful for erecting that cheap, temporary antenna system without putting any dent in the pocketbook. . . . K3LTB/5



Fred B. Cupp K8AOE
John Yeagle K8MSB
Willoughby, Ohio

AM–DSB Transmitter

6 Meters

Vox

Printed Circuit

ON the VHF scene, many manufacturers are bringing forth interesting new transceiver designs, but these are all AM systems. The home brew builder seems to have been left behind. Here is a project of special interest only to the home brew fan . . . a Six Meter AM-DSB transmitter with VOX included and all on a 5" x 7" printed circuit board.

Very few people will argue the validity of the claims made for the superiority of sideband operation. The increasing popularity of this mode of transmission on the lower frequencies attests to this. In the VHF range, however, sideband has yet to leave a very sizeable mark. The reasons are obvious. Only a small percentage of hams are ambitious enough to attack a project of this magnitude for VHF. Many manufacturers have good exciters for the lower bands, but none have been bold enough to bring forth an exciter specifically for VHF. The recent appearance of commercial transmitting converters is a step in the right direction but they are of no value to the ham who has no exciter.

Consider the Six Meter band. A majority of the operators are Technician Class licensees and have no reason to acquire a low band exciter. Here then is fertile ground for development of techniques and equipment. Simple transceivers have their place in the VHF sun, but the serious ham who is interested in the more exotic forms of communication is soon disillusioned with the limitations of commercial equipment.

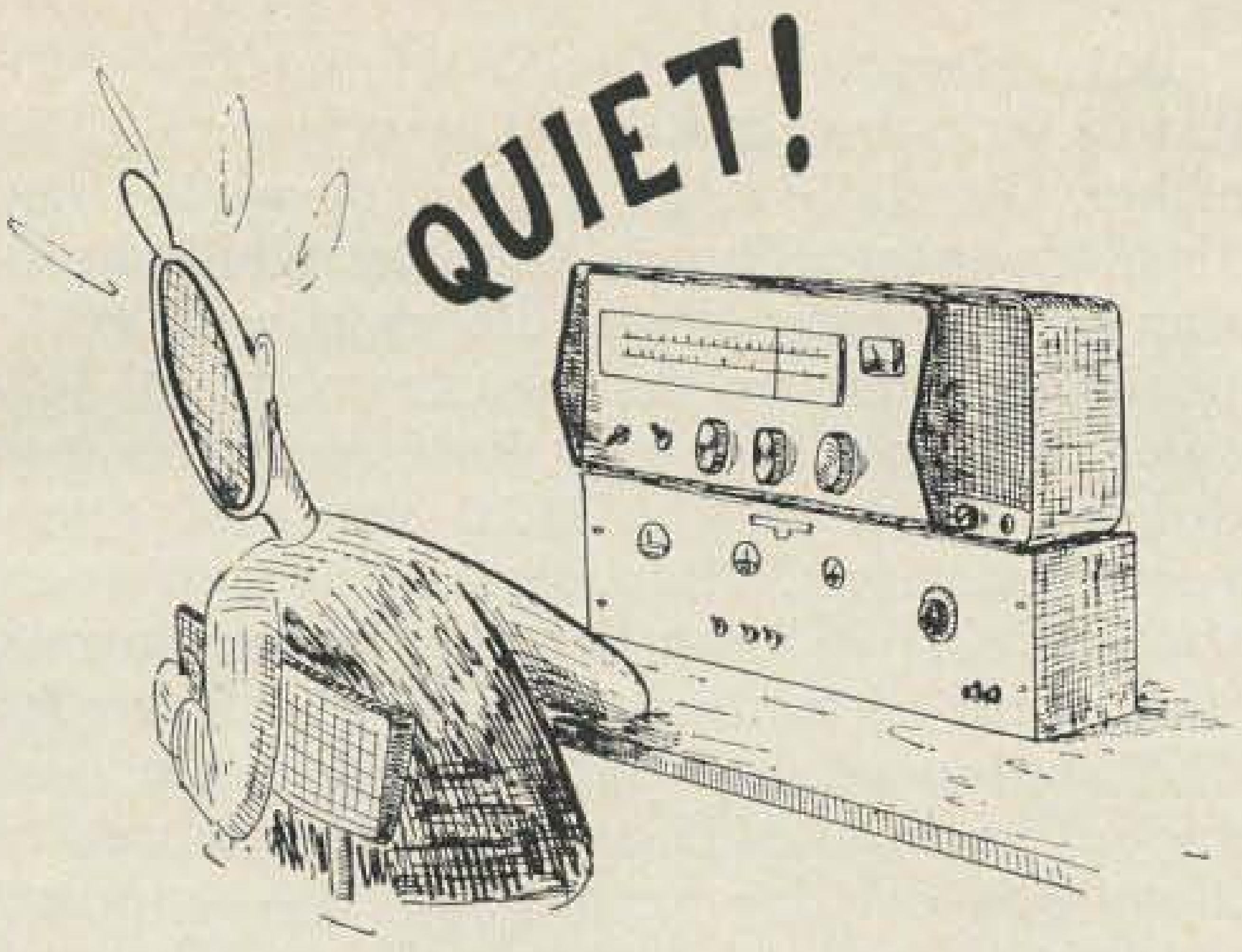
After several years of apprenticeship on AM, we indulged in a brief courtship with FM. Somewhat better to be sure, but still not the ultimate. The purchase of several sideband books strengthened our resolve, but the cost of filters and the complexity of phasing rigs and hetrodyne converters led to the final acceptance of Double Sideband Suppressed Carrier as a reasonable compromise.

Reception of Double Sideband signals is accomplished in exactly the same manner as single sideband signals, but .... The presence of both sets of sidebands imposes stiffer requirements on the receiving equipment. In exchange for transmitter simplicity we are requiring the receiving station to filter out the unwanted sideband. Stations have been worked by the author wherein the DSB signal was received on a Collins 75A-4. The reports were that either sideband was received just as well as an SSB signal. Other contacts made on less sophisticated receivers indicate that a steady hand is necessary. Two contacts were even made with stations using G-50 communicators in which case the VFO was turned on and used for carrier reinsertion.

The important case to be considered, however, is the average station. In all probability the if response is broad enough that both sidebands will be received. In this case, the two sidebands beat against each other as well as the BFO, producing a peculiar "growling" type of distortion. The only cure is to have the BFO frequency right "on the nose," although the effect is reduced by detuning the receiver so that the unwanted sideband is down the slope of the if response curve. This effect is not too bad to overcome especially if the receiver has a "Q" multiplier in which case the reception is just as good as SSB. The subject of double sideband reception is discussed at some length in Don Stoner's "New Sideband Handbook," page 107.

Several prototypes (and six months) later, members of the East Shore VHF Club of Cleveland, Ohio showed interest in the project. This was the spur necessary to push us into laying out a printed circuit board so that the club members could duplicate the design with a minimum of difficulty. This final design included several extra refinements such as a tone oscillator to facilitate tune up on DSB and an improved VOX circuit which is used on both AM and DSB. Also provision has been made for either 6 or 12 volt heater connections.

ARM CHAIR COPY?



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Audio Section

The first half of a 12AX7 is a speech preamp. When the microphone is unplugged, however, the closed circuit phone jack completes the circuit from the R-C phase shift network causing the preamp to oscillate at approximately 1 kc. This tone is used for tune-up on both AM and DSB. With the mike plugged in, the 12AX7 functions as a normal speech preamp. The output of the first stage is coupled through the .001 capacitor to the audio gain pot. This capacitor value is deliberately small to roll off the low frequency response to provide better intelligibility, primarily on DSB. The second half of the 12AX7 is a standard voltage amplifier.

VOX Circuitry

The output of the speech amplifiers is fed to the 6AQ5 modulator via switch section S1A and also to the VOX trip level pot. The first half of the 12AU7 is a voltage amplifier and its output is coupled through the .02 capacitor to the voltage doubler rectifiers. An audio signal thus results in a negative voltage being developed at the grid of the relay tube, the second half of the 12AU7. The 6.8 meg. grid resistor gives a positive return of the grid voltage and eliminates any tendency of the relay to chatter on noise spikes. Note that the VOX relay K1 is energized during receive and de-energized for transmit. This provides a more uniform load on the power supply since the rf section draws current when the VOX tube is cut-off and vice-versa.

Modulator

Referring now to the 6AQ5 modulator stage, it will be noted that switch section S1A selects either the full audio signal or audio via a 6 db attenuator. This is done to avoid the necessity of changing the audio gain and VOX trip settings when switching from DSB to AM, since AM requires only half as much modulation as DSB. In the DSB mode of operation switch section S1B grounds the center-tap of the modulation transformer. Thus the modulation energy supplies the screen voltage for the 2E26 balanced modulators. In the AM position, switch section S1B connects the center-tap to a voltage divider across the B+ supply thus applying constant screen voltage. The modulation voltage appearing across half of the secondary then adds to or subtracts from this screen voltage resulting in AM screen modulation. Note that in AM operation switch section S1C disables one of the 2E26 tubes. Since the balanced modulator is no longer balanced the carrier is not cancelled out and normal AM operation is achieved.

RF Section

The pentode section of the 6U8 is used as an oscillator-tripler combination. The screen is used as the plate in an untuned Pierce oscil-

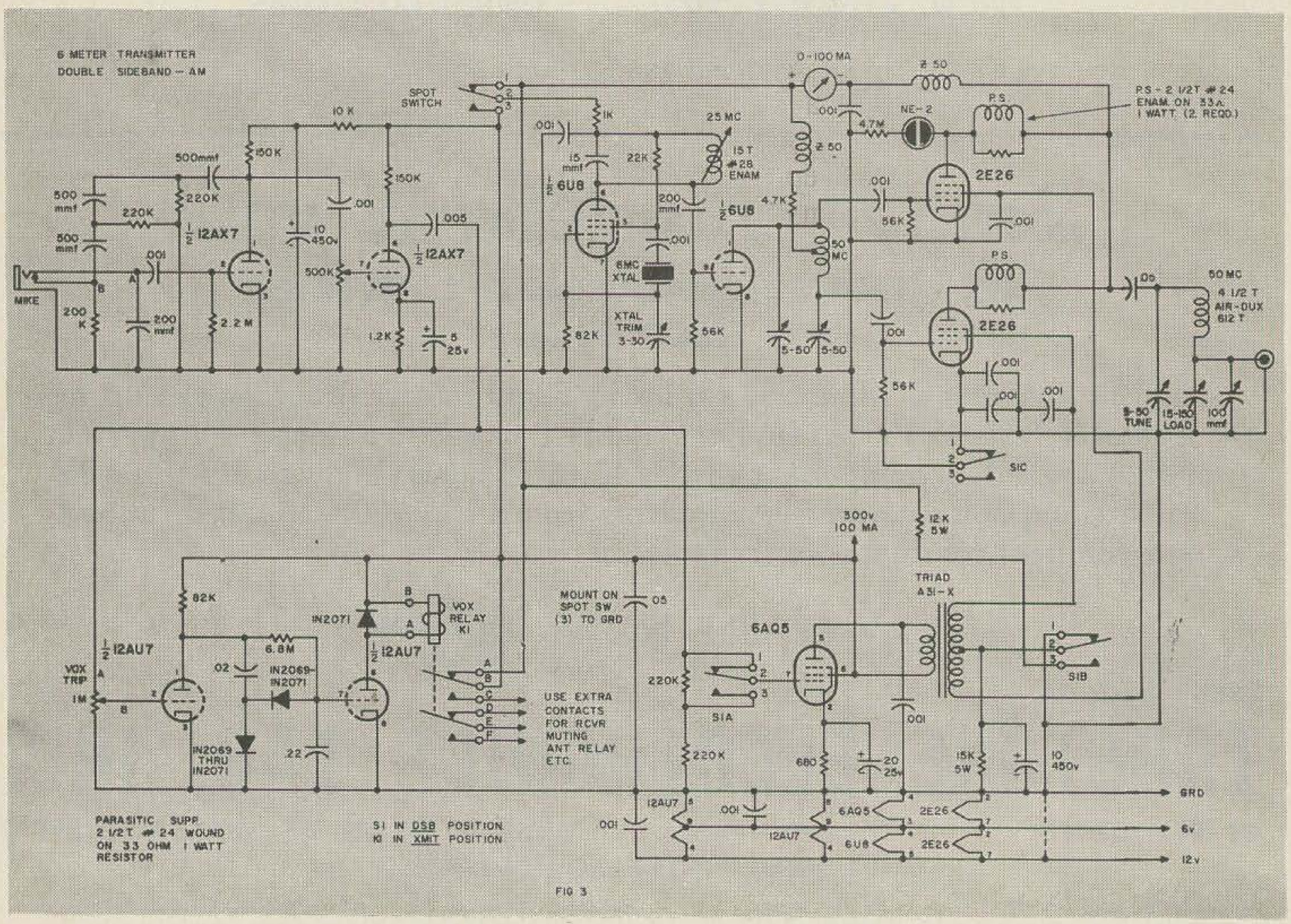

FIG 3

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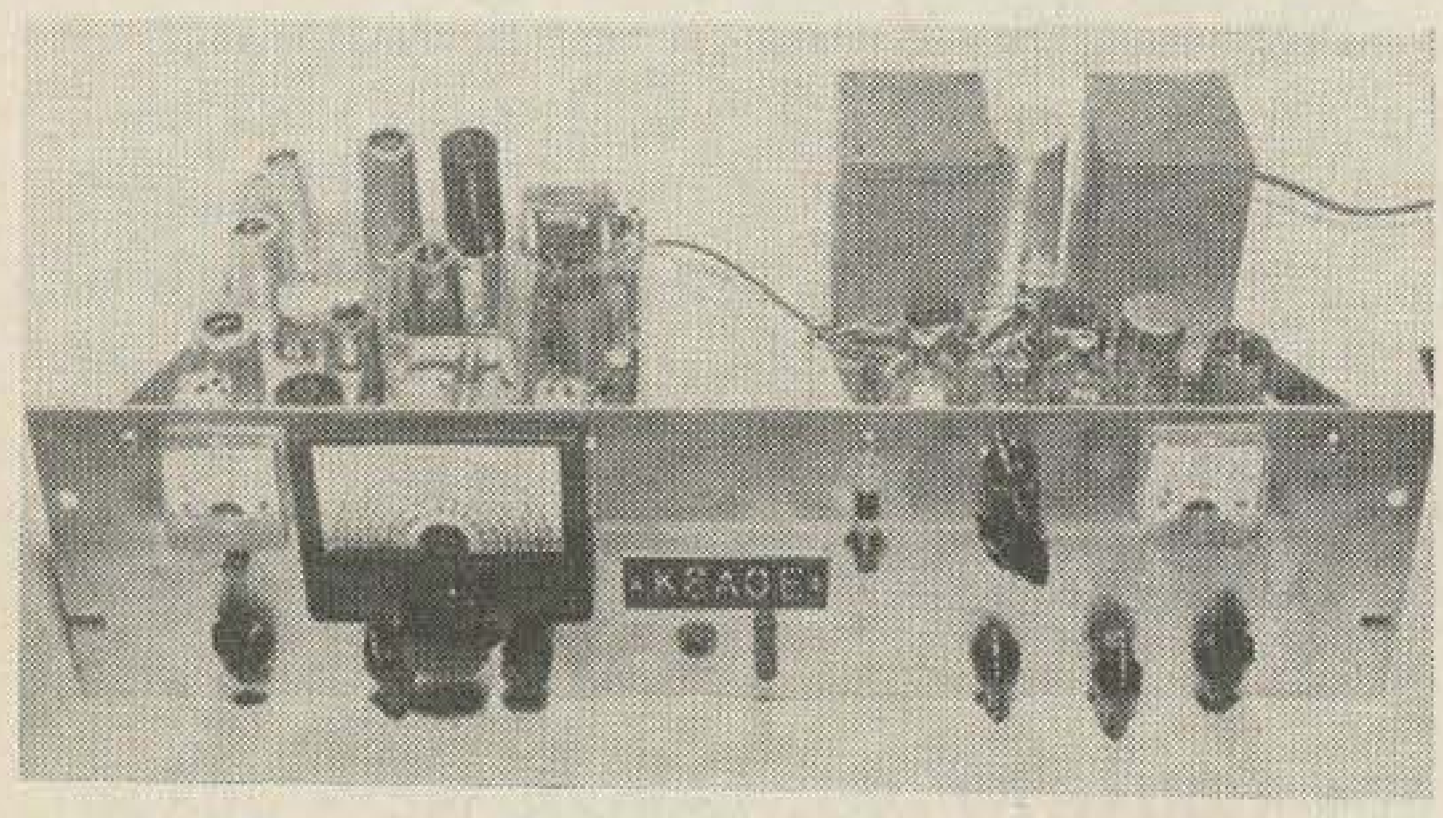
lator circuit. A 3-30 mmfd trimmer capacitor allows the crystal to be "rubbered" in the event of net operation or it may be adjusted for maximum drive. The plate of the pentode section triples to 25 mc. The tripler output is applied to the triode section of the 6U8 which doubles to 50 mc. The triode plate is connected to one end of the push-pull grid tank thus supplying a 180 degree phase shift between the grid voltages of the 2E26 balanced modulators. The push-pull grid circuit was chosen to allow the use of pi-network output rather than push-pull output with a link output coupling. Balance in the push-pull drive is accomplished by varying the ratio of the two trimmer capacitors at the opposite ends of the grid tank. Of course the capacitors must always be tuned for resonance as well as balance, but a little practice will allow re-tuning in a short time once you get the hang of it. (Several rigs have been built with a dual 25 mmfd air variable across the grid tank, however the one trimmer capacitor must be left on the end of the tank opposite the triode plate to balance out the plate capacity. If the builder desires, this modification may be added by mounting the dual variable on the front panel in such a position that the variable extends under the board near the grid tank. Short leads should be used from the variable to the tank circuit.)

A VTVM with a 100K resistor in series with the probe (to avoid detuning of the tank circuit) is used to check the grid voltages of the 2E26's while adjusting the balance. This setting is not critical, however, and relatively good carrier null can be obtained even without this check. The parasitic suppressors in the plate circuit of the 2E26's are for obvious purposes. The NE-2 neon bulb serves as an rf indicator (very impressive on DSB) and the 4.7 meg. resistor applies "keep alive" voltage to the neon bulb. The pi-net output circuit is quite standard. The 100 mmfd capacitor across the loading capacitor is to shunt the load control to the desired range, thus permitting the use of a physically smaller variable capacitor. This allows it to be placed as shown between the 2E26 tubes.

While the transmitter can be built on a regular chassis, we found that a circuit board greatly simplified matters. Fabrication of printed circuits has been covered in past issues of this and other amateur publications. If the builder does not wish to make the circuit board himself, the board is available from the authors at $7.50. This circuit board is Mil. grade glass epoxy with heavy copper coating and is tin plated for easier soldering. Also included are double-sized parts layout drill guide instruction sheets, a complete parts list, and everything else we could think of to help you.



Use sharp drills for all holes and do not overheat the copper while soldering. Reasonable parts substitutions can be made, of course, but check for physical size to insure that the new part will fit on the board. After drilling the holes, insert the parts in the board and solder. The four components located on the underside of the board are the grid tank coil, two .001 coupling capacitors to the 2E26 grids, and the 6.8 meg. resistor in the VOX circuit.

Now set the completed board aside and drill the holes in the 5" x 7" chassis. The DSB-AM switch, the audio gain pot and the dual variable (if desired) are mounted on the front of the chassis. The VOX trip pot and the VOX relay are mounted on the rear of the chassis. The actual location of the relay and the output connector will depend on the physical size of these components. Next an opening is cut in the top of the chassis to fit the printed circuit board. An ideal tool for the job is a nibbler (Adel Mfg. Co.). The front panel is held to the chassis by the controls mounted on the front of the chassis.

After all the parts are mounted the wiring may be completed. Dress the wiring in such a manner as to avoid the location of the shield partition which is left until last to permit easier wiring. The two 5 watt resistors may be mounted on terminal strips on the side of the chassis or between switch section S1B, terminal 2 and the shield partition for the 15K resistor and switch section S1B, terminal 3 and B+ on the 6AQ5 screen (pin 6) for the 12K resistor.

When the wiring has been completed, cut a piece of thin brass for the shield partition and solder it in place. Don't forget to cut a notch in the shield to clear the two conductors on the circuit board which pass under the partition.

Transmitter Checkout

After checking with an ohmeter for possible shorts on the filament or B+ lines, apply power. Install the 12AX7 speech amplifier tube and check with a scope (or VTVM) for output to the modulator grid. Check both with a mike and also for the tone oscillator with the mike unplugged. Tubes other than a 12AX7 or a weak 12AX7 may not have enough gain to oscillate. Also don't forget to install the jumper between the 12 volt heater connection and ground when operating on 6 volts.

Next the VOX tube (12AU7) may be installed. After warmup the relay should energize. Turn the VOX trip level pot until it is about 75% open. If the mike is unplugged (tone oscillator on) then increasing the audio gain control setting should cause the relay to

de-energize. Speaking into the mike should also cause the relay to drop out.

The 6U8 exciter is next checked out. Leave the audio gain control turned up so that the VOX relay remains de-energized and tune the tripler plate tank for maximum output. Insert the two 2E26 tubes in their sockets. Tune the grid tank of the 2E26 tubes to resonance. (Note that the DSB-AM switch must be in the DSB position.) With a 100K resistor in series with the probe of a VTVM read the voltage on each of the 2E26 grids. Increase the capacity of the trimmer on the grid with the highest voltage, then retune the grid tank to resonance with the other trimmer. Repeat this procedure until both grids read approximately the same voltage and the tank is at resonance. If you have added the dual 25 mmfd variable across the grid tank the job is a little easier. Just tune the remaining trimmer capacitor for balance and the dual air variable for maximum voltage on the grids.

The last step is to add the 6AQ5 modulator. With tone modulation advance the audio gain control until the plate current is about 50 ma. A scope pattern is almost essential here. Feed audio from one of the screens to the horizontal input of the scope and rf from across a dummy load into the vertical plates. The pattern should look like the typical "Bow Tie" display of double sideband transmission (ARRL '61 Handbook, p317, Fig. 11-15).

With the DSB-AM switch in the AM position the plate current should be 35 to 40 ma. The scope pattern should now be the typical trapezoid characteristic of AM. These current values are for a B+ voltage of approximately 300 volts. Some intrepid souls may wish to increase the output by running the final amplifier plates from a higher voltage supply, although we have not tried this. If you care to try it, disconnect the + side of the plate supply meter and connect it to a higher voltage supply.

As far as performance is concerned, the authors are not DX hounds, so the DX record is rather sparse, consisting of one Florida contact on a band opening, one extended ground wave contact, but many hours of local ragchews. Morrie, WA6CTL, is now the owner of the prototype and he sends back glowing reports of the rig's performance on ground wave between San Diego and Los Angeles. The authors hope to hear many of you on DSB in the future. ... K8AOE & K8MSB

Twoer Modifications

Ernest Jay Wolitzer K2ORY
2143—82nd Street
Brooklyn 14, N. Y.

Photo credit: Elliot Eckhaus, K2GUI.

The Heath transceiver units, commonly known as the Tener, Sixer & Twoer are excellent units in regard to operation, size, and cost. This article is based on the Twoer, but will hold the same for the others.

The Twoer was used in the home QTH for a while, and I became interested in using the rig mobile. As some of us might know, setting up a mobile rig takes time and most of all, patience.

In the Twoer, described here, I did away with all of the hard work, such as running cables, mounting power supplys, etc. The unit now will operate either 110 vac or 12 vdc at the flip of a switch.

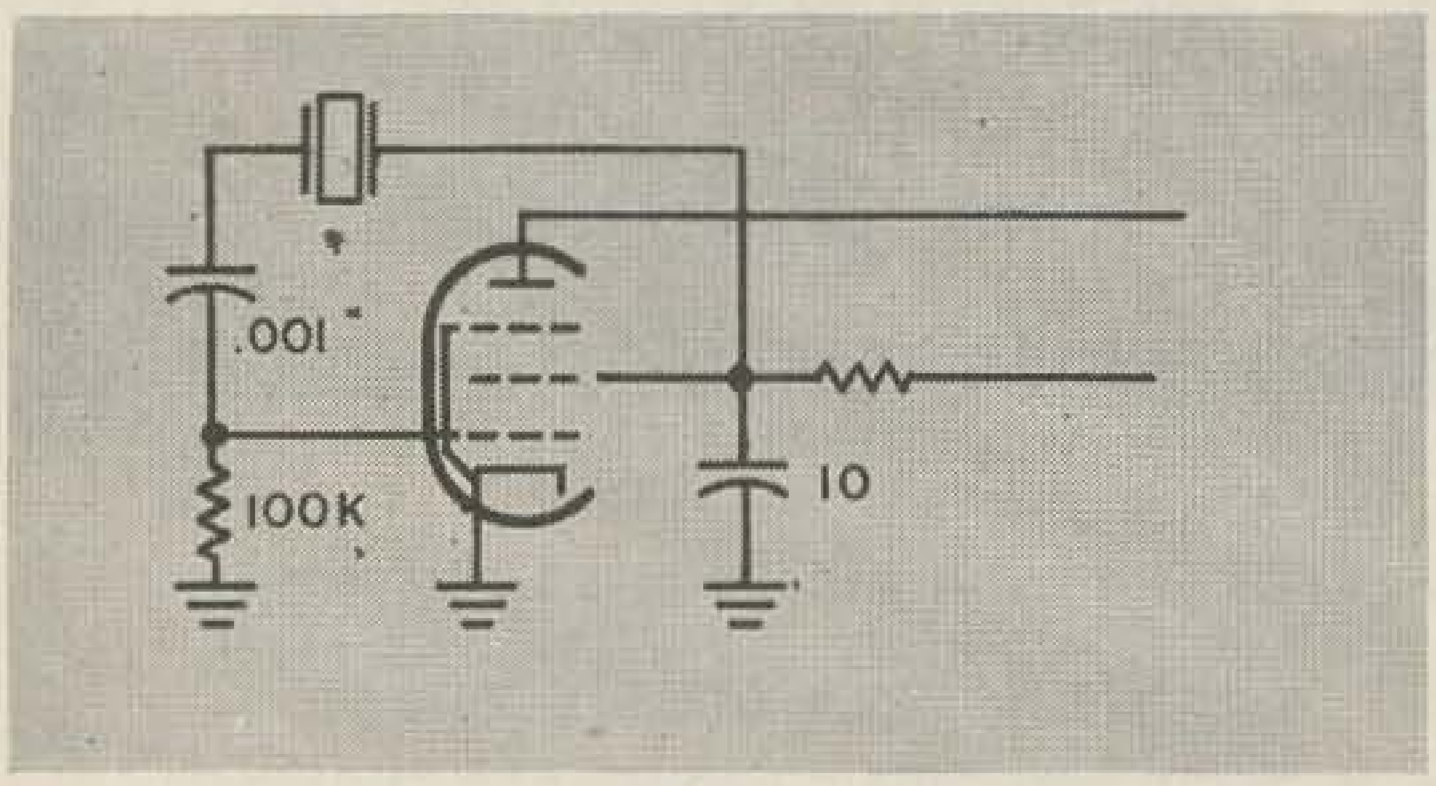
If ever it came to mind to use a VFO, you would probably not be too successful, because with the original oscillator circuit a VFO could not work. I made some minor oscillator changes that helped to stabilize the unit when a crystal was used, and now I can use a VFO.

Construction Details

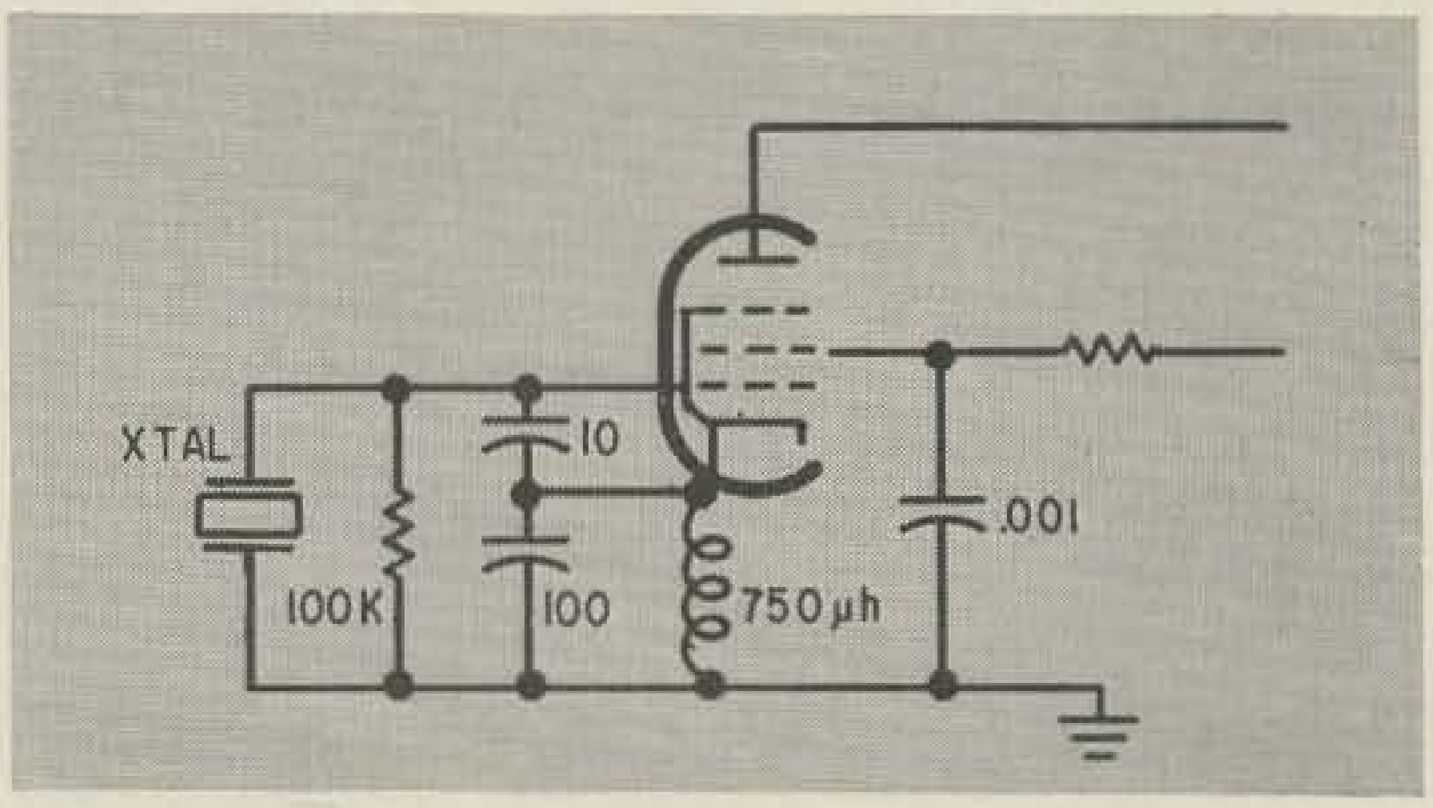
The fuse holder in the rear of the unit was removed and mounted in the space that had originally been used for the eight pin power plug. The hole that was used for the fuse is now the mounting hole for the new switch.

Part of the power supply is built on a sub-chassis which is mounted on the speaker baffle plate. This sub-chassis, measuring 3½ in. L. by 2¼ in. W., is made of a piece of ⅛ in. steel. A ½ in. lip is bent and used for mounting.

The silicon diodes and the rest of the power supply components are wired on a terminal strip, which is then mounted on the screw that holds the power transformer. The four prong power plug is mounted on brackets, and is positioned near the output transformer. It will be found that in order to have access to the



Before



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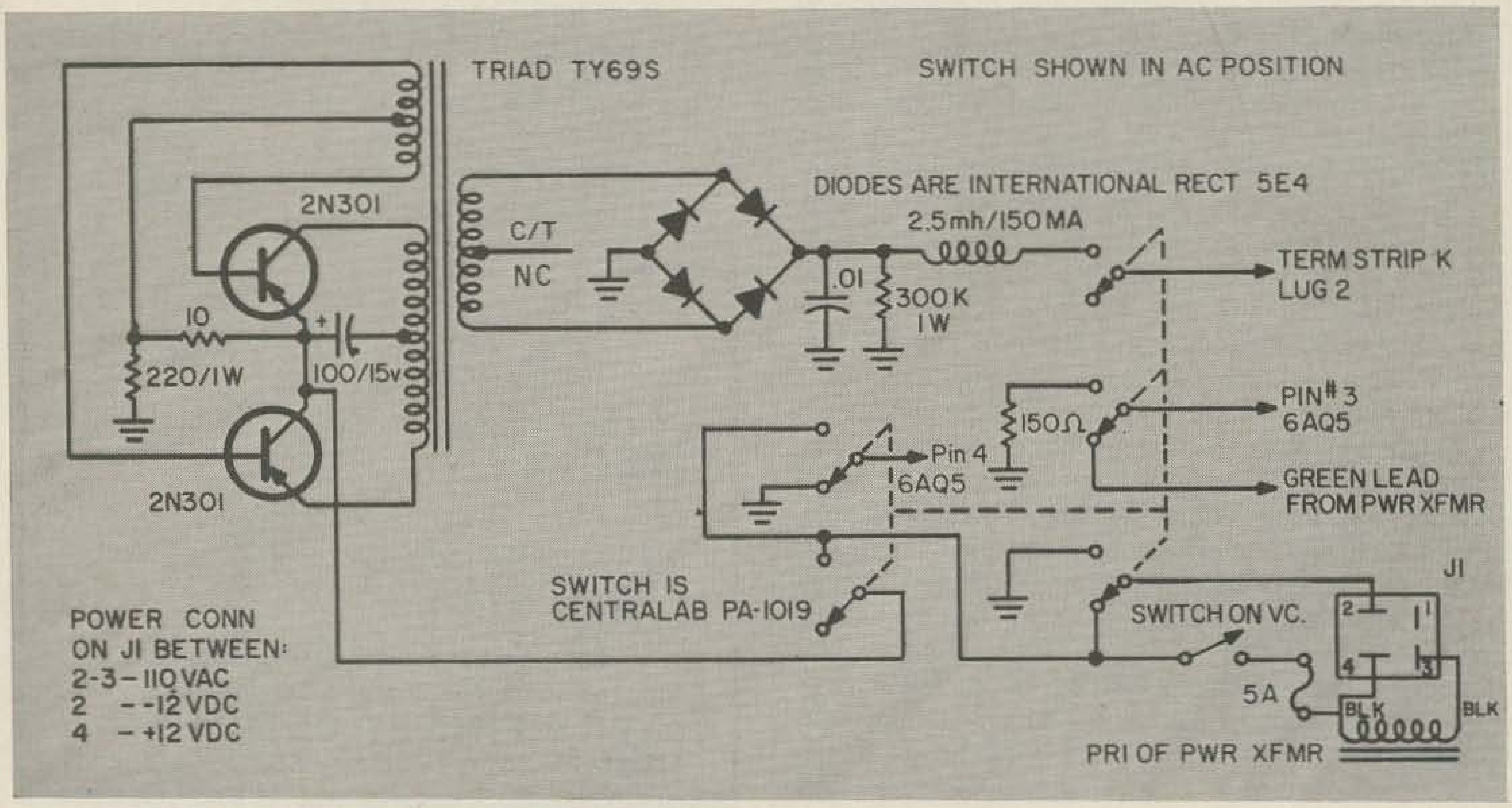
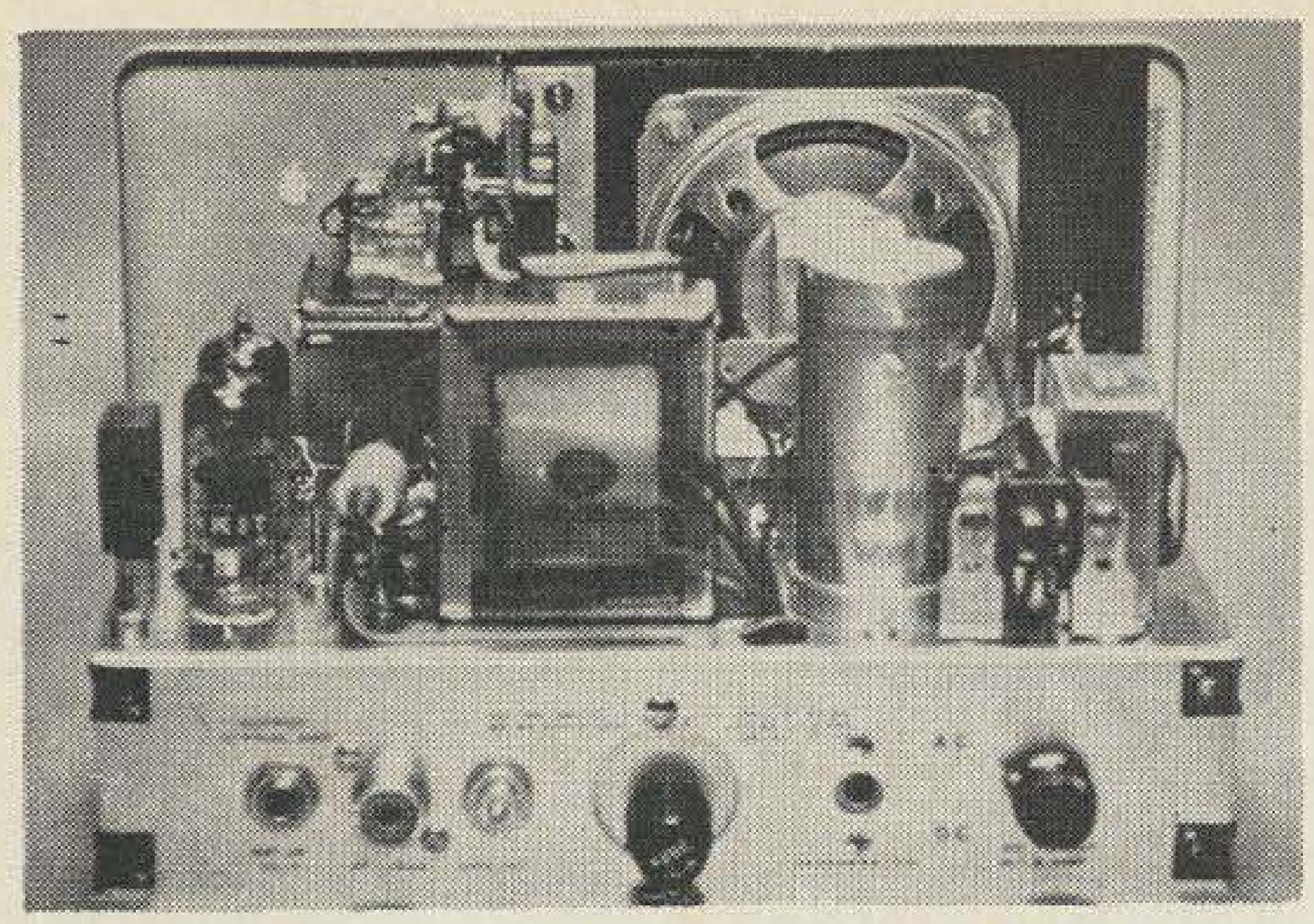




This picture shows the new location of the fuse, switch, and four prong plug. It also shows how power supply is mounted on the speaker baffle plate.

power plug when the cabinet is installed, you will have to cut a hole in the rear.

Operation

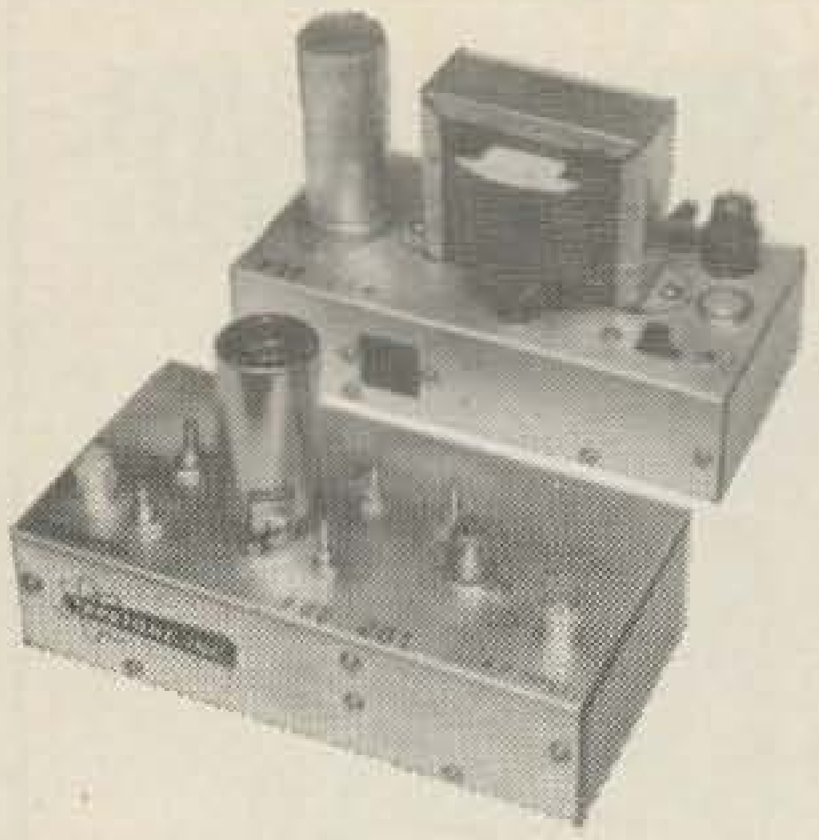
The new selector switch is used to select either ac or dc operation. For operating on 110 v, connect pins 2 and 3 to the power source. One 12 v., where the power can be taken from the car's cigarette lighter, connect pin 2 to −12 v and +12 v to pin 4 of J 1.

We found that when operating mobile, lowering the broadcast antenna to approximately 19 in. worked fairly well. . . . **K2ORY**

8 mc Xtal Multiplications

6M (x2 x3) (x6)		(2M) (x2 x3 x3) (x18)	
50 mc =	8333.333	144.0 mc =	8000.000
50.1	8350.000	145	8055.555
51	8500.000	146	8111.111
52	8666.666	147	8166.666
53	8833.333	147.9	8216.666
54	9000.000	148	8222.222
1¼M (x3 x3 x3) (x27)		¾M (x2 x3 x3 x3) (x54)	
220 mc =	8148.148	420 mc =	7777.777
221	8185.185	425	7870.370
222	8222.222	430	7962.962
223	8259.259	432	8000.000
224	8296.296	435	8055.555
225	8333.333	440	8148.148
		445	8240,740
		450	8333.333

. . . W4OAB



73 tests the Telco 201 Converter

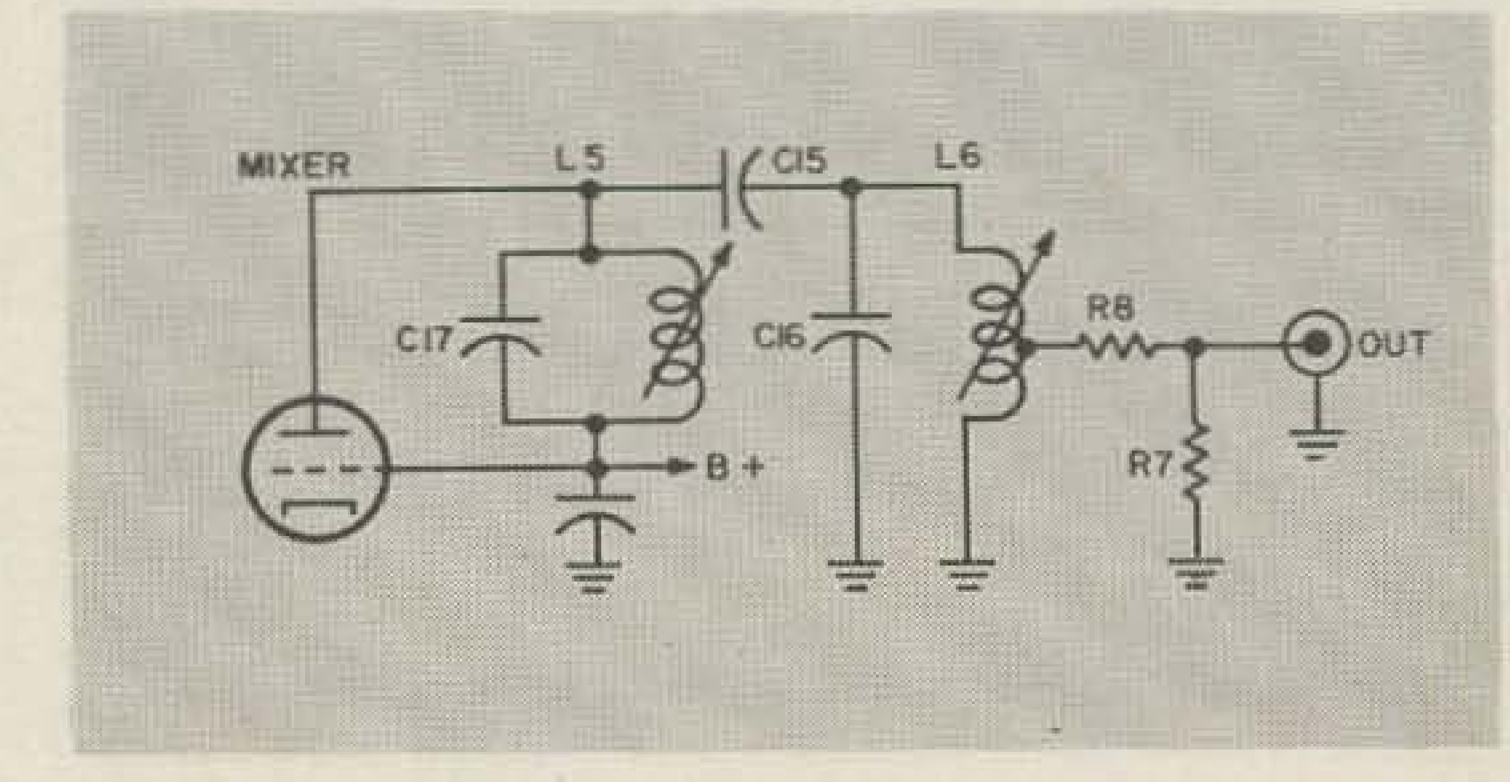
Larry Levy WA2INM
1114 East 18 Street
Brooklyn 30, New York

IN most heavily populated areas, 6 meter operation is getting to be a problem. There are so many stations on six that one or two strong stations are sure to be close enough to overload your six meter converter. With conventional 6 meter converters, the overload can be controlled, but only at the expense of noise figure. Such a compromise is usually a poor one, as it doesn't do much good to eliminate the overload if, after you do, you can't hear the station that you're trying to work. If you have a problem of this kind, the answer is a Telco 201 converter. The 201 is a low noise 6 meter nuvistor converter that is almost impossible to overload. Built and designed with the same quality that Tapetone is famous for, the 201 is undoubtedly the best 6 meter converter that I have ever heard. Tapetone rates the noise figure as better than 3 db. On the converter tested, the noise figure is considerably better than 3 db, probably between 2 and 2½ db. The reason that I say probably is that I can't measure a noise figure better than 2½ db with my present test equipment.

Anyhow, Tapetone is extremely conservative in their ratings, giving, a very consevative and true figure instead of an advertising fudge figure (true noise figure x .69 or something). This is achieved by the use of a 6CW4 nuvistor in a gounded grid rf amplifier. The rf stage is designed to provide maximum protection against overload without sacrificing noise figure. The cathode is carefully matched to the line, which should be a reasonably flat 50 ohm unbalanced one, by a tapped coil which is tuned for optimum performance. The plate circuit is one of Tapetone's double-tuned types which offers almost flat response across the entire 6 meter band, dropping off sharply at either end. The mixer uses ½ of a 6U8 in a circuit designed to reduce overload.

Tapetone did quite a bit of experimenting before they decided to use the 6U8. They were trying to find the best tube for noise figure as well as resistance to overload, a combination that requires several contradictory qualities. The 6U8, with the circuit values chosen, is a perfect choice. The noise figure is exceedingly low and it is as resistant to overload as a mixer is going to get. One unusual feature, and one that is getting extremely important as the band is getting more and more crowded, is the mixer output circuit. They use two coils, in a bandpass configuration, to provide almost perfect response across four megacycles. It is then matched, by a tap on the second coil and two resistors, to a flat 50 ohm output. (See Fig. 1). This is the only converter that I have seen using this, and it is important because it is just about impossible to get a flat response out of the conventional single coil that everybody seems to be using. This means that the converter using one of these coils has a flat response over 1 mc of the band at most, and the majority of them do not even have that much. With the increasing activity on the band it is not uncommon now to hear stations as high as 52 mc or more, and the ancient converters that were designed when you didn't have to tune over 50.1 mc to cover all the activity are now well outdated. It should be pointed out that while, with luck, a coil will tune 1 or 1½ mc reasonably flat at 50 mc, it will only tune less than ½ mc at 14 mc, since the bandwidth decreases with frequency. Since the rf bandpass is 4 mc and the output response is also 4 mc, this converter not only has a flat response over the entire band, but it also has a fantastic image rejection and suppression of feedthrough. This is because the more tuned circuits that there are, the greater the skirt selectivity. In the 201 there are two sets of bandpass circuits and the rejection of signals outside the passband is greatly increased.

The signal from the oscillator is fed into the cathode of the mixer. The Telco 201 only comes with an *if* of 14-18 mc, probably because Tapetone felt that image rejection would suffer if a lower *if* was used and most receiver's performance drops off if a higher one is



used.

I mentioned that the converter is hard to overload. How hard? For a test, I loaded my 100 watt transmitter into my 11 element beam and pointed it at a receiving dipole about 50 feet away. There was no interference with a received signal that was S-3 15 kc away from my transmitter except on strong modulation peaks. Even this disappeared about 20 kc away from my signal, and the overloading was probably due to my receiver.

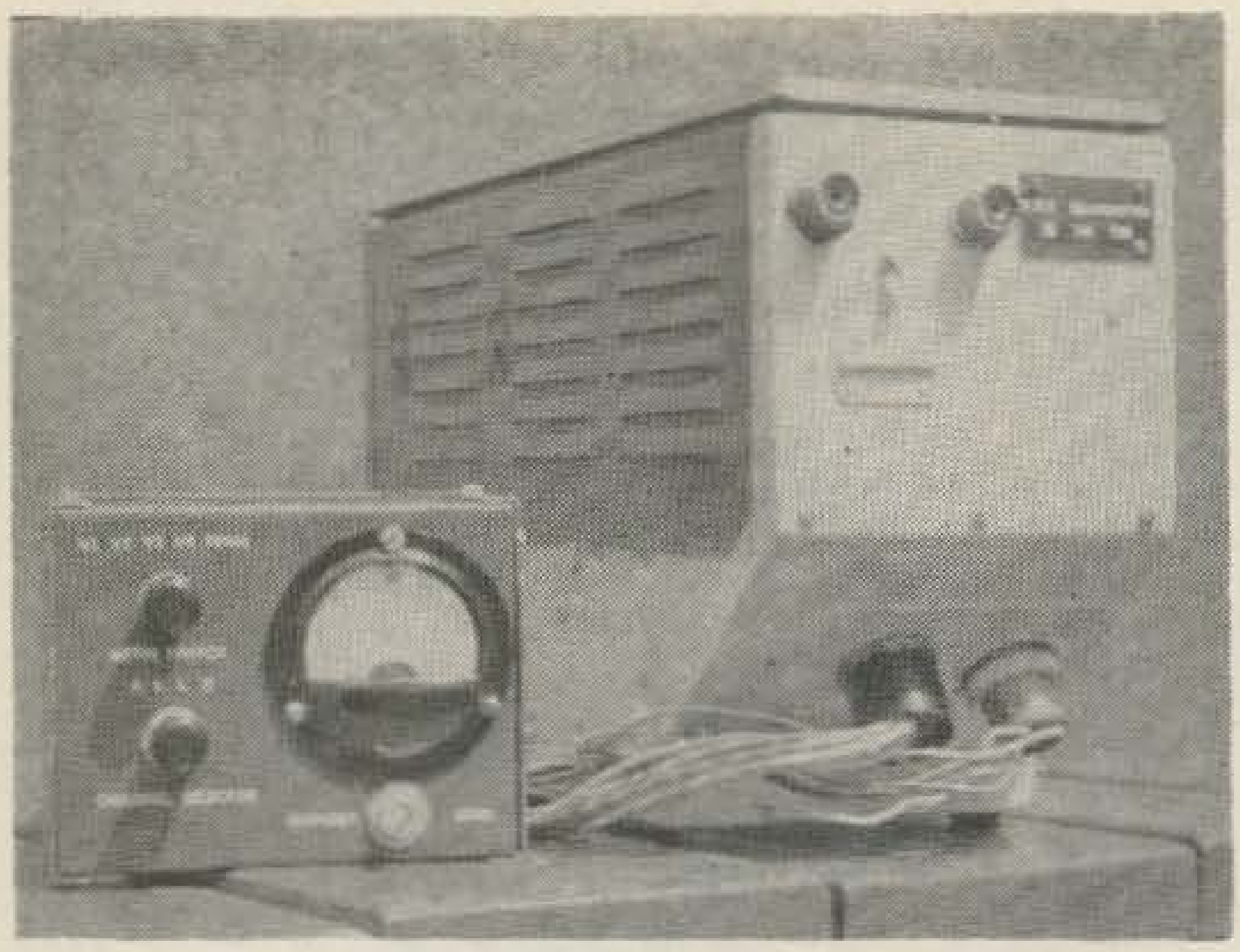
While this test is a little rough for any converter and, I'm sure that Tapetone never designed it to resist overload like that, it performs perfectly under these conditions. Part of this quality, I think, comes from the fact that the rf amplifier has no more gain than is needed. The converter has more than enough gain for even the simplest receiver and yet not enough to cause overload. This seems to be against the current trend to provide so much gain that the receiver doesn't need an "S" meter. It is only necessary to connect an O-1 ma "S" meter to measure the grid current of the mixer tube to tell the strength of the received signal. When an "S" meter is used, it reads 60/9 whenever a car starts up within a mile.

I would like to point out that the cause of cross modulation and related side effects is the fact that when a signal is strong enough to overcome the bias on positive signal peaks, the mixer will draw grid current and act as a detector. The audio voltage that is detected will modulate the received signals in the same way that a transmitter is grid modulated. This causes the effect of hearing one station's audio on all signals received. The 201 has the proper amount of gain and, therefore, these effects are missing. Even if there's no other stations within 100 miles of your mountain-top QTH, the 201 is still an ideal converter. Since, with a given bandwidth, the limitation of band (cosmic) noise still exists, the 201 will receive the signal perfectly, if it is at all possible to receive it. The noise figure of the 201 is well below natural noise in even the quietest location.

Even with all this, the Telco 201, at $37.40, is priced below the cost of a parametric amplifier. It is also more compact, being built on a 1½x3x6 inch chassis. The black and silver chassis is an attractive addition to any ham station. The connectors are the "BNC" type, which have a much lower loss than the "UHF" or Motorola types, besides being smaller and more convenient to work with. In conclusion, the Telco 201 is an amazingly low noise converter for 6 meters that is a real bargain at $37.40.

Gripes

Being of the type that has to find something to complain about, I have one complaint about this convertor: Why didn't Tapetone make this sooner? . . . WA2INM



Arc-5 VHF

Very high frequency.

Very low cost.

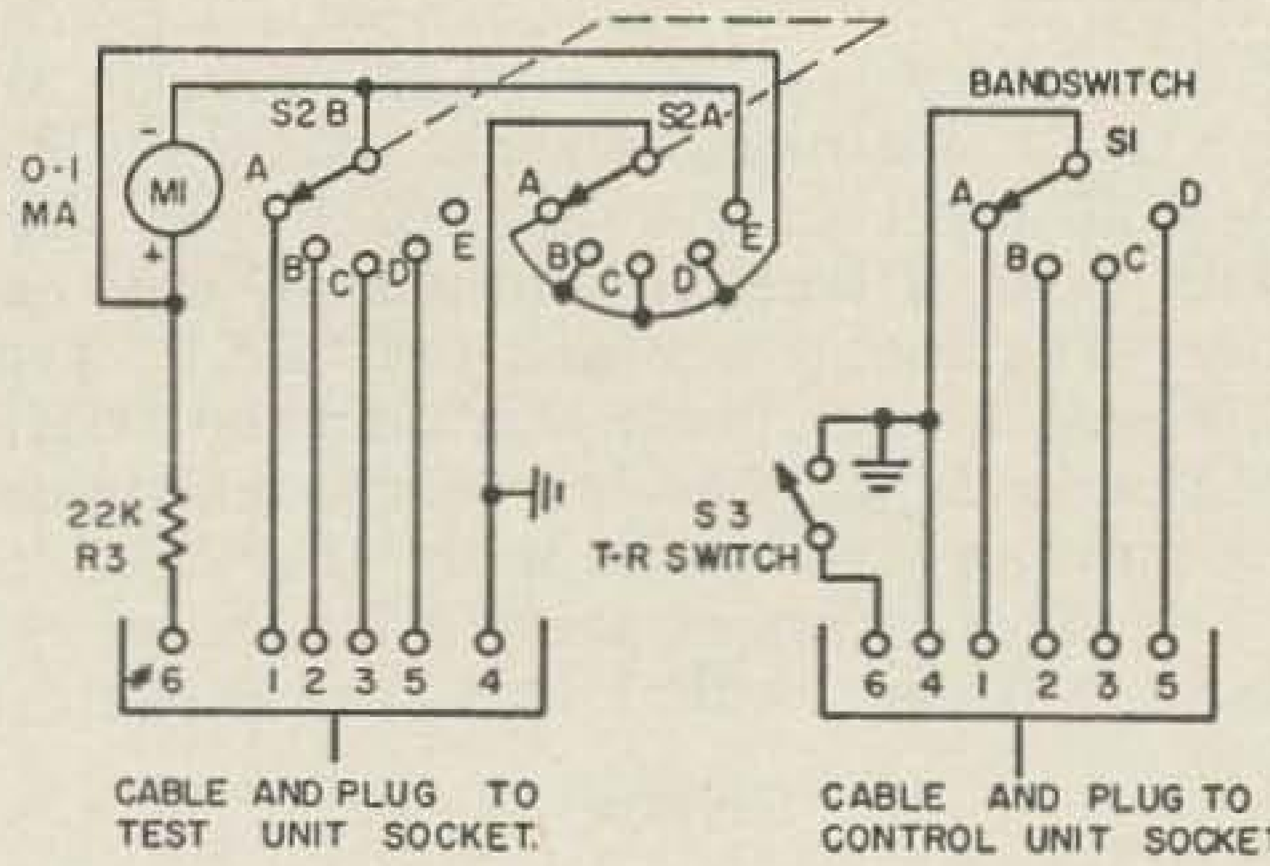
Charles L. Sizer WA2FHC
33 Tulip Street
Cranford, New Jersey

ARE you interested in a compact bandswitching VHF transmitter for 6, 2 and 1¼ meters? One with instant bandswitching that does not require you to retune from one band to the next? A transmitter that runs up to 35 watts on phone and can be put on the air for about two kilocents is the ARC-5/T-23. It has four channels which operate on or near two meters. These channels can easily be changed to operate on 50 and 220. Rex Radio in New York City seems to have one of the best prices on this rig. I suggest that you buy a diagram* of the transmitter to become better acquainted with it and to make the conversion a quick one. The conversion is quite simple and the result is a 35 watt phone rig which really puts out a beautiful signal.

To keep internal wiring changes to a minimum I decided to build a low voltage dc supply to run the motor and the relays. The filaments were disconnected from the 28 volt line and rewired for 12 vac. There are two good reasons for this change: (1) the filaments draw a lot of current and that would mean a high current rectifier system which would be expensive. (2) The relays and bandswitching motor will run on anything from 20 to 40 volts, while the filaments must stay within 10% of 12 volts. This makes it easy to find a transformer for the low voltage supply.

The two sockets on the sloping front of the transmitter and the one on the rear should be replaced with octal sockets since the original connectors are hard to find. The octal sockets will fit in the original holes. I found a plug to fit the control socket so this one did not have to be replaced. When you put in the octal sockets the best way to keep track of what is on each pin is to connect the wires from the original to the corresponding numbered pins on the octal socket. At the power socket on the rear of the transmitter pins #1, 2 and 6 are shorted together. The wire on pin #3 should be disconnected and run to the front of the transmitter to the control unit socket. This wire will be taken care of later. Make sure #4 is grounded. #7 will be modulated high voltage. #5 will have the low voltage dc for the motor and relays. #3 is the filament pin.

The filaments should be rewired as follows: At the 1625 oscillator and the final 832A no changes are made. At the second 1625 move the filament wires (filaments are the two large diameter pins) all to one of the pins and ground the pin from which the wires were just removed. At the first 832A move filament wires from one filament pin to the other and ground the pin from which the wires were just removed. This puts the filaments in parallel. Now a wire should be connected from the ungrounded side of the filaments at the first 832A to pin #3 on the power socket at the rear of the transmitter. After this is done make sure that no original wiring is still connected from the filaments to the 28 volt line or trouble will brew.



A = OSC
B = 2ND 1625
C = 1ST 832 A
D = FINAL GRID
E = FINAL PLATE

FIG_1

*Surplus Radio Conversion Manual Volume #2 (Radio Bookshop).

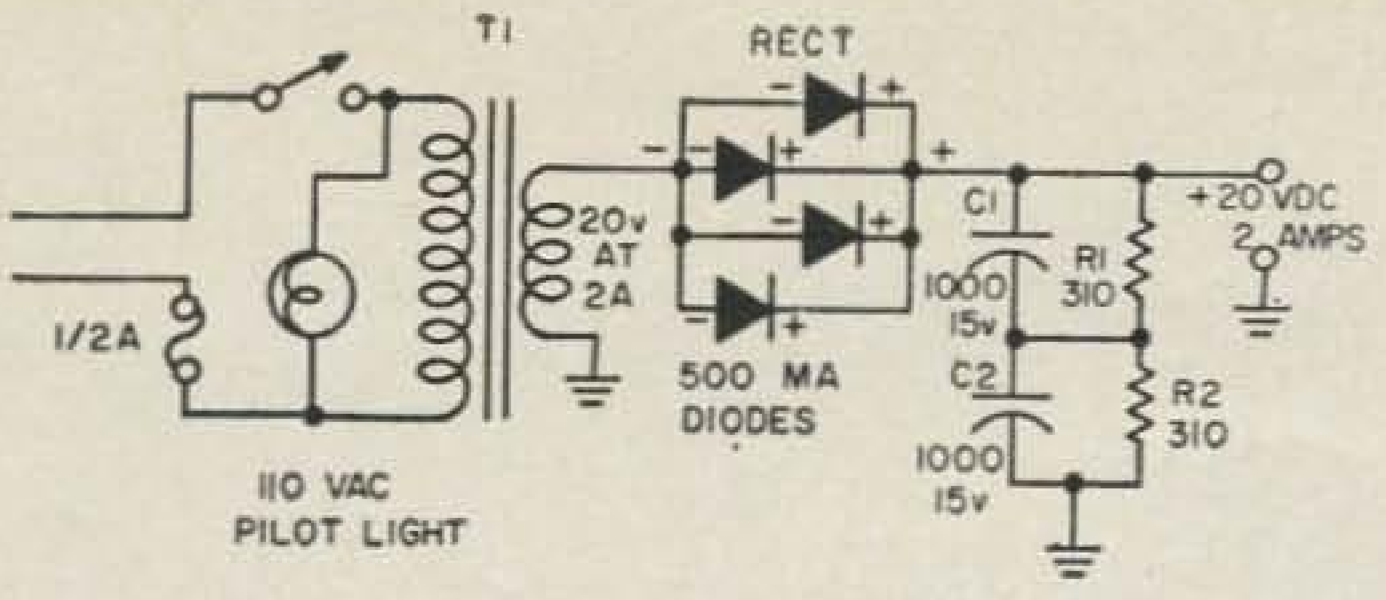


FIG. 2

Controlled Circuit Changes

Now let's take a peek at the control and metering circuits. At the control unit socket remove the wire that is on pin #6 and ground it at a convenient spot (pin #4 will do). Now take the wire that was disconnected from pin #3 on the rear of the chassis and connect it to pin #6 on the control unit socket. That's all at this socket and no changes are made at the test unit socket. This takes care of all the changes in the transmitter for operation on the original frequencies. The simple coil changes for 50 and 220 will follow the control unit and power supply discussion.

Control Unit

The control unit is simple and consists of a bandswitch, a transmit-receive switch and a meter. Bandswitching is accomplished by shorting the desired band control line to ground. This starts the turrets in motion and they will stop when the desired band is reached. The bandswitch (S1) is a single pole 4 position rotary. The TR switch (S3) is a SPST and it shorts pin #6 on the control socket to ground, closing all relays. Pins #1, 2, 3, and 5 are band control lines for bands A, B, C, and D respectively. Pin #4 is ground, and pins #7 and 8 are not used. The meter (M1) is a 0-1 ma. The meter switch (S2) is a 2 pole 5 position rotary. Position A goes to pin #1 on the test unit socket, B goes to pin #2, C to pin #3, D to pin #5, the positive side of the meter goes through a 22K 1 watt resistor to pin #6. The ground lead is pin #4. As on the control unit socket, the pins #7 and 8 are not used. Refer to Fig. 2 for the wiring of the control unit.

Power Supply

The voltages necessary to operate the transmitter are 12vac, 20-40 volts, 300-600 volts for plates and 300-600 volts modulated for the final. Low voltage for the screens is supplied by a voltage divider inside the transmitter. I

Table I

Tube	6 M	2 M	1¼ M
Xtal at 1625	8 mc	8	8
output 1625	16 mc	16	24
2nd 1625	48 mc	48	72
1st 832A	48 mc	144	216
final 832A	48 mc	144	216

found a 20 volt transformer for five bits so I used a half wave rectifier circuit. The rectifier consists of four 500 ma 100 volt silicon diodes in parallel. These are very inexpensive in the surplus stores. The filter uses two 1000 mfd 15 volt electrolytics in series with two 310 ohm 1 watt equalizing resistors. I use my regular station supply and modulator with about 400 volts on the plates. Connections are made to the rear power socket as follows: Pins #1, 2 and 6 get high voltage, pin #7 gets modulated high voltage, pin #3 gets 12vac, pin #4 is ground and pin #5 is for 20-40 volts dc at 2 amps.

Coil Changes

Though I am using the transmitter in this fashion, any variety of the four bands could be used.

Band A—6 meters—coil change necessary
Band B—2 meters—no coil change
Band C—1¼ meters—coil change necessary
Band D—2 meters—Entire band—no coil change

The following is necessary to put Channel A on 6 meters. Remove 3 turns from 3A and 3B. These are on the rear turret and are easily removed by removing a brass clip. Add a 22 mmfd ceramic capacitor across coil 4. This is between the two 832A's. The final should be rewound with 29 turns of #22 enamel wire and the link coil should be replaced with a one turn link around the center of the coil.

Shunt the loading capacitor with a fixed 40 mmfd fixed capacitor.

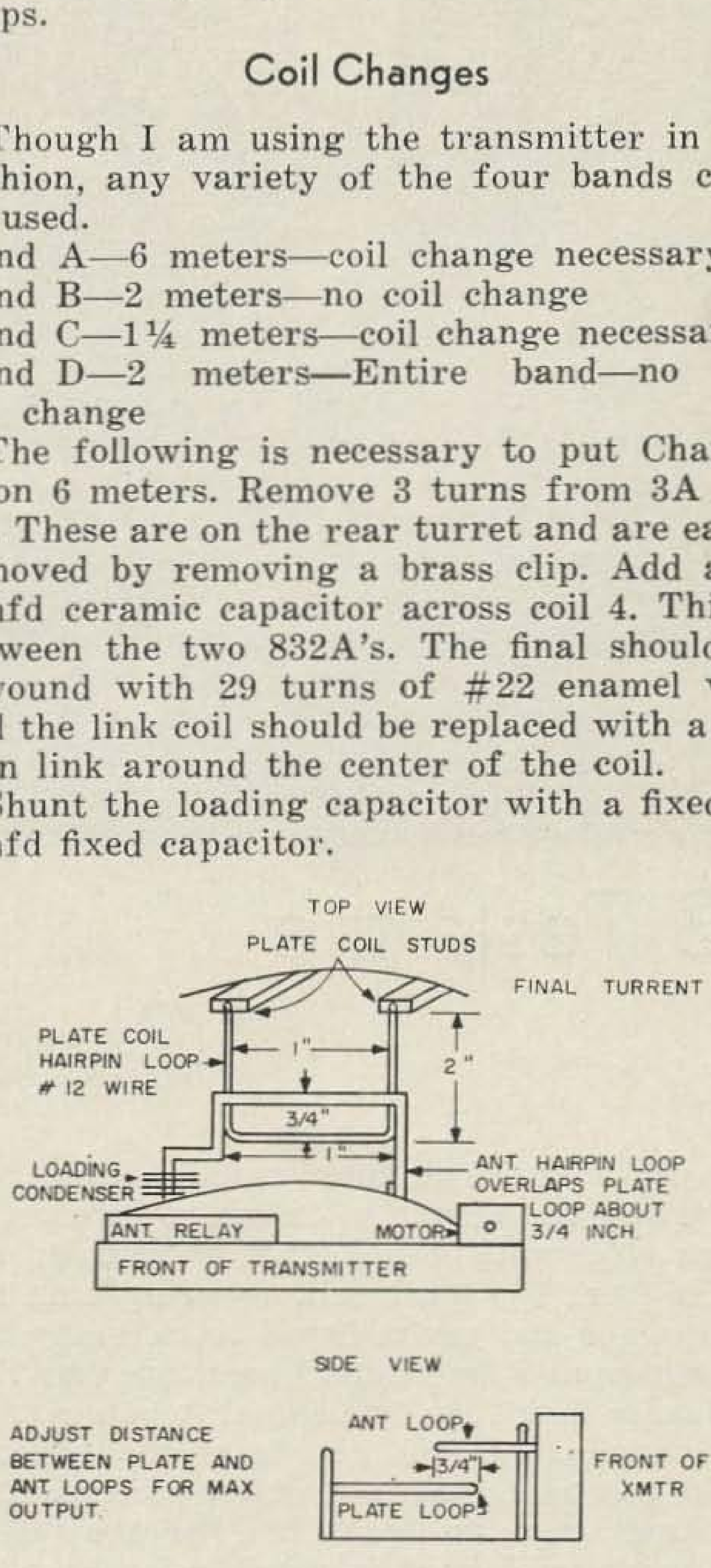
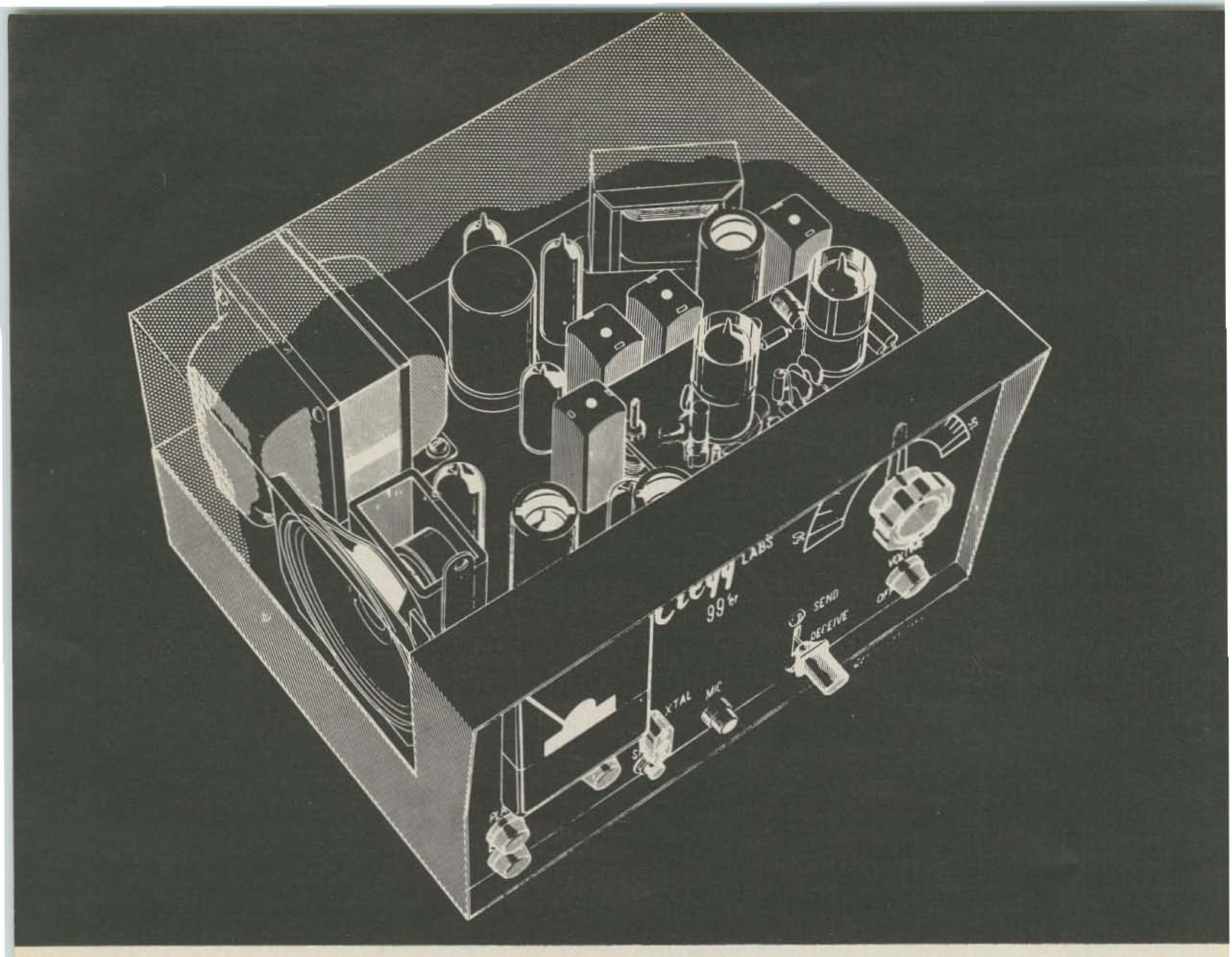


FIG 3

For 1¼ meters these changes are necessary. Band C was used. Remove all but 14 turns from the oscillator plate coil. Remove all but 5 turns from coil 3A. Remove all but 8 turns from 3B. Remove all but 2 turns from coil 4. Remove the final coil, antenna loop and the plate coil form. Mount a hairpin loop 2" long and 1" wide on the plate coil studs on the turret. The antenna loop should also be 1" wide and should overlap the plate loop by about ¾".

(Turn to page 29)



73 Tests the Clegg 99'er

Bill Pasternak WA2HVK
1525 West 8 Street
Brooklyn 4, New York

IF you do much in the way of six meter operating the report to be given here on the Clegg 99'er will be old stuff to you. By now you've heard several fellows using this new transceiver and you've heard them telling anyone who would listen just how much they liked it. You've heard the fine signal it puts out and the punch that you get from the adequate audio gain and good modulation system. After checking over the parts list for the 99'er I just don't see how it is possible for Ed Clegg W2LOY to sell this fabulous rig for only $139.95. He must do a lot of the wiring himself.

Until recently the ham on six meters had very little choice when purchasing a transceiver. He either had to spend about $300 for a communicator or suffer with one of the less expensive units. The main trouble with these inexpensive transceivers was in their receivers sensitivity and selectivity. However now that Clegg has introduced the 99'er, the problem has been solved.

The receiver is much better than is usually found in a transceiver and compares favorably with most communications receivers. It uses dual conversion with *ifs* at 10.7 mc and 455 kc. A 6DJ8/ECC88 twin triode (see 73, Nov. 1960 for more info on this tube) is used as a low noise cascode *rf* amplifier. The first conversion osc-mixer uses a 6U8/6EA8 (see 73, Aug. 1961, p. 18), with the triode section working as a tunable oscillator covering 39.3-41.3 mc. As you can probably gather from this, the receiver tunes only the first two mc of the band, affording excellent electrical bandspread.

The second mixer is a 6AN8. This is followed by a 6BA6 *if* amplifier and a 6AL5 detector, *avc* and *anl*. A line-up such as this provides plenty of gain while still retaining an excellent noise figure. The selectivity is very good because of the 455 kc *if*. Usually a transceiver has either selectivity or image rejection, mainly because of the choice of *if* frequency is a compromise between the two. The use of double conversion has the best features of both a high and a low *if* frequency.

Incidentally, the 99'er is one of the only transceivers that I have seen that has a local oscillator stable enough to permit the use of high selectivity. There is virtually no noticeable drift after a four or five minute warmup. With a BFO this receiver would do fine for SSB reception. A large accurate, easy to read "s" meter is mounted on the front panel and doubles as a tuning meter for the transmitter. The transmitter is a somewhat conventional 8 watt crystal-controlled one using a 7558 in the final. The pi network permits the final to load a wide variety of load impedances. The final is very efficient and sounds like a lot more than 8 watts input, according to signal reports received. (Clegg's specs say that the unit puts out 4 to 5 watts.) The driver is a 6EA8 and will operate from either 8, 12 or 25 mc crystals. In addition, the unit will operate with a vfo and has input and control circuits thru the rear panel power plug for this operation.

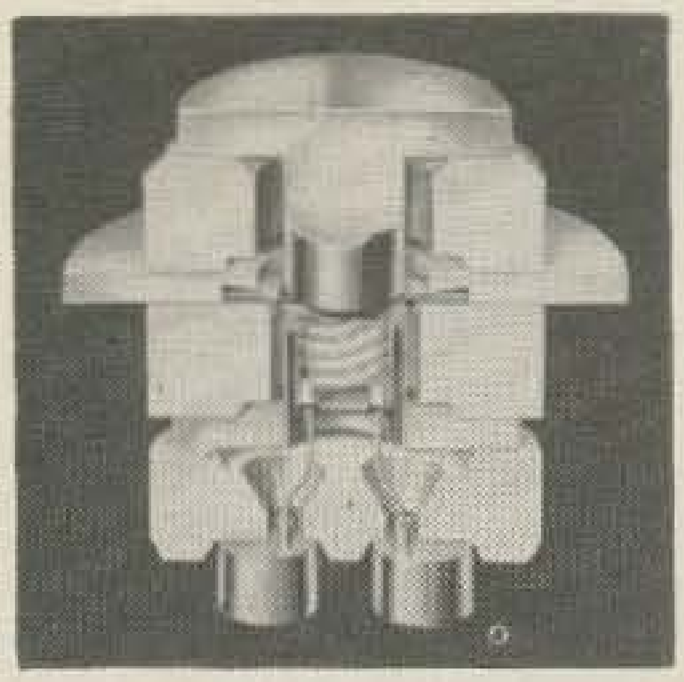
A very important feature is the spot switch, mounted on the front panel, which warns you before you louse up your frequency. The final amplifier is plate modulated by a 6AQ5 which doubles as the audio output in the receiver. The quality of the modulation is excellent and there is plenty of it. The 99'er has a gain control for the mic preamp which is a feature usually left out. While on the subject of features, the 99'er is loaded with them. The meter is automatically switched from "transmit" to a receiver "s" meter when the transmit switch is thrown.

The noise limiter works very well and it is in operation at all times. Clegg probably feels (as do I) that the limiter is used most of the time anyway, so why confuse the issue with an ANL switch. The power supply is not like most others. It uses a full wave rectifier (6BW4) instead of a half wave voltage doubler. I could never understand the use of voltage multiplier circuits in transceivers because for safety they have to use a power transformer anyway. If you are going to use a power transformer it is possible to get any necessary voltage without multipliers.

The full wave supply is much more efficient and easier to filter. The regulation of a full wave supply is far superior to any form of voltage doubler, which probably is the reason for the excellent stability of the receiver. The rig will work fine in the car if used with a 100 watt inverter. This can be reduced considerably if the tube heaters are connected directly to the battery.

I have been using the 99'er for some time now and I feel that there is little left out of the unit. It is quite attractive and a worthwhile addition to any hamshack. With the 99'er you get more than your money's worth. Congratulations to W2LOY and the rest of the crew in Mt. Tabor on a job well done.

. . . WA2HVK



A 7077 Two Meter Converter

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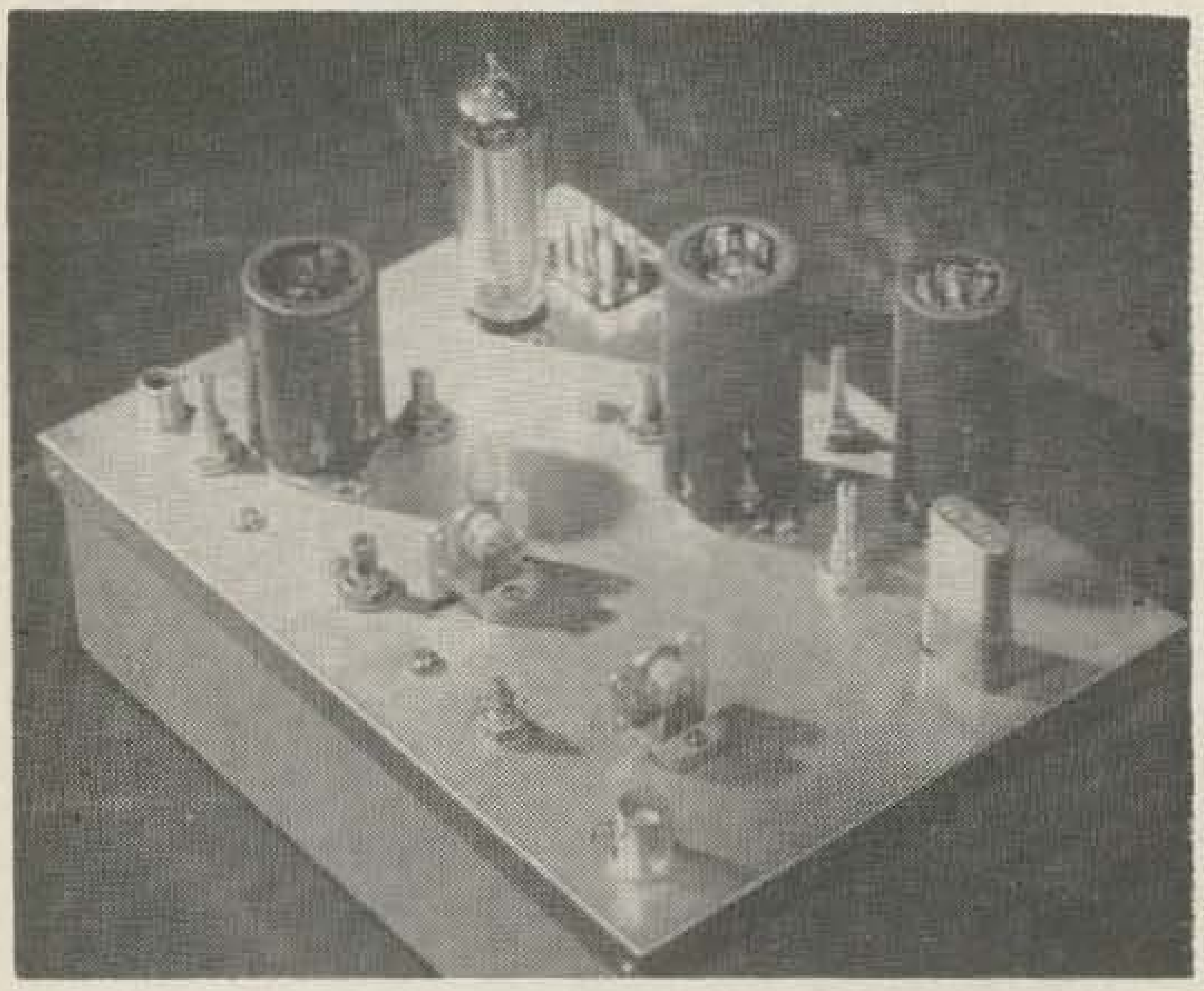
Los Angeles 24, California

THERE have been many two meter converter circuits published using either the 416B or 417A tubes. To the best of my knowledge there has been only one description of the application of the GE-7077 micro-miniature triode! A commercial converter is now available, manufactured by Centimeg. This tube is extensively used in satellite and space circuiting because of its extreme ruggedness, small size, and excellent electrical characteristics.



Top view of converter. The rf and mixer stage are to the left, the oscillator chain to the right. The OA2 regulator for the oscillator chain to the rear. The plastic buttons visible hold the tectronix tie strips.

The 7077 is a high-mu triode of ceramic and metal planar construction pimarily intended for use as an rf amplifier in the 30-1200 megacycle frequency range. It features an extremely low noise figure throughout its frequency range. A noise figure of between 2.5 and 2.8 decibels is claimed for this tube in two meter application. The 7077 was the class B final in the transmitter of the Pioneer IV satellite whose signals were heard on 960.05 megacycles 407,000 miles. The objections to the tube are its present unavailability except new, its relatively high cost, special socket requirements and desirability of a regulated heater supply.

Anticipating the more ready availability of the tube, the converter herein described was developed, using what appear to be desirable features from several circuits. Several of the ideas of DL3FM[2], in particular are employed.

Construction

The converter was constructed on a silvered soft copper plate with folded edges which fits over a standard 5 x 7 chassis whose lips were filed off. This construction permits bringing the interstage shields in very close approximation to the sides of the chassis. Silvering of the copper plate, partitions, and coils was done using a preparation called "Pure Silver Plate"* This material provides a very satisfactory and inexpensive method of silver plating and has many applications in the ham shack. This material is poisonous and can only be secured through a pharmacy. It is easily applied, if directions are followed. The plate and partitions are individually drilled and plated before assembling.

The final oscillator coil and trap, as well as the mixer inductance circuitry, were prefabricated and mounted on Tectronix ceramic tie point units which make neat and rigid assemblies. The neutralizing inductance was mounted on the rf amplifier shield using a standard tie point as a standoff insulator which isolates it from ground.

*V. Burkinshaw Co., P. O. Box 192, Vista, Calif.

Amplifier

The rf cascoded amplifier circuit was slightly modified from that described by W2ZHI in that 18K plate resistors were used, as recommended by the manufacturer, rather than potentiometers. The socket of the first 7077 is modified as illustrated because of its grounded cathode configuration. Shielding is provided between stages with feed through bypass condensers. All heater and plate leads are shielded and bypassed. While no button bypass condensers were empolyed, leads from the bypass condensers used were cut to negligible length. Provision for lifting the cathode of the first rf stage off ground, as well as breaking the B+ to the rf stages and mixer was incorporated using a miniature relay.

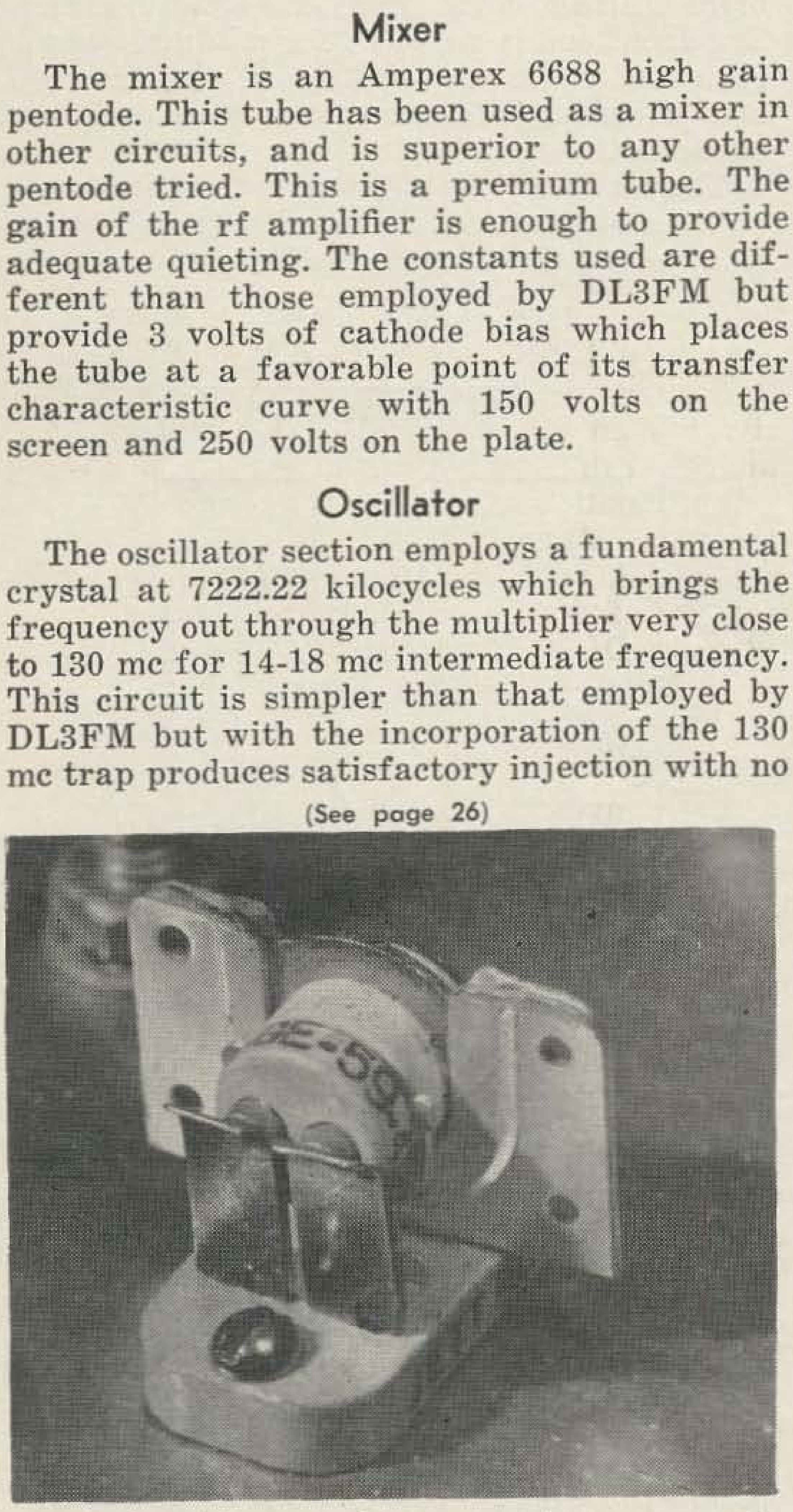
Mixer

The mixer is an Amperex 6688 high gain pentode. This tube has been used as a mixer in other circuits, and is superior to any other pentode tried. This is a premium tube. The gain of the rf amplifier is enough to provide adequate quieting. The constants used are different than those employed by DL3FM but provide 3 volts of cathode bias which places the tube at a favorable point of its transfer characteristic curve with 150 volts on the screen and 250 volts on the plate.

Oscillator

The oscillator section employs a fundamental crystal at 7222.22 kilocycles which brings the frequency out through the multiplier very close to 130 mc for 14-18 mc intermediate frequency. This circuit is simpler than that employed by DL3FM but with the incorporation of the 130 mc trap produces satisfactory injection with no

(See page 26)



Detail of modification of Jettron socket necessary for the first rf stage. The ground leafs are cut off flush with the base of the socket with sharp cutters. This makes the grid conection loose in the socket but this constitutes no problem. The sockets are Catalog #8670, Jettron Products, Inc., Route 10, Hanover, New Jersey.

(Ant. Switch from p. 84)

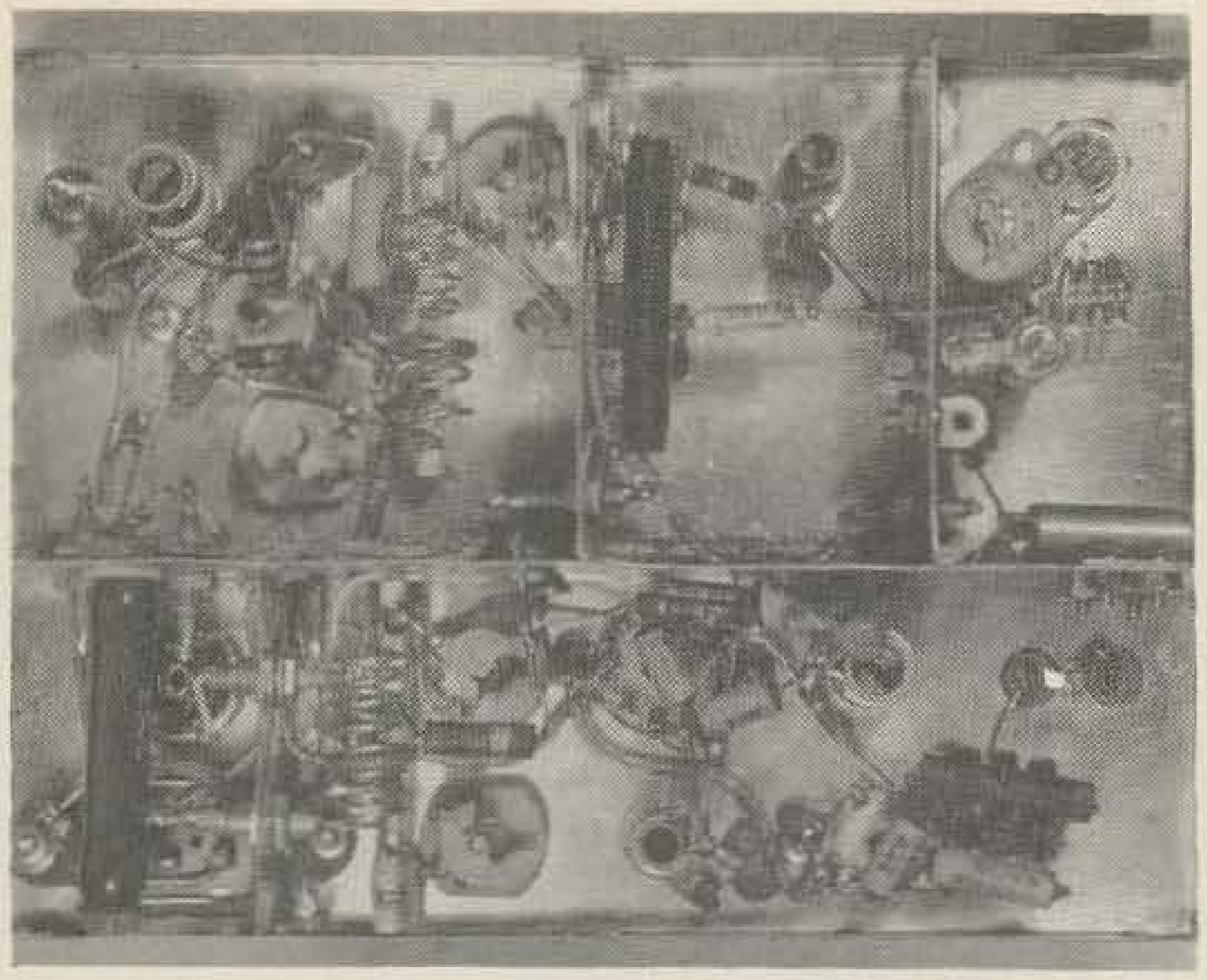
on a ¾" square, 1" high ceramic insulator post. The connection to this ferrule is a ¼" strip of copper slipped between the cable clamp and the ferrule and soldered to the antenna SO-239. 4-40 brass nuts and lock washers secure the soldering lugs to the other two switch contacts and 16 gauge bare wire connects these to the other two receptacles. Extreme care should be used to avoid breaking the glass to metal seals of the switch.

A 1-¾" length of ¼" Teflon rod is used as the actuating arm for the vacuum switch. The insulating qualities are superb and the rod is flexible enough to insure positive contact without placing undue strain on the switch. One end of the rod is drilled to a depth of ¾" with a #31 drill and the other end is slotted to accept an iron armature plate. One of the discarded relay armatures may be used and the rod and plate drilled to pass a #2 machine screw which will securely hold the armature in place. Very carefully push the drilled end of the Teflon rod on the exhaust tubulation of the switch. The crimp in the tubulation may be held with long nose pliers during this operation. Carefully orient the armature plate between the relay poles. If required, loosen the mounting screw of the ceramic post and position so that, when the contact is centered, the armature is centered between the poles.

Wire the balance of the unit, except for R-1 and R-2, and connect a jumper between pins 1 and 2 of J-1. Connect a 1,000 ohm adjustable, wirewound resistor, set for maximum resistance, in place of R-1. Apply power and adjust the resistor for 28 volts across the coil of RL-1. Remove the resistor, measure the value and install a 10 watt resistor of the nearest stock value for R-1. Remove the jumper from J-1 and repeat the procedure to arrive at the value for R-2. A 5 watt resistor will probably be adequate in this location. Key the unit and observe operation. The switch contacts should make just before the armature seats on the magnet poles, with the flexibility of the Teflon rod taking up the excess travel. If all is well, mount the plate on the chassis, using #6 sheet metal screws. If desired, brackets may be attached to permit mounting of the unit. Alternatively, the chassis may be mounted with screws through the top before the component mounting plate is attached.

The completed switching unit should cost less than a heavy duty coaxial relay and its performance more than justifies the construction effort. As described, the relay will function up through 30 megacycles without introducing noticeable discontinuity in the transmission line. The added bonus of quiet, dc operation and the ability of the unit to withstand considerable abuse make this a very worthwhile project.

......W4WKM



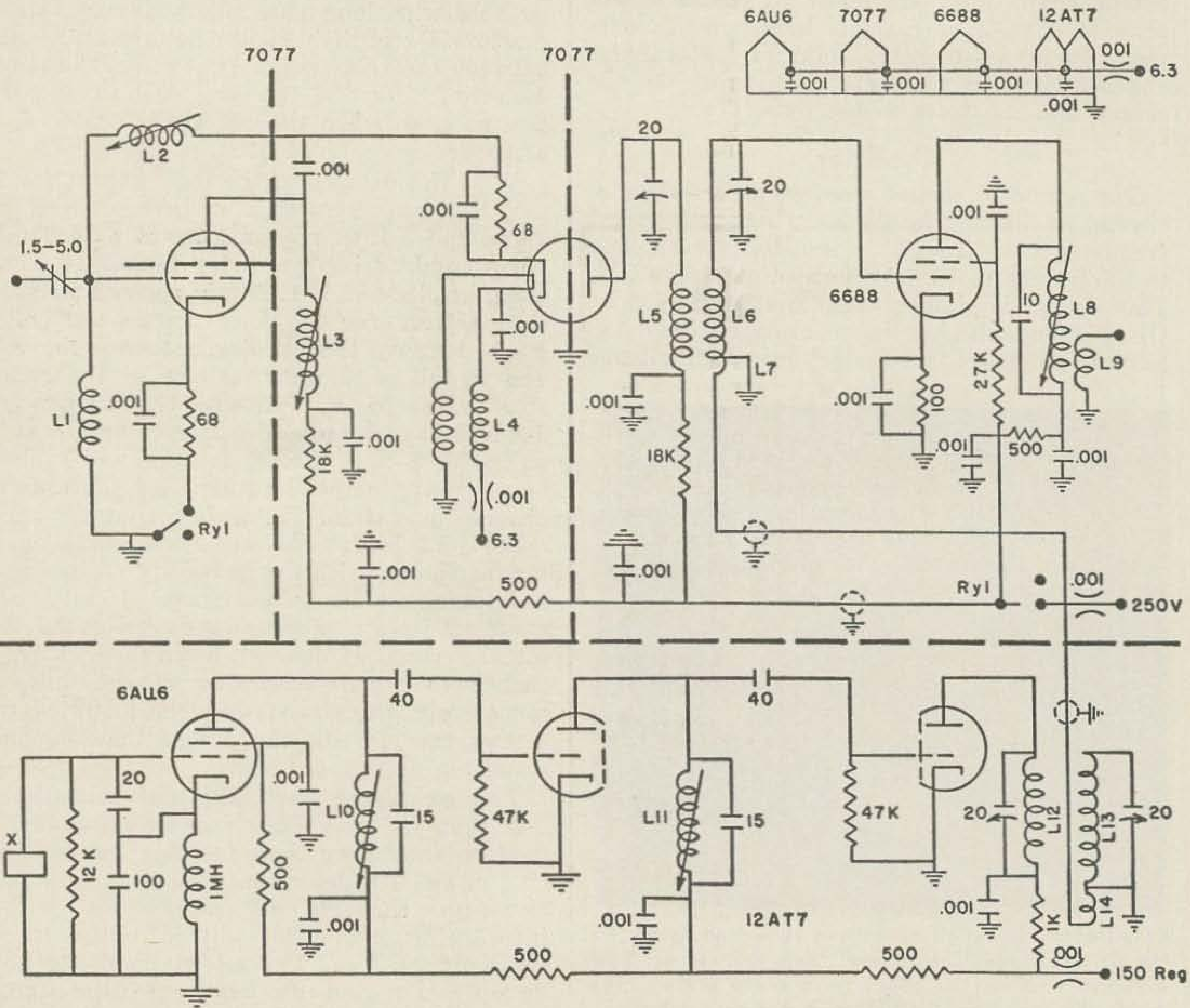
Converter from below: shows general position of components and shielding. Converter could easily be made smaller than 5x7 size.

evidence of spurious frequencies. The International Crystal Company circuit recommended for crystals operating on their fundamental frequency could be used here for more precise positioning of the injection frequency.

Adjustment

All tuned circuits were dipped and adjusted in the circuit with tubes in place but without voltage. The plate inductance of the first rf stage tunes very broadly and when it is adjusted to dip between 144-148 mc needs no further attention as positioning of the slug has no measurable effect on operation. The plate coil of the second rf amplifier and the grid coil of the mixer stage are slightly staggered and the plate coil of the mixer peaked for approximately a 1 mc portion of the band. The gain of the converter is such that adequate gain is obtained over the entire two meter band by adjustment of the rf gain of the communications receiver used. Swamping of the plate coil of the 6688 with 5K resistor can be used if more uniform coverage of the band is desired. The front end is adjusted for minimal noise by removing the heater voltage of the first 7077 and adjusting the neuterizing coil and input capacitor.

The oscillator chain is quite straight forward and is adjusted for maximum output. The trap is adjusted for 130 mc and its point of reso-



Circuit diagram of converter. All capacitors are in mm fd and all resistors may be ½ watt, although several 1 watt resistors were used in mixer circuit. All bypassing in R. F. circuit is done with shortest possible leads. Button capacitors may be preferable.

nance is quite noticeable on an incoming signal.

This converter, when tested with an accurately calibrated rf tight voltage source, gave a very noticeable signal with less than 0.1 microvolt input. There is very little tendency for overload except from a very powerful local transmitter and there is very little evidence of cross modulation. The noise figure was not measured but the gain is such that the rf gain of the communications receiver is kept reduced and even very, very weak signals pop out as if there were squelch action. . . . WA6EWV

References

[1]Coffey, William H. W2ZHI **7077 RF Amplifier for the 144 Megacycle Band** G. E. Ham News. January-February 1959.

[2]Lickfeld, Dr. Karl G. DL3FM **A Six Tube European Style 145 MC Converter** CQ. November 1960, page 38.

Coil Table

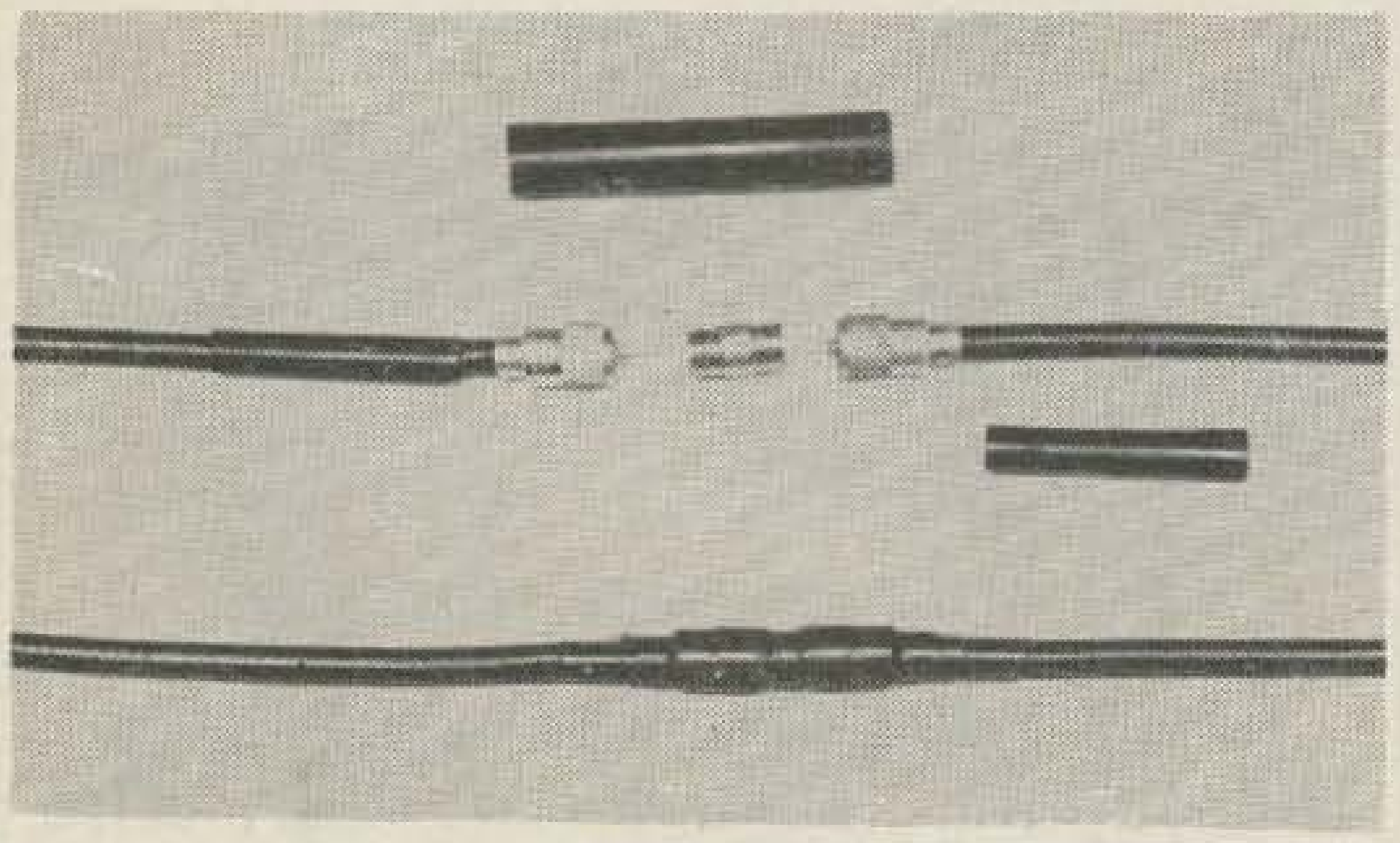
L1—4 turns #18 copper silver plated ⅜" 1.d. Approx. ½" long.
L2—0.76 uh—10 turns #22 enamel close wound ¼" iron slug.
L3—4 turns #18 ¼" iron slug. Approx. ⅜" long.
L4—R F C bifilar filament choce 2 strands #26 enamel 1½" long on ¼" plastic tube or rod.
L5—4 turns #18 copper silver plated ⅜" 1.d. Approx. ½".
L6—3 turns #18 copper silver plated ⅜" 1.d. Approx. ½".
L7—1 turn #18 insulated wire at cold end of L-5.
L8—20 turns #22 enameled close wound ⅜" iron slug.
L9—1 turn #20 insulated wire cold end L-7.
L10—14 turns #26 enamel close wound (Triples).
L11—10 turns #26 enamel close wound ¼" (Triples).
L12—5 turns #18 ⅜" 1.d. Approx. ½" (Doubles).
L13—5 turns #18 ⅜" 2.d. Approx. ½".
L14—1 turn #20 insulated wire cold end of L-13.

Photo Credit: Morgan S. Gassman, Jr.

Shrunk on Protection

Although not exactly new to the industry, many amateurs may not be aware of the many applications of shrinkable plastic tubing. Alpha Wire Corporation manufactures a line of this product known as "ALPHLEX" which is available through major distributors. This tubing is made from a modified, irradiated, polyolefin base plastic that is thermally stable. The tubing is supplied in expanded form and a size should be selected to just fit over the object to be covered.

Controlled shrinkage to the predetermined size occurs within 7 seconds when the tubing is subjected to temperatures between 275 and 300°F. Heat may be applied by an oven, proximity to a heating element, hot air gun (electric hair drier?) or by open flame if care is exercised.



Alpha Number	Size	Before Shrinking Min. I.D.	After Recovered I.D.	Nom. Wall Thickness
FIT-275-5/16	5/16"	.500"	.334"	.025"
FIT-275-7/16	7/16"	.693"	.462"	.025"

A typical amateur application is shown in the photograph. Two sizes of the tubing are used to weatherproof a UHF connector, coaxial cable junction. Characteristics of the tubing used are as follows:

Two sections of the 5/16" tubing are slipped over the cable and, after the PL-259A connectors are installed, pushed over the ferrules. A length of the 7/16" tubing is slipped over one of the cables and, after the PL-258 straight adaptor is installed, pushed over the junction. Exposure to heat (an oven was used in the example shown) shrinks the tubing to provide an insulated, weatherproof junction.

Space has not been taken to list the complete range of available sizes of this versatile insulation. A visit to your distributor or a letter to Alpha Wire Corporation will produce the required data along with information on other applications. ...W4WKM

(ARC-5 from page 21)

Mount a 3-30 mmfd trimmer across the plate studs. Shunt the two 3 mmfd capacitors in the grid leads to the final with two 2 mmfd capacitors to bring the total capacity up to 5 mmfd.

To improve drive for 220 the following grid leak resistors should be substituted for the originals. Oscillator—82k, 2nd 1625—50k, first 832A—100k, final 832A—unchanged.

Table 1 gives the approximate frequency of each multiplier stage based on an 8 mc rock in the oscillator. As a final touch I gave the transmitter a two tone paint job, reversed the name plate on the front of the transmitter and put on the decals. The control box also got a spray of blue paint and the decals were added for a better appearance.

The rig is tuned by means of a 3/16" nut-driver and the coils are adjusted for maximum indication on the meter. These readings will be from half scale to full scale, depending on the internal resistance of the meter. The final is tuned for dip with the slug in the final coil at the front of the transmitter and loaded with the antenna coupling (loading) capacitor.

Excellent signal reports have been received with the T-23 and I am quite satisfied with its overall performance. By the way that 0-1 ma meter is a real rugged beauty and it costs less than two dollars. So, how about a trip to radio row to become one of the boys on VHF. See you on 220.

Joe Crowling K4CPR
1034 Falmouth Street
Warrenton, Virginia

Four Layer Devices

IT is difficult to think of an electronic component for which hams have not found a use. Given a little information, time and a reasonable price, hams will find some use for almost anything. It is hoped that this article will provide a little information.

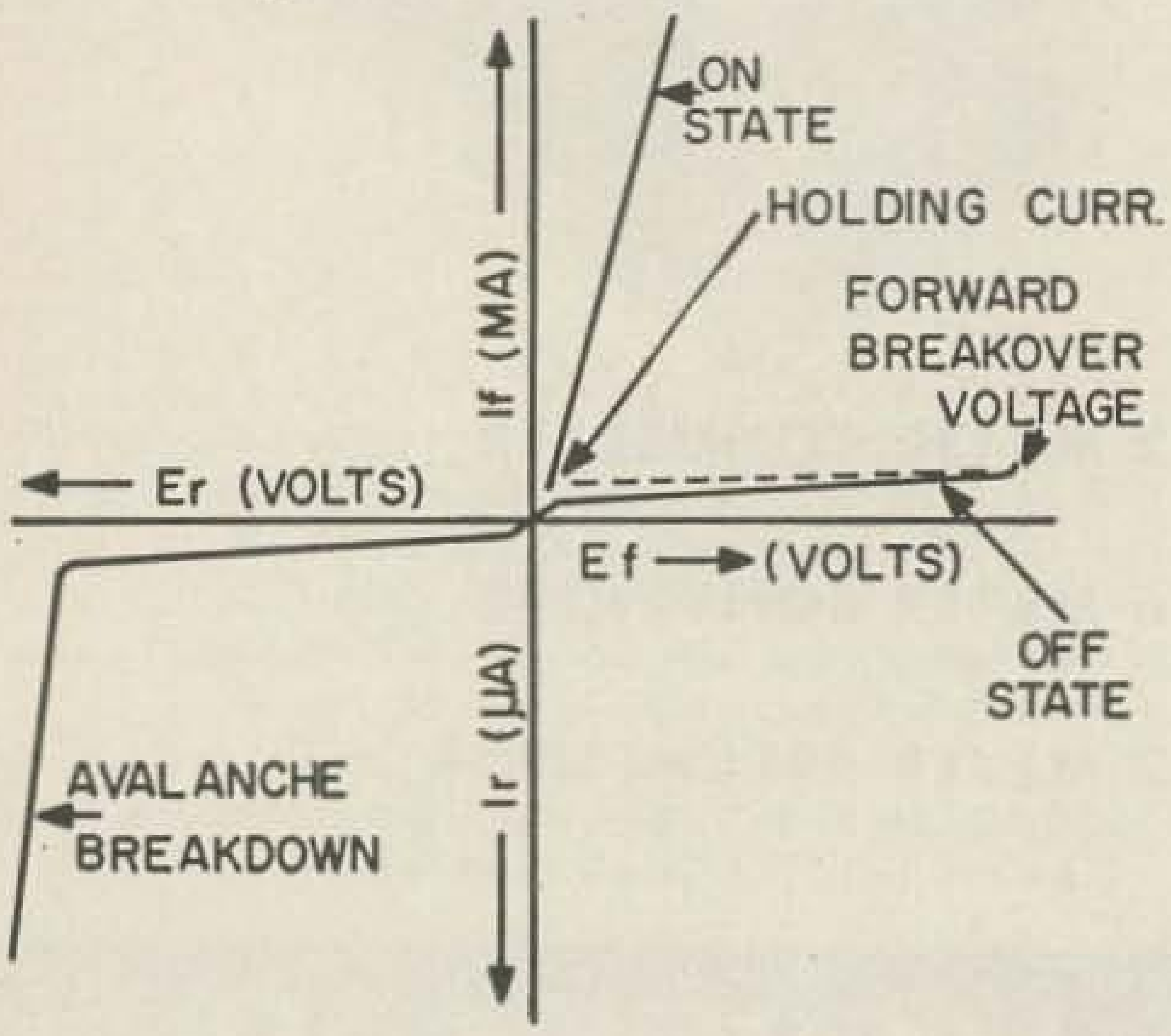


FIG. 1

Silicon Controlled Rectifiers (SCR) are not new, but now there is a family of devices (See Table) based on the SCR. The SCR is a semiconductor device that is similar to the gas thyratron. That is, it will remain in an "off" (non-conducting) state until turned "on" (conducting state) by a control signal. It will then remain "on" even if the control signal is removed. The SCR is turned "off" by reducing its anode current below the "holding" level (See Fig. 1). The devices listed in the table all resemble the SCR in theory and operation, but they have much greater firing sensitivity. Therefore, they are useful in low power circuits that are not within the capability of the SCR. Also, some of these devices are designed for control signal turn "off".

Compared to thyratrons these devices are smaller in size, more rugged, free of jitter, no filament, no aging effects and no firing instability. Also, their forward voltage drop is much lower than that of a thyratron. If used in place of a relay, they have no contact bounce, no arcing, no moving parts, high sensitivity and high speed operation.

The operation of these devices is best understood by using a two transistor analogy (See Fig. 2A). The collector of the NPN drives the base of the PNP, and the collector of the PNP drives the base of the NPN. This feedback loop has a gain equal to $\beta 1$ multiplied by $\beta 2$. The device remains in the "off" state as long as there is no positive gate signal, but when a positive trigger signal is applied to the gate the NPN is biased "on", causing its collector current to rise. The collector current of the NPN turns the PNP "on" and it in turn provides more base drive for the NPN. Both transistors are driven into saturation and the impedance between the anode and cathode (Fig. 2B) becomes very low. The gate signal is no longer needed because the PNP provides more than enough drive to the NPN. The device will now remain "on" until the anode current is reduced below the holding value (this can be done with a switch or a pulse). The functions of the two transistors are combined into a single PNPN silicon wafer. The curve in Fig. 1 is characteristic of four layer devices. Reverse voltages (E_R) cause only a few micro-amps of current to flow (I_R) until the avalanche breakdown point is reached. Forward voltages (E_F) cause only a few micro-amps to flow until the forward breakover voltage is reached. These devices will block either polarity voltage until turned on, then they will act as a diode.

The current gain of these devices is tremendous, 50,000 is practical. A representative gate signal for turn "on" is +.1 volt and 20 micro-amps (20 micro-watts). This gate signal might be used to control an anode current from a few milli-amps to a few amps at voltages up to 200 volts. Turn on time is usually a fraction of a micro-second.

The circuit in Fig. 3 can be used for direct control of current to a given load. Until the four layer device is turned "on" it will act like a few megohms of resistance, once it is turned "on" its impedance will drop to a low value (under one ohm at high anode currents) and current will be limited only by the load. If a regular dc relay is used for the load, it

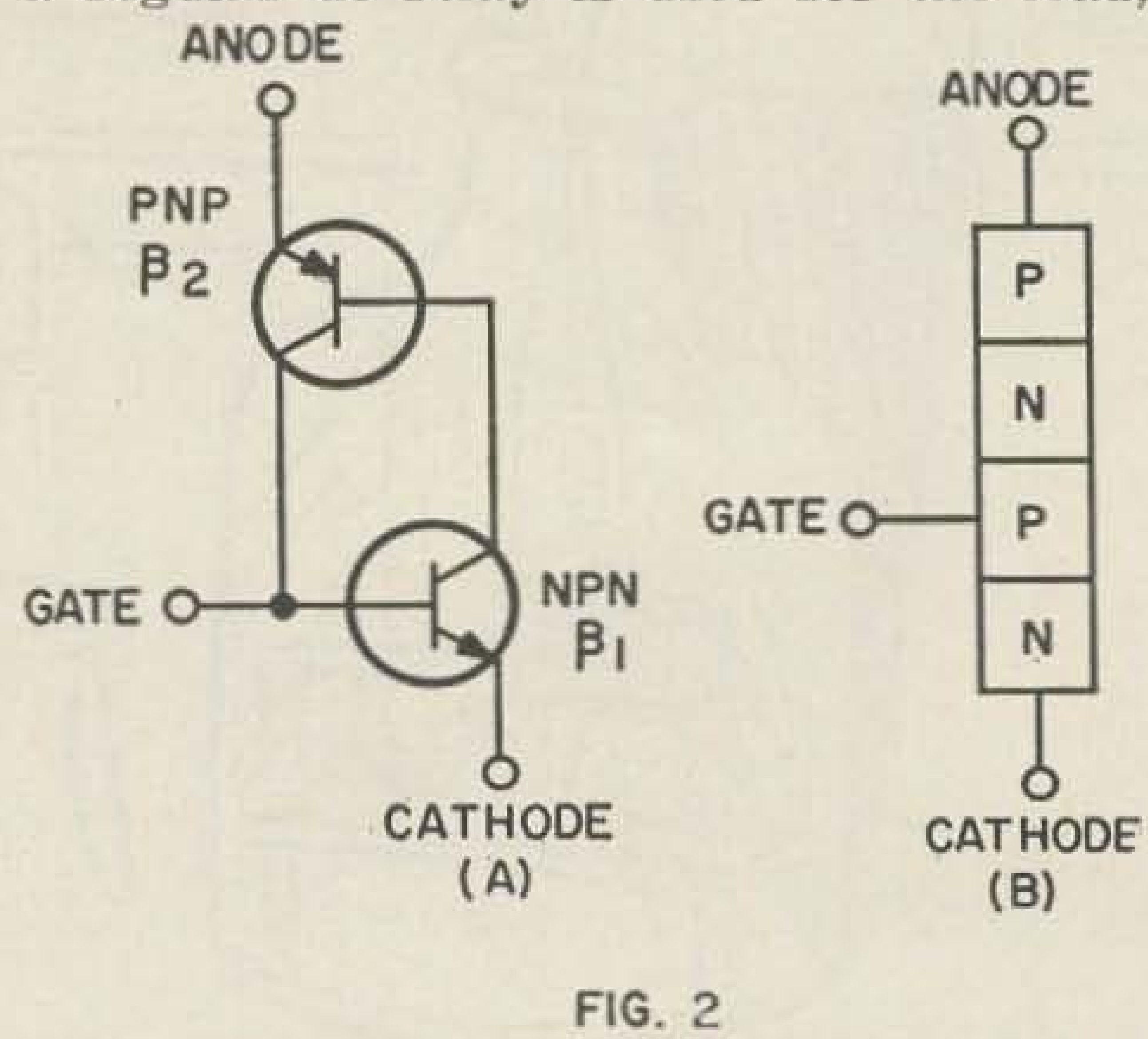


FIG. 2
a. Two transistor analogy of four layer device.
b. External connections to the silicon wafer.

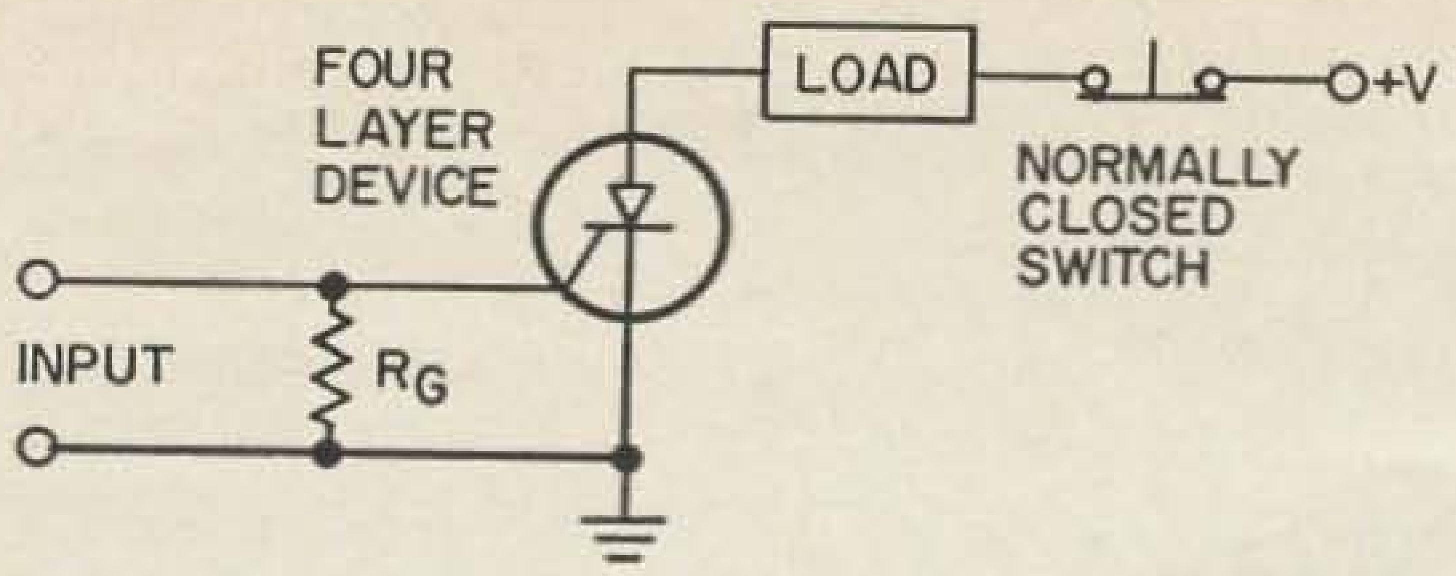


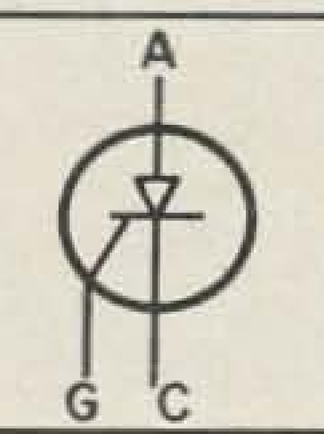
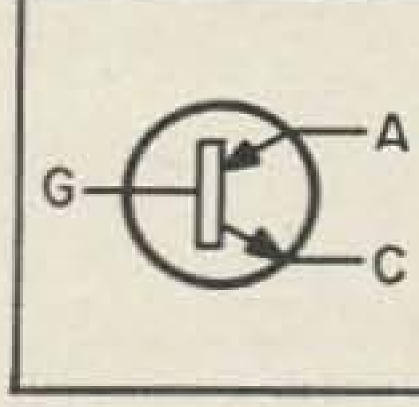
FIG 3

will be converted to a highly sensitive latching relay. The gate resistor (R_G) is for bias. Never operate a four layer device with the gate open. It is a high gain device and leakage current may cause "turn on" and possible self-destruction.

Four layer devices can be used as pulse generators, timing circuits, dc to dc converters, protective circuits (for those high priced bottles) and many other things. One might be used to replace the relay in an electronic keyer.

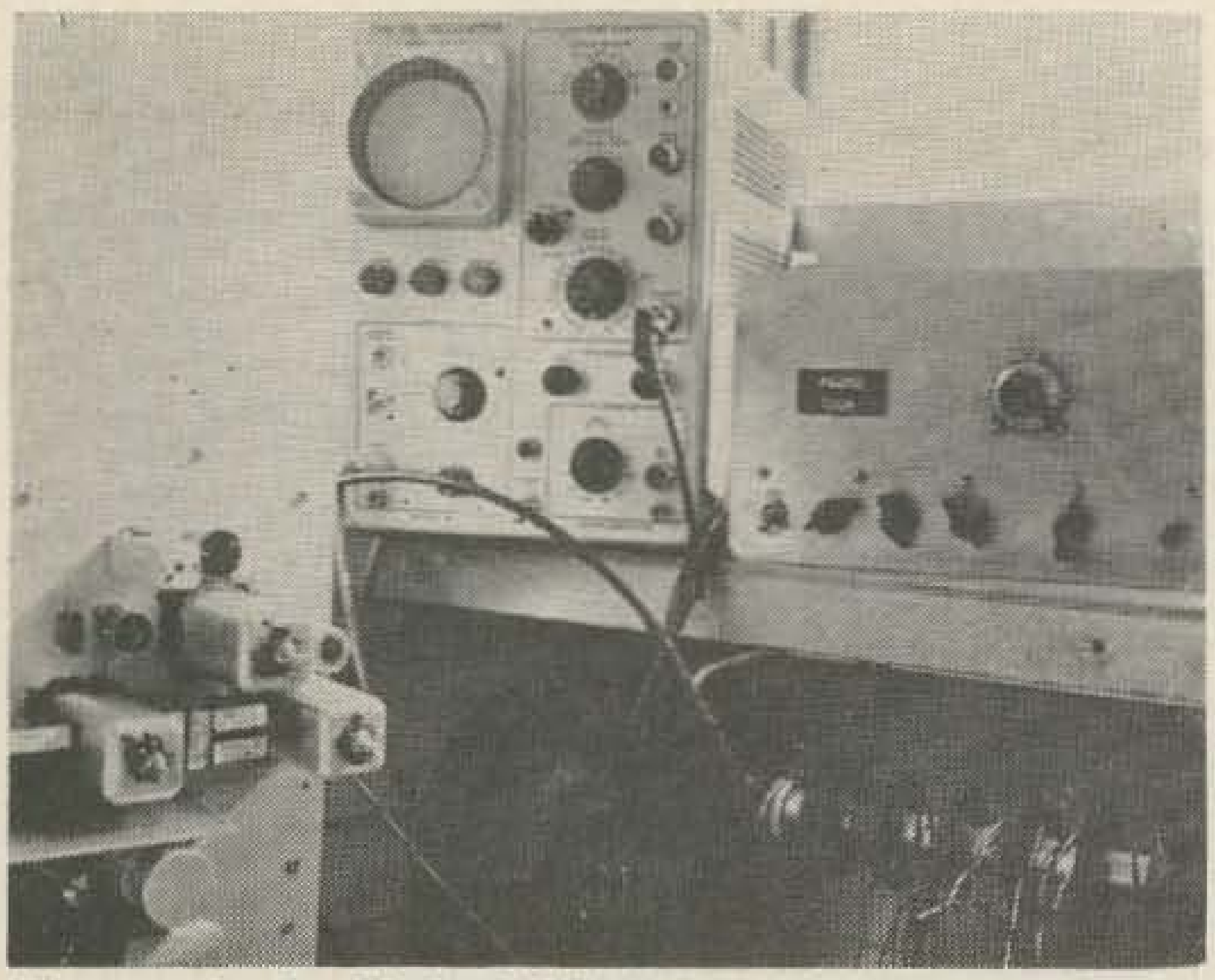
There are many potential uses for four layer diodes in amateur radio and it is hoped that this article will stimulate a little thought along these lines. For more information see the bibliography.

TABLE OF FOUR LAYER DEVICES

Name	Symbol	Description
Silicon Controlled Rectifier		Semiconductor device similar to a gas thyratron, acts like an ordinary diode that has been modified to prevent forward conduction until a small signal is applied to the gate.
Silicon Controlled Switch		Same as Silicon Controlled Rectifier except it is more sensitive (requires smaller gate signal) and designed for relatively low power levels.
Trigistor or Transwitch		Same as Silicon Controlled Rectifier except it is designed to be turned "off", as well as "on", by a control signal applied to its gate.

Bibliography

"Controlled Rectifier Manual," General Electric Company, Charles Bldg., Liverpool, New York.
"Silicon Controlled Rectifier," Bulletin #AN-1356A, Transitron Electronic Corporation, Wakefield, Massachusetts.
"Survey of Some Circuit Applications of the Silicon Controlled Switch and Silicon Controlled Rectifier," Bulletin #D420-02, Solid State Products, Inc., One Pingree Street, Salem, Massachusetts.
"Survey of Some Basic Trigistor Circuits," Bulletin #D410-02, Solid State Products, Inc., One Pingree Street, Salem, Massachusetts.
"The Transwitch," Bulletin #AN-1357A, Transitron Electronic Corp., Wakefield, Massachusetts.



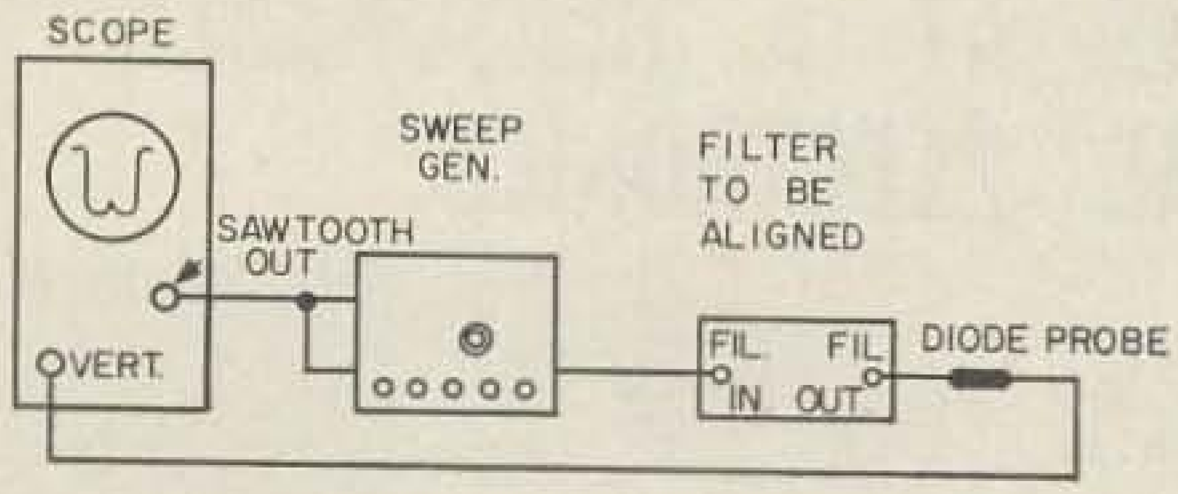
Photography by Linda Gridley

A New Broom

Dick Gridley K6JHJ
Edison Powerhouse #8
Auberry, California

MY attempts to build a crystal filter—and a stroke of luck—brought about the building of this piece of equipment. The unit is a sweep generator of simple design, with many uses.

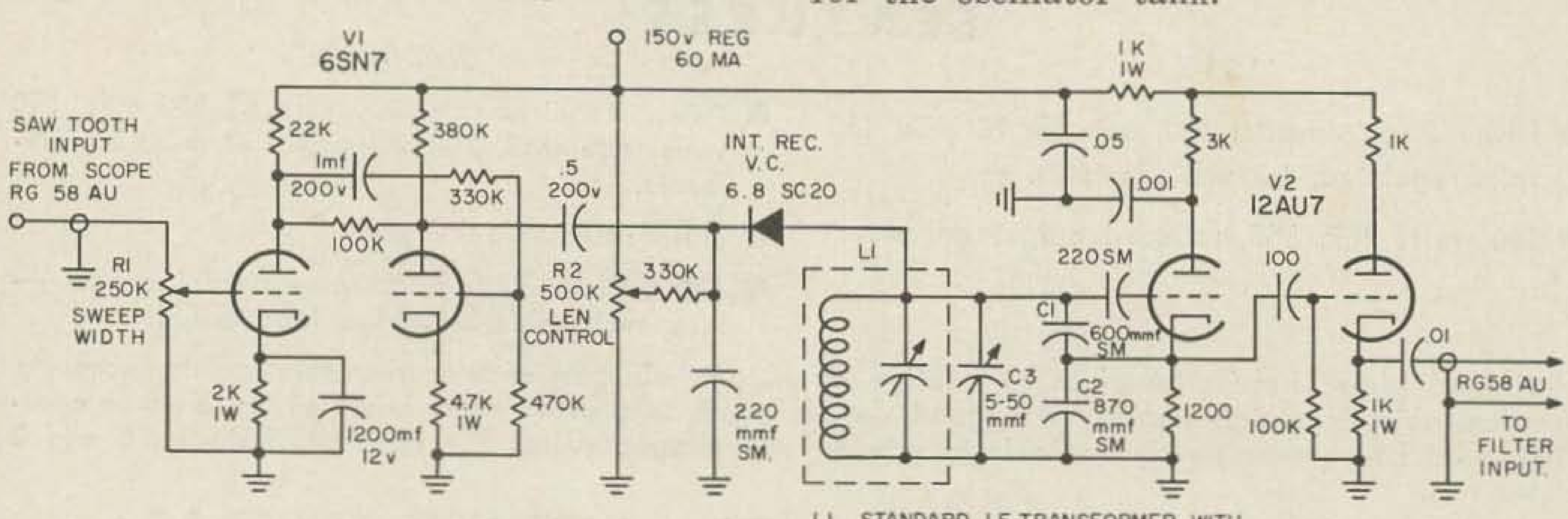
I, like many, started to build a single sideband exciter. With a light heart, a bucket full of FT-241-A crystals, and the available articles on crystal filters, I laid out a breadboard rig, grabbed the BC221 and a Hewlett-Packard 400D VTVM and immediately ran into trouble.



It seems the filter articles written to date are based on db readings using a receiver S meter. In using a precision VTVM I was not able to approach the shape factor or the final shape these fellows were getting using the receiver S meter. After attempting half lattice, full lattice, and a few others I was ready to give up. Enter the stroke of luck ————

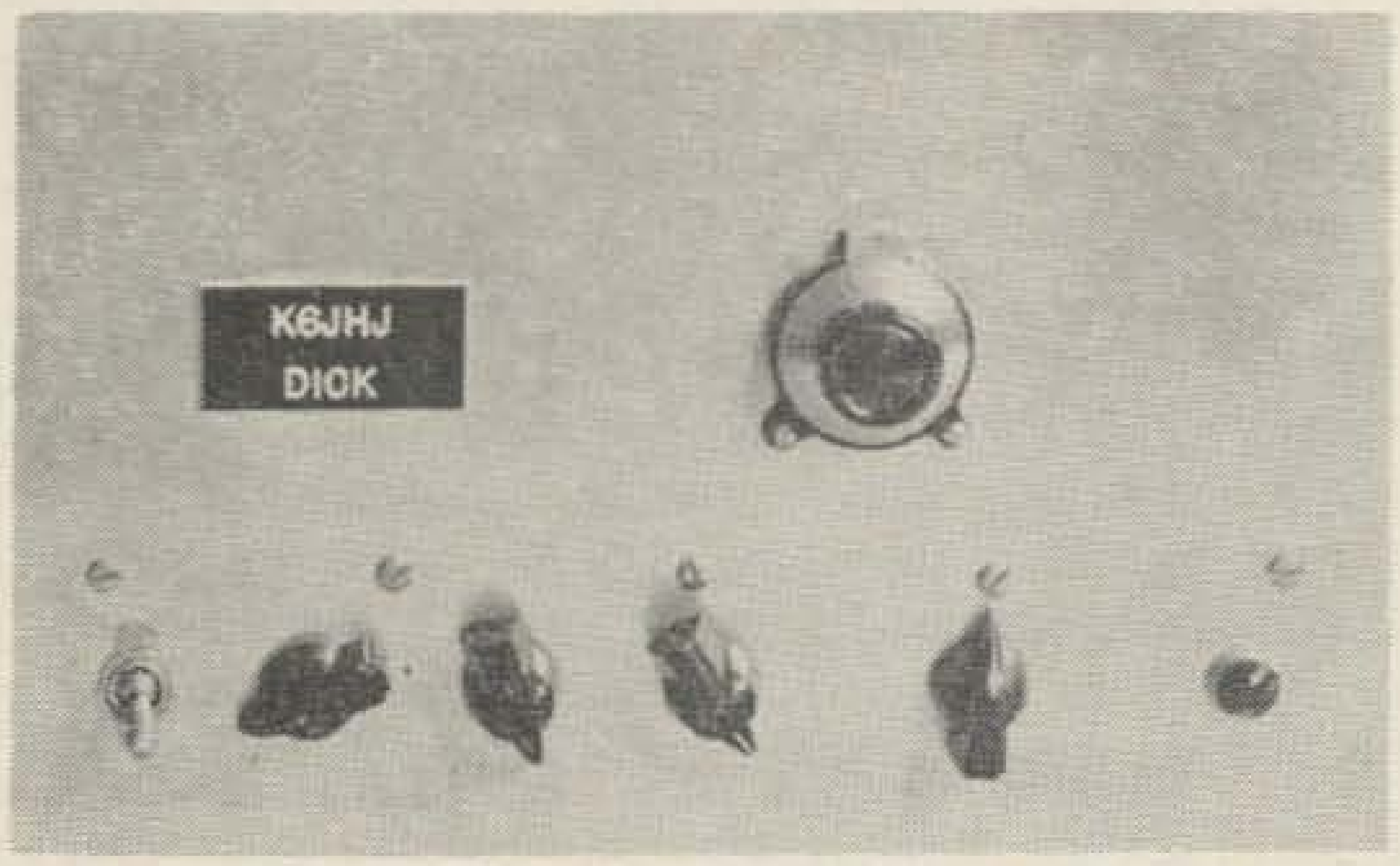
On May 6th I went to the hamfest in Fresno and attended a lecture by Bob Fisher K6BGJ on the use of Vari-Caps—ala sweep generator. This was the answer to my problem. Bob's rig was quite elaborate in that he had built in his own sawtooth oscillator and was using the unit with a BC221. He suggested the use of the scope's sawtooth oscillator directly into the BC221 as an alternate. Not wanting to disrupt the accuracy of my BC221, and being inherently lazy, I took the easy way out. I built my own oscillator and used the sawtooth output from my scope.

The heart of the rig is an inexpensive item called the Vari-Cap by International Rectifier Corp. Two are discussed here, the 6.8SC20 and the 100SC2. The 6.8SC20, according to the manufacturer, will vary its capacitance from 50 mmfd at .lv to 2.5 mmfd at -200v. The 100SC2 will vary from 600 mmfd at .lv to 100 mmfd at -10v. These units each cost less than $3.00. The construction is not critical in any way, nor is layout a problem—just use good ham practices. Any power supply delivering 150 v dc at 60 ma regulated will do. The oscillator tank must be grounded and I did have some trouble until I removed the unused winding from the 455 *if* transformer used for the oscillator tank.



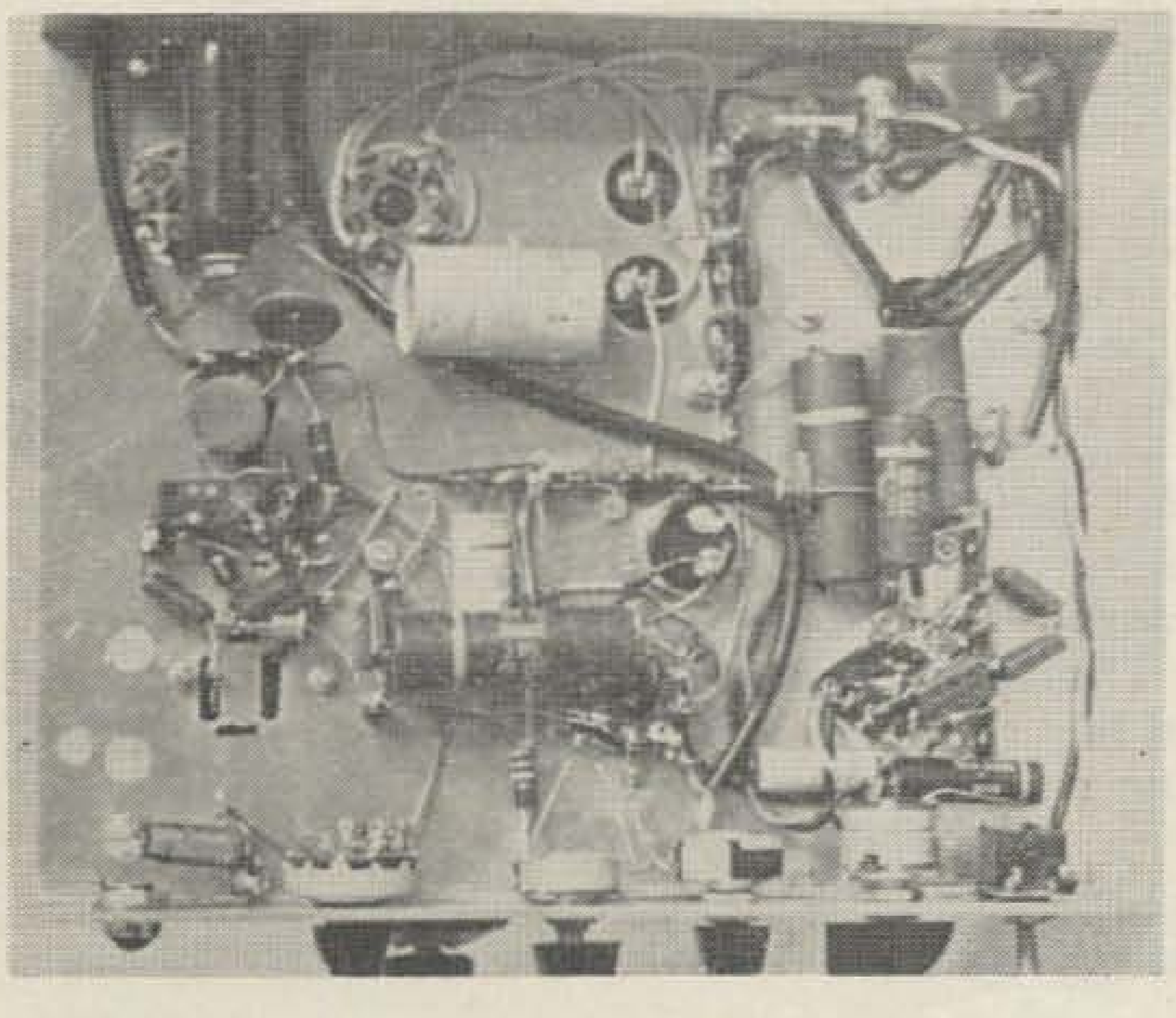
LI STANDARD I.F. TRANSFORMER WITH ONE WINDING REMOVED.
SM- INDICATES SILVER MICA.

Sawtooth energy is applied to R1 which regulates the amount to be amplified by V1. R2 linear control merely puts a portion of regulated voltage on the Vari-Cap and thus sets the capacity of Vari-Cap close to its center, so the sawtooth pulse creates a linear frequency swing. This circuit gives about 6 kc sweep. I have used TV horizontal coils for L1 and increased C1 and C2 to .003 for 85 kc and 50 kc operation. However, to get enough swing at low frequency, the Vari-Cap was changed to a 100 SC2. For 200 kc to 10 mc the 6.8SC20 gives plenty of sweep.



A note here about scopes. Most of the average do not go below 15 cycles and the sweep rate should be about 10 cycles. Some do not have a sawtooth output jack. The sawtooth output can be picked off the sync circuit. I found the best point is on the feed side of the sync pot through a .25 mfd capacitor. Some scopes have a couple of jack pins to add capacity externally, some don't. You will find little trouble adding about .25 mfd across the slowest speed.

The use of the rig is simple. Plug the lead from R1 into the scope's sawtooth output. Couple the output from the cathode follower section of V2 to the filter input through a .001 mfd capacitor. The vertical input of the scope is connected to the filter output through an rf probe. Adjust R1 and R2 about ½ open. With C3 about ½ meshed, adjust the trimmer in the *if* can to put you in the ball park, and then use C3 for fine adjustments of frequency. Ad-



ditional minor adjustments of R1 and R2 may be necessary. Of course, when used to align a receiver, the diode probe is unnecessary if the input to the scope is picked off of the diode detector. It goes without saying that it is necessary to plot an index for the scope bezel so that a ready reference is available for band pass width and depth of skirt.

Some one now says "This is just like setting ye old TV—*if* band pass." That it is. The only difference here is the frequency and the sweep generator cost was junk and $5.00.

The unused switch, shown in the photo, was installed to select one of three frequencies. However, this rig has been used on about six. I don't think I ever will decide which three to use. The unidentified tube is a 6U8 used as a 1 kc audio oscillator with cathode follower output.

I hope you will build this gadget, as it is like another hand around this builder's shack. If you do build it, you can bet the next time you shape a band pass—be it a filter for the exciter or the *if* in the old inhaler—it will be right. You might want to try just once more to build that crystal filter, and if you do, it will be a shoe-in. . . . K6JHJ

(Linear from page 37)

the goal of this project is to obtain a respectable signal for the least expenditure of money, this would be defeating my purpose, unless the changes were simple and inexpensive.

Before operating a unit such as this, one should run a series of tests to determine just what limitations should be placed on the unit in each class of service.

The author is well aware that nothing described here is unique; yet, seeing another angle and a different configuration helps those who are contemplating building a similar unit.

This combination can be heard on most any band, at any time, providing a barrel of fun. Good luck. . . . W9CJS

All Band Linear

David Gauger W9CJS
3900 Bluebird Lane South
Rolling Meadows, Illinois

MANY people shy away from the advantages of SSB because of the high cost involved, and to be sure, one can spend the proverbial "potful" on SSB equipment if he so desires. The setup described here has been in use for the last two years at this station and has evoked nothing but complementary comments by other operators, and yet its cost and complexity are little more than the average AM setup. It is designed primarily for SSB and CW operation but does an admirable job on AM as well.

The entire arrangement could be duplicated for considerably less than $200. If one is adept at scrounging various parts from surplus gear, he might conceivably reduce the investment by a large amount; however, it is not intended that anyone copy this arrangement exactly as it is. Rather, I would hope that I can convince some of the skeptics that it doesn't take a fortune in gold to put a very respectable signal on the air, both in quality and S units.

Front view of the amplifier in finished form. Below the meter are the power switch, the meter selector switch and the plate power switch. The other six knobs are as follows: top left to right, band switch, and plate tuning; middle, a dummy knob on the left and the output tuning on the right; bottom, CW / driver barefoot / final switch, and fixed capacity output tuning switch. The panel is 1/8 inch aluminum in smooth grey, 10½ x 19 inches. The knobs are the author's design and were turned from 1½ inch aluminum turning stock.

The setup is simply a vfo into a SSB generator into a final amplifier. The vfo used is the old HT-18. For the benefit of those who may be unfamiliar with the HT-18, it is a self contained VFO providing several watts of power output directly on each band, 80 through 10 meters. Because the SB-10 requires drive on the same band that output is desired on, the HT-18 is a natural choice for a vfo. How is the frequency stability you ask? The stability of my HT-18 is excellent. It will "sit" right on my crystal calibrator for very long periods of time, even on ten and fifteen meters, and it is a stock model in that no additional compensation or modifications have been made. I have never had a complaint of drift by any station in the two years that I have operated SSB.

The vfo will drive the SB-10 to rated output on all bands. Certainly the SB-10 needs no introduction. Perhaps you have heard criticisms of various troubles in the SB-10. Let me say this, if one follows all the simple suggestions for its operation that the Heath Company provides, it will provide a good clean signal with very adequate carrier and unwanted sideband suppression.

The final is simplicity itself. It consists of four EL-34 pentodes in parallel used in a very common grounded grid configuration.

With 1000 volts on the plates, one can run 250 watts pep on the lower three bands and about 150 watts pep on 15 and 10 meters. On CW one can run 300 watts input on all bands.

Circuit Description

On the final amplifier chassis are included a low voltage supply for the SB-10, the RF section, and its 1000 volt power supply. The low voltage supply provides slightly over 300 vdc at a capability of 125 ma. The output capacity is 40 mfd as recommended, to help improve the linearity of the driver output.

The final consists of four EL-34's with all grids grounded. No fixed bias is used. With this arrangement, the total final idling current is about 80 ma and provides adequate load for the HV supply so that no bleeder resistor was used. The cathodes of the EL-34's

are tied together and grounded through a 2.5 mh rfc. Drive from the SB-10 is applied directly to the cathodes and no input tuning is used or needed. The plate circuit uses a standard pi section comprised of a 250 mmfd plate tuning capacitor, and a three section output tuning capacitor of about 1100 mmfd. An additional switch is used to add fixed capacity if needed. The final tank coil consists of two coils, one for the lower three bands, and the smaller for fifteen and ten meters. The larger coil is an Illumitronics vari-pitch pi-dux, #2008D5 and is seriesed with a smaller coil of 6 turns of #12 wire, 1¼" diameter 2 inches long. For 40, meters, the large coil is tapped 15 turns from the bottom end. On 20 meters, the larger coil is tapped 21 turns from the bottom. For the top two bands, the builder must simply experiment to find the best taps. The author's taps were as follows: fifteen meters, tap at 2½ turns from the lower end of the small coil and for 10 meters, tap at 4½ turns from the bottom end.

The first high voltage power transformer used went up in a cloud of dense acrid smoke. Evidentally it had picked up some moisture and the author's baking hadn't done the job. The only replacement was a husky surplus unit giving 1280 volts ac across the secondary with a tap at about 250 volts from one end. There was no center tap, so a bridge circuit was contemplated. Since a bridge circuit is expensive, and I was trying to build the unit on a teacher's salary, I decided to try half wave rectification and prove to myself that it would not work, before going to the trouble and expense of incorporating a bridge circuit. Much to my surprise, the half wave circuit works. and does so, much better than I ever dreamed it would. Believe it or not, there is no trace of ripple on my CW note, even when running 300 ma to the final. The plate voltage drops from 1150 with 80 ma load to 1000 volts with 250 ma load. The familiar two tone test on the final shows that the final begins to flat top at about 250 ma.

Construction

A chassis of considerable size was needed to provide room for all necessary components. The chassis used is a Cadmium plated steel job of dimensions 17" x 14" x 2". The panel is ⅛" aluminum, sprayed grey. The cabinet is a surplus item painted grey to match the panel. The knobs were turned out of 1½" aluminum turning stock, and are the author's design. The front panel meter is a Simpson model 29 having a basic movement of 1 ma. The 300 ma scale was obtained directly from the Simpson people at a cost of a little over $1.00. The meter is lighted by two small sub miniature lamps placed through two holes drilled through the meter body at the top. It is recommended that the meter be removed from the case when this is done in order to remove drill chips. The illumination is very pleasing and serves as a pilot light. The meter is switched to read cathode current, high voltage, forward and reverse indications from the built-in Monimatch, and rf voltage across the antenna connection. In each application, one side of the meter is grounded.

A function switch is placed on the front panel which switches the SB-10 directly to the antenna for local operation, a second position for normal amplifier operation, and a CW position where the output from the vfo is bypassed around the SB-10 to drive the cathodes of the amplifier, directly.

A coarse loading switch was found to be almost unnecessary. This amplifier can be loaded to full output into a 50 ohm non reactive load on 80 meters, without the use of the fixed capacitors.

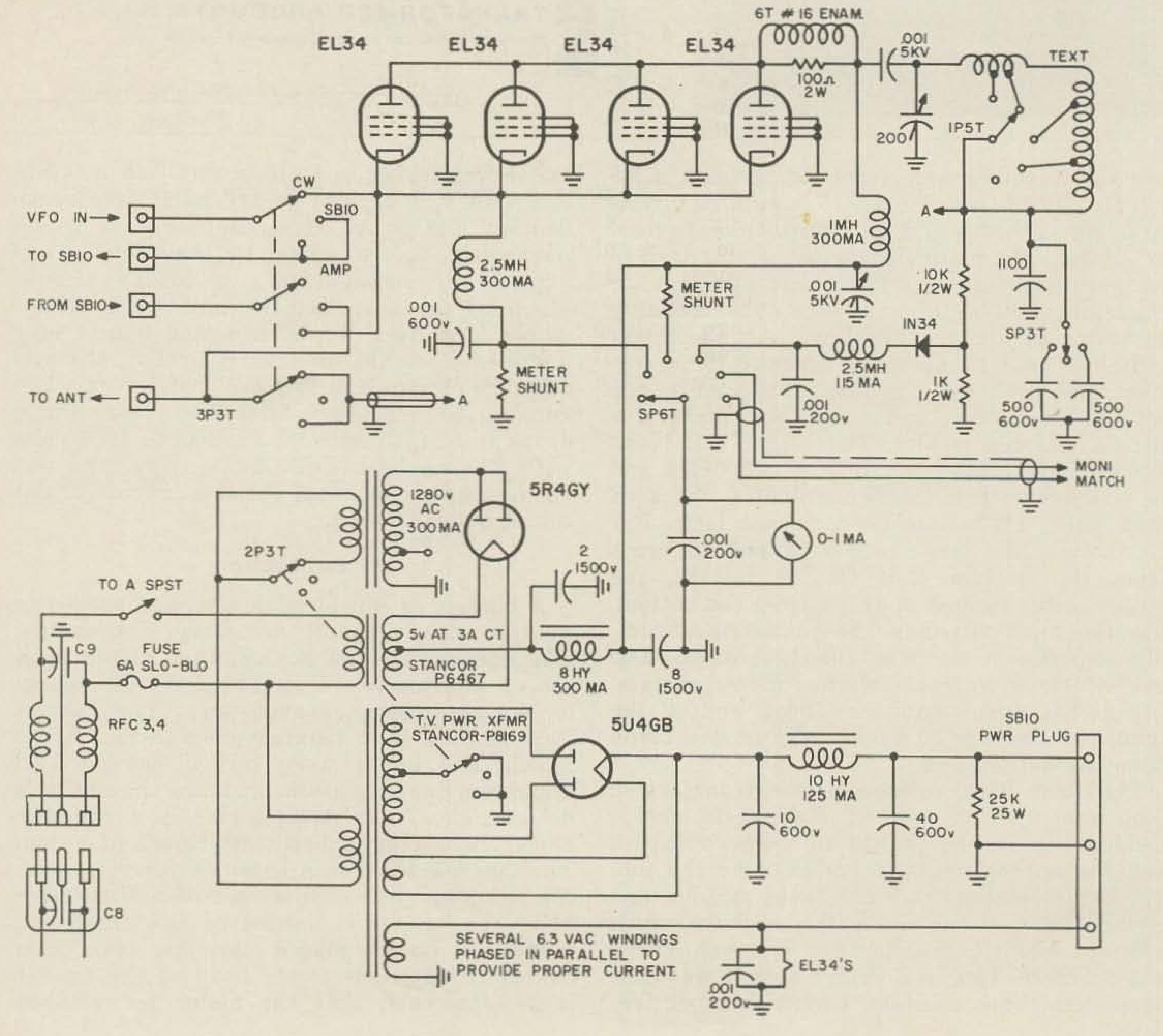
The back apron of the chassis includes a Jones plug connection for the ac power. The ac line is bypassed both inside, at the terminals and outside, within the shell of the connector. The line is filtered by an rf choke in each lead. Four coaxial connectors, the SB-10 power socket, and a fuse post complete the rear components.

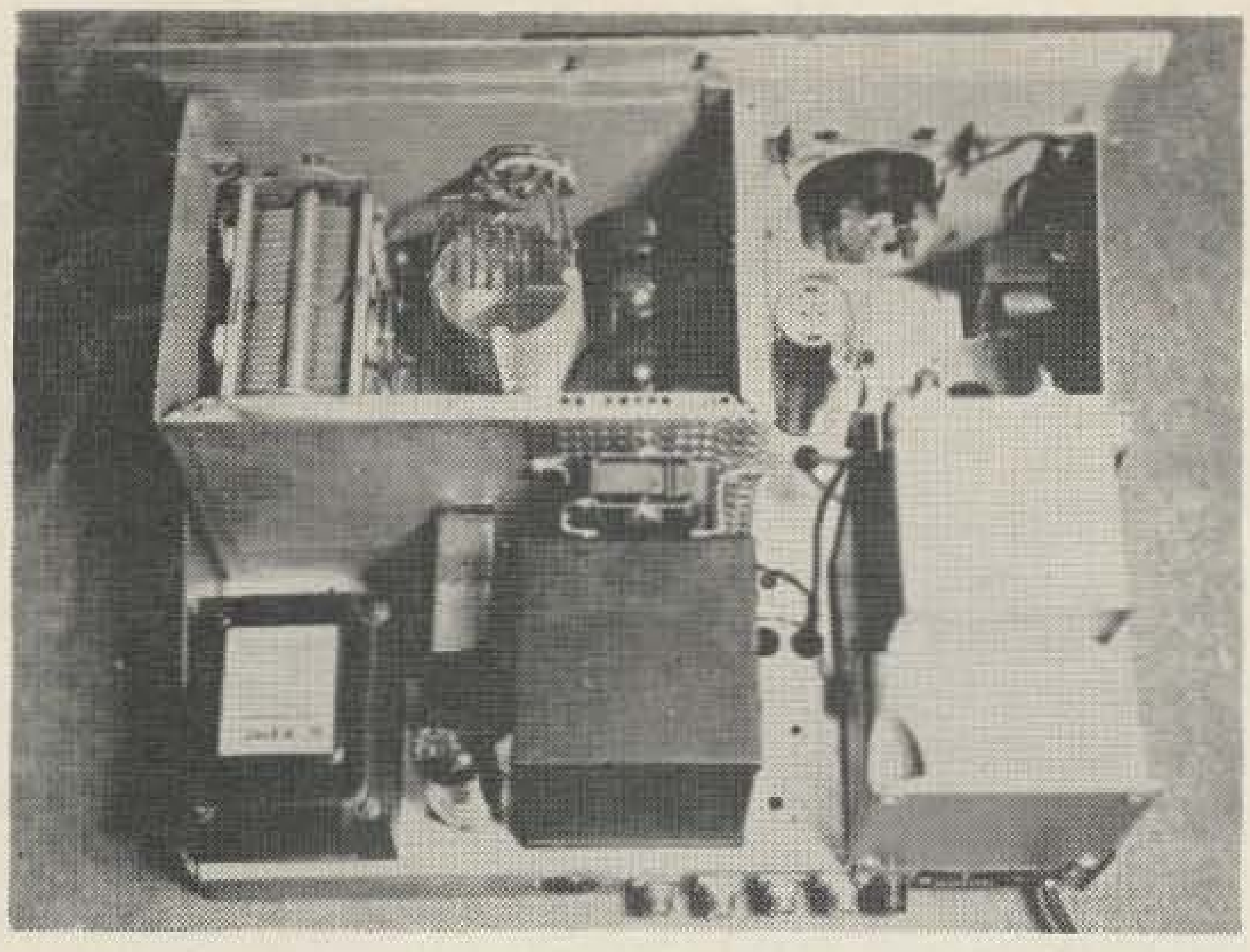
A Monimatch was constructed and mounted on the back of the cabinet. Its connections are made through a three conductor shielded cable which emerges through a grommeted hole in the back chassis apron and plugs into a three circuit jack in the bottom of the monimatch box.

Up topside on the chassis, the rf shield cage encloses the final tubes, tank circuit and tuning capacitors. The plate tuning capacitor is a double section unit of about 150 mmfd per section with both sections paralleled. The output capacitor is an old broadcast radio job having three sections of 365 mmfd each, paralleled.

On the front panel, to the left of the meter switch is the main power switch. To the right is the plate switch. It is a center off toggle switch wired such that when in the down position, only the low voltage to the driver is on, and when in the up position, both low and high voltage supplies are on.

No values in the schematic are critical, save only the meter shunt resistances which I pur-



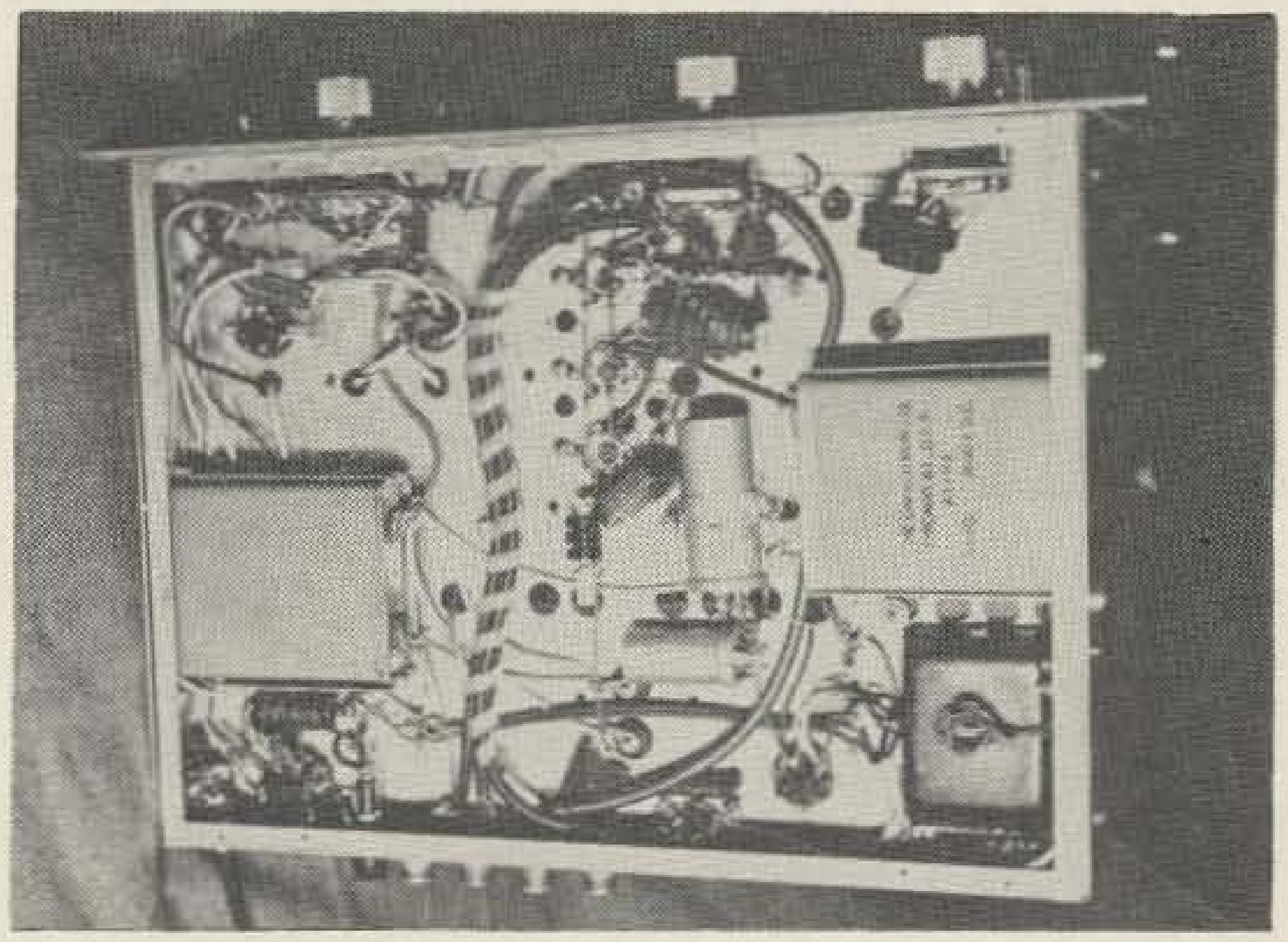


Top rear view of the amplifier with the top of the final amplifier rf cage removed to show interior detail. At the rear left is the low voltage power supply except for filter capacitors which are mounted below. At rear center is the H. V. filter choke, and to its right is the H.V. power transformer, on top of which is mounted the input filter capacitor. Note the cooling fan motor above the choke. Within the cage one can see the final plate tuning capacitor to the left. It hides from view the triple section output capacitor which is directly below. The final tank assembly and banndswitch can be seen along with the extra coil for 10 and 15 meters. At the front right are the H.V. rectifier and its filament transformer. The two small holes above the meter are to allow the two small lighting lamps to be inserted above the meter scale.

posely have not given values for. I feel that most people will use meters having different characteristics, and in that case different shunt values are dictated. The amplifier has not been de-TVI'd to any extent. The final amplifier has been enclosed in a cage, the line has been filtered to prevent any great amount of rf getting back into the house wiring, and a parasitic suppressor has been used in the final plate lead. Other than that no precautions were used, and yet no sign of TVI is seen on a portable TV set which is operating right next to the amplifier.

Adjustment

Operation of the combination is simplicity itself. The filaments are allowed to reach operating temperature and the plate supplies are turned on. The final cathode current should idle around 80 to 100 ma. With the vfo, SB-10 and final switched to the same band, say 75 meters, carrier is inserted by detuning one of the carrier null pots on the SB-10. As the SB-10 is peaked for maximum output, the cathode current should rise to between 250 and 300 ma. Next, the meter switch on the amplifier is turned to the forward position on the monimatch and the final amplifier controls are tuned for maximum output. Null the carrier on the SB-10, and turn up the gain. You are the proud possessor of several hundred watts of clean sideband power. One caution, watch carefully for signs of overdrive in the SB-10. If your carrier null is hard to obtain or keep, once it has been reached, chances are that you are driving the unit too hard. In this case, open up the HT-18 and detune the output slightly until the SB-10 is no longer overdriven. This may be necessary on several bands, as the HT-18 puts out a real wallop for a vfo unit. While the vfo is open, remove the wires from the tune switch on the front panel and parallel the switch across the keying terminals at the back. This facilitates zeroing in on frequency without placing any carrier on the air.



Bottom view of the amplifier, panel to the top. The two large capacitors are each 4 mfd at 1500 vdc and are parallel. They are the HV filter capacitors. The two small cylindrical capacitors are the LV filters for the SB-10 supply. At the bottom left one can see the AC line chokes and bypass condensers mounted near the Jones connector and fuse post. The four coaxial connectors are used as follows: from left to right, RF in from the HT-18 eco, RF to the SB-10, RF from the SB-10, and amplifier output to the Monimatch. In the upper left corner are the meter switch and HV rectifier socket. At top center are the four EL-34 sockets. At the bottom right is the LV power supply. The chassis is Cadmium plated steel 14" x 19" x 2" and was "rescued from the junk box."

There are several points in the design of the unit that may draw argument from some readers who are more technically proficient than I. Among them, the most obvious would probably be the use of a condenser input, half wave rectifier circuit. All I can say is that it works and works well. No doubt the unit would be linear to a greater power rating if a different power supply were used, however linearity is determined by a great many things, and in my case, the amplifier begins to flattop at about the same time the SB-10 begins to do so. Thus, to run more peak power would require several design changes. Since

(Turn to bottom of page 33)

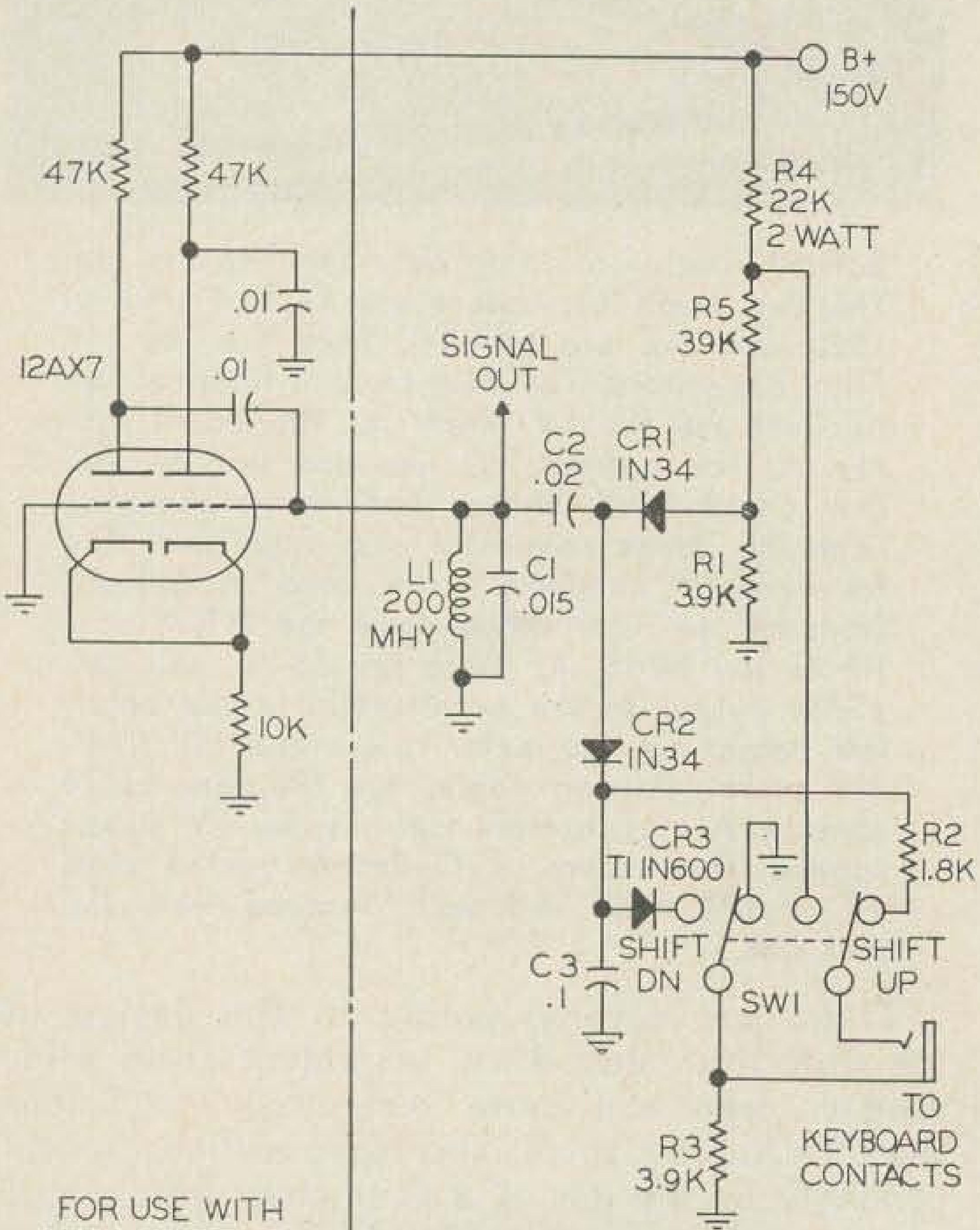
FSK Without Relays

Ted Hart W5QJR

Several articles have appeared in Ham magazines illustrating diode keying circuits for the FSK oscillator used in RTTY stations. By extending the idea, all the relays (except selector magnets) in the RTTY system may be eliminated. This includes the formidable polar relay, a device that is almost as hard to use correctly as it is to obtain.

Since most of the RTTY stations use a vacuum tube keyer for the selector magnets, the only remaining use for the polar relay is to provide the capability of shifting oscillator frequency up or down to achieve a function paralleling that of upper or lower sideband for SSB stations. This function can be achieved with diode keying, thus eliminating all the reasons for using a polar relay. Even the cost of the three diodes required is nominal and the units are available out of most junk boxes and at all electronics parts houses.

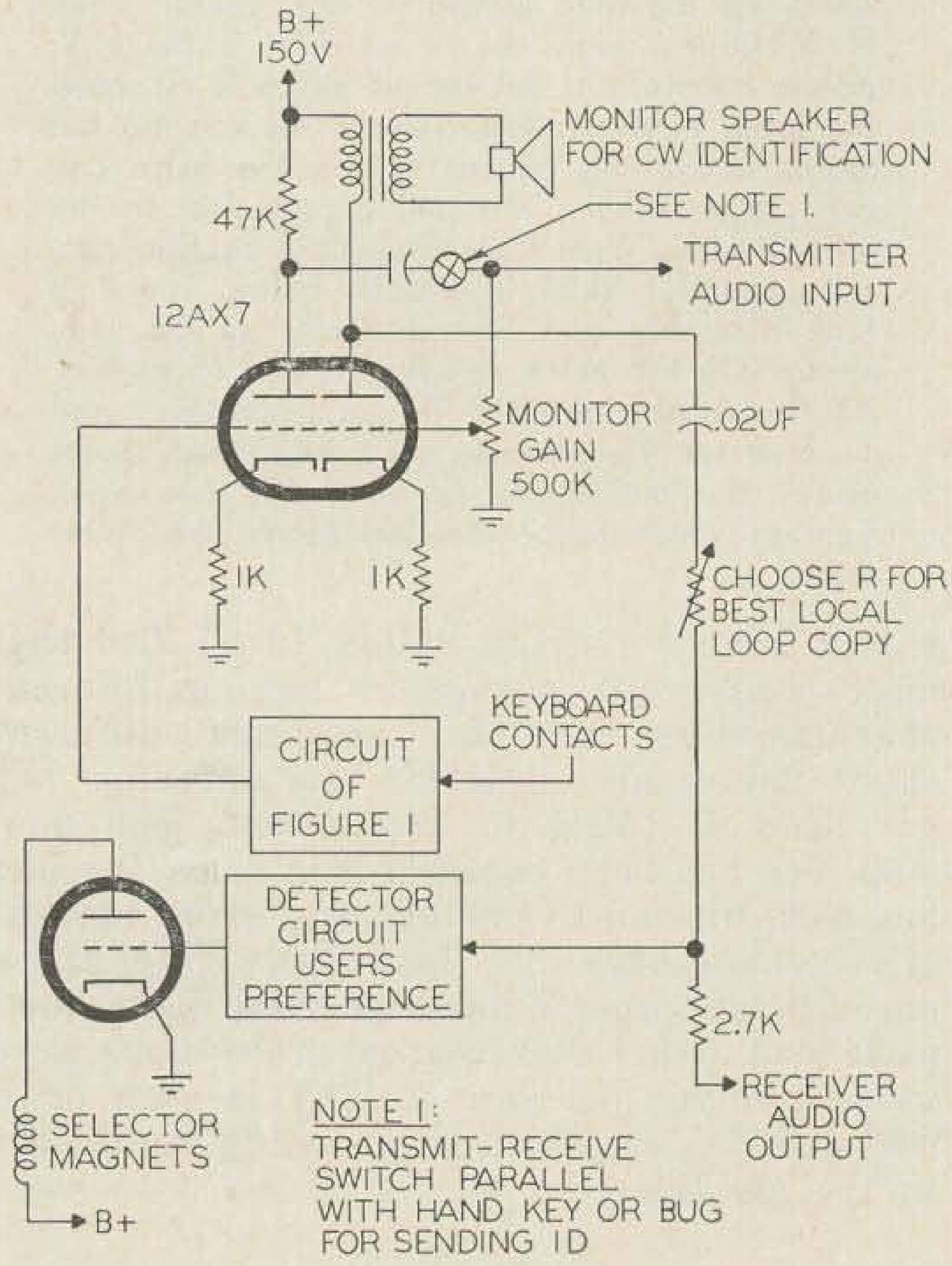
Fig. 1 is a schematic diagram of the diode keying circuit. The dashed line separating the oscillator tube and the tank circuit indicates



DIODE KEYING CIRCUIT

that the circuit may be used for either an AFSK system with the values shown or L1-C1 may be components of the VFO tank circuit for those who prefer keying at the rf frequency. The values shown on the Schematic for L1-C1-C2 are approximate only and should be selected for 2125 and 2975 cps. For keying the VFO choose L1-C1-C2 to provide 850 cps shift at the frequency desired.

Referring to the schematic diagram, Fig. 1, the switch is shown in the more conventional shift up condition. The keyboard contacts are closed in resting condition, causing a current to flow through diodes CR1 and CR2. CR2 is gated closed and places C2 in parallel with L1-C1 to cause the oscillator to be at the lowest frequency, F_L (2125 for AFSK). The .1 mf capacitor may be considered a short circuit for the frequencies chosen. When the keyboard contacts open, for a mark condition, no current flows and CR2 is gated open. C2 is removed from the tuned circuit and the frequency is determined by L1-C1 only as the higher frequency, F_H (2975 for AFSK).



With the switch positioned to the shift down position and, since the keyboard contacts are closed for space, a positive voltage will be applied to CR3 to prevent current flow through the diodes. The circuit now rests at F_H. A mark condition opens the keyboard contacts and allows current flow through CR2 causing the oscillator to shift to F_L.

When used with a 150 volt power supply current flow through the diodes is limited to 2.5 ma by the bleeder resistor networks, R1, R3, R4, and R5. R1, R2, and R3 were chosen to provide proper frequency shift in both switch positions, eliminating circuit interactions. CR3 should be a silicon diode, while CR1 and CR2 should be germanium diodes. Typical types are shown on the schematic but most available units will work satisfactorily.

Fig. 2 details the means for obtaining local loop copy. V2 provides input to the detector circuit from the AFSK oscillator and isolates the transmitter input from the receiver audio output. If selector magnets are keyed through a vacuum tube, no relays will be required in the system.

If the VFO is shifted, the receiver will serve as the local loop in the same manner used to monitor CW signals when a monitor is unavailable. . . . W5QJR

Letter

Dear Staff:

Three days ago a friend let me glance through your October issue. There I saw your article, "A Like-New Mixer Circuit." Since my old Super Pro was starting to feel its age I figured that this might be just the tonic.

So, after stuffing the mag. into my coat pocket when my friend was occupied with that ZL station he needed, I excused myself and hurried home to see if at last this might be my solution to that high noise level, low signal level, etc.

Using a war surplus LP-5 signal generator to set an "S" signal of 2, I found that I just could pick out the signal through the noise. So out came the soldering iron, and the rest of the elements.

The conversion itself took a bit over one hour. Most of the time was spent looking for the 4.7K resistor.

After alignment, the set was turned on and it was found that a full 3 "S" units was gained. The conversion made was for the 12AT7. However, a 12AU7 produced just under 2 units and a 12AX7 produced just under 3 units.

All in all, the time spent was more than justified in that the noise level that had bugged me so before now was in the background.

Going a bit further, I pulled the first RF and replaced the circuit with a cascode circuit. After alignment, a reading was taken and it was noted that with a 12AT7 in the circuit I could pick up only 2 more "S" units. So, I pulled the second RF tube and replaced it with another cascode circuit. After I was able to kill the oscillations that kept creeping in and re-re-aligning the front end, I had gained another 2 units. Not only that, but the noise had retreated to the point of "just barely"!!!

Well, I have returned the magazine that I made off with, and have had several comments from visitors as to the FB way my "OLD WARHORSE" sounds. And now I'd like to thank you for printing the article. It sure works good. And best of all, it makes an old RCVR "LIKE-NEW."

Jim Whitfield K6BHN

Slim Wilson W4WQT
Route 3, Box 39
Madison, Alabama

Do Hams Have Fun?

IT took me a full hour to convince the neighbor that the lines on his TV set were not caused by my ham station. His main argument had been that he had no trouble until I moved into his neighborhood and now he had a lot of interference. I proved to him that his trouble was in his UHF converter and that actually he was causing me a little TVI himself. He finally asked the inevitable question you get from all who view a ham station for the first time, "How far can you reach with that radio?" I quickly let him see a few of my choice DX QSL's, knowing full well what his next question would be. "What did it cost to set up all that fancy radio gear?" I told him that the radio cost about as much as his new set of "walking polo clubs," that I had built the transmitter and it cost about as much as he had spent that year for "green fees and 19th hole refreshments." I had learned long ago to never quote actual cost to a non-ham, just compare the cost with his hobby.

The neighbor finally got interested enough to ask, "What do you talk about when you hook up with another ham, can you really have fun with a hobby like this?" I decided that since he had already, by this time, killed half a pint of my favorite "sour mash" I would spin him a few tales of some actual "fun" I had experienced with ham radio. These tales are all true, only the names have been changed to protect . . . myself.

Tale No. One: **The Rum Runner.**

I used to talk to a lot of Hams that operated stations on ships. They are called maritime mobiles and back in the old days they were only allowed to operate on 10 meters. One in particular got to be one of my best buddies. I had been aboard his ship, seen his station and even met the captain of the ship. Old Hotch was a fine fellow and we had talked to each other from all over the world. I usually knew his ship's schedule a full month ahead of time. One afternoon I heard Hotch calling, "CQ, USA, CQ, USA." I quickly called him and he came right back to me. It seems that he was docked at a port in a small South American country and was being paid a visit by the local government radio inspector. Hotch carefully explained that he was having difficulty explaining the "extra" radio station that he had in the ship's radio-room, that the government inspector had an interpreter with him and that he wanted me to come back and tell them just who I was, where I was located and that we were, indeed, nothing but ham radio operators. I could just picture poor old Hotch sweating and the government inspector looking over his shoulder waiting for my reply. Did I comply with Hotch's request? Why certainly not, this would have spoiled my fun. I went back to him and said, "Old boy, your signals are pretty weak (it were 40 over S-9) but I think you were asking me if I had found any new Rum customers. Yes, I have . . . please try to smuggle 9 cases of Rum out this trip instead of 6 cases like you did on the last trip down there. How do you copy—Over." A full minute went by and then my ex-buddy came back with a single statement—"Consider your throat cut." I found out later that it took both the ship captain and old Hotch quite a long time to explain.

My neighbor, by this time, had nearly finished my bottle of sour mash and had seemed to enjoy the tale I had spun. I held up the nearly empty bottle and said, "Now who would ever think that the golden contents of this bottle could actually become a part of a radio?" I then proceeded with . . .

Tale No. Two: **The Most Unique Radio.**

Every Spring and all through the Summer the hams meet at various towns and cities for re-unions or conventions. We call them hamfests. The various radio manufacturers have displays of their newest radio gear and there are always "Door Prizes" given to a few lucky hams. Sometimes there are contests. One such ham-fest used to always have a contest for the most "unique home made radio." The requirements were that it had to be a simple Crystal radio, it had to actually work and it had to be unique. I entered this contest one year with a complete radio built in my earphones It was a powerful little set and worked real well. The judges awarded me second prize, a coil of acid core solder. I thought I should have gotten first prize but one of the judges explained it this way, "Well, we knew the other fellow." I made up my mind that come next year I would have a radio so unique that it would have to win first prize. Nearly 6 months went by before the idea came to me of just how I would build my contest radio—and I got busy.

I found a half pint plastic bottle, complete with bottle cap and decided to use it for a coil form. I first painted a vertical dial on the bottle with my XYL's red finger nail polish and then wound the outside of the "coil form" with some number 20 wire. I put a small fixed mica capacitor across the coil, a value that made the coil and capacitor combination tune to the middle of the broadcast band. I next mounted a 1N34 diode to the coil, another small coil with one end as antenna and one as the ground wire and then hooked a pair of earphones up to it. It actually worked, it wasn't very selective . . . in fact I could hear nearly all of the broadcast band at the same time, but it worked. I was proud of the little radio but still did not believe it was unique enough to win a prize. I decided that it would have to be tunable. What better way to tune a radio than to vary the inductance of the coil, I thought? I got to looking for some "Hi-Q Core Material" to put inside the plastic bottle—something that I could slide in and out to use as a "tuner." I could think of nothing with a Higher "Q" than a certain Tennessee Sour Mash bourbon . . . referred to in better circles as "B L J D." This was one ham experiment that I knew I would enjoy. I quickly filled the "coil" with BLJD, put on my ear phones and began to slowly "sip the core material." As the core level got lower and lower, the radio signals got stronger and stronger. By the time I got it "tuned" half way up the band the signals really began to come in. I will always swear that just as I took the last "tuning sip" that I heard a ZL calling "CQ 6 meters." I handed my "unique radio" to the ham-fest judges (complete with a full coil of Hi-Q core material) and explained how to "tune it." I knew I was a sure winner as soon as I noted the judges stooping down behind the judges' stand to "tune" my receiver. A certain radio magazine Editor attended that ham-fest and I noticed that he stooped a couple of times with the judges. This might explain why he nearly tripped twice while giving his little talk from the judges' stand later that day. After the contest I received my "unique radio" completely tuned and the first prize . . . a roll of rosin core solder. I reached up on the shelf and handed my most unique radio to my visiting neighbor, who by this time was ready to tune anything. He was nearly convinced, by this time, that hams do have a lot of fun. I proceeded with . . .

Tale No. Three: **The Cat Operation.**

While chatting one evening on 75 meters a fellow ham broke in with a sad story about his little girl's pet cat. We could even hear the cat in the background every once in awhile. It sure seemed to be in pain. It seems, he

said, that the cat had gotten its tail caught in the back door and it was almost cut off. He was trying to decide if he should cut it the rest of the way off or try to put a splint on it. We had suggestions to make but we knew that unless the poor cat got some attention pretty soon his crys of pain would drive us crazy. Finally one of the boys could stand it no longer, he called up a local pet doctor and phone patched him on the frequency. My friend with the cat carefully explained the cat's trouble and the Doc spent about 15 minutes carefully telling him how to amputate the cat's tail. My friend was not satisfied, however. He had another fellow to call another Doctor and this one, via the phone patch, carefully explained how to put a splint on a cat's tail. Now, I ask you neighbor, where else can one obtain the expert advice from the leading cat doctors in New York and Chicago in a matter of minutes after such a bad accident to a cat? What I didn't tell my neighbor and reveal to you for the first time . . . yes, it was a fictitious cat . . . I happen to know that the only pet my friend has is an old lazy hound dog. To hear the careful explanations from the doctors and the questions put to them by my friend was one of the most enjoyable hours I have ever spent with my hobby.

Tale No. Four: **The Trial**

Operating a Ham Station is a good way to spend a winter evening. I remember one time we had a culprit on 75 meters that was always giving us all a hard time. One Saturday evening we decided we were tired of his actions and decided to have a complete trial "on the air." We appointed a Judge (who also acted as a net control station), a complete panel of jurors, the defending lawyer and the prosecuting attorney. There were also many witnesses. The trial lasted all night. It took nearly three hours of discussion for the jury to reach a verdict. The culprit was found guilty and the Judge sentenced him to six weeks on two meters.

Yes, sir, a lot of funny things happen to hams. I had a pretty hard time a few years back trying to explain to my XYL why a certain YL short wave listener kept sending me sweet, perfumed, powder sprinkled letters. My XYL just couldn't understand why the YL "fell in love" with my radio voice. By this time my neighbor had forgotten all about his TVI and really seemed to be interested in ham radio. He looked up on the shelf as he put my "unique radio" back—less core material and noted a little aluminum box with an ac cord coming out one end. He said, "What is this little gadget?" It was my little fuse tester and I proceeded with

Tale No. Five: **The Little Gem Fuse Tester.**

Sometimes a little fun can backfire. One year, just before ham fest time, I was sitting around tuning my "unique radio" and came upon the idea of building a little fuse tester. I knew that I would start out to the ham fest, which was located over 300 miles away, and probably spend a couple of nights with old buddies of mine. I wanted to have some fun while at each place. I took the small aluminum box and mounted a little fuse holder on its top, a heavy ON-OFF switch on one end under a neon bulb holder. I brought out an ac cord out the opposite end after hooking it up "properly" in the little box. The Little Gem Fuse Tester was complete and, after the application of proper lettering on the outside, looked quite professional. The most important thing came next . . . the writing of a simple "Operation Manual." The instructions read something like this:

CAUTION

This tester is designed to test the one to ten ampere fuses contained in your ham gear. Do not try to test any fuse larger than 10 amperes. Follow instructions very carefully."

1. Turn radio on and set dial to 3980 kc. Set receiver gain control for comfortable listening level.
2. Remove top of fuse holder and insert fuse to be tested. Carefully replace fuse holder top.
3. Place ON-OFF switch in the OFF position.
4. Plug the ac line into the nearest ac receptacle. NOTE: This test is best conducted on your operating desk. The Test Lamp should light when the ac line is plugged in.
5. Turn the ON-OFF switch to the ON position. The test lamp should go out.
6. Replace Fuse.

In making up these instructions I was very careful to fill an entire page with them. I then had an out if some "smart boy" wanted to know what indication he should get for a good or bad fuse. I would merely state that I had lost page two of the instructions but the action of his receiver tuned to 3980 kc would let him know if the fuse was good or bad.

My first victim was an old ex-buddy of mine, Crumpy. Crumpy had an ideal ham shack in a beautiful Pine paneled Den. He had the complete KW Collins SSB rig with a fancy clock and beam position indicator. Crumpy served us all a delightful portion of Hi-Q core material and settled down at his operating desk to try out my little Tester. He spent a little time telling us about his fancy clock that had never been off by more than two seconds, all the while carefully reading the tester instructions. Rather than take a fuse from some piece of his gear he said he would try one of his spares first. We assured him this would be a good idea. Crumpy carefully tuned his receiver in on 3980 kc. set the gain control and proceeded to "test" the fuse. I shall never forget what happened when he turned the switch to the ON position. All the lights went out, the room was suddenly completely quite because the radio had also gone dead. The clock stopped too, of course and for a minute or two there was a general scrambling noise from Crumpy and then a flash light was turned on. Crumpy opened up the box of spare fuses and was about to put another in the tester when he caught on. Instruction 6 had said replace fuse —but it didn't say which fuse. You see, the fuse holder on the tester was a dummy, hooked to absolutely nothing while the switch was hooked directly across the ac line when placed on the ON position. My ex-buddy, Crumpy, soon found another service fuse and placed it in the fuse box down in the basement while we began to think of ways to get out without getting shot.

My next victim was old Joseph. How was I to know that he had his Ham Shack wired through a 50 AMP circuit breaker. He went through the same ordeal as Crumpy but when he placed the switch on the Little Gem Fuse Tester to the ON position there was a small explosion inside the little box and my little tester went up in smoke. So, dear neighbor, the little box you hold contains a little charred mess of switch and wire. I've never had the heart to rebuild it.

My neighbor, by this time, was convinced that we hams do have a lot of fun. He next asked. "I hear that you hams are a great help during times of distress. Did you ever help any one with your hobby"? I thought to myself, "I have helped this jerk, he has drank up all my Sour Mash." I quickly replied, however, "Oh yes, I have done my share I guess." I showed him the '55 Hurricane Hazel and '57 Kentucky Train Wreck Public Service Awards I had hanging on the wall. I next told him that I felt the most help I had ever been to anyone was back in '49 when I helped in . . . *Tale No. Six:* **The Movement to Keep Grandy Windy.**

Grandy, an old ex-buddy of mine, was perhaps the windiest Texan ever to operate on ten meters. He broadcast his braggings to every W1, W2, W6 and W7 that he could hook

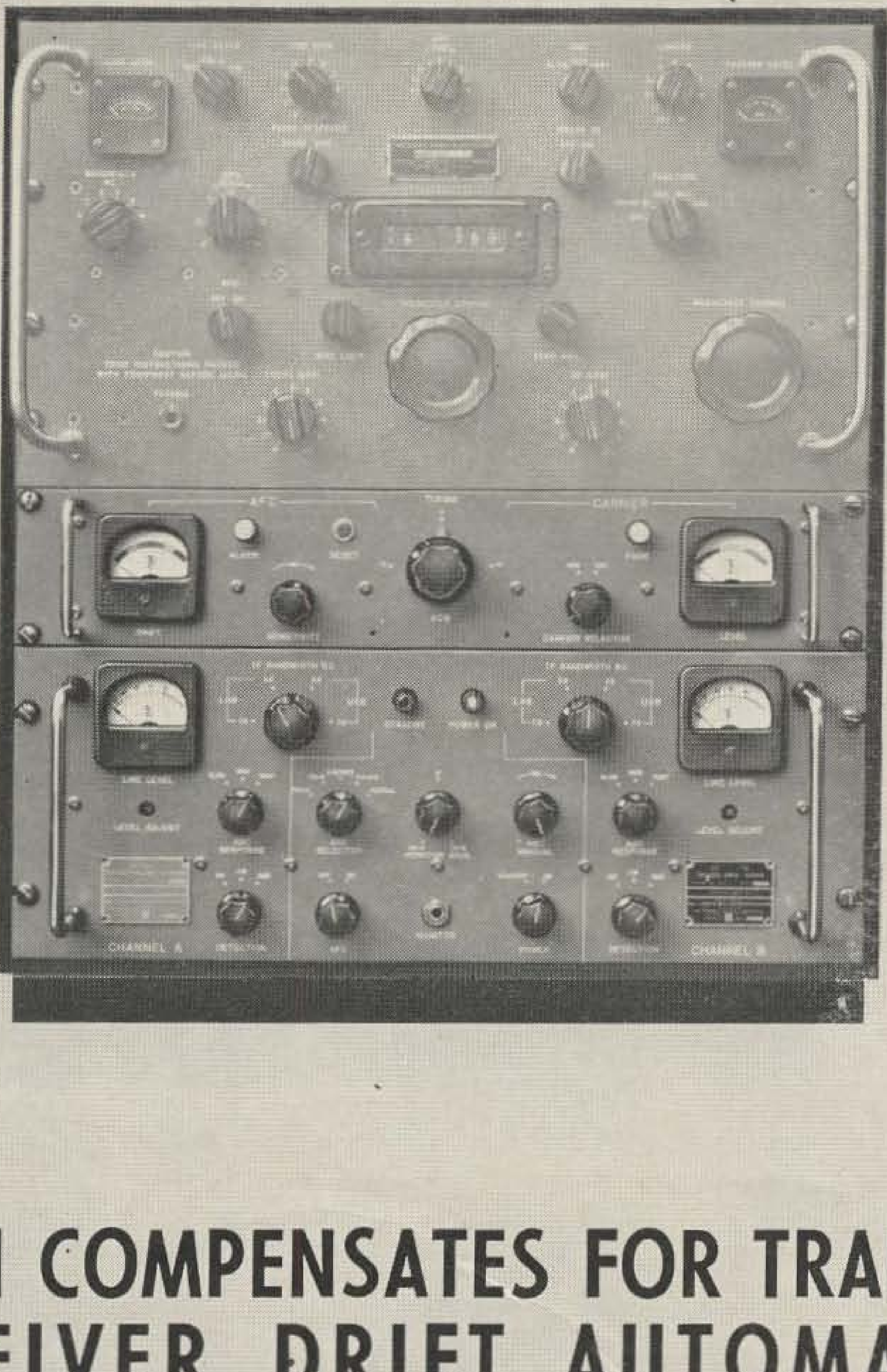
up with. He lived in a little Texas town about 20 miles from my old home QTH. One day during a QSO with a certain W7 it was suggested that we should do our best to keep Grandy windy. It was decided that if he had plenty of beans in his daily diet it would help keep him windy. We agreed that we would ask everyone we talked to on ten meters to ship Grandy a can or two of beans. Thus, the Bean Campaign was born. The local radio club thought it to be a good idea and we all really got busy asking for beans for Grandy. We asked everyone we talked to if they would also spread the word. We W5's talked to the W1's, 2's, 6's and 7's. The W7's covered the middlewest, the east coast boys covered the South. Actually, as it turned out, quite a few DX stations got into the act too. One of the boys in New York suggested that it would also be a good idea to include a bar of soap with the beans. This idea caught on very rapidly. Grandy began to get beans and soap and I mean he began to get just lots of beans and soap. One fellow even sent him a full case of each. Grandy became extremely windy and in fact he got right down irrational at times, these times being every time someone asked him about beans or soap. He steadfastly refused to open a single can of beans or unwrap a single bar of soap. I decided to take my life in my own hands and pay him a visit. I got to his home just as a large truck from the post office pulled into his driveway. The postman unloaded about 25 or 30 packages. I asked the Postman if he made many deliveries to this address. He said, "Oh yes, I have made a trip nearly every day for several weeks now. A local ham told me that this fellow was on a bean diet and was trying out various brands from all over the world. I don't know what the soap is for." Since Grandy was not speaking to me, I had his XYL to sneak me in the back door. I have been in some pretty big Supermarkets in my day but I have never seen as many cans of beans or as much soap. Grandy had built two large shelves from floor to ceiling in one room. He had carefully unpacked each package and had a complete record of who sent what. I beat a hasty retreat before he got his shot gun loaded and gave a full report at the next ham club meeting.

A few weeks later I received a telegram from my W7 friend which read something like this: "Stop Bean Campaign. Think It is Illegal." I quickly grabbed the message and headed down town to the local FCC office. I put the question to the local FCC Inspector. Some few minutes later, after he recovered from a laughing fit (he knew Grandy), he explained that there was a rule some place about soliciting anything of value over the air. He advised that our Bean & Soap Campaign might be considered as being on the fringe of "soliciting something of value over the air." I agreed that we would do all we could to stop the campaign but that I felt sure it would have to just die a natural death. It finally tapered off but it took several weeks. Grandy donated a large truck load of beans and soap to an orphan home. I am sure it was a windy place for several months . . . but very clean. Today Grandy is perhaps the windiest fellow in the state of Texas. Yes, ham radio can be most helpful and a lot of fun.

My neighbor mumbled something about going home. I helped him out the door after he promised me to do something about all the TVI he was causing with his UHF Converter. I then tuned around the 75 meter phone band to see what was going on. The usual stuff was heard. A gang of SSB operators cussing AM, a gang of AM operators gripping about SSB, QRM and a CW station telling off some joker for calling CQ on his net frequency. It was a typical evening and I wondered how many hams were really having no fun that evening. I fired up my old sideband rig, set up my chess board and grunted a couple of times into the mike. Soon the frequency was filled with such remarks as, "I move my old black Mule to King three . . . I move my little pawn on Rook four to your Mule (Ham for Knight) three and capture your old Lady (Queen). About this time some joker disguised his voice to sound like my opponents and had me to move into a wrong play. All heck broke loose. Luckily, we had a Judge on the frequency following the game and he soon got our chess game back on the right road. We threatened to "have a trial and try" the joker next Saturday night if he messed us up again. We really knew, though, that he would try it again and all agreed that playing chess on a clear channel wouldn't be near as much fun anyhow.

I finally threw the big switch and decided to call it an evening. Just before I left the shack I took a long look around. There was the Little Gem Fuse Tester and the Unique Receiver . . . less core material . . . on the shelf. A little clear plastic "pill bottle" containing a small red ape with a bandage on its rear set on the speaker. A little tag was attached that read, "A Texan complete with Saddle Sores." On the wall hung a large poster received in the mail one day. It advertised a glorious Cosmo-Color movie entitled "Intimate Strangers," starring Jayne Mansfield and . . . myself. I'll never know who sent these little momentos but you can bet it was a ham. Just before going to sleep that night I wondered just how many hams devote their full hobby time to trying to "pass a law" our ham radio into some regimented mess of clear channels or just worry themselves to sleep every evening over the QRM. I decided to remain an "omphaloskepsis" (look that one up in your dictionary) and remain one of the many who still have a good time with our hobby—ham radio.

. . . W4WQT



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Receiver Anthology

1961

Collins 75S-3 ....620.00
Hallicrafters S118 .... 99.95
Hallicrafters S119 .... 49.95
Hallicrafters S120 .... 69.95
National NC-190 .....199.50
National NC-303 .....449.00

1960

Drake 2B 279.95
Gonset G-63 ....239.50
Heath GC-1 Mohican.. 99.95
Hallicrafters SX-62A .395.00
Hallicrafters SX-115 .595.00
Hallicrafters SX-140 .109.95
Lafayette HE-30 ..... 99.50
National NC-270 .....249.95
National NC-400 .....895.00
RME 6900 ....349.00

1959

Drake 2A 269.95
Gonset G-33 .... 89.95
Gonset G-43 ....159.50
Hallicrafters S-107 ... 89.95
Hallicrafters S-108 ...129.50
Hallicrafters SX-110 .169.50
Hallicrafters SX-111 .249.50
Hallicrafters SX-101A.399.50
Hammarlund HQ-180 .429.00
Lafayette KT-200 .... 64.50

1958

Collins 75S-1 ....495.00
Hammarlund HQ-160 .379.00
Hammarlund HQ-170 .359.00
Hammarlund HQ-145 .269.00
Heath RX-1 ....274.95
National NC-303 .....449.00
RME 4350A 249.00

1958

Hallicrafters S-38E .. 54.95
Hammarlund HQ-110 .229.00
National NC-66 ......129.95
National NC-188 .....159.95
National NC-109 .....199.95
RME 4350 ....229.50

1956

Hallicrafters S-101 ...395.00
Hallicrafters S-102 ... 59.95
Hallicrafters S-106 ... 59.95
Hammarlund HQ-100 .169.00
Hammarlund HQ-140X.249.50
Hammarlund HQ-150 .295.00
Hammarlund PRO-310 ....595.00
Heath AR-3 .... 27.95
RME-4300 ....194.00

1955

Collins 75A-4 ....595.00
GPR-90 ....395.00
Hallicrafters SX-99 ..149.50
Hallicrafters SX-100 .295.00
Hallicrafters SX-380 . 49.95
National NC-300 .....349.95

1954

Hallicrafters S-85 ....119.95
Hallicrafters SX-96 ..249.95
National NC-98 ......149.95

1953

Hallicrafters S-38C .. 49.50
Hallicrafters S-53A .. 89.95
Hallicrafters SX-88 ..499.95
Hammarlund HQ-140X.264.50
Heath AR-2 .... 25.50
National NC-88 ......119.95

1952

Collins 75A-3 ....550.00
Hallicrafters SX-73 ..975.00
Hammarlund SP600JX 985.00
National HRO 50-1 ..383.50
National HRO-60 ....483.50
National NC-183-D ...369.50

1951

Collins 75A-2 ....420.00
Hallicrafters S-76 ....169.50
National SW54 ...... 49.95

1950

Hallicrafters S-40B .. 89.95
Hallicrafters S-77 ... 99.95
National NC-125 .....149.50

1949

Collins 51-J 375.00
Hallicrafters S-52 .... 99.50
Hallicrafters SX-71 ..179.50
Hallicrafters S-72 .... 79.95
National HRO-50 ....349.00
RME VHF 2-11 ......146.00

1948

Hallicrafters S-51 ....149.50
Hallicrafters S-53 .... 79.50
Hallicrafters SX-62 ..269.50
National HFS 125.00
National NC-33 ...... 69.95
National NC-108 ..... 99.50

1947

Collins 75-A 530.00
Collins 75-A1 ....375.00
Hallicrafters SX-16 ..125.00
Hallicrafters S40-A .. 99.50
National HRO-7 .....311.36
National NC-46 ......107.40
National NC-173 .....179.50
National NC-183 .....269.00
National NC-200 .....159.50
RME HF 10-20 ...... 77.00
RME 84 .... 98.70

1946

Hallicrafters S20R ... 60.00
Hallicrafters S22R ... 74.50
Hallicrafters SX-25 .. 94.50
Hallicrafters SX-28A .223.00
Hallicrafters S-36X ..415.00
Hallicrafters S-38 .... 39.50
Hallicrafters S-39 ....110.00
Hallicrafters S-40 .... 79.50
Hallicrafters SX-42 ..250.00
Hallicrafters SX-43 ..150.00
Hallicrafters SX-46 ..115.00
Hallicrafters SX-47 ..135.00
Hammarlund SPC-400X 334.05
Hammarlund SPC-400SX 310.05
National HRO 5-TA ..274.35
National NC-240C 240.00
RME 45 ....166.00
RME VHF 152 ...... 86.60
Hammarlund HQ-129X 139.50

1941

Echophone 1 .... 19.95
Echophone 2 .... 29.95
Echophone 3 .... 49.95
Hallicrafters S-27B ..195.00
Howard 435A 29.95
Howard 436A 39.95

Howard 437A 54.50
National NC-45 ...... 57.50
RME 41 .... 94.50
RME 43 ....109.50

1940

Hallicrafters SX-23 ..115.20
Hallicrafters SX-25 .. 99.50
Hallicrafters S-27 ....175.00
Hallicrafters SX-28 ..159.90
Howard 490 ....149.50
Howard 437 .... 54.50
National ONE-TEN .. 85.00
National NC-200 .....147.50
National HRO (RACK) 320.00
RCA AR-77 ....154.50
RME 99 ....139.20

1939

Hallicrafters SX-17 ..149.50
Hallicrafters S20-R .. 49.50
Hallicrafters SX-24 .. 69.50
Howard 438 .... 49.95
National NC-100XA ..142.50

1938

Hammarlund HQ-120 .129.00
Howard 430 .... 29.95
Howard 440 .... 69.50
National NC-44 ...... 49.50
National HRO 179.70
RME 70 ....138.60

1937

Hallicrafters SX-15 .. 69.50
Hallicrafters SX-16 .. 99.00
Hammarlund SUPER-PRO 255.70
National NC-80 ...... 88.00
National NC-81 ...... 88.00
RCA ACR-11 .... 46.00
Sargent Model 11 .... 44.50

1936

Hallicrafters Sky Buddy 29.50
Hallicrafters Sky Chief 44.50
National HRO Junior. 99.00

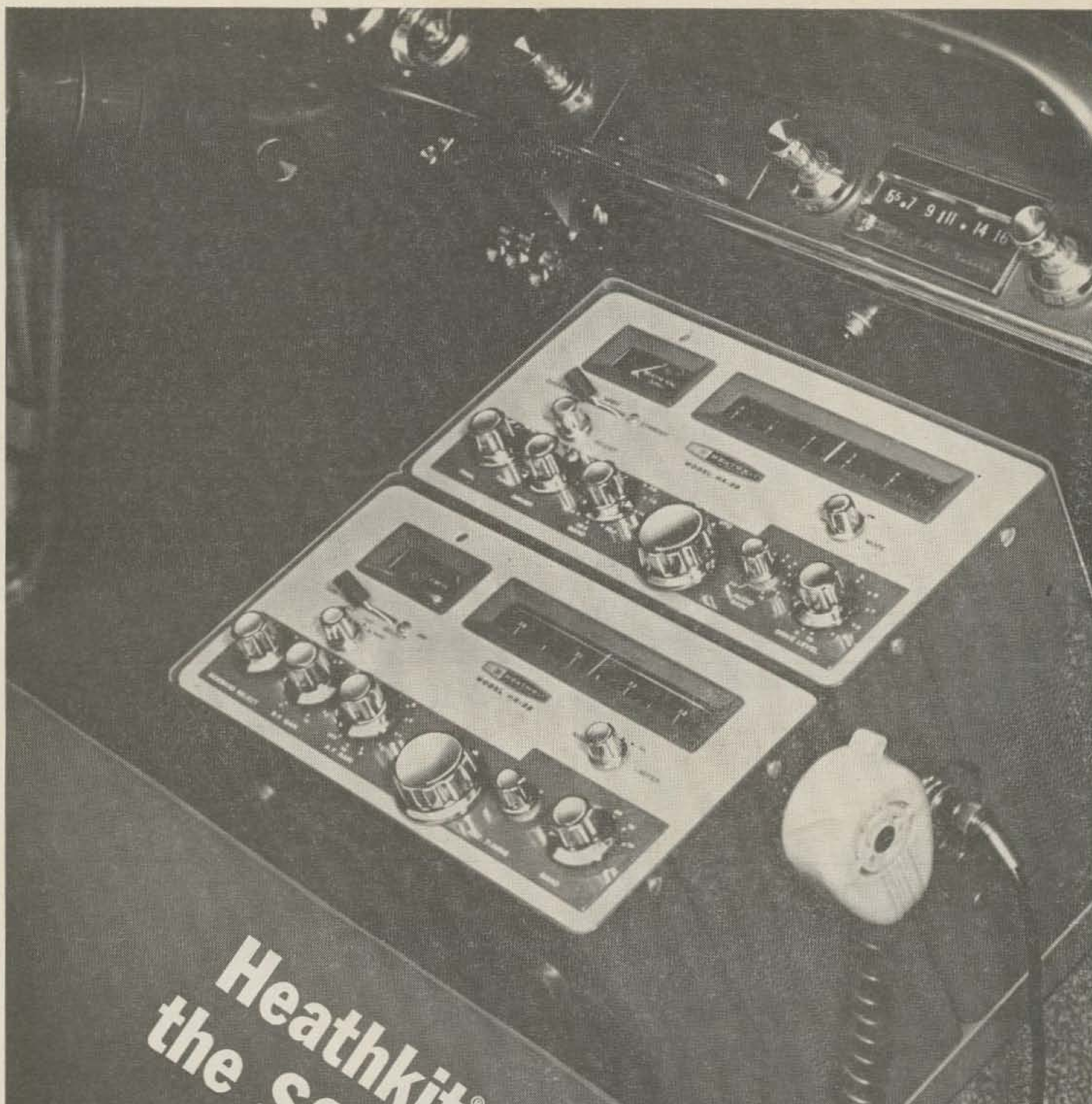
National NC-100 .....140.60
National NC-101X ...125.00
Patterson PR-16 ..... 95.70
RCA ARC-175 ....119.50

1935

Hallicrafters Super Skyrider 79.50
National FBX-A 51.50
Patterson PR-12 .....101.70
RME 69 ....134.90
RCA ACR-136 .... 69.50
RCA AR-60 ....495.00
Sargent 20MA 59.50
TOBE 41.40

PRE 1935

National Thrill Box .. 34.50
National SW3 .... 14.42
National FB7 .... 26.46
Silver Marshall SM-735 64.90
Silver Marshall SM-737 ....139.60
Hammarlund Comet Pro .... ?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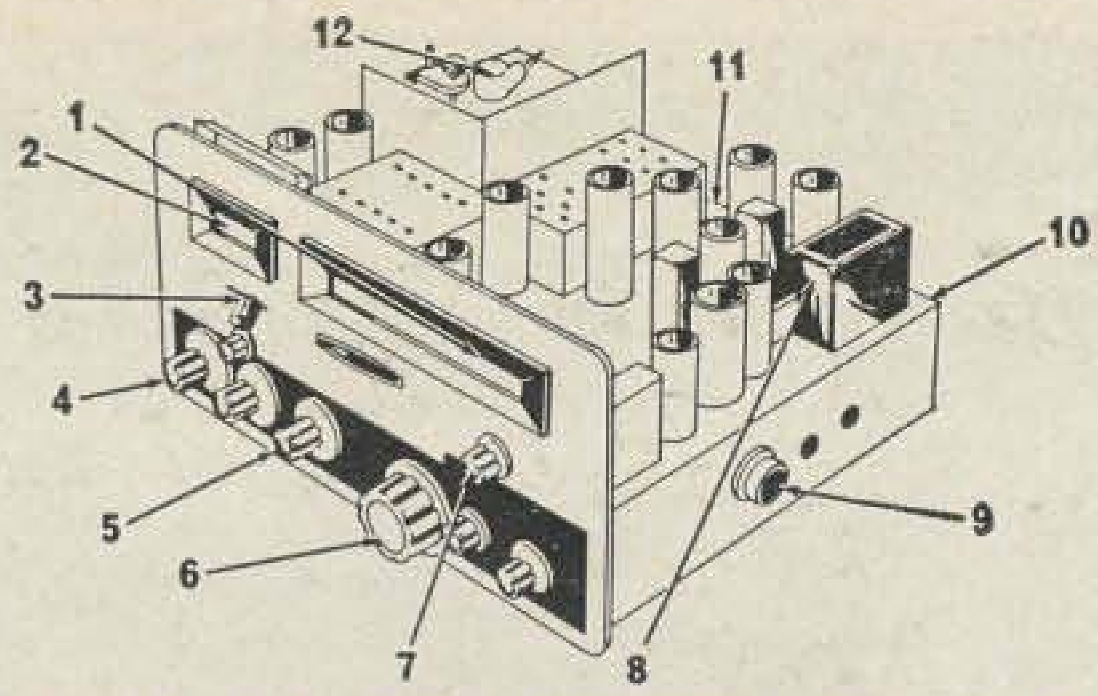

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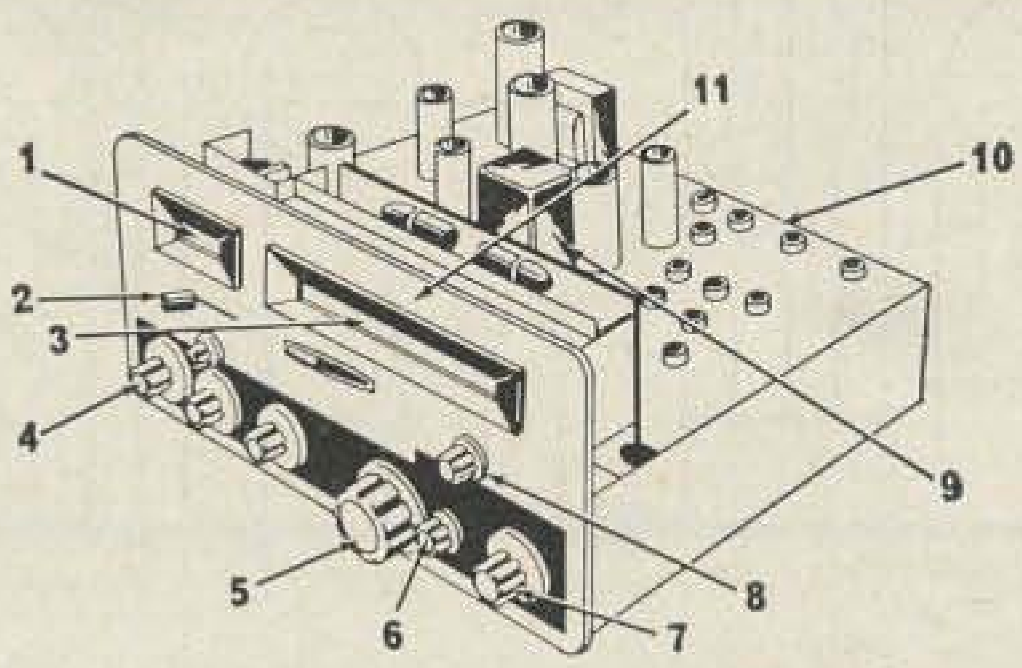

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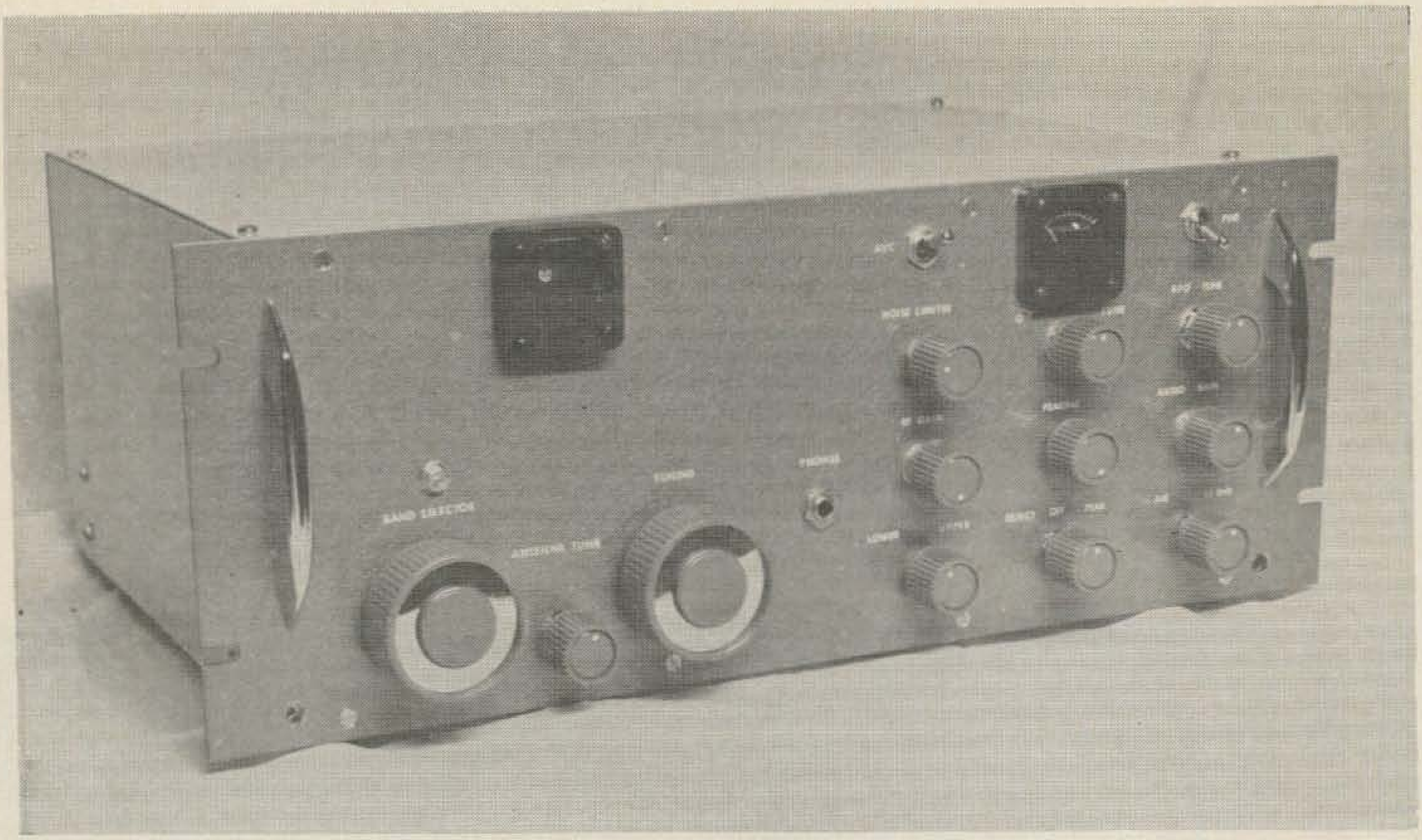


The 85 B.14 All Band Receiver

W. B. Bernard, Capt., USN

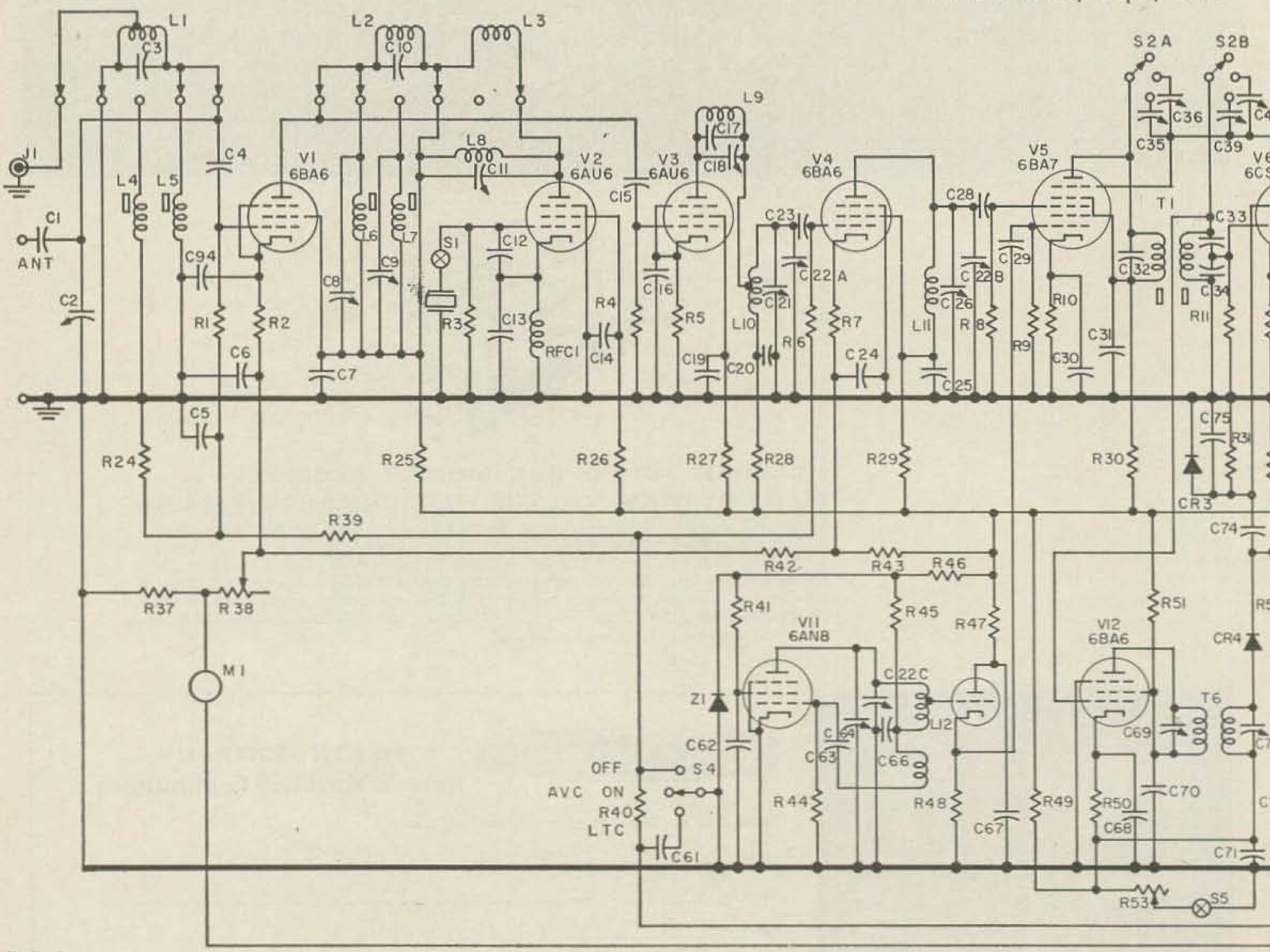


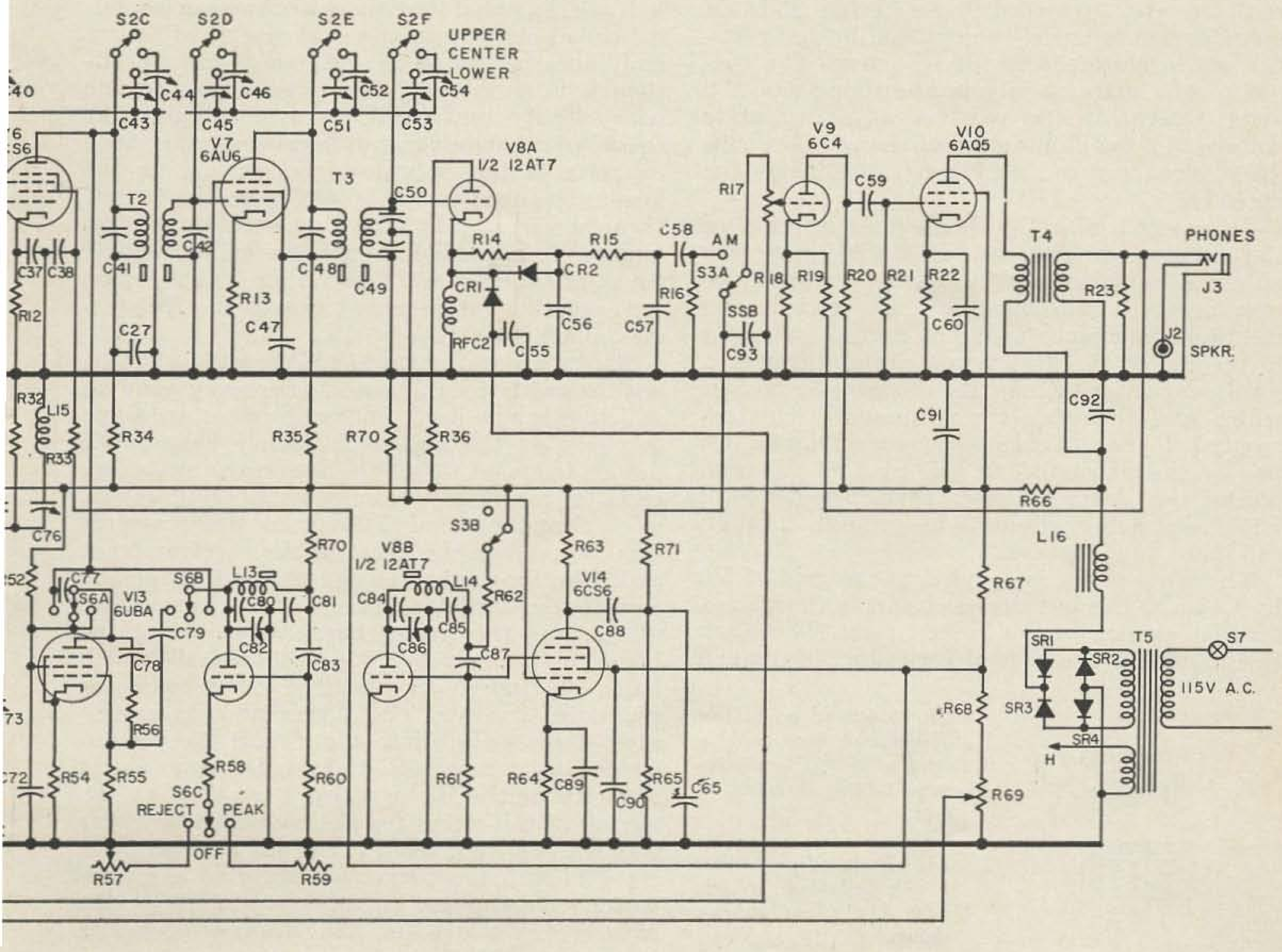
Fig. 3

THE need for a new receiver and the price asked for commercially built models which would meet the requirements of operation on the amateur bands today leaves the amateur with the choice of mortgaging the homestead or engaging in a do-it-yourself project. The writer decided on the do-it-yourself project. The experienced builder should not be intimidated by any apparent complexity of the finished receiver. The entire project was constructed with only hand tools and a ½ inch drill press. No doubt, most of the holes drilled with the press could have been done with a hand drill.

Before the construction project comes the design project. It was necessary to decide on the general features required in the receiver. The first requirement was the coverage of all amateur bands from 3.5 to 29.7 mc, with sufficient stability to receive SSB on any of the bands. About the only way to accomplish this is by using a crystal first oscillator and a variable *if* system. Other features desired were: A Lamb noise silencer, selection of upper and lower side band without retuning, a quick attack-slow release AVC system, a Q-multiplier, and a product detector. All of these features were designed and built into the 85 B. 14.

The resulting receiver, including the power supply is built behind a seven inch rack panel, and it extends eleven inches behind the panel. The completed receiver is shown in Fig. 1. Fig. 2 is the block diagram of the receiver. The receiver covers the desired frequency range in 8 bands of 500 kc each. Each of the bands is beat down to a variable first *if* of 2500 to 3000 kc by a crystal controlled injection signal higher in frequency than the received signal. The output of the first mixer (V3) is fed to the first *if* amplifier (V4) and then to the second mixer (V5). The tuned circuits in the first *if* system and the second oscillator are tuned by a three gang variable capacitor of the type used in FM tuners. This capacitor, in turn, is mechanically coupled to permeability tuned coils which tune the *rf* amplifier and first mixer.

The output of the second mixer is fed into the second *if* amplifier system which consists of two stages. The first stage in this system (V6, the second *if* amplifier) is a 6CS6 controlled amplifier, the third grid of which is controlled by the output of the noise limiter system which consists of the 6BA6 noise *if* amplifier (V12) and a crystal detector. Also, connected to the second *if* amplifier plate is the Q-multiplier which uses a 6U8A tube (V13). The second stage in the system (V7, the third *if* amplifier) is a 6AU6 which is used mainly for isolation of the second and third *if* trans-



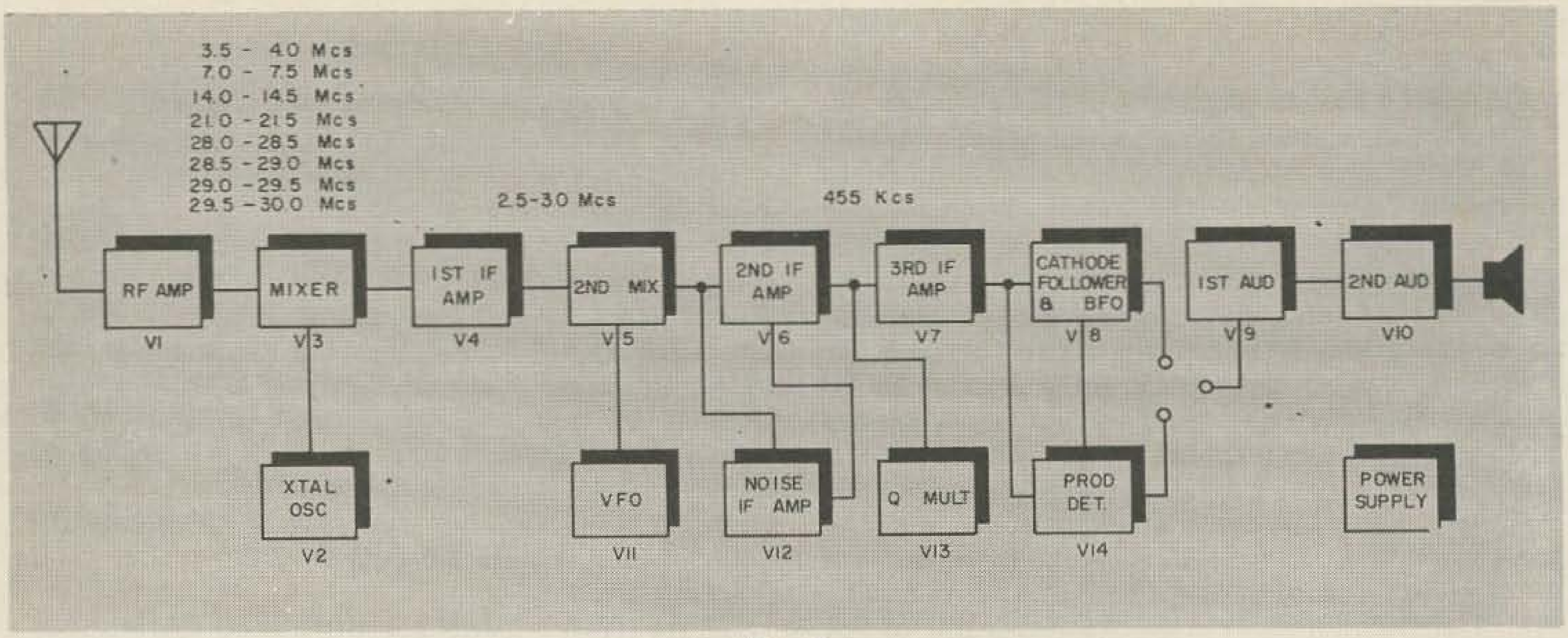


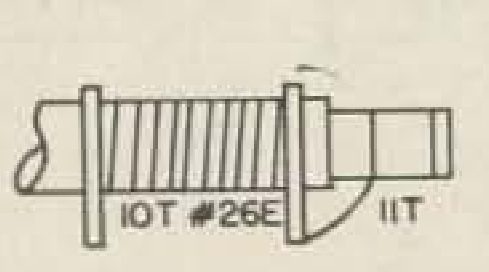
Fig. 2

formers in the system. Additional capacity may be switched across the *if* transformer windings to move the *if* system response, thus permitting the selection of either the upper or lower side band.

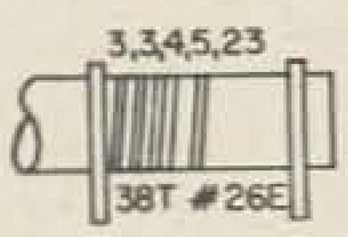
The output of the second *if* system is fed into a cathode follower (V8A) which drives the AM and AVC detectors, and into the first grid of the 6CS6 (V14) product detector. The detectors are followed by a two stage audio amplifier consisting of a 6C4 (V9) and a 6AQ5 (V10). Plate and heater power for the receiver are furnished by a Triad R-73 B transformer followed by a silicon bridge rectifier and a choke input filter system. The output of the plate supply is approximately 120 volts. Operating the receiver at a low plate voltage and the elimination of the rectifier tube greatly reduces the heat generated inside the receiver.

To proceed with the detailed description of the circuits, we turn to Fig. 3. We have two antenna input terminals. The low impedance terminal taps into the first tuned circuit and the high impedance terminal connects directly to the top of the first tuned circuit through a small capacitor. C2 is the antenna trimmer, which also furnishes the minimum circuit capacity on the higher frequency bands. C4 passes the rf signal to the grid of V1 and blocks the AVC voltage, furnished through R1, from being shunted to ground through the input tuned circuit.

The plate of V1 is coupled to the grid of V3 by C15 and the interstage circuit is tuned in a manner similar to the input circuit. The plate circuit of V2, the crystal oscillator, is coupled



L5, L6 wound on Millen 69046 coil form with a length of 3/8" polystyrene tubing inserted in end.



L4, L7 wound on Millen 69046 coil form. Winding distributed as shown.

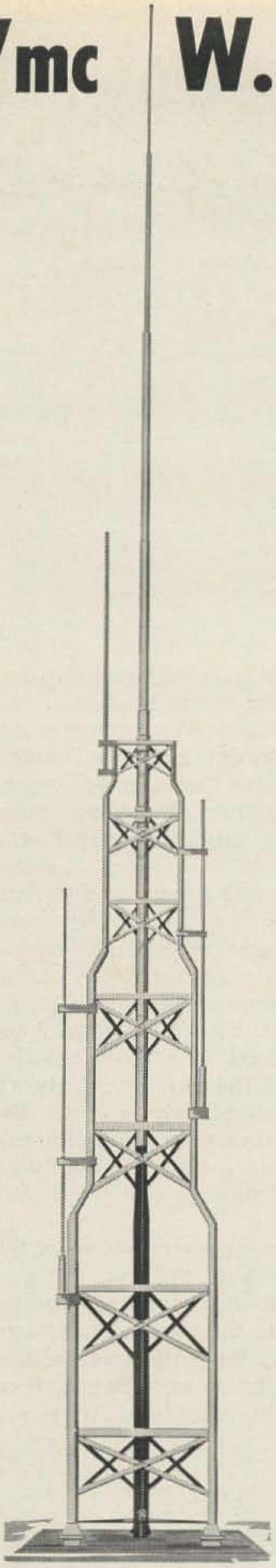
to the interstage circuit to inject the beating signal into the grid of the mixer circuit. On the lower frequency bands the coupling is capacitive, and on the higher frequency bands the coupling is inductive.

Since there are no variable capacitors, controllable from the front panel, connected across the interstage and oscillator circuits, it is necessary to install trimmers to compensate for changes in tube capacity and for ease of initial alignment. C8, 9 and 11 are the trimmers for these purposes.

It will be noted that there are two permeability tuned circuits in the grid circuit of the rf amplifier and two in the interstage circuit. Although it is theoretically possible to use one permeability tuned coil to cover all eight of the 500 kc bands desired, because of the stray capacity of the coils designed for use on the lower frequencies, it is not possible to use them at as much as four times the lowest frequency. It is possible to use the coils designed for 3.5 to 4.0 mc on 7.0 to 7.5 mc, but we must have another set of coils to cover the frequencies above 14 mc.

The permeability tuned coils must be shunted with capacity on the lowest frequency band on which they are used, and with inductance and capacity on the higher frequency bands. The accomplishment of all the necessary switching calls for a relatively complex switching device, so a Standard Coil TV turret tuner system was adopted as the heart of the receiver front end. The tuner chassis and the coil strips are completely stripped, except for the contact strips, and the tuner chassis is bolted to the inside of a 5 x 9½ x 1½ inch chassis which holds the tubes, permeability tuned coils and oscillator crystals. The turret and its associated strips switch into the circuit the desired permeability tuned coil and the necessary shunt capacity and/or inductance. Fig. 4 shows the wiring of the strips for the eight bands. There was not sufficient room to include the oscillator crystals into the turret assembly so a switch wafer was mounted on the front of the turret chassis to switch in the desired oscillator

7mc W.A.C. in 1 hour 11 minutes



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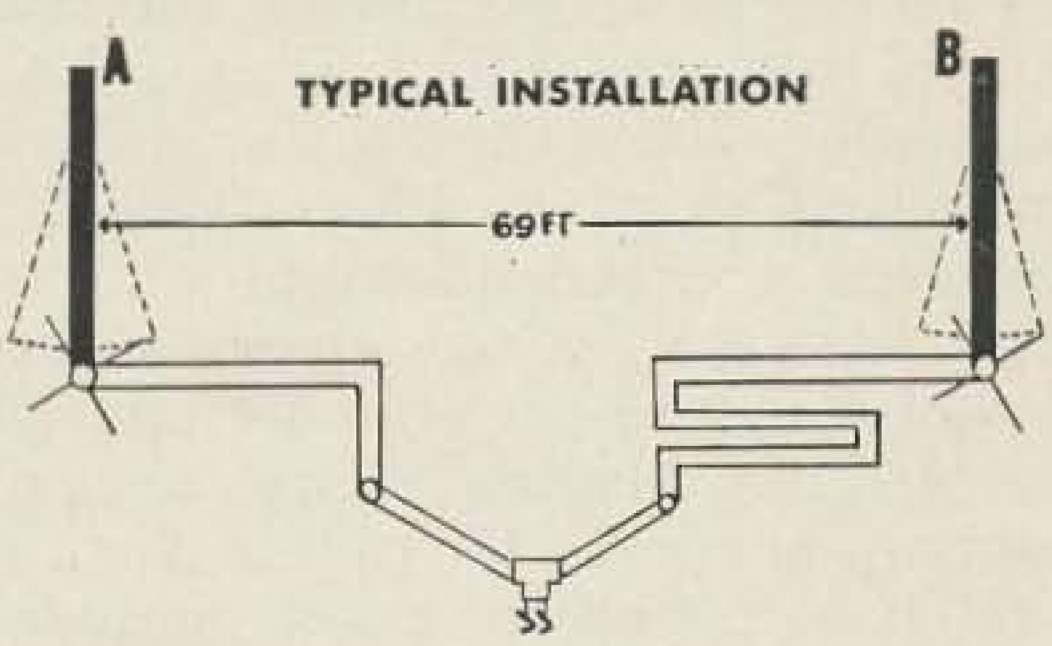
John Mayes, W6BYB Sebastopol, California

*EA 8 CG 0838 GMT	JA 3 CB 0927 GMT
LA 8 FG/**P** 0850 GMT	VK 2SA 0942 GMT
PY 5 OF 0910 GMT	VE 4 MZ 0949 GMT

PHASE TWO FOR 3DB GAIN



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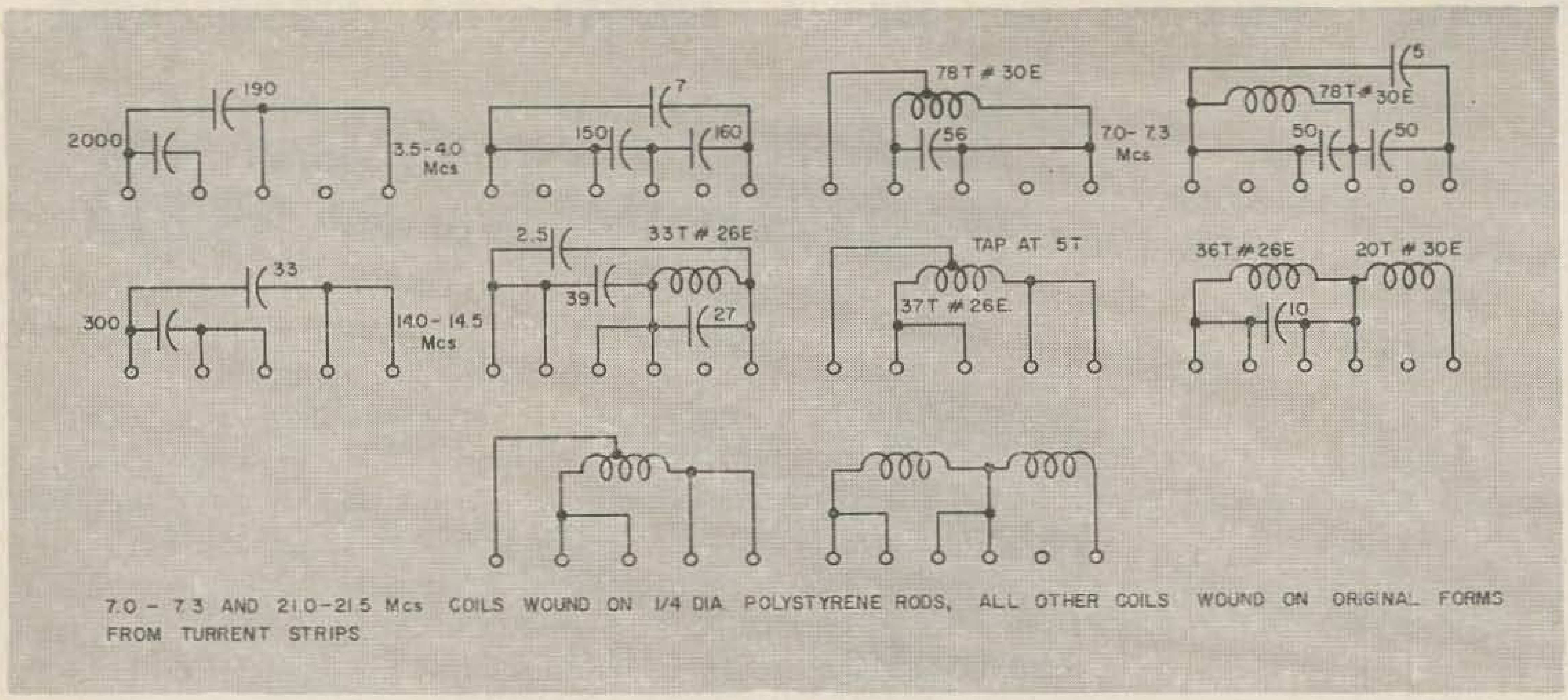


Fig. 4

crystal when the turret is rotated. The turret shaft is flatted to fit the rotor of the switch wafer. Figs. 5 and 6 show the front end chassis details.

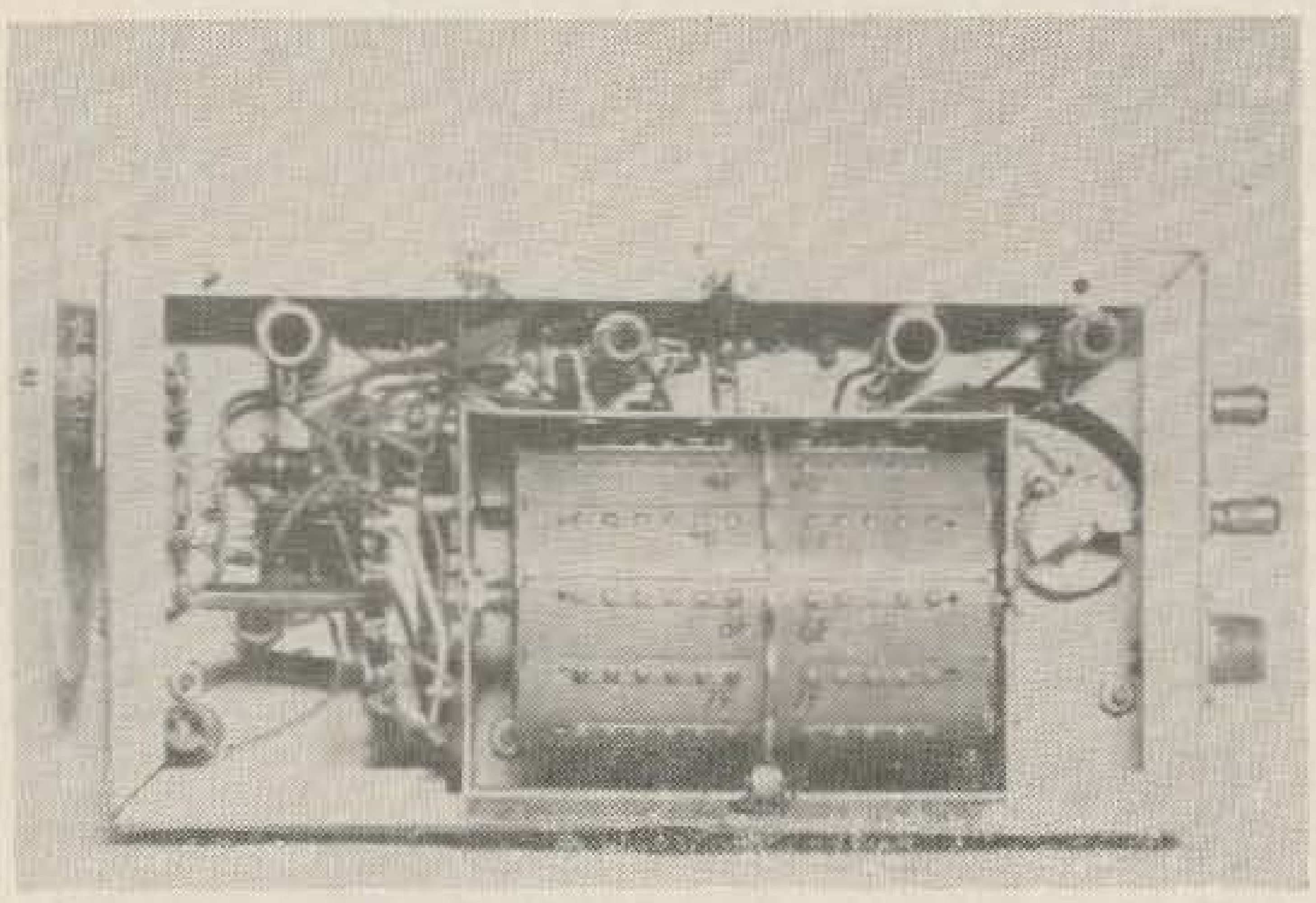
The output signal from the mixer is passed through a parallel resonant 6500 kc trap (C17, 18 and L9) which eliminates, or reduces to a negligible level, a few birdies found on the 3.5 to 4.0 mc band. Following the trap, the signal is fed into the input circuit V4, the first *if* amplifier. Here the rf signal is passed to the grid by C23 which blocks the dc from flowing between the tuned circuit and the AVC system. Another tuned circuit forms the interstage coupling between V4 and V5, the second mixer. The beating signal to beat the first *if* signal down to 455 kc is furnished by V11 which is connected as a pentode grid tickler oscillator and a triode cathode follower. The plate and screen voltages of the oscillator are regulated by Z1, a 62 volt zener diode.

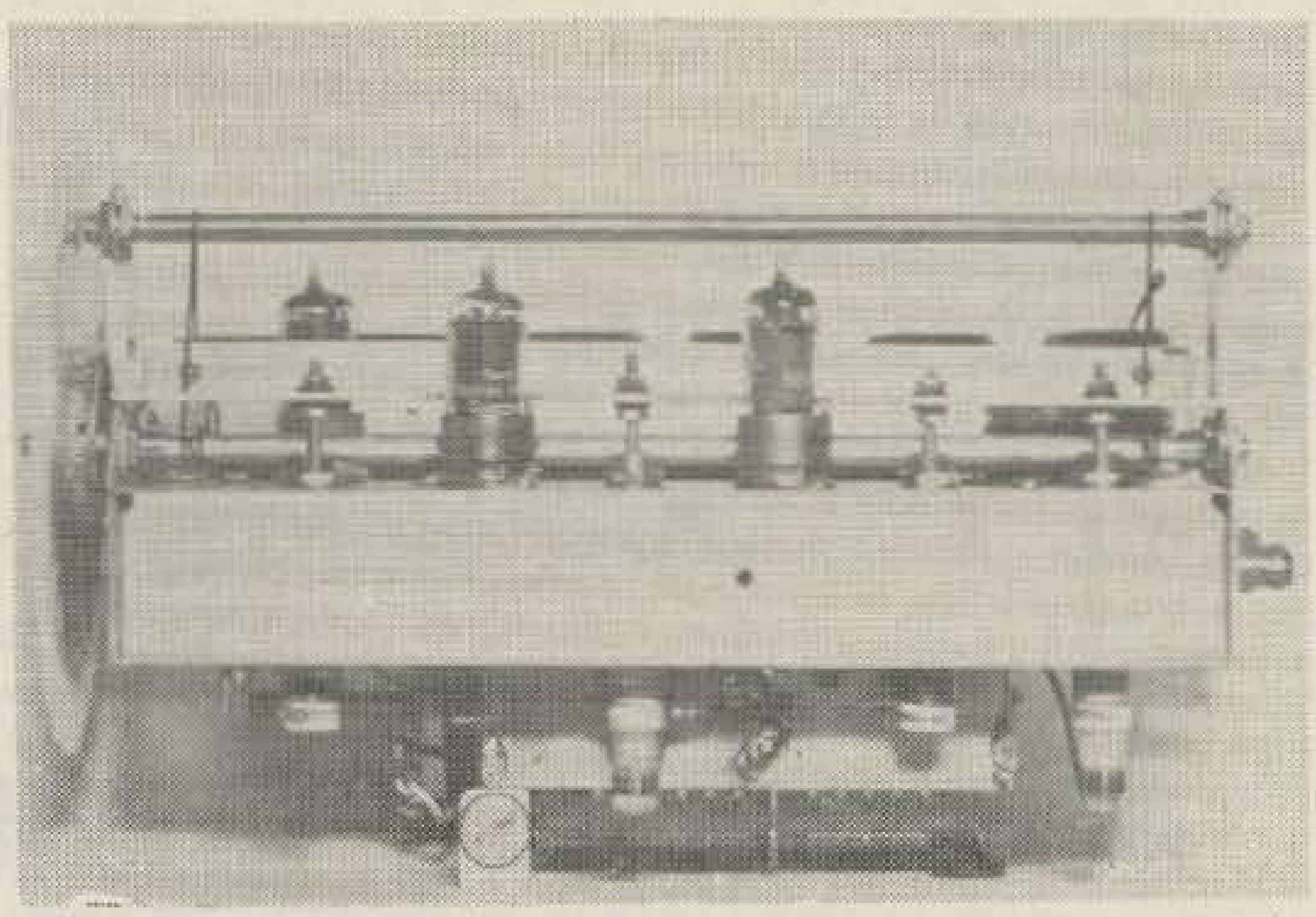
The circuits associated with the first *if* amplifier, second mixer and second oscillator are tuned by C22, a three gang FM tuning capacitor. Because the capacity variation of this capacitor is so small, it was necessary to take some precautions to insure satisfactory oscillator stability. The oscillator coil is wound on a ceramic form and a cathode follower is used to isolate the oscillator from the load.

C22 is driven by a cable drive arrangement. The same cable is used to drive the dial which is mounted on the windlass shaft which operates the elevator for the four slug tuned coils (L4, 5, 6 and 7) used in the front end of the receiver.

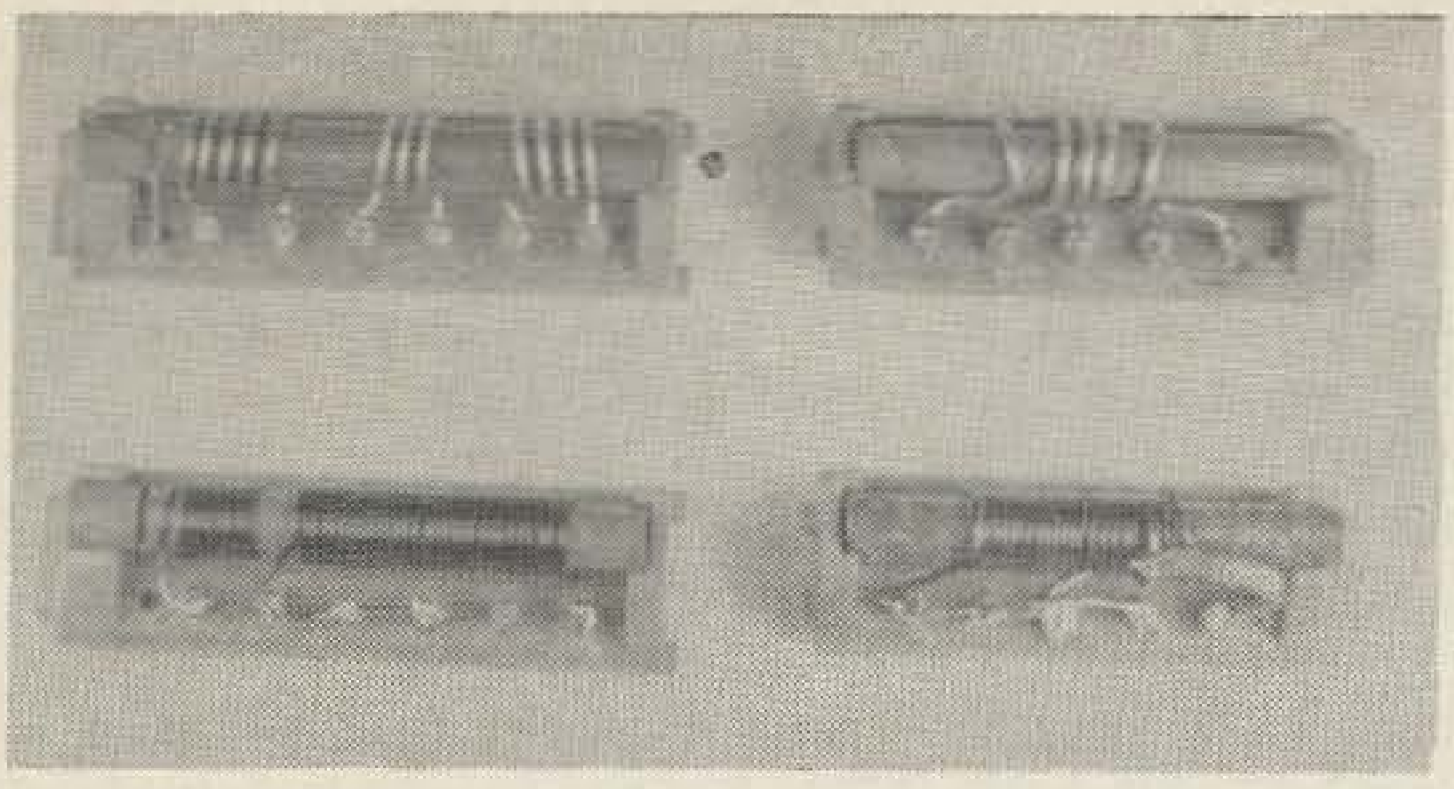
The output of the second mixer is fed into T1. The T1, T2 and T3 are *if* cathode traps from MN-26 radio compass receivers. The inductors in these traps are enclosed in ferrite pots with adjustable cores and the Q at 455 kc is in the vicinity of 200. The 5000 mmfd capacitors originally connected across the inductors are removed and the capacitors shown in the diagram substituted. S2 selects the proper additional capacitors to move the bandpass of the *if* system from the upper side band to either the center band pass or the lower side band.

The full voltage across the secondary of T1 is applied to the grid of V12, the noise *if* amplifier. One-tenth of the secondary voltage is applied to the grid of V6, the controlled *if* amplifier. This makes available sufficient voltage to properly operate the noise silencer without danger of overloading the remainder of the *if*





Figs. 5 and 6



Details of turret tuner strips.

system.

The output of V12 feeds the primary of T6 and the voltage developed across the secondary of T6 is rectified by the diode CR4. The output of the diode rectifier is filtered by a series resonant filter consisting of C76 and L15. The filtered noise pulses are ac coupled to grid 3 of V6 to cut off the plate current of V6 when a noise pulse is present in the *if* system. CR3 is a dc restorer which prevents grid 3 of V6 from being driven positive with respect to ground. A 6CS6 was selected for the controlled *if* amplifier since the plate current in this type tube may be cut off with a much lower value of negative voltage than that which would be necessary to cut off the plate current of a pentagrid mixer tube such as a 6BE6 or a 6BA7. R53 varies the amplification of V12 and also sets the initial bias on CR4.

The output of V6 is fed into T2. The Q-multiplier V13, is also connected to the primary of T2. The triode section of V13 is connected in the regenerative circuit which may be switched to reduce the losses in T2 when S6 is placed in the PEAK position or to increase the inverse feedback in the pentode section when S6 is set to the REJECT position. C77 compensates for the change in capacity which occurs across the primary of T2 when S6 is set to different positions.

The secondary of T2 feeds the grid of V7. V7 is operated at very low gain by placing a large unbypassed resistor in the cathode circuit. The output of V7 feeds into the primary of T3. The secondary of T3 feeds the cathode follower, V8A, which drives the AM and AVC detectors and it feeds, at a level of one-tenth the maximum secondary voltage, grid 1 of the product detector V14. The grid 3 of V14 is connected in parallel with the grid of the BFO, V8B.

The audio outputs of both detectors are filtered in pi section RC filters and connected to S3 which selects the desired audio output and applies the plate voltage to the BFO for SSB and CW reception.

The entire AVC voltage is applied to V4 and half the AVC voltage is applied to V1. S4 may be thrown to short the AVC voltage to ground, or to connect a large capacitor from the AVC bus to ground to produce a long release time constant. In the center position of S4, the AVC circuit is left in normal operation.

R38 varies the cathode bias on V1 and V4 and in conjunction with R37 and R69 forms a bridge circuit for the operation of the S meter.

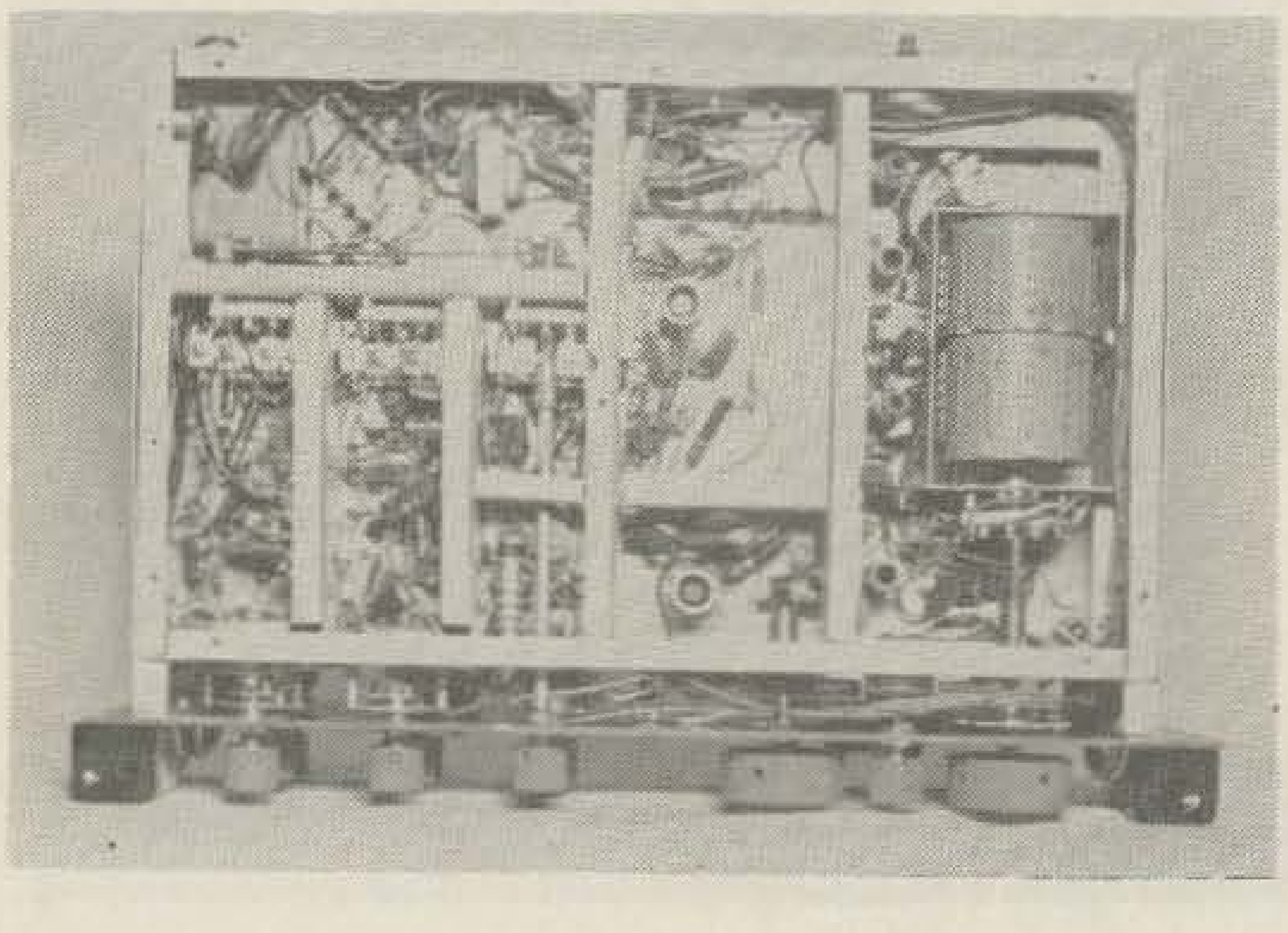
The audio amplifier is a conventional two stage system with about 6 db of inverse feedback applied to lower the output impedance of the system and to prevent extreme voltages from being developed across the primary of T4 in case the load is removed from the secondary of T4. A closed circuit jack in the secondary of T4 allows the use of headphones, and it cuts off the audio signal to the speaker jack when a plug is inserted in the jack. R23 is a resistor load used to maintain the stability of the amplifier under all conditions.

The power transformer, T5, feeds into a silicon bridge rectifier and then into the choke input filter system consisting of L16 and C92. Further filtering for all circuits, except the plate of V10, is done by R66 and C91. R67 and R68 act as a bleeder system and furnishes 30 volts to screen grids of V6 and V14.

The entire receiver is built on a 10 x 17 x 2 inch chassis, which is mounted an inch behind the 7 x 19 inch rack panel. Special end brackets were made to simplify the remainder of the receiver enclosure. Under-chassis partitions were placed between the various stages of the receiver to minimize birdies and instabilities. Because of the low *if* gain in the receiver, the *if* interstage partitions may well be superfluous, however it is easier to build them in in the first place than to add them after the receiver is finished. See Figs. 7, 8, 9 and 10.

After the construction of the receiver is completed, we may begin the process of alignment and calibration. The rf gain control is set at minimum gain S3 set at AM, noise limiter turned off, Q multiplier set at reject and R57 set at maximum value. S2 is set for the upper sideband and the *if* transformers are aligned to 457 kc. The Q multiplier is then turned off and C77 is adjusted for maximu *if* response.

S2 is then set at the center position and trimmers C36, 40, 44, 46, 52 and 54 are adjusted to set the *if* bandpass to 455 kc. With the signal generator set to produce an unmodulated signal at 455 kcs, the S3 is set to SSB, L14 is adjusted to give a zero beat between



the BFO and the signal generator with the BFO tuning capacitor set at midscale. S3 is then reset to AM.

S2 is set for the lower side band and trimmers C35, 39, 43, 45, 51 and 53 are adjusted for maximum response at 453 kcs.

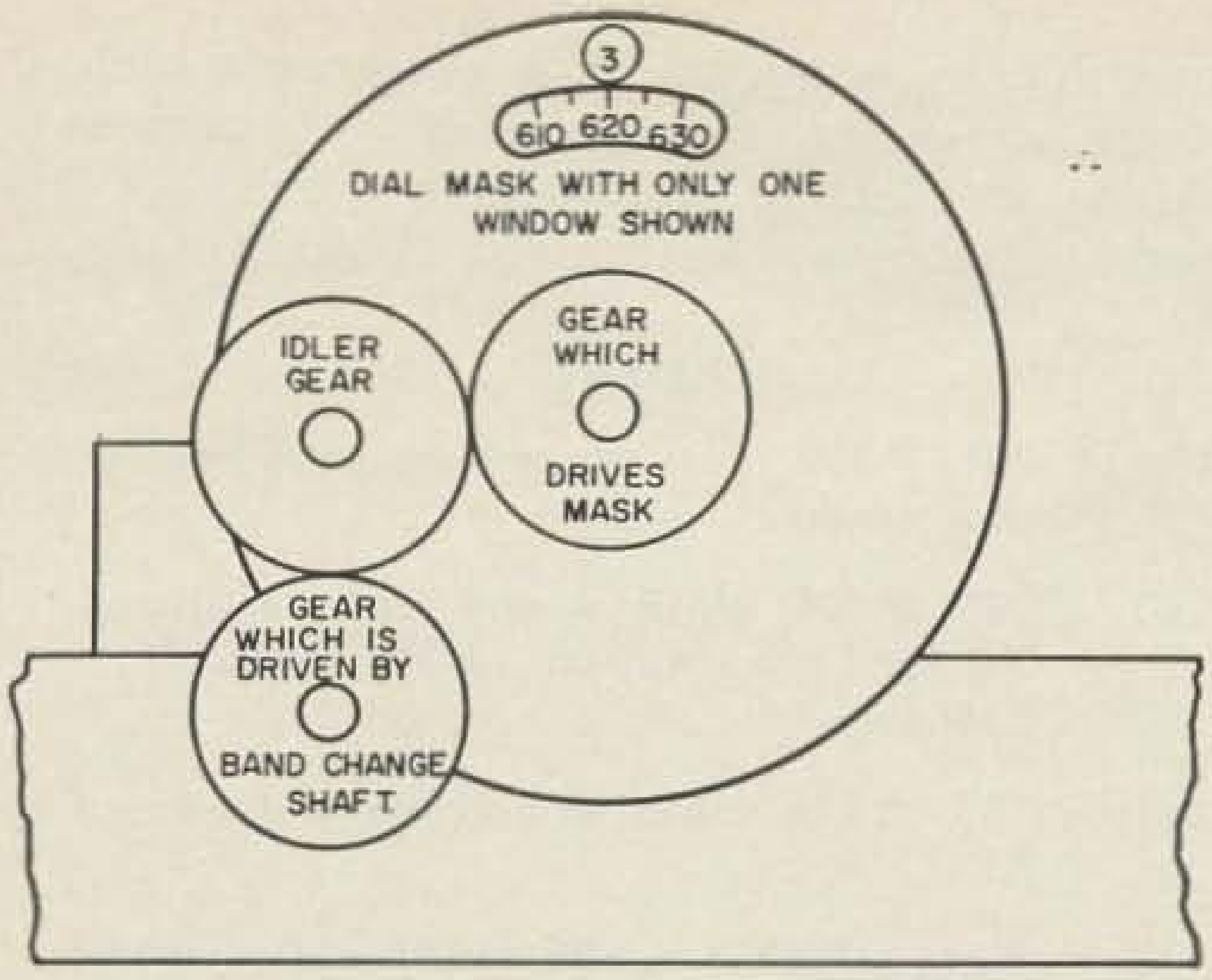
With S6 set at PEAK, S3 set on AM, C82 set at mid range, and R59 set so V13 is oscillating, L13 is adjusted to give a zero beat between the BFO and V13.

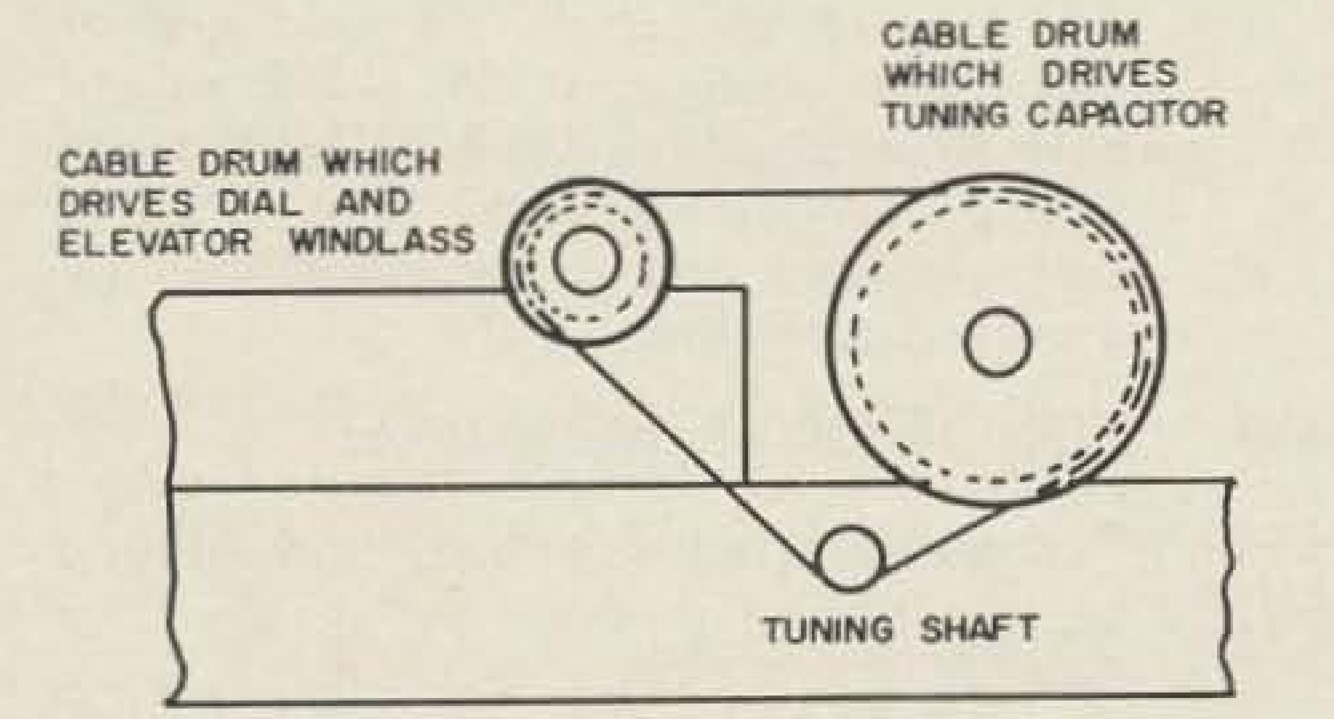
Next the BFO and the Q multiplier are turned off and a 455 kc modulated signal is applied to the grid of V5 and adjusted for an audio output well above the noise level. The noise limiter system is then turned on and the gain of V12 increased until an increase in the output signal is observed. The primary and secondary of T6 are then adjusted to give maximum output. C76 is then adjusted to give a minimum output.

We are now ready to align the first *if* system. To do this we must connect a signal generator covering the frequency range of 2500 to 3000 kc to the grid of V3. By adjusting the trimmer capacitors at the high frequency end of the band and the inductors at the low frequency end of the band, it should be possible to get the desired coverage after going through the adjustment process a few times. Once all the adjustments are considered to be satisfactory and the tracking of the three circuits is proper, the dial may be calibrated. This should be done with an accurate frequency meter or frequency standard. When the dial is being lettered, it must be remembered that the high frequency end of the first *if* band is the low end of the input frequency band. Thus a first *if* of 3000 kc corresponds to an input frequency of 3500 kc and a first *if* of 2500 kc corresponds to an input frequency of 4000 kc. By having the first figure, or figures, of the desired band on the dial mask, it is necessary to have only two scales on the dial. One from 0 to 500 kc and one from 500 kc to 1000 kc.

The alignment of the front end of the receiver becomes a little more tedious, but it is not difficult. The crystals and turret strips are inserted for one band at a time, starting with the lowest frequency. Thus the 6500 kc crystal and the 80 meter strips are placed in the receiver and a signal generator covering the band is connected to the antenna. With the generator and receiver dials set at 4000 kc, the antenna trimmer and trimmers C9 and 11 are adjusted for maximum signal. The generator and receiver dials are then set for 3500 kc and the antenna trimmer and C9 adjusted for maximum response. If the trimmers required an increase in capacity, the coil slugs should be lowered further into the coil forms. If they require a decrease in capacity, the slugs should be withdrawn slightly from the forms. It may take a few adjustments before satisfactory tracking is achieved. Once the 80 meter band is finished, we may move to the 40 meter band.

The 5000 kc crystal and the 40 meter strips

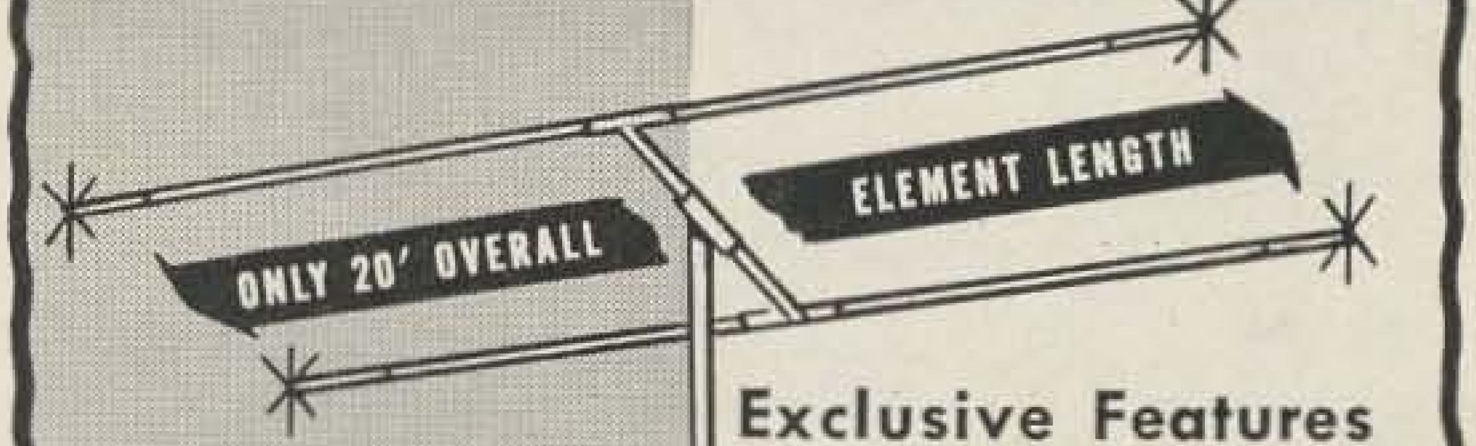


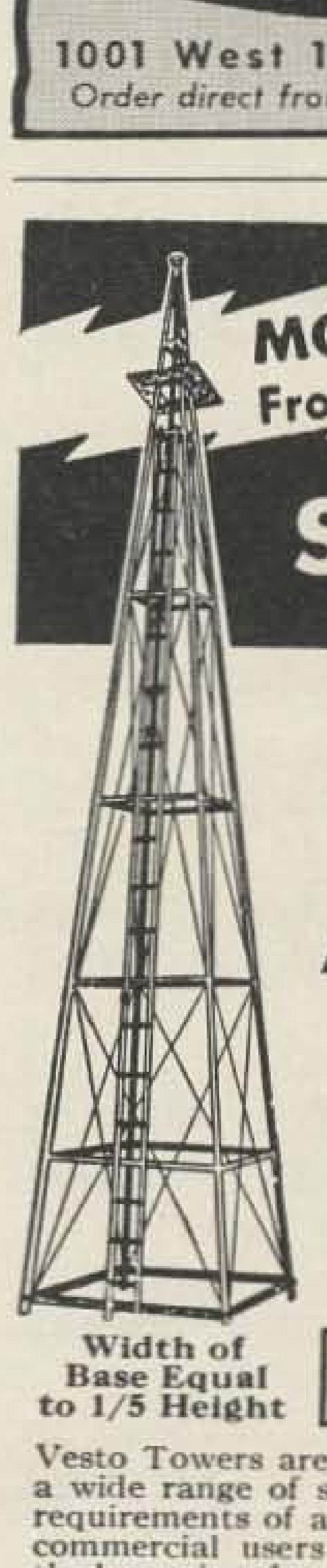


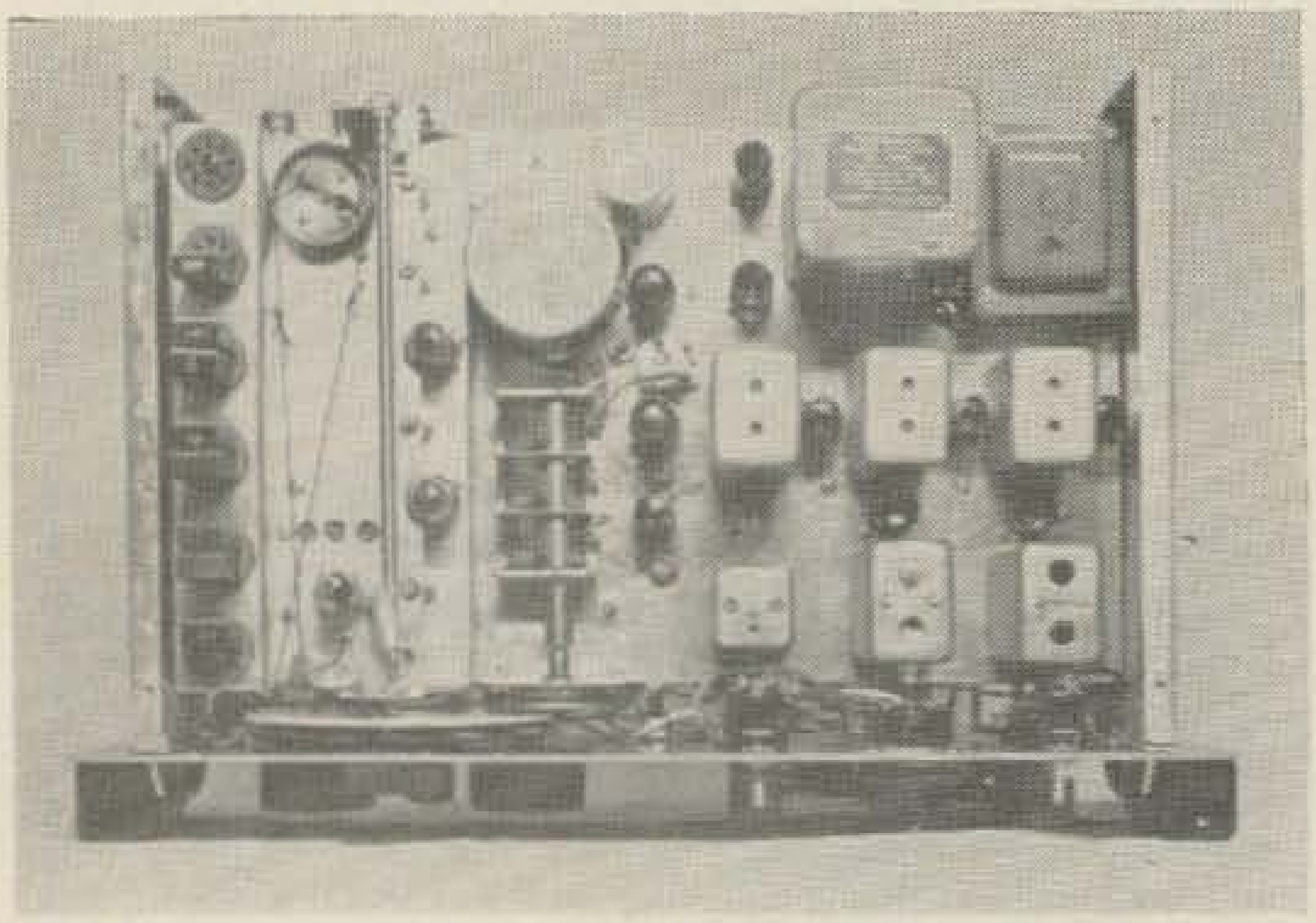
are inserted in the receiver and the signal generator and the receiver dial are set for 7200 kc. The antenna and mixer coils are then adjusted for maximum response by pushing and stretching. The generator and receiver should then be tuned to 7000 kc and the antenna trimmer varied for maximum response. If it must be tuned to a higher capacity, the antenna coil should be pushed together slightly. If the trimmer must be turned to a lower capacity, the antenna coil should be stretched slightly. The generator and receiver should then be returned to 7200 kc and the results of the operation checked. After a few adjustments, the coils should be properly adjusted and polystyrene coil dope should be applied to maintain the adjustment.

Next the 8500 kc crystal and the 20 meter strips are installed in the receiver. The alignment on 20 is similar to the alignment on 80 except that the antenna trimmer, C8 and the slugs in L5 and L6 are the adjustments for tracking. The shunt coil for the oscillator must also be adjusted for maximum response of the receiver.

For the 15 meter band and the 10 meter band there are three shunt coils for each band which must be adjusted. In general, if the antenna trimmer is set for the 20 meter band it should be possible to align the higher frequency bands in the center of each band since the tracking becomes less critical as the frequency is raised. For instance, at 29 mc if the tuned circuit Q were as high as 100, the mixer grid circuit could be mistuned almost 150 kc before the loss in gain reached 3db. When we align in the center of the 500 kc band we would not be likely to get anything like this much mistracking when we tune only







250 kc each side of center.

Naturally, after having built the receiver, there are some suggestions that I would make to any one wishing to build one like it. The first is one that would result in a little more ease of construction. If I had it to do over again, I would leave 1½ or 2 inches between the front panel and the front of the chassis. A larger tuning capacitor for the first *if* system would make it easier to achieve the desired second oscillator stability. If the constructor has or can obtain a tuning capacitor with a straight line frequency characteristic and a $\triangle C$ of about 150 mmfd per section, I would highly recommend it as a replacement for the capacitor specified. If the capacitor has four sections instead of three it would be possibe to use a double tuned circuit between the first mixer and the first *if* amplifier. This would possibly give enough rejection to make the 6500 kc trap unnecessary.

For the designer who wishes to use some means of producing *if* selectivity other than the double tuned transformers described, there is an abundance of reserve gain available in the second *if* system to make up for the loss in any filter system which may be desired.

The grid of V6 could be moved up toward the top of the secondary of T1 with a possible gain increase of 20 db. Another 15 of 20 db of gain could be realized by reducing the value of the cathode resistor of V7 and bypassing the resistor.

An additional three 500 kc bands within the frequency range of the receiver may be covered by the insertion of the proper crystals and coils in the front end. This can be increased to four additional bands if a twelve position rather than an eleven position switch is used for switching the crystals.

The total desired range may be covered in seven bands if the tuning range of the first *if* is increased to 2400 to 3000 kc. This would allow one extra band to be covered in addition to the amateur bands. This would require some modification of the slug tuned coils and would require three dial scales rather than two.

Whether or not the reader wishes to duplicate this receiver exactly, this article will have served its purpose if he is convinced that it is possible to home build a receiver which is modern in every respect and one which is equal to, or better, than the majority of receivers which may be bought commercially.

. . . Bernard

COIL DATA

L8, L9	20T #26E close wound on a ⅜" diameter form
L10	75T #30E close wound on a National XR-72 form tapped at 40 turns from bottom end
L11	75T #30E close wound on a National XR-72 form
L12	Plate winding is 60T #26E close wound and tapped 20 turns from cold end of coil. Grid winding is 10T #30E wound next to cold end of coil. Windings are wound on National XR-62 form with iron slug removed and a silver disk ¼" diameter substituted
L13	Miller #6300 ferrite antenna
L14	Permeability tuned coil .4 to .6 Mh.
L15	2.5 Mh RF choke
L16	10 H 100 Ma filter choke

Details of Turret Tuner Staips

28.0-28.5 Mcs	30T #22E tapped at 6T	30T #22E	14T #26E
28.5-29.0 Mcs	28T #22E tapped at 6T	28T #22E	14T #26E
29.0-29.5 Mcs	26T #22E tapped at 5T	26T #22E	13T #26E
29.5-30.0 Mcs	25T #22E tapped at 5T	25T #22E	13T #26E

PARTS LIST

C1	100 mmfd GP ceramic
C2	100 mmfd air variable
C3, 10	See coil data
C4	220 mmfd GP ceramic
C5, 20, 55	.01 mfd GP ceramic
C6, 7, 14, 16, 19, 24, 25, 27, 30, 31, 37, 38, 47, 58, 59, 62, 67, 68, 70, 71, 72, 74, 88, 89, 90, 94	.02 mfd GP ceramic
C8, 9, 11, 18, 21, 26, 76, 77	5-50 mmfd ceramic trimmer
C12	22 mmfd mica
C13, 23, 28, 29, 83	220 mmfd mica
C15, 56, 57, 65, 78, 79, 93	220 mmfd GP ceramic
C17	150 mmfd mica
C22	3 gang FM tuning capacitor, Miller 1461
C32, 33, 41, 42, 48, 49	270 mmfd silver mica
C34, 50	2700 mmfd silver mica
C35, 36, 39, 40, 43, 44, 45, 46, 51, 52, 53, 54	1-12 mmfd mica trimmers
C60	10 mfd 25 V electrolytic
C61	2 mfd 200 V paper
C63, 87	100 mmfd mica
C64	50 mmfd air trimmer
C66	1200 mmfd silver mica
C69, 73	part of T6
C75	50 mmfd GP ceramic
C80	900 mmfd silver mica
C81	2500 mmfd silver mica
C82	50 mmfd air variable
C84	330 mmfd silver mica
C85	1200 mmfd silver mica

C86	35 mmfd air variable
C91	40 mfd 150 volt electrolytic
C92	80 mfd 150 volt electrolytic

All resistors ½ watt fixed carbon unless otherwise specified

R 1, 11	270K
R 2, 7, 51	68
R 3, 32, 62	100K
R 4, 52, 55, 56	1M
R 5	4.7K
R 6, 8, 21, 24, 39, 71	470K
R 9, 48	22K
R10	150
R12, 64	390
R13, 26, 54	10K
R14	33K
R15	27K
R16, 65	2M
R17	500K potentiometer
R18	1.5K
R19	3.3K
R20, 27, 44, 61, 63, 71	47K
R22	560
R23, 37	22
R25, 28, 29, 30, 31, 33, 34, 35, 36, 41, 47, 50	1K
R38	20K potentiometer
R49	68K
R43	39K
R45	2.7K
R46	10K 1 watt
R49	82K
R53	20K potentiometer with switch
R57, 59	15K potentiometer
R58	6.8K
R60	560K
R66	56 2 watts
R67	6.8K 2 watts
R68	4.7K 1 watt
R69	50 potentiometer
RFC 1	2.5 Mh National R-100U
RFC 2	2.5 Mh Millen J-300-2500
S1	Centralab type UD wafer mounted on turret tuner
S2	3 double pole 3 position switches mechanically ganged
S3	DPDT rotary switch
S4	SPDT toggle switch with center off position
S5	SPST, part of R53
S6	3 pole 3 position rotary switch
S7	SPST toggle switch
T1, 2, 3,	Cathode traps from MN-26 radio compass receivers. Millen 61455 suggested as substitute
T4	Output transformer 7000 to 3.2 ohms
T5	Power transformer, Triad R-73-B
T6	455 Kcs output if transformer, Miller 512-C4
M1	500 uA 1½ inch meter
Z1	62 V Zener diode, 1 watt minimum
SR1, 2, 3, 4	Silicon rectifiers, minimum ratings 200 PIV, 125 Ma 400 PIV, 500 Ma should cost litt'e more and have a desirable safety factor

Crystals for first oscillator

Range Mcs	Injection Frequency Mcs	Crystal Frequency Mcs
3.5- 4.0	6.5	6.5
7.0- 7.5	10.0	5.0
14.0-14.5	17.0	8.5
21.0-21.5	24.0	8.0
28.0-28.5	31.0	7.750
28.5-29.0	31.5	7.875
29.0-29.5	32.0	8.0
29.5-30.0	32.5	8.125

Vacuum Capacitor Traps

Charles Spitz W4API
1420 South Randolph Street
Arlington 4, Virginia

ONE questionable benefit of being a DX station is that you are on the receiving end of things and are able to develope some perspective about the efficacy of various antennas and transmitters. Several years of operating and thousands of QSO's have convinced me that the long wire multi-band trap antennas put out a signal second only to vertical antennas in weakness. They seem to work a lot better on 40 and 80 meters and are kind of handy to have around as a result.

One of the major problems in getting these antennas working and keeping them working is in making the traps. I tried the traps described by W9JYH in the December 1955 QST (page 24), only to have the wooden dowels go up in smoke when I fed a kilowatt to them. Next I tried ceramic rods, but eventually the sun and rain corroded the aluminum tubing capacitor and I was out of business again.

The original trap specifications call for 95 mmfd and 5 uh in order to have resonance in the 40 meter phone band. Ceramic capacitors are OK, but limit you in power. This was explained by W2CYK in his October 1956 QST article. The solution to this problem suddenly dawned when I spotted some Jennings vacuum 20,000 volt capacitors in a local surplus store. They were inexpensive and performed perfectly.

Details

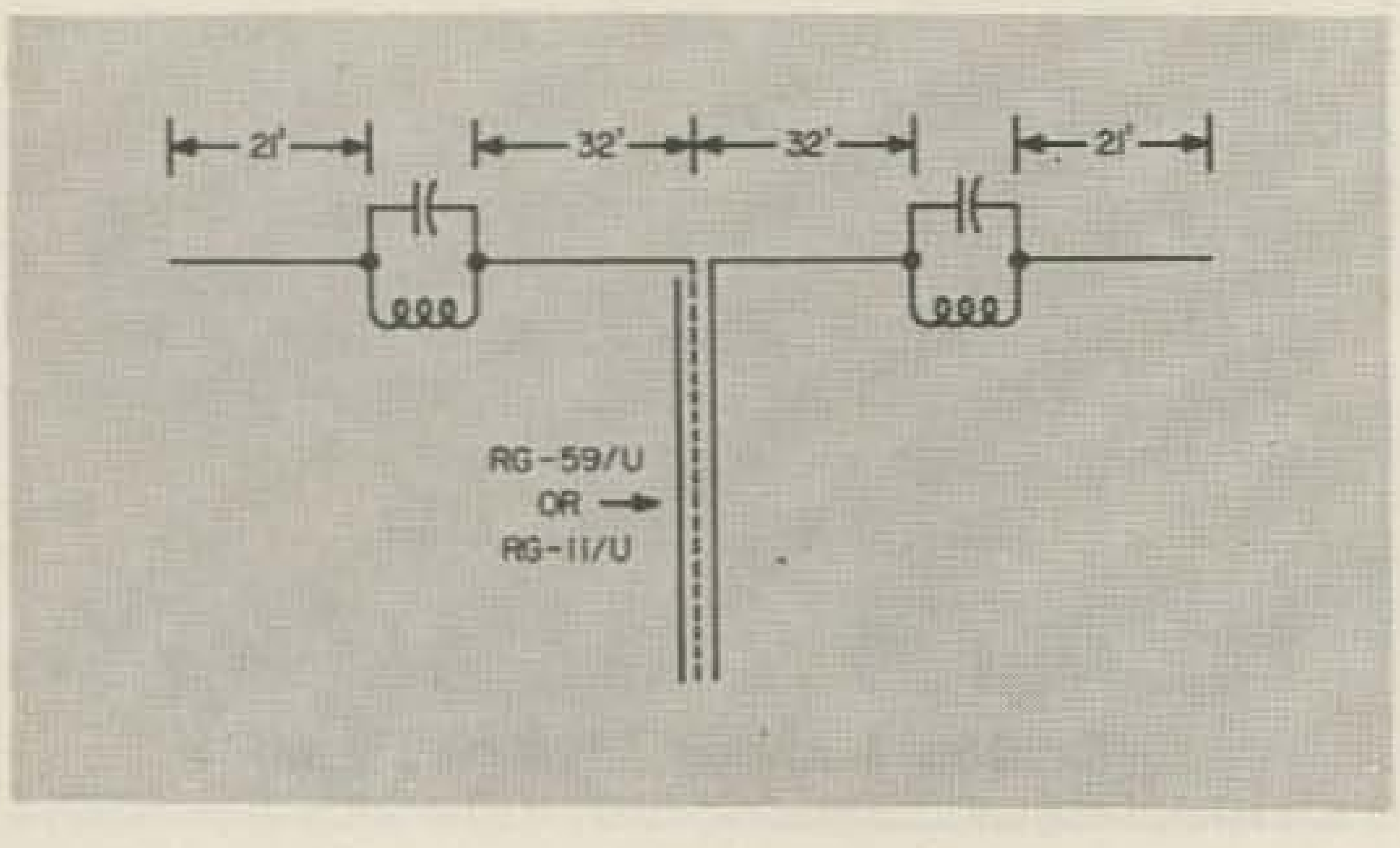
A 28 turn close-wound coil of number 14 enameled wire was wound over the center section of the capacitor glass (3½" dia.). This was tuned with a grid-dip meter to 7200 kc by pulling turns apart one at a time. The trap was then sprayed with General Cement No. 9123 high voltage Spra-Koat to hold the turns firmly in place. The capacitor was connected to the antenna with hose clamps, but a long insulator was used to take up the weight of the element which would be too much for the glass of the capacitor alone. A Birnbach 668 was used for this.

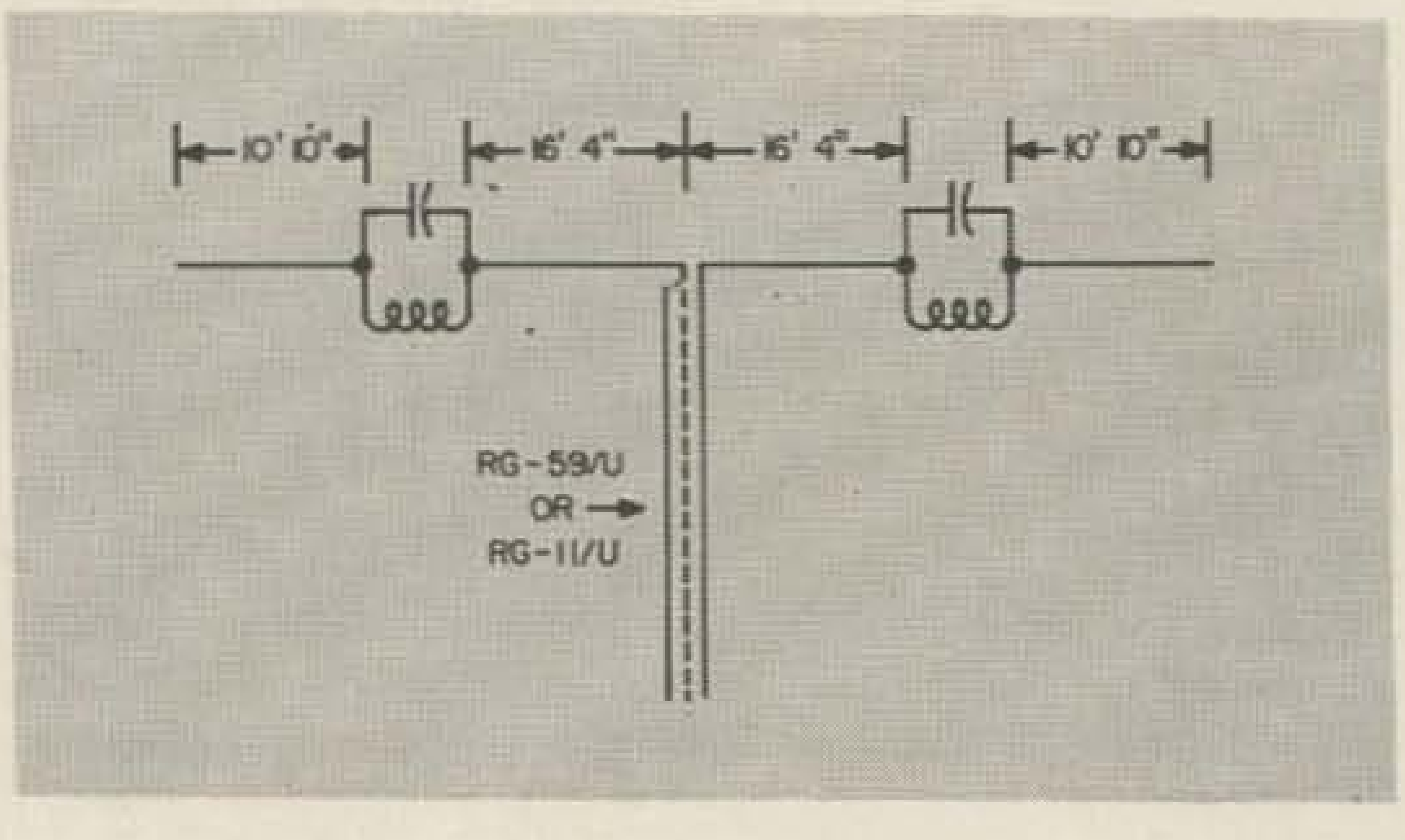
This same deal can be perpetrated on a 40/20 meter antenna such as is described on page 365 of the 1960 ARRL Handbook. In this case 25 mmfd capacitors and a 4.7 uh coil would be used. The dimensions in Fig. 2 are for the phone bands. With the smaller vacuum capacitors it is possible to make a good connection by carefully drilling the ferrule ends and inserting a bolt. Use care as the exhaust stem is in the ferrule on many of these and drilling should be done as far away from the capacitor end as possible.

The very common General Electric 50 mmfd capacitors are available surplus in good quantity and can be used, two in series, to provide the 25 mmfd. They may be connected in parallel for 40/80. In this case the simplest method is to use nine turns of B & W 3905-1 air inductor, as recommended by W2CTK.

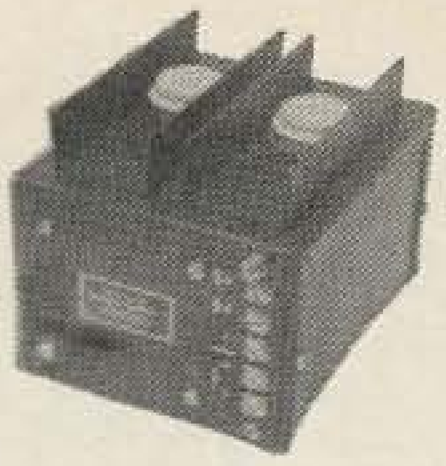
The use of vacuum capacitor eliminates the most critical source of deterioration in traps. Should you be experiencing poor performance from your trap antenna you might look to them for an answer. Due to mechanical problems, vacuum capacitors apply only to long wire antennas rather than to beams.

. . . W4API





SOLID, MAN



By now everyone has heard of solid-state power supplies—or have they? Here is a rugged little unit, extremely light weight, that is ideally rated for transmitters such as the Elmac, etc. Input 12 V, Output 500 V and 250 V at any combination of currents totalling 125 watts. We know of tests where they have held up for hours at much higher drains, so this is conservative. Just a palmful, 3" x 4" x 5" and 28 ozs., yet power to spare in running a medium-power transmitter and receiver. You might want to bug AIR ELECTRONICS, 7250 Hinds Ave., North Hollywood, Calif. for more details. At last count they were $49.50 each.

Filter

The November '61 issue of 73 had a very nice TV tuner receiver which seems to have headed quite a few readers toward the workbench. A lot of interest has been generated in the little filter shown as part of this circuit. This is made by Itek Electro-Products Company and you can get a catalog sheet, complete with considerable circuit data from them by dropping a line to Hugh Ware W1PYD, Itek, 75 Cambridge Parkway, Cambridge 42, Mass.

Letter

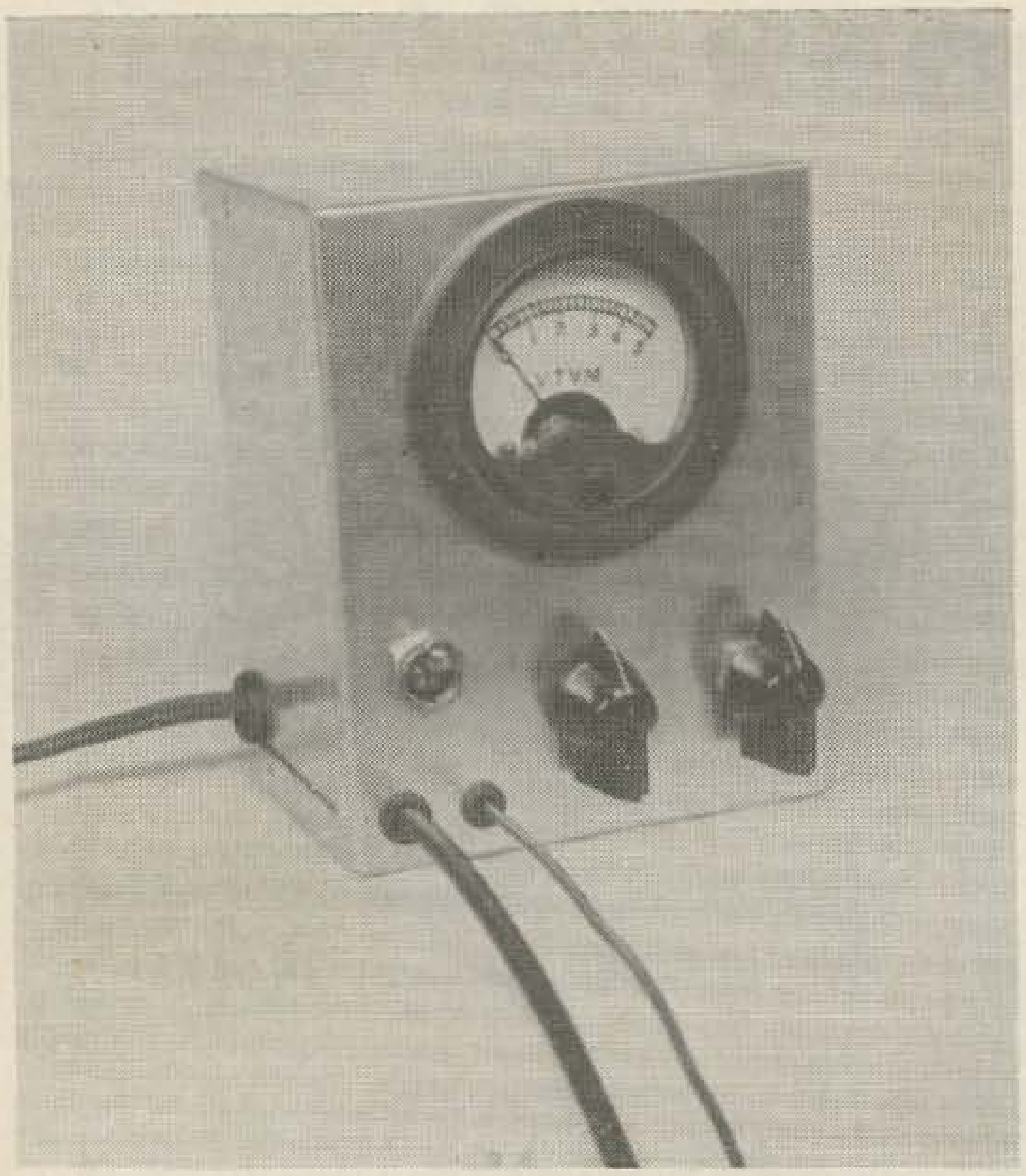
Dear Sir:

I hope some day to become a Ham and experiment in the 432 Mc. band with A5 (television) emission. This is an ambition easily achieved in your land of freedom with your unique development, the Technician's license. Here in Canada, things are different. I must obtain an Amateur Radio Operator's Certificate requiring 100% perfect morse code at 10 w.p.m.; purchase a HF transmitter receiver; erect an antenna and operate for a year to obtain sufficient QSL cards to qualify for an Advanced Amateur License which itself requires 15 w.p.m., 100% perfect code. This final license is endorsable for A5 emission.

There appear to be two types of Hams: the operating and the experimenting. You in the States have recognized ·he existence and importance of the experimenter; we in Canada force the experimenter to become an operator and make a considerable outlay in money and time in order to qualify for a license which allows him to experiment. This is unjust in my opinion.

At present, the Canadian Amateur Radio Operator's Certificate allows the amateur to transmit an unmodulated carrier, tone, AM voice, FM voice, facsimile, teletype, etc., but not television. I for one would like to see the privileges of this certificate increased to include television.

B. A. Robinson, P. Eng. VE9OX



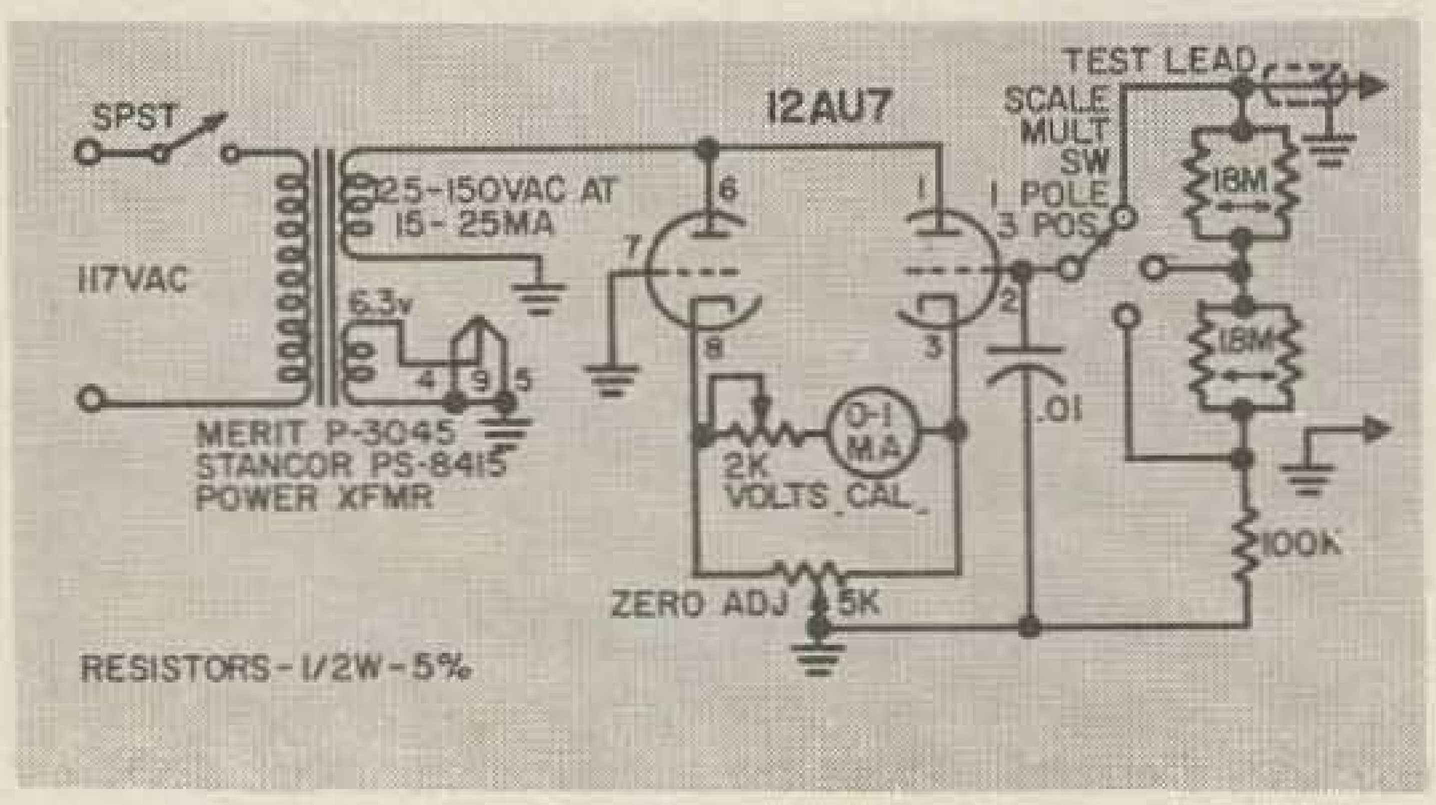
Budget VTVM

Ken Matsen W7INX
900 N.E. 87th Avenue
Portland 20, Oregon

It certainly isn't necessary to extoll the usefulness of the vacuum-tube voltmeter, however, many hams and casual experimenters do without the aid of this instrument because they already have an ordinary volt-ohm meter, and feel they can't shell out the extra cash for a commercially built job, or even one in kit form. If you fall in this category, here is your chance to add a VTVM to your test equipment, economically.

Every effort has been made to reduce the circuit to its simplest form and still maintain good performance, accuracy and stability. This has been done, for the most part, by eliminating the frills and everything not absolutely connected with the voltmeter operation itself. Leaving all other possible functions, such as resistance and current readings, to the aforementioned volt-ohm meter.

The circuit is the familiar bridge, with each triode section of the 12AU7 forming one arm, and the "zero adjust" potentiometer forming the other two arms. Voltage from the transformer is applied to two corners of the bridge, the one formed by the connection of the two plates of the 12AU7, and the other by the center tap of the "zero adjust" potentiometer through ground. With no voltage on the 12AU7 grids the bridge is balanced by this control. A positive voltage to the grid of the 12AU7 (pin 2) will make the triode draw more current, which in turn causes the cathode voltage to rise. The milliammeter then reads the current flow between the two cathodes, which is proportionate to the voltage applied to the grid.

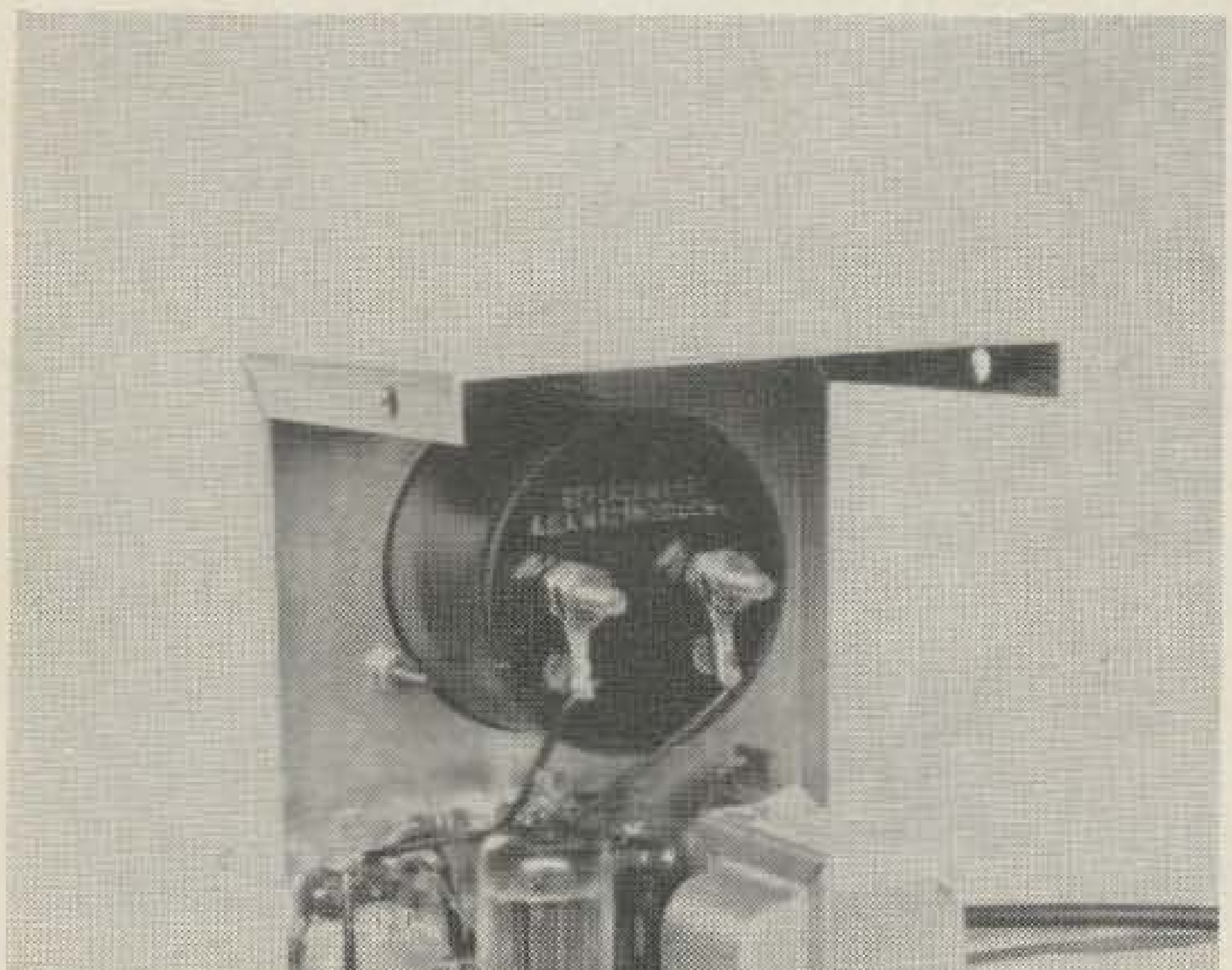


In building a unit such as this on a budget, considerable savings can be made with a reasonably well stocked junk box. When building my own meter the only purchases necessary were the power transformer and the minibox, so the actual cost was less than five dollars. The milliammeter was removed from a piece of Navy surplus and the rest scavenged from the proverbial junk box. However, even if all parts have to be purchased, the cost should still be less than half that of a VTVM in kit form. The costliest single item is the 0-1 milliammeter, but the more reasonably priced moving vane type of meter will keep the cost low, and it works very well in the circuit.

All components are housed in a 3 x 4 x 5 minibox, however the location of parts is not critical, so any convenient box can be used and this is left to the discretion of the builder. Controls on the front panel from left to right are, ac switch, scale multiplier switch, and "zero adjust" potentiometer. The "calibration" potentiometer is mounted on a bracket inside the case, and after once adjusted need not be touched for long periods of time. The "hot" test lead must be shielded cable. A two or three foot length of microphone cable, or even small co-ax is ideal for this purpose. The common lead is ordinary flexible test lead wire. No attempt was made to provide jacks for the leads because they need never be removed. This also eliminates any possible trouble due to loosening and subsequent poor contacts. The resistors necessary to multiply the meter scale in the proper ratio, are not standard values, so in each case two standard resistors are paralleled to obtain the proper resistance values.

In calibrating the meter it is necessary to calibrate the low voltage scale only. The others will be automatically calibrated in multiples of ten and one hundred. A new scale must be made for the meter. To do this, cut a piece of heavy white paper to the size and shape of the original meter face. Draw an arc corresponding to the one on the meter and divide it into five equal parts. Subdivide these into five equal subdivisions. You will now have a basic five volt scale, which is multiplied to 50 volt and 500 volt scales. A known voltage source is needed for calibration, a couple of flashlight batteries in series will do nicely. Accurately measure the voltage with another meter. Zero the meter on the VTVM and put the leads across the known voltage. Adjust the "calibrate" control, which is mounted inside the case, until the meter reads the known voltage. The meter then should read correctly for all scales.

During the several months that the meter has been in operation here in the shack, it has held its zero adjust and calibration very well, and has worked most satisfactorily on all counts. . . . W7INX

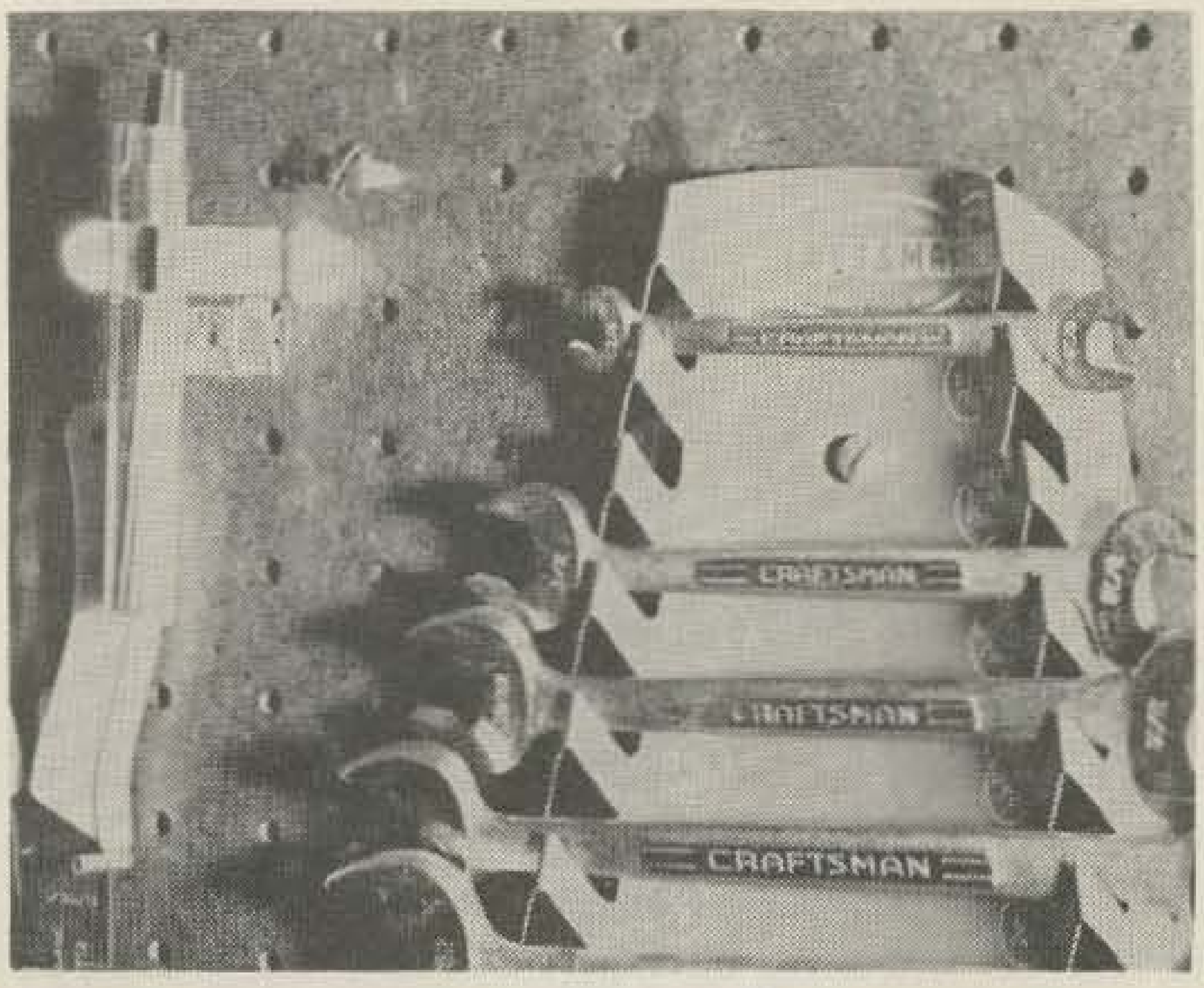


Pegboard Mounting Aids

Many amateurs use peg-board for mounting tools and accessories and with the wide range of hangers available, its use goes a long way toward reducing clutter in the shack and shop. There are, however, many items that do not lend themselves to mounting with commercial hangers. The photograph shows two techniques that are useful in mounting those "difficult" items.

Very small tools and accessories may be stored in plastic "pill boxes" or tubes. A standard, clip type tool holder may then be used to mount the tube. The photograph shows an assortment of Swiss needle files stored in this fashion.

Mounting special fixtures on pegboard is complicated by the fact that there is normally no access to the rear of the board. If the object to be mounted is not too heavy, standard machine screws may be used. The 12-24 size screw threads nicely into the perforations of the board and will hold a substantial weight. The photograph shows a commercial wrench set mounted using this technique. . . . W4WKM



Photograph by: Morgan S. Gasman, Jr.

Letter

Dear Wayne:

If you'd like to increase the DX capability of the 2.455 kmc receiver in the March 62 issue, try putting about 50 microamps forward bias on the 1N21B diode. This is standard practice in crystal-video receivers and greatly increases the sensitivity of the diode detector. Paul Barton's explanation of the modulation you receive on the police radar signal wasn't quite correct. To get the doppler modulation, the received signal has to be beat against the transmitted signal, which is not available in your car. The received signal does turn out to be amplitude modulated, but this is due to the ground reflected signal setting up an interference pattern with the direct signal. This causes a rapid flutter as you drive through the pattern, similar to what you get operating vhf mobile, but enough higher in frequency to be audible as a tone. In any case, the receiver should work. **Nathan Gold K1MIA**

more notes on

Silicon Rectifiers

John C. Wait K5IPY
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Fayetteville, Arkansas

REFERENCE is made to the two articles in 73 *Magazine* on silicon rectifiers. (Vol. I, No. 12, Sept. 1961, "Silicon Rectifiers" by Henry Cross, W1OOP, and Vol. III, No. 1, Feb. 1962, 'Silicon Rectifiers . . . Continued" by Charles Pierce, WA6QFD). The article by Cross states "For the simple way out, avoid: Choke Input Filters . . ." Both articles appear to deal with capacitor input filters and avoid the choke-input type.

Choke Input Filters have superior voltage-regulation compared to the capacitor input type. And, because of the high current peaks during the charging of the input capacitor, there is a reduction of the current-carrying capacity of the rectifiers when used with a capacitor input filter.

The Peak Inverse Voltage of the rectifiers (the peak voltage that the rectifier must withstand when the voltage is applied in the non-conducting direction) depends upon the circuit used. The p.i.v. can be 3.14 (π) times the dc output voltage for the case of a single-phase, full-wave, center-tap connection. (The p.i.v. of 3.14 happens when, say, the cathode is at a positive peak voltage +E and the peak voltage applied to the anode is —E, resulting in a p.i.v. of 2E. Since the dc voltage is $2E/\pi$, the ratio of the two is π which is equal to about 3.14.)

As An Example, if 600 p.i.v. silicon diodes are to be used to supply 1500 vdc using a single-phase, full-wave, center-taped circuit (which is the usual case), the p.i.v. is equal to (1500 x 3.14) which equals 4710 volts. The number of diodes used in each leg would be equal to (4710/600) which equals eight. One might use nine diodes in each leg as a factor of safety.

The Voltage Peaks (transient voltage) are not evenly distributed across the string of diodes and may exceed the voltage rating of the diodes. This can cause one diode at a time to be short-circuited and result in failure of the entire string. The use of 0.01 mfd capacitors connected across each diode will tend to keep the peak voltages equalized across the diodes. If there are many diodes in a string, a 0.001 mfd capacitor can be put across a group of about six diodes. Other means of protection against transient voltages would be the use of each rectifier with a p.i.v. rating higher than that which might occur (which would be more costly), or the use of nonlinear resistors to give protection against the voltage peaks (General Electric trade name Thyrite).

Overload protection for silicon rectifiers must be fast acting (about one-half cycle or less). This can be done by using special high-speed fuses (such as Bussman's Silver Strand). A more costly means of protection would be to use rectifiers of higher current rating.

While on the subject of choke-input circuits, we might consider the minimum value of inductance needed. This is the value of inductance needed to ensure a continuous flow of current under low-load conditions. The following example (in which transformer and rectifier resistances are neglected) will serve to illustrate a method of calculating the minimum inductance.

We have a single-phase, full-wave choke-input power supply operating from a 60-cycle source. The dc output voltage is 1500 volts, minimum load current is 100 ma., bleeder resister is 50,000 ohms, and the choke resistance is 80 ohms. The external load resistance at minimum load is

$$\frac{\text{E output}}{\text{I min. load}} = \frac{1500}{0.100} = 15{,}000 \text{ ohms.}$$

External load resistance paralleled with bleeder resistance is

$$\frac{15000 \times 50000}{15000 + 50000} = 11540 \text{ ohms.}$$

Total load resistance (choke resistance plus bleeder resistance paralleled with external load) is

$$R = 80 + 11540 = 11620 \text{ ohms.}$$

The minimum (critical) inductance is

$$L_c = R/A = 11540/1130 = 10 \text{ henrys.}$$

("A" is a constant, and is equal to 1130 for a 60-cycle source and a single-phase full-wave rectifier).

(Note: values have been rounded off.)

A value of inductance of about ten henrys or greater should be used, or the value of the bleeder resistor could be made less, and the problem recalculated. . . . K5IPY

73 Tests The Heathkit HA-10 Linear

Al Brogdon W4UWA/K3KMO
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State College, Pennsylvania

HEATH has come through again with a real deal—where else can you get a kilowatt for $230? The Heath HA-10 sells for $230 in kit form or (for the Citizens Band crowd) $330 wired and tested. The kit takes about ten hours to wire, so if you want to brag about the time you did a job for ten bucks an hour, buy the kit and wire it yourself. As with all Heathkits, you need no knowledge of radio or electronics—all you need is a reaonable ability in reading plain English, and a hot soldering iron for where it says (S).

The HA-10 circuit is the "tried and the true" 811A grounded grid circuit that has been described a great number of times in the various amateur radio publications. This particular kit uses four of the 811A's in parallel to run 1000 watts PEP on sideband, 1000 watts CW, 400 watts AM linear, or 500 watts with a controlled-carrier exciter. A neat little neutralizing circuit is used that makes use of a third winding on the filament choke for the necessary feedback.

The HA-10 has an untuned input circuit that matches the 50-75 ohm output of most exciters, and a bandswitching tank circuit for 80 through 10 meters that uses a pi-section to match 50-75 ohm loads. Any antenna outside this impedance range should be fed through an antenna tuner. The instruction manual recommends that "every effort be made to get the SWR of the antenna down to less than 2 to 1." Of course, this is no problem, since most modern hams think it is impossible to "get out" with an SWR higher than 1.5:1, and have their feedlines perfectly flat. Personally, I would rather "get out" well than have a pretty reading on a "vizwaar" meter, but some hams prefer the pretty reading. But I digress.

Condensed Specifications

Driving power required—50 to 75 watts, repending on frequency in use.
Maximum power input—1000 watts PEP SSB, 1000 watts CW, 400 watts AM (500 watts controlled carrier).
Input circuit—approximately 70 ohms, untuned.
Output circuit—Pi-network, 80 through 10 meters, 50 to 75 ohms.
Tube complement—four 811A, two 866A.
Power requirements—117 v ac, 50-60 cps, 1250 watts maximum.
Cabinet size—19½" wide x 11⅝" high x 16" deep.
Weight—90 pounds actual, 100 pounds shipping.

The HA-10's plate power supply is a husky full-wave rectifier with a pair of 866A's delivering nominal voltages of 1600 key-up and 1350 key-down. (A note of explanation is in order here. "Key-up" and "key-down" are archaic phrases that allude to ancient times when amateurs used telegraph keys for communications. These conditions are equivalent to "no load" and "full load" respectively.) The bias supply delivers a stiff 4.5 volts to the grids of the 811A's, with provision on the rear panel for connecting 45 to 150 volts of cut-off bias during receiving periods. A cooling fan is mounted directly behind the 811A compartment and comes on when the filaments are turned on to insure adequate cooling.

A single 1 ma meter is used for metering, being switched to read (full-scale) 200 ma grid current, 1000 ma plate current, 2000 volts plate voltage, and an arbitrary scale (0-1000) relative power output. The relative power output position is valuable for "on-the-nose" tuning, since maximum output does not always coincide with minimum plate current. (As a note of historical interest, it should be mentioned that the phrase "on-the-nose" is a tribute to one of our contemporaries in amateur radio, and a great operator—Mr. K. Nose, KH6IJ. Many such phases may be found in ham radio, such as the CW operators' favorite expressions of "FB" and "73," referring, of course, to the grand old man of telegraphy, Samuel F. B. Morse, and their favorite magazine, respectively.)

In addition to the panel meter, an adjustable oscilloscope take-off is provided on the rear apron of the chassis. The instruction manual gives full details on hook-up for monitoring of your signal on a scope, a worth-while feature for proper linear operation.

The rf section of the HA-10 is placed along the front half of the chassis, with the power supply components along the rear half. The rf section is provided with a full shield around it. This, plus the added shielding of the cabinet itself, does an excellent job of shielding which aids in TVI reduction. The packaging job on the HA-10 is very nice, with the whole linear weighing in at 90 pounds and taking up less than two cubic feet. Indeed, this is a far cry from the 75 meter phone kilowatts of ten years ago, which were built in seven-foot relay racks and required a dozen husky men to move around.

The instruction manual gives full information on operation of the linear, including description of pads to be used if your exciter runs more than 100 watts output, or if the linear is to be used for extensive AM operation. The HA-10 is designed for use with the common 50 to 100 watt exciters, but may be run at reduced input with less than 50 watts. A statement appears in the manual saying that "the HA-10 should not be used to amplify AM signals in excess of 100 watts, as a worthwhile increase in power will not be realized." I admire Heath's honesty in making this statement, since there are many of our fellow amateurs today who do not realize that the S-unit scale is not linear, but requires a *four times* power boost to read one S unit higher. But nowadays, the kilowatt is a status symbol, and a lot of the fellows will run the HA-10 behind their Apaches, DX-100's and Viking II's with the only indication of the power increase being the increased electric bill each month. Speaking of electric power, the HA-10 manual mentions no less than three times that wiring to the outlet feeding the HA-10 115 vac input should be no smaller than #14. This advice should be heeded, since the Warrior draws over 10 amps under full load.

The front-panel controls include bandswitch, tuning, loading, meter switch, relative power sensitivity, filament switch and plate switch. Also on the front panel are the meter and the two king-size pilot lamps. Across the rear apron of the HA-10 are the following connections: rf input, rf output, ground lug, AC input, bias terminals, scope output, and scope amplitude adjustment.

W3JZF, now in Florida awaiting his new "four" call, was kind enough to allow his Warrior to be used in some efficiency measurements. Table 1 shows the results of this effort. The Warrior was driven by an HT-32A exciter, and the output was fed to a 50 ohm dummy load. The rf voltage was measured at the load with a Hewlett-Packard model 410B VTVM. Input was adjusted to 700 ma indicated plate current on all bands except 10 meters, where the HT-32A could only drive the Warrior to 660 ma plate current. As noted in the instruction manual, 30 ma of bleeder current is included in the current indicated on the plate meter, so this amount was discounted from the meter reading. The efficiency as shown in Table 1 is called "indicated efficiency," since part of the HT-32A output will appear in the Warrior output. It would have required far more time than was available for measurements, to measure the actual efficiency, so the figures are labeled apparent efficiency and the heck with it.

The apparent efficiency on all bands is 50% or better, so this is fair efficiency. There are some purists in the crowd who by now are screaming, "I can get 75% efficiency with a class C stage!" True, but let us mull this over a bit. Assume we have two one-KW amplifiers, one of which is 50% efficient, the other, 75%. So one puts out 500 watts, and the other, 750. So what? This is only 1½ db, or a quarter of an S unit. If you are so bad off that this quarter of an S unit will kill you—take up stamp collecting. Worrying about that last db is somewhat akin to the fellow who worked for months in finding compass directions from his location to any point in the world—within one half of one degree. Then he used these figures to aim his four element beam—you know, the one with a beamwidth of 15 degrees.

It should be pointed out to owners and prospective owners of the Warrior or any other linear amplifier that the FCC defines input power with grounded grid amplifiers to be the input to all stages supplying power to the antenna. This means that the input power with the combination used in the tests mentioned above, according to FCC definition, would be the sum of the input power to the HT-32A and that of the Warrior. And this sum should not exceed 1000 watts. The 1000 watts was exceeded during the efficiency tests, but this was into a dummy load, so it was OK. But be careful not to exceed the limit when you're on the air, else a friendly FCC representative might catch you at it some day.

All in all, the Warrior is a very attractive, lightweight (considering), and compact package that is well worth the asking price. In fact, if you will check catalog prices of comparable components, you will see that it would be difficult to copy the Warrior for $230. And an added feature as far as economy goes is that the 811A final tubes may be bought on the surplus market for as little as $3.65 each. This beats having to buy a $35 tube in case of a failure. . . . K3KMO

Frequency (kc)	Plate Current	Plate Voltage	Output* (rf volts)	Power Input	Power Output	Apparent Efficiency
3900	670	1350	165	905	545	60%
7250	670	1390	170	930	580	62%
14330	670	1460	162	980	525	54%
21300	670	1450	156	970	490	51%
28900	670	1420	158	895	500	56%

*Output measured across a 50 ohm dummy load.

Complete Fire Insurance

Or How Not To Tune for Maximum Smoke

James Lee W6VAT
Box 45621
Los Angeles 45, California

IF you ever reversed the polarity of your power supply when hooking it to your latest vacuum tube creation, most likely nothing happened, in more ways than one! Oh, you may have "popped" an electrolytic or two, but vacuum tubes are notoriously lousy conductors when their plate and screen voltage polarities are reversed.

Not so transistors. If you catch it in time, no harm may be done, if not—well, back to the local radio store for more transistors. Once W6VAT mistook an NPN transistor for a PNP (just another way polarity can be reversed) in an rf amplifier. It worked beautifully just long enough for the tank circuit to be tuned to resonance. Suddenly, as the nice sine wave slowly faded from the scope screen, the light dawned—but too late.

So, what can be done about it? Take advantage of the very thing that the vacuum tube has in its favor—high conduction in one direction, and none (or very little) in the other. This assures GO/NO GO performance with no destructive results, only don't use vacuum tubes. Use a semi-conductor diode of the proper current rating for the job. One simple method is shown in Fig. 1.

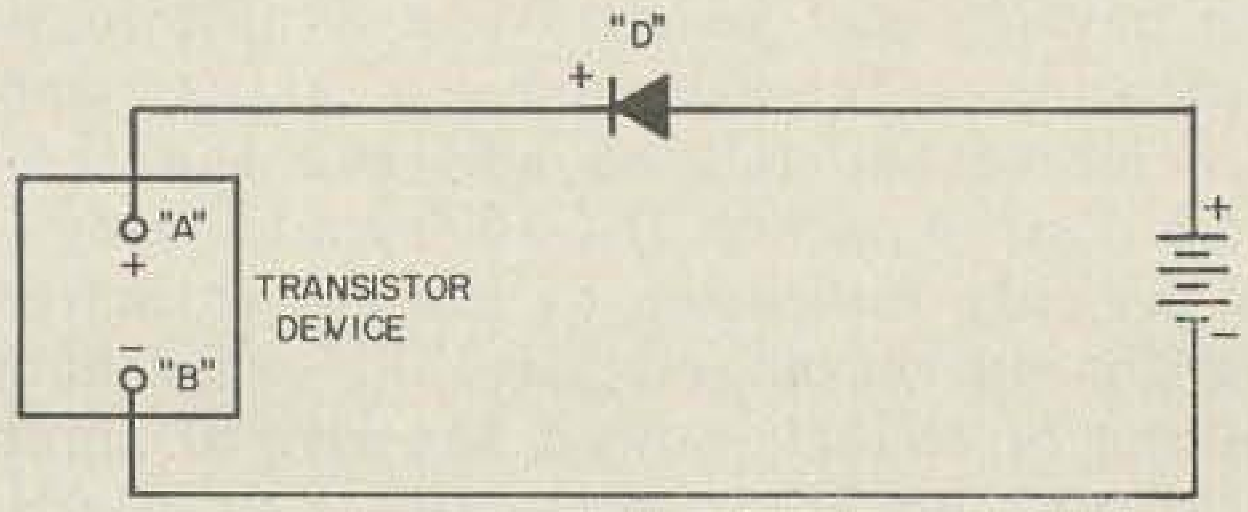
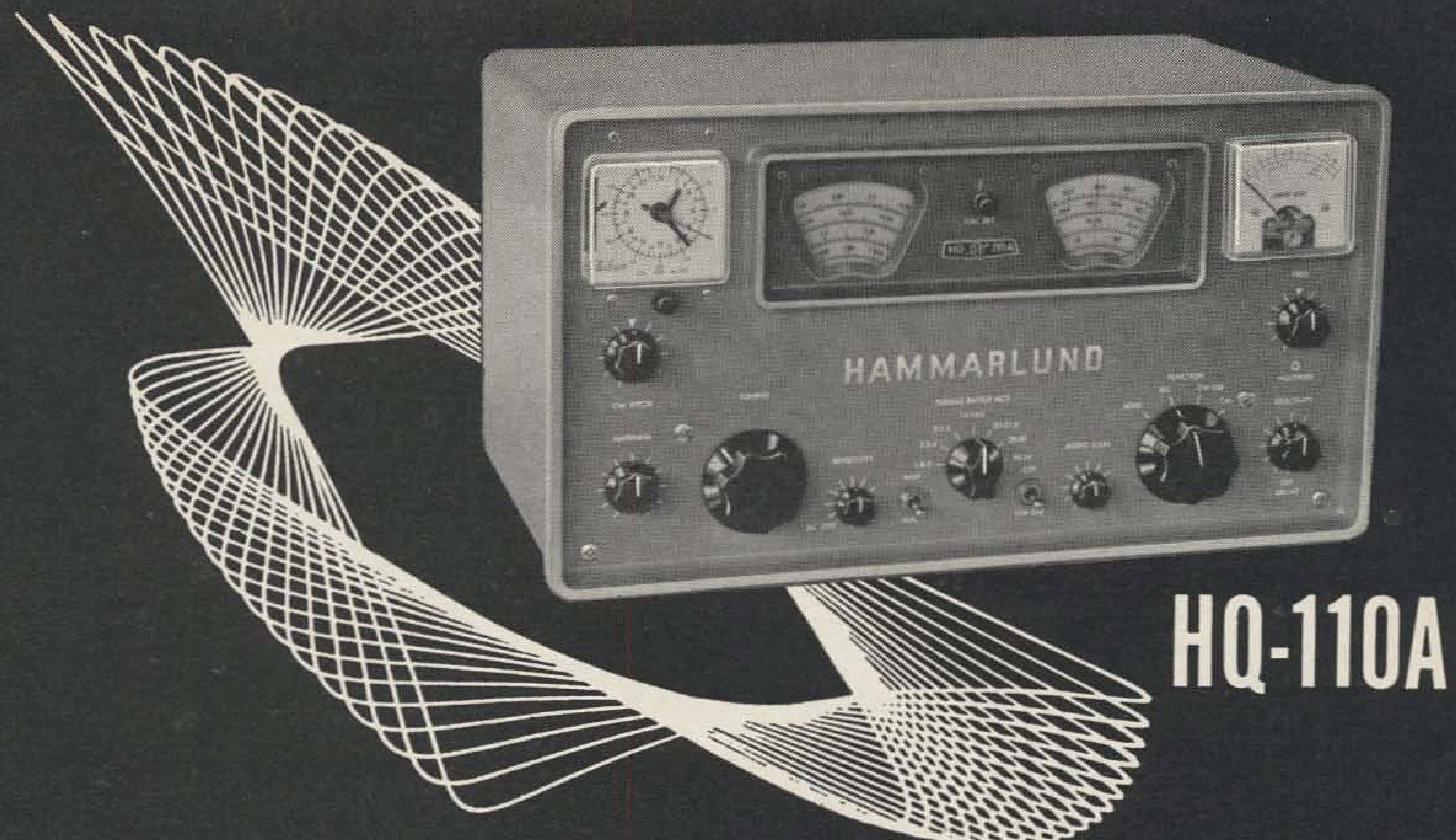


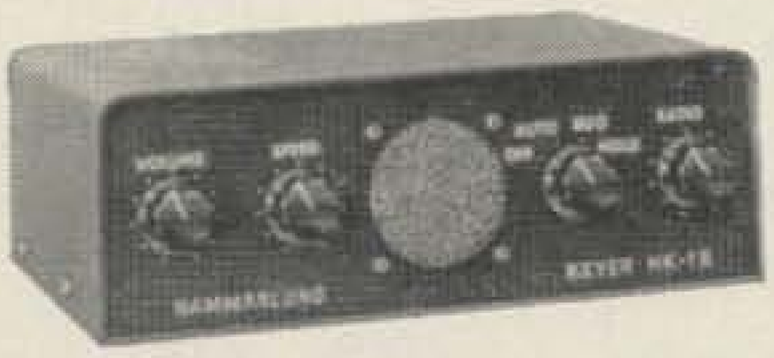
FIG. 1

"A" is the positive terminal of the transistor device and "B" the negative. Hooking the cathode (or +) terminal of diode "D" to "A" will allow the current from battery "V" to flow normally as though "D" were a short circuit. A good diode will have less than a one volt forward drop at currents of several mils or more. If "V" is reversed, "D" will severely limit the flow of current, thus protecting the transistor device. What about the reverse voltage across "D"? First, the transistor device has some resistance which with "D", forms a voltage divider so that the voltage across "D" is lowed. Second, most transistor devices run on voltages (both plus and minus) of less than 100 volts total. Thus, any diode with a maximum reverse voltage rating of 100 volts or so, should work well. Always



A New Dimension in Amateur Radio

The Hammarlund HQ-110A looks like the 110—but basic design changes create the subtle difference between excellent and exquisite! A joyful performer as the HQ-110, the new HQ-110A reaches new heights of operating pleasure by including such extras as:



"Personal Touch" Electronic Keyer—HK-1B

Twice the value—half the cost. The all-transistorized HK-1B is comparable feature-for-feature with keyers costing **twice as much.** Adjustable "personal Touch" ratio for dots/dashes. Suitable for automatic, semi-automatic (bug) or straight key operation.

only **$39.95**
(less battery)

- Significantly tighter mechanical and electrical stability
- Accessory socket for pre-amp or converter application
- Expanded dial—with 144-148 MC calibrations for use with 2 meter converters
- Separate 6 meter coax input for rapid shift from VHF to LF operation

This 12 tube, dual-conversion superheterodyne receiver covers all amateur bands, from 160 to 6 meters—with optimum reception of CW and SSB signals through a separate linear detector.

You have to try this receiver to see just how good it really is—but if you can't—send for the new, informative brochure on the HQ-110A—or pick one up at your local Hammarlund distributor.

Still only
$249.00

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MANUFACTURING COMPANY, INC.
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53 West 23rd Street, New York 10, N.Y.

(Fire from page 70)

remember to hook the diode to the circuit—not the battery. If the anode of "D" is hooked to the battery first and then the combination to the circuit, no protection is available, since the diode will always be forward biased. If you hook the diode up to the circuit wrong to begin with, you will have to make another mistake to cause trouble. That mistake is reversing the battery voltage. Generally, people don't make two consecutive mistakes—one is usually enough.

If you don't want to worry about whether the battery is hookel up properly or not, build up the circuit shown in Fig. 2 and keep it around. The circuit is simply a bridge circuit.

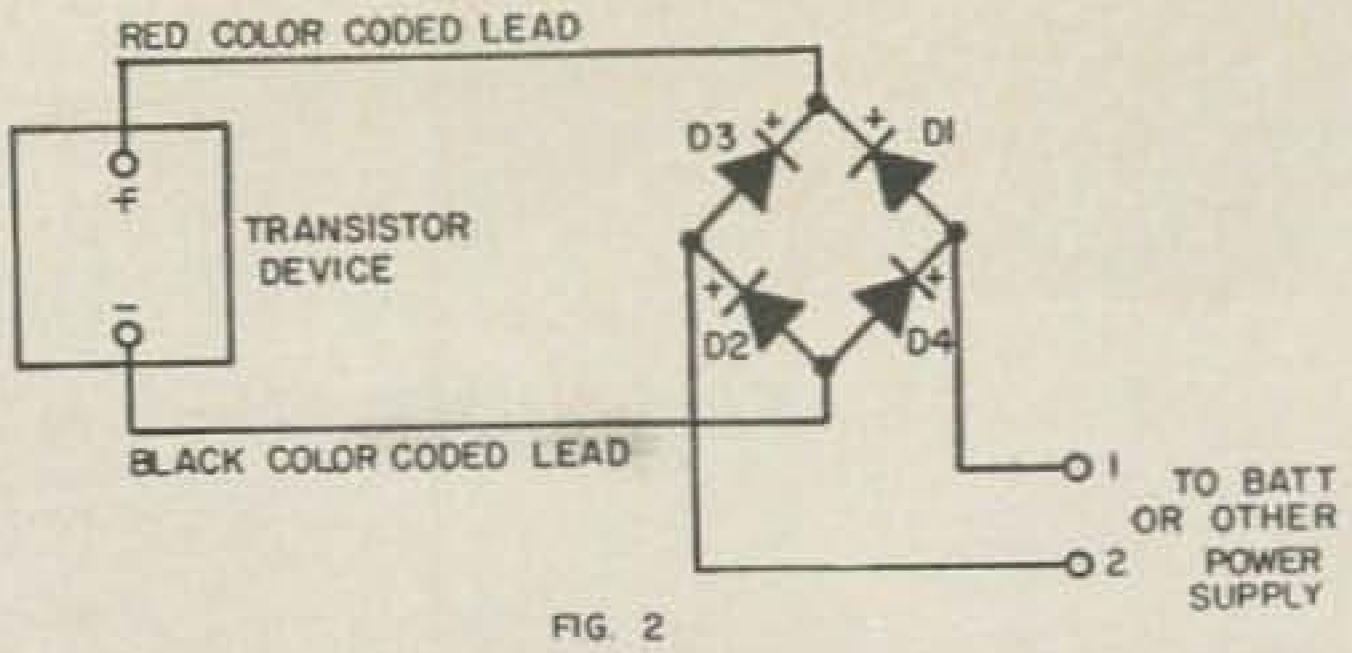


FIG. 2

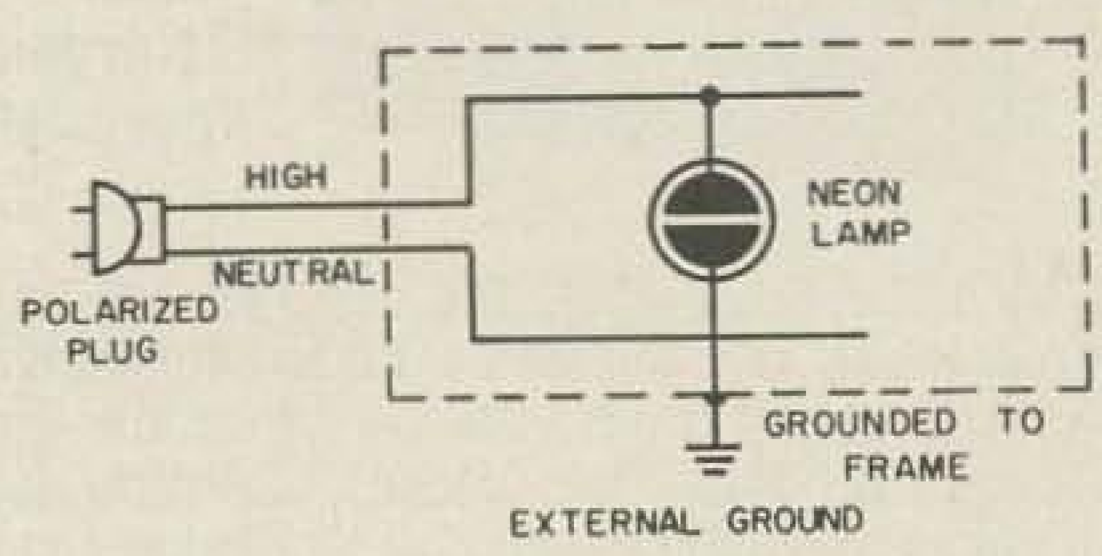
Once connected properly to the transistor device, it does not matter how the battery is hooked to terminals 1 and 2. If 1 is positive, conduction is by way of diodes D_1, D_2 since D_3, D_4 will be back biased. If 2 is positive, then D_3, D_4 conduct. By color coding the leads, the job of connecting them is easier. Of course, you can *still* make a mistake, but devices can be made only "idiot resistant," not "idiot proof." Current considerations of the diodes and the circuits are the main things. For low voltage, lower power circuits, four 1N34's should be fine. Voltages up to 100 V and currents up to 300 ma could use four 1N91 germanium rectifiers in this circuit.

Cathodes are either marked with a band or the symbols "CATH" or "+". Remember, the arrow head points in the direction of POSITIVE current flow, and as such, toward the POSITIVE terminal of any device. The cathode of any rectifier is the terminal from which POSITIVE voltage is obtained. Either circuit in Fig. 1 and 2 will help keep your shack and workbench smoke free.

. . . W6VAT

This could save your life

In the interest of safety, it is wise to ground the frame or chassis of every piece of equipment in the shack. This precaution could prevent fatal shock, should the frame of the equipment become "live" through contact with the "hot" side of the power line.



The circuit shown here gives a POSITIVE indication of proper grounding, as well as correct polarization of the power plug. A neon lamp, mounted on the front panel, is connected between the frame of the apparatus and the HIGH side of the incoming line. The neon lamp will glow ONLY if the power plug is properly polarized and the chassis is connected to an external ground.

. . . W2WYM

Radio Bookshop

Your hamshack is no better than your reference library (things are in bad shape, eh?), so get cracking at this list of recommended books. If you still have some money left over then look back over the last ad or two in past issues of 73.

We surveyed a number of top electronics schools and have it on good authority that these are the best up-to-date books on

TRANSISTORS:

63—G.E. TRANSISTOR MANUAL 6th EDITION $2.00
64—INTRO. TO THEORY & PRACTICE OF TRANSISTORS—by Tillman $8.00
65—TRANSISTOR CIRCUIT ANALYSIS—Joyce & Clark $10.75
66—DESIGN MANUAL FOR TRANSISTOR CIRCUITS—Carroll $9.50
67—TRANSISTOR CIRCUIT & DESIGN—Fitchen ... $13.00
68—HANDBOOK OF TRANSISTOR CIRCUIT DESIGN—Pullen $13.00
55—TRANSISTOR CIRCUIT HANDBOOK—Garner ... $4.95
G94—TRANSISTORS—Test'm, Build Test Eqpt. $1.95
79—TRANSISTOR PROJECTS—Skip Theory, start having fun $2.90

8—RADIO - TELEVISION & BASIC ELECTRONICS — Oldfield Logical presentation and descriptive illustration make this an ideal book for the beginner. 342 pages. $4.95

16—HAM REGISTER—Lewis (W3VKD). Thumbnail sketches of 10,000 of the active and well known hams on the air today. This is the Who's Who of ham radio. Fascinating reading. Now only $2.50

18—SO YOU WANT TO BE A HAM—Hertzberg (W2DJJ) Second edition. Good introduction to the hobby. Has photos and brief descriptions of almost every commercially available transmitter and receiver, plus accessories. Lavishly illustrated and readable. $2.95

57A—HOW TO OBTAIN YOUR CITIZEN'S RADIO LICENSE—Orr $1.00

21—VHF HANDBOOK—Johnson (W6QKI). Types of VHF propagation, VHF circuitry, component limitations, antenna design and construction, test equipment. Very thorough book and one that should be in every VHF shack. $2.95

22—BEAM ANTENNA HANDBOOK—Orr (W6SAI). Basics, theory and construction of beams, transmission lines, matching devices, and test equipment. Almost all ham stations need a beam of some sort . . . here is the only source of basic info to help you decide what beam to build or buy, to install it, how to tune it. $2.70

26—5-9 SIGNALS—Orr (W6SAI). A manual of practical detailed data covering design and construction of highly efficient, inexpensive antennas for the amateur bands that you can build yourself. $1.00

27—QUAD ANTENNAS—Orr (W6SAI). Theory, design, construction, and operation of cubical quads. Build-it yourself info. Feed systems, tuning. $2.85

58—ANTENNAS FOR CITIZENS RADIO—Orr (W6SAI). General coverage, mobile and directional antennas for 27 mc. band. Build and tune 'em. $1.00

74—HANDBOOK OF ELECTRONIC TABLES & FORMULAS—Formulas & laws, constants, standards, symbols and codes. Math tables, misc. data. $2.95

731—HAM TV-WΦKYQ. This is the only book available on this fascinating branch of ham radio. Describes complete ham TV station that costs under $50. Very simple. $3.00

734—INDEX TO SURPLUS—Bibliography of all surplus articles printed in all radio magazines to date. Brief description, etc. $1.50

735—BOUND VOLUME—October 1960 through December 1961, 15 issues (Vol. 1). $15.00

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45—CURTA COMPUTER. The world's smallest computer. Send for detailed information. Makes the slide rule look sick. Like a Monroe computer only hand size. $125.00
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Radar!

Bradford Electronics makes a little gadget that is designed to detect police radar units. Though we haven't tested it, we understand that this is the most sensitive yet made. Just by accident this unit tunes two UHF amateur bands and we highly recommend it for this purpose. 12 v. Sells for $44.95.
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73 Tests The Knight RF Z–Bridge

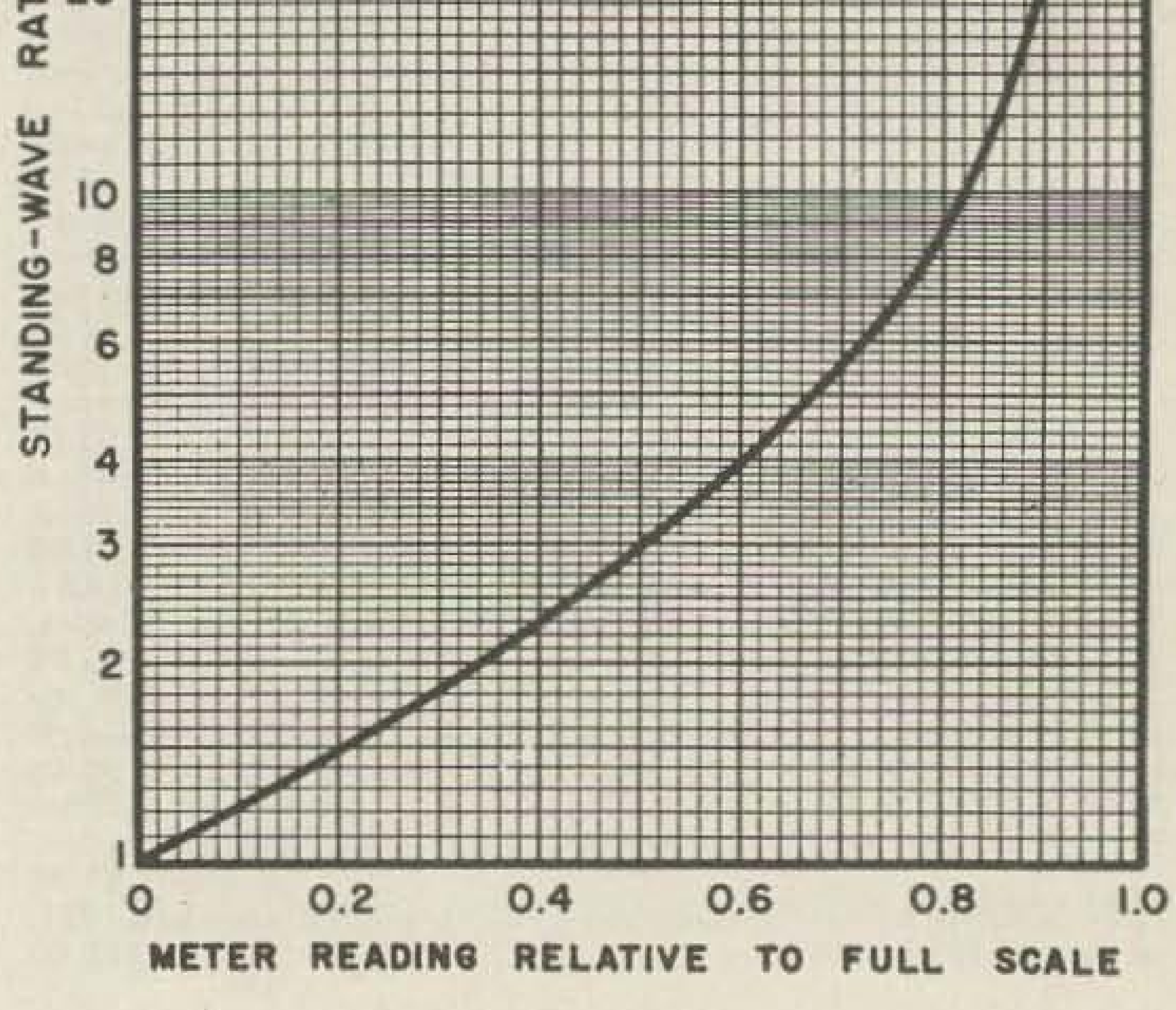
Larry Levy WA2INM

The Knight "Z" bridge is a very useful and inexpensive piece of test equipment. This is a necessity to anyone who wants to tune his antenna. The "Z" bridge can be used to measure antenna impedance, adjust antenna couplers, matching networks, and tune antennas to resonance. It can be used from 100 kc to 144 mc, therefore covering the 160, 80, 75, 40, 20, 15, 10, 6, and 2 meter amateur bands. It requires the use of a VOM or VTVM measuring 0-2½ or 0-5 vdc. If a VOM is used it should have a sensitivity of at least 5000 ohms/volt. It is also necessary to have a source of rf at the frequency that the antenna will be operating on. This should be about 1 watt in order to prevent damage to the bridge, which is not an instrument that can be used with any power. Just loosely coupled to the xmtr should suffice.

One of the most useful, and probably the most popular, uses of the bridge is to measure SWR. Most hams would like to have an SWR bridge, but usually don't buy them because of the cost. If that is your trouble, the "Z" bridge is the ideal answer, as it only costs $5.85 for the complete do-it-yourself-antenna tuning, matching, and SWR measuring kit. Figure 1 shows the relation between forward and reflected power to SWR. By using this chart with the bridge it is possible to measure SWR accurately. There is a plastic chart included with the kit that can be used for a long time before it falls apart.

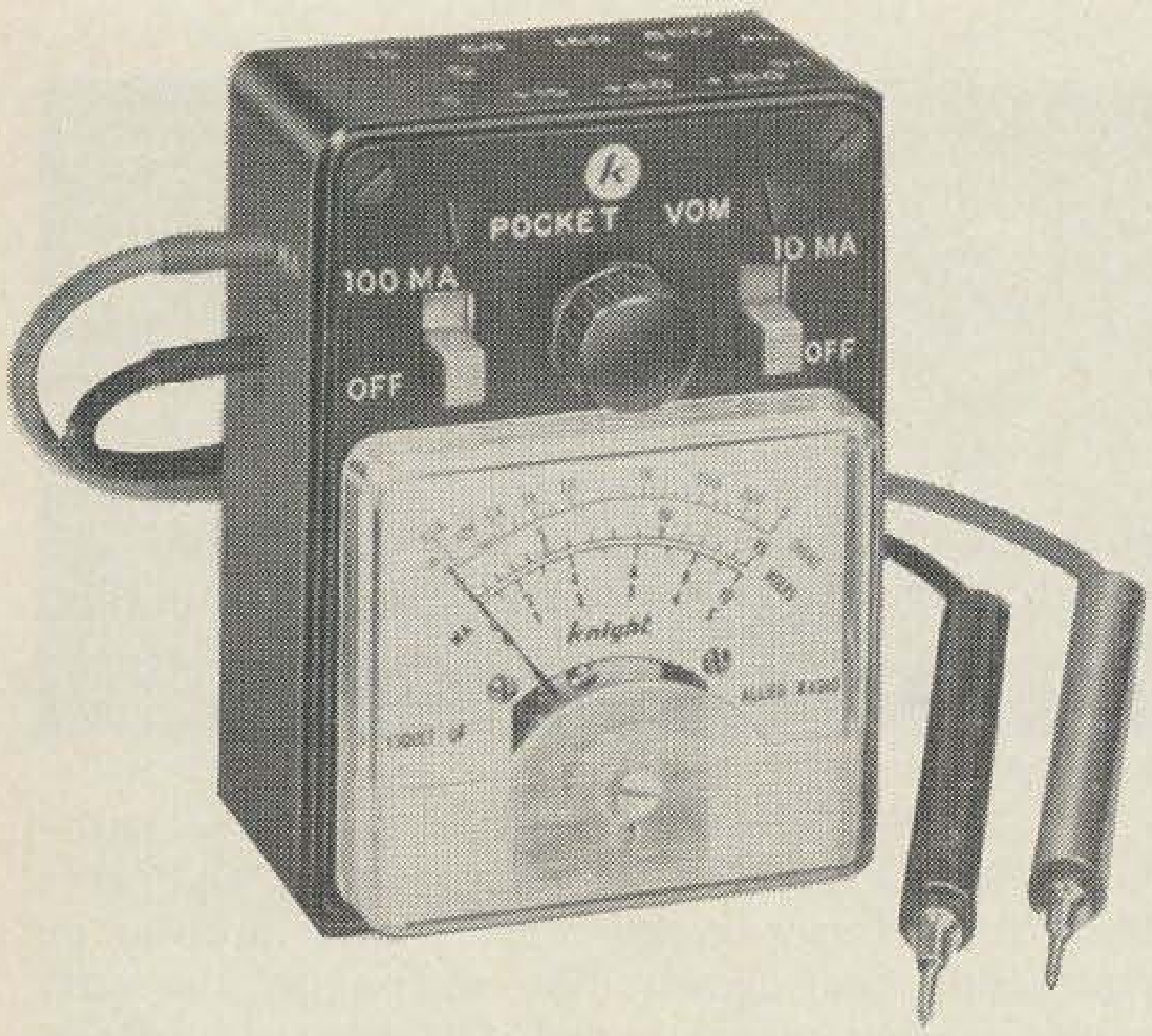
The kit can be put together in about a half hour, as there are no critical steps or extensive mountings. Included with the kit is wire, solder, hardware, a 72 ohm precision resistor (for calibration) and, of course, the parts. The instruction book is well written and the manual contains step by step instructions for wiring each part. There are a few large, easy to see, pictorials to help the inexperienced builder, and even the experienced constructor can use them to save time and make a neater job. The last half of the manual contains detailed instructions on how to use the bridge for impedance measurements, SWR, tuning the antenna to resonance, obtaining the best match, measuring the standing wave ratio on parallel lines, measuring impedance on parallel lines, and other uses. There is, at no extra cost, a section on how to solder. This is definitely an instrument that can be used by any ham for many things and, at the low price of $5.85, an instrument that you surely cannot afford to be without.

. . . WA2INM



73 Also Tests The Knight Pocket VOM

Larry Levy WA2INM



The Knight pocket VOM is a 1000 ohm per volt VOM that is both inexpensive and compact. The dimensions are about 2½ x 3-¾ x 1½ inches, small enough to actually fit in your pocket. Even though it is small, it is a high quality instrument. The ranges are: dc volts 0-5, 15, 150, and 500; ac volts 0-5, 15, 50, 150, and 500. dc ma. O-1, 10, and 100. Ohms, 0-30k. There is no crowding of parts because of the novel arrangement of range switching. Instead of a switch, there is a jack for each range. This not only simplifies construction, but also accounts for its small size and low cost. The VOM costs $9.95 complete with probes and battery. It features a large, easy to read 2½ inch meter. The construction takes about an hour and the result is a handy, compact, and portable instrument. This is just the thing to have if you have to climb a tower to check for a break in the coax (you can also qualify for a life subscription at the same time if you do it habitually).

. . . WA2INM

73 Tests the Hallicrafters HT-40K

Donald Smith W3UZN
Associate Editor

THE Hallicrafters company has added to its line two kits, the HT-40K and a receiver, the SX-140K. The transmitter is housed in a typical Hallicrafter two-tone gray cabinet, runs 75 watts input on CW and controlled carrier AM phone operation. It covers the 80 through 6 meter bands.

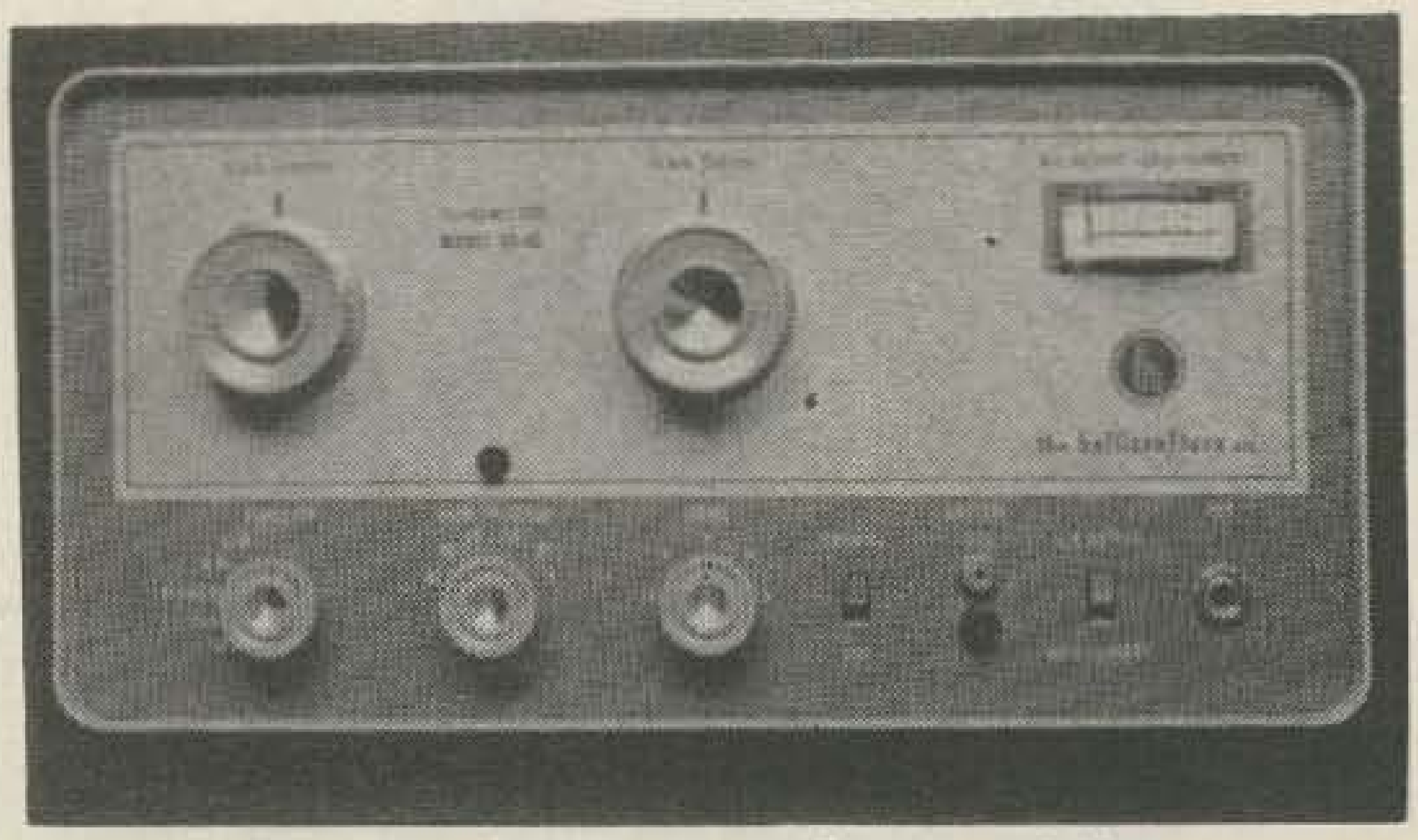
Specifications of the rig:

Oscillator	Crystal control or external VFO
Power input	75 watts CW 75 watts controlled carrier AM phone
Frequency coverage	80, 40, 20, 15, 10 and 6 meter Amateur bands
Audio input	.004 volts minimum from microphone — Crystal, Ceramic or Dynamic type
Output	50-75 ohms unbalanced coax, Pi-coupled
Power requirements	105-125 vac, 60 cy, 175 watt power consumption
Dimensions	7-3/16" high, 13⅜" wide, 8¼" deep
Net Weight	17 pounds
Price (Kit)	79.95
Construction time	Approximately 8-9 hours

Hallicrafters has put a lot of thought and engineering into their new kits. The manual is very comprehensive, with many illustrations and even complete information on how to solder for the newcomer. Each part is in a separate, transparent bag, with the part and diagram number on it.

Circuit Description

A 6CX8 (triode section) is used as the crystal oscillator in a modified Pierce circuit, receiving feed-back from the plate of the oscillator through a 4700 mmfd capacitor (C1). The output of the oscillator is developed across an RFC and coupled to the buffer-multiplier through a 1000 mmfd capacitor. If VFO operation is used, feedback from the oscillator plate is removed by the xtal-VFO switch. It is not



even necessary to remove the crystal.

The buffer is the pentode half of the same 6CX8 used for the oscillator and operates straight through on 80 meters and doubles or triples on other bands. The output of the buffer-multiplier is not tuned, but has the output developed across a 1 mh RFC. This output is connected to the band switch, to be coupled to the final amplifier.

The final amplifier is a rugged 6DQ5 tube, with the grid circuit tuned to the operating frequency and operates straight through, with the exception of 6 meters. On 6 meters, the frequency is doubled in the final. The final plate operates into a pi-coupled circuit on all bands. A diode is connected to the output of the coupler to rectify a small part of the output signal. This rectified signal is connected to the front panel meter, giving an indication of the output. Note that the final is not "dipped," but rather peaked for maximum indication on the meter. A switch is provided to read this output signal or to read grid current of the final. In the grid current position, the meter which is divided into 5 divisions, will read to 5 mils, one mil per division. In the output position, each division indicated on the meter is approximately 10 watts of rf output power. Thus the output power of the rig delivered to the antenna can be closely estimated.

The speech amplifier consists of a 12AX7 tube, one triode being used as a mike preamplifier, rc coupled to the second triode section of the tube, which is the first audio amplifier. The gain control is placed in this stage. A second audio amplifier is used, which is one triode of a 6DE7 tube, the second triode being the modulator. The second audio amplifier is direct-coupled to the modulator.

CW operation is accomplished by keying the cathode circuits of all stages in the transmitter section of the rig. A jack is provided for this purpose on the front panel, as if to encourage CW operation.

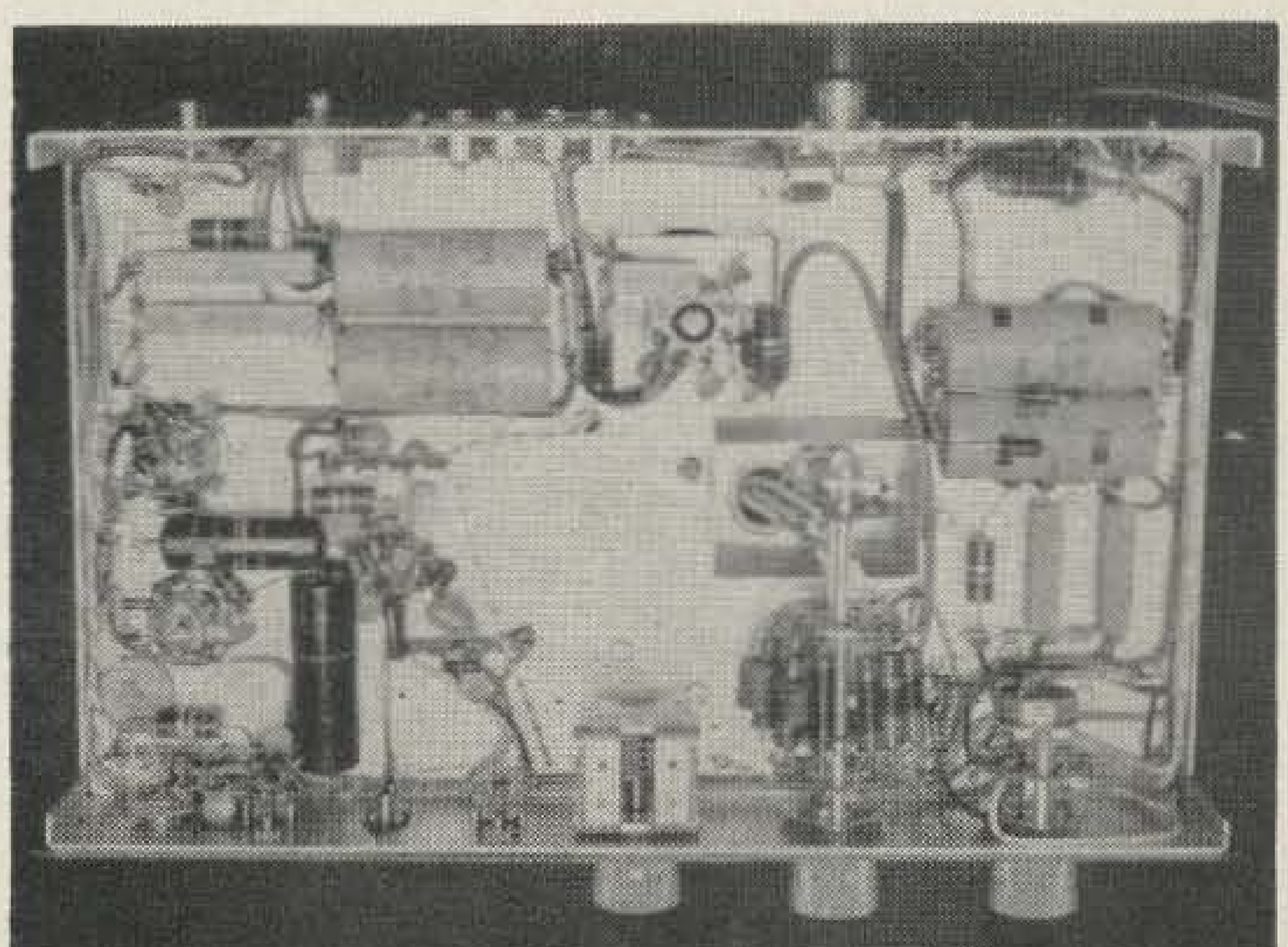
The design of the modulator is such that the modulator has low plate resistance and acts as a high level cathode follower. The screen of the final has considerably higher impedance and thus becomes a considerable portion of the cathode follower impedance. The audio from the cathode follower (modulator), is applied to the screen of the final through a .47 mfd capacitor and of course modulates the screen of the final in normal, controlled carrier fashion.

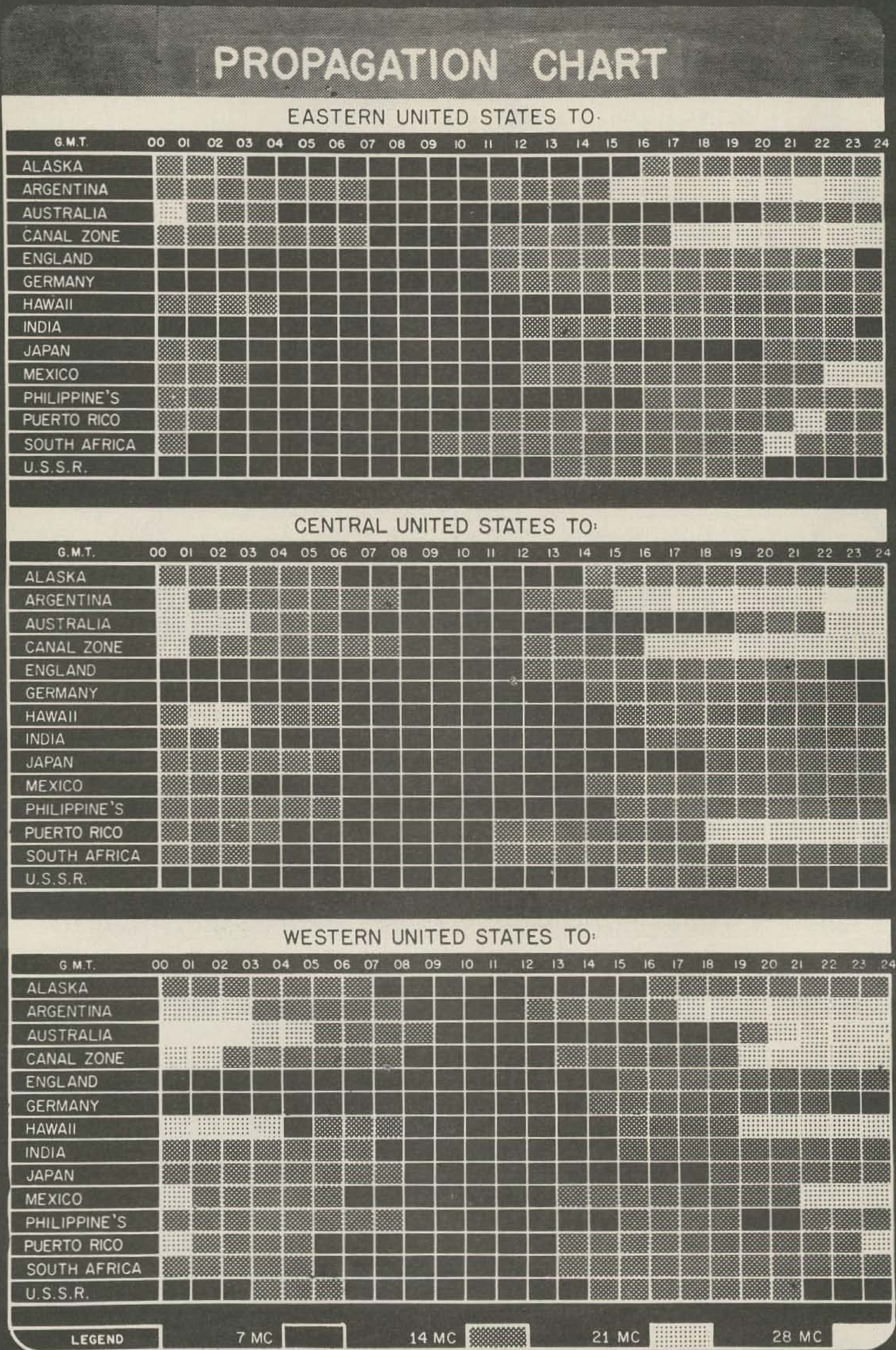
The power supply is transformer operated and uses a voltage doubler circuit (full-wave), to develop the high B+ voltage. Diodes are used for rectification, cutting considerably the heat which is characteristic of tube type rectifiers. Filtering is accomplished by a pi-type filter circuit, with a filter choke being used in the pi, for better filtering. RFC chokes and capacitors are used in the line to minimize TVI.

The kit was easy to build and went together smoothly. A cabled harness is furnished for the long runs of wire, simplifying and making a neater job of the wiring. In the final assembly you begin to see just how attractive the rig looks. The final tuning and loading knobs are large, helping to make tuning easy.

Tune up is very easy; only the drive capacitor and final tune and loading need be adjusted. It is impossible to tune the drive control (a capacitor in the final grid circuit) to a harmonic of the operating frequency, due to the selection of coils used in the grid circuit. Output into a dummy load was 43 watts on CW and 39 watts on AM phone peaks. On 6 meters this output was somewhat less, no doubt due to doubling in the final.

I think that Hallicrafter with their entry into the kit field has put out a rig which will be of interest to many amateurs, particularly the newcomer. It has reasonable power output, simplicity of construction and good design coupled with looks and a well known manufacturer. . . . W3UZN





PROPAGATION CHART
EASTERN UNITED STATES TO
CENTRAL UNITED STATES TO:
WESTERN UNITED STATES TO:
G.M.T.
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
ALASKA
ARGENTINA
AUSTRALIA
CANAL ZONE
ENGLAND
GERMANY
HAWAII
INDIA
JAPAN
MEXICO
PHILIPPINE'S
PUERTO RICO
SOUTH AFRICA
U.S.S.R.
LEGEND
7 MC
14 MC
21 MC
28 MC

Propagation Charts

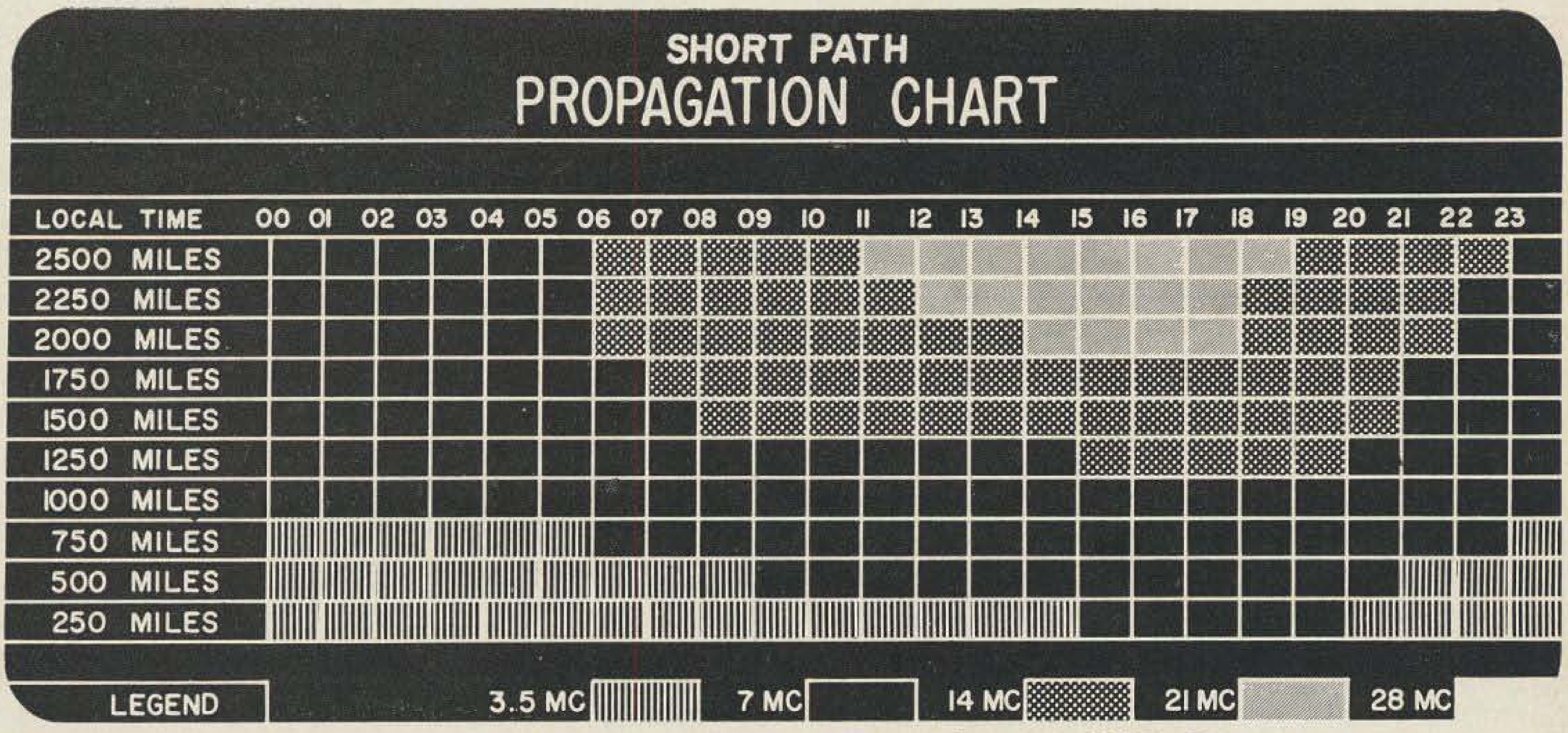
David A. Brown K2IGY
30 Lambert Avenue
Farmingdale, N. Y.

For the DX propagation chart, I have listed the HBF which is the best Ham Band Frequency to be used for the time periods given. A higher HBF will not work and a lower HBF sometimes will work, but not nearly as well. The time is in GMT, not local time.

The Short Path propagation chart has been set up to show what HBF to use for coverage between the 48 states. Alaska and Hawaii are covered in the DX chart. The use of this chart is somewhat different than the DX chart. First, the time is the local time centered on the mid-point of the path. Second, the distance given in miles is the Great Circle path distance because of the Earth's curvature. Here are a couple of examples of how to use the chart. A.) To work the path Boston to Miami (1250 miles), the local time centered on the mid-point of the path is the same in Boston as in Miami. Looking up the HBF's next to the 1250 mile listings will give the HBF to use and the time periods given will be the same at each end of the circuit. B.) To work the path New York to San Francisco (2,600 miles), the local time centered on the mid-point of the path will be 1½ hours later than at San Francisco and 1½ hours earlier than in New York (the time difference between New York and San Francisco is 3 hours). Looking up the HBF's next to the 2,500 mile listings will give the HBF to use. In San Francisco subtract 1½ hours from the time periods listed for local time and in New York add 1½ hours to the time periods listed for local time.

Advance Forecast: May 1962

Good: 1-2, 5-6, 9-17, 23-30
Fair: 3-4, 7-8, 18, 22, 31
Bad: 19-21



RF Q Multiplier

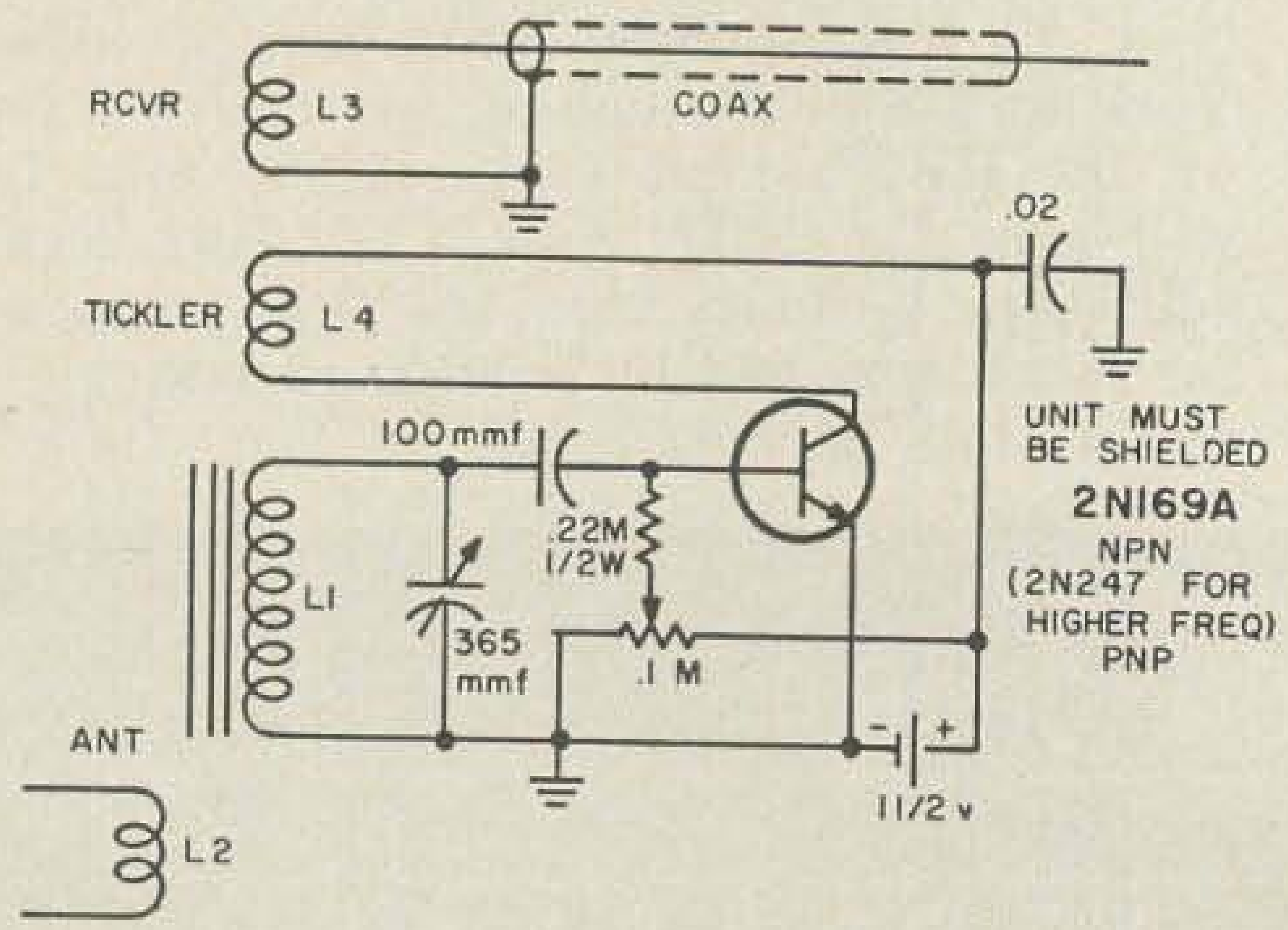
Gus Gercke K6BIJ

Q Multiplier at the *if* input is a familiar gadget. What it does (and that is-narrowing your *if* passband) is accomplished by introducing some regeneration at the *if* input making it high "Q".

It does nothing to improve Image Rejection, or to lessen the effects of Crossmodulation (overloading the mixer by a strong near by signal).

Much more logical place for a "Q Multiplier" would be at the rf Section—where it will reject the image and improve or eliminate crossmodulation. Why then is it used in the *if* Section only? Here are the reasons:

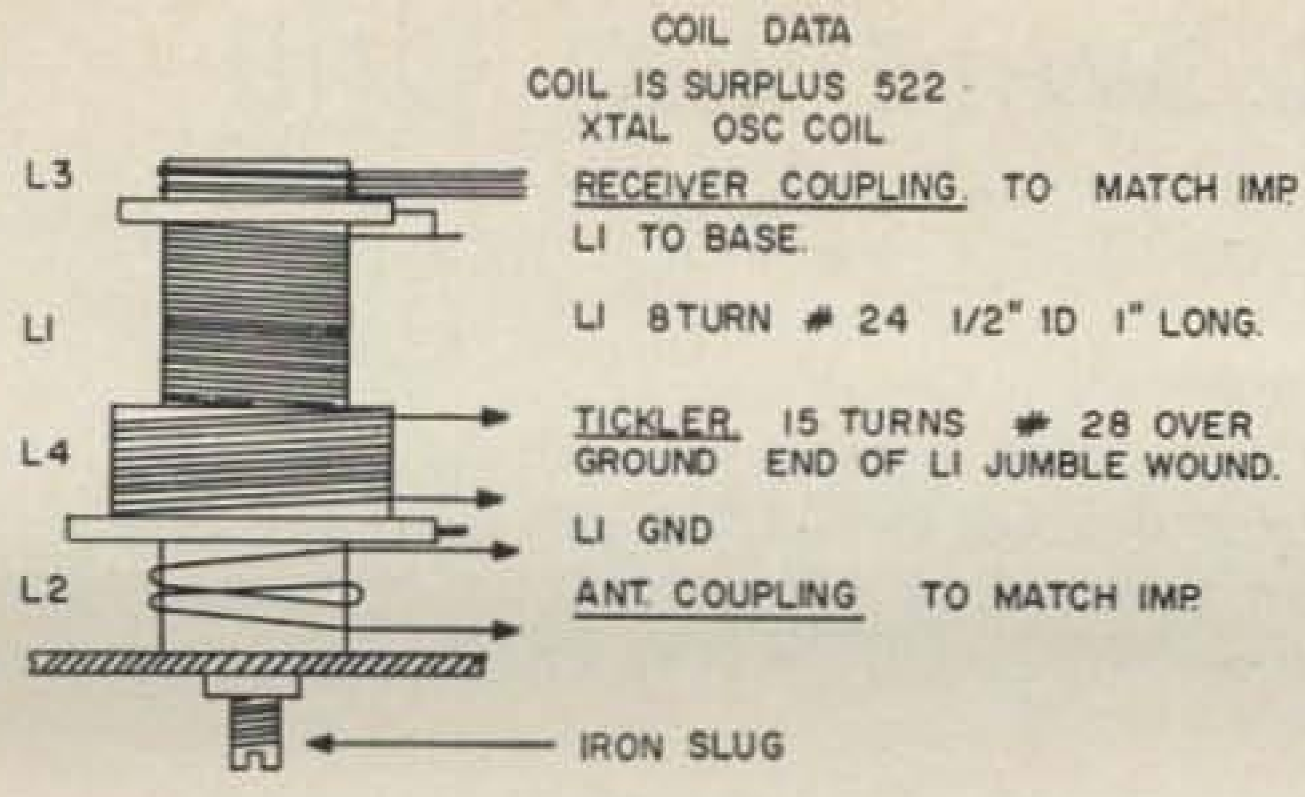
1. rf "Q Multiplier" has to be tunable and (at maximum selectivity) will not track as a normally broad rf Amplifier does. This means additional controls.
2. An attempt to use one was made in "Regenerative Pre-selector"—it failed because it had mostly *gain* and not *selectivity* in its design.
3. Nobody tried.



The following gadget was built mostly to prove that it can be done. In order not to dig into the receiver—it was designed as a separate unit, and connects between the antenna and the receiver. It is self powered (drain—50 microamps). With transistor and constants shown it covers both 80 and 40 meter bands.

The theory behind it, though not quite clearly understood, is something like this:

There is practically no coupling between L2 and L3 until L1 is at resonance. Since L1 is a part of a circuit that can be brought close



to regeneration—its "Q" is high, and only a sharply resonant signal will be coupled to L3. This results in a narrower bandpass, by a factor of about 25-30, compared to that of an rf Amplifier, and no doubt can be improved further.

Regeneration is very smooth, and even in this crude form it will be a useful addition to many receivers and converters.

. . . K6BIJ

Including the Kitchen Sink

The amateur constructor who hopes to match commercial equipment appearance must be on the alert for hardware items and construction techniques to incorporate in his projects. In this connection, a pleasing treatment of speaker openings is one problem that often arises.

There is available in the dime stores a chrome plated sink strainer that will help dress up your equipment. This perforated metal disk is shown installed in a previously described[1] conversion of the AN/ARC-3 receiver. The strainer is supplied with a metal retaining clip riveted to the center of the disk. Drill this rivet out and proceed with the installation.

The strainer shown measures 3⅛" in diameter and is manufactured by Franklin Metal & Rubber Company of Hatboro, Pa. For 19 cents you can't go wrong.

. . . W4WKM

[1] "Another Two Meter Conversion," W4WKM, Dec., 1961 73 Magazine.

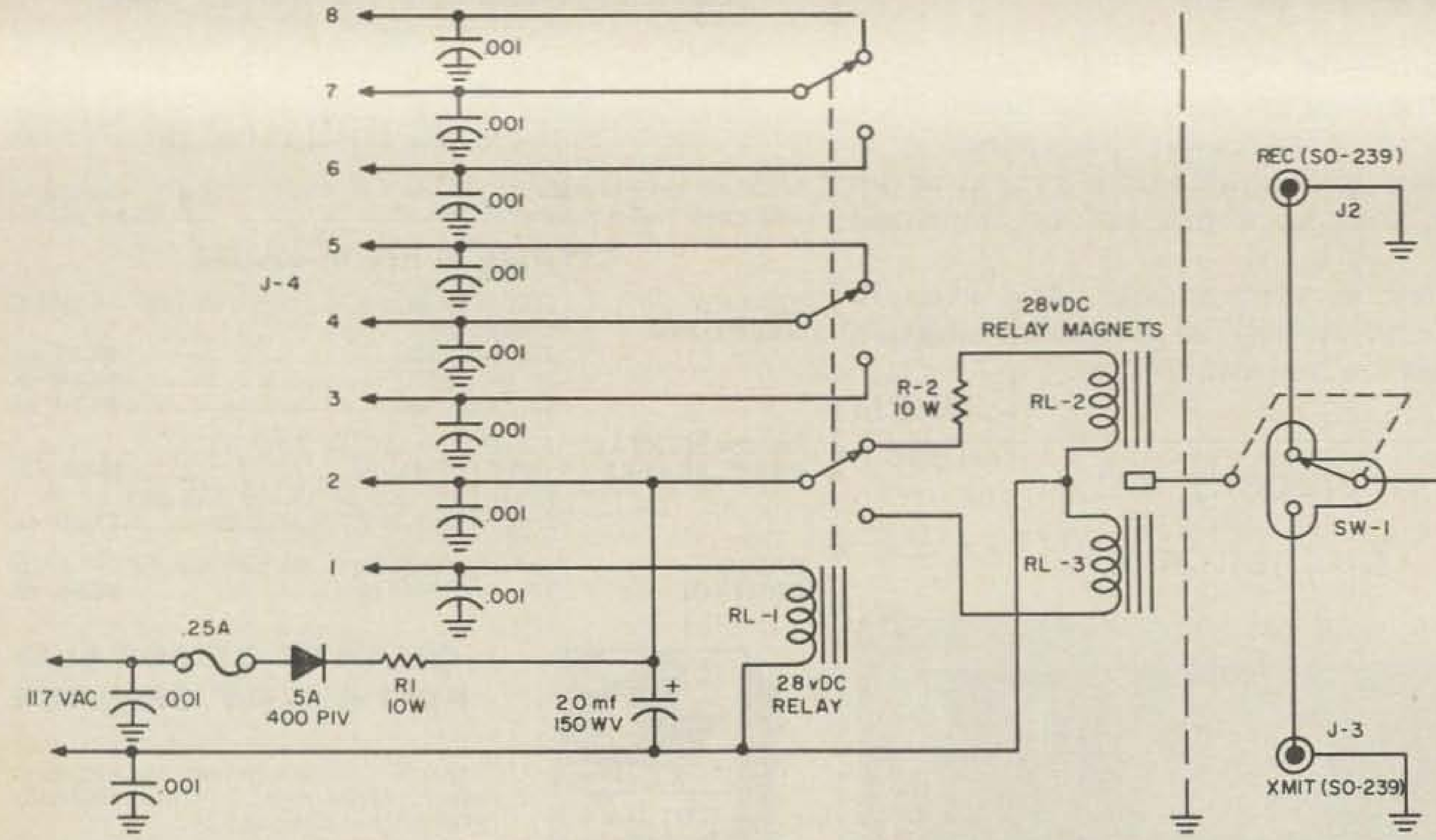
Photo Credit: Morgan S. Gassman, Jr.

High Power Antenna Switching Unit

Roy E. Pafenberg W4WKM
316 Stratford Avenue
Fairfax, Virginia

Photo Credit: Morgan S. Gassman, Jr.

COMMERCIAL coaxial relays are thoroughly reliable devices and should give many years of satisfactory service *IF* the rated power is not exceeded, *IF* they are operated in lines with low SWR and *IF* they are never required to switch with appreciable rf power applied. Failure to observe these precautions will result in the catastrophic demise

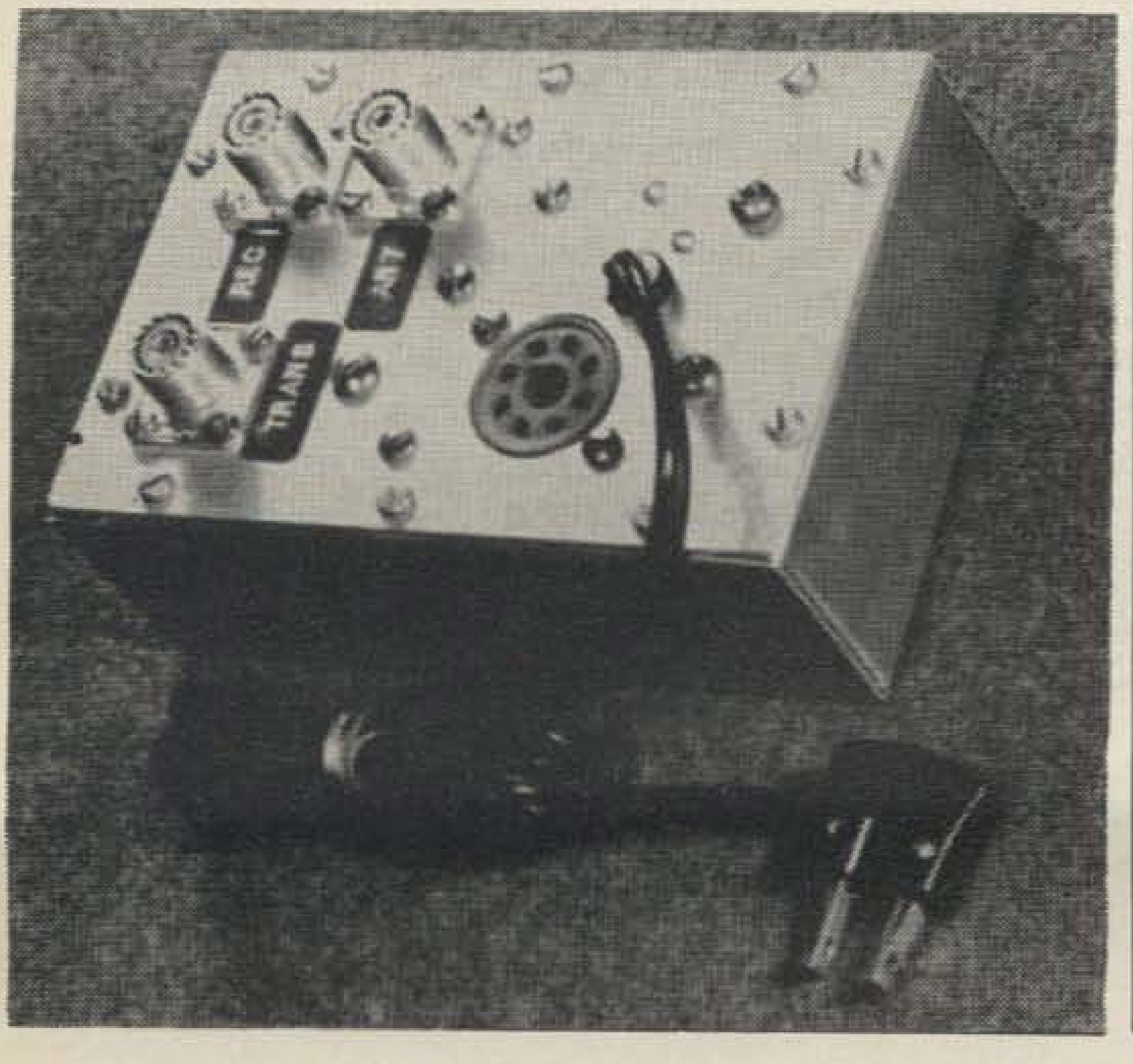


or deterioration of the relay contacts.

For those who are tired of welded contacts and the smell of burning insulation, vacuum antenna switching relays will stand almost any amount of abuse without failure. The advantage of these vacuum switches cannot be questioned. The writer was once asked to test, to destruction if possible, a number of Jennings units. Two of these relays were installed in a 600 ohm, open wire transmission line to switch a 50 KW transmitter from a rhombic antenna to dummy load. A timer was arranged to switch these relays, under load, at 10 second intervals. The test was terminated after 40 minutes because of transmitter trouble. Although the transmitter output coupling circuit had broken down under the high switching transients, the relays suffered absolutely no damage.

Despite the obvious advantages of these components, their cost prohibits their use in many amateur installations. There is, however, a low cost answer available on the surplus market. The AN/ART-13 transmitter uses a compact vacuum switch in the keying relay assembly. Although the relay is used in the relatively low power AN/ART-13, the switch contacts can handle a KW with ease. High altitude operation and the unpredictable characteristics of military aircraft antennas required an even more generous safety factor than is engineered into most military equipment.

Although the actuator mechanism used in the AN(ART-13 is unsuited to most amateur applications, this poses no particular problem since a more satisfactory device is easily fabricated from surplus 28 volt dc relays. Since a simple power supply is required for the relay magnets, it may also be used to actuate a slave relay and the additional contacts brought out for utility station switching use. Figure 1 shows the schematic diagram of the complete unit. The vacuum switch specified is apparently in good supply on the surplus market.



Fair Radio Sales Company lists the relay at $1.50 under the Signal Corps Stock Number of 3Z9874-4.

The relays shown as RL-2 and RL-3 should have a coil resistance of between 200 and 500 ohms and should be of the type that is easily disassembled. RL-1 is a three pole, double throw unit which, besides controlling the vacuum switch magnets, provides additional control contacts for utility use. Almost any 28 volt dc relay may be used although a small, low current unit is to be desired. R-1 and R-2 should be selected after the equipment is wired to insure 28 volts across the relay coils under both transmit and receive conditions. Since the power supply is required in both modes, ac power should be controlled by the station master switch.

For ease of assembly and to insure adequate shielding, the unit is constructed on a scrap of aluminum cut to serve as a bottom plate for a 4" x 6" x 2" aluminum chassis. Isolation of the control circuitry from the rf switch is provided by the small shield plate that is punched to pass the actuating arm of the switch. The only critical dimension is the spacing between the vacuum switch magnet poles. This should be adjusted so as to provide about 3/16" armature travel.

The contacts and armature should be removed from RL-2 and RL-3. If you are fortunate in your selection, the contact stack mounting holes may be used to secure the magnets to the plate. If not, small angle brackets may be used. In any event, the magnets should be positioned so that the center of the poles lines up with the center of the actuating arm. Use spacers if required. Mount the SO-239 receptacles, RL-1, the octal socket, the shield plate and a grommet for the line cord. Also mount the clip for the diode if the Sarkes Tarzian unit is used. The vacuum switch is mounted by a ¾ or ⅞" plastic cable clamp secured around the metal ferrule of the "antenna" contact. This clamp is mounted

(Continued on page 25)

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MD-7

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115-77 224 Street
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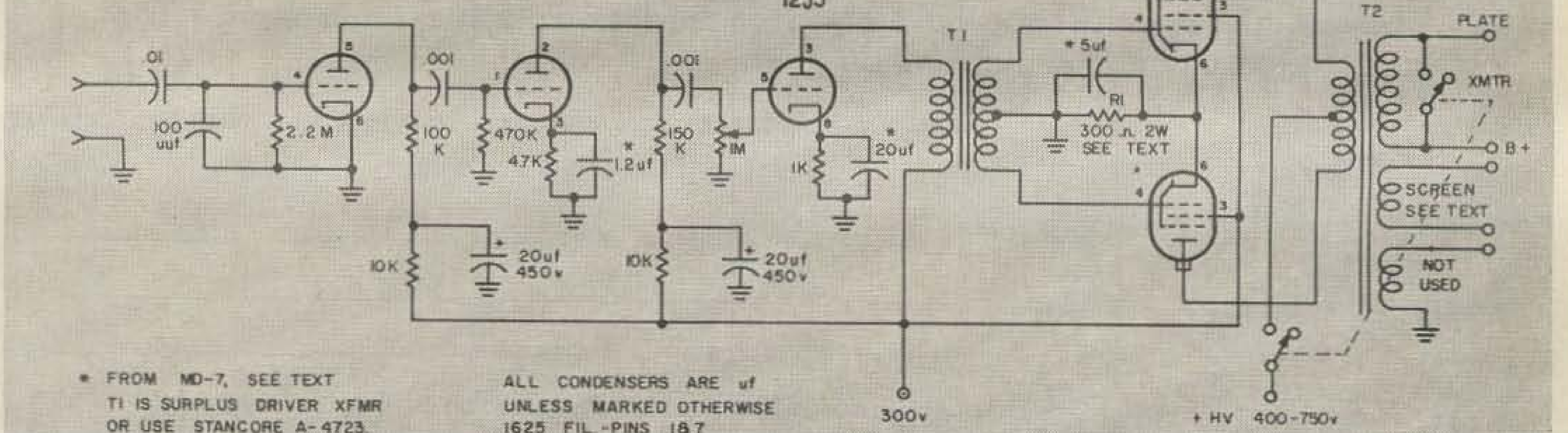
As the title implies, this modulator is an inexpensive unit requiring a minimum of construction time and chassis butchery. It is just the thing for modulating most Novice or CW carrier controlled phone rigs having anywhere from 50-to 120 watts input. These include the DX 20-60 series transmitters, HT-40, Globe Chief, Navigator, and especially ARC-5 rigs converted for ham use, because these were originally used with this modulator. Using carrier control I found that I could barely get through the first layer of QRM, but now I can push through almost anything. Even more important, the all too familiar report "You're 40db over S-9, but can't you bring up the audio just a little?" isn't heard in my shack any more.

The heart of this modulator is a surplus MD-7, ARC-5 plate modulator which is available locally for about eight or nine dollars, depending on your patience and ability to argue price. One word of caution though, make sure you get an MD-7 and not a BC-456 screen modulator. It is possible to mistake one for the other because of the similarity in their chassis. The MD-7 has two 1625's which are visible when you remove the unit's top plate, the BC-456 has only one. Also, their positions are marked on the unit's cover.

The main part of the conversion consists of adding a speech amplifier to the modulator to make possible the use of a crystal mike or other low output type. A dual triode, a 6SN7, is mounted in the socket originally occupied by the 12J5, while the 12J5 driver tube is placed in the VR-150's socket. This is done to facilitate the parts layout. I had both a 6SN7 and a 6 volt supply available, so I used them. It would probably be wise to use the 12 volt equivalent of the 6SN7, the 12SN7, and the existing 12 volt supply. Also, you can build the unit on a regular chassis. I didn't for two reasons: the tube sockets and transformer were already mounted, and the chassis looked pretty good as it was.

To begin construction, remove the cover plate and remove the tubes to prevent their breakage, then remove the bottom plate. Unscrew all components from the side of the chassis except for one 1.2 mfd condenser, and the dual 5 mfd and 20 mfd condenser; the tube sockets and the two 620 ohm resistors soldered to the 1625 sockets also remain. Remove all wires connected to the plugs at the rear of the chassis and all others necessary to free the components you just released. Leave the wires connected to the output transformer and also leave the wires connecting pins 3, 5, 6, and 7 of the two 1625 sockets together.

Next, remove the mike and key jacks from the rear panel and replace the mike jack with an Amphonol type 75-PC-1M mike connector or its equivalent. (the connector fits right into the original hole.) Remove both fuseholders and their covers, and fit the driver transformer in two of the holes left by the fuseholder on the left of the chassis. My pot fit in one of the holes left towards the front of the driver transformer, right in the corner, and I mounted the dual 20 mfd can on the right of the chassis. All directions referred to are looking at the underside of the chassis with the 1625 sockets to the rear. Mount the AM-CW switch on the front panel to the left of the square condenser, and mount your output socket in the space previously occupied by the three-prong dynamotor



connector. This connector is easily removed by prying it up with a screwdriver. The actual wiring of the unit is straightforward; follow the usual wiring procedures and run the long lead from the 6- or 12SN7 to the gain control with shielded wire. The wires can be laid out for convenience in lacing if you wish, but this is not necessary.

As a final note I would like to say that the switching arrangement I have shown is most suited for my rig; however, all that is required is that the AM-CW switch shorts out the secondary of the modulation transformer during C.W. operation and that there is provision for removing the high voltage from the plates of the tubes at the same time.

There are two outputs available on the transformer; one is roughly 6000 ohms and is a close enough match for most tubes operating in the vicinity of 600 volts at 150 mils such as the 807, 6146, 1625, and 6DQ5. This is only a partial list. The reason that you can match quite a few tubes is that the 1625's are running at about half their rated output and as such are very non-critical as to loading. The second output is a screen winding and this can also be used for most tubes with no ill effects. I used this winding when modulating my HT-40 because it has the screen tied to its own supply, and I came up with excellent results.

This ends the list of gory details associated with building the modulator; so, if you have dispensed with the proverbial smoke test, connect the rig, modulator and power supply and let everything warm up. Tune the rig in the CW position into a dummy load and turn the modulator on, making sure that the unit is in the AM position and that the transformer is not shorted out. When you talk into the mike, the lamp's brilliance should vary with your voice intensity. Adjust the gain control until it just brightens on voice peaks. The best way to properly adjust the unit is with a scope, but since most of us don't have one, here is an alternate method. Have someone with a crystal filter in his receiver listen to your signal as you bring the gain up. When you just begin splattering, reduce the gain a trifle and you're in business.

In general, you should have no trouble building the unit or getting it into operation, and you will find that the modulator has plenty of reserve punch, even when delivering a full 60 watts of audio. Also it will make an excellent driver for any high level modulator, so the unit really will be a good, long term investment.

. . . WA2PGX

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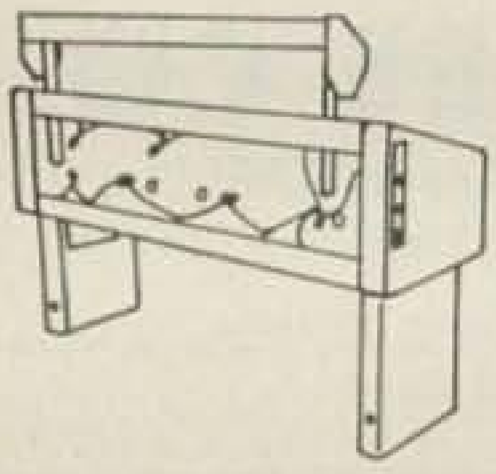

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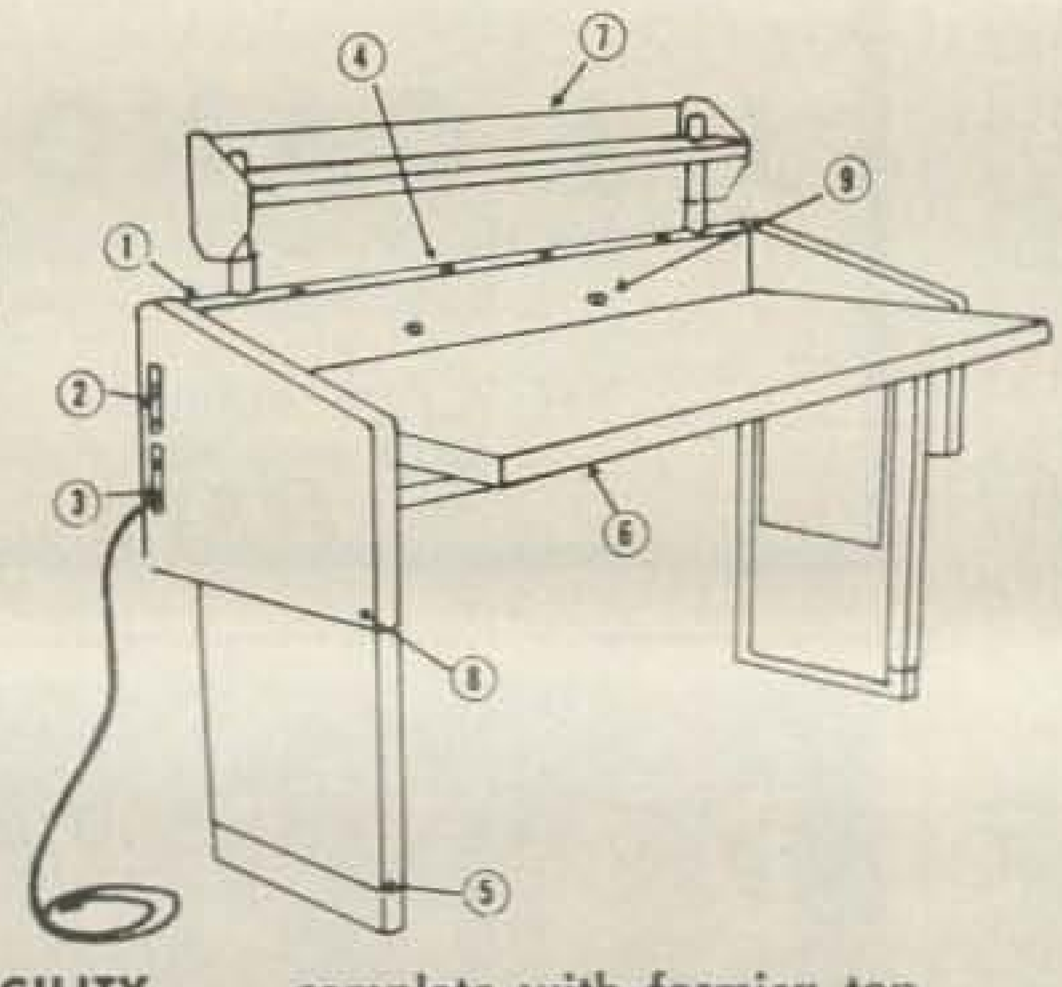

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Keep your Key from Crawling

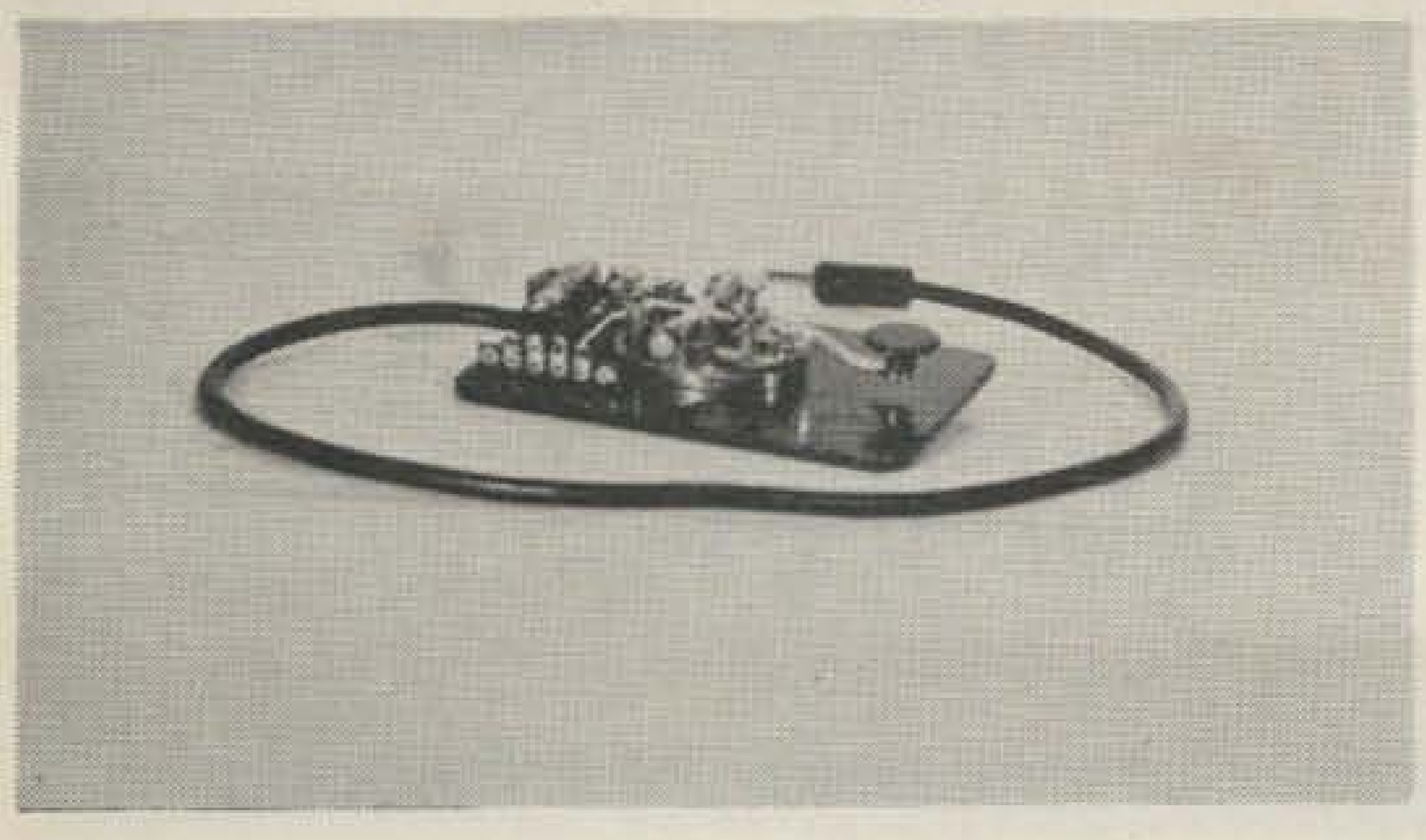
Howard S. Pyle
3434 74th Ave., S.E.
Mercer Island, Wash.

FOR many years I traveled throughout most of the Western states in connection with my profession. Being an ardent ham I wanted to take my gear with me and this often presented some major as well as many minor problems. One of the latter was to make the key "stay put" when set up in a portable location. You can't make screw holes in a hotel or motel desk or table without either an argument or a "pay-through-the-nose" price to the management! On the other hand, you don't want to chase your key all around the operating surface while trying to make decent code characters which are reasonably decipherable by the stations whom you contact. What to do?

Several years ago I solved this problem by contacting a local metal fabricating shop and having a piece of black iron, or "boiler-plate" as it is known in some localities, cut to a reasonable size and of a thickness which guaranteed sufficient weight to hold the thing in place on the operating surface. The most practicable size and weight which I found, was a piece ⅛" thick and of a dimension of 4" x 7" and which weighed slightly less than three pounds with the key and click filter mounted. For one dollar, the metal shop turned out a piece like this and ground the four corners down at a ½" radius which eliminated the sharp edges which could tear clothing . . . and flesh! Using this basic metal base I positioned the key symmetrically, drilled the two mounting holes and tapped them for 8/32 flathead machine screws. This done, the base was given a coat of gloss black enamel for the sake of appearance as well as rust-proofing. A small piece of felt (10c at the local variety store) was then glued to the underside of the base; you wouldn't want to scratch the table top would you?

Such an arrangement has proven not only most adaptable to portable operation but has been found to be a very convenient arrangement for the key at the fixed station at home. With a flexible cord and a plug to insert in the transmitter keying jack, the "creeping" problem is readily solved. Your key will stay put and you'll also have plenty of room on the base plate back of the key to mount a condenser, choke and resistor . . . one or all . . . whatever you find necessary for a key click filter, if you need one.

A "bug" key may, of course, be mounted on a similar base if you prefer, in place of a hand key. . . .W7OE



Amateurs who were originally licensed in 1912 are eligible for the Golden Anniversary of Amateur Radio Licensing Award sponsored by a number of societies including ARRL, AFCEA, IRE, QCWA, Radio Club of America and SSBARA. They should send the original or an attested photocopy of their initial amateur radio license issued in 1912 to ARRL Headquarters, West Hartford 7, Connecticut, Attention Mr. John Huntoon, before **August 15, 1962.** In cases where the original 1912 license has been lost or destroyed, the listing of the ham's name and amateur station call letters in the July 1, 1913 edition of the government callbook may be considered as satisfactory proof.

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1 1/4 meters 16 turns #22 on 5/16" dia.
. . . W9SLM

Crystal Calibrators

Lafayette Radio has been at it again. They will soon have a bigger line of ham goods than anyone else. This time they have brought out the TE-27, a 100 kc and 1 mc oscillator, which sells for $17.95, and the TE-29, a 100 kc oscillator, which sells for only $11.95 net. Both are self contained and use little 49¢ 9 v transister bateries. Both provide harmonic up to 54 mc and can be zeroed in on WWV.

Letters

Editor 73

Yesterday, March 28, propagation conditions were the worst I have observed in many a moon. A quick check of Dave Brown's predictions in the March issue, made a couple of months in advance, indicated that the only bad day in March would be the 28th! That's what I call top notch forecasting. It is significent to note that George Jacob's March predictions in "CQ" listed four exceptionally good days for March, one of them being the 28th!! You can draw your own conclusions.

Gil Countryman W4JA (ex W3HH)

Dear Wayne,

I am writing in regard to the article I wrote, "One More Use For The BC453." In the article I quoted XL1AAX as saying the 6AR8 is as extinct as the dodo bird, and suggested the use of the 7360 or the 6BU8—so far so good. This week I had the chance to try the 6BU8 in the circuit. I did what I feel some one else might do. I installed the tube without checking the specs and developed a very microphonic tube. After checking, I found that I should not exceed 150 volts on the plate. When I corrected this goof all was FB. I then put the 6AR8 back in and found that 150 volts seemed to make no change in the original unit.

If the article's schematics have not been redrawn as yet, would you change the voltage that supplies the 6AR8 and the IF amp to 150 volts MAX. If it is too late, please print it in the "goof column" as the author's error.

Dick P. Gridley K6JHJ

Too late . . . ed

(W2NSD from page 4)

modification of the G4ZU tri-band beam got a lot of votes. Here is a tri-bander that has no loading coils or traps and can be tuned right from the shack. W9HOV compares the attenuation of different types of coax to open wire line on the various ham bands, making it apparent why few VHF DX men are using coax. K2IGY went way out on a limb with his predictions of propagation conditions to come. Dave predicted a much shorter sunspot cycle than the National Bureau of Standards or W3ASK. So far he has been a lot righter than anyone else, erring only on the conservative side. The Lafayette KT-200 receiver is reviewed and found to be a lot of receiver for the money. In the test equipment line we have the Vary-Volt, a little device which gives you from 97 to 132 volts ac output for trouble-shooting.

Dave Bell W8GUE provided us with a fine first hand report of the first moonbounce QSO as heard from W8LIO in Ohio. Illustrated. K2TKN provided us with a chart which enables us to calculate how much power, what size antenna, etc., is needed to establish contact via the moon on the different ham bands. W2OKU, one of our local Porsche-Pushing hams, ran a fine test on the Knight G. D. O. You get a lot for the $22.95 involved. W4WKM told us how to buy precision resistors at a bargain and then move them to the resistance that we desire. We were sort of specializing in test equipment in May. Another article that has brought a lot of requests for the issue is on calibrating volt-ohmmeter ac scales. K5JKX had a great idea in his Ohms By The Yard. With this you can build a simple resistance box which will give you an accurate voltage divider or potentiometer within amazing limits. You can choose an output voltage, for instance, anywhere between 50 and 150 volts to the nearest .01 volt! W3KET gives us some charts on blowers so we can figure out what size we need for which application. Our big technical article for May is on the audio amplifier part of the receiver. Various methods of achieving audio selectivity are discussed.

Again we had many more pages of technical and construction articles than the other magazines. Send for a copy, 50c.

Dagnabit

The March issue contained some of the most horrendous errors we've yet managed. Thank heavens they are rather obvious (to everyone but me when I'm rushing) and were probably corrected when you read the articles. The first misery was in the VFO schematic on page 6 where the screen and control grids were switched on the 6AH6 and 6CB6's. We tried a new draftsman just to see how it would work. Not so good, eh? The bottom of L2 should get some B-plus. The RFC is the usual 2½ mh. If you get the circuit board from Irving Electronics or make it as described you won't get into any of these troubles.

K5CKC/6 went to the trouble to do what I should have and worked out the formula presented by W2KPE and found that the line should be 22.7 feet, not 27.7 feet. Ugh on W2KPE and on me for not checking with the slide rule. Change that on page 27.

Oscar

This project has been so extensively covered in the other ham magazines that I didn't see much purpose in printing more of the same. The fellows involved are to be commended for helping to put ham radio into public view. Publicity like this will be of great value to the hobby. Let's get more of those gadgets up there fellows.

One of the local space hardware manufacturers called to find out if we might be interested in getting the hams behind the construction of another satellite, one which would furnish us with a frequency standard. With the price of calibration oscillators where it is now I guess we don't need anything so fancy.

Commercial Notes

Waters Manufacturing is really going into the ham market in a big way. In addition to their hybrid coupler (phone patch) they now have added a nice looking coax switch and some notch filters for the Collins owners that fit right into the units just as if they were original equipment. Watch for their new RF power meter with built-in dummy load too.

Gavin Instruments will be introducing a fine little two meter band pass TVI filter next month, thereby adding to their present line of six meter and all-band filters. Gavin has been working night and day to keep up with the demand.

New-Tronics had a winner in their contest. Their new line of all-band mobile whips will now be called "The Hustler". Some 6000 fellows wrote in with entries and hopes of winning the KWM-2. Now aren't you sorry that you didn't give it a try? K8VZU, John Nowacki (16 years old) if the winner, say hello to him on the air.

Barker & Williamson put their new rig on view at the SSB Dinner in New York during the IRE show and attracted a lot of attention. The 6100 uses a crystal synthesizer, the first one to appear in ham gear so far. The dial is resettable to 100 cycles!

P & H has done a lot toward bringing SSB to six meters. Their 6-150 transmitting converter works like a charm and is getting very popular. We'll have a review of this rig soon.

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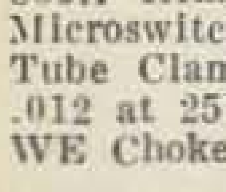

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6BA6	.59	25L6	.72	5670	.90
6BE6	.59	25T	4.00	5686	1.75
6BG6	1.49	25Z5	.72	5687	1.15
6BH6	.79	25Z6	.75	5691	4.70
6BJ6	.72	26A7	3.69	5725	1.95

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		
6BZ6	.91	RK39	2.99	No See—Write!	

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Operation Up to 125° C Case Temp.

D.C. Amps.	200Piv 140Rms	100Piv 70Rms	300Piv 210Rms
2	.55	.35	.80
3	1.25	.85	1.50
6	1.50	1.00	1.75
12	1.70	1.20	2.00
35	2.90	2.15	4.95
70	5.60	4.50	10.80
240	8.40	5.70	19.60

50Piv 35Rms	150Piv 105Rms	D.C. Amps	400Piv 280Rms
.25	.45	2	1.00
.60	1.00	3	1.80
.70	1.25	6	2.00
.85	1.50	12	2.20
1.20	2.50	35	6.10
3.75	4.95	70	15.30
1.80	6.90	240	29.75

**Derate 20% for Battery or Capacitive Load or D.C. Blocking!*
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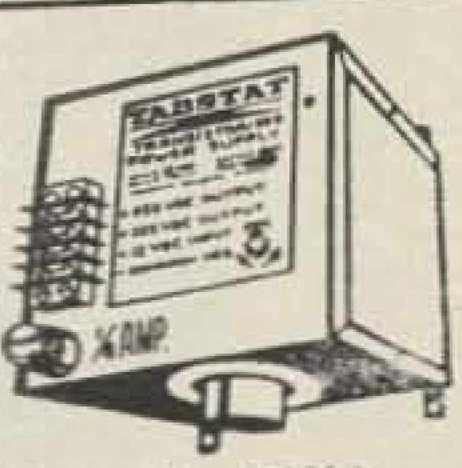

DB500 $30

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Kit 5 Sub-Min Tubes
Kit 75 Mica Condensers
Kit 8 Crystal Diodes
Kit 200ft Hook Up Wire
4 Rolls. 50ft/ea. Asstd. Color
Kit 100 Ceramic Condensers
Kit 5 FT243 Xtal Holders
Kit 4 Microswitches
Kit 8 Xtal Osc-Blanks
Kit 4 Asstd Rectifiers
Kit 100 Self/Tap Screws
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Kit 6 ea Phonoplugs & Jacks
Kit 2 pair SO239 & PL59
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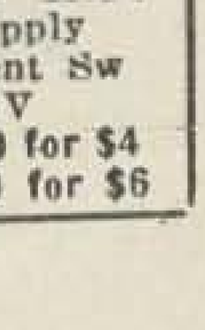

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T866	5000/10400	0.3	$4
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