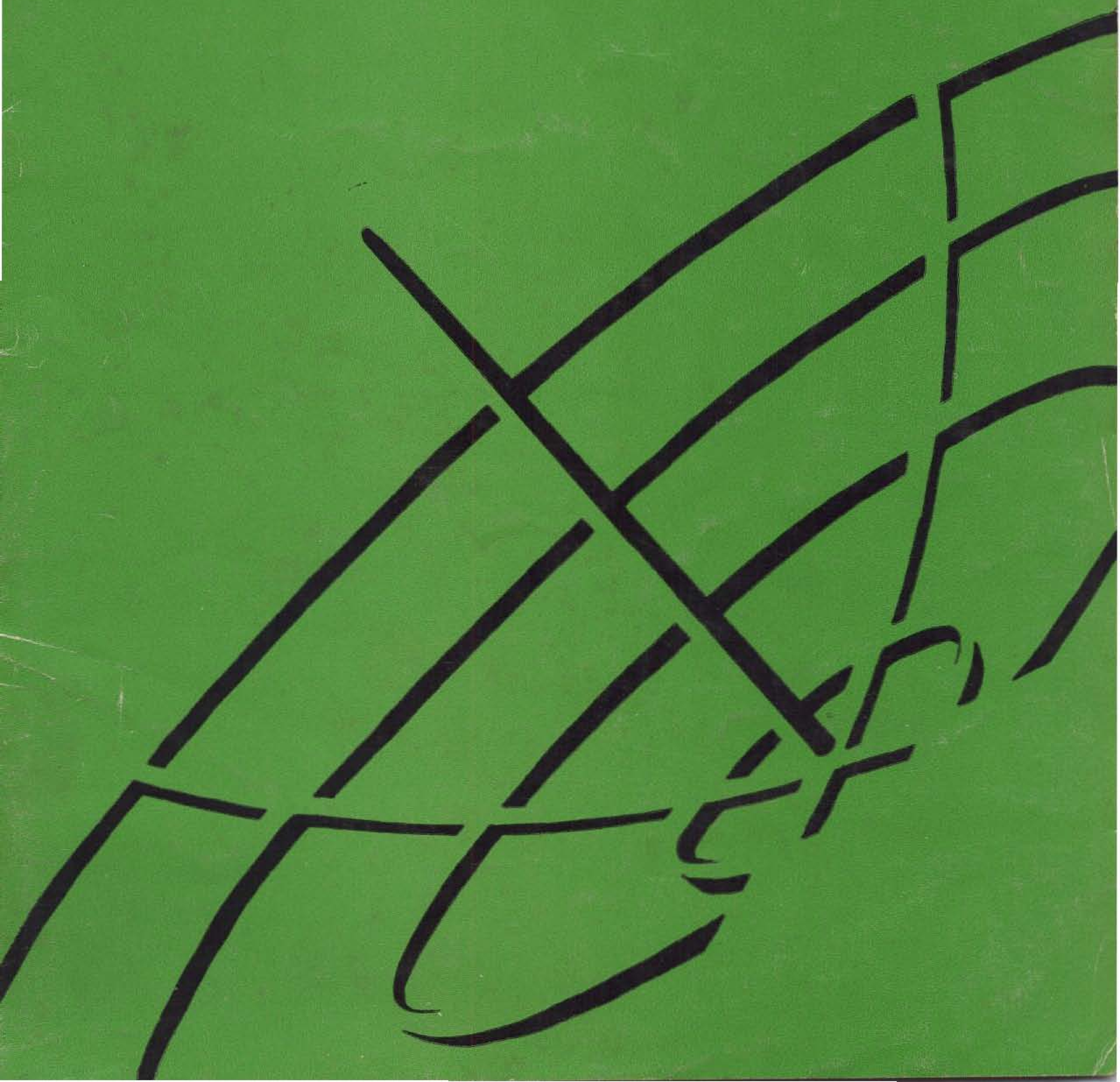
AMATEUR RADIO

73

September 1962

a paltry 40¢



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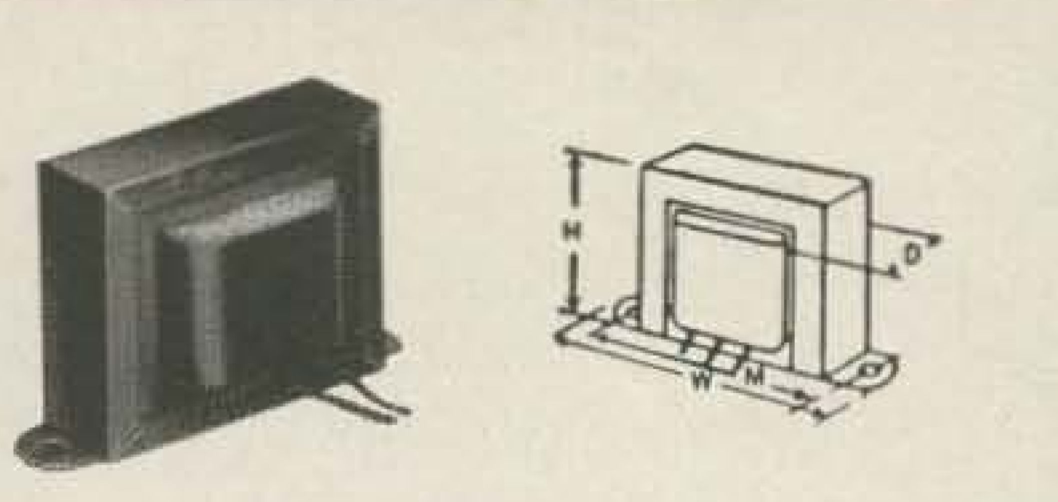
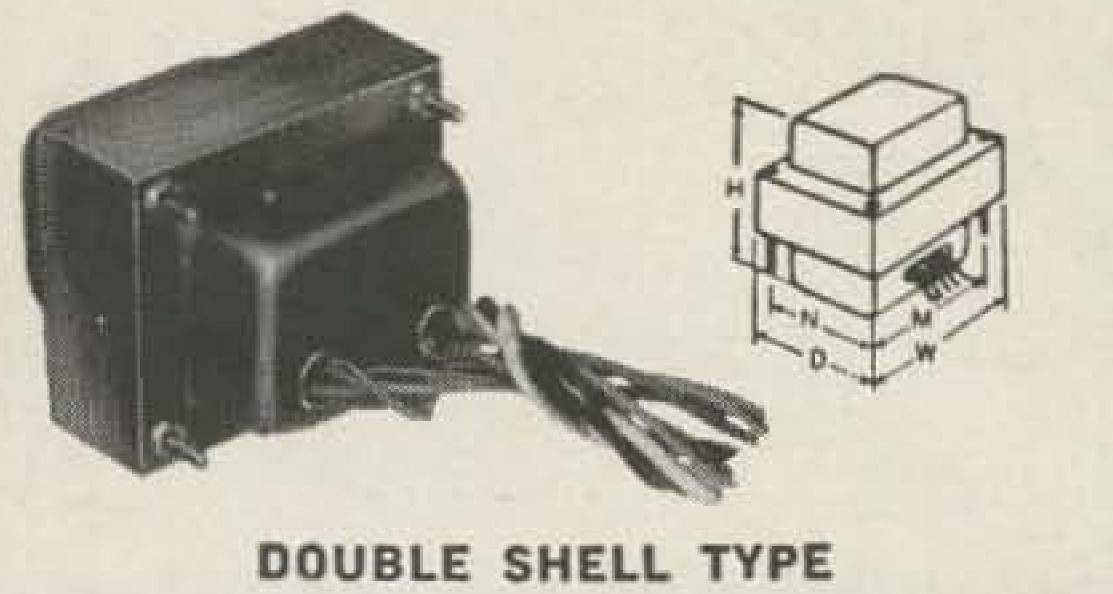
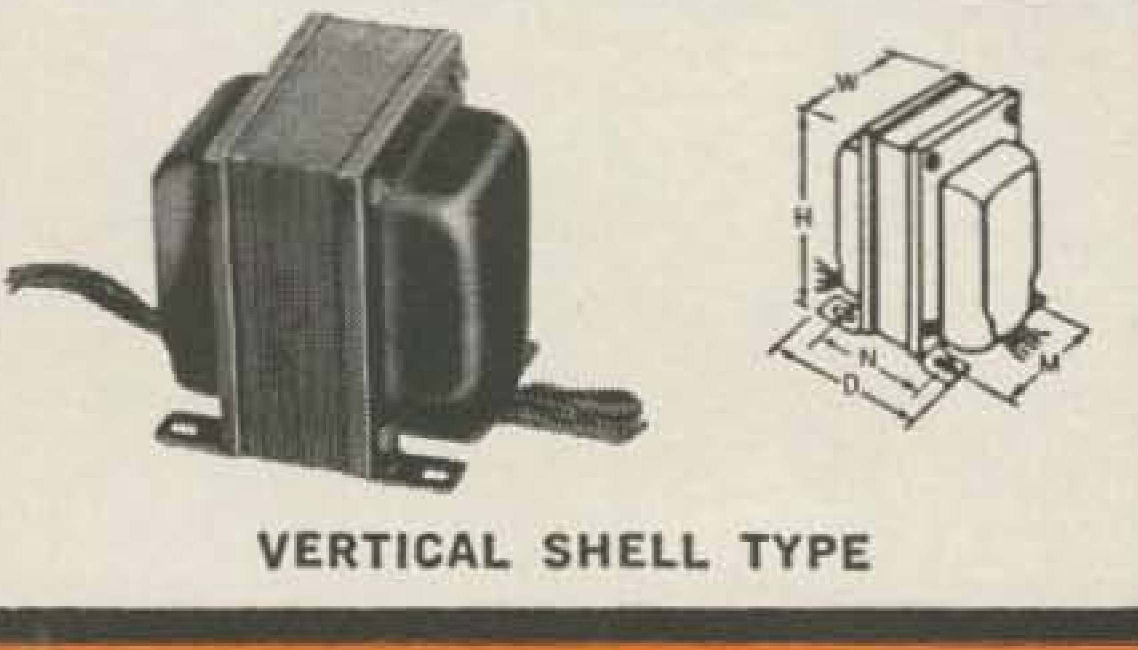


CHANNEL TYPE



DOUBLE SHELL TYPE



VERTICAL SHELL TYPE

CHANNEL FRAME FILAMENT/TRANSISTOR TRANSFS.

Pri. 115 V 50/60 Cycles—Test Volts RMS: 1500

Type No.	Secondary	W	D	H	M	Lbs.
FT-1	2.5 VCT-3A	2 7/8	1 1/2	1 11/16	2 3/8	3/4
FT-2	6.3 VCT-1.2A	2 7/8	1 1/2	1 11/16	2 3/8	3/4
FT-3	2.5 VCT-6A	3 5/16	1 7/8	2	2 13/16	1
FT-4	6.3 VCT-3A	3 5/16	1 7/8	2	2 13/16	1
FT-5	2.5 VCT-10A	3 3/4	2 1/8	2 5/16	3 1/8	1 1/2
FT-6	5 VCT-3A	3 3/4	2 1/8	2 5/16	3 1/8	1 1/2
FT-7	7.5 VCT-3A	3 3/4	2 1/8	2 5/16	3 1/8	1 1/2
FT-8	6.3 VCT-8A	4	2 1/2	2 5/8	3 5/16	2 1/2
FT-10	24 VCT-2A or 12V-4A	4	2 5/8	2 5/8	3 5/16	2 1/2
FT-11	24 VCT-1A or 12V-2A	3 3/4	2 1/8	2 5/16	3 1/8	1 1/2
FT-12	36 VCT-1.3A or 18V-2.6A	4	2 5/8	2 5/8	3 5/16	2 1/2

Taps on pri. of FT-13 & FT-14 to modify sec. nominal V, −6% +6%, +12%

FT-13	26 VCT-.04A	2 1/8	1 3/8	1 1/4	1 3/4	1/4
FT-14	26 VCT-.25A	2 7/8	1 3/8	1 11/16	2 3/8	3/4

DOUBLE SHELL POWER TRANSFORMERS

Type No.	High V.	DC ma	5V. Fil.	6.3 VCT Fil.	W	D	H	M	N	Wt. Lbs.
R-101	275-0-275	50	2A	2.7A	3	2 1/2	3	2 1/2	2	2 1/2
R-102	350-0-350	70	3A	3A	3	2 1/2	3 5/8	2 1/2	2	3 1/2
R-103	350-0-350	90	3A	3.5A	3 3/8	2 7/8	3 15/16	2 13/16	2 1/4	4 1/2
R-104	350-0-350	120	3A	5A	3 3/4	3 1/8	3 7/8	3 1/8	2 1/2	5 1/2
R-105	385-0-385	160	3A	5A	3 3/4	3 1/8	4 5/16	3 1/8	2 1/2	7

VERTICAL SHELL POWER TRANSFORMERS

Type No.	High V.	DC ma	5V. Fil.	6.3 VCT Fil.	W	D	H	M	N	Wt. Lbs.
R-110	300-0-300	50	2A	2.7A	2 5/8	2 13/32	3 1/4	2	1 3/4	2 1/2
R-111	350-0-350	70	3A	3A	2 5/8	3 7/32	3 1/4	2	2 3/8	3 1/2
R-112	350-0-350	120	3A	5A	3 5/16	3 11/16	4	2 1/2	2 5/16	5 1/2
R-113	400-0-400	200	3A	6A	3 7/8	4 5/16	4 5/8	3	3 1/8	8

CHANNEL FRAME FILTER REACTORS

Inductance Shown is at Rated DC ma—Test Volts RMS: 1500

Type No.	Induct. Hys.	Current	Resistance Ohms	W	Dimensions, in. D	H	M	Wt. Lbs.
R-55	6	40ma	300	2 3/8	1 3/8	1 3/4	2	1/2
R-14	8	40ma	250	2 7/8	1 1/2	1 11/16	2 3/8	3/4
R-15	12	30ma	450	2 7/8	1 1/2	1 11/16	2 3/8	3/4
R-16	15	30ma	630	2 7/8	1 1/2	1 11/16	2 3/8	3/4
R-17	20	40ma	850	3 5/16	1 5/8	2	2 13/16	1
R-18	8	80ma	250	3 5/16	1 5/8	2	2 13/16	1
R-19	14	100ma	450	3 3/4	1 7/8	2 5/16	3 1/8	1 1/2
R-20	5	200ma	90	4 1/8	2 1/4	2 5/8	3 5/16	2 1/2
R-21	15/3	200ma	90	4 1/8	2 1/4	2 5/8	3 5/16	2 1/2
R-220	100/8 Mhy 25/2 Mhy	2.5A 5A	.6 .16	3 3/4	2	2 5/16	3 1/8	1 1/2

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73 Magazine

Wayne Green, W2NSD
Editor, etcetera

September, 1962
Vol. X, No. 1

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Cover: W1MEL.

W2NSD/1

Never Say Die

SEVERAL vacationers have stopped by for a hello and been put to work hanging up antennas and sorting out radio equipment from the hundreds of cartons all over the barn. Paul Day W1PYM has practically become a staff member by now, having spent almost his entire vacation here. Now he usually turns up around dinner time and puts in a strenuous evening working on some project or other. Dave Brown K2IGY came up in his Porsche for a short visit and found out how much trouble we have to go through each month to prepare his propagation chart for publication. We sat him down at a card table (our version of a desk) with a large blank chart and hundreds of strips of patterned paper to paste on the chart. Two days later he got through and headed back to Long Island vowing he would never come back here during chart makeup time.

Another welcome visitor was Paul Smith WA2SPB who spent three days with us carrying around all the heavy things we could find for him plus installing an intercom and about two hundred other odd jobs. He swears he had fun. Jesse Adams K1LYC, a naval surgeon from Kittery, Maine, stopped by and was soon put to work assembling steel shelving to hold the ham gear. Unless we get a lot more filled up with permanent guests than we are now we can put up any visiting firemen for the night, and may well have some little chore to keep them out of mischief. Porsche pushers particularly welcome.

A Ball

The new headquarters building is teeming with activity. Towers are going up. Beams are being swung. Rigs are being assembled and hooked up. The request for help brought several good answers and we have a happy little staff living and working together to put out 73 and get as much ham gear on the air as possible.

After just three weeks we are set up with something on all bands from two through 80 meters. We'll get on the rest of them before long too. Next we will start putting in amplifiers and bigger antennas so we can really be heard. I don't know how many of you appreciate what an exciting thing it is to be able to get on the air again after being buried in the middle of Brooklyn for some years. Now, when I call a KX6, he comes back to me. Even on six meters I can sit there and work one DX station after another. There was a little matter of my TVI wiping out channel two for the entire town, but then Peterborough isn't very large. I whipped out the Gavin filter which I had somehow neglected to return after our little test of it this month and brought the TVI under control.

We can still probably use one or two more eager beavers who are interested in hamming more than money. We have a lot of ham gear to install, a lot of booklets to put out, and a lot of work to be done for 73. In return for this we will provide room, board, and some pocket money and a wealth of fun and experience. Absolutely no smoking or drinking here though.

This issue of 73 rounds out two years of publishing. The magazine is going well . . . almost everyone likes it and we have enjoyed a growth rate that is a phenomenon in our field. We have our new gigantic quarters with a fine ham station being installed and an impressive test lab being built in. We have the first of a growing group of regular employees. Our Math, Coils, Mickey Miker, Ham TV and

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We are going to do everything we can this fall to make sure that as many amateurs as possible are convinced to subscribe. Those of you that like what we are doing and want to help can accomplish a lot by mentioning our articles and the magazine during your QSO's. You can talk up 73 in club bulletins and at club meetings. We try to be restrained in our promotion, leaving the enthusiasm up to you.

In the closing part of my editorial last month I hinted that readers might pay a bit more attention to the companies that are advertising in 73. Ron Levine of Polytronics was afraid that this might lead to problems for every-other-month advertisers, who might be considered non-advertisers half of the time. This is a complication, to be sure, but I doubt if anyone will forget the four page Polytronics ad in the April issue. Another reader suggests that we give the name of the advertising manager in a list in 73 so the readers can write to the right man and register their opinions. This might lead to some emotional problems. When in doubt address your letter to the president of the company and let him pass it to the advertising manager.

Club Subscriptions

There is still time to get in your club subscriptions at our present low rate if you get a move on. Used to be we could only handle new subscriptions at this rate, but we've enlarged our staff and can now handle renewals as well. The special club rate is available to any group, whether spontaneous or organized, that submits five or more subscriptions at a time. This saves us enough time so we can afford to present you with a bit of rebate in the form of a lower rate. Use a separate sheet of paper and send us your list. Be sure to mention the name of the club somewhere as well as the names, QTH's and calls of subscribers. We also like to know whether it is a new or renewal subscription. All club subscriptions will start with the next published issue unless rather obvious attention is called that you desire otherwise.

Club rate: $3.00 per year, five or more at a time.

VHF Amateur Defuncts

Though the details are somewhat obscure as yet, it does seem as if CQ has gobbled up

(Turn to page 58)

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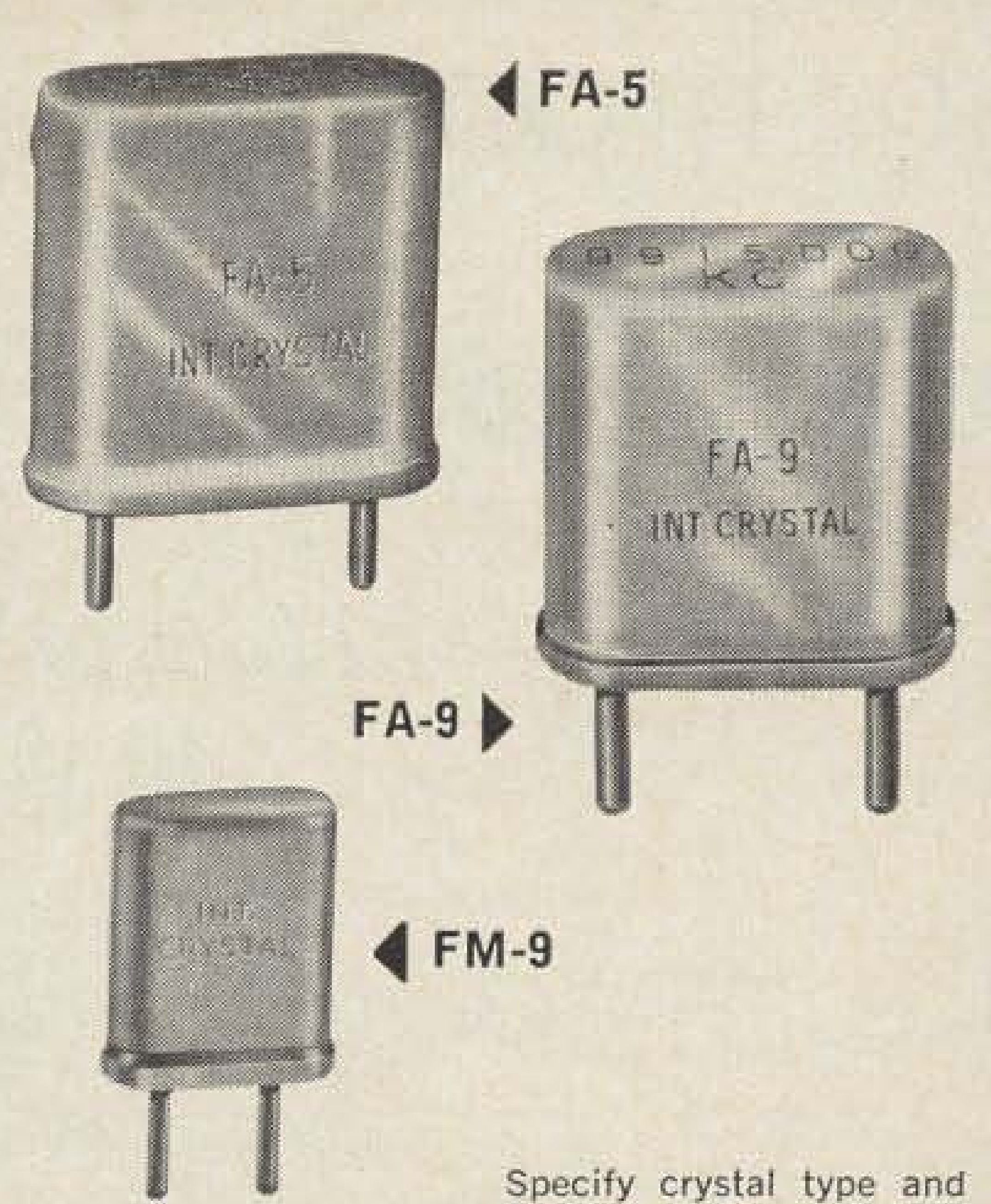

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Overtone (5th)	60 - 75.99 mc 76 - 99.99 mc Not available	60 - 89.99 mc 90 - 100 mc 101 - 109.99 mc
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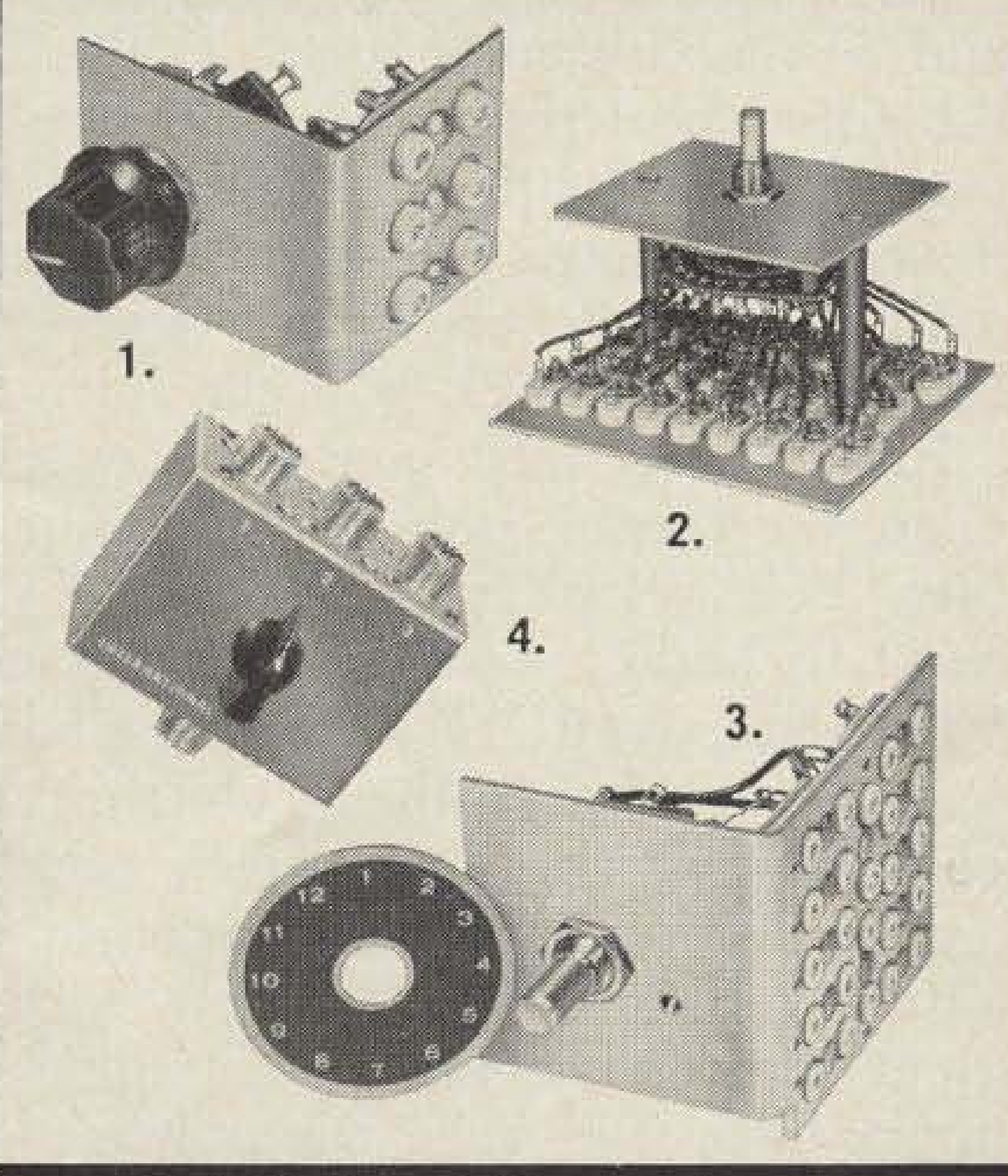

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Synchronous Detection

How to read signals that are 40 db under the noise

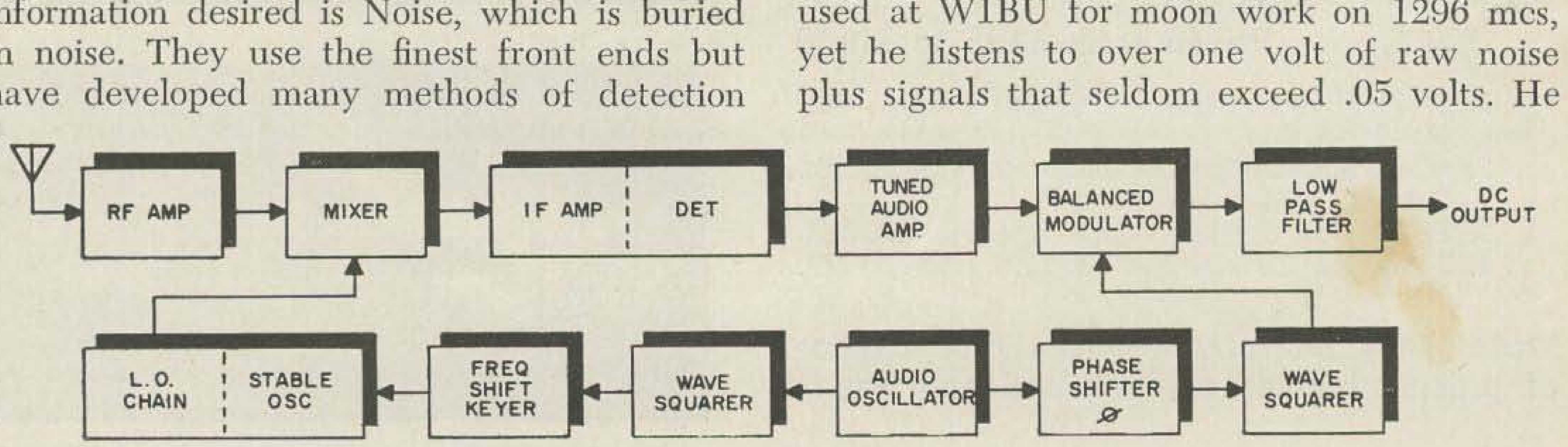
Bill Ashby K2TKN
Box 97
Pluckemin, New Jersey

LITERALLY thousands of engineers and entire engineering divisions of many large companies as well as countless other people have spent millions of hours attempting to improve the ability of a receiver to extract a signal from a noisy spectrum. To improve signal to noise ratio has been a prime objective for many years and because of the very evident thermal noise in the first stage, most work has been in this area. The present state of the art and available components results in less than a 4db signal plus noise to noise ratio—using tubes below 400 mc and diodes above. There are two known methods to improve on this, the MASER amplifier, and PARAMETRICS. The MASER will get down to less than 1db, but is very complex (expensive) and therefore feasible only to the military, universities, Bell Telephone, etc. A PARAMP is not hard to build, once you know how, and SAM HARRIS, WIBU/WIFZJ single-handedly gave this knowledge to the world, but neither device will improve things much more than 10db actually overall in signal to noise.

Starting with Grote Reber many years ago, a W9 at the time, a completely different receiving problem has been the object of much research. This is Radio Astronomy, where the information desired is Noise, which is buried in noise. They use the finest front ends but have developed many methods of detection not previously applied in the communication field. These systems are based on schemes to force any locally generated (within 100,000 miles) noise to cancel out, leaving the desired information available for use. The Lamb noise silencer, Collins noise blanker system, Frequency Shift RTTY are some very simple versions of this that will improve Signal to Noise many db under certain conditions, but have very little effect on thermal 1st stage noise—the real problem.

Space communication and telemetery research has come up with several systems to improve signal to noise ratios but the majority are lock-on systems that require bursts of good signal to reference against or prediction of where and what kind of signal is going to be received as well as when. These have had very little success in Amateur applications to date.

Out of all of this it would seem that it is possible to combine advantages of each area of research and to build a receiver that is a radical improvement over what was known 25 years ago. As Sam Harris says, "Amateurs have never actually worked weak signals," and he is right. In his own case, the finest receiving technique and equipment ever assembled for amateur use, and probably any other, is being used at W1BU for moon work on 1296 mcs, yet he listens to over one volt of raw noise plus signals that seldom exceed .05 volts. He



admits it took almost a month to learn what to listen for. I said, "Why not get rid of some of that noise," and his answer was "What noise?"

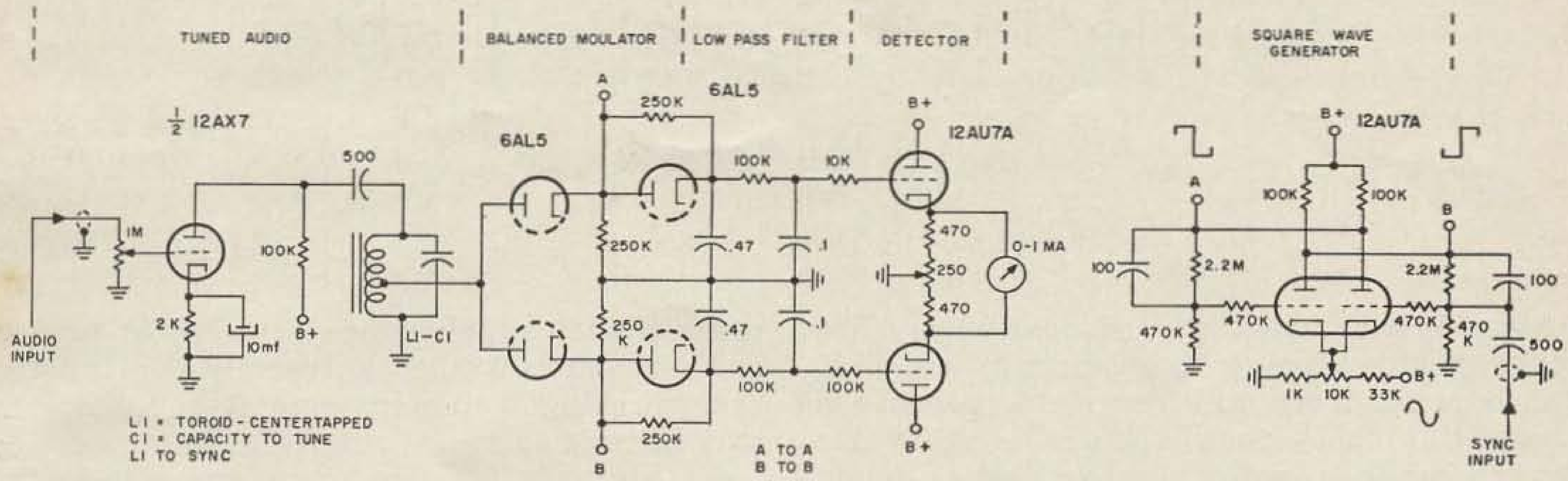
He has developed the first molecular anti-noise detector right between his ears and beard! This reminds me of a few years ago, with one of my first really sharp receivers—W9ECZ listened for a while to this six foot rack of *if's*, etc., with about 100 cycles of total band width, to the pile-ups on the low end of 20 and then said "Very nice, but how do you keep track of what's doing on the rest of the low end?" My tin ear on CW requires listening to one signal at a time, and I have found that my head does not cancel noise, it generates faint "CQ de W1BU" in several watts of noise after a few minutes.

All of this has led to no sleep in the past few weeks and definite information on a lot of circuits that will not help, but one combination of systems has excellent promise of fantastic results.

The Sync detection system borrows from many sources a number of techniques.

(a) A stable frequency is locally generated. This can be from a few cps to ultra-sonic, depending on the application. For purposes of illustration—say 400 cycles.

(b) A square wave derived from this 400 cycles is used to F.S.K. (Frequency Shift Key) the local oscillator chain so that the front end of the receiver is alternately looking at two closely spaced frequencies, possibly 100 kc apart on 1296 mcs, one of which is tuned to the desired signal. Information is being fed the *if* Strip, detector, and audio that consists of galatic and front end noise that is the same on both channels, and any signal, noise, etc., that appears in only one channel – that will appear to be signal with heavy 400 cycle modulation. Band width of these portions of the receiver are not important as long as the two channels are selectively scanned.



This does not require switching of the antenna input, which is inherent in most Astronomy setups, and does not require components that can't even be swiped, let alone purchased by normal human types. A number of systems have been tried that were of the frequency diversity type, based on two channels of reception, each on a different frequency, whose outputs were tied together so that noise cancels but a signal in one channel gets thru. Noise is not coherent so 6 or 8 db actual was about all that could be gained in practice. Band width of detection is a very serious matter. Theory based on Boltzman's Constant says that if the band width can be made narrow enough, any signal to noise ratio is possible. In practice about 100 cycles is the narrowest band width that can be handled, due to tuning difficulty and limitations of the human hearing mechanism. Narrowing up, and using a pen recorder can improve things many db, but if you can't keep the receiver tuned to the signal, it is of little practical value.

(c) The audio output from the normal detector, consisting of a lot of receiver noise, a little cosmic static, and maybe .001 percent modulated signal is put thru a very selective 400 cycle filter. This removes everything but 400 cycle noise and 400 cycle modulation of the signal, and these are fed to the balanced modulator.

(d) The same 400 cycle frequency generated in "a" is fed to a phase shifter then is squared off and this is fed to the balanced modulator.

(e) The balanced modulator not only is selective as to frequency but selects phase as well. Signal that is modulated with 400 cycles is compared with the original 400 cycles in the balanced modulator. Output is only upper and lower side band products of the two. We are interested in the lower only so a low pass filter is used to eliminate the upper sideband at the balanced modulator output.

Since the two signals being compared are of the same frequency, the lower sideband is zero. *This is dc.* If the two frequencies are in phase, the output is dc of one polarity and the amplitude is proportional to signal strength. If the phase is 180° the output is dc of the opposite polarity and proportional. This means signal in one receiving channel gives positive output and one gives negative. There is 30 to 40 db of suppression of any information that appears on both frequencies. Since any signal within the pass band of the entire receiver is converted to a 400 cycle component, this system will not work under QRM, but there isn't any yet above 400 mc. There is no tuning problem—overall band widths of 10 cycles are easily obtained. The dc output of the balanced modulator is used to key an oscillator for CW, drive a pen recorder for real weak ones, or modulate an audio system but here the 400 cycle master oscillator would be raised to 10 kc.

Preliminary work has shown that a minimum of 30 db signal to noise ratio improvement can be obtained on slow speed CW!

This article is a plea to try to cut down the development time cycle by Amateurs. This sync detector along with State-of-the-Art receivers and a Preamp will allow 432 and 1296 moon work with yagi antennas or square corners and 2C39's. If W2AZL, W6NLZ, WIFFR, WIRFU, K2LMG, W4HHK, W6AJR, W6MMU, W2TTM, just to name a few, start on some version of this scheme, we will beat the commercials a mile as usual. As working circuits finish tests, full info will be appearing in 73. These tests are aimed at good reception of W1BU and KH6UK with a six foot dish and a lot of feed line. More later! . . . K2TKN

Reference: "Lock-in Amplifiers" Electronics; June 8, 1962: Robert D. Moore.

An Electric Cigarette Lighter

for your shack

Charles E. Spitz W4API

Since I have spent a good deal of my life working on developing lung cancer by smoking, and because there are few better times to pursue this hobby than when relaxing by the rig talking to a buddy, I have always found it annoying when my cigarette lighter runs out of fluid just as sked time approaches. And so I decided to rig up a lighter that would always be ready for use; an electric one.

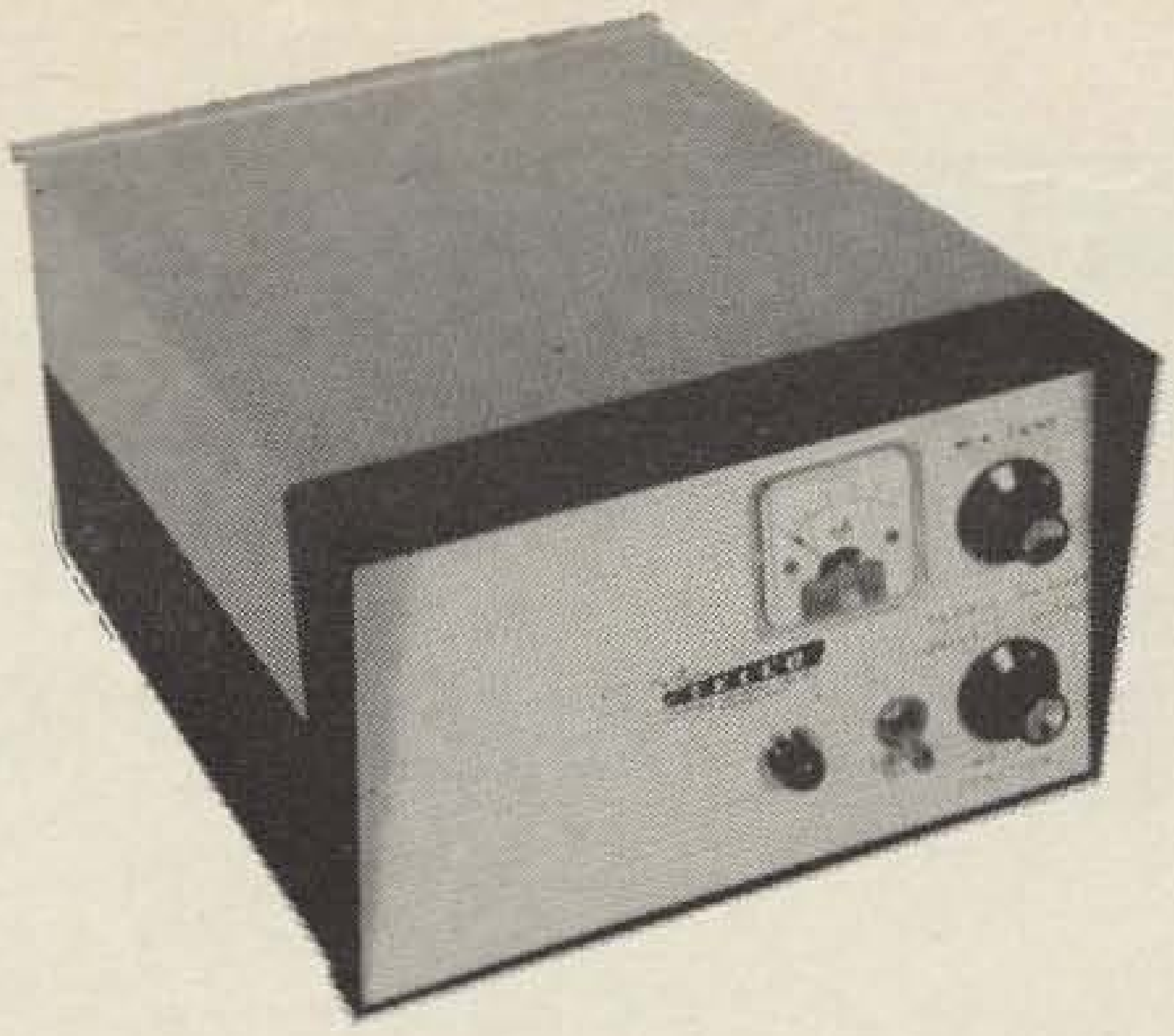
Although a resistance wire across the ac line would give a suitable hot plate, this idea was discarded because I prefer to be isolated from the line. Between the junk box and the nearest auto supply store I was able to find parts to put together a transformer isolated system using a pop-up cigarette lighter, as may be seen in the photograph.

An ordinary filament transformer is bolted inside of a small metal cabinet and is connected to an automatic lighter well. The MO is the same as in your car; press the lighter knob down and the lighter springs up when hot. Through trial and error I found that the lighter works best with 7.5 volts ac. If you do not have a 7.5 volt filament transformer, you can use a multiple filament transformer, placing the 5 and 2.5 volt windings in series. If you don't have these either, you can get by with 6.3 and 2.5 volt windings in series, taking care to phase the windings so that the voltages add. If one is reversed you won't do any harm, but the lighter won't work.

A pilot light was installed to show when the lighter is on, however so little current is drawn when the lighter is not pressed in that this frill may be discarded and the unit left on all the time.

Since it takes a fair amount of pressure to push the lighter down, and the heating unit cools rapidly, this gadget should be safe even if small children wander into the shack. And perhaps it will be such a success that the xyl will ask you to make more for the rest of the house. . . . W4API

FLIP the SWITCH and YOU'RE ON 6 METERS



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SPECIFICATIONS

INPUT: 14 to 18MC., 5-10 watts (any Emission) 50 ohms imp. VSWR less than 1.06/1
OUTPUT: approx 30 watts any emission, 50 ohms imp.
TUBE COMPLEMENT: 6U8 Xtal Osc and Mult., 5763 Hi-Level Mixer, and 6146 Linear Amplifier
POWER REQUIREMENTS: 300-600 VDC @ 150 ma, 200-265 VDC @ 40-50 ma., and 6.3 VAC @ 1.3 amps
(Take power from your rig, or get the Heath HP-20)
DRIVE REQUIREMENTS: 5-10 watts AM, FM, CW, 2-5 watts SSB

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73 Tests The Maverick Tunable Six Meter Filter

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

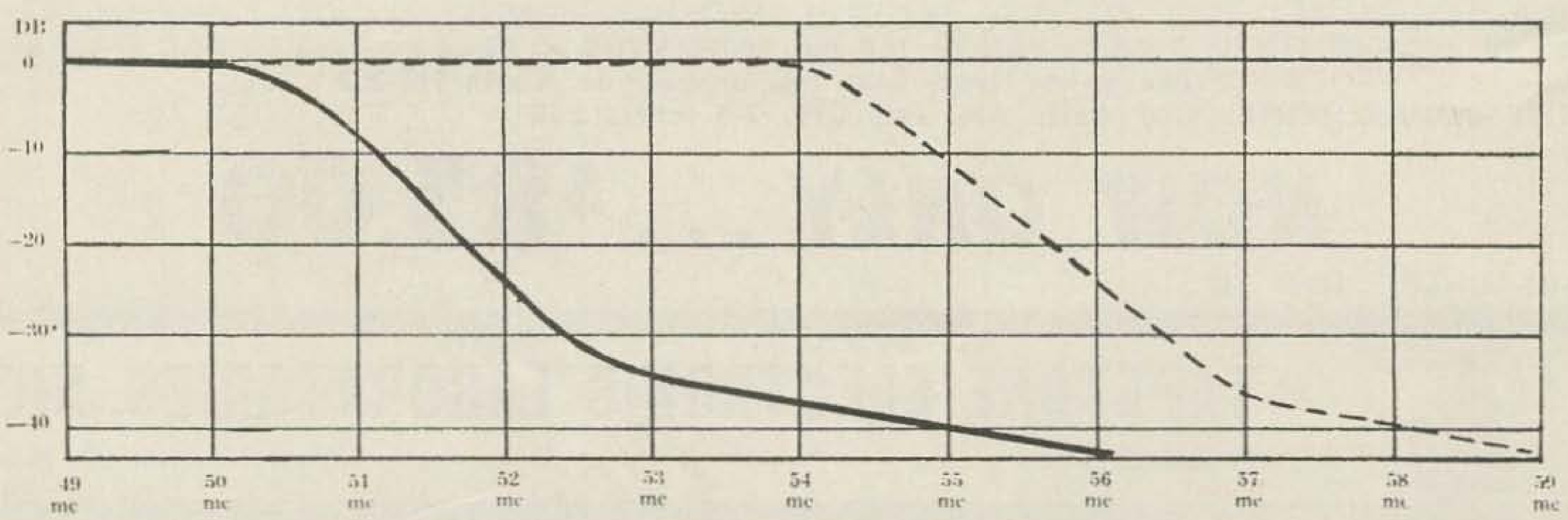
THE Maverick Six Meter Filter is one of the few low-pass filters that have been designed with the special problems of six meter operation in mind. There are five stages of the constant K and M derived types, all tunable. The combination of K and M filters provides the sharpest cutoff with the lowest insertion loss. This is tunable and the advantages over fixed tuned filters of a similar design are many. One is that fixed tuned filters are usually set for a cutoff frequency of 52 mc and will start to effect the SWR as low as 51½ mc. With the increased activity on the band, as well as the growing use of wide-band FM, such a filter presents problems. The Maverick can be adjusted for a cutoff of up to 54 mc so that you can operate as high on the band as you want and still be able to suppress TVI. There are several other uses for the Maverick. It will prevent converter front ends from being overloaded by strong TV stations it will suppress unwanted and spurious mixer products in SSB rigs and it will even match a 52 ohm line to a 72 ohm line.

Tests on the filter have shown that the suppression of unwanted signals to be at least 35 db, with less than one db of insertion loss. The tuning is extremely simple. Connect the filter between the antenna and the transmitter and peak all of the five stages for maximum output, as measured on an SWR bridge or other output indicator. The filter comes from the factory with a cutoff of 51 mc. I made a few tests on a little transmitter which seems to be designed to give a large amount of TVI. Without the filter, it takes out several channels of a nearby television set. With the filter in the line, there is no trace of interference on any television channel. This seems to prove the effectiveness of the filter quite conclusively, as all kinds of test-bench measurements are completely useless if the filter will not eliminate TVI when connected to a transmitter. The filter will handle up to 400 watts at the antenna. It is manufactured by Gavin Instruments and sells for $16.95. The attenuation curves are shown in Fig. 1.

. . . WA2INM

TYPICAL ATTENUATION CURVES

SHOWING UPPER AND LOWER TUNING LIMITS



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for "rock-crusher" reports or just plain "chewing the rag" . . .

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Take, for instance, Clegg's ZEUS VHF Transmitter. It gives you full coverage of the amateur 6 & 2 meter bands and associated Mars frequencies, with maximum TVI suppression. Automatic modulation control with up to 18 db of speech clipping provides magnificent audio with "talk power" greater than many kilowatt rigs. This beautiful unit with its ultra-stable VFO is the ultimate in VHF equipment for amateur and Mars operation.

Clegg's all new INTERCEPTOR VHF Receiver, designed for the serious operator on these bands offers performance features unmatched by presently available equipment for these frequencies. Exactly matching the famous Zeus Transmitter, the Interceptor offers reception with virtually no cross modulation. Nuvistor RF stages provide an extremely low noise figure with high sensitivity. Stability is ideal for the exacting requirements of SSB and CW.

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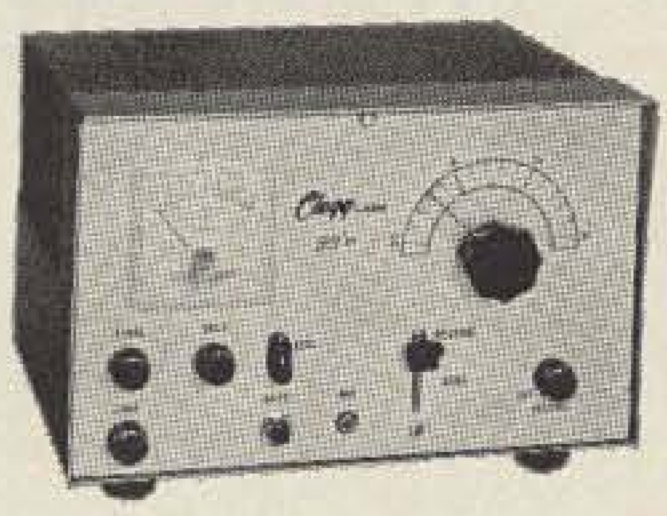

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ZEUS, $695.
INTERCEPTOR, $473.
99'ER, $159.95

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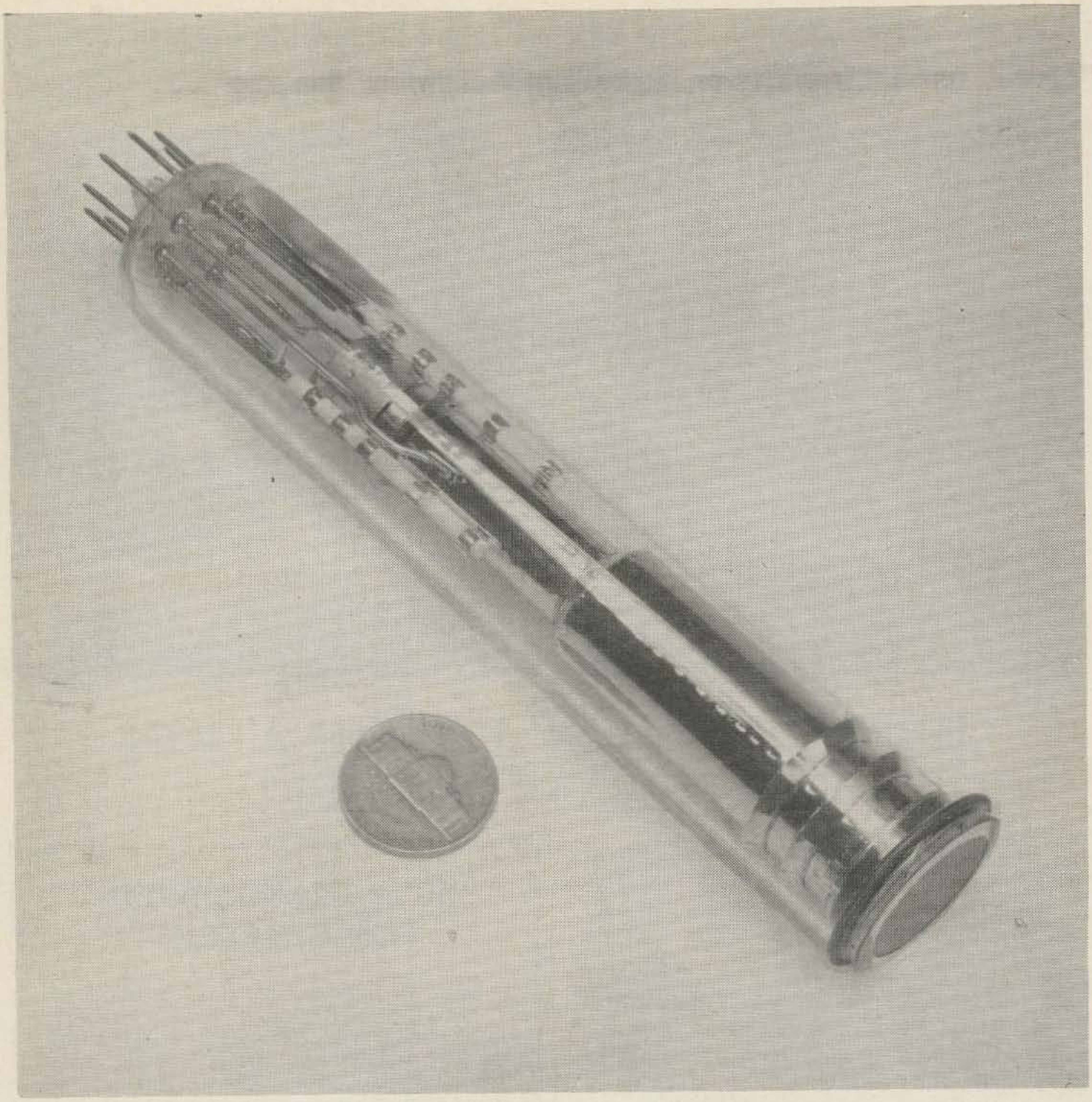


What's a Vidicon?

Fred Haines W2RWJ
123 Roberta Drive
Liverpool, New York

IF you aren't on speaking terms with the vidicon television camera pick-up tube, then you should definitely read on. You see, the vidicon tube is a most remarkable electronic device which in about ten years has virtually made the phenomenal growth of closed circuit television possible. The image orthicon, used extensively in broadcast TV, is a more sensitive and refined tube, but its cost and the complexity of its associated circuits have ruled it out for use in inexpensive television systems. Of course this applies also to ham television, and the vidicon will no doubt become known as the single advancement which contributed most to the popularization of Amateur TV.

In this discussion we shall describe the vidicon tube both physically and electrically, with emphasis on the internal process which results in the formation of a television signal.

The first and most basic requirement in any television system is the conversion of an illuminated subject or scene into an electrical equivalent. This may be thought of as analogous to the action of a microphone which converts sound waves into an electrical equivalent called an AUDIO signal. The vidicon tube with its associated circuits produces a VIDEO signal which is the equivalent of the scene to be televised.

Refer to Fig. 1. which illustrates the internal construction of a typical vidicon tube. Note that it consists basically of an evacuated tube with an electron gun at one end and a semi-transparent photiconductive layer at the other. The bulb is just over 6 inches long and is about 1 inch in diameter. Just for the record it's interesting to note that experimental vidicons are in use which are ½ inch and 1½ inches in diameter. These at present are for special purposes and are not in common use. A new family of short vidicons only 5 inches long is just becoming popular, but they are identical electrically with the older and standard 6 inch tube, except for slightly less heater current drain.

You've probably noticed already that the vidicon bears a family resemblance to the picture tube in your TV set, an electron gun, some grids, and an anode. So far, so good, we're on the right track. Instead of a phosphor screen to light up when struck by the electron beam however, a new element called a signal electrode or target is found. The target has the interesting property called photoconductivity. That is, it is made from a material which is an insulator in the dark and a conductor in the light, the degree of conductivity depending

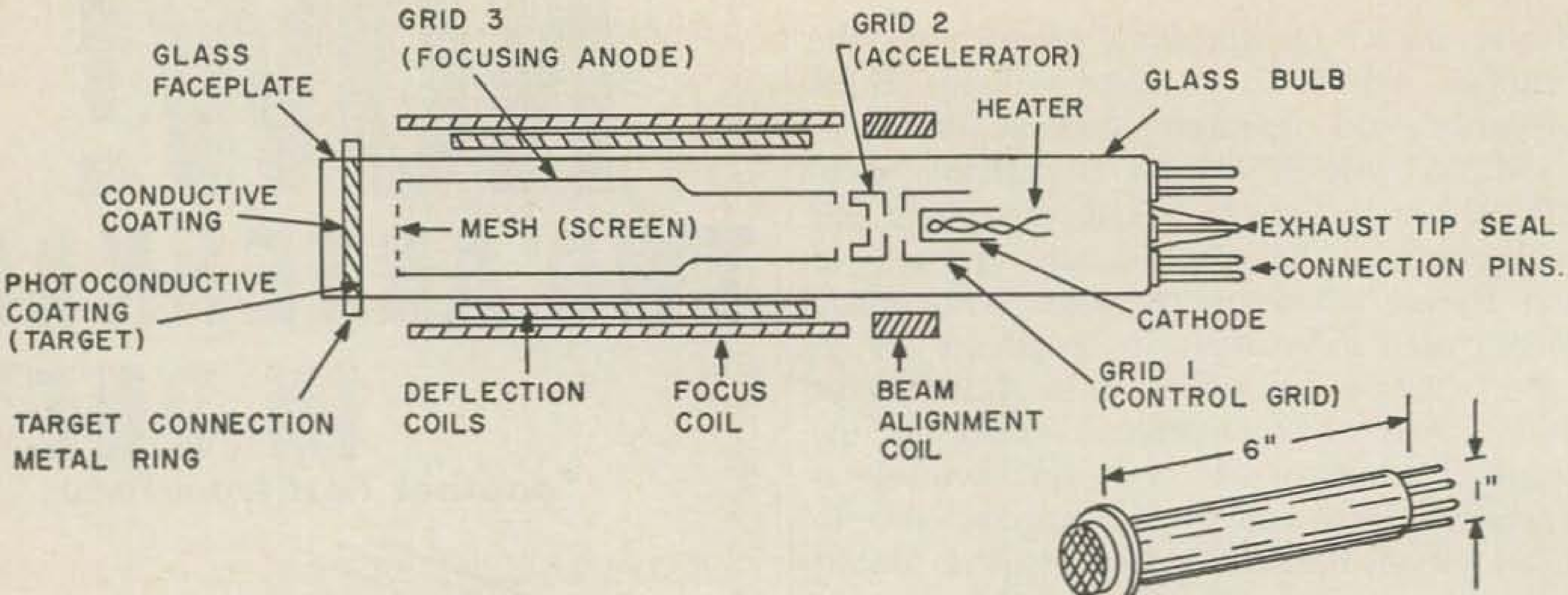


FIG. 1

upon the intensity of the light! Aha, you say, a photocell; and you aren't too far wrong, because the target can be considered a photocell having special properties.

Now, before we can proceed with the internal action of the vidicon, we must review the basic idea of scanning. Scanning, as you know, is the process resorted to in order to break a scene down into small parts or areas. This is required because a television system cannot transmit conveniently all of the information in a scene simultaneously. Therefore the scene is broken down into strips by a scanning pattern. When the electron beam in the picture tube of a TV set "paints" the picture on the phosphor screen, it is duplicating the scanning pattern of an electron beam in the television camera pick-up tube.

Any number of scanning patterns can be devised, but the standard one in the United States will be described. Refer to Fig. 2 which shows a basic scanning pattern. Note that the electron beam starts at the top left and proceeds down the pattern by moving back and forth horizontally. The beam is steadily moved downward as it scans from left to right so that it eventually reaches the bottom

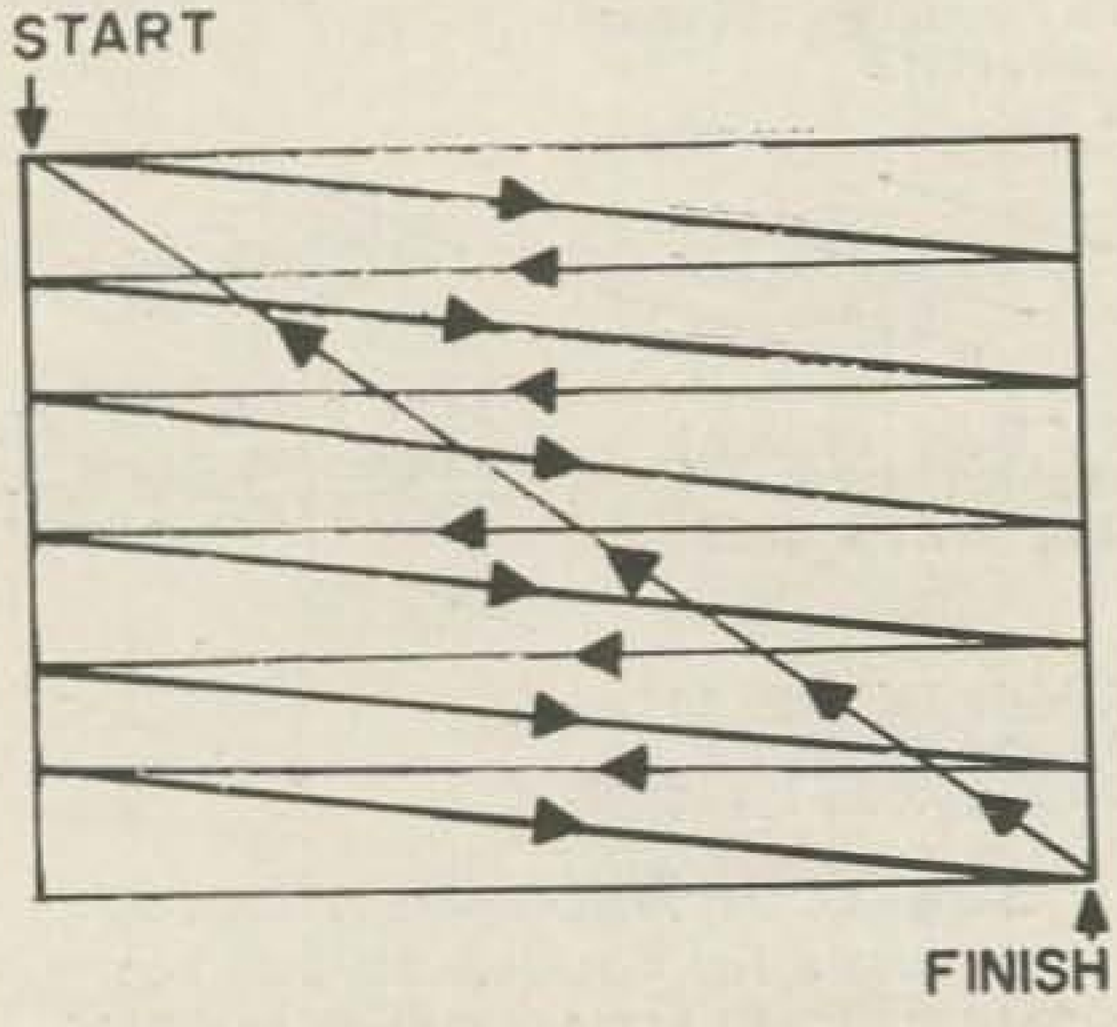


FIG 2

of the pattern, is moved rapidly to the top left, and repeats the scanning pattern over and over. Each horizontal scan from left to right is called a televsion line. The entire pattern taken once is called a television field.

Fig. 3 depicts the television pattern in actual use in the U. S. It is similar to the basic scan in Fig. 2, but it is made up of two fields which are interlaced. The two interlaced fields together, taken once, are called a television frame.

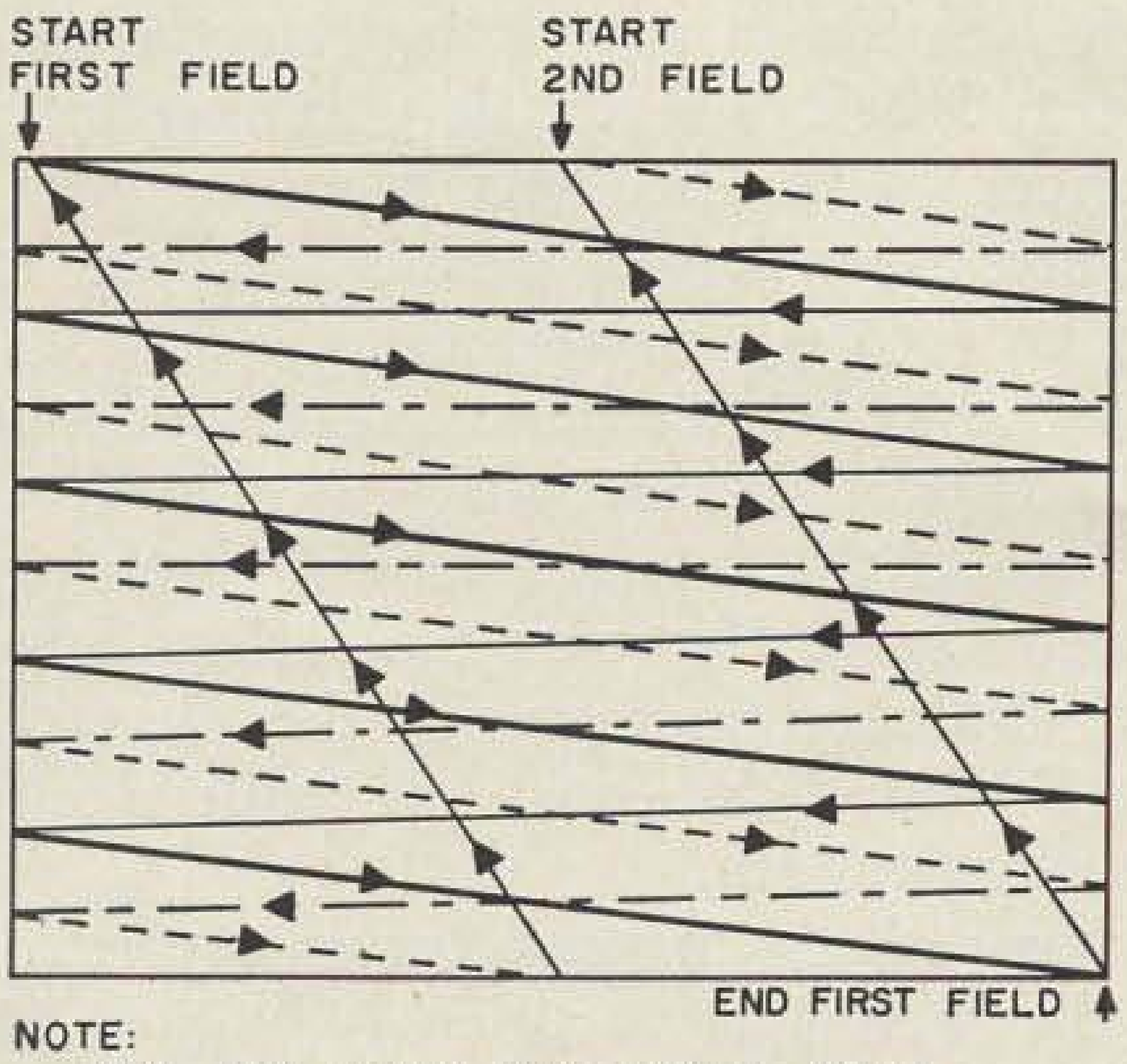
This really isn't the place to expound at length on television scanning patterns and philosophy, but we can't leave anyone up in the air wondering why all the trouble of generating an interlaced scanning pattern is considered worthwhile. One reason which is sufficient in itself to make interlace valuable is the degree it tends to minimize the effects of static and other interference when the television signal is transmitted over a radio link. Assume that a burst of ignition noise occurs during the first field of a frame but not during the second field. Since the first and second fields essentially contain the same picture information, only half as much bad effect (picture tearing) is noticed. Another, and perhaps more basic for interlace is that less flicker is apparent in any picture as the frames per second are increased. Interlace gives the effect of increasing the frame rate without actually doing so.

Now back to the vidicon for a spell (Fig. 1). The cathode-heater assembly produces electrons which are attracted by the electrostatic field created by the high potential applied to the second grid, the accelerator grid. Grids 1 and 2 are equipped with holes through which the electrons must pass, thus resulting in a fine round beam of electrons squirting out of grid 2 into the grid 3 region. At this point electron optics comes into play, and the beam is focused into a fine point at precisely the spot where it strikes the rear of the target surface. The focusing action is the result of an electromagnetic field produced by the focus coil outside the tube, and the electrostatic field of grid 3 which is connected to a relatively high voltage. To achieve exact beam focus, the voltage of grid 3 is varied. The voltage applied to grid 1 determines the strength of the electron beam hitting the rear of the target surface.

Now consider the deflection coils which are wrapped around the outside of the tube. Currents are caused to flow in the coils which then, through magnetic action, deflect the vidicon electron beam in the scanning pattern we previously discussed. So it is then, that the scanning beam strikes the rear surface of the target photoconductive layer.

A detailed representation of the target area of the vidicon is illustrated in Fig. 4. It's interesting to note that the glass faceplate of the tube is ground and polished optically flat so no distortion of the lens image will occur. The rear surface of the faceplate is coated with a transparent but electrically conductive coating. Over this is deposited the layer of photoconductive material, which the electron beam is scanning.

In operation, the front surface of the photoconductor is held at a positive potential with respect to the tube cathode of some 30 volts, give or take. This is applied to the tube through the target contact metal ring which connects internally to the transparent conductive coating.



NOTE:
ONLY TEN LINES ARE SHOWN HERE, 525 LINES IS THE U.S. STANDARD.

FIG. 3

The scanning electron beam deposits a charge pattern of negative electrons on the back surface of the target. Where the photoconductor is dark and its resistance therefore high, the negative charge accumulates until it reaches the same potential as the cathode;

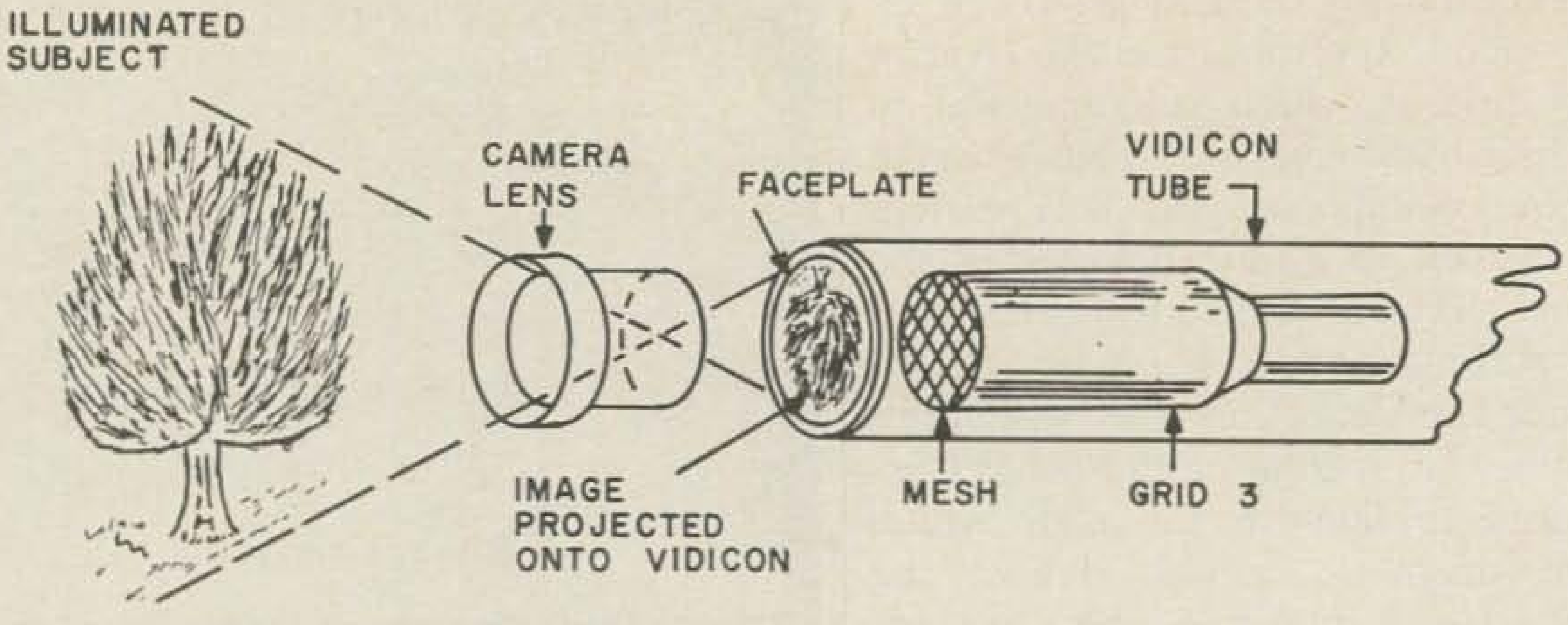


FIG. 4

any further electrons will be turned away.

Where light falls upon the photoconductor however, the conductivity of the material is substantially increased. The electron charge here leaks through the photoconductor to the conductive coating of the faceplate and flows in the load resistor, R_L (see Fig. 5). The resulting voltage across the load resistor is the video signal which is then suitably amplified and transmitted through coaxial cables or over the air to receivers or monitors.

Let's tie up a few more details which would have cluttered up the preceeding explanation. First, notice the fine screen mesh at the end of grid 3 nearest the target. The scanning electrons must pass through the mesh to reach the photoconductive layer. The purpose of this screen is to provide a uniform decelerating field in the vicinity of the photoconductive surface. What this means is, we want the electron beam to slow down just before striking the target so it won't "splash" all over and spoil the focus of the scanned pattern. The screen has holes, so the beam moves through and doesn't realize until it's too late that the screen is actually at a higher voltage than the target. At that point the beam wants to slow down and turn around to go back to the screen, but it strikes the target first at the lower velocity desired.

If you've been wondering about the extra coils around the vidicon in Fig. 1 called alignment coils, your curiosity is about to be satisfied. Due to the extremely close tolerance required when putting such a complicated tube together, and considering the small diameter of the holes in the grids 1 and 2 through which the beam must pass, it's no wonder that the holes are not always perfectly aligned on the same axis. The alignment coils then are placed over the vidicon and create two magnetic fields which are perpendicular to the axis of the tube and to each other. When the strengths of the fields are adjusted, the beam can be deflected up, down or to either side, allowing it to pass properly through the two holes in grids 1 and 2.

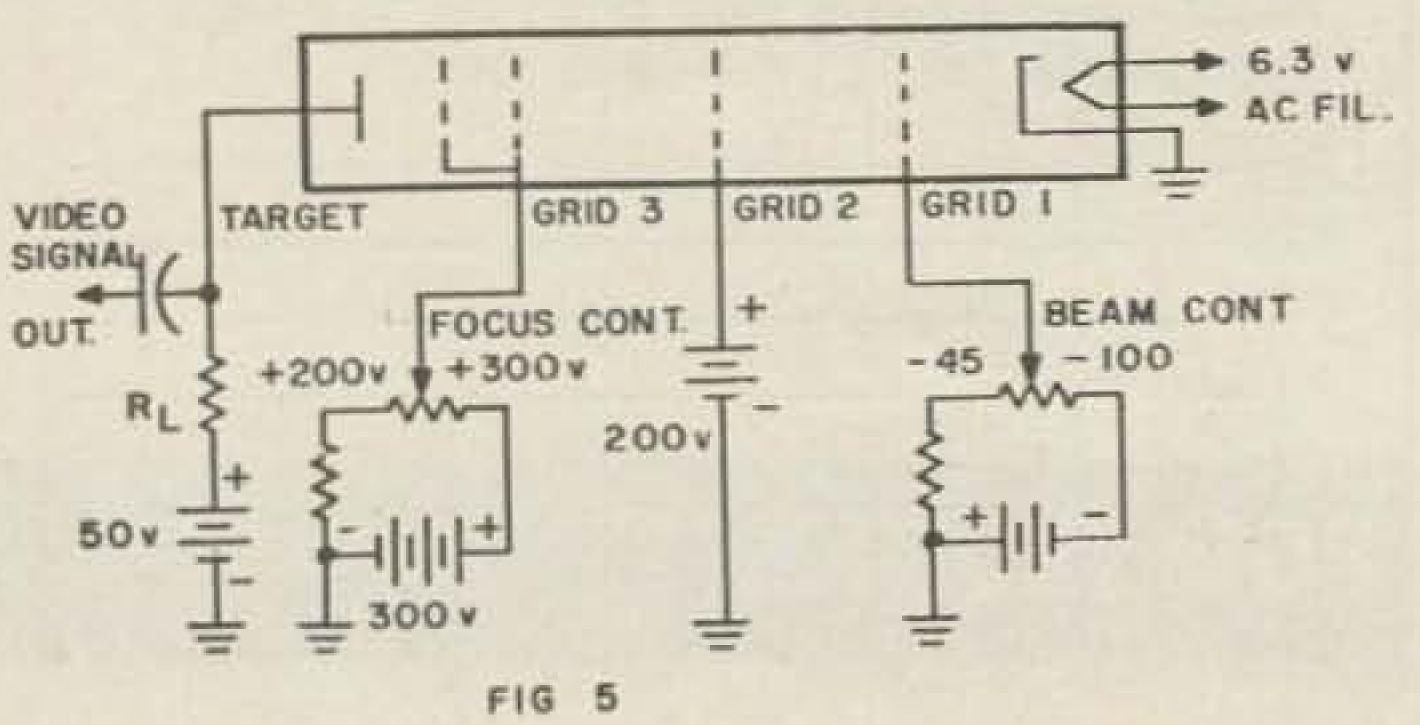


FIG 5

The vidicon has another advantage in terms of low cost operation. It is designed to operate with 16 mm movie camera lenses, which are small and relatively inexpensive, beside being commonly available. To be exact, some 16 mm movie lenses will not work perfectly with vidicons, and before a lens is purchased it is well to check with the lens manufacturer as to whether a particular lens is "vidicon format" or not.

At this point we have introduced ourselves to the vidicon camera pick-up tube. We have a fair idea of the internal action which produces a video signal. However the surface has barely been scratched in terms of the electronic circuits required to come up with a complete television system.

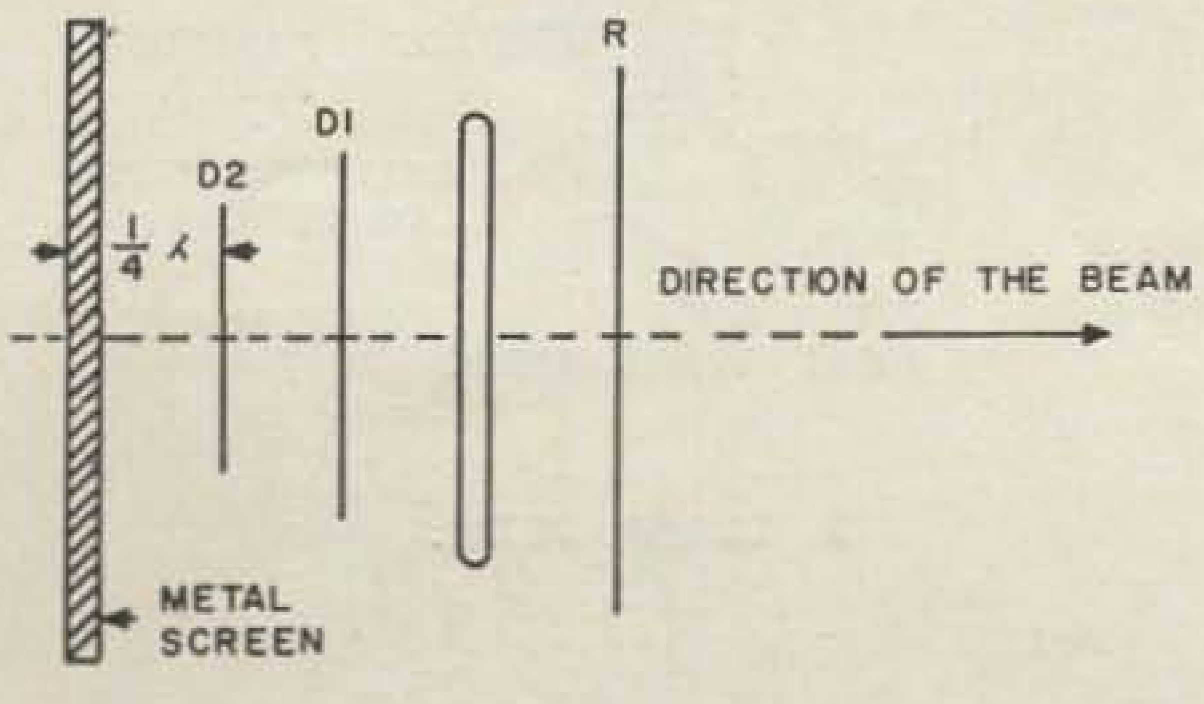
Some vidicon manufacturers market a grade B vidicon at a large price reduction, the reason being some relatively minor flaws in the photoconductive surface which show up as small spots in the picture. Another manufacturer who specializes in deflection, focus and alignment coils is offering these in relatively low cost sets. The time is here for some of us who are truly interested to do some investigation in this area. If you are interested in some further info, let Wayne know about it and we'll see what we can work up. . . . W2RWJ

Reverse Beam Antenna

Several European radio magazines recently described a so called "Reversed Beam Antenna" for VHF bands. Additional 5 db is claimed due to the narrowing of the beam (approximately twice) compared to a regular Dipole-Director-Reflector arrangement.

This is accomplished by pointing a regular Yagi toward a large 2 x 2 wavelength reflecting surface and *AWAY* from the station you are in contact with. Reflecting surface (it can be a solid metal or a screen) is located ¼ wave from the nearest director.

Same idea can be used with the stacked beams and a correspondingly larger screens. Antenna was used successfully on 144 mc and on all television channels. There is no information on how this screen affects the input impedance. . . . K6BIJ



Twin Cavity Two Meter Filter

Frank VanBrunt W3TUZ
1003 North Belgrade Road
Silver Spring, Maryland

FOR operation of transmitting and receiving equipment there is often a requirement for additional filtering between the equipment and the antenna. In a typical hf installation, this usually is accomplished by low pass filters and/or antenna tuners consisting of conventional lumped L-C circuits. At frequencies of 144 mc and higher low pass filters are not easily realizable because of the poor performance of lumped circuits. There is also an increased need for attenuation of spurious responses—it's less than pleasant to have television, taxicabs, airplanes, etc. superimposed on a 144 mc signal. The long multiplier chain of the typical VHF transmitter with its inherent potentialities for unwanted harmonic radiation argues for a highly selective filter in the output when transmitting.

The case for this hardly needs lengthy arguments and the obvious solution is a high Q resonant circuit placed between the equipment and the antenna. Such filters are far from new, they have been described on a number of occasions. These have been made of tin cans, brass tubing, or aluminum tubing, yet they all had one basic structure, they were coaxial capacity loaded quarter wave lines. This is, of course, a simple case to compile mathematically, and a relatively familiar mechanical structure. Unfortunately, I don't have a lathe in my basement, I dislike using blowtorches, and I haven't found an easy way to solder aluminum. Further, and most important from a lazy man's point of view, I always assume there should be an easier way to do the job.

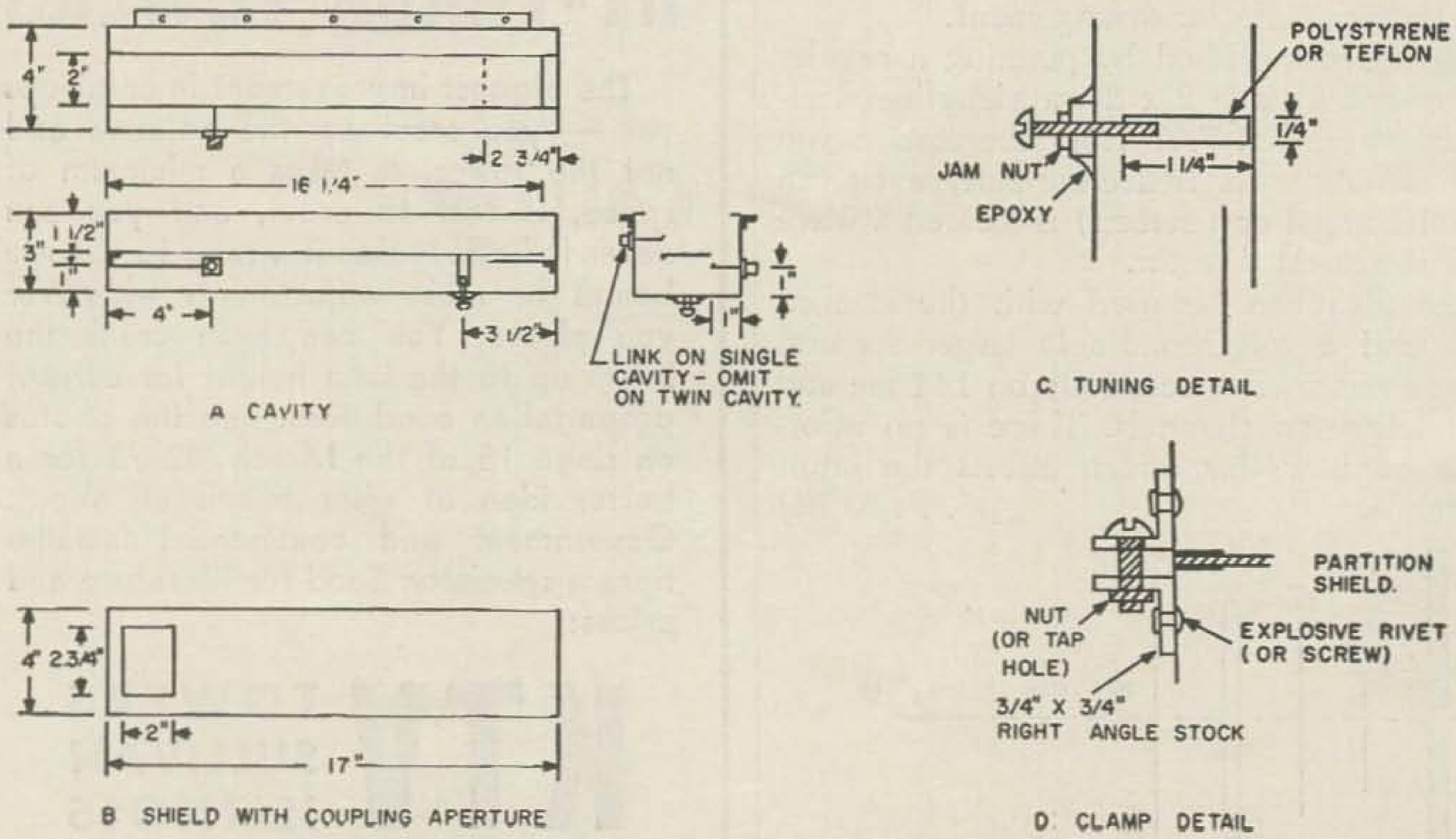
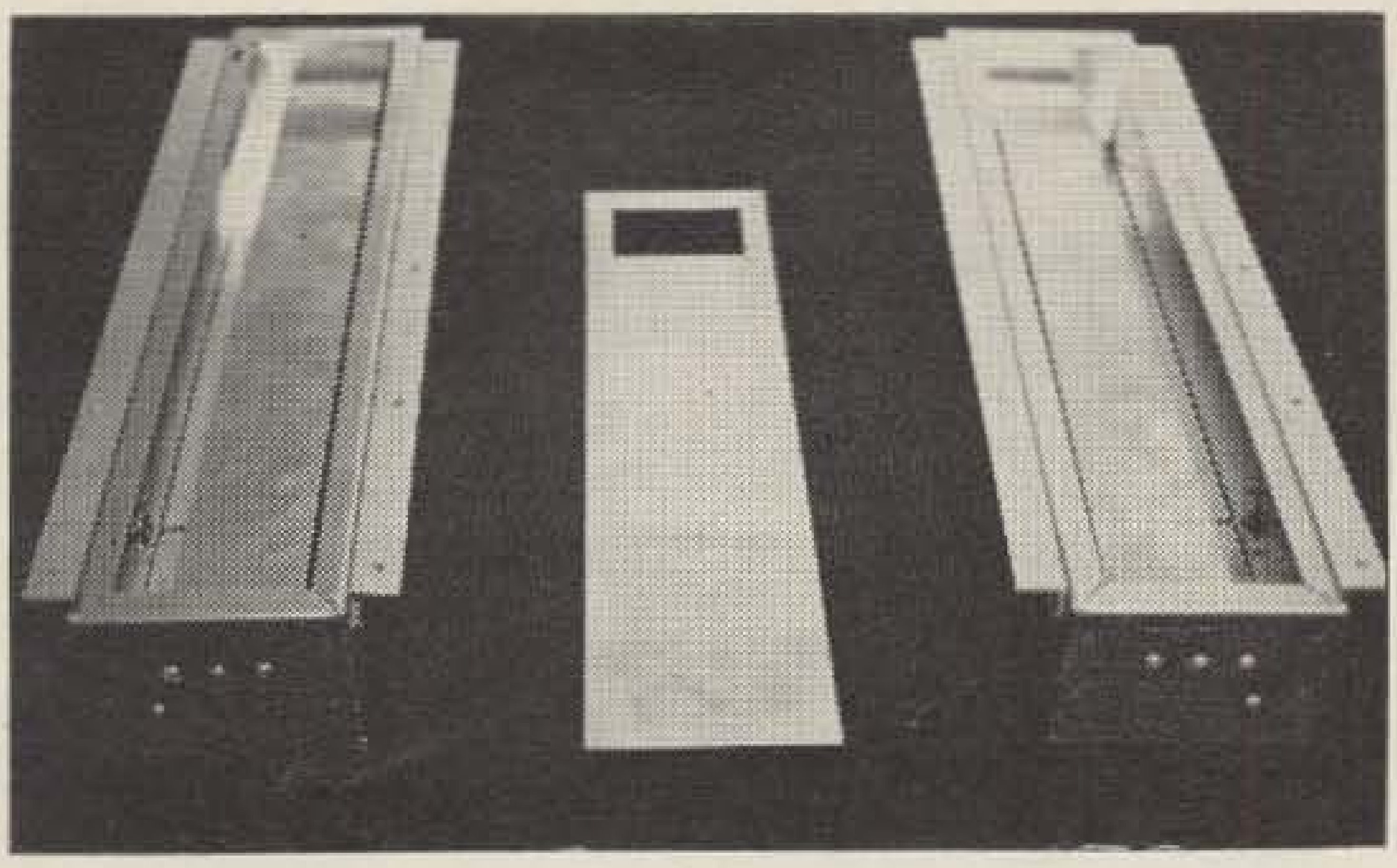


FIG. 1

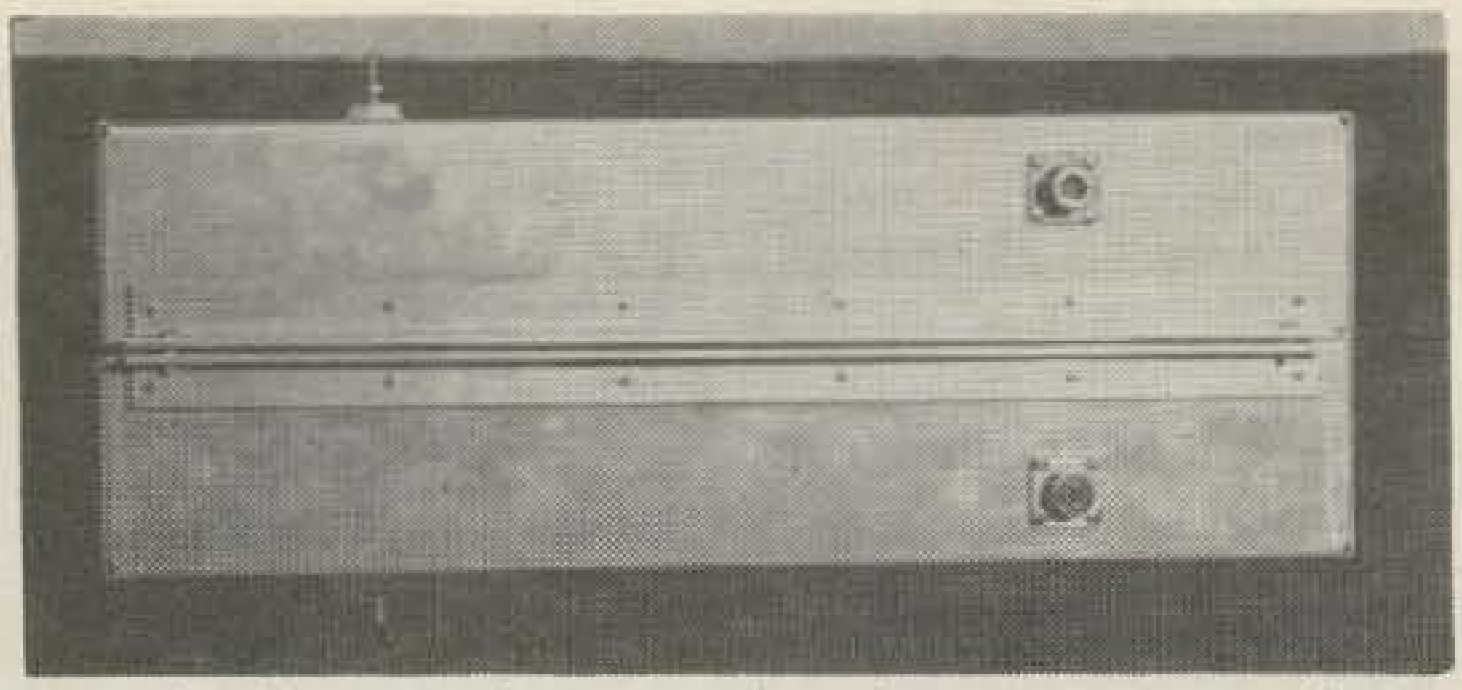


Inside View—note that the aperture is at the wrong end, it should be at the cold end.

The result, after going to a number of reference books on the characteristics of various transmission line structures, was to use a strip line in a rectangular enclosure. Complete dimension details are given in Fig. 1. The enclosure is a simple structure, a 3 x 4 x 17" aluminum chassis, which is a standard item available from the local distributor. The center strip is simply a 2" wide piece of aluminum, 16¼" long mounted by using a 2" length of aluminum right angle stock. The thickness of the piece is not important, the width, while not critical, was chosen to give the optimum Q for this structural configuration. Another piece of 2" wide strip, 2¾" long, is mounted on the other end of the chassis, and is positioned about ¼" away from the center-line. This piece furnishes the capacitance to tune the line to resonance. Tuning is accomplished by the simple expediency of controlling the distance between the main strip and the capacitor plate. To accomplish this a hole is drilled 3½" from the end of the chassis. Either an extra thickness of aluminum is placed there and the total thickness tapped, or, if you don't have a tap, merely remove the bushing from a slug tuned coil form and put this in the hole.

The technique used in our units was to cut a square piece of ¼" thick aluminum and bond it with epoxy. A piece of polystyrene or teflon rod about an inch long is used for tuning. This rod is drilled about ⅜" deep and tapped for the tuning screw. The screw is one inch long and is inserted and the insulating rod screwed on. (See detail in Fig. 1C.) The tuning is accomplished by pushing the strip away from the fixed capacitor plate. There is enough spring in the line to bring the strip closer to the plate. It can be easily bent for proper action.

This tuning technique has the added advantage of economy; there is no necessity for



Side View—only two clamping screws are in place. Actually five are used, the remainder were not replaced by the photographer.

purchasing a fancy disc neutralizing cacpacitor and dissembling and remounting the disc to tune the tank circuit.

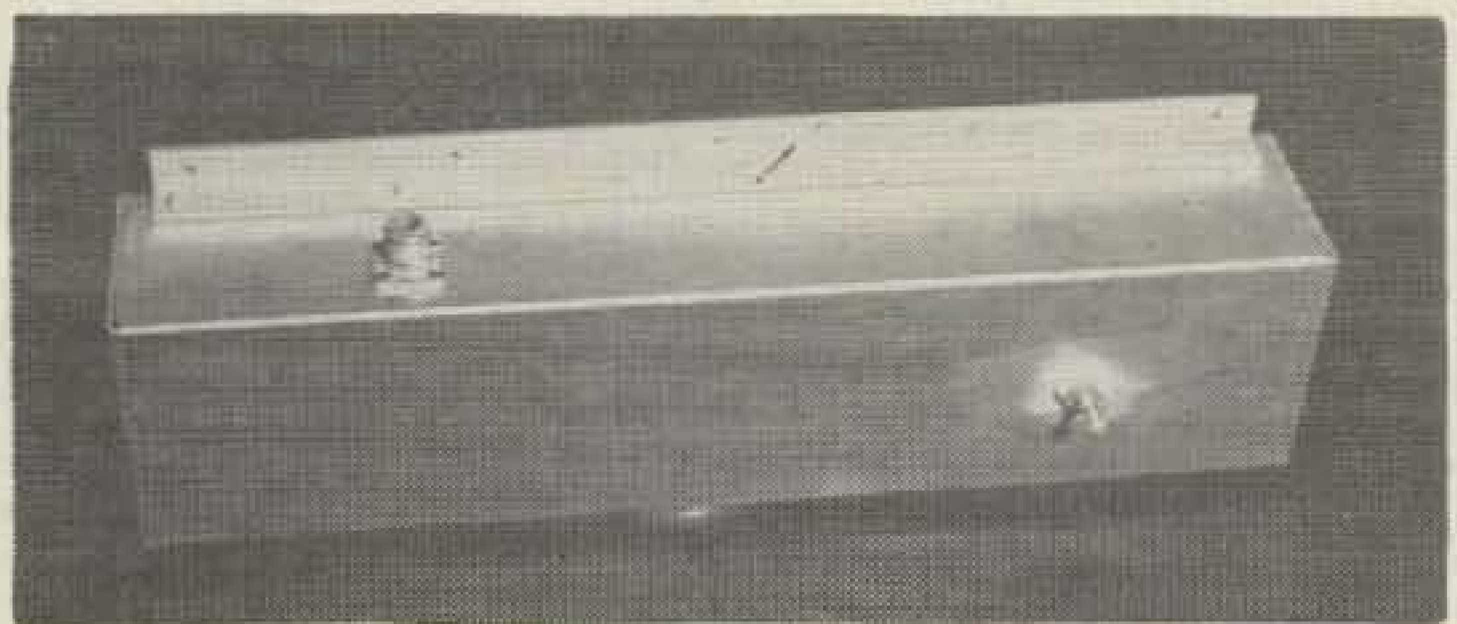
The coupling links are made of 14 gauge wire to coaxial sockets placed 4″ from the end of the enclosure and 1″ from the side. These are placed on opposite sides of the strip line and on opposite sides of the chassis to minimize capacitive coupling. The wire is run about 1¼″ in from the side of the enclosure and the screws to connect the ground end of the link are drilled 1″ from the sides and 1″ from the top and 1″ from the top and bottom respectively. This gives a good match to 50 ohm line, if you use 72 ohm line make the link longer. A 4″ x 17″ sheet of aluminum is used for a cover to seal the cavity.

The next logical step is based on the old proposition that if one is good, two are better. With two instead of one you can either have greater selectivity with optimum coupling, or, if broader coverage is required, they may be broad-banded by overcoupling the units, while still doing a fine job of removing birdies.

The dual unit is easily built, two identical units are constructed with only one coupling link in each. This link is placed on the side of the strip closest to the chassis top. 16″ strips of right angle stock are mounted on the bottom edges of the chassis (actually done with explosive rivet, but screws should do nicely) and holes are drilled so that screws may draw the bottoms of the two units tightly together. (See detail in Fig. 1D.) A thin sheet of aluminum 4″ x 17″ is placed between the two units and forms a common wall between the two filters. A rectangular hole 1½″ x 2¾″ is cut near one end of the sheet. This gives approximately optimum coupling. Larger apertures may be used if overcoupling, and thus broadbanding is desired. Since the partition is merely a thin sheet of aluminum stock held in by compression, it is quite feasible to have two sheets, and by merely loosening the screws, remove one sheet and replace it by another, as required. The aperture should be at the cold (link) end of the cavity. The second aperture we use is 2″ x 2¾″, which we found satisfactory for general purpose use. Those who use a larger portion of the band than is in general use in our area might find even larger apertures desirable.

The photographs of the unit give further detail of the construction. The two different coaxial connectors have caused comment and I carefully explain I had a requirement for these two connectors—and I must confess they were luckily the only two in the junk box at the moment. Note the position of the shield in the photograph. The aperture is at the wrong end—these things happen when you aren't around when the photographer goes to work.

As to actual performance characteristics, we don't have a laboratory at our disposal, but with considerable difficulty we measured response of − 45 db at 125 mc and −70 db at 165 mc. The insertion loss is about .3 db with the smallest aperture and less with the larger—so small the fellow at the other end will never miss it.

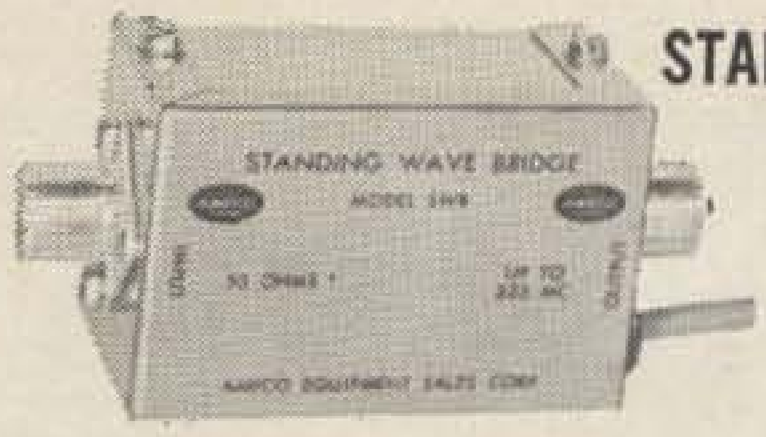


Top Detail—the five clamping screw holes are shown and the tuning screw detail is shown.

The end product is a high Q resonant filter which is constructed of readily available materials and needs no tools more exotic than a hacksaw! In actual operation it has effectively disposed of the effects of a local FM station (3 blocks is local and then some!) and a TV sound birdie I used to swear at. It has been tried at other locations and does an effective job of eliminating an assortment of unwelcome intruders.

Lest you jump to the conclusion that it is a cure-all for the entire range of birdies, it unfortunately does nothing for offending signals which do not come in via the coax from the VHF beam. You still need effective shielding between the converter and the receiver, for no amount of pre-converter filtering will help if the signals are coming into a poorly shielded receiver. Another point on birdie elimination is to use your low frequency high pass filter between the VHF converter and the station receiver. This helps keep harmonics of the receiver oscillator (or oscillators) out of the converter.

. . . W3TUZ



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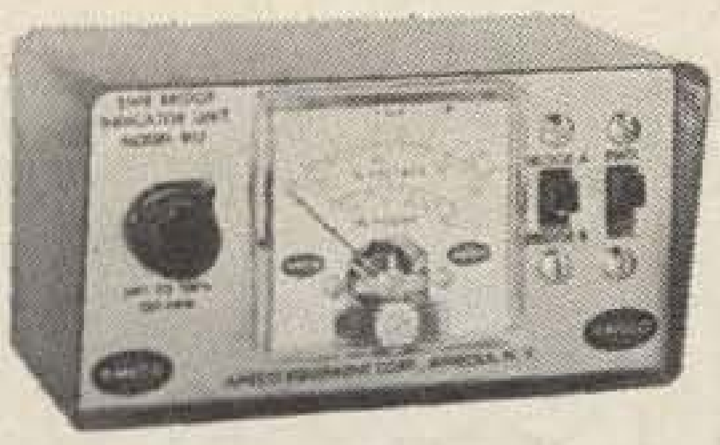
High quality bridge accurately reads SWR's from 1.8 to 225 mc. (including ham, CB and commercial bands). Can handle up to 1 KW. Uses inductive coupling and can be left in the line continuously without insertion loss. Contains two SO-239 VHF connectors. Satin copper case, 1⅝" x 2¼" x 4½". Wired and tested. **$9.95**



AMECO MODEL BIU BRIDGE INDICATOR UNIT

Model BIU, when used with the Ameco SWB or other make of bridge, will accurately read SWR, percentage power and percentage voltage (3 scales). Contains a sensitive 100 microampere 2⅛" D'Arsonval meter. Unique switching circuit provides for reading either one of 2 bridges. Charcoal grey cabinet with satin copper panel, 2¾" x 5" x 3". Wired and tested. **$15.95**

AMECO MODEL CSB CONVERTER SELECTOR BOX

Model CSB makes bandswitching possible with several VHF converters. 4-position selector switch allows user to switch any one of up to 3 converters or connect the receiver directly to the low band antenna. Both RF and power are automatically switched. Can be used with Ameco or other makes of converters and power supplies. Available in kit form only, with all plugs and cables. Size: 2" x 2½" x 4½". **$9.95**

CLEGG 99'er 6 METER TRANSCEIVER

A true ham station, ideal for both fixed station and mobile operation. Double conversion superhet gives you extreme selectivity and freedom from images and cross modulation. Transmitter section has an ultra-stable crystal oscillator which also may be controlled by external VFO. Efficient, fully modulated 8 watt final works into flexible Pi network tank circuit. Large S meter serves for transmitter tune-up procedure.
Amateur net price $159.95.

ZEUS and INTERCEPTOR also in stock.

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Shown approx. actual size.

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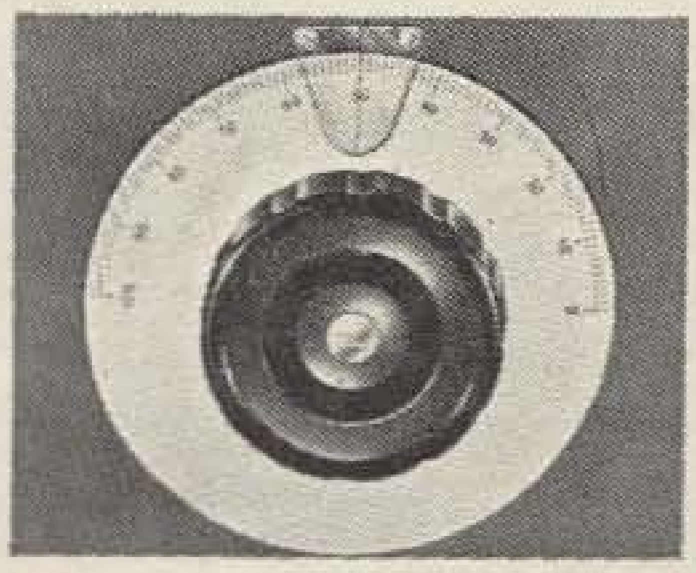
Another superb product of Jackson Bros. of England. 4" dia. dial with 6:1 ball drive ratio. Fits standard ¼" shaft. For that velvet touch...
Amateur net $3.95



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VERSATILE MINIATURE TRANSFORMER

Same as used in W2EWL SSB Rig—March, 1956 QST. Three sets of CT windings for a combination of impedances: 600 ohms, 5200 ohms, 22000 ohms. (By using center-taps the impedances are quartered). The ideal transformer for a SSB transmitter. Other uses: interstage, transistor, high impedance choke, line to grid or plate, etc. Size only 2" h. x ¾" w. x ¾" d. New and fully shielded.

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Treasures in the Junk Yard

Floyd O'Kelly W5VOH
418 E. Hickory
Midland, Texas

WOULD you like to have a good quality broadcast receiver with excellent sensitivity, selectivity and stability, plus a fine push-pull audio output—for ten to fifteen dollars? This may seem like quite an order, but you can find these bargains piled abusively in the corner of one of your local automobile wrecking yards. These unfortunate victims of our modern society are the automobile receivers that were removed from the mutilated bodies of discarded cars.

"That's all well and good," you say, "but I've already got a radio in my car—what do I want with another one?"

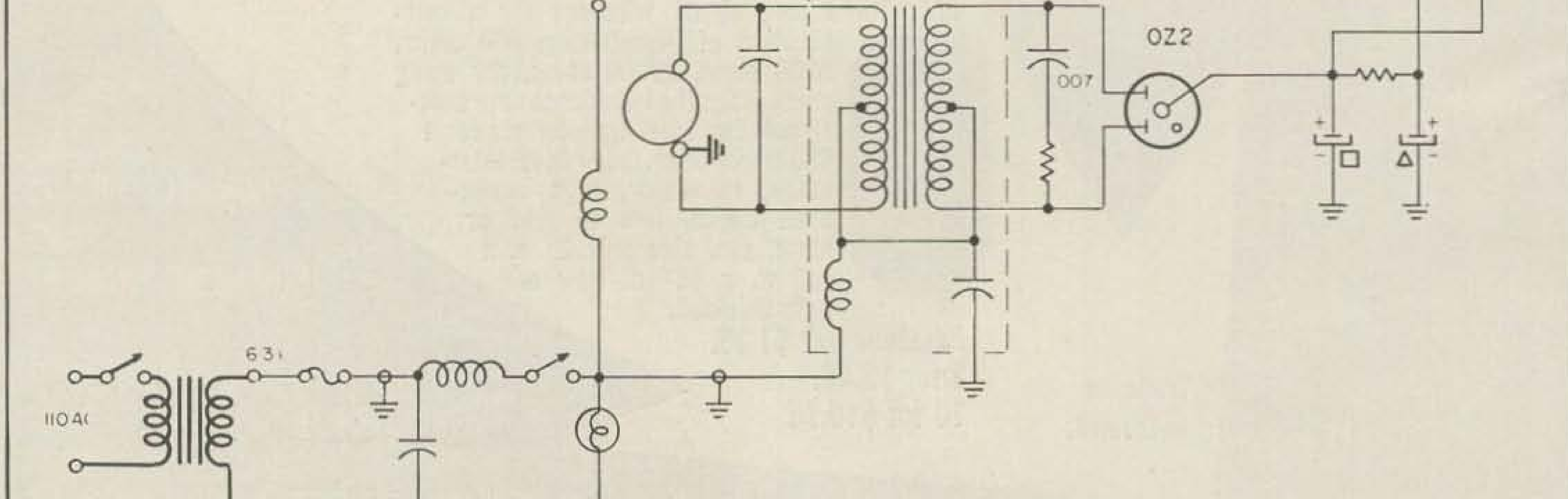
These ruggedly constructed units that perform so faithfully under the extreme conditions associated with mobile operations, may be retired to the home or shop and converted to 110 VAC operations in about five minutes.

"Why bother with all this converting jazz when for about $19.95, I can get one of those new plastic case jobs down at the corner drug?"

I believe you can answer your own question if you will make an eyeball comparison of the construction and schematic diagram of a popular ac-dc receiver and auto receiver. Besides having tuned rf amplifier stage (almost unheard of in the ac-dc sets), and selectivity from the 262 kc *if*, most automobile receivers have a good push-pull audio output. I have priced these units across West Texas and find they cost as little as a "saw-buck" to about fifteen dollars each—depending on condition, age, type, and whether it is still in the car. The one I have was removed from a 1951 Mercury and was purchased for $1.50. It would not utter a sound when we tried it at the wrecking yard, but after examining and smelling it for a while, I parted with my buck-fifty, tucked the dusty box under my arm and headed for the nearest service station to blow the dust and crud from my prize.

Troubleshooting disclosed that only a burned out 6SN7, OZ4 and vibrator needed replacing to restore the unit to its original condition. And, using a battery eliminator as a six volt source, I let it play for a couple of days to see if anything would break down.

It became apparent that the battery eliminator was fine for test purposes, but was not the most convenient arrangement for a permanent installation. The general consensus of opinion from the local "electronic experts" was to remove the vibrator power supply and replace it with a conventional 110 vac power supply. But finding a transformer that would fit in the allocated space seemed to be an impossible assignment. I had resorted to constructing a complete external power supply when I got into a discussion of the problem with my good buddy Ike Searles W5SMJ. Ike

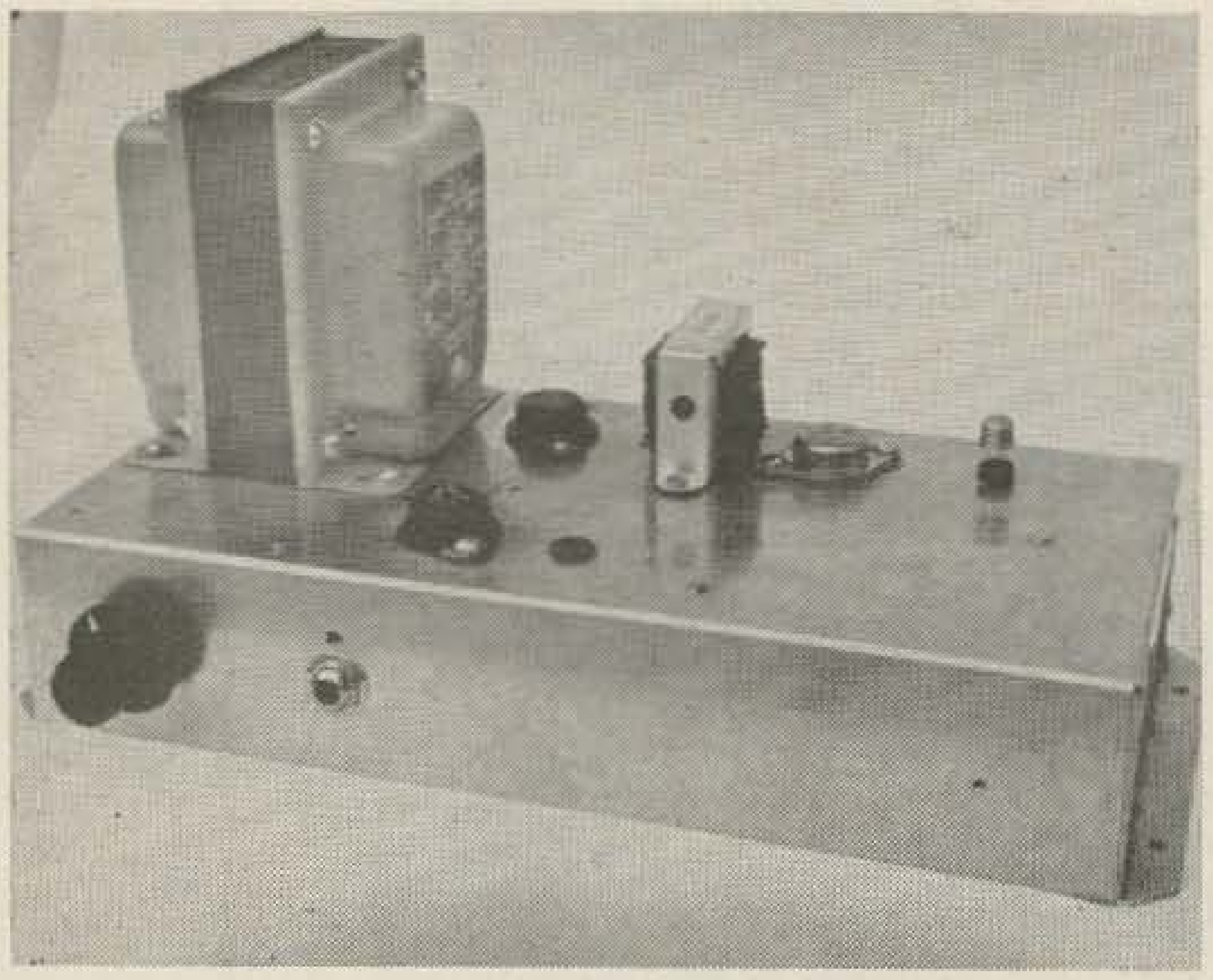


felt that the six volt-one hundred cycle power transformer probably had enough iron in it to handle a 60 cycle power source, and all that should be necessary would be to apply a six volt ac supply across half of the vibrator transformer.

A quick look at the basic six volt vibrator power supply schematic showed that the function of the vibrator was to switch six volts dc between the ends of the primary of the high voltage transformer at approximately one hundred times a second and make the transformer believe it's looking at a six volt ac source. It was obvious that all that was necessary to make the vibrator transformer operate would be to place a six colt ac source across half the primary. This conversion is very simple. Remove the vibrator from its socket, ground one of the small pins on the vibrator socket, connect one lead from the secondary of a six volt transformer of adequate current rating to the receiver power input line (usually around six to eight amps—the one I used was an old TV transformer that had an open high voltage winding) and ground the other six volt transformer lead to the receiver chassis. Plug in the primary leads to a 110 ac source and sit back and enjoy reception from a receiver that will compare to one in the $75.00 or better class.

Norm, W5GOS, made the above conversion, placed a converter on the front end and used it as a portable ham receiver. I have assisted several of my non-technical friends convert and install these units in cabinets, kitchens, bed headboards, etc., and to date no problems have resulted.

So, if you are looking for a second receiver, a conelrad monitor, or a portable rig, try this simple conversion and I believe you will be as pleased as I am with mine. . . . W5VOH



Lester Earnshaw VE7QL
7169 Agate St.
Alta Loma, California

A Low Current, Slide Bias, Modulator

TRANSISTORS have been with us long enough now to have found their way into most AM mobile equipment, especially in the audio department. Although this has resulted in a major saving in battery current, no one is adverse to even greater savings. This is especially true when the increased saving is effected without further circuit complication.

The modulator described below delivers 40 watts of audio to the load. Yet, during the no signal condition, total current drawn from the battery is only 250 ma!

The microphone pre-amplifier consists of a Motorola 2N1181 which is connected in the common emitter configuration. This stage should be driven by a dynamic microphone. If a ceramic or crystal microphone is preferred it will be necessary to insert a matching stage between the microphone and the pre-amplifier. Transistors other than the 2N1191 may be used without circuit alteration. Those tested and found satisfactory were the T.I. 2N1381, the Philco 2N1478 and the RCA 2N408.

The 2N1191 drives a class A Motorola 2N555. The 2N555 is a very inexpensive experimenter type transistor. Other equivalent transistors should give similar results. The 2N555 stage has its bias controlled by the following class B modulator stage. As the signal level increases so does the bias on the 2N555 stage increase. The 4.7K forward bias resistor allows a small bias current to flow so that the transistor is operating class A even for small signals.

Following the sliding bias stage are two Motorola 2N1554 transistors. These transistors

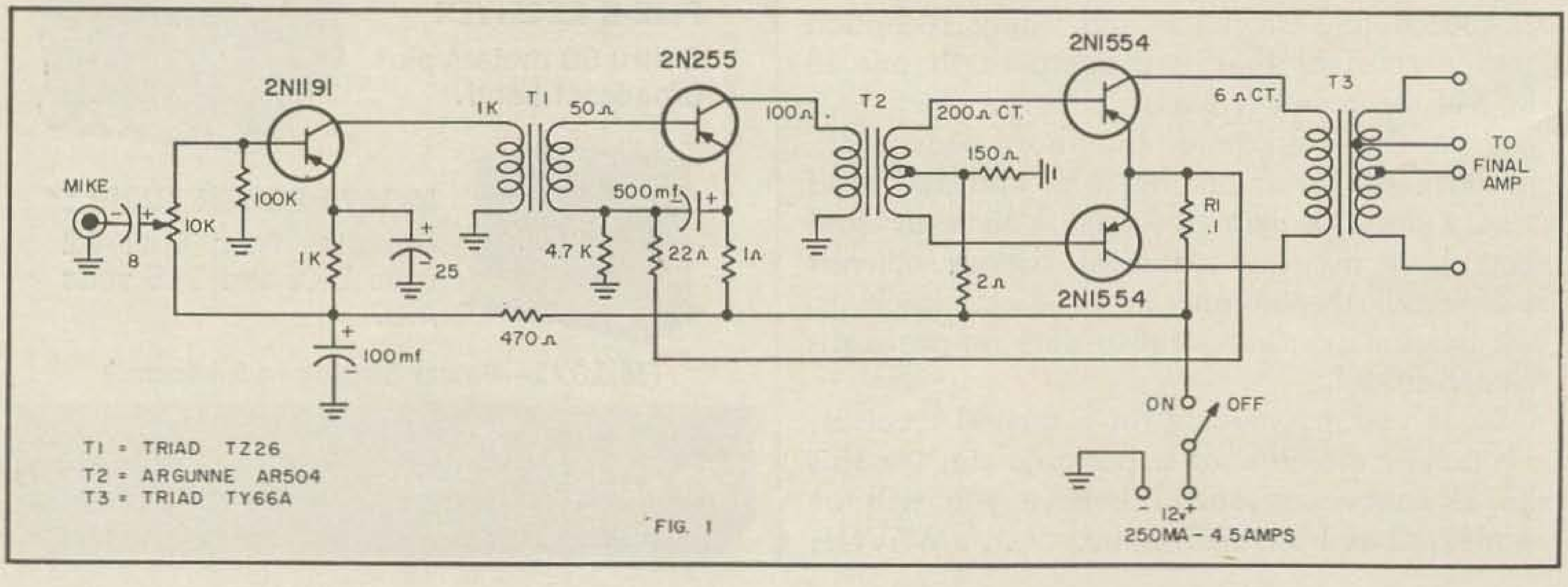


FIG. 1

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4 VERSATILE MODELS, A.C. or D.C.
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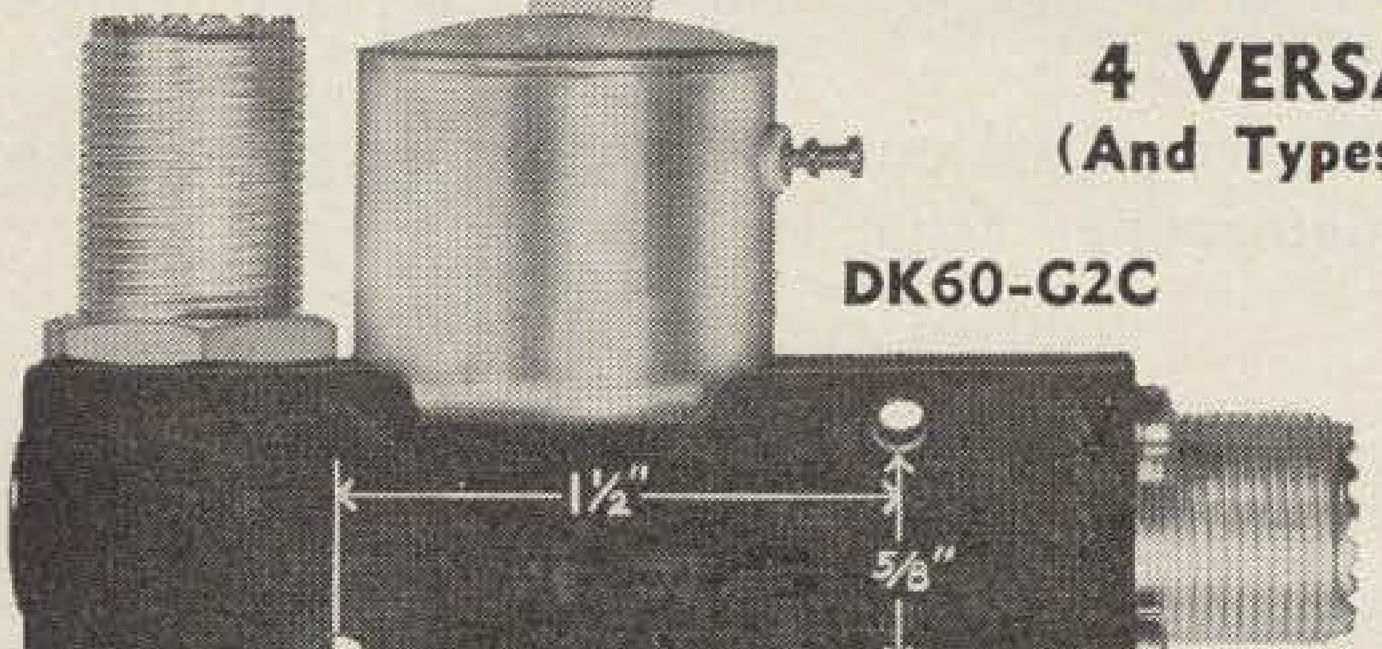

DK60-G2C

Size 2¾x3¾x1⅛ Less than 9 oz.

STANDARD RELAYS WITH TYPE UHF CONNECTORS INCLUDE:

- DK60—SPDT r.f. switch.
- DK60-G—SPDT r.f. switch with special "isolation" connector in de-energized position.
- DK60-2C—SPDT r.f. switch with DPDT auxiliary contacts.
- DK60-G2C—SPDT r.f. switch with DPDT auxiliary contacts and special "isolation" connector in de-energized position.

DK60 SERIES from $12.45

★ All Relays in weatherproof boxes for exterior installation.

★ Ganged, multiple position switch arrangement available for remote control selection of antennas.

r.f. SPECIFICATIONS:

Low VSWR: less than 1.15:1 from 0 to 500 mc. **Low Losses:** Pure silver contacts. Parts in crucial positions plated with fine silver. **Low Cross-Talk:** (greater than 80 db) in DK60-G and DK60-G2C through use of patented "isolated connector" (in energized position). **High Power Rating:** (a) 1 kw through straight connectors (b) to 10w through "isolated connector" — excellent for video switching. **SPDT r.f. Contacts:** r.f. leakage extremely low, below typical r.f. connectors.

MECHANICAL SPECIFICATIONS:

High Contact Pressures: Long life expectancy greater than 1 million operations. **Continuous Duty:** Teflon feed-through terminals used on coil to provide connection ease.

ELECTRICAL SPECIFICATIONS:

Wide Variety of Coil Voltages: 6,12,24,32,48,110,220 D.C. coils at 2.0 watts; 6,12,24,110,220 A.C. volts at 6 volt-amps, 50-60 cps. (Special voltage or resistance available on request.) **Less Than 50°C Temperature Rise Above Ambient:** Maximum operating temperature is 100°C except on special order. Auxiliary contacts available for power control — DPDT at 5a. 110 v A.C. on DK60-2C and DK60-G2C.

DOW-KEY NEW DK2-60 DPDT r.f. SWITCH

For switching two coaxial lines simultaneously. Specifications similar to DK60 series.

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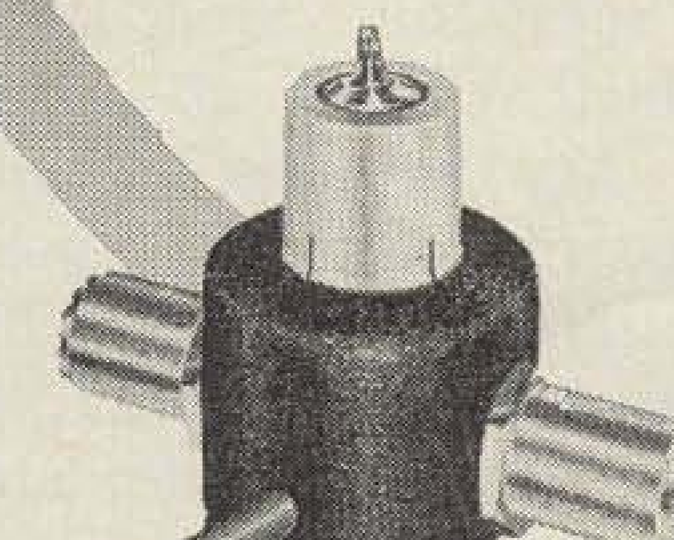

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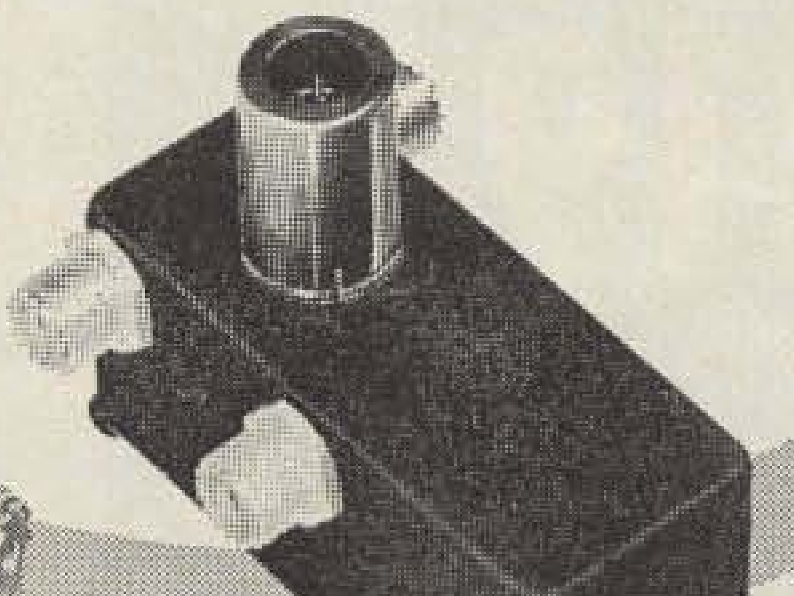

DKC-TRP COAXIAL ELECTRONIC TR SWITCH

Operates in 1.8 to 30 mc. range, 120 v. A.C. Low VSWR, TVI proof, rated maximum legal power.

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DKC-71 SINGLE POLE SIX-THROW COAXIAL RELAY

REMOTE SELECTION OF R.F. SOURCES

Weatherproof, electro-magnetic, less than 1.2:1 VSWR at 100 mc, 1 kw power rating, available in UHF, N, BNC, TNC & C connectors. Continuous duty, over 1,000,000 operations. 5-¾" x 2-⅜", silver plated connectors.

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are excellent for this purpose which is something that cannot be said for a good number of other transistors. A perusal of the 2N1554 I_c–E_c curves show that the transistor has very even spacing between the base lines which indicates that the 2N1554 is capable of excellent linearity. If other transistors are substituted, only those with good linearity characteristics should be used or distortion will result. Another Motorola transistor which gave excellent results (although a smaller transistor) was the 2N1540. If full output is required from the modulator, the builder is advised to stick with the 2N1554 even though it does cost more.

The required output transformer impedance is determined from the formula:

$$R_L = \frac{2\,(V_{ce})^2}{\text{Power out.}}$$

Where V_{ce} = collector to emitter voltage.

Example. $$R_L = \frac{2 \times 12^2}{50 \text{ watts.}} = 5.8 \text{ ohms.}$$

Note that the transformer impedance is calculated to allow 50 watts of audio to be developed. The reason for this is that approximately 10 watts is lost in the transformer. The closest available transformer was the Triad TY66A.

It is pointed out that it will not be possible to develop 50 watts of audio across the primary of the transformer unless the secondary is properly matched. The transistors "see" 6 ohms only when the transformer secondary "sees" the correct load. An incorrect secondary load will reflect an incorrect primary load.

As the class B modulator is caused to draw current (simply by speaking into the microphone), so is a voltage dropped across the emitter resistor R1. This voltage is *negative going* in character and thus, when applied to the base of the driver through the 22 ohm resistor, causes an increase in 2N555 collector

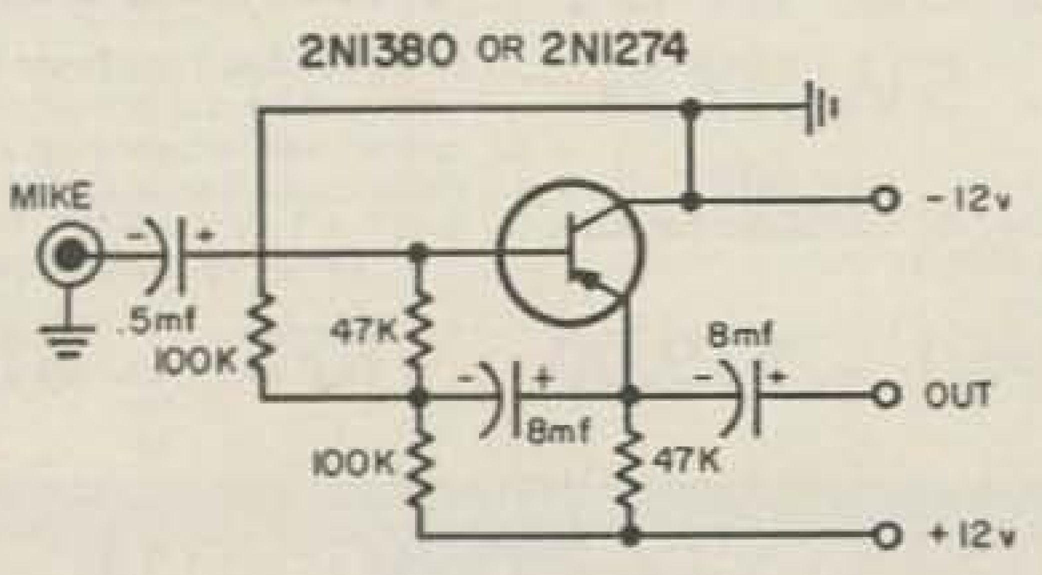


FIG. 2

current. The 2N555 current increases from approximately 50 ma at no signal to approximately .5 amps at maximum signal.

Total current drawn by the modulator during standby is approximately 250 ma. This value will change 20% or so with changes in temperature. If necessary, the 150 ohm forward bias resistor may be raised in value to effect a decrease in the standby current. However, unless a compensating thermistor is added to the circuit, cross over distortion is likely to occur during cold weather.

Maximum current on voice peaks will be between 4 and 5 amps.

A 0.1 ohm resistor is not normally available from a supply store. However, the resistor is easily fabricated from a piece of resistance wire or even copper wire. If the latter is used the correct length may be obtained from a wire table.

The transistors should be firmly mounted to the chassis but insulated from it with mica washers. The chassis should have a reasonable area to dissipate heat generated when talking. Don't forget to remove the burrs from the holes before bolting the transistors down. A piece of fine emery paper wrapped around a flat ruler and rubbed over the area will effect the greatest amount of burr removal.

A suitable matching stage for use with the crystal or ceramic microphone is shown in Fig. 2. The stage may conveniently be mounted in the microphone case if desired.

. . . VE7QL

Amateur Radio Regulations in the U.S.S.R.

January 1962 issue of "RADIO" (published in Moscow) has the following information: There are three kinds of registrations; beginners (3rd Class) are permitted to use 3.5-3.65 mc and 7.0-7.1 mc telegraph only, max. power TEN watts. Phone and CW is permitted on 28.0-29.7 mc (ten watts) and 144-146 mc, 420-435 mc (5 w), 2nd Class is permitted to use in addition 14-14.35 mc, CW with a power of 40 watts on all bands except VHF where it remains 5 watts.

1st Class gets another addition, 21-21.45 mc, power goes up to 200 watts, and both phone and CW are permitted. The VHF, however is still 5 watts.

There is a considerable Red-Tape involved in getting the ticket; several offices have to be contacted, questionnaires filled, photos enclosed, and even "character report" from the place where you are working are needed. Also needed is a complete diagram of your future station, and you can start building it only *after* you receive the license. Examinations are necessary for all groups.

. . . K6BIJ

How's My What?

Edwin Cole W7IDF
P.O. Box 3
Vashon, Washington

THE June issue of 73 pried into my public life with the question "How Is Your Ham Image?" and I promptly fell into a deep sleep. Hours later, my aplomb restored, I clipped a ground lead to my identification bracelet and carefully read K7NZA's disquieting series of examples and admonitions.

Well aware that self-analysis can be painful and invite depressing conclusions, I encouraged myself with the thought, "I'm doing this for my country." Shifting the brain down for hill-climbing usually means clapper-valve trouble in the tummy for me, but "Green's Principle" is a comfort: "Think gently; if you detect elements of great issues stop thinking instantly." This rule has served well to protect my peace of mind and has kept me from learning much about anything—two ways of saying the same thing, really.

After reflecting on what K7NZA had to say I turned for comfort to the June issue of Harper's, a magazine of equivalent calibre in its own field. There I found "Stop Worrying About Your Image" by David Finn, president of Ruder and Finn. Mr. Finn has been selling Image Kits for years to the big operators who mass-produce good things for us, like tail fins, Betsy Wetsy dolls and ugly commercials, and he explains and deprecates his subject with guilty facility. His concluding advice to the bemused iconophile (in this case you and me) is simply, " . . . he should stop worrying about his image altogether and concentrate on finding himself."

Know himself would be more to the point I should think, but be that as it may when Harper's and 73 meet head-on we follow Our Leader, don't we? So I kept right on sulking about my Ham Image until it occurred to me that such shortcomings as those in the 73 article are really only symptoms of a more general failing. An echo down the years helped me to this conclusion, but more about that later, I'm afraid. My point is that we take ourselves too seriously as artisans and not seriously enough as members of the human race.

To the superficially curious non-amateur (most of us were, once) the sounds of RACES, MARS and other activities inspired by patriotism or simple sensitivity to community needs are just not distinguishable from the tired inanities, contest numbers, DX riots, AM-SSB needling and rollicking roundtables. As individuals we sound incomprehensible; as funny license plate types, we seem to be a phenomenon of the electronic era with a common hunger for more and wider kilocycles. These we want for sending code, chatter (English and sideband), telephoning from cars and running spooky typewriters.

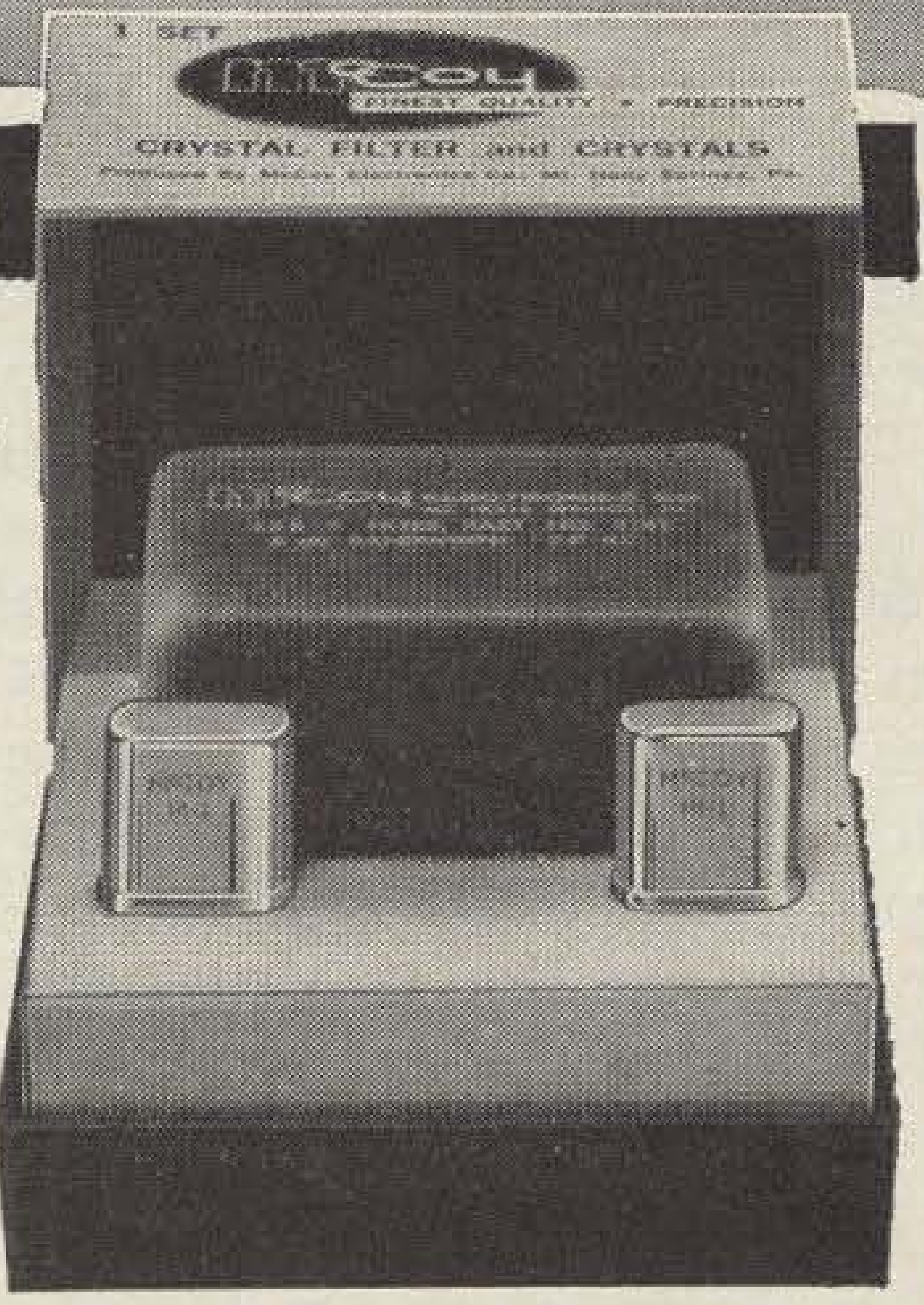
The listener who is too bored or discouraged to pursue the subject might reasonably conclude that our only distinction is a rather pointless virtuosity with our little black boxes. The inference follows that licensing and regulating our operations at public expense is equally pointless, or worse. Although community services, disaster communications nets and phone patches from servicemen to their families are demonstrations of our value that would change such an opinion, as evidence they are overwhelmed by the nonsense on the air. Most of us are aware of this image and we know we can polish it up, but there is another and more serious picture.

Even in our purview recognition of the radio amateur as a veritable human being possessing

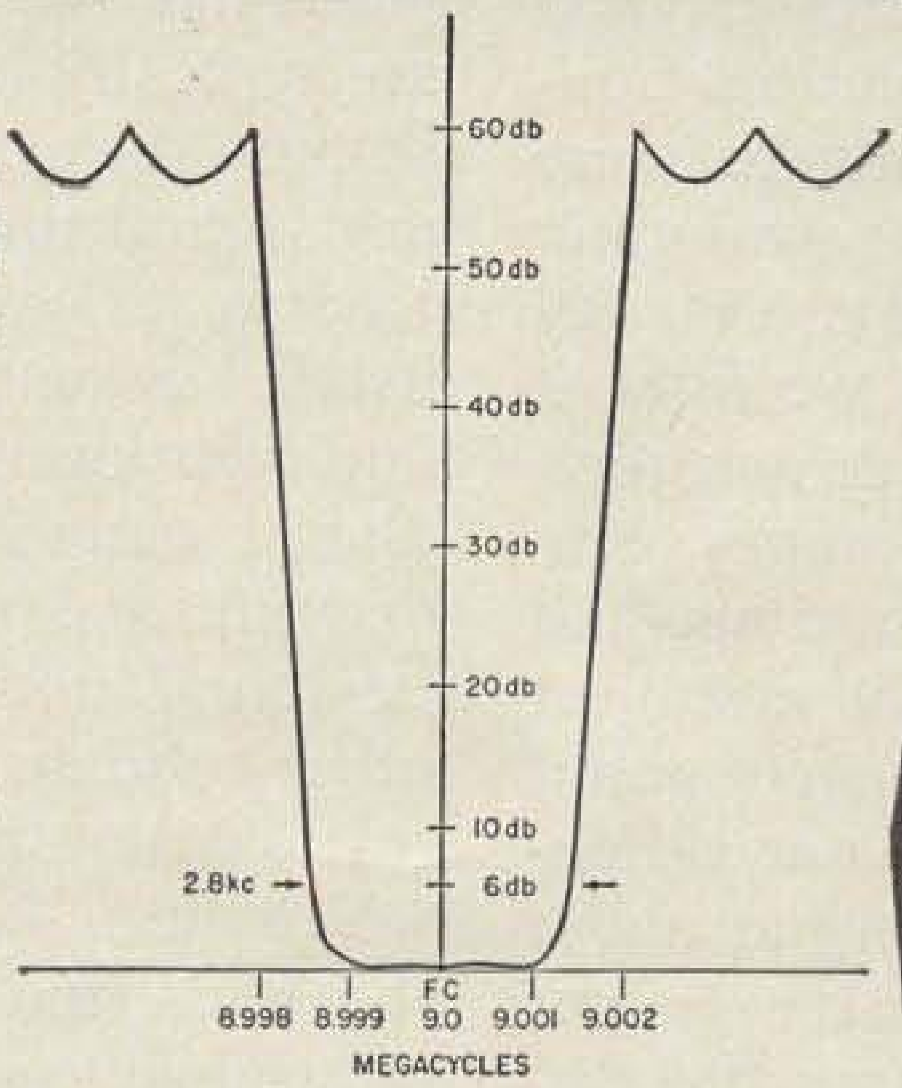
Now! for discriminating amateurs who are satisfied with nothing less than *THE VERY BEST*

McCoy SINGLE SIDE BAND FILTERS

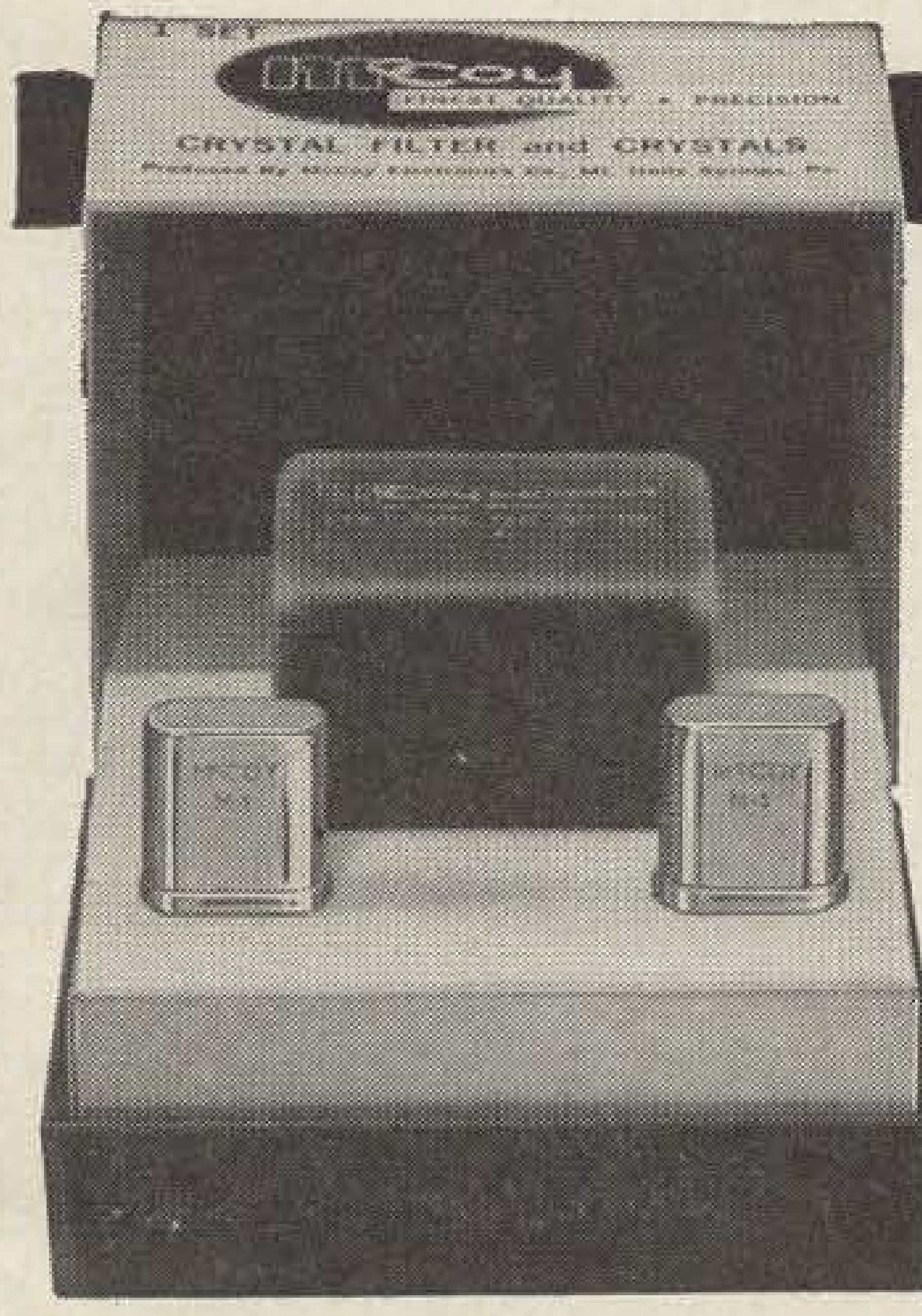
The GOLDEN GUARDIAN (48B1)

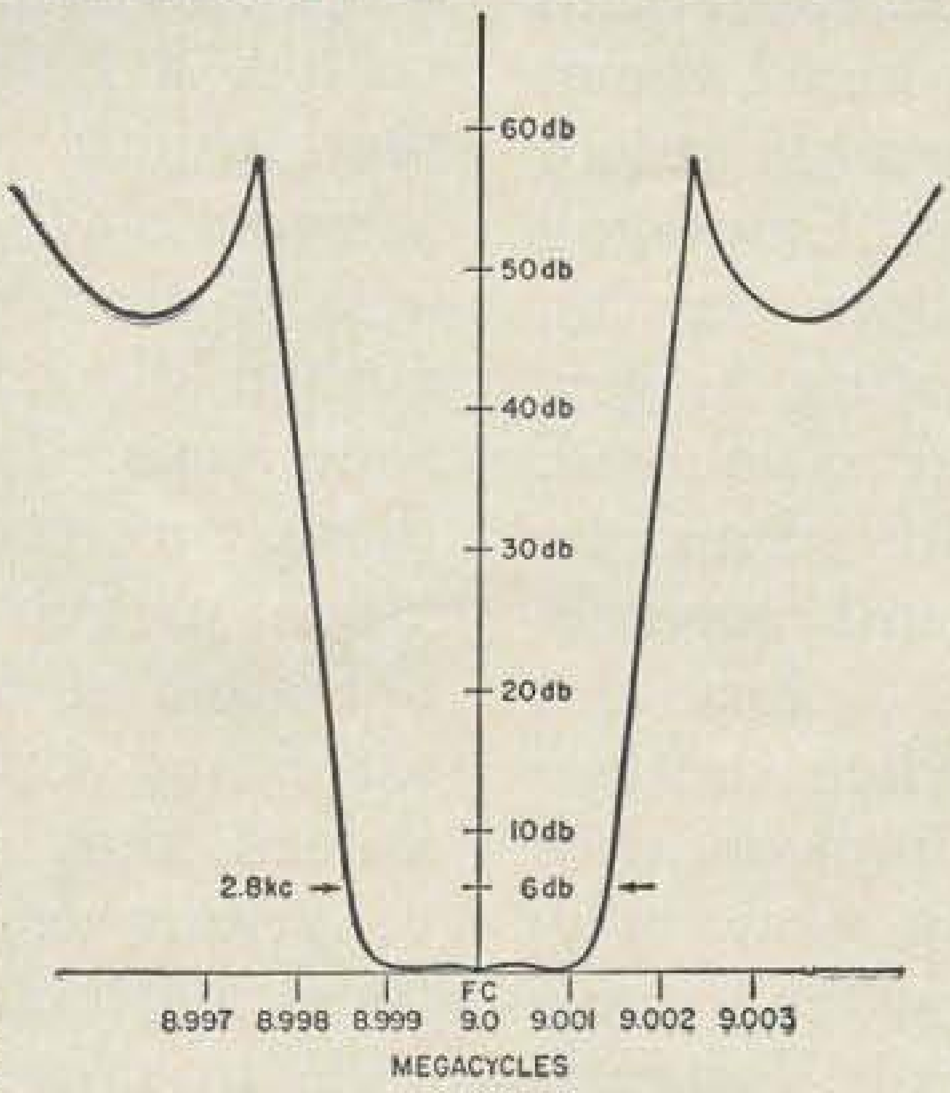


TECHNICAL DATA
Impedance: 640 Ohms in and out (unbalanced to ground)
Unwanted Side Band Rejection: Greater than 55db
Passband Ripple: ± .5db
Shape factor: 6 to 20db 1.15 to 1
Shape factor: 6 to 50db 1.44 to 1
Package Size: 2 7/16" x 1 19/32" x 1"
Price: $42.95 Each



The SILVER SENTINEL (32B1)





TECHNICAL DATA
Impedance: 560 Ohms in and out
Unwanted Side Band Rejection: Greater than 40db
Passband Ripple: ± .5db
Shape factor: 6 to 20db 1.21 to 1
Shape factor: 6 to 50db 1.56 to 1
Package Size: 1 3/4" x 1 1/4" x 1"
Price: $32.95 Each

Both the Golden Guardian and the Silver Sentinel contain a precision McCoy filter and two of the famous M-1 McCoy Oscillator crystals. By switching crystals either upper or lower side band operation may be selected. Balanced modulator circuit will be supplied upon request.

Both sets are available through leading distributors. To obtain the name of the distributor nearest you or for additional specific information, write:

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imagination and intellectual awareness of the influence of his art is rare. Trace elements of international inflection turn up in 73 editorials, evidence that one editor is gambling that our minds have breadth as well as length, but in our journals generally this is a rule observed mainly in the breach (a literary phrase from the June issue of Collier's). The narrowness of scope, editorial inertia and prolix re-hashing of worn ideas in too many issues suggests to me that we are regarded as communication-oriented readers with spines topped by small knobs.

Hopefully I submit that we can be thoughtful about ends as well as means, although the means have been getting all the attention. Consider the potential good of diverting to more productive channels the constant wrangling over filters, modes, linear efficiency, etc. All the answers are in the books, but we fight it out anyway, expending time, airspace and temper usually to fall through the ropes into ambiguity or error. We get deadly serious, and deadly tiresome, for example, about a subject like SSB. Actually there is nothing new about the concept, and nothing to justify our ridiculous quarreling—but if we didn't argue about someone else's ideas we would have to get some of our own. But did you know the discovery of SSB antedates Marconi, Popov and West Hartford? It seems that when the British first sailed to the Treaty Ports of China with empty bottoms and a hunger to fill them with silks and tea, a serious difficulty faced them. How to bargain for the best possible prices with merchants speaking Mandarin, Cantonese and Samshu brogue? One fortuitous day an Englishman was earnestly negotiating in gestures with an amused exporter and to no avail. Eventually one of his gestures misfired and he was taken behind a godown and severely beaten, but that's another story. Before this happened there was a moment when the two principals were standing at an impasse with the Chinese gentleman wondering aloud why the English had such long noses, when a passing urchin whistled a melancholy air. Instantly the Chinese speech was intelligible to the foreigner, although he later remembered there seemed to be a bit of background garbling. At his first opportunity he hired a boy to accompany him on business trips and taught him to crouch behind a tical of tea and whistle softly during the conferences. After a few profitable years the Englishman retired to the South of France. Unfortunately the secret was temporarily lost when he succumbed to apoplexy while trying to inject an air of lucidity into a Basque political speech. Basque is double sideband—a system known to give the SSB men horrible fits.

French scholars brought to light the historical facts above, and if we weren't generally aware of them it is because of the intramural character of our journalism. Little news of the amateur community of foreign lands is published here, I might add, grumpily. And less consideration granted their members. Granted that letters from them are published, that we see snapshots of them in the DX columns and that concern is growing over such problems as cooperation on the DX bands and reciprocal licensing, too much is missing. Their letters are typically legitimate gripes about our members on the air; the captions under their photos are significantly less than expansive: "José Duarte, 90 watts on twenty, three element beam." Sometimes the editor goes overboard and mentions the receiver. If our interest seems almost clinical at least in this area we don't discriminate—the same exciting captions may be found under photos of the home team in other columns. But to continue—on the reciprocal licensing question they've been giving and we've been taking; in the DX slots we have the mass and power; they learn English and occasionally we have the grace to compliment them. In English of course.

Now and again we show our interest by mounting an expedition to a quiet corner of some far country courteous enough to grant visitors a license. The communications effort that results usually demonstrates technical prowess on that end, some surpassing boorishness on this end, and how silent the band can get ten kilocycles offside. I'm sure the traveling Americans who have the initiative to carry out these projects make good impressions individually, but I doubt the citizens view the operation as anything more than a cryptically satisfying activity of Inscrutable America. If, indeed, they are aware of it at all.

Writing as a non-participating ignoramus in these matters, I wonder if it wouldn't be possible to provide a foreign ham or ham club near the target with expense funds and some equipment to do the job, rather than ship the stuff and people from here to there and back again? Perhaps it wouldn't be practical but there is a measure of madness in our fabric anyway, and practicality is the foe of pleasure otherwise parties would break up at midnight in favor of early morning gardening. It's never been my privilege to work a DXpedition, or contribute to one, but if they could be set up this way I'd be inclined to chip in and hope

George would come out of it feeling adequately compensated by the shattering experience and the extra gear. Well, it was just a friendly suggestion, and fortunately there are others around to choose among, such as K6BX's plan to help you send your extra Callbooks overseas and the International Ham-Hop Club Wayne has mentioned in his Porsche department.

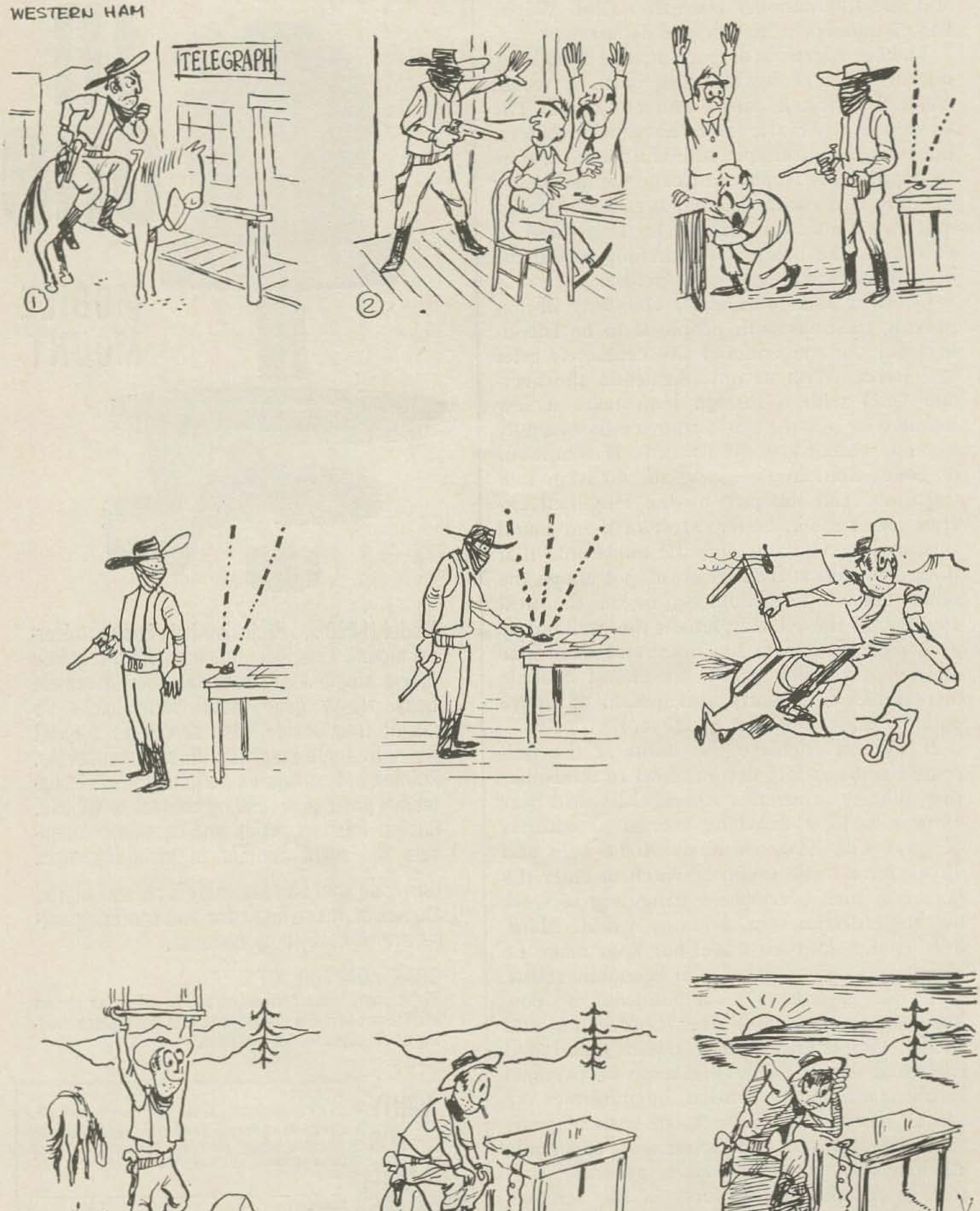
Making friends is important, like breathing, but in times of world crises when it would mean the most it comes under a cloud. The barricades that rise men have seen before, but the cloud is unique and while there is time to improve the American Image we had better get at it. It is our distinction, as radio amateurs, that we have the means to help, and it shouldn't take much soul-searching to see the obligation implicit in our franchise.

Consider this profundity: One way of improving relations with people is to be friendlier. Yet the conventional DX contact is brief and sterile. With us unsophisticates the average QSO with a foreign ham takes a few minutes to run the scale from embarrassingly eager to embarrassingly taciturn. If conditions or congestion interfere we can do it in half the time. And the pros on the long-haul circuits aren't much better. Most of them sound slick and laconic and give the impression that their attention is focused on a spot above the other fellow's left shoulder, or on the next country. In these conversations the preliminary exchange of names, locations and tube size normally is followed by an almost audible mental block, a hearty anticipation of future contacts and a diffident goodbye.

If we can't achieve the status of the tail-coated ambassadors it won't hurt to remember that military cemeteries around the world bear witness to their smashing success as couriers of good will. They could use some help and all we have to do is flip a switch to enter the homes of men everywhere struggling to work out their destinies in a jumpy world. Moreover in the skies we travel our laws make no reference to creed or color or economic status, and our privileged communications flow heedless as the wind over borderlines and battlefields. If this sounds rather grand and rhetorical it's probably my sense of personal involvement, and frustration, bugging me. We are all mortals running out our span of years in mixed moods and circumstances, commonly afflicted with corns and taxes, generally content to search for happiness in the achievement of reasonable ambitions. Individually we want peace and justice; nationally our govern-

(More on page 71)

WESTERN HAM



Improved Grounded Grid Operation

Paul Barton W6JAT
14666 Berry Way
San Jose, California

GROUNDED grid linear amplifiers have been popular for some years. The reasons are varied and numerous.

Many hams originally went to grounded grid for reasons of stability. Due to the relatively high drive requirements, a grounded grid stage is less prone to driving itself (taking off) from stray feedback. Of course, at any frequency that the grid is not at ground rf potential, the stage is no longer a grounded grid stage, but an unneutralized rf amplifier or, more likely, an oscillator. So great care must be exercised to be sure the grid is truly grounded for all the frequencies involved—usually to about 100 mc for 2-30 mc work.

Grounded grid amplifiers are degenerative, which, like inverse feedback, makes for better linearity. Pentode and tetrode tubes are not as linear in their characteristics as a good triode can be, but have better gain capabilities. A grounded grid tetrode with the usual plus voltage on the screen (preferably clamp tube controlled) can have linear characteristics approaching that of a good triode but better gain than a triode.

Examination of Fig. I reveals that a grounded grid amplifier presents only a half wave load to the exciter, due to the diode action of the amplifier tube from cathode to grids. This means the exciter is not loaded on the positive peaks of excitation and results in exciter distortion, which is then amplified by the final.

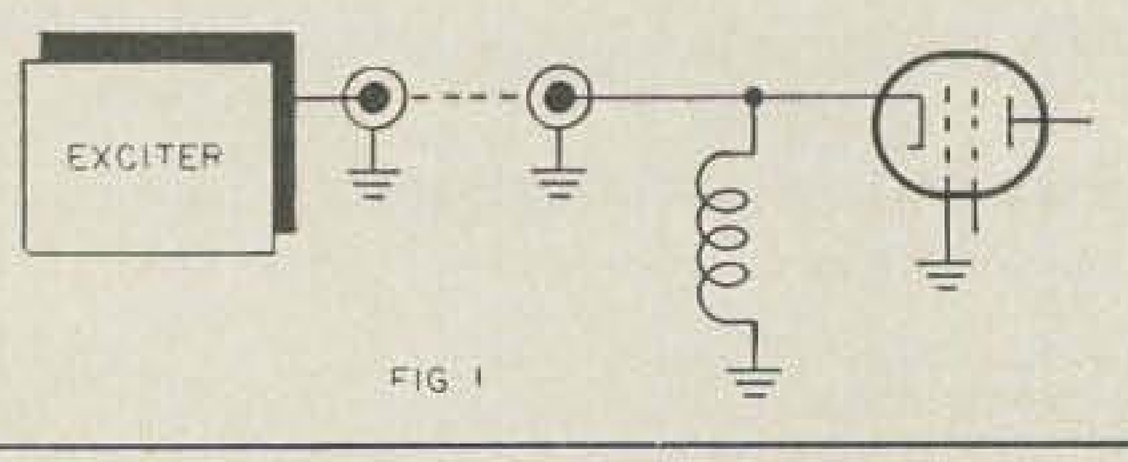


FIG 1

This distortion is not a high order of distortion. It is probably below the level that can be detected by ear, but is very real when low order distortion products are important.

For instance, in commercial applications, where both high and low sidebands are being used simultaneously for separate communications, the distortion products from the opposite side band should be down not less than 60 db.

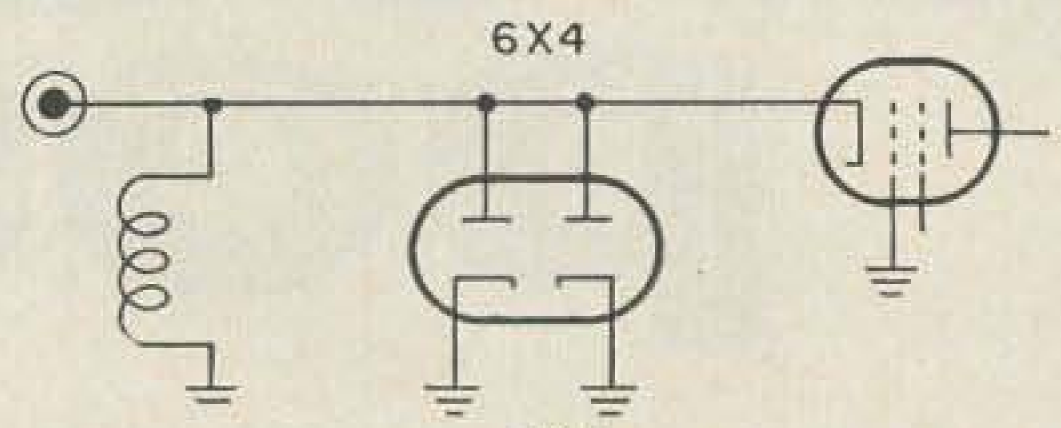


FIG 2

Preferably much more. At 6 db per "S" unit, a common figure on communications receivers, a 30 db over S-9 signal with 60 db suppression would have S-4 distortion products on the other side band. This might be tolerable in critical work but only barely so.

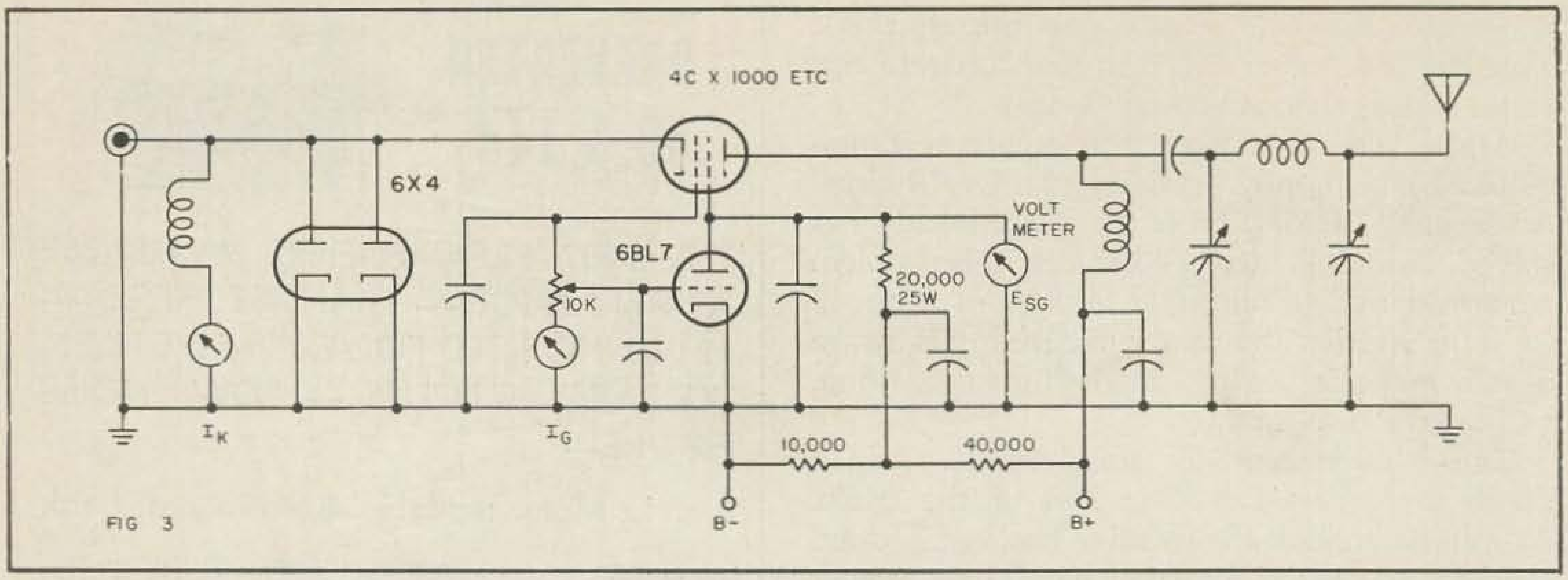
Some commercial applications have found grounded grid unsatisfactory for this reason. In at least one instance (not limited to a KW input) they went to a high powered class "A" amplifier to get away from diode distortion.

On today's market are numerous fine SSB exciters having 50 to 100 watts output. Dissipating this power into the cathode of a grounded grid stage is a natural, and is one of the reasons this is often done. But this can spoil the otherwise excellent suppression of a good exciter. The Collins KWM-2, etc., is an excellent example. This could be used to drive two 4CX300A tubes in parallel in grounded grid. However, instability and TVI in the exciter have been commonly experienced when this was tried. (This is strictly the voice of experience speaking. Please pass the aspirins). This has been experienced in four separate rigs to this writer's positive knowledge.

At the Jennings plant the amateur station (K6LSZ) is happily presided over by "Buddy" Alvernaz W6DMN. Over the years Buddy has solved many a knotty problem. So this problem was presented to him, and he figured it out in jig time. Neither the writer nor Buddy is aware of anyone else having done this same thing, so it may be a "first."

The solution is really quite simple. Add a diode to rectify the other half of the cycle. As yet no solid state rectifier has been found that is good for rf and will handle the power so a 6X4 was used. No doubt there are many other rectifiers that will do the job, but the 6X4 works OK.

In Fig. 2 a diode has been added to the grounded grid amplifier. This should be wired in as close as possible from cathode to grid. The internal resistance of the 6X4 is low enough to match approximately the usual G-G tubes. The addition of this diode has reduced TVI and exciter instability in each case tried. It has been used in several KW 4CX300W linears, one ½ KW 811A linear and one



4CW2000 linear, all grounded grid. Strangely enough no more excitation is required.

Of course, a push-pull G-G stage would not require this treatment. Also, it is thought that it would be unnecessary if the Q of the tank circuit of the exciter was sufficiently great. However, this is seldom the case. A high Q tuned circuit at the cathode of the G-G linear amplifier would perhaps solve the distortion problem, but would add another control to the amplifier and would be difficult to switch in case band switching was desired. In fact, tentative calculations indicate this value of L & C to be impractical. An L-C with a Q of 30 and seeing a shunt load of 50 ohms would require 26,000 mmfd (.026 mfd) tuning capacity at 3.8 mc.

It should be noted that the 4CX1000 and the 4CW2000 are rated for zero grid current. A consultation with Eimac engineers reveals that there are excellent reasons for this restriction. Futher, this is a very outstanding tube for AB service. So no grid current is neccessary or advisible. Notwithstanding however, at W6JAT a 4CW2000 has been in grounded grid, Class "B" clamp tube, tetrode connected, SSB operation for two years without difficulty. But a 10K grid leak is used to limit the grid currents. On voice, only a fraction of a milliamp of grid current is read on a 2½ ma meter. On tune up, this may go to 1 milliamps for a few seconds. Recently the 6X4 diode was added with the expected improvement.

Buddy has my thanks for another contribution to amateur radio.

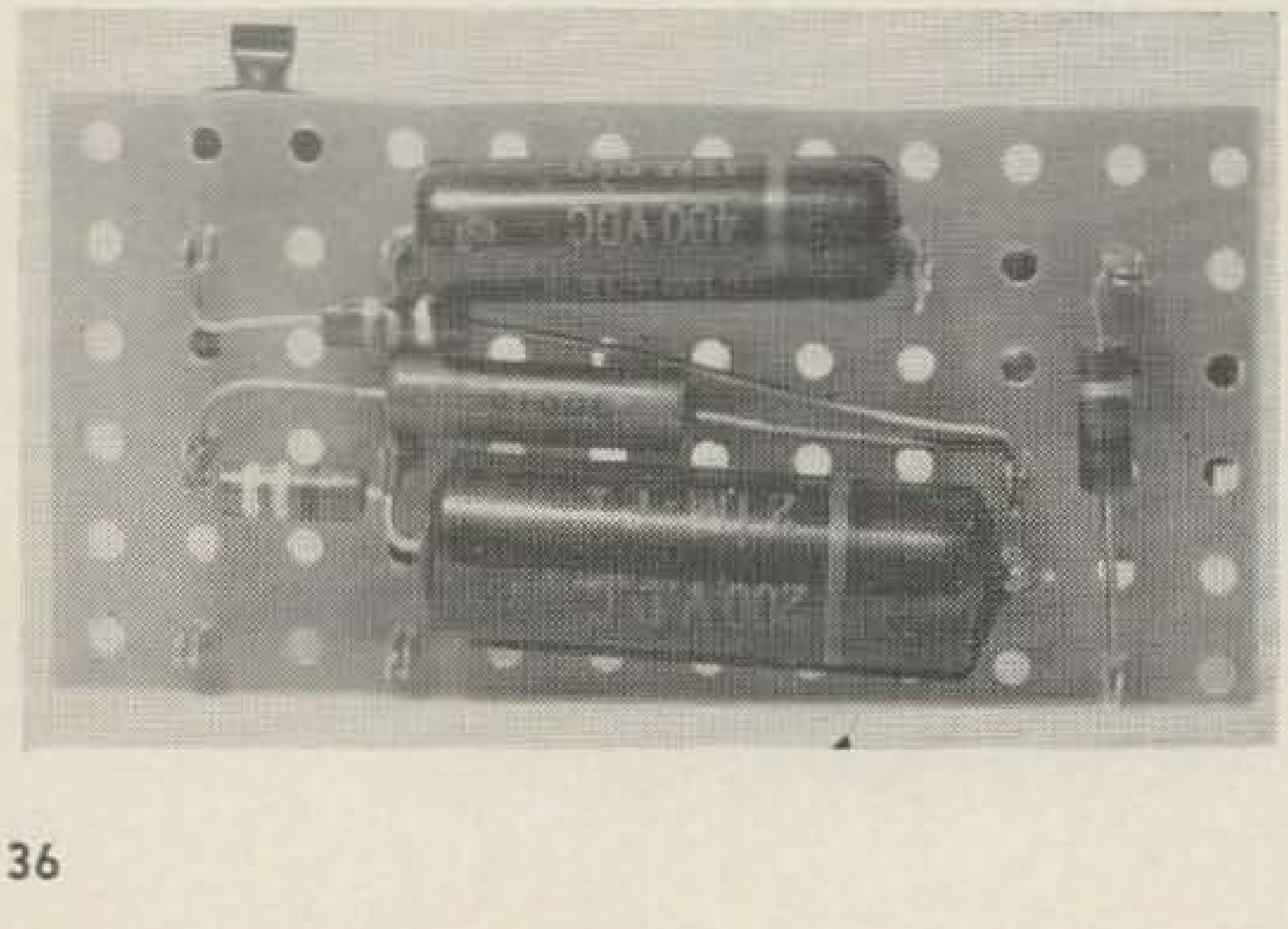
. . . W6JAT

The Rate-of-Change Limiter, Revisited

Or, How To Do It With Diodes

Jim Kyle K5JKX

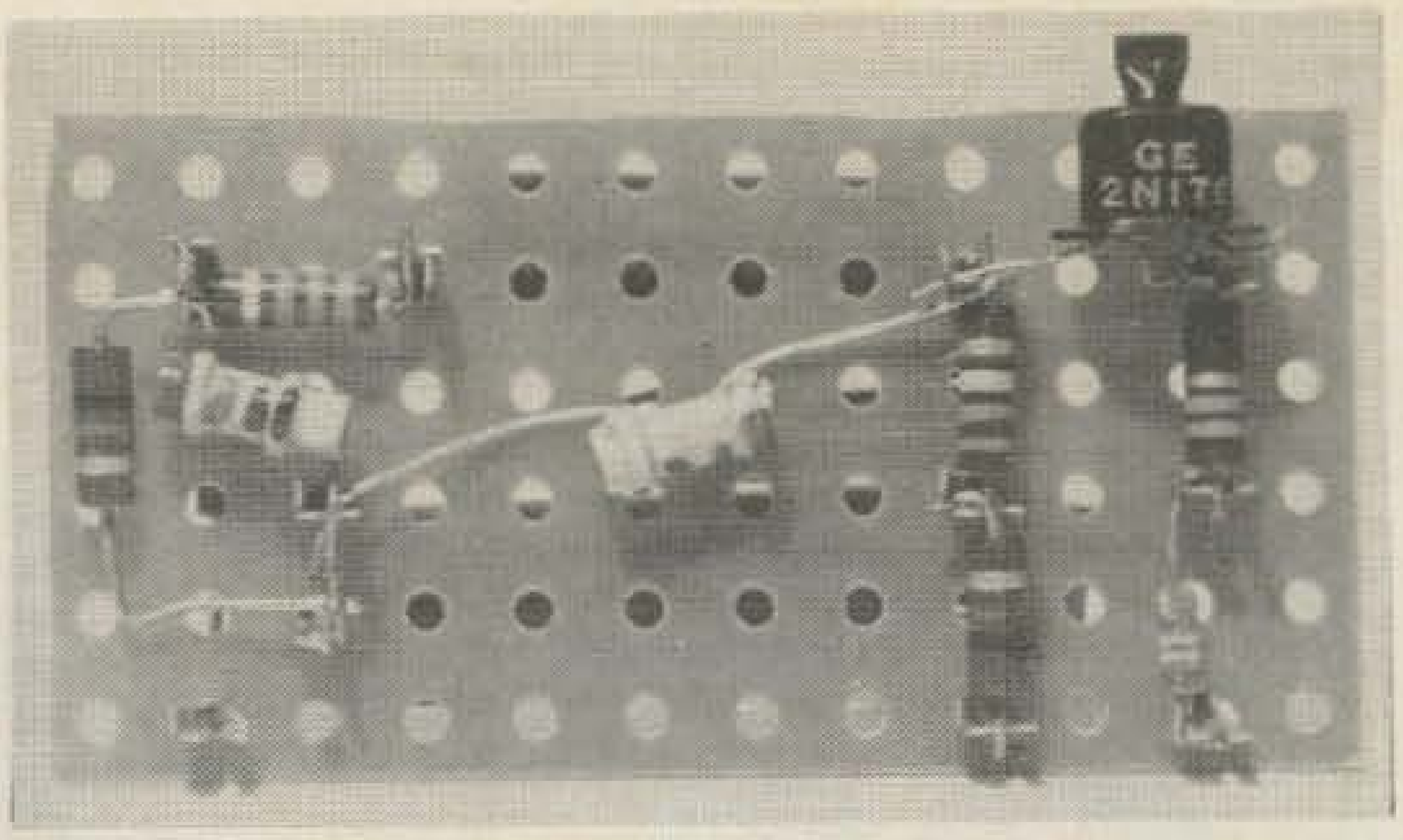
SINCE the rate-of-change noise limiter was described in these pages (A *New* Noise Limiter, page 16, April issue), a number of readers have asked about the possibility of using crystal diodes instead of the vacuum tube employed in the original design.



Despite the negative answers given to the original questioners, it *can* be done—and inexpensively, too! See the photos for proof.

The only objection to crystal diodes in a noise limiter at any time is that most common types have too little back resistance to limit properly. This is especially true of this circuit; the 1N34 and its relatives not only refuse to limit properly, they distort the audio beyond recognition as well.

However, high-back-resistance diodes are available at a price. That fact, coupled with

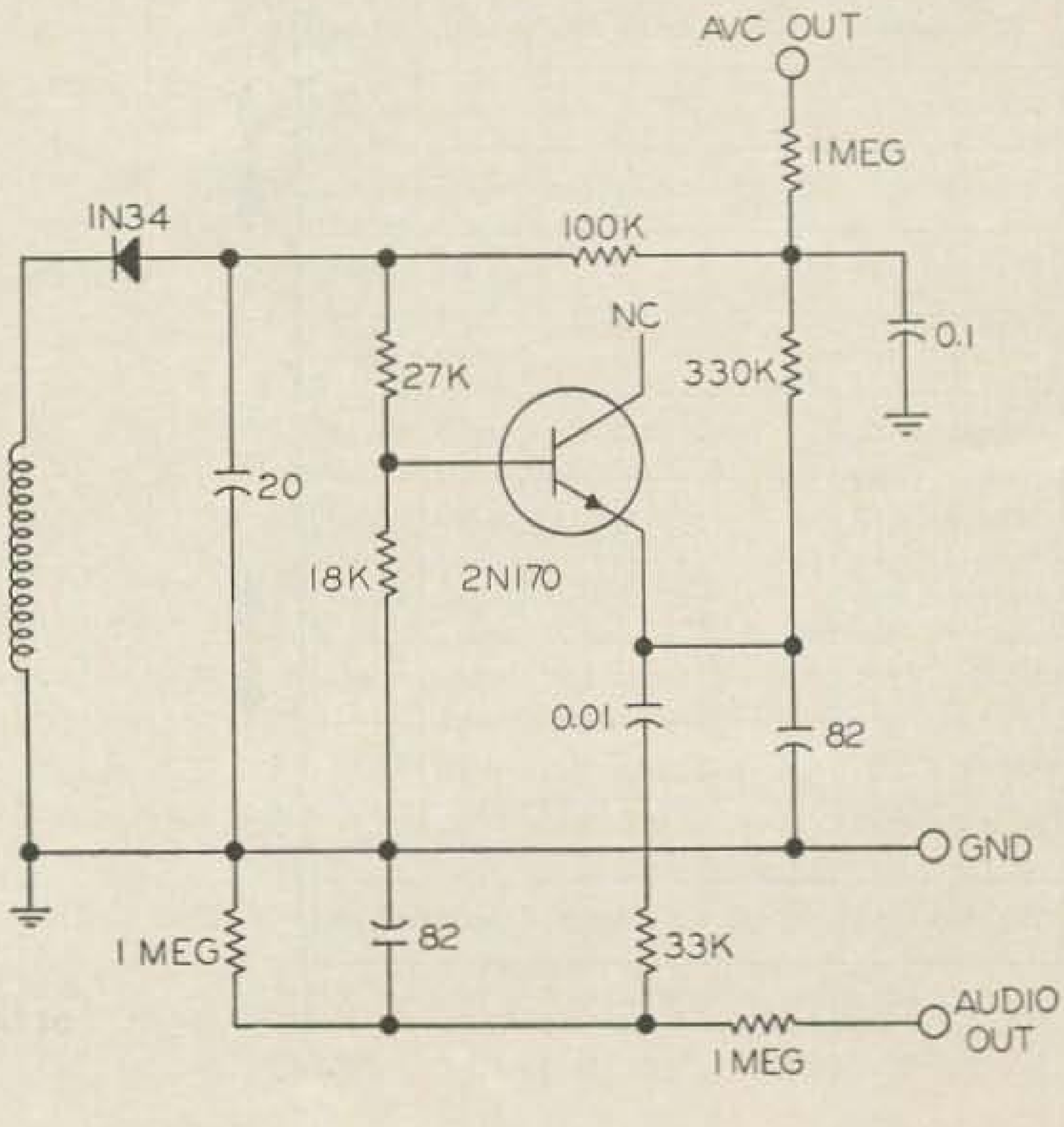


availability of a number of special computer diodes of unknown characteristics, prompted construction of the unit shown on a small piece of Vectorboard, followed by extensive experimentation.

Incidentally, the Vectorboard construction used here is ideal for such a project; the push-in terminals (Vector type 9.4) allow good connections to be made without soldering. This, in turn, allows easy change of components, yet the final working unit is ready to be installed. The unit shown in the photos is the actual breadboard—*not* a prettied-up copy built later!

Since the special computer diodes were available, they were tried first. The only thing this proved was that millimicrosecond switching capabilities and super-high-conductance don't necessarily correlate with high back resistance. Some of the units eliminated noise, but these eliminated the audio too. Others produced excellent audio, but emphasized the noise.

Just before taking $2 in hand and rushing out to buy a 1N497 silicon diode (reverse current ¼ *micro*amp at 50 volts!), an old but not-too-well known trick was remembered. You may have been wondering what the transistor shown in the pictures is doing in the circuit; the mystery is about to be unveiled. So far



as this circuit is concerned, it's not a transistor at all—just a good noise-limiting diode.

It's inherent in junction transistor construction that the emitter-base junction has extra-high back resistance. Your only problem in making use of this fact is in determining which should be considered the cathode: emitter, or base.

The unit shown uses a GE type 2N170 NPN rf transistor; with the NPN transitor, the base becomes the anode and the emitter is the cathode. If a PNP transistor is used, the connections will be reversed.

How does it work? Happily, it performs at least as well as the original vacuum-tube unit, at a great saving in space. Tubular ceramic capacitors were used in the 82- and 20-mmf positions; even more space can be saved by substituting disc ceramics for the paper tubular 0.1 and 0.01 mf units too.

In addition to saving space, eliminating heater-power problems, and getting away from the associated problem of hum, this crystal-diode version of the rate-of-change limiter includes a couple of other features not found in the tube-type model. It provides AVC voltage, and allows you to retain the receiver's original volume control.

The original circuit, developed for use in TV sound channels where AGC is developed from video information, made no provision for AVC. However, the voltage across the 0.1-mf capacitor is suitable for AVC use; addition of the 1-megohm resistor as shown will isolate the AVC line enough to provide perfect operation. If slower release time is desired, capacity can be added to the AVC line, externally to the detector-limiter circuitry.

In the original circuit, also, the volume control value was fixed at 1 megohm; the limiter must still see a 1-megohm load impedance, but this is now provided by a fixed resistor across the output and the existing volume control is isolated by another 1-megohm resistor in series. The series resistor causes 6 db audio loss, but this is seldom serious.

For testing, the semiconductor limiter was installed in a vintage Super-Pro; the AVC line for the Super-Pro *if* strip was disconnected and reconnected to the limiter AVC takeoff. Under these conditions, 8 volts of AVC voltage were developed on the strongest signals; detector overload proved impossible; distortion was not detectable by ear; and, finally but far from least, ignition noise and other "sputter" went away as if a switch had been thrown when the limiter was cut into the circuit.

NOTE: Vectorboard and the type 9.4 terminals are available directly from Vector Electronic Co., 1100 Flower Street, Glendale 1, Calif., if your favorite distributor doesn't stock them. Write to Mr. Floyd Hill, general sales manager, and tell him you saw it in 73.

. . . K5JKX/6


Go Linear...
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Quad Mode Monitor

Part I of this article, published last month, went into details on the design and operation of this receiver. Now for the construction details.

John Wonsowicz W9DUT
4227 North Oriole Avenue
Norridge 34, Illinois

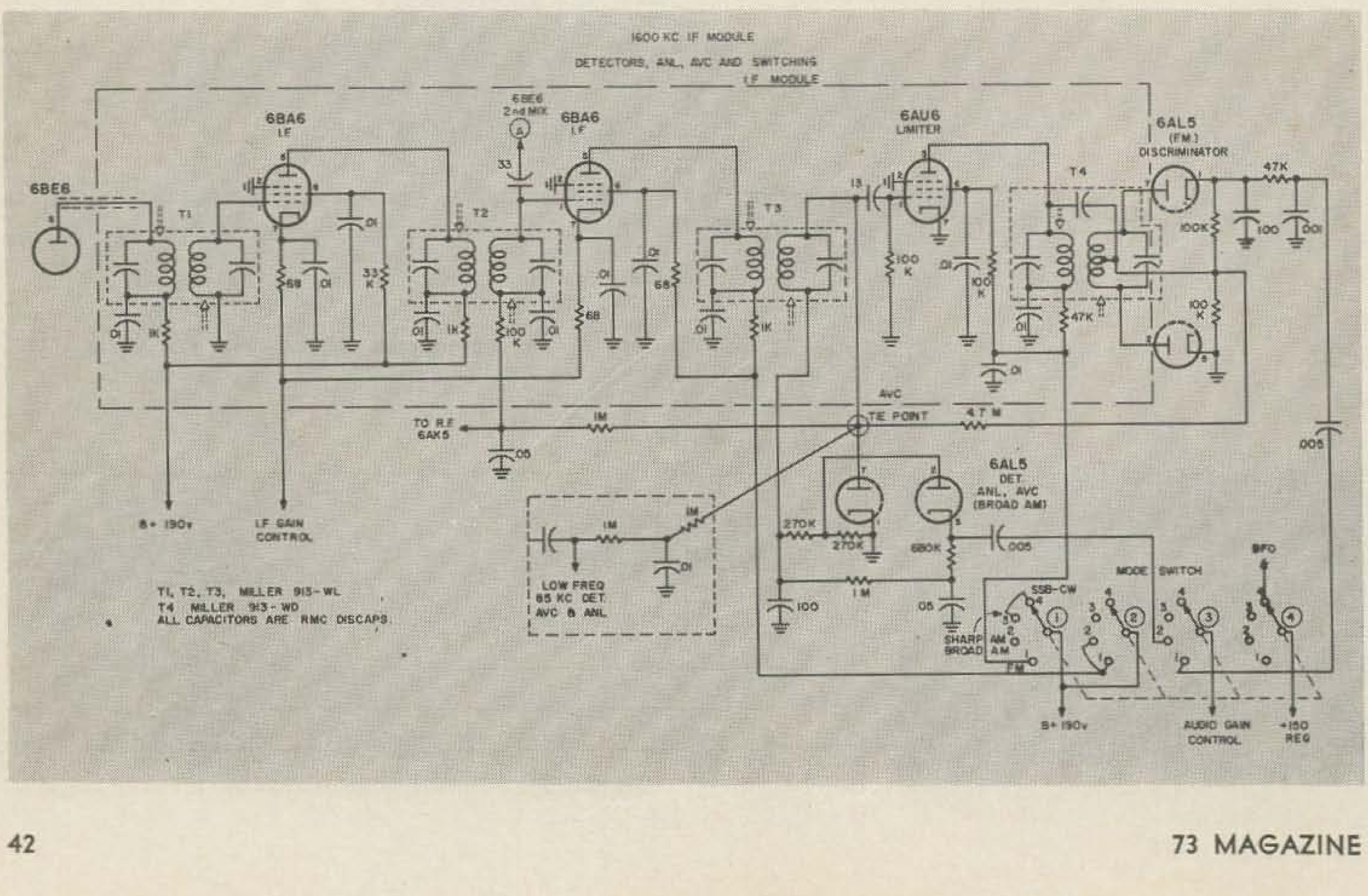
First *if*

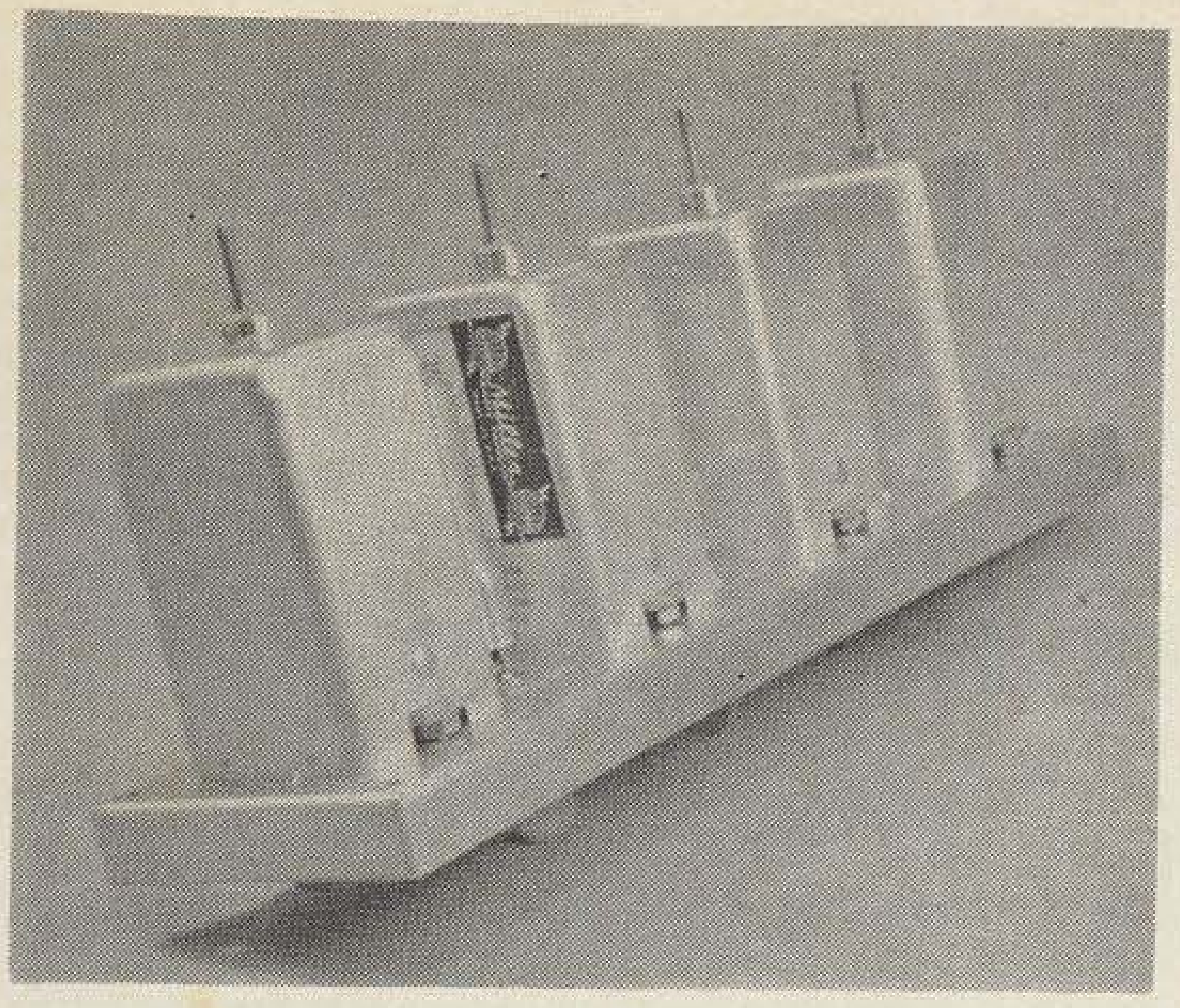
First module constructed after analyzing all associated circuits was the 1600 kc intermediate frequency amplifier. This unit was built on a aluminum chassis formed on a sheet metal brake and measures 2"x9½"x½".

Four Miller *if* transformers and three 6BA6 pentodes are used in this strip. The first three transformers, Miller 913-W1 tuned to 1600 kc, are the amplifiers and the limiter. The fourth transformer, Miller 913-WD tuned to 1600 kc, is the discriminator. Since high gain was required in this strip for broad AM mode, the above transformers, which are slug tuned, were selected due to their high gain and good stability.

In conversion to lower *if* frequency the signal is amplified through only one stage of 1600 kc and is coupled to the 6BE6 second mixer through a 33 mmfd NPO capacitor right at the grid of the second 6BA6 amplifier shown in the schematic.

To follow the broad AM signal further, let's look at the limiter stage. You will notice that the grid of the 6AU6 limiter is coupled to the preceding transformer by a 13 mmfd NPO capacitor, but the secondary of this transformer ties in to the 6AL5 dual diode, making it the AM detector ANL and AVC all in one envelope. This detector and tow high gain 1600 kc stages are used in the broad AM mode of reception. Now, switching to fm mode, the B+ is fed to the limiter stage and the audio from





1600 kc if Module: Aluminum chassis 2" x 9½" x ½." Three Miller 913-WI and one Miller 913-WD transformers. Two 6BA6 pentodes as amplifiers, one 6AU6 limiter in this module. The 6AL5 discriminator is on main chassis.

6AL5 Foster-Seeley discriminator is coupled through the multi-mode switch into the audio amplifier. This 6AL5 is grouped with the three other detectors on the main chassis between the *if* strips.

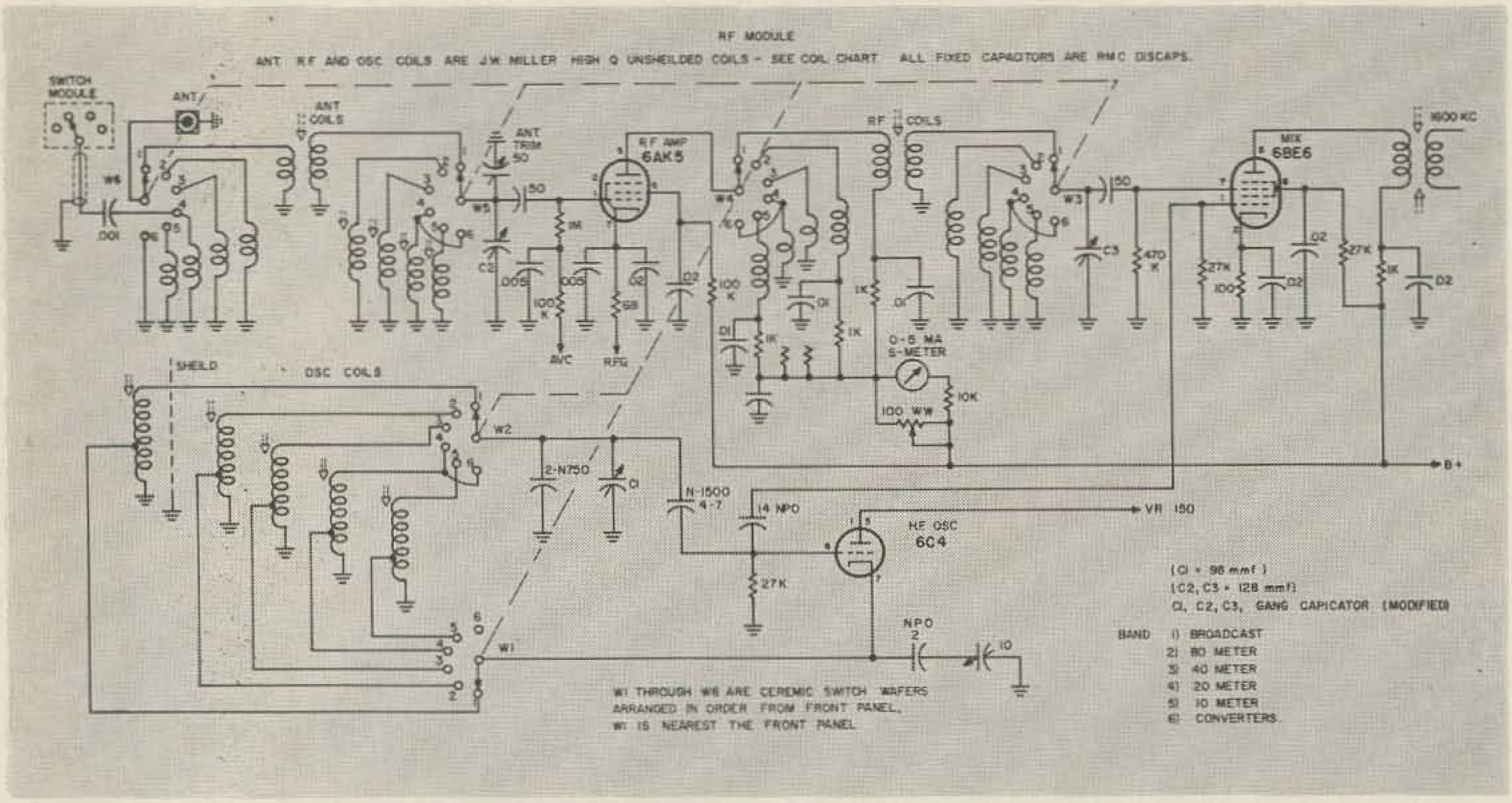
A cut-out provided in the main chassis measuring 1¾"x8½" over which the *if* module is secured with 6-32 machine screws. In this fashion, rigidity was added to the main chassis and removal or addition of components in the module presents no problem. Peaking the button cores of the transformers is also accomplished through this cut-out.

As shown on the schematic, the circuitry is straight forward. However, keep in mind to make all grid and plate connections as short and direct as possible to prevent unwanted regeneration resulting from high gain. Also remember to bring out a lead from the junction of the two 68 ohm cathode resistors to the 5K pot on the front panel which is used as the *if* gain control. Since two of these stages can be biased highly with this system, overloading of this strip is prevented. After this strip was completed and tested, it was tuned to 1600 kc since that frequency seemed to be clear of strong commercial stations and then the *if* was shelved until the rf unit demanded it for tracking.

Front End

Now that a basic unit for tracking of the front-end is completed let's start on the "grand-payyp." As you have guessed, this module is most difficult, so extra precautions should be taken to achieve utmost stability, sensitivity and of course, good tracking. Therefore, to start off on the right foot, a rugged foundation should be used and nothing less than ⅛" aluminum plate should be considered as the base. The plate in this receiver measures 7" x 10" by ⅛" is of hard drawn aluminum to which right angle shield partitions were secured by 4-40 machine screws on the underneath side. These partitions not only add rigidity but also act as coil shields and serve as brackets for the ceramic band switch as seen in the photo. The switch was assembled from standard parts which are as follows: Centralab shaft assembly 302, six PA-1 single pole 2 to 12 position ceramic wafers and one type 31 phenolic wafer. The phenolic wafer is used in switching neon pilot lites on the front panel to indicate the band in use. Ordinarily this type of switch is not used in band switching communication receivers, but it worked out very well in this receiver.

If you have studied schematics of all band commercial receivers, you have perhaps noticed the difficult switching arrangement of wafers in a complicated assembly. Normally what is done is this; besides switching in different



sections of the tuning capacitor, the unused coils are either shorted out or grounded, to prevent suck-outs and stray coupling. This is good engineering practice but a very confusing arrangement. Besides, a switch of this kind cannot be purchased over the counter, it has to be specially built.

The simple switch used in this receiver presented only one difficulty, but was immediately rectified by inserting a shield between the broadcast oscillator coil and the adjacent band two oscillator coil. What was happening is that the close proximity of the two coils created a suck-out on band two at about 3 mc. The reason was that the broadcast oscillator coil was self resonant at 4.6 mc and when a signal of 3 mc on band two was tuned in, the oscillator coil being at 1600 kc above the signal frequency was weakened by absorption of the adjacent coil. In other words it worked like a grid dipper. The aluminum shield between the two coils solved the problem and no further remedies were necessary throughout the entire tuning range of the front end.

A coax antenna connector is mounted on the last partition so that the antenna or the output of converters could be brought right up to the switch, thus avoiding long leads. A short piece of coax is connected to this input and soldered to the antenna input connector on the back of the main chassis as shown on the photo. This method of shielding the input eliminates possibility of picking up stray unwanted signals, which can become a problem with sensitive front-ends.

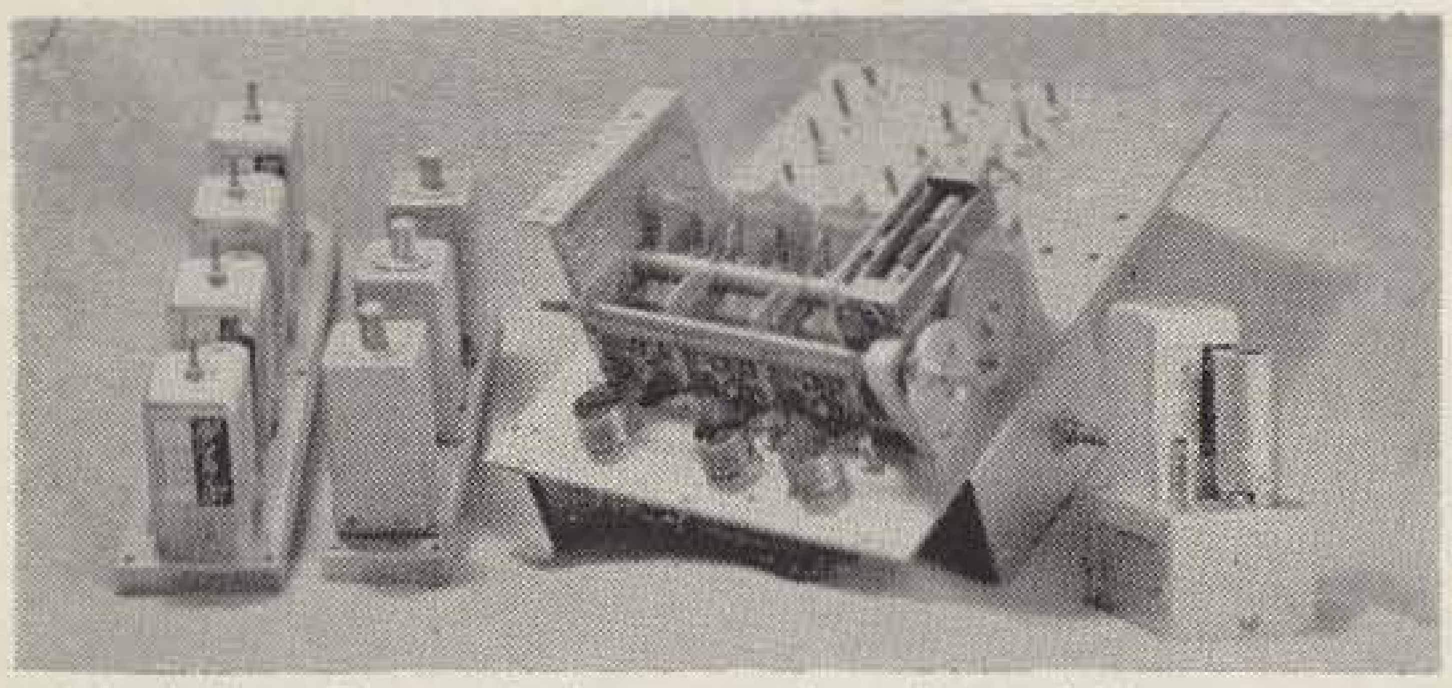
All rf coils are Miller high Q unshielded slug tuned coils listed in the parts list. Originally, the oscillator coils above the broadcast frequency were phenolic type but were rewound on the slug tuned ceramic coil forms that were on hand. Nothing has been gained in making the change since phenolic at frequency up to 30 mc is quite stable and does not warrant the trouble.

A slight modification of the broadcast oscillator coil was required since it was designed to be used with a lower *if* frequency. This was a simple matter of peeling 10 turns to get up to the higher *if* used in this unit.

As noted on the coil list, band 4 uses the same type of coils as band 3, with only the oscillator coil modified by peeling off 3 turns. Of course the slugs in band three are set deeper into the coils to lower the frequency.

Notice on the frequency list that the broadcast frequency coverage is only 500 to 800 kc. This was done to simplify construction of the front end and to use only one tuning capacitor for all the bands. Since the main tuning capacitor had to be stripped down to the value listed, a range of 300 kc on the broadcast band was all that could be covered. Of course the frequency could be shifted up a little higher and a greater spread could be had, but the interest was mainly on the distress frequency of 500 kc and the Conelrad frequency of 640 kc, letting the additional broadcast frequencies fall where they may since no attempt was made to cover the entire range.

The very important item of this rf module is the main tuning capacitor which was purchased in a surplus house for practically nothing. Having good bearings and good alignment of plates, it had to be modified by removing some plates, since the original capacities were 250 mmfd per section. It was also modified



Modules. Four of the completed modules.

The rf module showing the line up of tube sockets and the method of fastening of the added 6" brass shaft.

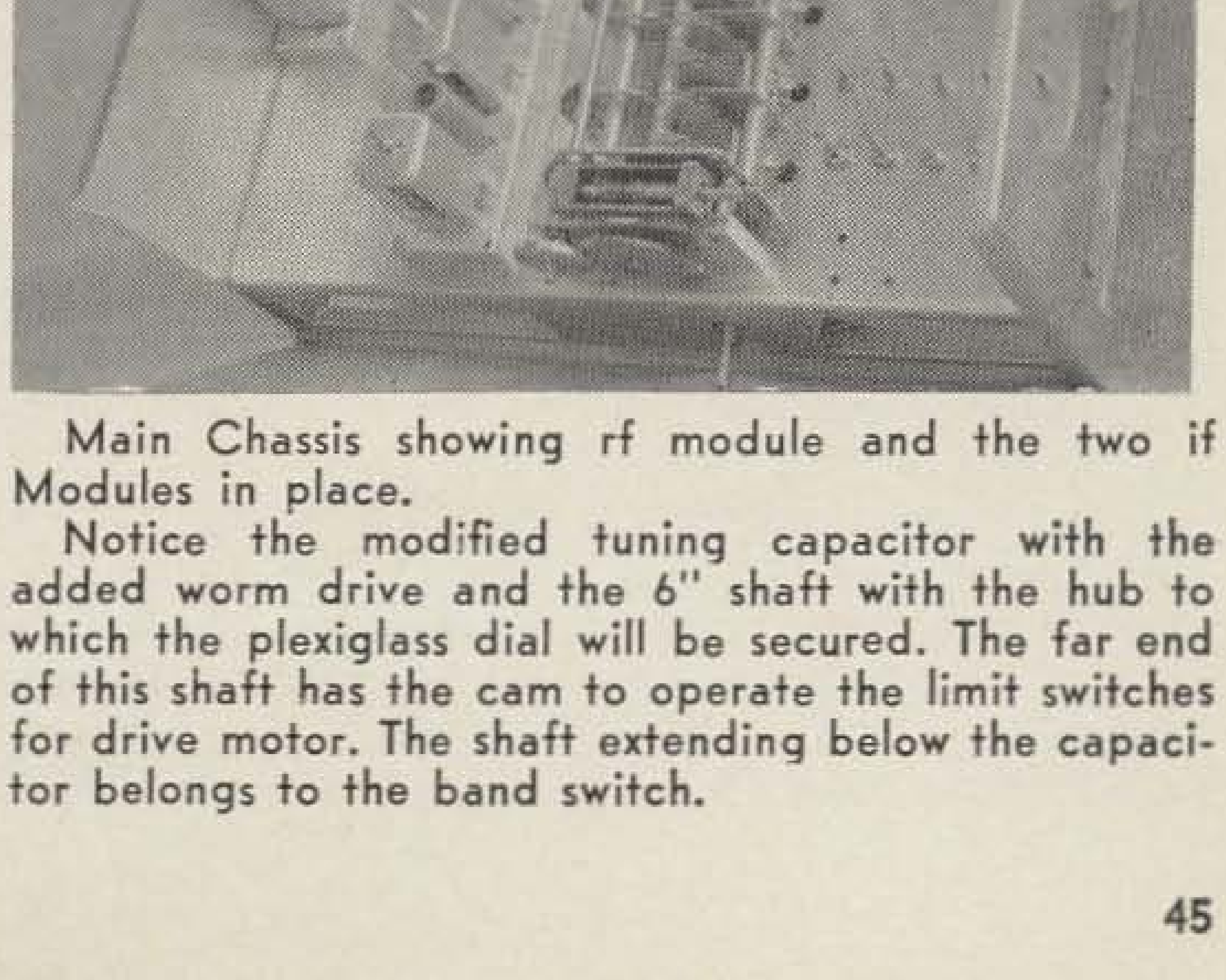
mechanically by altering the frame and adding a worm drive; a couple of drive gears with an additional shaft running parallel to the capacitor shaft so a large dial could be fastened to the front end of this shaft and motor limit switches could be provided at the back of this shaft. On the worm drive shaft a 4 inch aluminum disc was fastened, partly projecting through the front panel, to be used as vernier tuning. The top side of this knurled disc serves as a reduction drive for the motor. This can be seen on the photo. The 4" aluminum disc was made from ¼ inch flat stock and fastened to a hub turned out on a lathe.

A small dc reversable motor fastened to a rigid bracket drives the 4" disc by friction through a ⅜" rubber covered pulley on the motor. A detailed illustration of this assembly would be superfluous, since those interested in copying this design will have their own ideas for fabricating and assembling of similar parts.

The perforated box seen in the picture is a cover under which is housed the 25 volt dc supply for the motor. This unit is assembled on a aluminum plate that serves as a chassis, and this in turn fastened to the main capacitor dust cover.

In altering the capacity in each of the three sections, a Tektronix-Type 130 L, C, meter was used which simplified the work and produced accurate results. However, since a meter like that is seldom found in a ham shack, an alternate method reasonably accurate could be done in the following manner.

In purchasing a tuning capacitor the max. and min. capacity is generally specified. With this knowledge on hand, count the number of rotor and stator plates, then divide the total section max. capacity by the total number of plates. This gives you the mmfd per plate. Knowing this, its just a matter of removing the rotor plates (these are easier) to get the desired max. capacity in each section. The max. capacity in the oscillator section should be between 95 and 100 mmfd and the max. capacity of the rf and antenna sections should be 125 to 130 mmfd. A word of caution! When buy-



Main Chassis showing rf module and the two if Modules in place.

Notice the modified tuning capacitor with the added worm drive and the 6" shaft with the hub to which the plexiglass dial will be secured. The far end of this shaft has the cam to operate the limit switches for drive motor. The shaft extending below the capacitor belongs to the band switch.

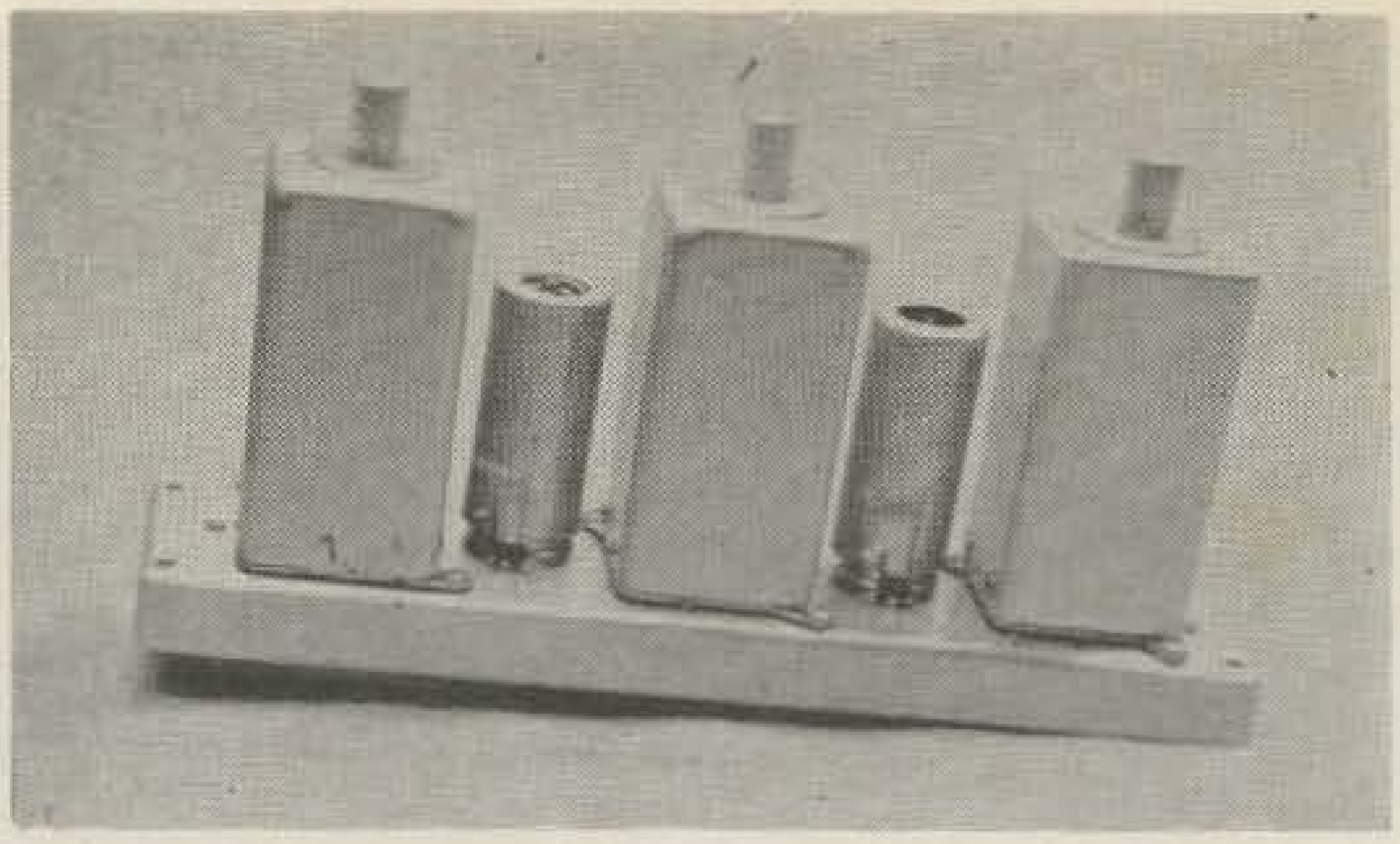
ing capacitors of this type, be sure that the unit is ruggedly built with good front and back bearings and good alignment of plates. Otherwise, you might experience frequency shift, instability and microphonics, so common in bargain variables.

RF Circuit

Now that the front-end mechanics are out of the way lets take a peek at the circuit. The three tubes are parallel to the capacitor and are placed within 1" on center from the frame. The first tube nearest the front panel is a 6C4 hf oscillator, next is the 6BE6 mixer and the farthest one is the 6AK5 rf amplifier that replaced the original 6BA6 because of better performance. Shown on the schematic are the jumpers in the switch wafers from band 4 to band 6; this is done so that in position 6 the receiver is used as a *if* strip for the xtal converters that feed into band 4 antenna circuit through the .001 capacitor, but the antenna itself is grounded. A slight shift in frequency was apparent due to the increase in inductance of the coils through these jumpers. Since the dial was hand calibrated on all bands, including the converter bands, that presented no difficulty.

The rf socket is wired so that tubes, such as 6AU6, 6AG5, 6BA6 and others can be used as replacements with slight loss of gain. This is accomplished by the usual method of tying the suppressor grid to the cathode, adding a little self bias by the 68 ohm fixed resistor and connecting this resistor with the 5K pot on the front panel used as the rf gain control. This cathode circuit is by-passed for low and high frequencies with .02 and .005 ceramic disc capacitors as shown.

The grid of this stage returns to the AVC bus, through the isolation resistors indicated on the schematic and is coupled to the tank circuit



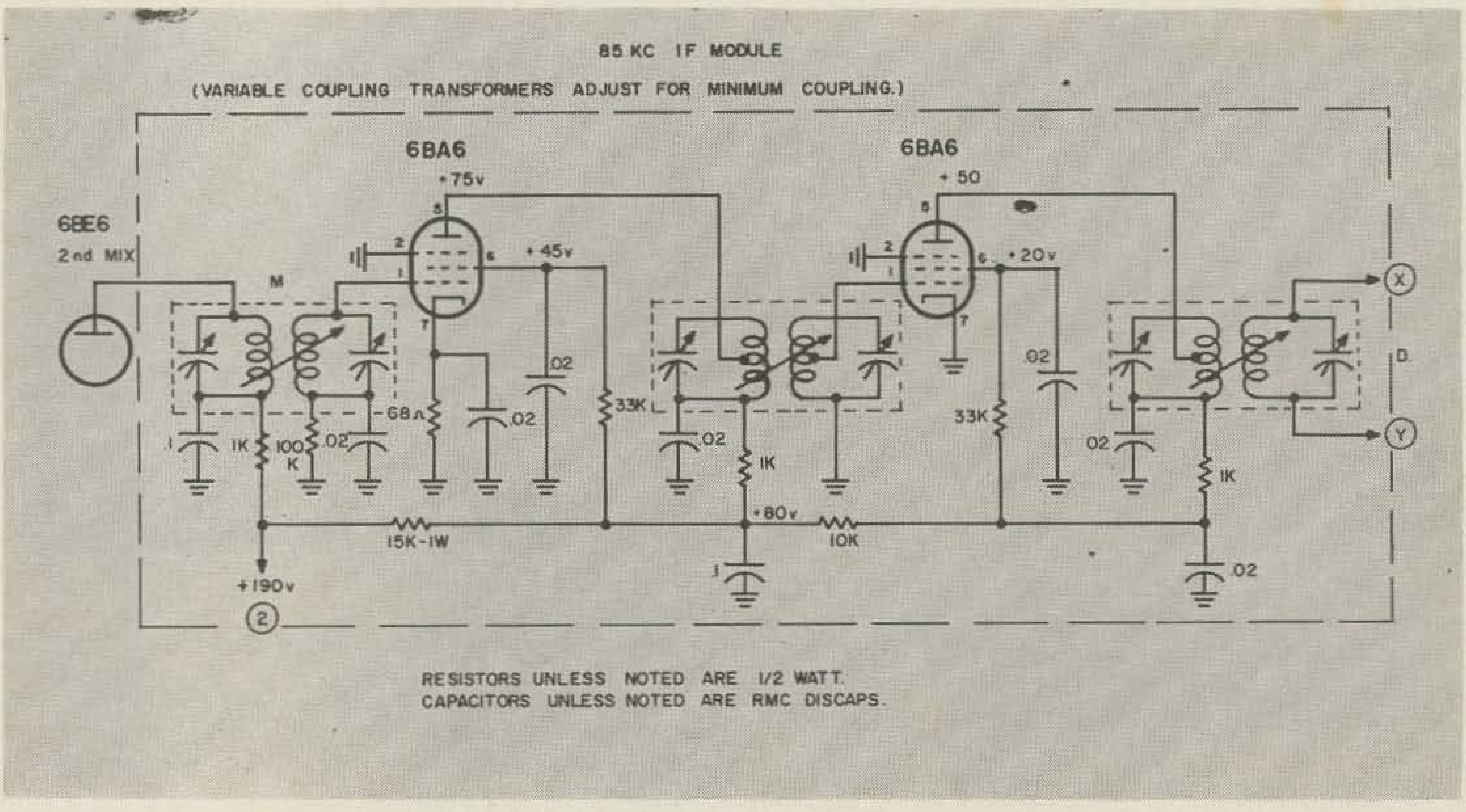
85 K C Module: Aluminum chassis is 1¾" x 8" x ½". Three 85 kc variable coupling transformers; coupling adjusting bakelite rod under the knurled caps in center of transformers.
Two 6BA6 pentode amplifiers.

through a 50 mmfd capacitor. From the stator of the main tuning capacitor (antenna section) a lead is brought out to the 50 mmfd trimmer on the front panel that is used as the antenna trimmer.

The plate of the amplifier returns to the arm of the ceramic band switch and the cold bypassed end of all rf coils tie together and connect through the 5 ma S meter to B+ as shown on the schematic.

The meter has a 100 ohm pot for zero adjustment and this is placed on the front panel just below the S meter. This arrangement provides flexibility in signal strength readings, since the meter can be set for zero noise reference, when giving reports.

The final mixer stage is the common variety of 6BE6 pentagrid converter, using separate injection as shown on the rf schematic. Coupling capacitor which is a 14 mmfd NPO is used to bring the signal from the high frequency variable oscillator to the mixer. This coupling capacitor can be varied slightly, however, this



value proved to be optimum in this arrangement of band switching. Oscillator injection is varied to a large degree in an arrangement where band switching is used due to the varied output of the oscillators, so a compromise must be made by selecting the proper coupling capacitor to tie the injection voltage in the proximity of 10 volts on all the bands.

Higher injection, by using larger capacitors, will increase the signal strength slightly, but will also bring in a lot more noise. Lower injection voltage will decrease the over all sensitivity of the front end.

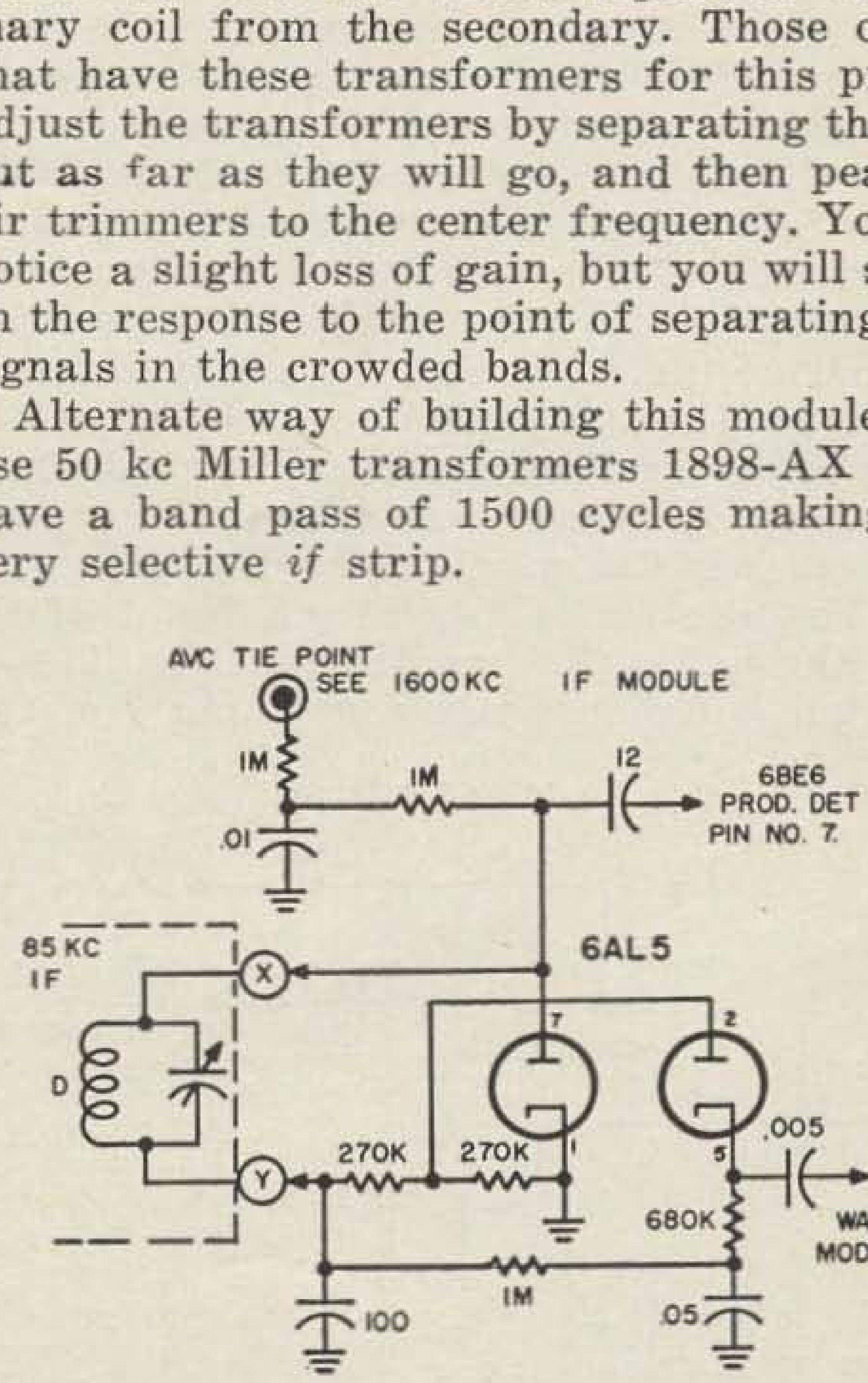
The plate of the mixer ties into the 1600 kc *if* transformer as shown.

Oscillator tube is a 6C4, connected in a Hartley circuit and drift compensated with a 2 mmfd N750 ceramic capacitor and the 47 mmfd N1500 grid blocking capacitor, as shown on the schematic. A 2 mmfd NPO, in series with a 10 mmfd variable capacitor, is soldered to the cathode of this tube and is used as fine tuning in the SSB or CW position. Front panel engraved as "Osc Cal.". The plate of this 6C4 returns to the OA2, 150 volt regulator tube.

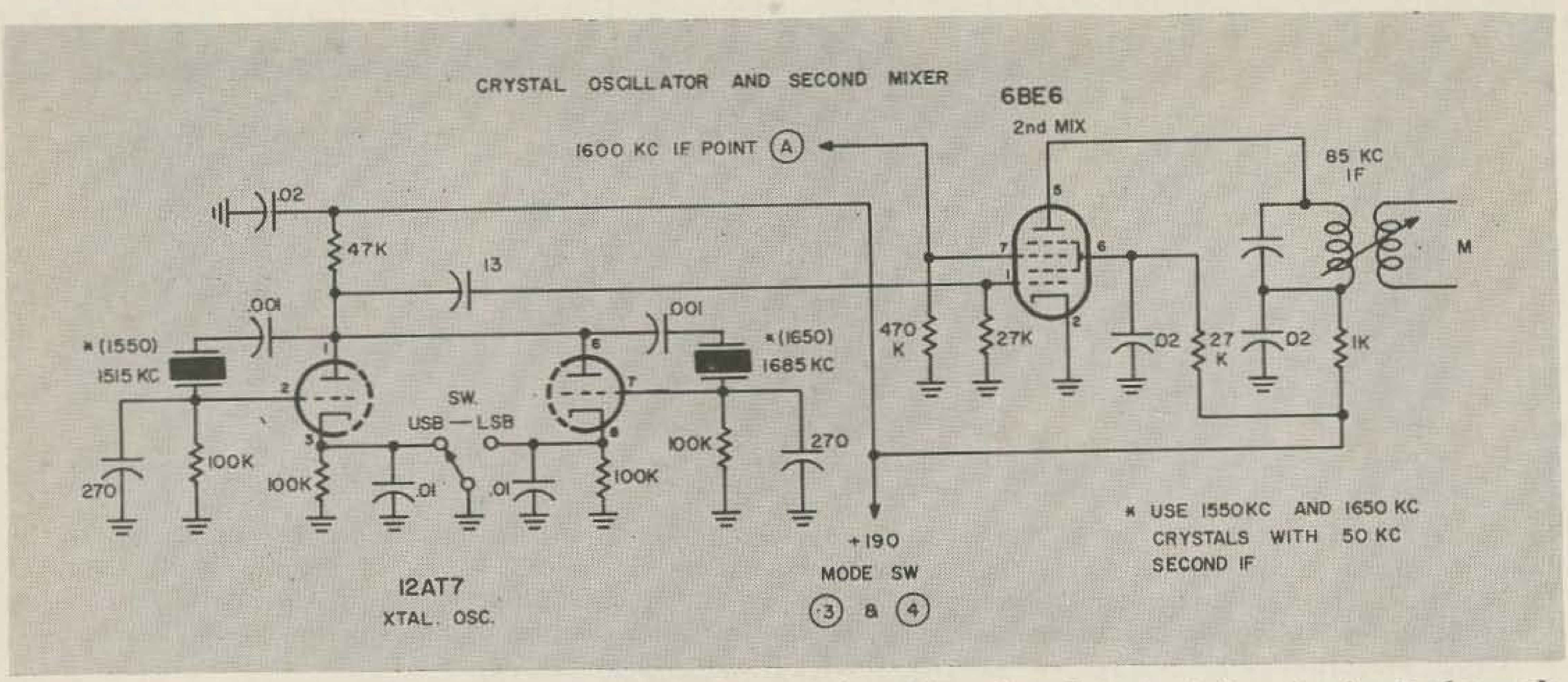
Second *if*

With two modules out of the way, the low frequency *if* strip was next on the agenda. This unit is similar to the 1600 kc *if* but the fabricated chassis measures 1¾" x 8" x ½", for which a cut-out in the main chassis was made ½" smaller all around. The three 85 kc transformers used in this module have means of adjusting the coupling by a bakelite rod located in the center of the transformer. Coupling from "critical" to "overcouple" can be varied by this rod which separates the primary coil from the secondary. Those of you that have these transformers for this project, adjust the transformers by separating the coils out as far as they will go, and then peak the air trimmers to the center frequency. You will notice a slight loss of gain, but you will sharpen the response to the point of separating most signals in the crowded bands.

Alternate way of building this module is to use 50 kc Miller transformers 1898-AX which have a band pass of 1500 cycles making it a very selective *if* strip.



LOW FREQ. (85 KC) DETECTOR, ANL AVC

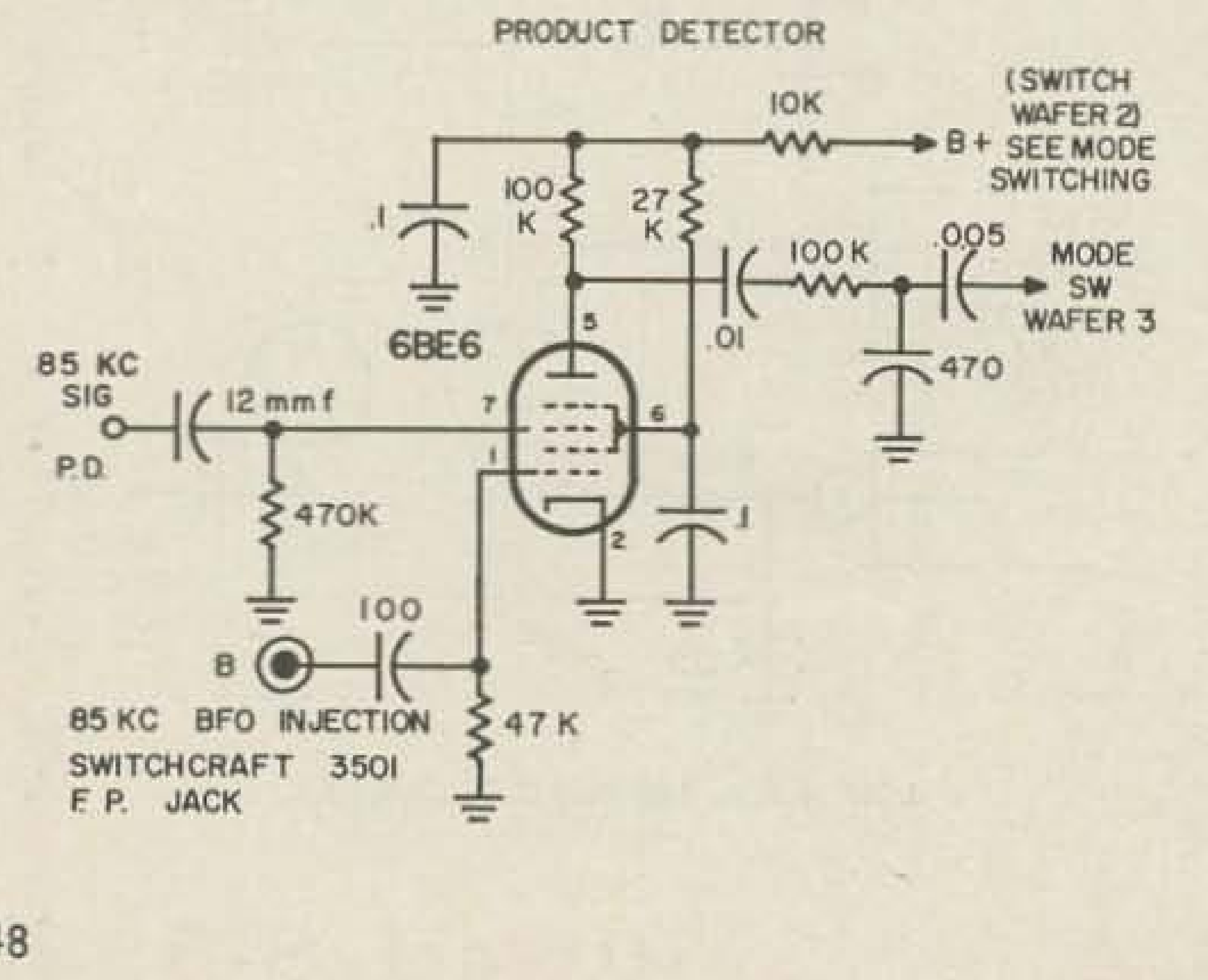


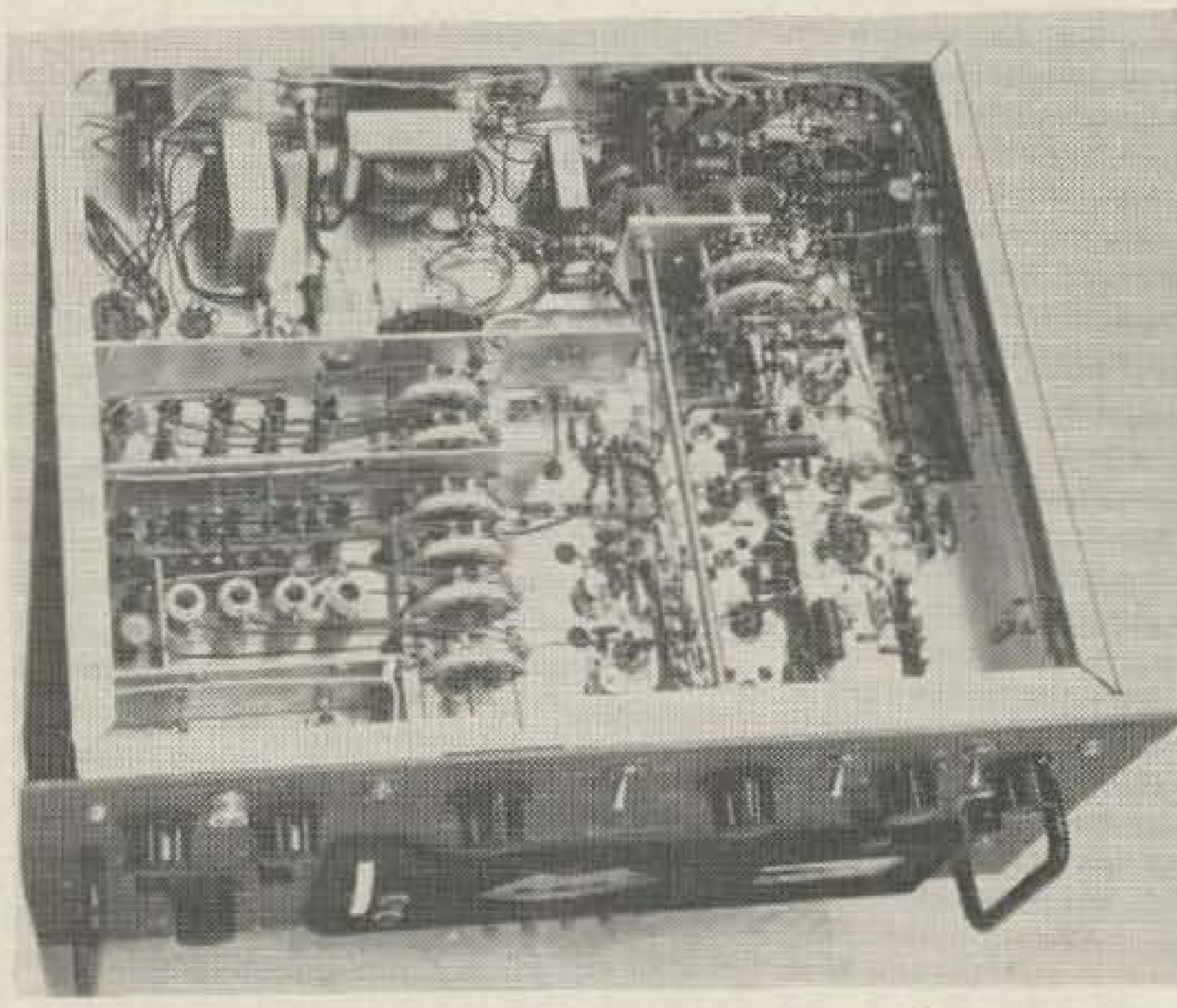
The circuit, as per schematic, is quite standard and no mention of small components are necessary since they are all listed in the parts list or shown on the drawings.

The second mixer is also a 6BE6 pentagrid converter tube with separate injection oscillators consisting of a 12AT7 wired as dual xtal oscillators, using crystals of 1515 and 1685 kc. The oscillators can be turned on by grounding the cathode of each triode through a single pole double throw toggle switch placed on the front panel and engraved USB or LSB. Either oscillator is used in the sharp AM position but in SSB, upper or lower side band can be selected. This oscillator is only active when the mode switch is in sharp AM or SSB position.

The AM detectors, as indicated in the schematic, are 6AL5 which serve as detectors, automatic noise limiters, and AVC generators.

The FM discriminator is the old stand-by Foster Seeley and AVC voltage is taken at the junction of the two 100 K resistors and fed through a 4.7 meg resistor to a junction terminal of the AVC bus. At this point it is filtered by the .05 capacitor and fed to the stages requiring AVC control. The product detector is a 6BE6 converter tube with separate injection oscillator which is the 6C4 BFO module. The injection is to grid pin No. 1 of the 6BE6 through a 100 mmfd capacitor. The 85 kc signal is fed into signal grid pin 7 of this tube. The signal output is at pin 5 through the RC network, which connects into the mode switch.

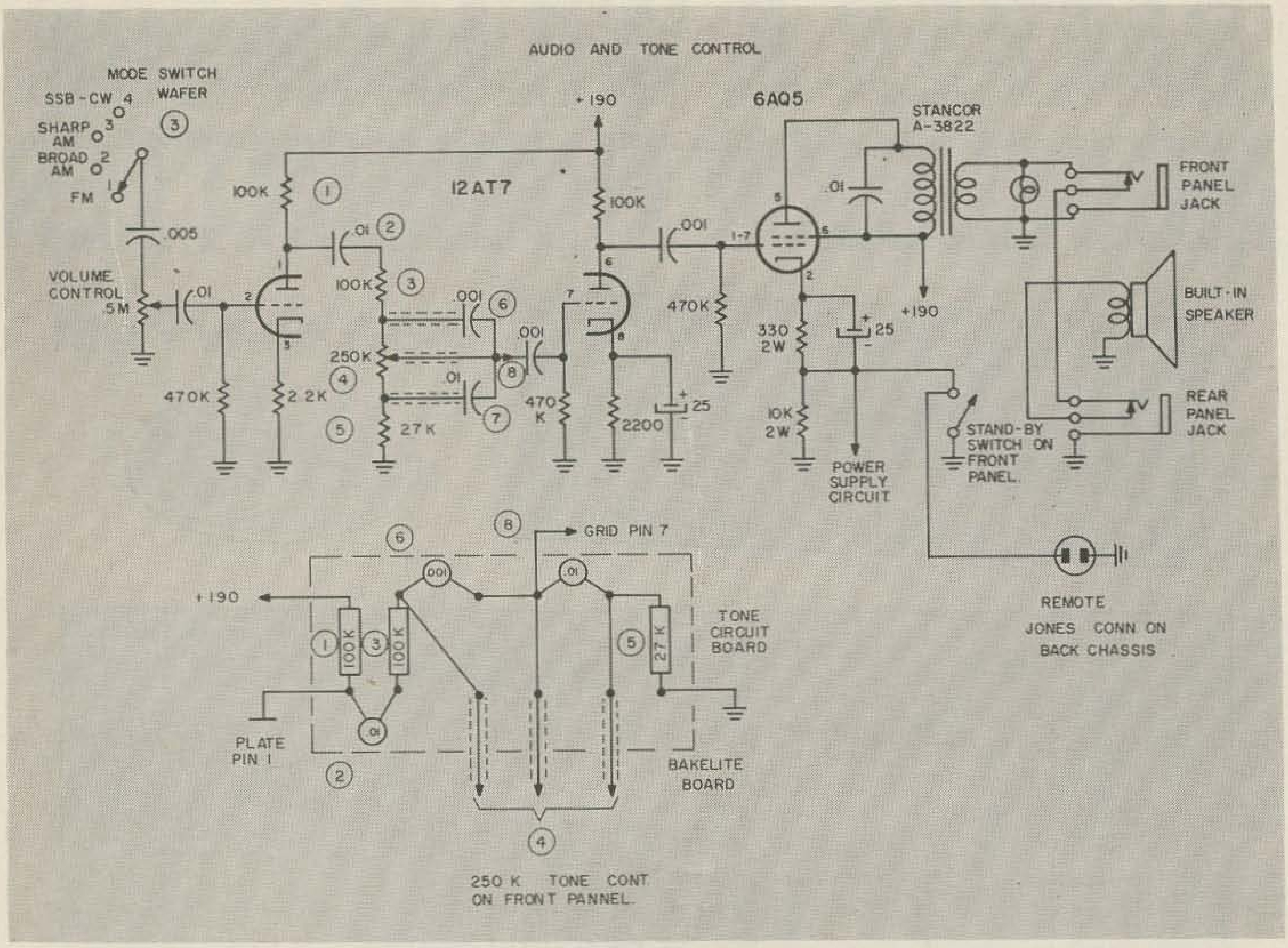




Bottom View showing the ceramic band switch and the aluminum partitions for shielding of the rf coils. Shown also is the gear driven mode switch and just below the gears mounted on the back of the chassis is the "tone module." The coax antenna cable and connector is also shown running to the rf partition. Before the final adjustment of the rf coils, the bottom plate 13 x 17" made of aluminum is secured for good shielding.

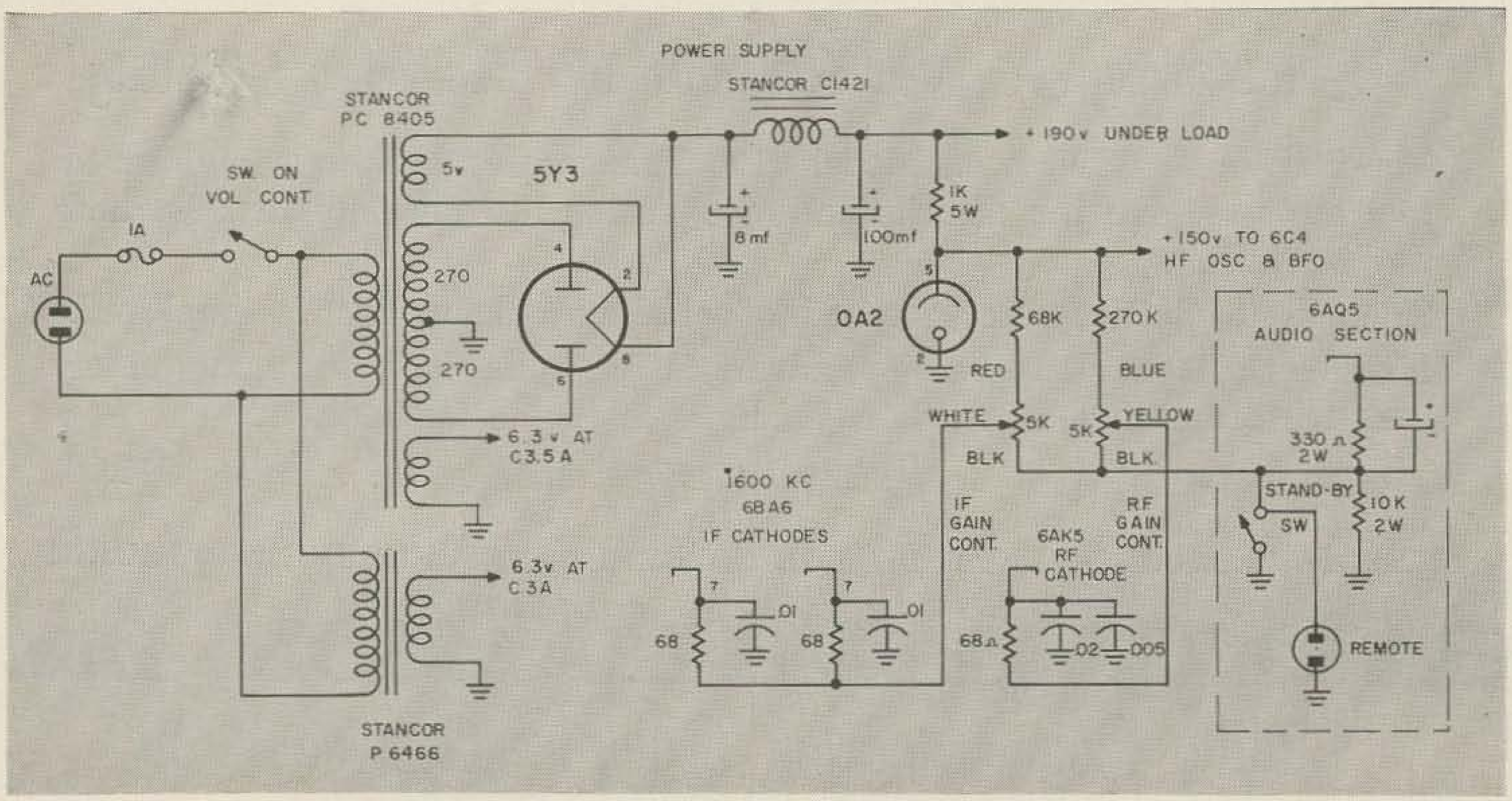
The audio section is a 12AT7 voltage amplifier and a 6AQ5 as a power amplifier which drives a Stancor A-3822 output transformer. The secondary of this transformer is shunted with a No. 44 pilot lamp to protect the voice coil on the 4" built-in speaker. This speaker is disabled by inserting a phone plug into either the front panel jack or the rear jack when using a larger speaker or low impedance phones.

The mode switch located at the far end from the front panel is a ceramic two wafer 2 pole, 6 position per wafer Centralab switch No. 2011 with the stop set for 4 positions. This switch is mounted on a bracket fastened to the main chassis and is gear driven for the purpose of

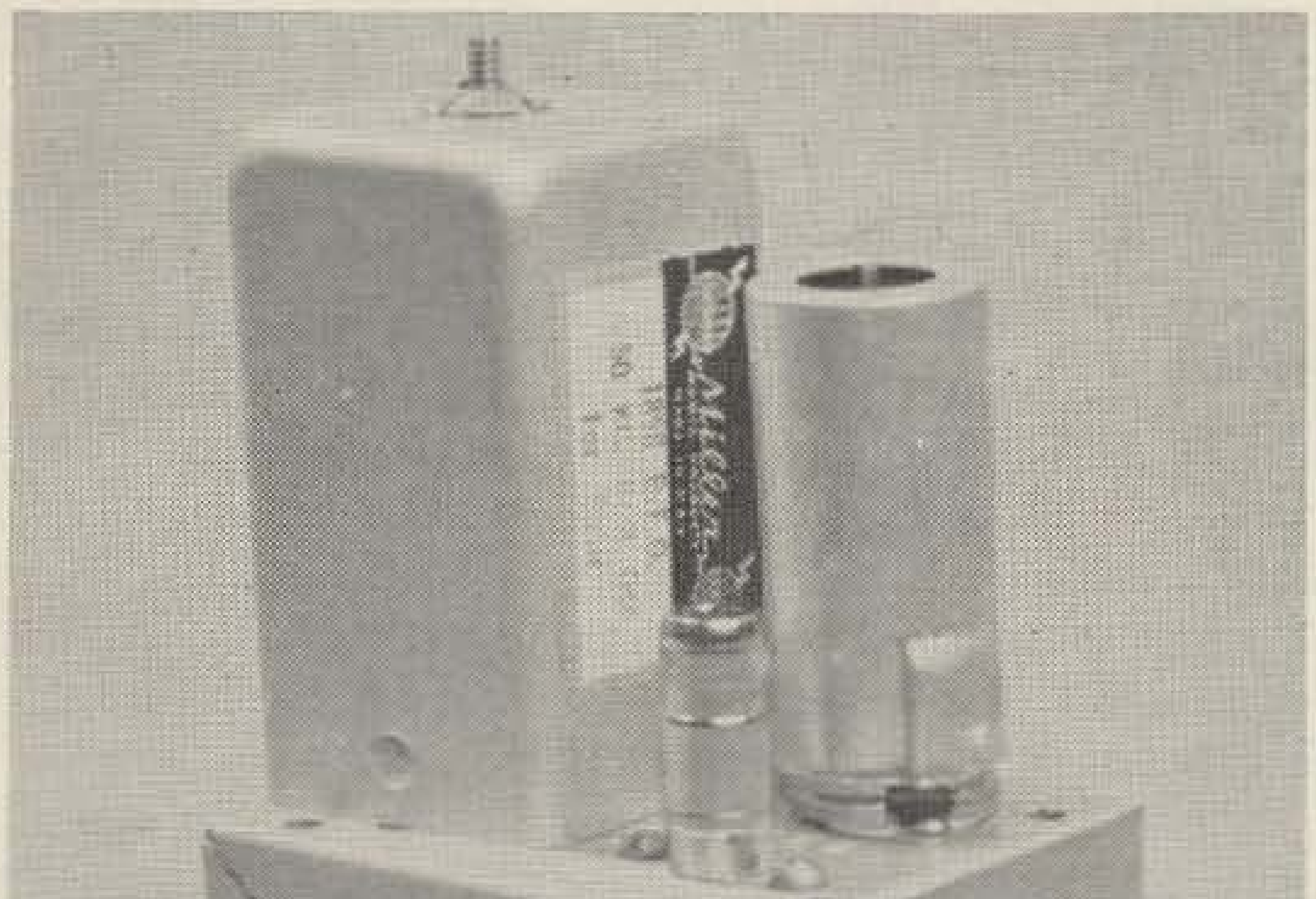


locating this switch right at the detectors. Shielded wires are unnecessary because of the very short leads to this switch. The switching of operational mode is accomplished by selecting the detectors and at the same time feeding B+ to the desired part of the circuit as shown in the schematic.

Main power supply is of a full wave design, using a 5Y3 rectifier and a PC8405 Stancor power transformer, with a Stancor C1421 filter choke. An 8 mfd input capacitor and a 100 mfd filter capacitor at the output makes a hum free power source. Since a large number of tubes are used in this receiver, the heater supply was insufficient in the power transformer alone, so an additional filament transformer had to be used and the heaters currents so divided that neither transformer was overloaded. The filament transformer is a Stancor P6466 a 3 amp job. Voltage regulator which is a OA2,



150 volt regulator tube supplies power to the VHF tuning oscillator, the BFO oscillator and the bias for rf and *if* gain control as seen in the schematic. DC motor power supply is a half wave selenium rectifier type, using a Stancor P6469 25 volt at 1. amp transformer and a 500 ma rectifier.

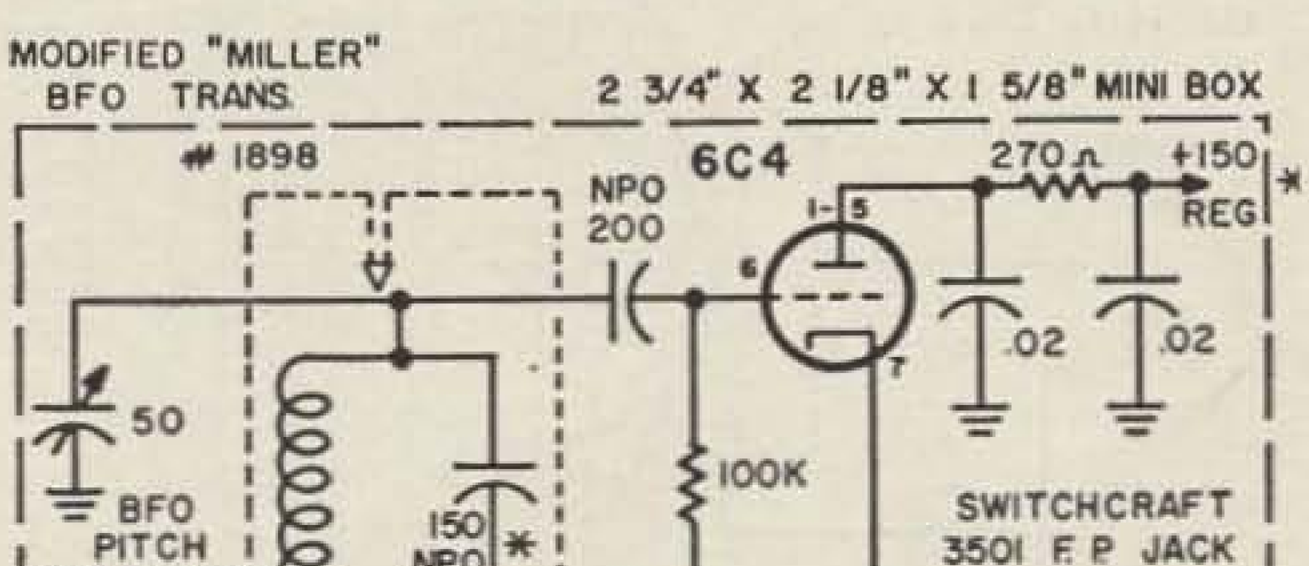


BFO Module: Mini-box chassis 2¾" x 2⅛ x 1⅝". 6C4 triode connected as Hartley oscillator using modified Miller 1898 BFO transformer. Cathode output through switch-craft Jack 3501 F P and plug 3502.

Dial

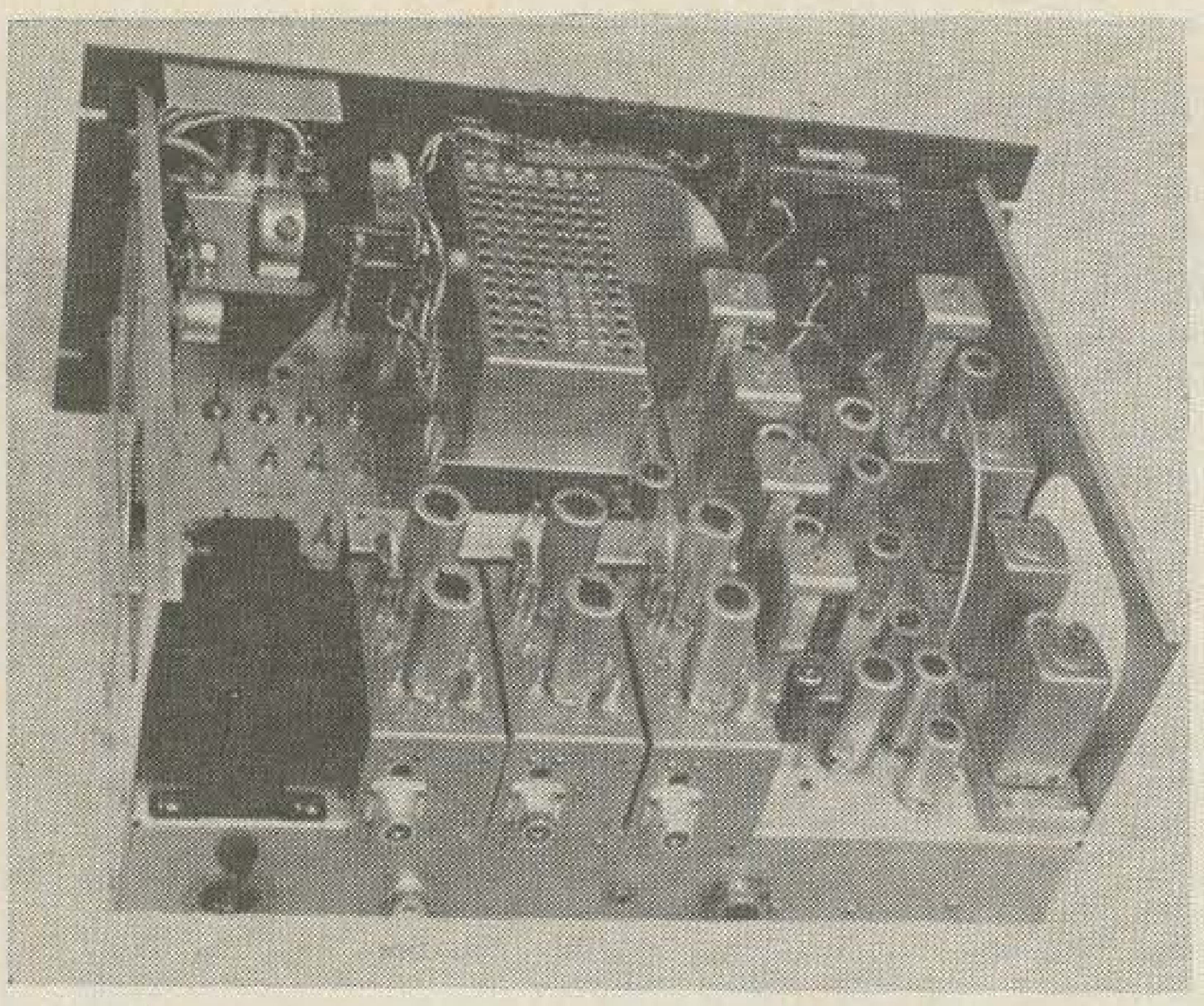
One of the most difficult items to make is a commercial looking dial. If you ever tried to duplicate a snappy looking dial for your receiver, VFO or what have you, you have probably made several of them before you obtained satisfaction; at least this was the case of this dial. Several attempts were made before a satisfactory dial was assembled without the use

BFO MODULE

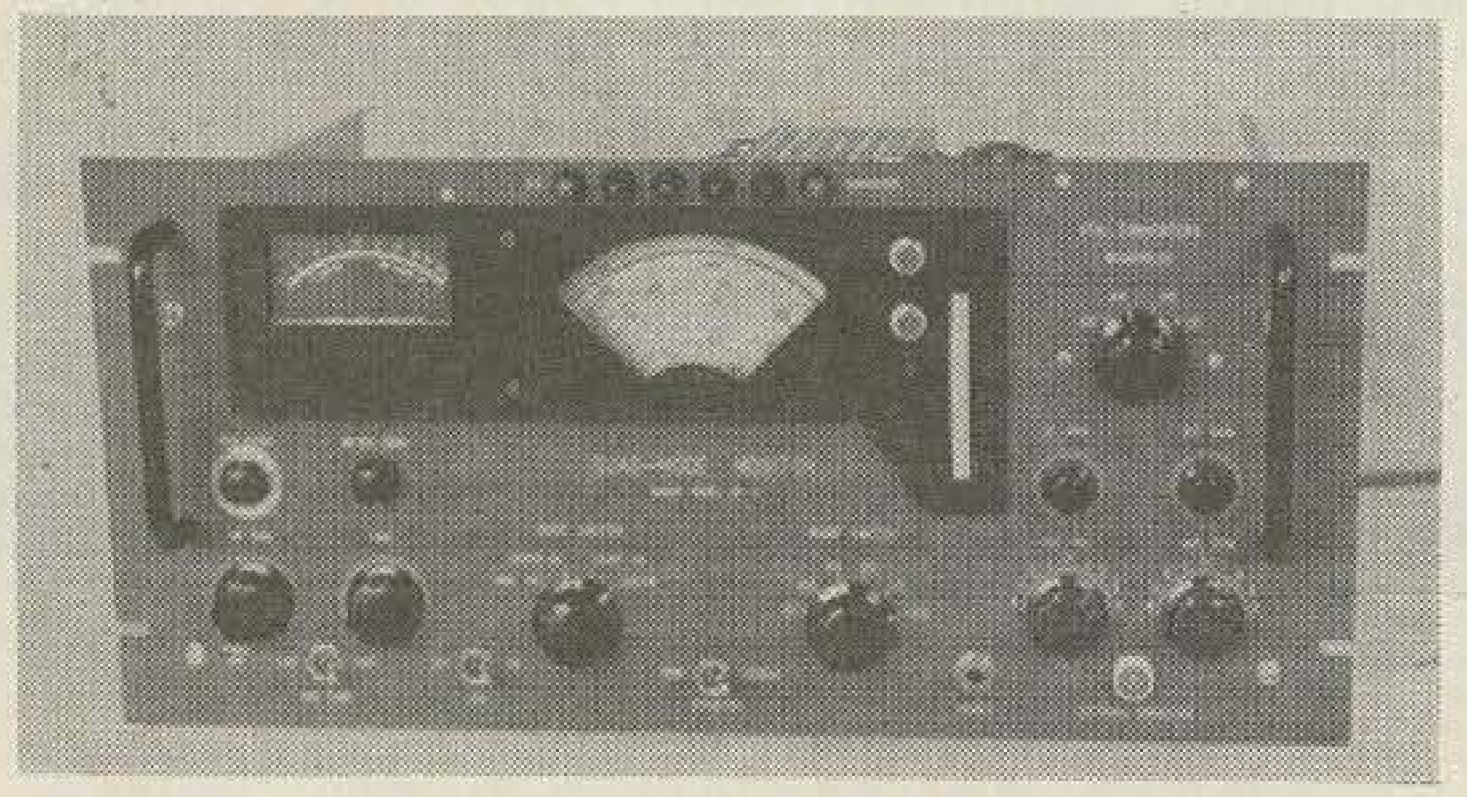


NOTE: REPLACE ORIGINAL TUNING CAPACITOR IN THE TRANSFORMER WITH NPO 150 mmf * TO TUNE TO 85 KC.

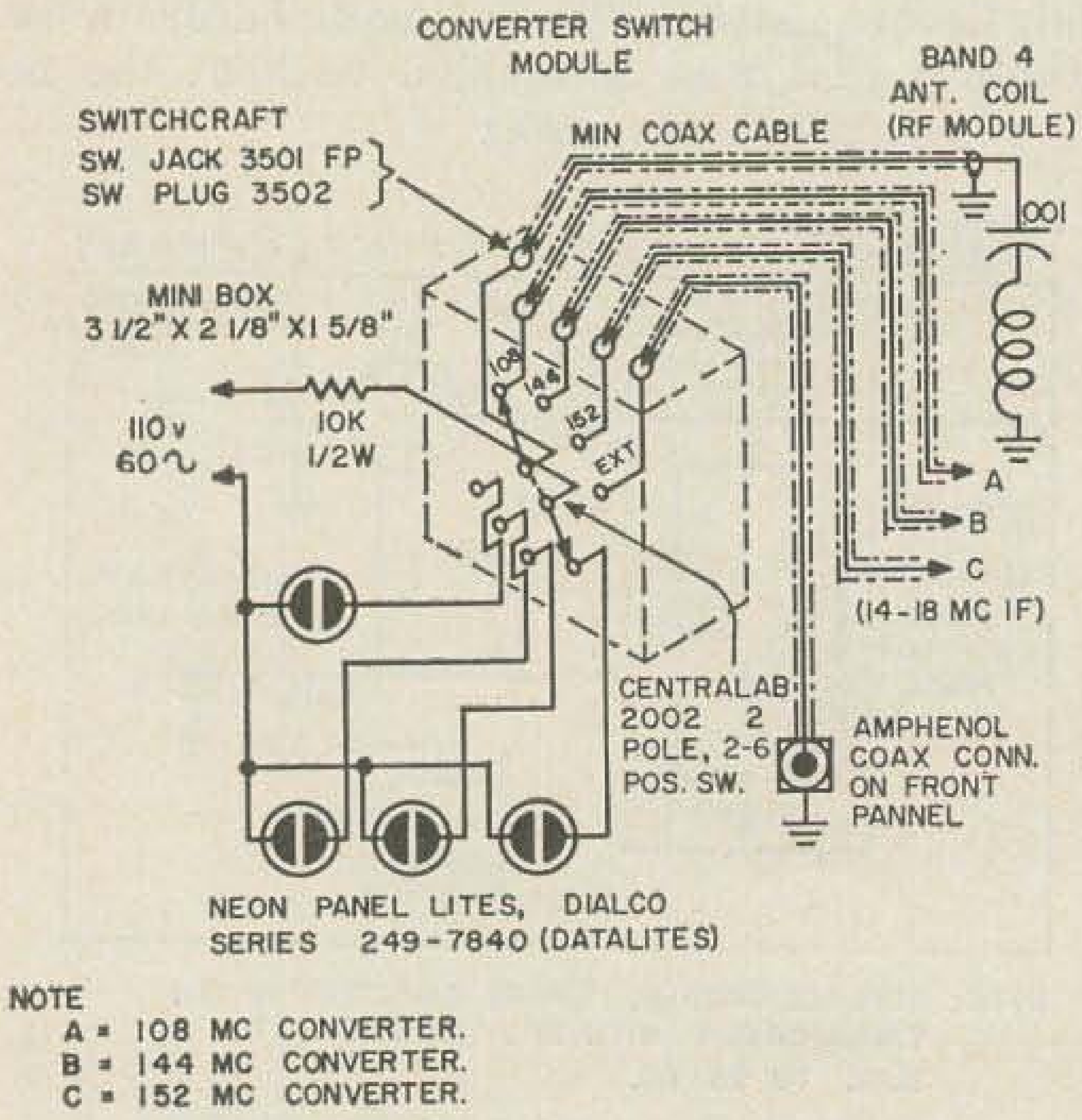
* POS 4 ON 4th WAFER. SEE MODE SWITCHING.



Back View showing the xtal converters, 25 volt DC power supply, and the small drive motor. To the left of the motor is the speaker with the pilot bulb overload protection. In back of the motor is the converter switch module showing the switch-craft plugs. To the right of the converters is the audio amplifier and the four detectors. In front of the detectors is the second mixer and the crystal oscillators.



Front View, showing all controls and engraved nomenclature for ease of operating. The two buttons to the right of the calibrated dial are the push button motor switches. Just to the right of these switches is the knurled disc for vernier tuning. When the picture was taken, the plexiglass window with a black hair line for the dail was removed to eliminate reflections.

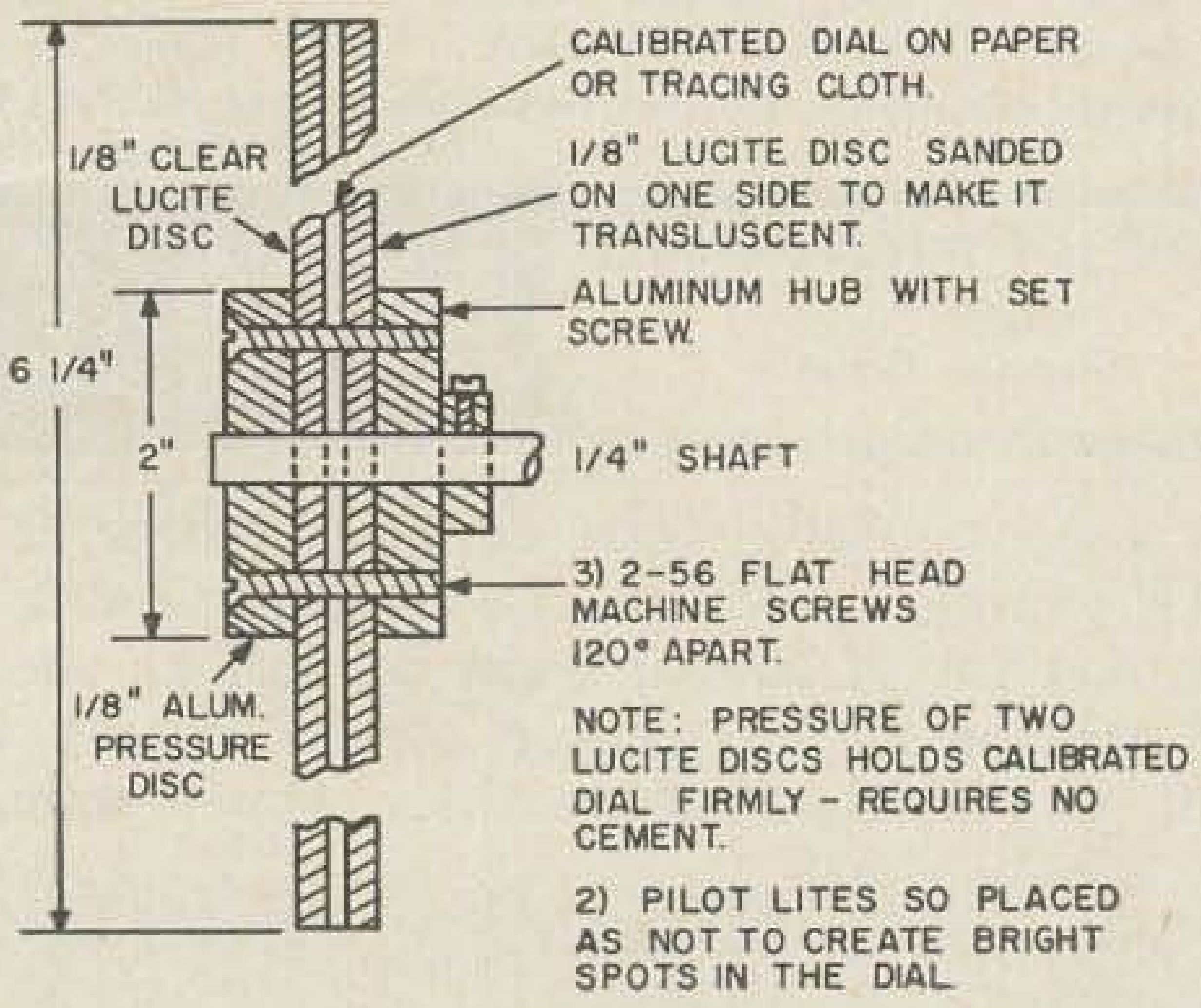


of cement. A cross sectional detail is shown how this was accomplished with great success. The dial scale was drawn with India ink on a piece of transparent tracing cloth. Then two 6¼" discs of ⅛" plexiglass were cut out with a fly-cutter. Placing the cloth scale between the two plexiglass disc and securing them in place, as shown on the detail, makes a blemish proof dial comparable to the silk screen dials used on commercial equipment.

Converters

Looking at the back of this receiver you will notice the three identical boxes to the right of the power transformer. These are the bantam converters previously described in Oct. 1960 issue of 73. Slight mechanical modifications were necessary to enable them to fit into this design but the good circuit was left alone. In modifying the units the mini boxes which are Bud CU-3003A, 4" x 2¼" x 2¼" are used so that the adjustable ceramic antenna coupling capacitor can be placed above the coax antenna connector for easier access to peaking.

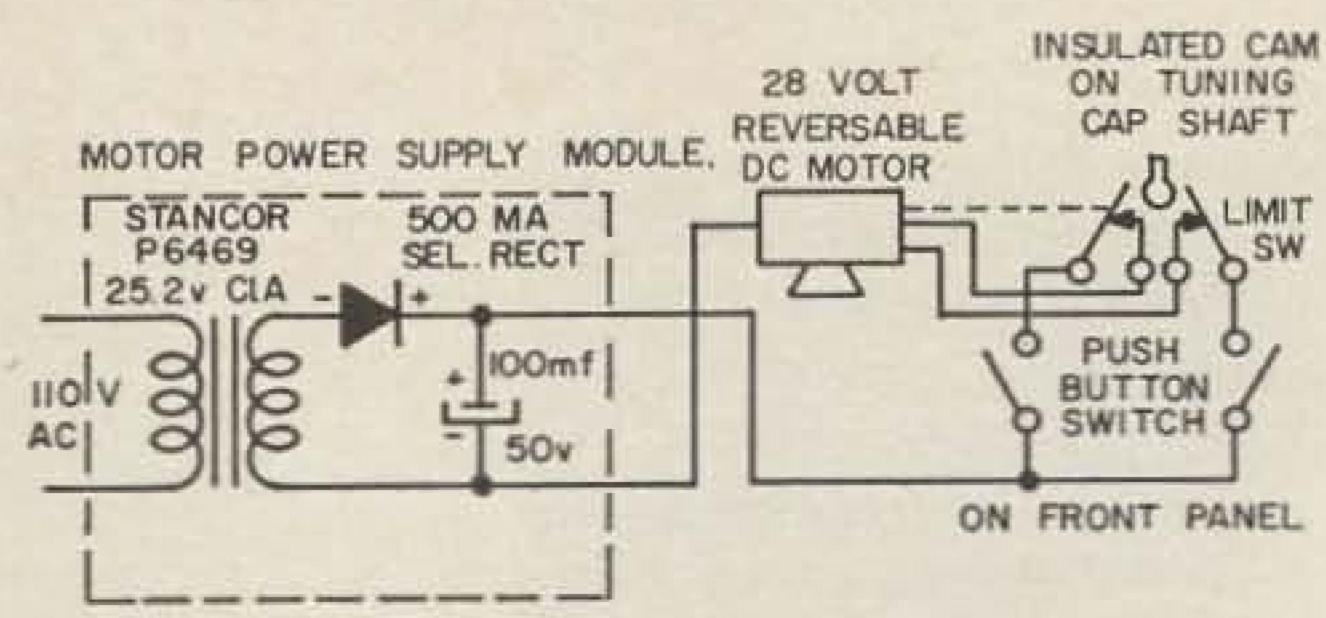
CROSS SECTION DETAIL OF DIAL CONSTRUCTION



Previously this capacitor was trimmed from the side of the mini box and had to be adjusted before securing the converter in place. The *if* output connector was also changed to switchcraft 3501 FP and placed on top of the converter. This connector is much smaller and lends itself for better arrangement. All coil forms used in these converters are J. W. Miller ceramic foil forms No. 4400 because of smoother peaking action and rugged construction.

Converter plug-in assembly is made up of two L shaped pieces of aluminum 7" long by 2¼" high by 1⅛" wide which are arranged into a rectangular tunnel to house the power wires and the coax cables. These L pieces are held together by spacers and only one L is secured to the main chassis by 4-40 screws. The other L piece which is held by the spacers has the cut-outs for the three Jones connectors S-303-AB and the three ¼" holes for the miniature coax *if* cables seen in the picture. The S-303-AB connectors are fastened by binding head 4-40 machine screws which are placed in

25 VOLT POWER SUPPLY AND MOTOR SWITCHING.



oversize holes to permit good alignment of converters.

In conclusion may I say that in the past few months I have received a number of letters and post cards voicing constructive criticism from those that are duplicating the "Tri-Mode Monitor" described in Nov. 1960 issue of this magazine. Most of the mail stated that pertinent details and photos were not included in the manuscript thereby making construction of that project more difficult. So to comply with these requests, I sincerely hope that those of you who will attempt this project find in this manuscript sufficient material to go ahead without delay—Good luck!

To Frank Lodi my thanks for the use of his camera.

To Howard Trieb K9EPB my thanks for his part in processing the pictures. . . . W9DUT

J. W. Miller coils

	ANT.	RF	OSC.
BAND 1	A-5495	A-5495 RF	A-5496-C remove 10 turns
BAND 2	B-5495-A	B-5495 RF	B-5496-C
BAND 3	C-5495-A	C-5495 RF	C-5496-C
BAND 4	Same as band 3 but remove 3T from os: coil only.		
BAND 5	D-5495-A	D-5495 RF	D-5496-C
BAND 6	converters		

2—1600 KC IF J. W. Miller 913-WI Transformer
1—1600 KC LIM. J. W. Miller 913-WI Transformer
1—1600 KC DISC J. W. Miller 913-WD Transformer

Alternate

If 85 KC if transformers are not available
3—50 KC IF J. W. Miller 1898-AX transformers. Use xtals of 1550 KC and 1650 for second conversion
1—BFO TRANS. J. W. Miller 1898-BFO
3—CONVERTERS
18—COIL FORMS J. W. Miller No. 4400 ceremic ⅜" x 1 1/16"

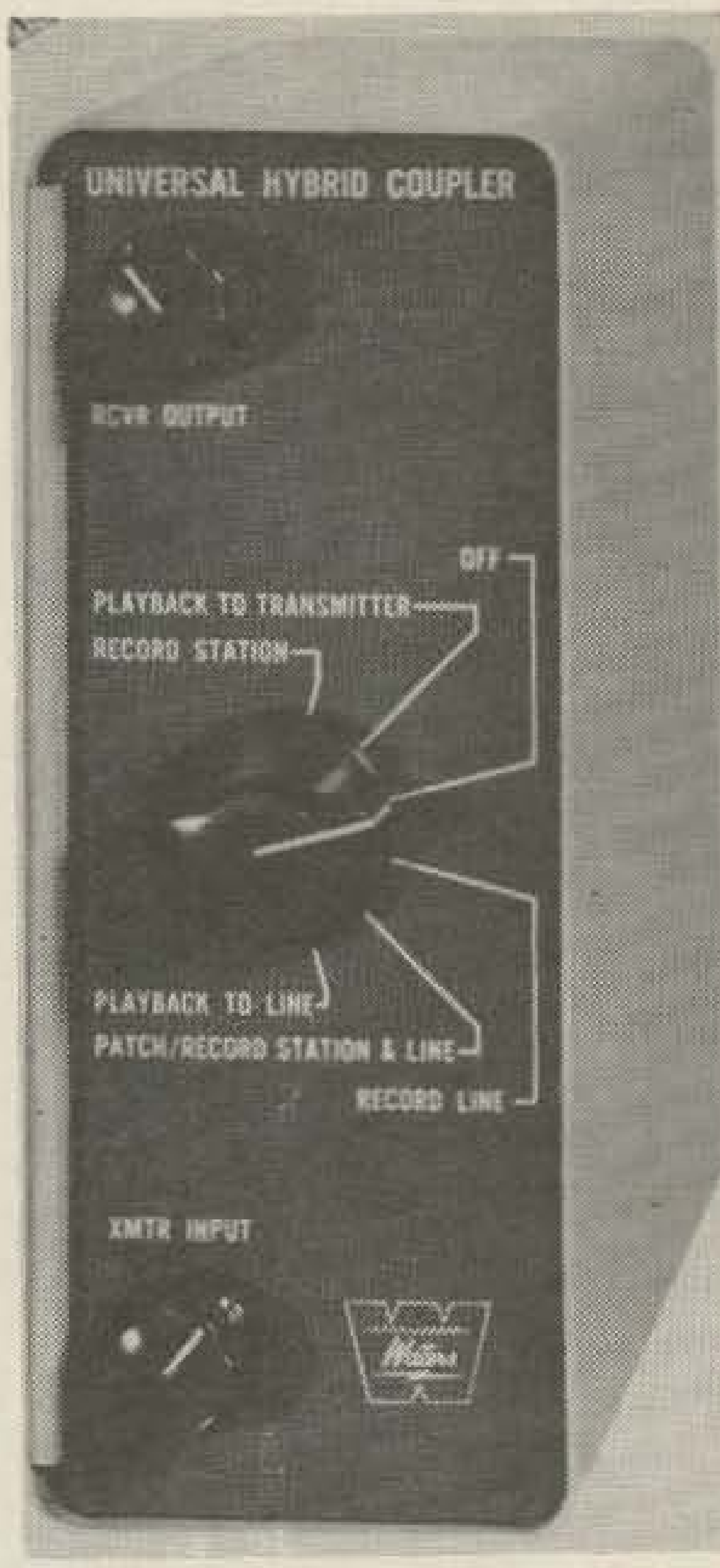
see Oct. 1960 73 Magazine for details

Note

All resistors unless otherwise noted are ½ watt.
All ceremic disc capacitors are "RMC discaps."

Tom McCann K2CM
146 Hillcrest Avenue
Morristown, New Jersey

73 Tests The
Waters Universal Hybrid Coupler



A Break-through in Operating Versatility

NOW here is something really NEW in phone patches and the gang will want to know about it. If the Waters Universal Hybrid Coupler were nothing more than a cracking good fone patch (which it is) it is competitively priced at $49.50 net. As fone patches go, it's about as near a "set-and-forget" item as we've tried—including some pretty fancy and some home-spun versions. But this neat little gadget in providing facility for connecting in your tape recorder, affords a range of operating and experimental capability not heretofore available.

Regardless of your operating interests, phone or CW, traffic handler or experimenter, DXer or plain rag-chewer, you are likely to find the record and playback feature fulfilling a need few of us have realized could be satisfied so conveniently. Let's take a case we've all encountered for example—"Look OM, I hate to tell you because I can't describe it, but there's something wrong with your signal there and I think you'll want to have a look around and see if you can run down the trouble." So you bat around a while trying to find out what is meant—maybe make a few checks with other stations—and end up with so many confusing versions and pot-shot guesses that soon you are staring out into space confused and contemplating taking up stamp collecting. Not now, you don't—with the Hybrid Coupler and tape recorder. You switch the Coupler to RECORD STATION, put the transmitter on the dummy antenna, crank down the gain of the receiver, and record your signals right there in your own station! Now *you* know what the gang "couldn't describe" to you and you can check and make adjustments until you *know* the signal is a good one.

The experimenter will use the record-playback feature like he uses his oscilloscope—in fact, as a supplement thereto— for checking out his audio, a new filter, modulation capability, linearity adjustments, compressor characteristics and a host of other things. It's well enough and necessary to see on the scope what the signal *looks* like, but what else than the Universal Hybrid coupler and the tape recorder to tell you what it *sounds* like? After all, it's what the receiving operator hears that counts. And another thing—if the receiving operator asks you to tell him what *he* sounds like you just switch the Coupler to PLAYBACK TO XMTR and shoot his stuff right back to him. If you do satellite tracking like we do here at K2CM, you glamorize the gang with the signals from OSCAR (or some other bird) as received on the latest pass! For satellite

HERE IS THE SENSATIONAL NEW SINGLE SIDEBAND TRANSCEIVER YOU'VE BEEN HEARING ABOUT!!

- **One Band, High Efficiency Design**
- **Rugged High Quality Construction**
- **180 watts PEP Input, 6DQ5 Final**
- **High Frequency Crystal Filter**
- **Mobile, Portable, Fixed Station**

Models for 20, 40, and 75 Meters Now In Production

$275

NET PRICE, from authorized dealers only

Matching 12 Volt Power Supply $99.50

For Additional Information See Your Dealer, or write:

Swan Engineering Company OCEANSIDE, CALIFORNIA tracking, gentlemen, recording is the *only* way. You've got all your data canned immediately and available for call-out at any time.

I'm not what you call a traffic man and maybe you aren't either but we all like to do a favor. Like when I get "Say Mac, when you talk to W9XYZ tonight will you tell him his XYL will be on Flite 513 arriving Chicago O'Hare Airport at 2:20 tomorrow afternoon and he's to meet her and bring the dog along." Gosh, I used to have scraps of paper all over the place, but not now. I just say "Hold it Fred—now give me that again" and meanwhile I've switched my Coupler to RECORD STATION, flipped on the recorder, and I got

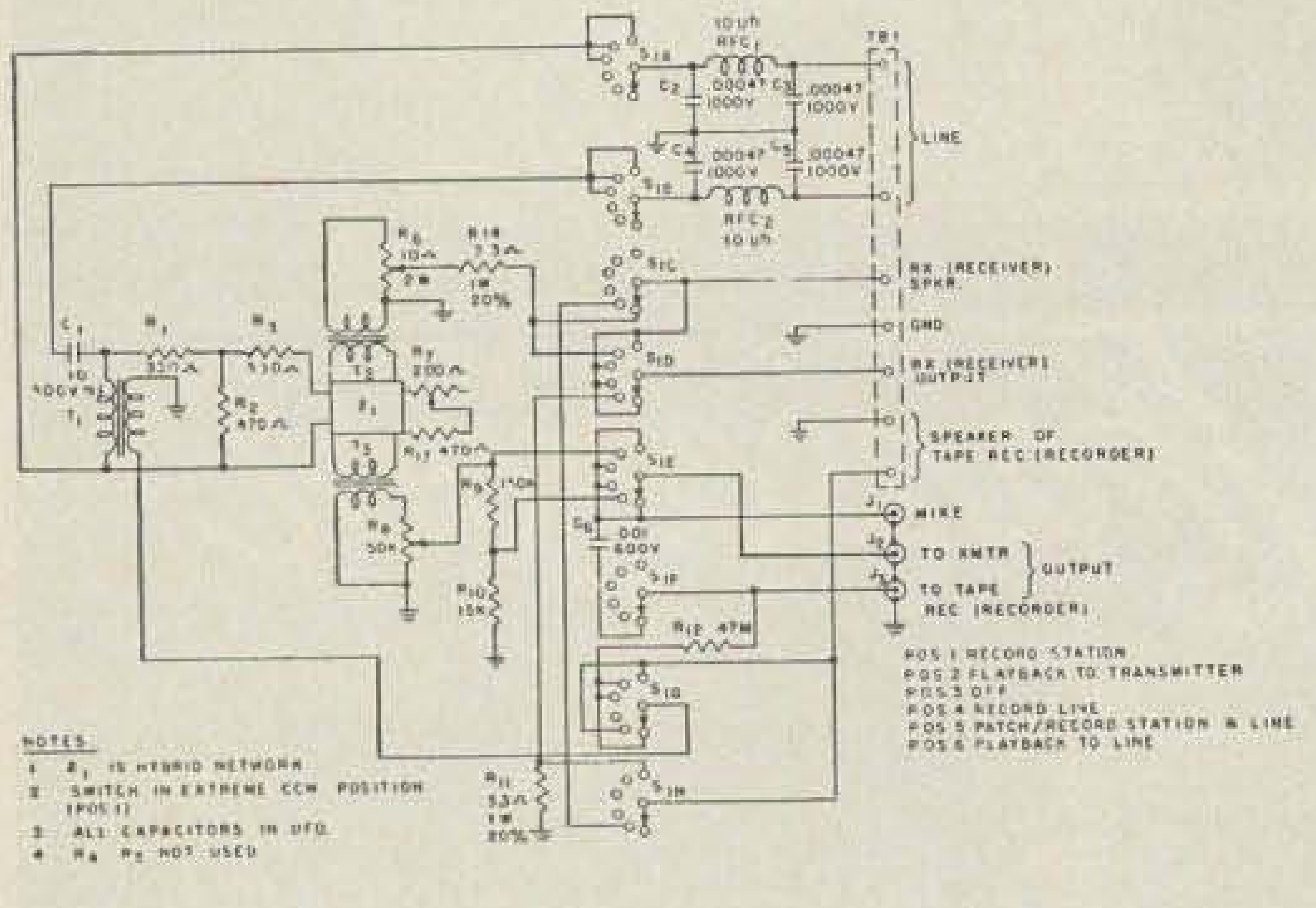


FIG I SCHEMATIC
WATERS UNIVERSAL HYBRID
COUPLER—MODEL 3001

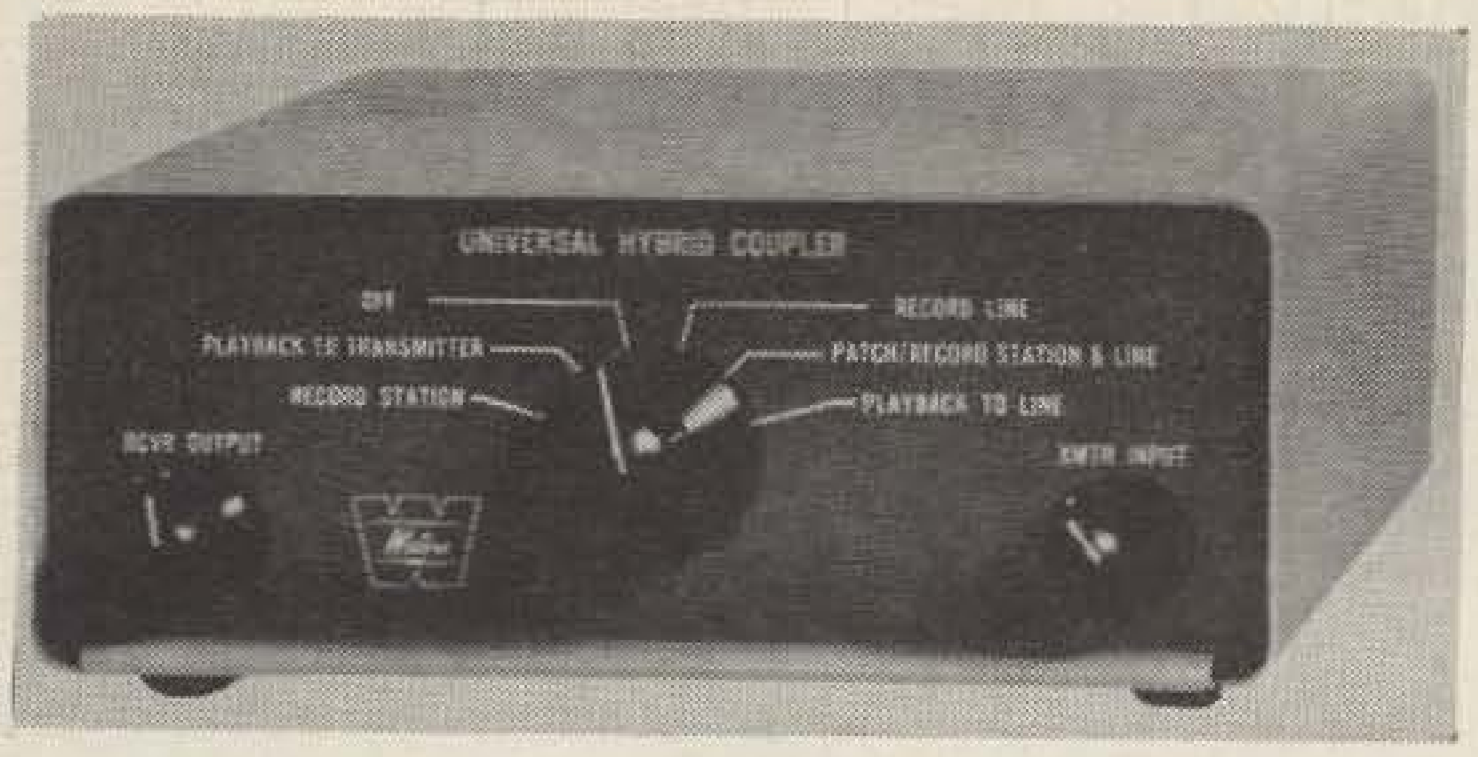
it. When W9XYZ comes on I say "Hey Joe, I got some word on your XYL" and I spill the tape when I switch the Coupler to PLAYBACK TO XMTR. Easy, eh. Real traffic men will need no priming. They'll accept messages by telephone by recording direct from the line and "store" them till net time. They will save net time by recording incoming radio traffic for "copy" later after the net is closed. The Coupler provides this facility.

DXers can exchange information on that "rare one" by recording as they work him and playing back the signal characteristics to pals they want to cut in on how to find him.

Since you're working with voice or CW, a very ordinary "monaural" recorder does the job very nicely. No need to swipe the family hi-fi stereo job from Junior or the XYL, though it will do just dandy, if you can get away with it. The point here is that many hi-fi buffs are replacing the older recorders with the new snazzy jobs and the second-hand jobs are found in the want-ads of your local paper and can be picked up quite reasonably.

Whether you foot-switch from REC to SEND, use push-to-talk or work voice-operate or use CW, AM or SSB makes little difference in applying the Universal Hybrid Coupler to your station. This is all covered in the manual that comes with the device. And the package is designed with thought of affording convenience in locating the Coupler in your operating position. If vertical mounting fits better than horizontal in your layout, you simply remove the front panel and reverse it and the panel designations are reading the right way. Clever, ain't it?

The front panel carries only the six-position function switch and the output and input gain controls. These gain controls accommodate your leaving the transmitter and receiver controls in their normal positions so you don't have to fuss with things when you switch in the Coupler—and this is nice. With the function switch at RECORD STATION your radio equipment operates normally and the recorder takes both sides of your QSO. At PLAYBACK TO TRANSMITTER, what's on the tape goes out on the air and your receiver speaker is automatically connected to monitor the stuff outgoing. In the OFF position, telephone line is absolutely clear and disconnected and your station functions as normally. At RECORD LINE your station is still as used normally but the tape recorder is bridged on the telephone line available to take down an incoming



message from the "twisted pair." In the PATCH/RECORD STATION & LINE you are in the fone patch position and can or not, as you choose, record all that goes on, yourself on your own telephone instrument, the distant party on the wire, and the party at the distant radio terminal with whom you are in contact. Your receiver speaker and microphone are inactive–you handle the whole business on the telephone. Messages received via radio and recorded may be delivered by telephone by switching to PLAYBACK TO LINE. In either this or the RECORD LINE position your station is not involved and may therefore either be shut down or on the air.

All connections to the Coupler are made to the back of the instrument thus keeping the front panel clean. The "set-and-forget" NULL BALANCE control is also on the back. The Universal Hybrid Coupler provides such an unusually ample margin of balance that it may be adjusted on either a local or toll call connection that, once set, it just doesn't need to be touched again. All circuit elements of the Coupler are inactive, there is nothing to deteriorate, and a high degree of stability and reliability is thus afforded.

The circuit is shown in Fig. 1. The telephone line enters the Coupler through an rf filter to choke and by-pass any signal your telephone line may pick up from your antenna. A T-pad isolates the hybrid network, Z_1, and affords ease and stability of balance adjustment. Eight decks of switchpoints arrange the circuitry for the function selected by the operator.

We're not given much to going overboard with predictions, but we'll hazard a guess that the Universal Hybrid Coupler is going to find its way into many a ham station–not only because it's a good fone patch, but because, phone patch or not, it provides so many other useful features which are handy to have and have not heretofore been so conveniently available. Here at K2CM we've found the thing grows in on you–like a grid dipper, or an oscilloscope–you get to wondering how you got along without it.

(W2NSD from page 4)

little VHF Amateur magazine. It is kind of sad to see it go—for the fellows that put it out worked hard for a long time to try and make it succeed in supporting itself. As I recall, the bulletin started back in 1957 or 8 as Channel A, a bulletin devoted to the doings of a small six meter net in northern new Jersey. Bob Brown K2ZSQ did a nice interesting job of it and fellows started requesting subscriptions from other areas. As the bulletin outgrew the little net the name was changed to QSO. Then as it grew further into an all-purpose VHF bulletin the name was again changed to VHF Amateur. Now all that remains of about five long hard years of work are a few yellowing back issues.

Older timers will perhaps remember back to the VHF News by Bill McNatt. This was a marvelous VHF bulletin and I treasure my back issues of it. This one was gobbled up by CQ back in 1952 or thereabouts. Bill sold out to CQ and ran the column in CQ for a few months before he gave up and quit completely.

Goodbye VHF Amateur.

Radio Cairo

The Potomac Valley Radio Club has lodged a complaint against Radio Cairo for violating the international frequency agreement and operating on 7050 kc. This segment of the 40 meter band is allocated internationally to the amateurs and RC has no business there. It just might be helpful for clubs and interested amateurs to log reception of RC and send letters to RC, the International Telecommunications Union in Geneva, and the FCC. After the 1000th official complaint we might get some results.

Parts

National Radio Company has been busy adding to their rather wide line of parts. You might send for a catalog and let 'em know that hams still buy parts. You may be interested in their new line of low torque capacitors which are ball-bearinged to a fair-the-well (for working with small synchros) and should be great for an inertia dial. Then there are a couple of reduction mechanisms which reduce shaft rotation by 5:1 or 10:1, miniaturized and ball-bearinged. There are over 100 different models so you really have to have the catalog.

ATV Bulletin

The second issue of the Ham-TV bimonthly bulletin has just been published. This is a real interesting little (12 pages) paper which not only gives the latest operating news for TV hams, but also has some hot construction and conversion articles. Editor Shadbolt WøKYQ brings us three excellent articles this time, one by Jim Kennedy K6MIO on how to convert UHF converters to ham TV reception. This article covers the general conversion and goes into particulars on the Mallory Inductuner, the RME Model 200, and the G.E. UHF-103. Bruce Robinson VE9OX has a fine article on the conversion of the surplus monitor receiver which was originally designed to accompany the famous ATJ/ATK iconoscope cameras. This monitor is the ID-66/AXR-1 (available from US #1 Electronics). Bruce also has a technical article on dc restoration. The ATV Bulletin costs just $1.00 per year for six issues. Send a dollar to 73, Peterborough, N.H. and mark it for ATV, we'll sends issues 1 & 2.

OLD License Plates

Now that we have a huge hamsack to decorate it would nice to have some more unusual license plates to hang around. I'm particularly interested in getting call letter plates where the call letters are out-of-district calls. My meager collection now consists of a few W2NSD New Hampshire plates and a couple W6THN Tennessee plates. If anyone has any old plates like this to spare we would appreciate their sending 'tm on up to us.

Mountaintopping

One of my joys down through the years has been operating from the top of a mountain during VHF contests. There is nothing like a few thousand feet of height to bolster up one's score. I even have to admit that the availability of Pack Monadnock, one of the most popular New England VHF mountaintops, had more than a little to do with the selection of Peterborough as the first place to look for a new location for 73. The 73 HQ is exactly 3.5 miles down Route 101 from the Pack.

Now, after partially surviving the VHF Amateur magazine VHF contest, I can see that trying to operate a VHF station in the immediate vicinity of a popular mountaintop has its drawbacks. One of those non-crosstalk Telco converters would have been very beneficial. The Memorial High School Radio Club of Manchester took over the mountain and all we heard here for the weekend on six and two was Kay One Ugly Green Zombie, buoyed by seven inexhaustible youngsters.

I really can't grumble about it because they had the time of their lives and I'm all for such outings. This is one of the big benefits of the ARRL Field Day. But I can see where I have some mixed benefits on this mountain. What on earth will happen if the 73 clan moves up on the mountain for a contest at the same time as the Swamp clan with Sam Harris W1FZJ as their prophet? Can two kilowatt two meter stations with 64 element beams work side by side? Tune in on two and see.

Remember The Conelrad

The FCC, giving the arched bones a little kick, officially pronounced Conelrad dead on

(Turn to page 74)


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.

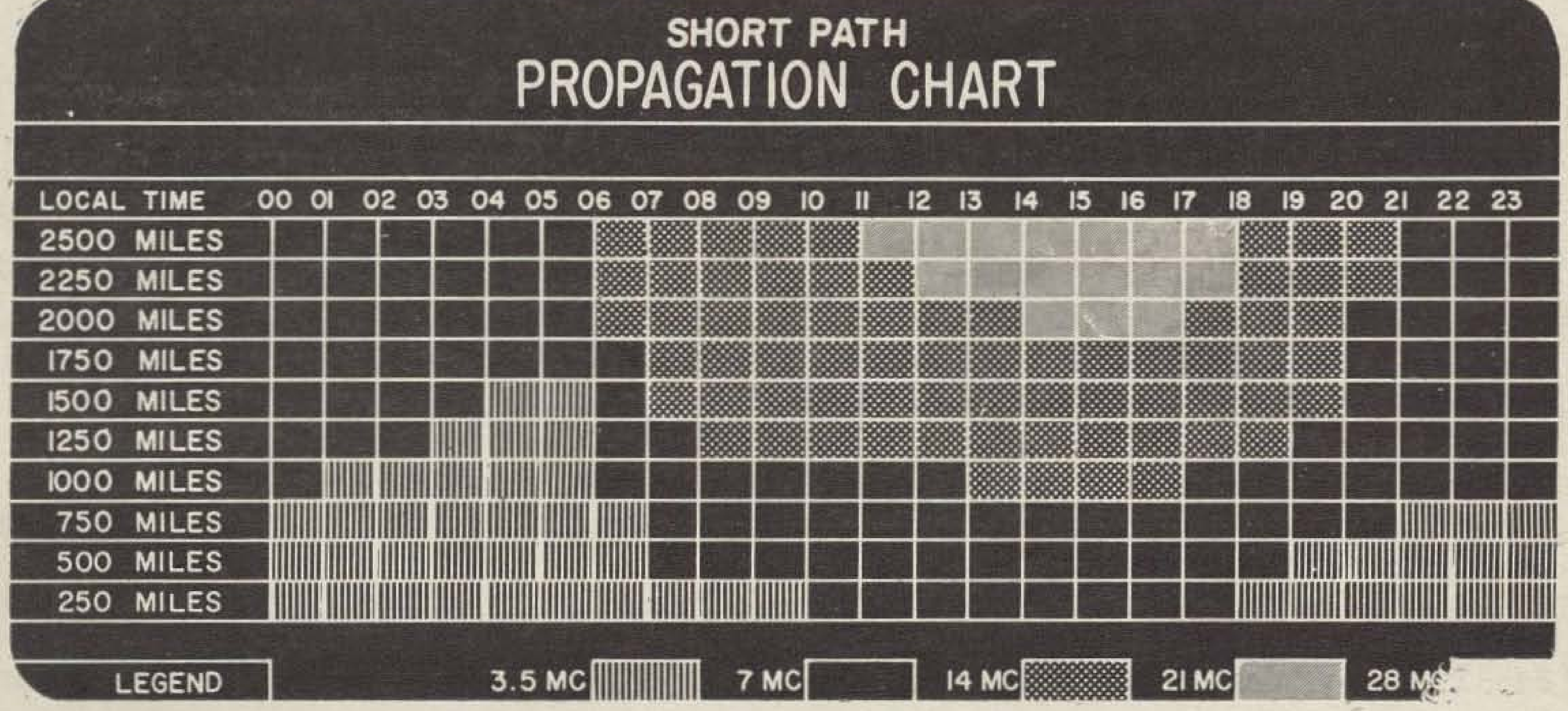
The Short Path propagation chart has been set up to show what HBF to use for coverage between the 48 states. Alaska and Hawaii are covered in the DX chart. The use of this chart is somewhat different than the DX chart. First, the time is the local time centered on the mid-point of the path. Second, the 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: September 1962

Good: 4-9, 14-26

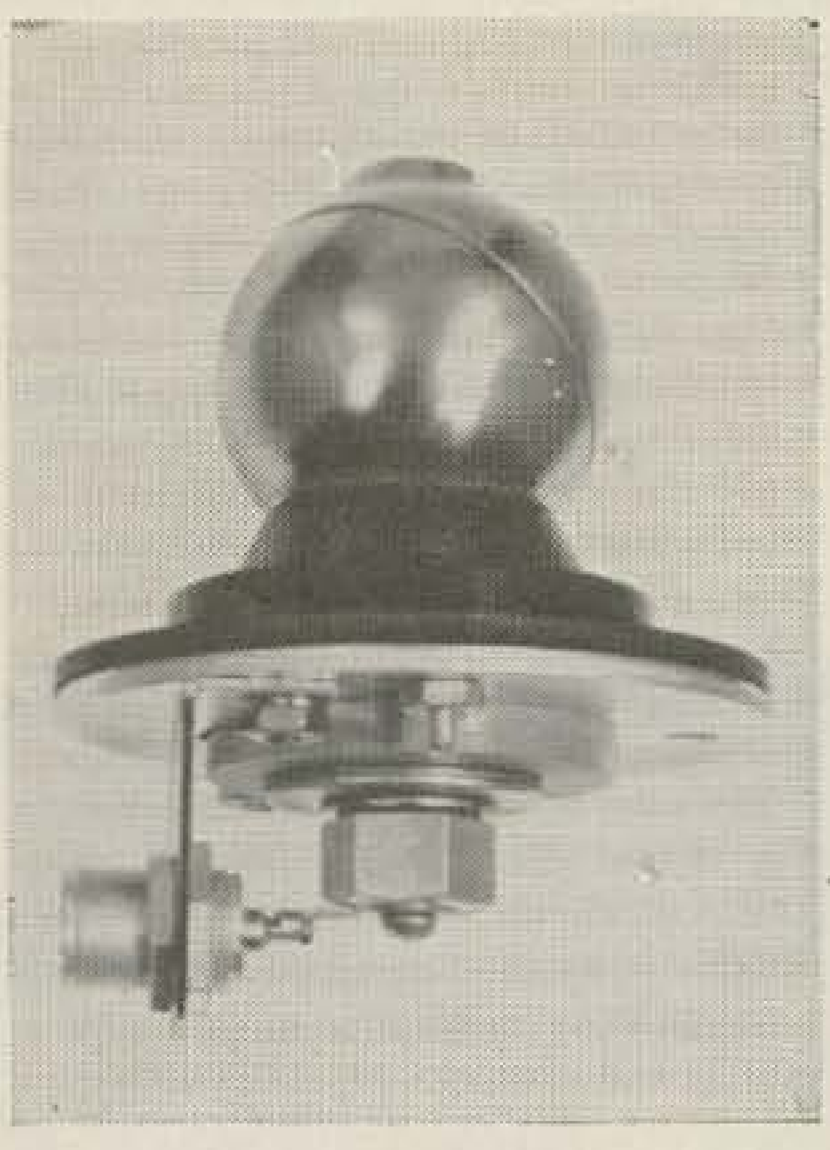
Fair: 1-3, 10-13, 27-28

Bad: 29-30



New Products

Lafayette has beaten the dollar-a-watt line with their new 90 watt CW input Starflite. Tunes 80 through 10 meters, holds fixe crystals (external VFO provision), controlled carrier modulation, grid-block keying, 6146 final. $82.75 in kit form. It even has a built-in low pass filter to keep the Indians down. If you send for information on this one tell 'em you saw it in Fortune and we'll drive 'em nuts trying to find it there. Lafayette, 111 Jericho, Syosset, N.Y.

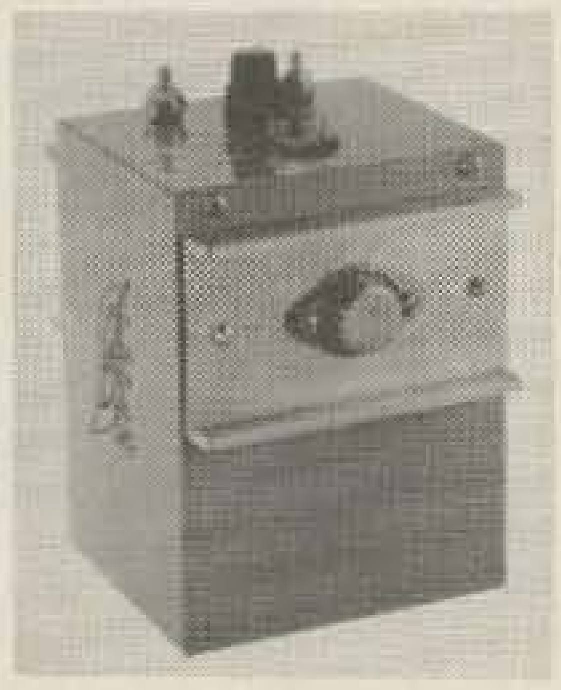


Hole in One

Webster Manufacturing, a brand new advertiser (page 31, write 'em), has a new mount which requires only one single $1\frac{1}{16}''$ hole instead of the usual four holes. This is very handy since you can yank the amount when you get ready to pawn off that old wreck on some unsuspecting car dealer and fill the hole with the usual old broadcast whip.

Epsilon Records has just announced a new code record, ER1003. The 12" LP, which sells for $2.49, contains 46½ minutes of perfect code recorded at 15 WPM and presents a sketch of the life of Nikola Tesla in Morse Code. Played at 33⅓ rpm it comes out at 15 WPM; at 45 rmp you hear it at 20 WPM and at 7R rpm the code speed is 35 WPM. This record is an ideal way to increase code speed for it not only gives you perfect sending, but it gives you exact code speeds to measure your progress. See the Epsilon ad on page 67 of this issue and the piece on page 65 of the August 1961 issue.

Propagation Products, one of our more recent advertisers, piloted by W4EXQ, mentions that he is looking for tech manuals that may be laying around the shack. Bill wants surplus or commercial manuals on aircraft or electronics, including old ham equipment manuals and back dated ham magazines. Get a bid from Box 242, Jacksonville, Florida.

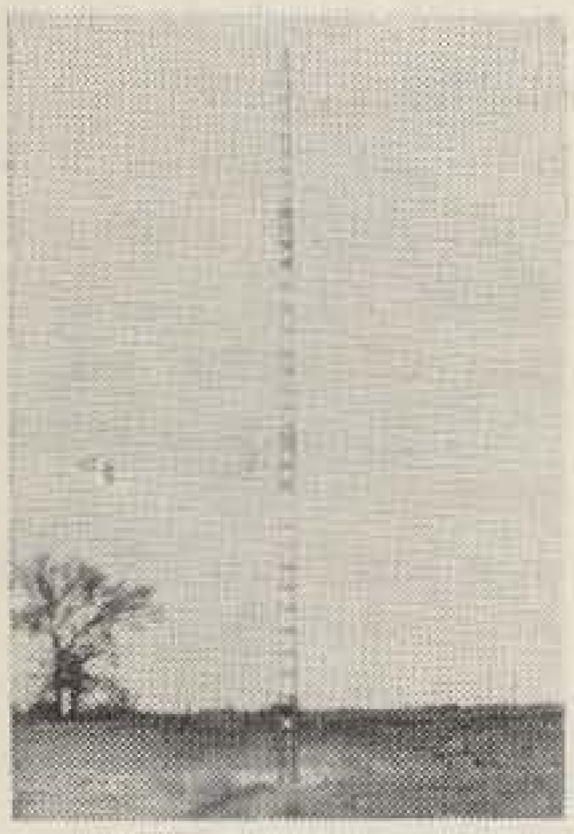


Quite a Handfull

Jim Morrissett brought one of the Topaz converters back with him when he reported for managing editor duty while I was off selling subscriptions in Europe. Somehow you don't really get the idea of the compactness of this unit until you are holding one in your hand. I've read the Topaz ads, of course, and even noted the dimensions they list, but still the actual converter was a surprise. 250 watts in that tiny package! (4" x 4½" x 6" approx.).

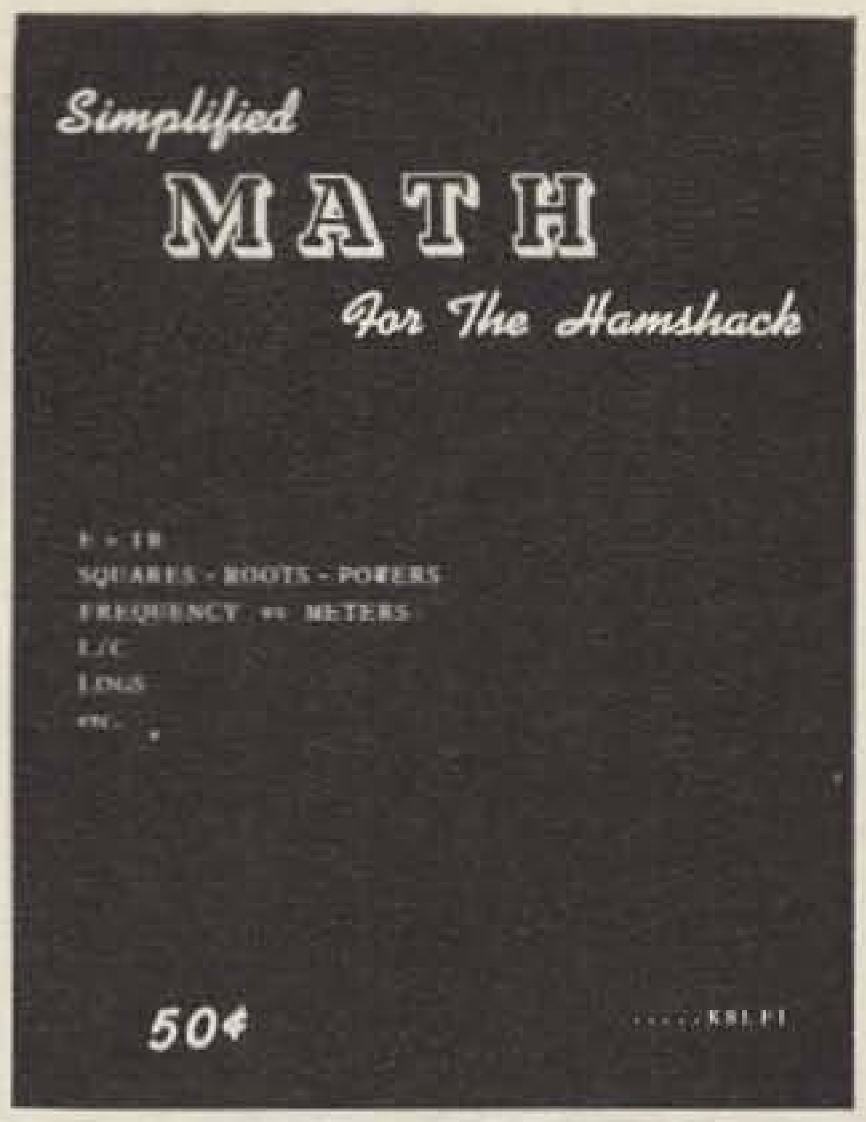
Topaz has models designed for most of the commercial transceivers and transmitters that you might consider using in your car. They particularly have specific models for the Swan Transceiver and the Collins KWM units. The outputs are available in the various units from 600 to 800 volts for the high voltage and around 300 volts for the medium voltage, plus a bias output. Even the turn-on relay is built into most models, sparing your transceiver the high currents involved and cutting down the heavy cabling.

By keeping the power supply floating they have surmounted the usual problem of positive or negative grounding. Most of the models are for 12 volt systems, however, they have just recently come out with the first commercially available transistorized supply giving 250 watts of output with 6 volts input. This provides me with an answer to the chaps who write in with a tear in their voice, wanting to know what they can do in the way of mobile gear to put in their Volkswagen or Porsches, six volt cars. Topaz has six different six volt models available and they will handle most of the commercial transceivers and rigs. Drop a line to Topaz and get their detailed specs. 3802 Houston Street, San Diego 10, California. Tell 'em Wayne sent you.

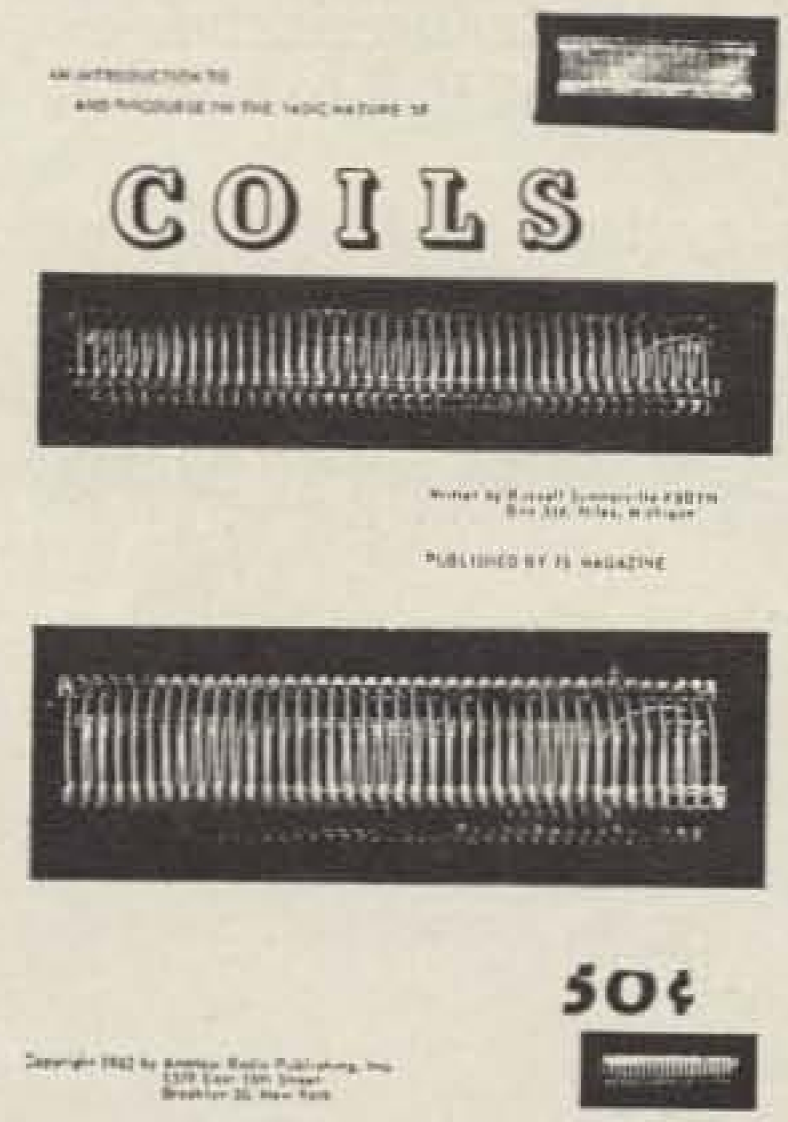


Crank-Up

Rohn has announced the availability of their #6 tower in a crank-up model in heights from 18 to 54 feet. It wouldn't hurt for you to drop them a note and find out more about this. Rohn, Box 2000, Peoria, Illinois. Tell 'em you read about it.



K8LFI has come up with a booklet on "Simplified Math for the Hamshack" that you mustn't miss. This booklet presents the simplest and most understandable explanation of the math that we need for ham radio work that we have ever seen. It covers with utter simplicity Ohm's Law, squares, roots, powers, frequency VS meters, L/C, logs, etc. It even introduces you to the slide rule. This will be one of the best investments you've ever made. 50¢



This little twelve page booklet will be an interesting addition to your library. It will not only give you quite a rounded body of information about all sorts of coils, but is a fine thing to whip out and show someone who is interested in learning about radio. Marvelously written by Russ Summerville K8BYN, it is also well illustrated. It covers all types of coils and discusses their resistance, inductance, reactance, Q, and distributed capacitance. only 50¢

Full Break-in

George Thurston W4MLE
3407 Prock Drive
Tallahassee, Florida

"SO who needs full break-in? I never handle traffic."

So OK. You work DX? Rag chew? Don't like QRM? Read on. If you use CW at all, full break-in is like the automatic transmission on a car. You can get along without it, but there's nothing like it.

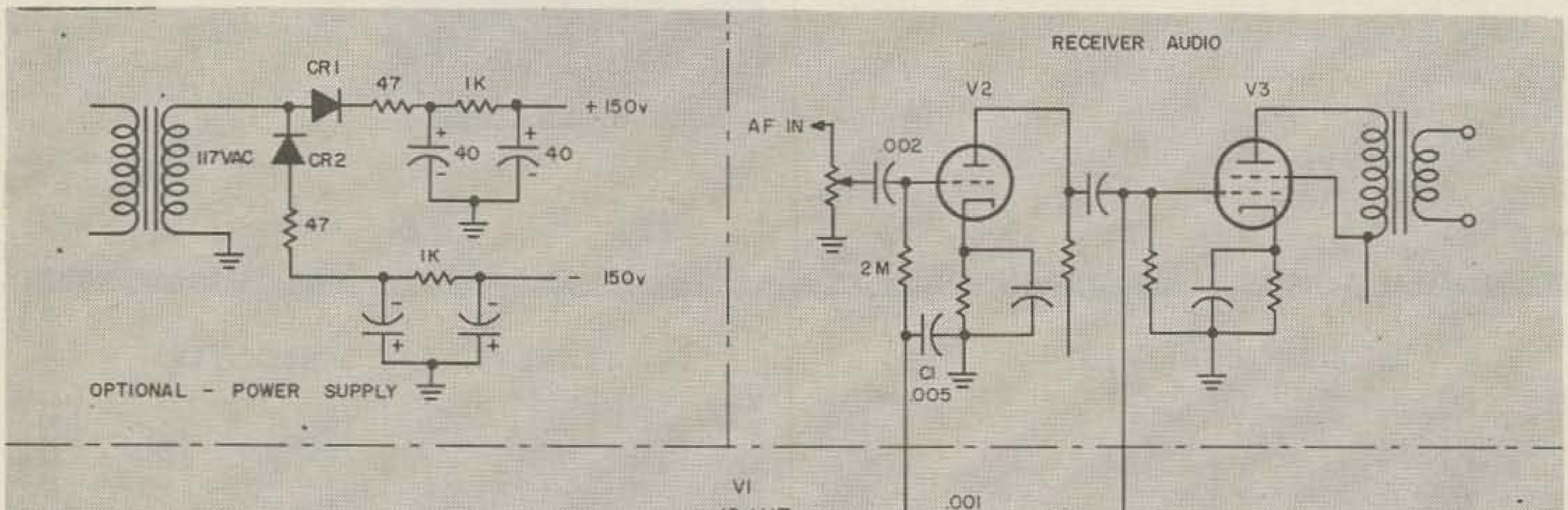
Full break-in is any system which will let you hear during brief pauses in your sending. It speeds your operating immensely. There are no switches to throw to go from send to receive. Hit the key—you're on. Let go—you're listening.

DX? You can hear other stations calling the boy you're after. Time it right, and your call will be the last one, and in the clear.

Rag chewing? You can hear that South American phone when he clobbers your frequency—and just stop sending until he drifts down the band a little. And the guy on the other end can stop you to tell you he's on the land-line, so "pse QRX."

Contests? Work 'em and log 'em. No switches to throw.

"Yeah, but what about all that racket in the phones—the clicks, squawks, grunts, blaats and



screeches? And besides, I don't like having to tune in my own signal all the time to monitor."

Relax. All that's solved. It takes one tube, one relay, a neon lamp and three diodes.

Here's how it works.

Audio Grid Block Keying

You just key the receiver. The audio part of the receiver, to be exact, so you don't hear all that racket. And feed in a "sidetone" to monitor your own keying.

That's all there is to it.

The keying is clickless, thumpless, squawkless and so fast that a strong station can "break" through a string of dots at 25 wpm.

The diagram shows how this is accomplished.

This is not a blow-by-blow construction article. Nothing is critical. It can be built on any convenient chassis, in any convenient nook or cranny. It can have its own power supply or can steal power from existing equipment.

Changes required in your receiver are very minor and you can avoid them completely, if you want to build an additional small amplifier. No changes at all are made in the transmitter, assuming that you're already keying the oscillator (or mixer of a heterodyne rig).

Power requirements are small. Filament voltage for one tube, 150 volts positive at 20 ma and 150 volts negative at 5 ma.

Cost? Nil, if you have a good junk box. Maybe $15 if you buy parts new and steal voltages from existing equipment.

How It Works

With the key open, V4 is cut off by blocking bias, no plate current flows and the relay remains open—resting. One pair of contacts of the DPDT relay short the grid resistors for V2 to ground and the stage operates as an ordinary audio amplifier.

The other pair of relay contacts shorts the grid of V1 to ground, preventing it from feeding any side tone to the audio output stage.

When the key closes, plate current through V4 causes the relay to pull in. This removes both the short circuits.

A hundred and fifty volts negative bias cuts off V2, so that it won't pass any of the audio arriving fom the receiver's demodulator ("second detector" if you like). At the same time, V1 is permitted to amplify the audio output of the little NE2 relaxation oscillator. And the output of V1 is fed to the grid of the receiver's audio *output* stage, which has not been affected by the blocking bias.

Thus, almost instantaneously, the receiver "goes dead" and the sidetone pops up in the speaker, or phones. When the key goes up, the reverse happens.

The Relay

If you have a DPDT relay in your electronic keyer, you can eliminate V4 and the relay altogether and use the keyer relay contacts to do the job. Most keyers, unfortunately, have a SPDT relay. And if you use a bug or handkey, you will need some means of operating the keying relay. This is about the simplest way to do it.

Sidetone Generator

Any kind of audio oscillator device may be used. An NE2 was chosen because it can work from voltage of either polarity, it is cheap, small, effective and requires no filament supply.

It will be necessary to fiddle with values of C2, R2 and R6 to get the audio pitch you like. R2 permits varying the pitch from the front panel. The bigger the resistance of R2 compared to R6, the greater range of pitch control you'll have. Different values will be required for different voltages. The values shown are about right to start experimenting with, for a voltage of about 150.

R3 permits controlling the volume of the sidetone from the front panel. Sidetone level in the speaker or phones is completely independent of the setting of the receiver volume control. It is determined solely by the setting of R3.

At the author's station, the whole unit is built into a home brew W9TO keyer chassis. The keyer already supplies all the necessary voltages, sidetone generator and amplifier.

Unfortunately, the TO keyer normally uses a SPDT relay, and this had to be changed to a DPDT unit.

It might be possible to use the circuit shown in Fig. 2 to use the SPDT relay in a TO keyer, for transmitters using grid-block keying. Transmitter bias is used to block the grid of the sidetone amplifier. I have not tried this approach, but it should work nicely.

Receiver Modifications

The only changes in the receiver are indicated by the broken-line box in the diagram.

You don't want dc bias voltages on your receiver volume control. It makes for noisy operation. So you isolate the arm of the pot with a blocking capacitor. Bias is fed to the grid through the 2M resistor shown. Exact value is not critical but should be approximately 3 or 4 times the value of the audio pot, because it is in parallel with it for audio. Too low a value would reduce the effective resistance of the pot.

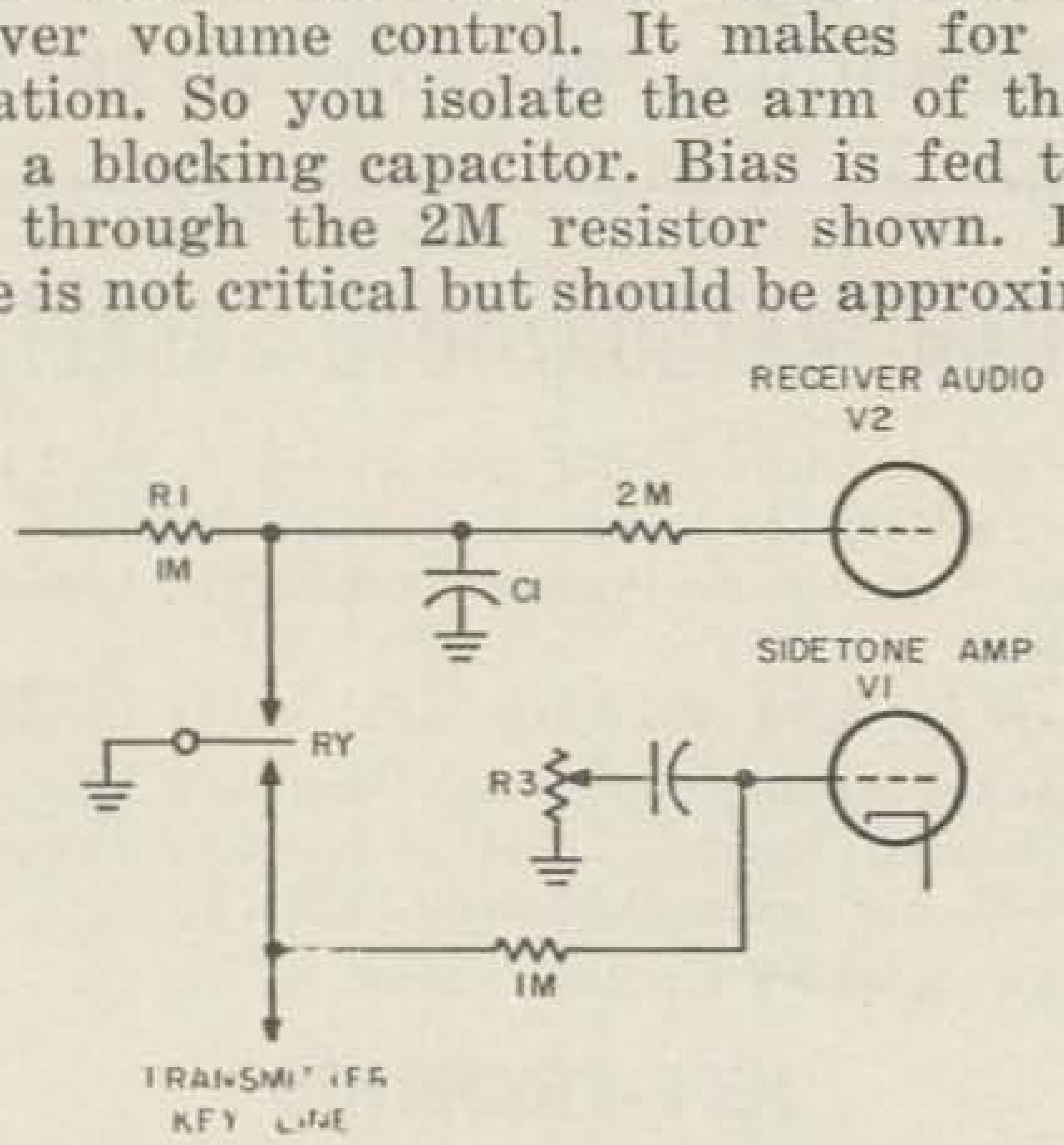


FIG 2

Sidetone is fed to the output stage through a shielded wire connected directly to the grid. R4 may be mounted in the break-in unit. Its value should not be too high in proportion to the value of the V3 grid resistor, since the two in series form a voltage divider for the sidetone audio voltage, with the grid tapped down on it. High values of R4 will result in low sidetone levels. R4 may not even be strictly necessary but it probably helps keep down injection of tube noise and hum from V1.

If you don't want to tear in and modify that new $1200 Super Gizmo receiver, you don't need to. Just build a simple two-tube audio amplifier and feed it from the receiver headphone jack. Then key the grid and feed the audio tone to the outboard amplifier.

Key Shaping

Without some kind of key shaping, the rapid make-break of the blocking bias on the audio grid could produce clicks. We don't want these.

The solution is key character shaping with an RC network. (Or the use of an audio peak clipper in the following stage.)

This is the function of R7, the 1N34, C1 and R1. When the key goes down, bias is applied to the grid through R1 and R7 in series. But it must charge C1 first. The higher the combined resistance of R7 and R1, and the larger the capacity of C1, the longer it takes the bias to reach the value required to cut off the tube.

If it reaches this value too quickly, a click results. If it reaches this value too slowly, a click or squawk results, because the transmitter may come on before the tube cuts off.

Because of the polarity of the 1N34, its *forward resistance* (very low) shunts R7. So the charging time is determined almost entirely by R1 and C1. Charge time should be made as short as possible without producing clicks on the "make."

When the key is lifted, C1 discharges to ground through R7. But this time, the high *back resistance* of the diode shunts R7 and the effective value is approximately that of R7, so C1 discharges slower than it charged, for high values of R7, and faster than it charged for low values of R7. If the resistance of R7 is zero, discharge is virtually instantaneous. This could produce a click. If discharge is too slow, the receiver won't "open up" quickly between letters.

It is not possible to give exact values for R7, R1 or C1. They will be different for each audio tube which may be keyed, and they will be different for different values of bias voltage.

In general, they should be adjusted to give the fastest keying possible without clicks. The value of R1 must be kept above 500K because when the key is up, R1 shunts the bias supply as a bleeder. Too low a value will overload the supply or overheat the resistor.

Receiver Front End Protection

A TR switch will work fine to keep damaging amounts of rf out of the receiver's front end. I use a separate receiving antenna, however, and I protect the receiver with a pair of 1N34's connected back to back, across the antenna terminals. Transmitter input—up to 1 KW.

At very low voltages, the 1N34's have very high resistance, both in the forward and back directions. They have no effect on receiver performance.

When high rf voltages are present from the transmitter, however, they conduct heavily and the receiver behaves as though the antenna terminals were shorted together. Simple, but effective.

Many hams use an NE2 or NE1 across the antenna terminals for the same purpose.

Comments

Like every construction project, no matter how simple, this one has three phases:

(1) putting it together
(2) figuring out why it doesn't work
(3) Getting it to work right.

It's a real pleasure to be able to tell the guy on the other end "QSK HR OM." . . . W4MLE

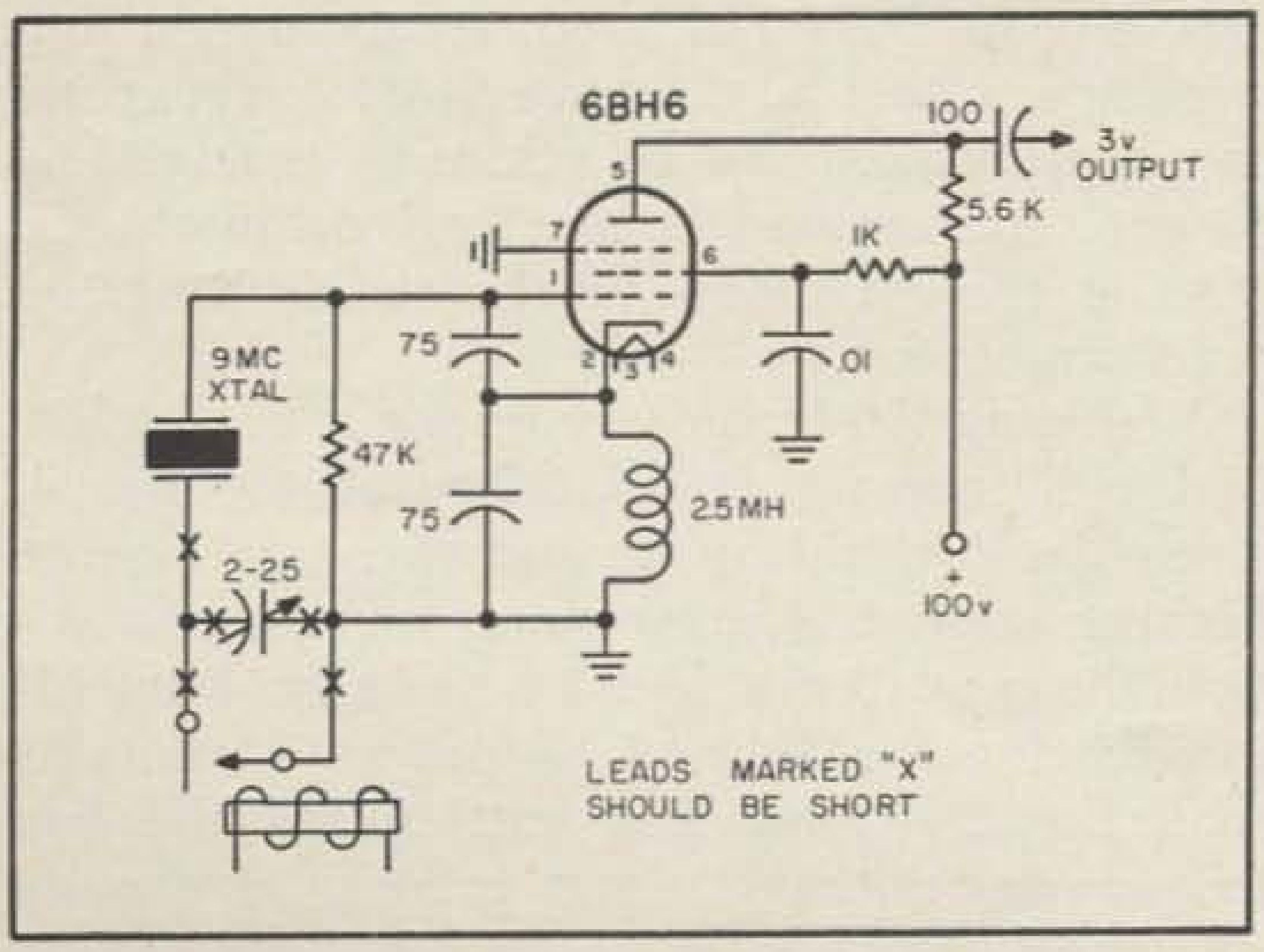
FSK a 9mc Osc.

Here is a circuit developed for frequency shift keying a 9 mc Crystal Oscillator.

The output of this oscillator feeding into a 9 mc SSB rig replacing the output of the 9 mc SSB Generator will give the 850 cycle shift required for RTTY.

Closing of the contacts produces the higher tone, the lower tone being set by adjusting the 2-25 mmfd condenser. The frequency shift will remain the same on all bands.

. . . WØPHY



The Frequency Response Argument

A New Approach

James L. Tonne W5SUC

THERE are probably as many opinions among phone operators as to the "best" frequency response for a transmitter as there are phone operators. Those who bought their equipment could care less, but the fellows who roll their own are sometimes highly concerned, since they have the power to alter components to achieve better results—embarrassingly enough sometimes better than that pretty store-bought thing.

There are books by the boxful telling how to adjust your equipment for the most potent-sounding signal. And the best of these were written by fellows who did the testing under the most favorable possible conditions with some of the world's finest test equipment.

That's where the rub comes in—they didn't run their signals through a transmitter and receiver. And that is a highly important step, chiefly because of the limited amount of audio power that the transmitter can handle. When these boys did their testing they did it with signal sources feeding amplifiers that could very easily drive the headphones that the listeners wore. Although some electrical noise may have been added to the signal, everything was kept very linear. This is very fine for the lab, but when it comes to testing a new-found frequency response curve over the air, that signal is definitely going to run through a transmitter with limited modulation capabilities and a receiver with a very definite effect on the signal.

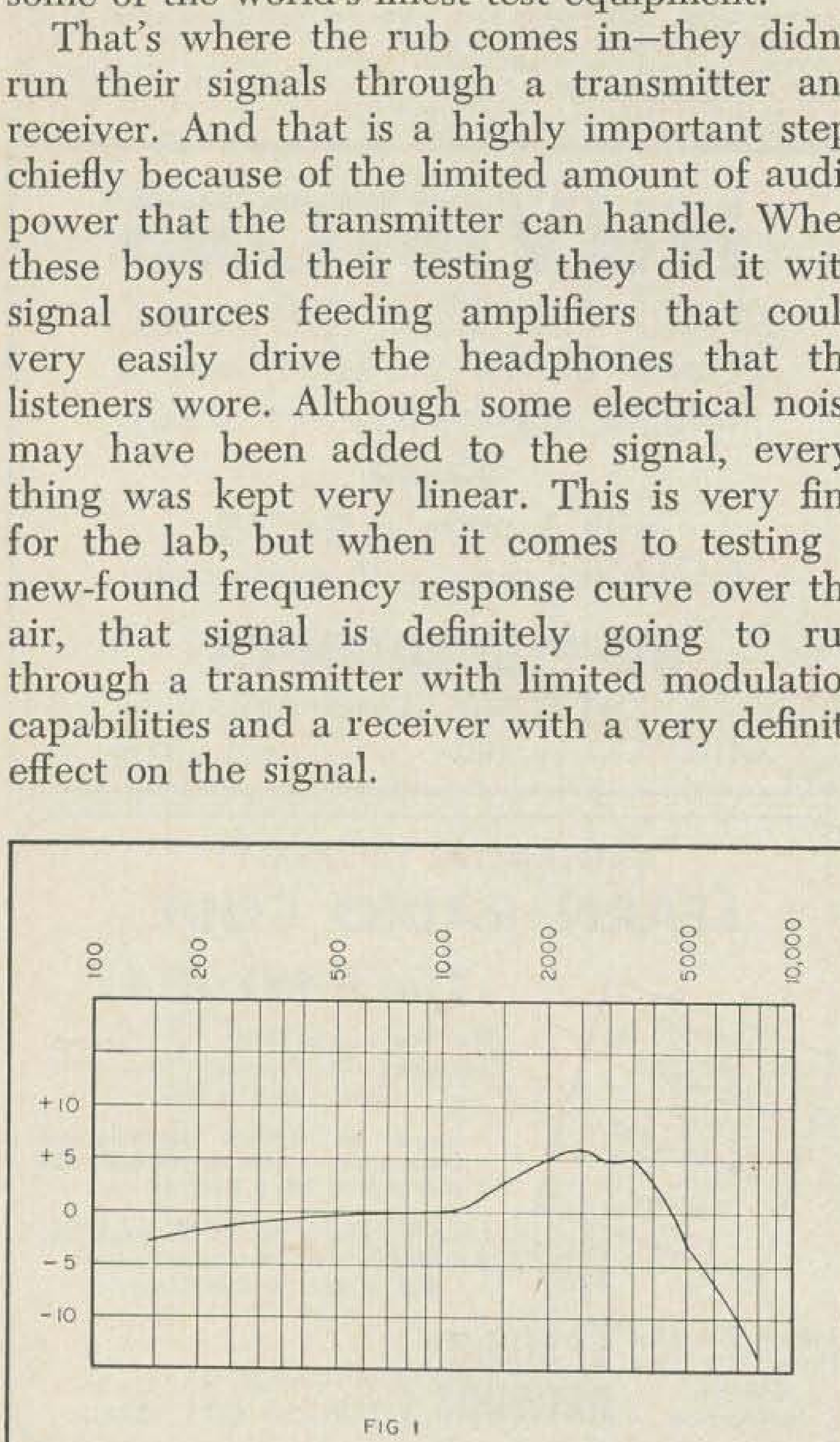


FIG 1

So here we go—at complete odds with the "authorities."

Ye writer has built and operated a number of amateur band transmitters, most of them using modulation techniques of high quality. Usually plate amplitude modulation was used, sometimes efficiency (screen grid) modulation was employed. In each case, the optimum frequency response to transmit was radically different from that which it is commonly supposed is best. By the way, don't laugh at "high quality" being used in the same paragraph as screen modulation. KFI in Los Angeles, WOAI in San Antonio, WCKY in Cincinnati and KDKA in Pittsburgh all use screen modulation. Distortion? In the vicinity of 1%.

Frequency Response

Let us suppose that conditions over the communications path are more or less ideal, and that a good signal to noise ratio exists, say in excess of 15 or 20 db. The receiving operator will doubtless open up the bandwidth of his receiver in order to let more of the high frequency components come through. He will do this until the signal to noise ratio of the signal as received begins to decline. Seldom will the receiver be allowed to receive components beyond 4000 cps.

It has been found by the writer that the high frequencies do contribute considerable intelligence, but that components above 4000 cps are to be considered secondary in importance, rather than above 3000 cps as commonly published. To be ethical it is advisable to cut off components that will definitely fall outside the passband of the receiver at the receiving end.

Reducing the frequency response on the low end will increase intelligibility of the signal, since the low end of the speech range has the highest amount of power, and this range additionally contributes less to the signal intelligibility for the amount of power it contains than the high end. But cutting out the low frequencies entirely is not proper, as can be shown.

If the goal of this deliberate alteration of the frequency response is to make all frequencies have about the same amplitude, then the proper thing to do is to install an equalizer which mirrors the speech distribution. Such an equalizer can be fabricated quite simply by using a high frequency boost of about 12 db/octave above 1000 cps. The boost should cease at about 3000 or 3500 cps. Such a scheme will produce much better results than cutting out the lows, and the two results will sound quite different. Boosting the highs is considerably easier to listen to, especially under adverse conditions.

Such a frequency response, flat on the low end and rising on the high end, is to be highly recommended.

Suppose now that instead of boosting the highs we cut the lows. Suppose further that we cut everything below 800 cps, as has actually been proposed. The audio level of the signal as received is now critically dependent on the bandwidth of the receiver at the receiving station. If the receiver is quite wide, sufficiently so to capture all of the sidebands, then the signal to noise ratio will be poor because of the interference and noise that probably will be on the channel. But if the bandwidth is reduced, the modulation percentage of the signal as detected is cut down. It is this very same reduction of modulation percentage by the *if* strip that causes so much trouble with oscilloscopic modulation checks by the receiving operator. He will consistently give out low modulation percentage reports which will disagree with the transmitter operator. And yet both are correct—if you remember that the receiver will actually reduce the high-frequency modulation percentage as received. Indeed, if everything below 800 cps is removed at the transmitter and all above 800 cps is removed at the receiver through the *if* selectivity, then there will be nothing, but nothing coming out of the receiver's loudspeaker. Nothing, that is, but noise. For it has been proposed that such an extreme cut of the low frequencies as transmitted be used under extreme circumstances. And under extreme circumstances the receiving operator will no doubt sharpen his selectivity. Hence little of the modulation will be detected.

Whereas if some of the low end is left intact, albeit reduced, then the receiver would have something left with which to play regardless of the amount of selectivity used.

Distortion

In practice it is found, provided that the modulation system is nearly distortionless, that

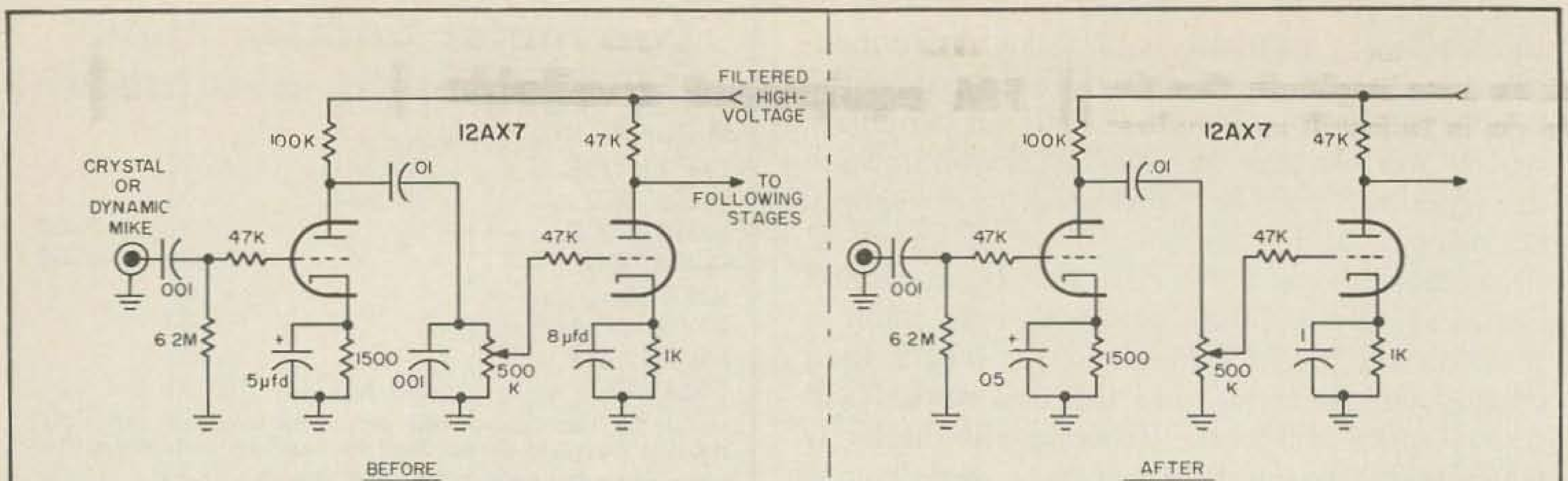


FIG. 2

the low end should be preserved as carefully as possible. To make up for the losses in the rest of the system, it might be advised to actually raise the response on the low end, particularly if a carbon microphone is to be used. This must be done very carefully. Distortion must be kept to a low level, preferably at the vanishing point. The degree of distortion that is allowable depends chiefly on two things: the amount of reduction in intelligibility that results from a high degree of audio nonlinearity (distortion), and secondly the increase in bandwidth that results from distorting the audio signal.

If the high frequencies are distorted, as for example if a 3000 cps signal developed some 3rd and 5th harmonic distortion, the intelligibility would not suffer in the least. That's because 9000 and 15000 cps signals will not be passed by any modern day receiver. The fact that remains is that the signal as transmitted will be broad, even if overmodulation does not occur.

If such a high frequency distortion occurs, the only way that these components can be detected is by tuning off to the side of the signal. Their presence will be most obvious. The signal will have the so-called "hairy" sidebands.

If the low frequencies are distorted, this is the cause of some very irritating intermodulation troubles. Unfortunately, the low frequencies are most difficult to keep distortion-free if economy enters into the picture at all. Large amounts of iron are required in the modulator and the power supply must be capable of handling the low frequency components. If the low frequencies are distorted, then the high frequency components "riding on top of" these signals will be distorted too—sometimes to the point of non-intelligibility.

A distortion figure of 50 db down would be gladly accepted by most broadcast stations, whose typical distortion at 100% modulation might run from 1 to 3%. So if you can make your signal sound of BC quality, then you are on the right track as far as distortion is concerned.

Circuitry

Of probable interest is the frequency response curve of the newer telephone sets—the Type 500. See Fig. 1.

Methods used to boost the high frequencies are very simple. If the speech amplifier has a little gain to spare, merely remove one of the cathode bypass capacitors and replace it with a smaller value—typical values run from .025 to .1 mfd, depending on the value of the cathode resistor. Do this for 2 or 3 stages and you have it made. Or you can use a simple voltage divider with a small capacitor to shunt the highs around it, as in Fig. 3. If any of the low level stages have a capacitor from some point to ground other than cathode or screen, remove that capacitor as it is reducing the high frequency response.

If you want to increase the lows, remember two very important things: first you'll probably raise your hum level, and secondly the modulator must be clean as a whistle in order to handle the lows without distortion. If you can borrow distortion checking equipment, by all means do so.

In Summary

Don't cut out the low end entirely. It is

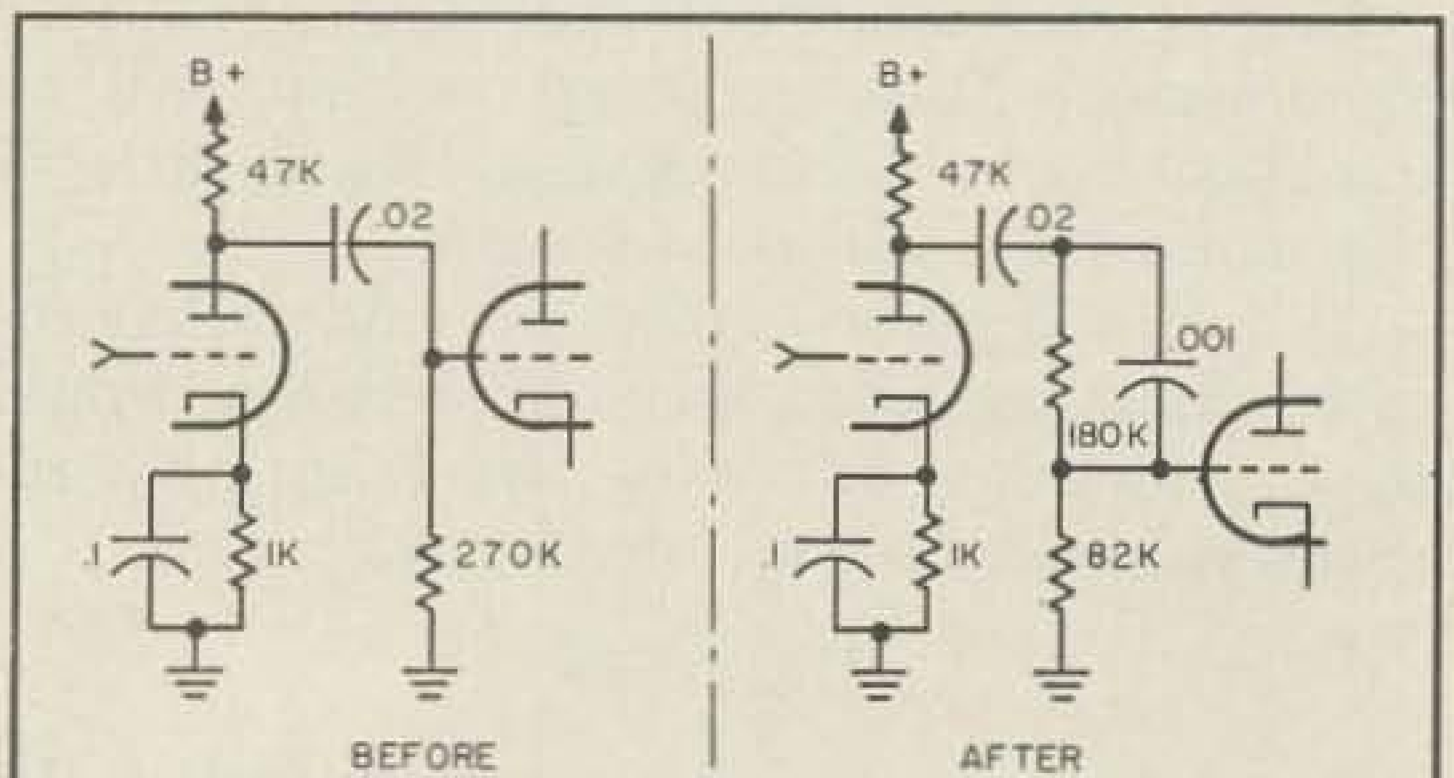


FIG. 3

best to boost the highs instead. But frequencies above 3000 cps are not too important, and those above 4000 need not be transmitted at all.

If the audio system has poor low frequency response, make up for that and get the overall response flat on the low end. Then, if the receiving operator uses considerable selectivity, your modulation will still hold up.

Keep distortion at the vanishing point. Operate the transmitter conservatively. This will make your signal cleaner, which makes for higher intelligibility and also uses less spectrum.

Just because the other guy has a miserable signal is no reason for the rest to follow suit.

. . . W5SUC

(How's my What? from page 31)

ments are at each other's throats. And while the diplomats in what may be a generic twilight grope for omens in their chicken entrails, what messages do we send around the world? RST. QSL. CUL.

Germane to all this moaning I've been doing about taking up the slack in the bonds of mankind is an uncomfortably illustrative personal experience. In June of 1941 I was sloping around the deck of a freighter docked at Shanghai. Classy Japanese destroyers were hot-rodding in the river and Imperial Marines with fixed bayonets patrolled the miserable streets while I enjoyed the Chinese summer sun. A blonde youth came up the gangway and asked me for a job. Impossible. He hesitated and then said he had a Telefunken short wave receiver to sell. We discussed this and he told me that he had had a ham station in Germany. There was other gear for sale too and we talked shop for quite a while but we didn't come to terms in the way he had hoped. However I think we did later, in another sense, after I learned how many European refugees were trapped and desperate there on the mud banks of the Whangpoo, selling everything they possessed for food. I should have guessed, but I let him walk away. When it was too late to think of the man I remembered well how curious I had been about his receiver. That was a long time ago, but the memory is sharp and clear. For impact nothing beats sudden illumination of your image.

At your expense I've deferred applying "Green's Principle" in favor of another rule: "When you have an uncomfortable thought, share it." And the best answer I have to the question asked by K7NZA is: "About the same as the average ham's, but I'm working on it."

. . . W7IDF

BOUND VOLUME $15

We have had a tough job getting enough volumes of 73 bound to meet the demand, even at the price of $15. This may be because so many fellows have seen one around and have a hankering for the bright red cover and the first fifteen issues of the magazine that are bound inside.

YEARLY BINDERS $3.00

These are also in bright red and are stamped either 1960-1 or 1962. You tell us which you want. We managed to get some 1960-1 binders that will hold 14 copies of the magazine. This makes for a better fit if you don't have all 15 issues. Specify large or small binder for this year.

MRT-90 CONVERSION: 50c

This booklet gives complete conversion instructions for converting the little pack-set surplus units into a fine two meter walkie-talkie. An article appeared in 73 on this unit in the October 1961 issue.

HAM-TV $3.00

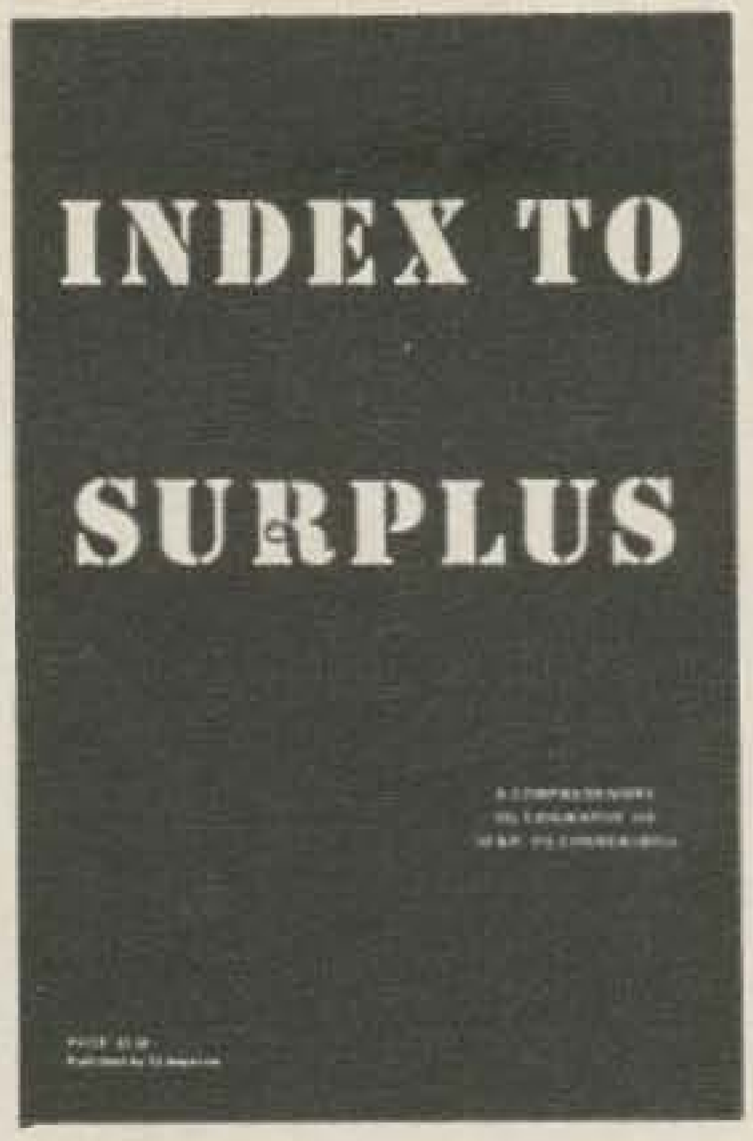
TV is one of the newest and most exciting phases of ham activity. This book gives clear and simple instructions for getting an operating TV station on the air for under $50 outlay! It is no wonder that hundreds of fellows are rushing to get on the air. The interest has been so high that a bi-monthly bulletin has now been started to keep everyone up to date on the advances and latest stations to get into operation.

IMPEDANCE BRIDGE $1.00

Here is a complete set of full scale drawings of the parts for the Impedance Bridge which was featured in the August 1961 issue of 73. This bridge is one of the most useful pieces of test equipment that you could possibly build. It would cost you hundreds of dollars to buy this unit commercially made. This set of plans comes complete with a reprint of the original article.

SSB TRANSCEIVER SCHEMATIC $1.00

There have been many requests for a giant sized schematic of the wonderful little transceiver that appeared in the November 1961 issue of 73. This schematic comes complete with a spare issue of the magazine in case you missed it.



INDEX TO SURPLUS $1.50

This is a masterful compilation of all articles that have ever been printed on surplus conversions, complete with a brief run-down of the content of each article

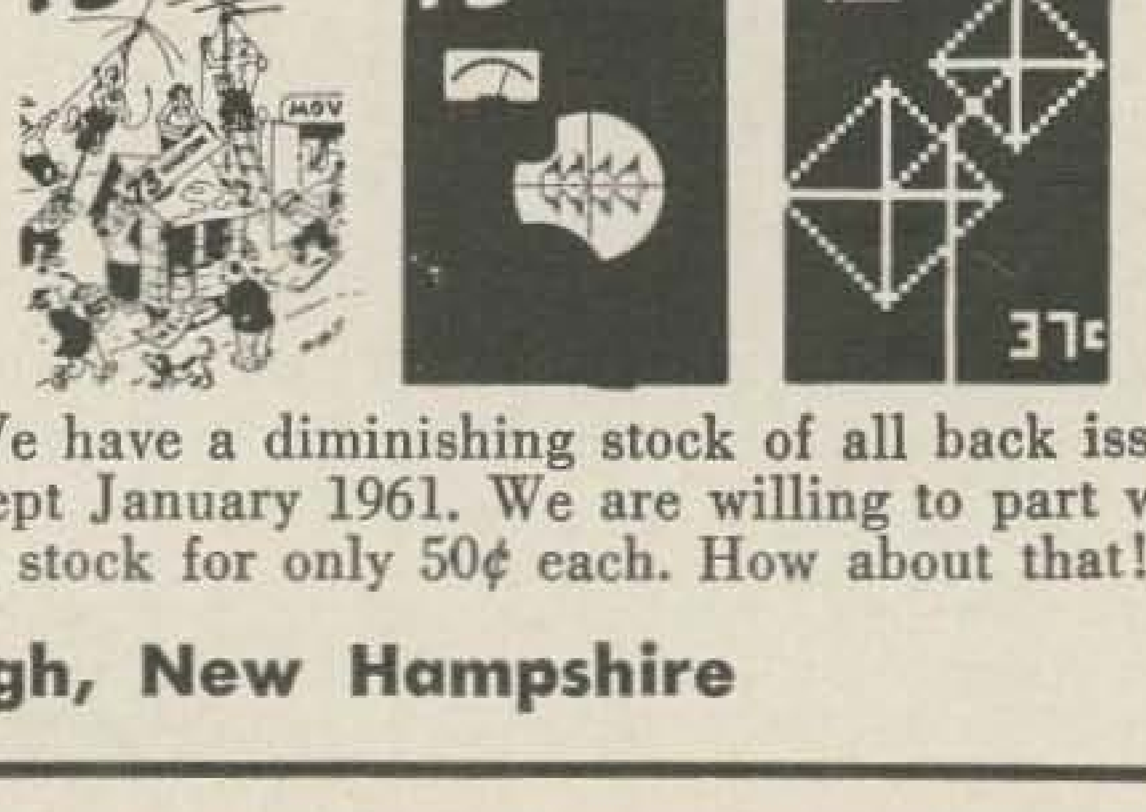
TV BULLETIN $1.00 per year

The first issue of the TV Bulletin is now ready for mailing. This is a bi-monthly bulletin designed to keep all fellows interested in Ham-TV up to date on technical improvements in Ham-TV gear and on all activities. In the first issue of the Bulletin there is a list of all known hams who are reported to be getting on the air on TV. The Bulletin is edited by Mel Shadbolt, WØKYQ, the author of the popular HAM-TV book. Get in on this from the first issue and have a complete set of information at your fingertips. The present plans call for six issues of the Bulletin per year, with at least 12 pages per issue.

MICKEY MIKER 50c

This is the first of our small booklets to come off the press. It is a complete description of the construction and operation of a little device which will measure capacity to a high degree of accuracy. This is a gadget that can be built out of most junk boxes and will forever be a handy item to have around when you are building something new or fixing something old.

BACK ISSUES



We have a diminishing stock of all back issues except January 1961. We are willing to part with this stock for only 50¢ each. How about that!

73 Magazine Peterborough, New Hampshire

Radio Bookshop

We'll have a lot better summer of it if you'll make a slight enlargement of your radio library. Order copiously.

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Because of the replacement of vacuum tubes with transistors, transistor technology has expanded so rapidly that the latest books on the subject are imperative, to bring your knowledge up to date. We found these books were favored by the top electronic schools:

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(W2NSD from page 59)

July 13th. It's about time. It didn't make any sense when it was proposed for the amateurs, it didn't make any sense when they made it law, and it doesn't make any sense in retrospect.

Ad Rates

When you consider that a one page ad in QST costs $476 and one in CQ runs $430, perhaps you can understand why our new ad rates may cause some eyebrow raising. We are trying in every way possible to make it possible to advertise ham products at the lowest cost. On the off chance that there might be a reader or two who might eventually be interested in advertising something in 73 or who might have a chance to drop a hint to a prospective advertiser, here are our latest advertising rates.

1 page	$165	¼ page	$45
½ page	85	⅛ page	25
⅜ page	65	1/16 page	15

These rates are for prepaid ads on a monthly basis (contract) which are submitted before our 20th of the month deadline. We have a premium system to pass along our extra expenses for non-contract ads, late arriving ads, and slow paying advertisers. We'll send a complete rate sheet to anyone interested. Agencies get 15% commission.

You will probably not be surprised to know that our rates are completely different from any other magazine. The basic difference being that all other magazines normally make a flat charge for space and then grant discounts for frequency of insertion and ten day payment. They also usually include extras such as making engravings, typesetting, etc., at no charge. My idea is to pass along extra expenses to the advertisers that cause them. We'll see how it works. I've never been much of a one to do things a certain way just because they always have been done that way.

August 1961 Issue

In the August issue last year there were 18 feature articles, all of which are still of topical interest. The article that created the most interest was our evaluation of the Drake 2B receiver. Drake hasn't yet caught up with the demand for this receiver. John Reinartz K6BJ came up with a clever little piece of gear, a frequency deviation meter . . . simple to build and impressive to use for net operation, etc. Irving has a printed circuit available for this one if you want. He also has one for the W3BUL noise limiter in the same issue. W8GUE passes along some hints and encouragement on the use of the bi-square beam. This issue also had one of the best RTTY converters we've ever seen in print. This one, using a simple printed circuit board, is completely transistorized and really could be built into most printer cases if you wanted to. The board is available commercially for $2 and the toroids are $2 for the pair. One of the better two meter nuvistor converters appeared in the August issue. This one has been repeated in most of the other radio magazines by now. The big construction project in this issue was the RF Impedance Bridge by K6CRT. We have made sets of full scale plans for this one and have sold hundreds of them at $1 per set. This bridge is essentially the equivalent of one of your $400 commercial bridges, but can be built for a few dollars when you have the plans.

The A-B-C's of radio are pretty simple when you read the Kyle article on the different classes of amplifiers. W2BXE shows us a novel transistorized power supply which uses two six volt filament transformers instead of the expensive specially wound jobs usually called for. W3UZN's test of the Finney 6 & 2 meter beam is thorough and should have you looking it up in the catalogs and ads. Kyle came through with a fine treatise on noise, defining the differences in types of noise and explaining the various methods of coping with each basic type of noise. Very edifying.

We still have some of the August 1961 issues of 73 on hand and they will be sent to you for the regular back issue price of only 50c. While you're at it you might also want to get one of the September 1961 issues. Same price.

The big technical article in September is on crystal oscillators. By the time you get through a working description of all of the different types of crystal oscillators in common use you will be able to give an authoritative lecture at the club. The article is written for the newcomer and won't panic even a Novice. W1OOP has a fine article on silicon rectifiers. Both engineers and amateurs are warned to be sure to read this one before they start flinging these rectifiers into their rigs. Hank has learned a lot about how not to pop 'em, so learn from him . . . it's cheaper. There are a dozen or so more articles in this issue, just send for it if you missed it the first time around, you'll enjoy it.

SUBSCRIBING

A great many of you readers have proven remarkably resistant to subscription entreaties. You must certainly recognize that if I take up all this space that might otherwise be devoted to an article that there must be a sound reason. Let's neglect for the moment that you save quite a bit of money when you subscribe to 73 (it costs $4.80 per year on the counter or newsstand and only $3.50 by subscription) and that this assures you of getting every copy so you don't have to haunt the store waiting for the issue to come out to be sure not to miss one. Let's also put aside the fact that as a subscriber you have a greater feeling of participation in our interesting journalistic adventure . . . the establishment of a new and successful magazine in a day and age when magazines are floundering and failing right and left, even in our own field, where almost every other magazine is in near disastrous financial condition.

Now, with all the important factors set aside, we are left with rather flimsy arguments. Your subscription will do a lot to help us buy more and better articles and run more pages in the magazine. It will give us added ammunition to sell advertisers on the advantages of using 73. It will also help us pay our bills and keep us from joining the widening ranks of near-bankrupt ham publishers. Let's fill out the little old subscription blank (separate paper is all OK with us if you like to preserve your copies of 73.) The subscription rates still have not gone up.

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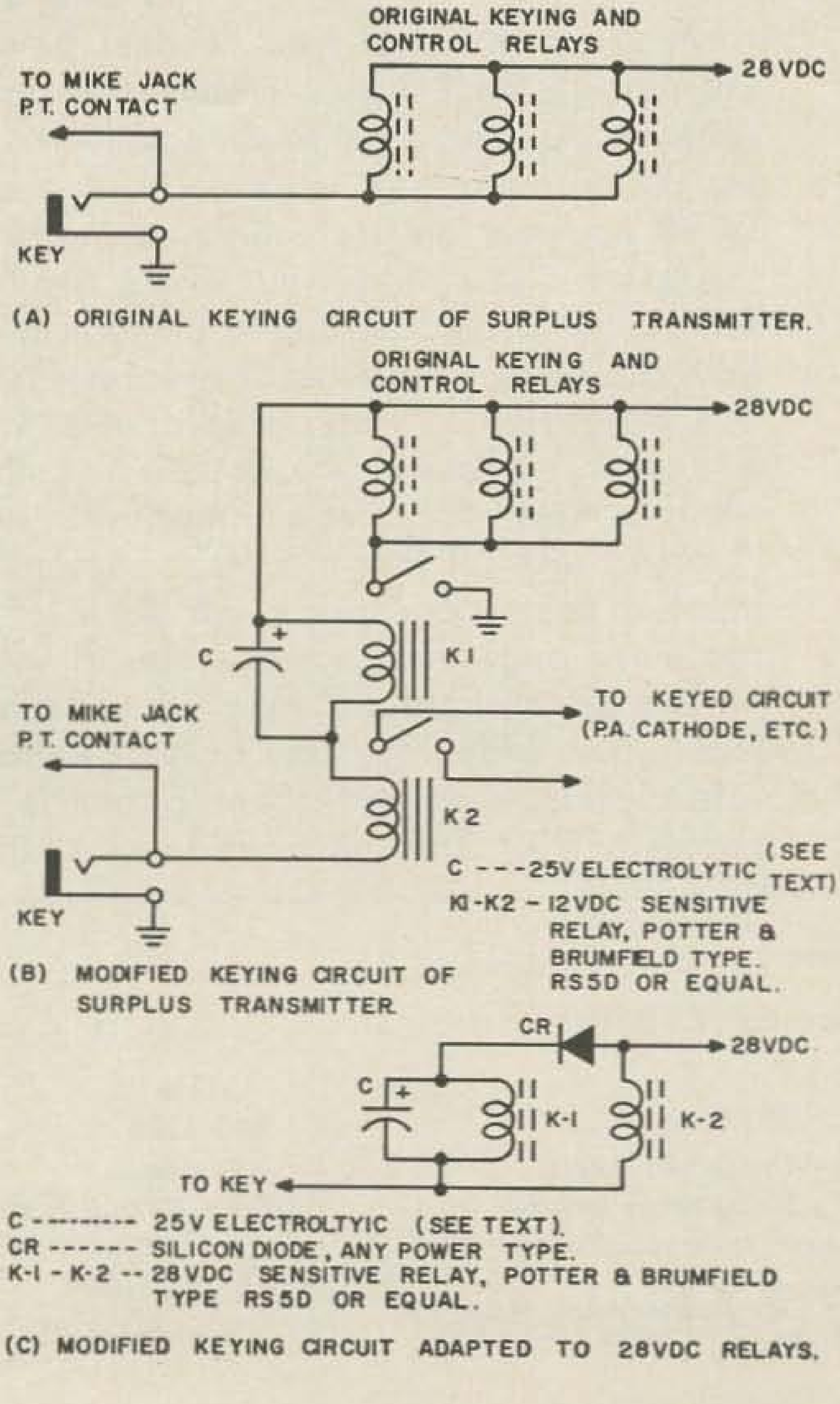
A Surplus Conversion Keying Circuit

Photograph by Morgan Gassman, Jr.

Roy Pafenberg W4WKM

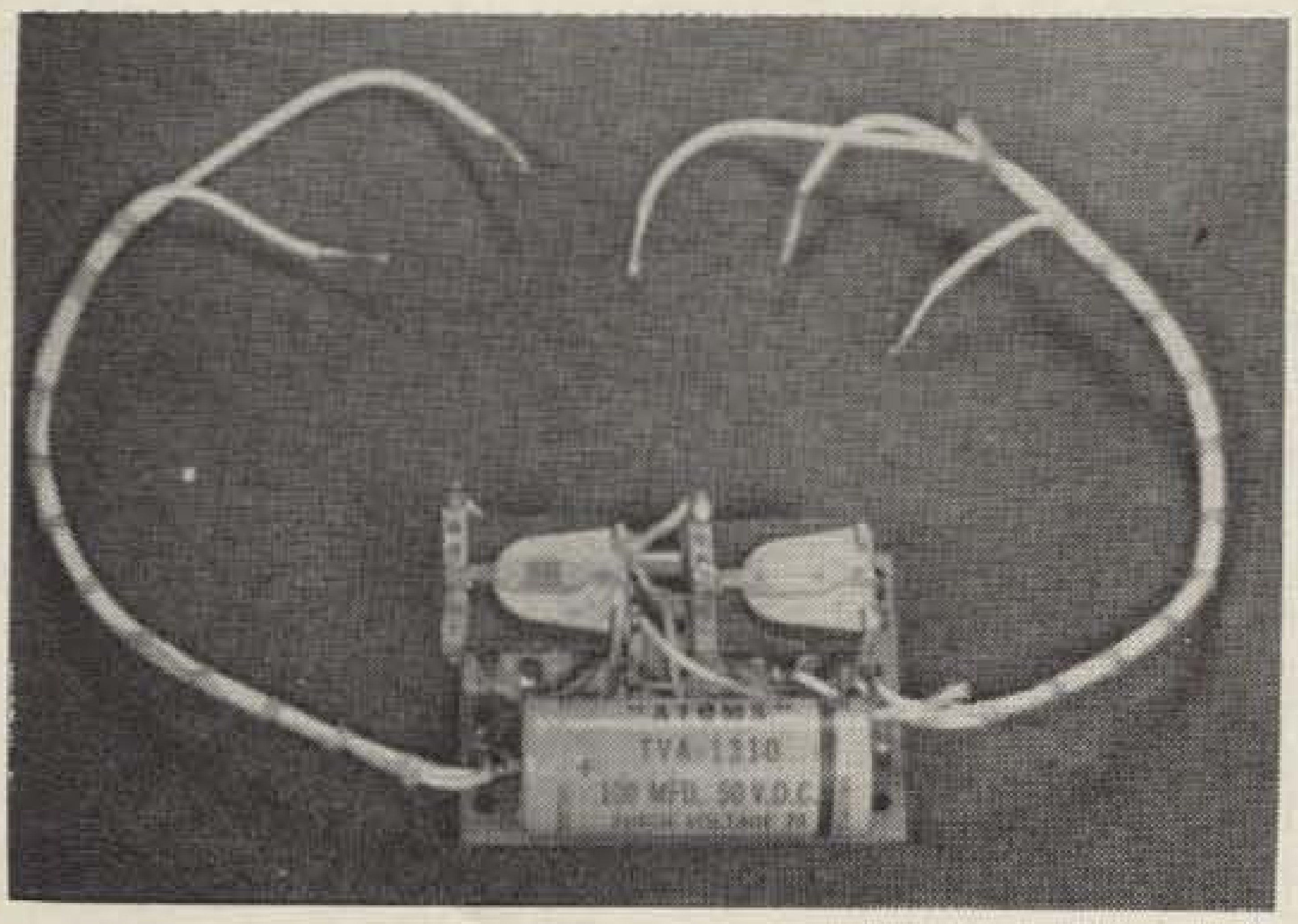
MOST surplus transmitters are provided with extensive relay circuits and this concept is carried into the area of carrier control and keying. Numerous functions are performed by these relays in addition to simple interruption of the carrier for CW transmission. Also, some real monsters were used in much of the older equipment to meet the severe altitude and vibration requirements of aircraft radio service. While these relays *will* follow slow speed CW keying, the resulting clank and clatter is not conducive to a happy home life. Further, many of the relays used will not follow a bug with any degree of faithfulness.

The wiring complications attendant to the generous use of relays makes it difficult to completely redesign and rewire the control circuits in most surplus equipment. The draw-



ing shows a typical surplus transmitter keying circuit and a couple of answers to the problem. In both cases, a small relay subassembly is inserted between the key and the original keying circuits.

The assembly shown in Figure B consists of two sensitive 12 volt dc relays with the coils in series and a capacitor connected across the winding of K-1. When the key is closed, this relay operates, locking up the original keying relays. When the key is opened, the capacitor charge holds K-1 closed for a period of time dependent on the value of the cacpacitor and the relay characteristics. Each closure of the



key recharges the capacitor and the time constant is chosen to be such as to hold the relay closed between characters and words. The value of the capacitor must be determined experimentally and will range upward from 10 mfd. With the relays specified, 100 mfd proved satisfactory. The second sensitive relay, K-2, follows normal keying speeds and the contacts of this relay are connected in a part of the circuit that will allow satisfactory high speed keying. The choice will depend on the design of the transmitter and, to a large degree, personal preference.

If 28 volt sensitive relays are used, they must be connected in parallel as shown in Fig. C. In this case, the lockup relay and capacitor are isolated by a silicon diode. Polarity is such as to allow the relay to close and the capacitor to charge. When the key is opened, the diode blocks the flow of current and prevents K-2 from being held closed.

The photograph shows the series version of this circuit, using Potter and Brumfield RS5D, 12 volt dc relays, ready for wiring into an AN/ARC-2 conversion. Both of these circuits preserve the original "break-in" features of the equipment, allow minimum change to be made to the original wiring and greatly reduce the mechanical noise level of the converted transmitter. . . . W4WKM

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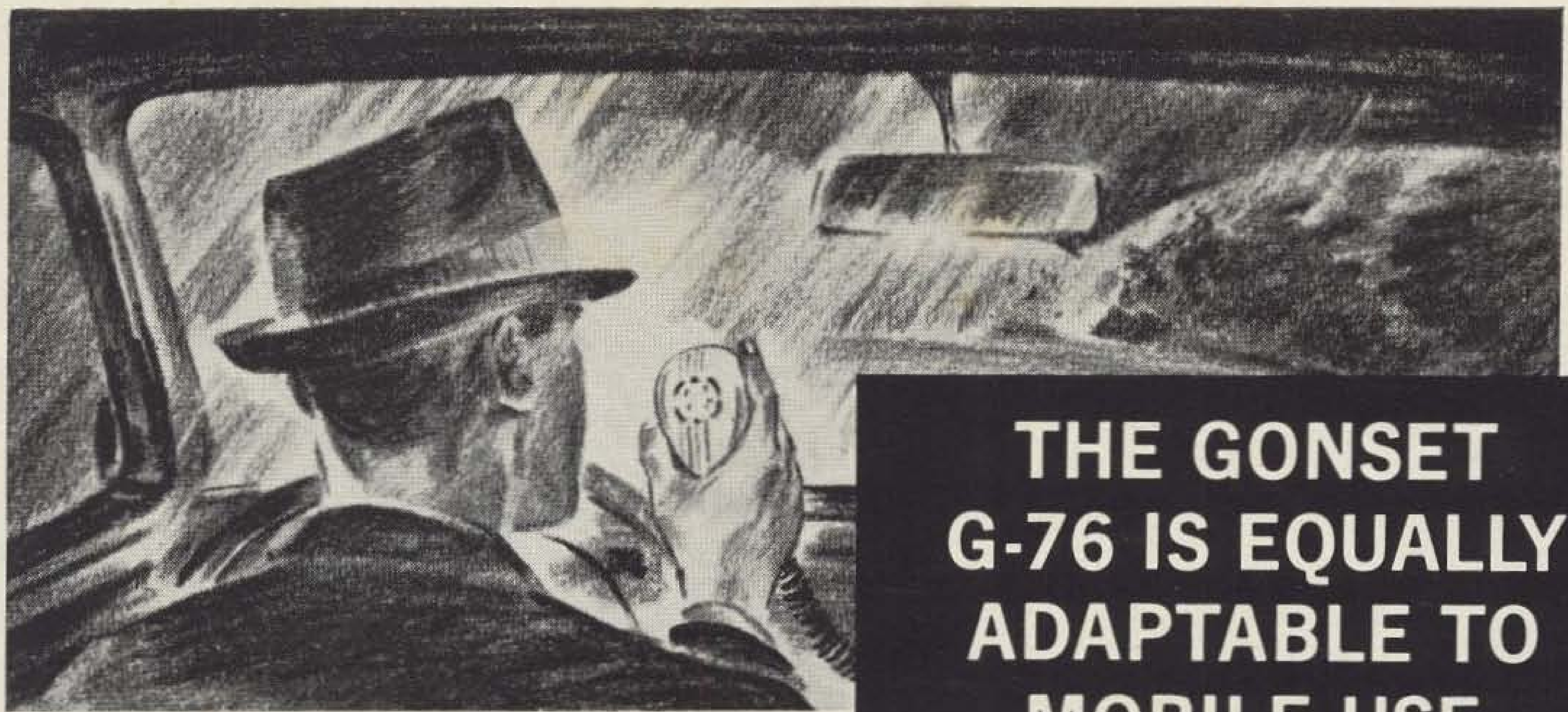

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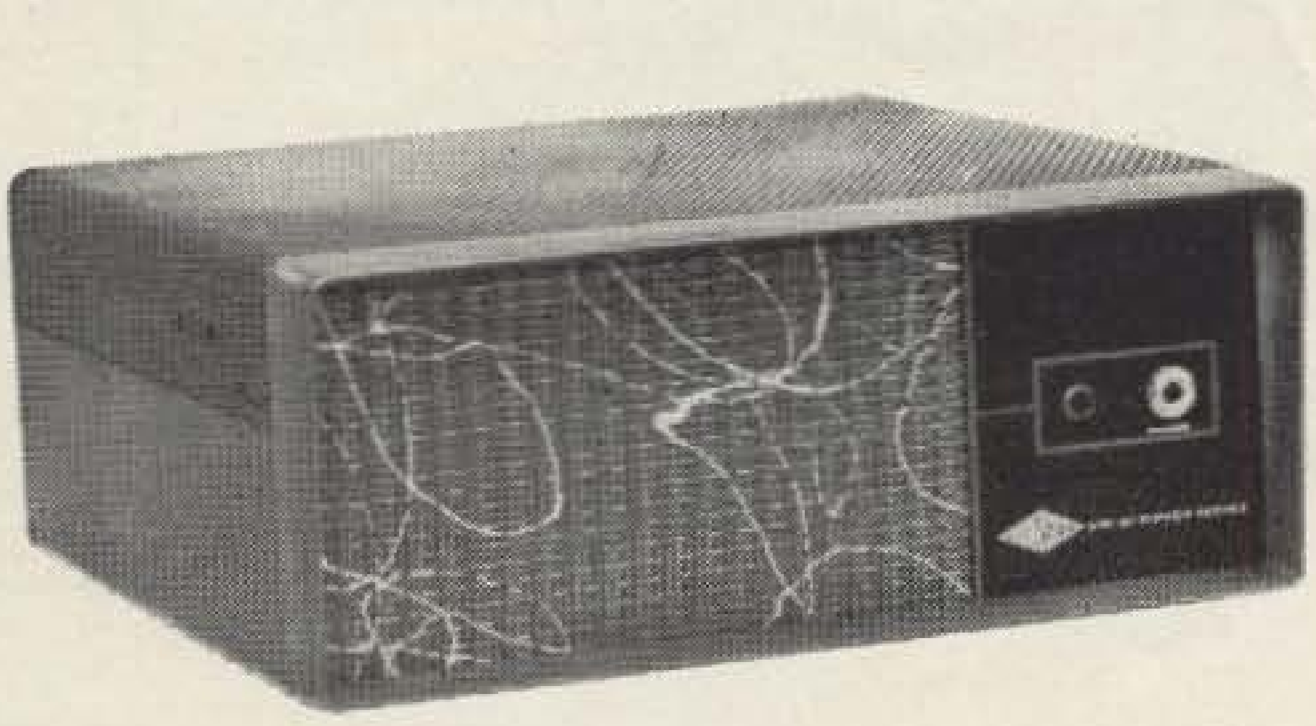

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