73

Amateur Radio

UGUST 1963

c, What Else?

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Export: Hallicrafters, International Dept., Commercial Div. **Canada:** Gould Sales Co., Montreal, P.Q.

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Magazine

Wishy-washy

Wayne Green W2NSD/1

Editor, etcetera

August, 1963

Vol. XIV, No. 8

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Photo by Paul Porcaro

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Important! See page 65 for ballot on restricted phone bands.

de W2NSD

never say die

ARRL Policy

The July QST editorial has several rather momentous revelations for us all. If you are not a subscriber then you might take the time to read it while visiting one. The bulk of the editorial is occupied with an attempt to stem the obvious flood of critical mail they are receiving as a result of their pronouncement on incentive licensing. I suspect that the July editorial will only add fuel to the fire of thinking amateurs.

The most important revelation, and it is one that may shatter thousands of dream worlds all over the country, is their frank admission that the ARRL has no intention of representing its members and that this has been their policy in the past. They admit that they put little stock in polls (which no doubt explains the lack of them). They point out that they are representing the "best interests" of the amateurs and they admit that this has often been contrary to the wishes of the membership.

It is admittedly a lot simpler to run things dictatorially than it is democratically. Thus we have the picture of the ARRL Executive Committee and Board of Directors in a position to make the most earthshaking of decisions without consulting the membership. It seems to me that the best interests of the amateurs would be served by taking a page from our own government and attempting to have the Directors of the ARRL keep in closer touch with their constituents as do the U. S. Senators and Representatives. One basic for this is an enlightened constituentcy, which has been virtually impossible in the past because of economic pressures from ARRL members and advertisers who would not permit any criticism of the League. The slightest attempt at bringing hidden matters to light was met with cries of anti-ARRL. The fact that I believe that they are being very wrong in this matter of incentive licensing does not, I hope, make me anti-ARRL any more than my distress over the present state of the income tax, foreign aid, social security, etc., makes me anti-American.

To get back to the QST editorial, I notice that the FCC is brought into the matter in support of their position. Hmmm. Since it is the FCC that is actually running ham radio these days I suspect that if the FCC did have incentive licensing in mind that they would have done something about it directly. My not infrequent discussions with the FCC have not uncovered any enthusiasm for the ARRL plan.

How about the amateurs? What do they think? In my editorial last month I attempted to examine carefully and unemotionally the ARRL stand on incentive licensing. I expected to get the usual response from angry ARRL supporters who believe that anything the League does is right. Well, either angry ARRL'ers are slow writers or else they are a dying breed for not one has yet protested my evaluation of the situation.

On the contrary, hundreds of letters applauding the editorial have come in. I could devote the bulk of several issues of 73 to reprinting the more lucid of these letters.

ARRL, Pro and Con

I think it was about 1938 that I first joined the ARRL. Or perhaps it would be more accurate to say that I subscribed to QST and in the process received an ARRL membership certificate. QST was no more helpful then than it is today in letting a person know about what is going on within the ARRL, and the only other ham magazine, Radio, was equally silent, so I didn't know much about the internal workings of the hobby.

After the war, When I began to devote large lumps of my life to the hobby, DX'ing VHF'ing, RTTY'ing, etc., I began to take more interest in the ARRL. Having been, from the first, predominantly a phone operator, I soon began to sense a strong CW bias of the League, though I realized that this was quite natural since the basic reason for the League

(Turn to page 6)

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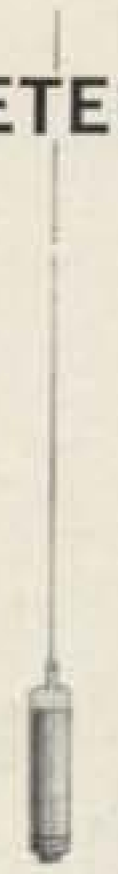

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W2NSD from page 2

to exist had to do with relaying messages, a process that was almost exclusively carried on via CW.

I watched with increasing interest as pressures built up for more adequate representation of the phone contingent of our hobby and saw this pressure result in the formation of the National Amateur Radio Council. With the opening of the forty meter phone band and an expansion of the seventy-five meter phone band the pressures were relieved and NARC gradually disappeared.

But the NARC left its mark behind, indelibly. Where before its existance the FCC had been rubber stamping the requests for amateur rule changes proposed by the ARRL, now there was a complete reversal. I suspect that the FCC was rather shocked to find that the ARRL had been pursuing its own ends and not, as billed, those of the amateur. The almost instant success of the NARC was proof to anyone that things weren't going right.

The FCC apparently thought the whole matter over and decided that if this is the way things were going, that they would be boss and run ham radio themselves. This spelled the end for the ARRL as a representative of amateur radio.

At this time in history I had become quite involved in RTTY and was publishing a monthly bulletin on the subject to some 2000 interested hams and had started a semi-monthly column in CQ. This brought me into contact with the then editor of CQ, Perry Ferrell, and I began for the first time to learn some of the things that had been going on in our hobby. It frankly was quite a shock.

The new FCC administration proceedures system must have been quite a bombshell to the ARRL. Where before they had been virtually running our hobby, suddenly they were completely rejected. I wondered what they would do about this monumental setback and watched QST with interest to see what would happen. For those of you who are not familiar with this ruling, it specifies that henceforward any individual amateur or group of amateurs who want to have the rules changed can petition the FCC directly for such rule change and that the FCC will consider all comments, pro and con, on the rule change and decide on the basis of the validity of the comments, whether they come from individuals of clubs. This put the ARRL on an equal basis with individual amateurs, giving them an edge only if they

Turn to page 80

LEADING THE FIELD–THE SWAN SW-240

YOU ARE HEARING THEM ON THE AIR IN EVER-INCREASING NUMBERS. TO THOSE OF YOU WHO HAVE AGAIN CHOSEN SWAN, THANK YOU!

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Dry Cell Amateur Stations

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William Hoisington KICLL
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Melrose 76, Massachusetts

Ever since 1923, when, in Rye, New York, as W2BAV, I operated from a rowboat loaded with large B batteries, no. 6 dry cells, a 201A regenerative receiver and a loop-modulated 201A transmitter on two hundred meters, the antenna strung between bamboo poles on each end of the boat, portable battery operation has held a great fascination for me.

The idea of two-way communication while walking, climbing, or camping, in the true sense of the word, has resulted in many varieties of battery rigs and walkie-talkies over the years. One of my most enjoyable periods of amateur radio occurred before World War II, on an island in Penobscot Bay, Maine, when, as W1LAS/1, I used 3 B batteries, some dry cells, a 30 "speech amplifier," a 33 modulator, a 30 oscillator, and a 33 final (all dry cell tubes) running about a watt on 160 meter phone, with a 270 foot high antenna and a salt water ground. Many of the locals that were contacted are now still on the air: W1IRQ in Castine, W1RPH in Deer Isle, now on 2 meters, among them.

Later, a new series of tubes came into use; the 1T4, the 1R4 being examples. These were good dry cell tubes, but restricted mainly to the BC and SW bands for good operation. Their utility fell off rapidly with increased frequency of the use of the VHF bands.

In the last few years, several features were developed at the same time providing for a considerable increase in the attractiveness of dry cell operation. 6 meter stations became more plentiful, good portable VHF dipoles and beams were made up, and good VHF subminature tubes came into use such as the 1AD4, 1AH4, 1AJ4, 1V6, and others. Surprisingly good portable double-conversion superhets could then be made at *low-cost.* Fig. 1 shows a 6 meter receiver circuit of this type.

For the rf stage you have a choice of the 1AD4 or the 1AH4. The 1AD4 has higher gain but costs more. The GM is around 2,000, while the 1AH4 rates about 900. Either small 30 to 50 mc iron cores may be used, for small overall size, or large air-wound coils, which will give higher Q and greater freedom from image, TV harmonics, etc.

A convenient way to build low-cost units is to use thin copper-clad bakelite for base boards. This is rigid enough to hold everything, yet solders at a touch of a small iron for all ground connections. Front panels, shields, trough-lines, and even boxes can be soldered together quickly with the copper-clad bakelite.

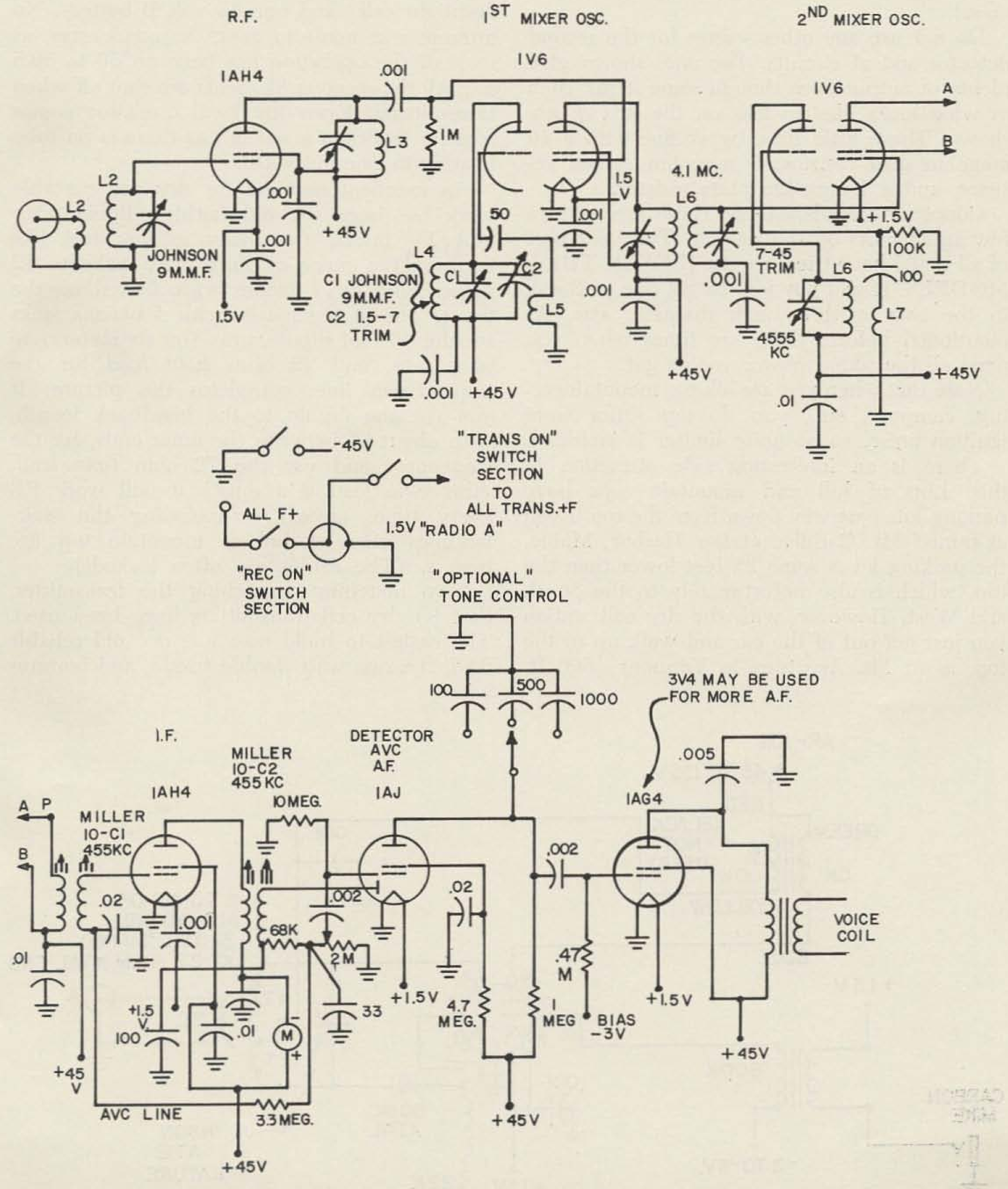
After the rf stage comes the mixer-oscillator. The 1V6 must be mentioned here. Just who designed this red-hot little dry-cell item is something I would like to know for sure. I think it was originally a Raytheon job. Maybe somebody will speak up. When the oscillator plate section is used as the tuned portion of the oscillator it is a very sensitive mixer, way up into the VHF band, with little "oscillator pulling" from the pentode signal grid circuit. By the way, use good capacitors in the oscillator section. I had one that shifted many kc every time I got out of the car and started to walk up a mountain in cold weather.

The 1V6 mixer plate can be fed directly into the miniature *if* transformer, or go through another mixer at 4 mc. The circuit of Fig. 1 shows this double conversion, as there is less oscillator pulling and greater freedom from image, with the oscillator 4 mc away from the rf signal. The additional gain doesn't do any harm either.

A 1AH4 is in the *if* stage. All the miniature *if* transformers (Miller 10-C1 and 10-C2) I have ever tried have all worked well. Be sure and get a *very* small insulated tuning screwdriver in your local store, and try it on these *if* transformers *before* you leave.

The diode, af, and audio stages come right out of the tried and true RCA circuit handbook, and have also worked every time FB.

I word about dry cell *if* and af diagrams, and good down-to-earth economy circuits in general. Probably for simply good marketing reasons RCA has published excellent circuits on dry cell receivers, at least for the broadcast and SW bands. When you get up in the 28-50 mc region, that is another story. The low-cost RCA tube handbooks have very good *if,* detector, and af circuits for the dry-cell tubes



L1 8T wide spaced #28 ¼OD
L2 9T 16/inch air wound
L3 8T 16/inch air wound
L4 6T 16/inch air wound

L5 3T wound on L4 #28 insulated
L6 64T 32/inch air wound
L7 64T 32/inch air wound
(L6 and L7 Miller #6203 4.5 mc if T)

mentioned here but a few changes for the better can *still* be added. Fixed bias on the grid return of the 3V4 audio is one of these. This is a *must* for the 3V4 when used as a modulator. About the batteries: 45 volts is FB for rf, mixer-oscillator and *if* stages. 90 volts gives better "sock" to the audio output. On some mountains, there is plenty of external noise!

Do *not* use any other values for the second detector and af circuits. The ones shown give plenty of output even though some items, such as what looks like no bias on the first *if*, are shown. Those little tubes work fine with a 10 megohm grid resistor, 5 megohm screen resistor, and a 1 megohm plate resistor.

Concerning loudspeakers, there are quite a few small units on the market. The very best of all that I have tried are the JENSEN THIN-MODELS. It will pay you to get one of these, in the two or three inch diameter size. As mentioned before, there are times when you need all the sound power you've got.

Note that when you are hiking, mountaineering, camping, etc., you do *not* suffer from ignition noise, so no noise limiter is included.

There is an interesting side attraction to this. Lots of hill and mountain tops have parking lots part way down from the top. Even at famed Mt. Cadillac at Bar Harbor, Maine, the parking lot is some 25 feet lower than the top, which is also unfortunately to the South and West. However, with the dry cell station you just get out of the car and walk up to the top, as at Mt. Ascutney in Vermont (500 ft. more elevation), Mt. Kearsage in New Hampshire, and many others. Also, you can climb the fire towers with this rig! Furthermore, all this gets you away from ignition noise kibitzers, Super-Regen TWO-ers, etc.!

This receiver is amazingly sensitive, and with the double-conversion handles very well. It uses one "radio A" cell, 1.5 v (overgrown flashlight cell) and one 45 volt B battery. No attempt was made to gang the condensers, as most of the operation has been on 50 to 50.5 mc. All the receiver filaments are shut off when transmitting. Even the local oscillator comes back in less than a second, as there is no tube heating to contend with.

An excellent antenna for dry cell portable work has been the old faithful dipole. Five foot TV masts, (as many as you feel like carrying!) a piece of linen base bakelite 12 inches long by 2 inches wide bolted on the top of one of the masts, with 4 banana jacks for the 4¼ foot dipole arms (on six meters) to plug into, and 72 ohm *twin lead* for the transmission line, completes the picture. If you cut the dipole to the handbook length, with about ½" between the inner ends, for the frequency, and use the 72 ohm *twin lead*, (this twin lead is a must) it will work FB every time, anywhere, including the stair-landings of most hill or mountain top fire towers. (The cabins are often locked!)

Two matching (matching the transmitter, that is) dry cell transmitters have been used. The easiest to build uses just *one* old reliable 3A5, the two watt double triode, and features

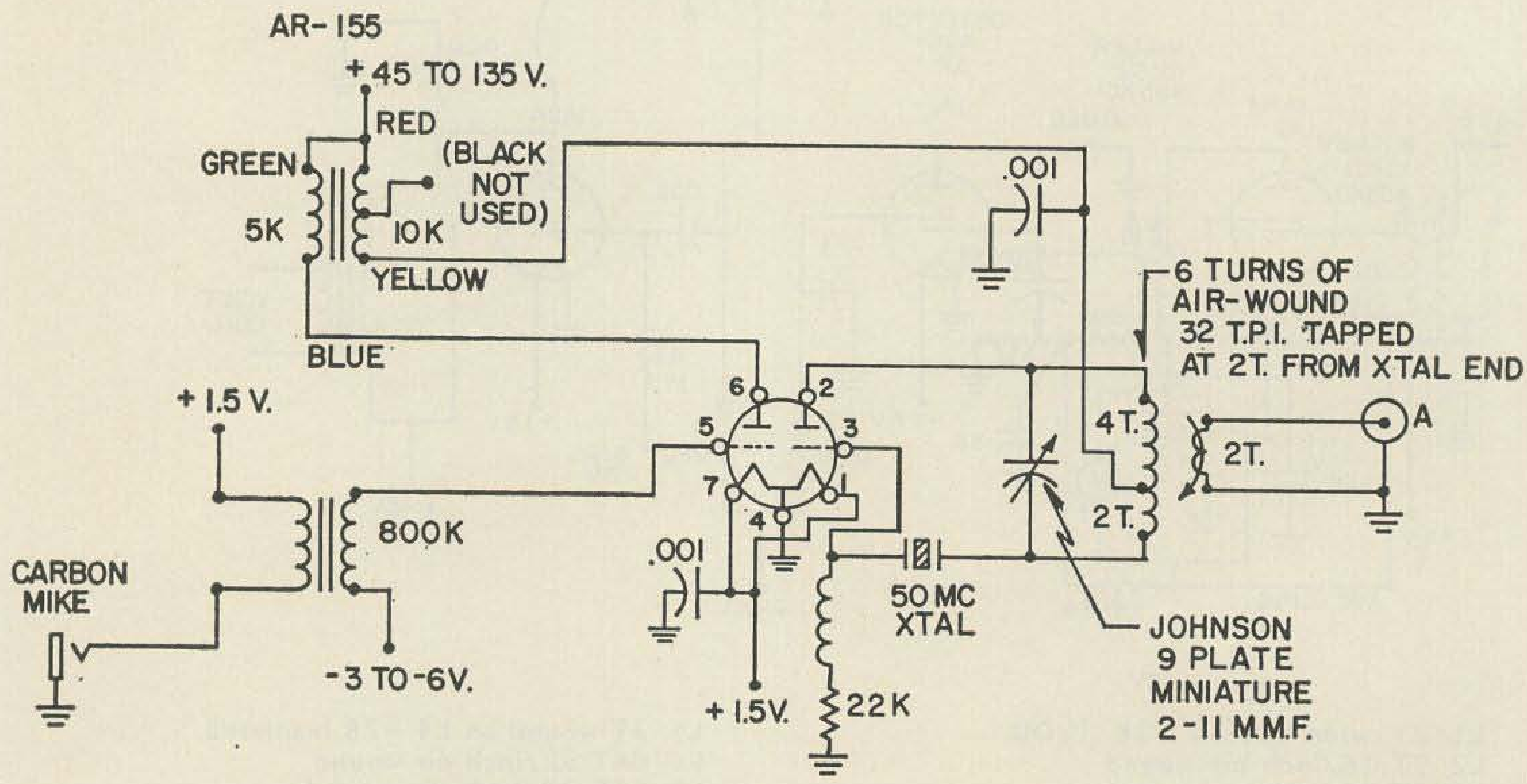


FIG. 2

crystal control and high level modulation in *one* dry cell tube. You have to hear it to believe what is sounds like. Fig. 2 shows the circuit. Taking the cue from several CB manufacturers (RCA for one) that were using a modulated crystal oscillator, it was soon found that excellent quality was obtained this way at some 75 to 80 percent modulation. (It's also legal!) The other half of the tube is the modulator. A carbon mike with a very high gain transformer, 30 ohms primary to 500,000 ohms secondary drives the grid plenty hard. With the tube not lit, *30 volts* of audio can be found on the grid when whistling in the mike.

Another interesting item is the voltage rating of the 3A5. It will take 3 B batteries, or 135 volts all day and like it. It will actually take more, but remember, there is a transmitter wattage level at which it starts to be uneconomical to use B batteries. This is between ½ and one watt. The crystal in this rig is an item requiring attention, not only by the builder, but by the crystal manufacturers. Not all 50 mc crystals are good ones. Some jump a little in frequency, others jump a little in amplitude.

The second transmitter is a "regular" type, although it only uses three tubes. The 3V4, a "dry cell 6L6" type of tube works FB as an oscillator, final, and modulator on 50mc. Caution: Do *not* use more than 90 volts on these tubes! The circuit is shown in Fig. 3. Again the high gain mike transformer is used to advantage. Feeding this audio to the beam power tube as the modulator, this little walking station sounds, on a hilltop, like a big ac rig anchored in the shack.

There is a good plate dip on the meter, without load, and the semi-adjustable antenna link allows easy adjustment of the rf output, which is some 200 milliwatts.

The tinned sockets are soldered on their sides directly to the copper-clad base plate. The whole assembly can be under 2 inches in height. The input power to the final has generally been kept to about 6 ma at 85 volts. This keeps down the B battery buying, and allows use of the small size B's. One of the complete stations weighed only 4 lbs.

A handy method of mounting this type of station is by the use of the multiple-shelf concept. You simply start with the batteries and speaker on the bottom, the transmitter on the next shelf, the receiver on the top shelf, and finally the handle, and/or shoulder strap on top. This also allows easy removal for adjustment, tube testing, circuit changing, etc.

This little rig has been used on many hills and mountain tops (at least, here in New England, they are named mountains) in the East and has worked consistently over 50 miles, using only the dipole.

If you really want a new experience on the VHF bands, try something like the following "Expedition" with dry cell 6 meter operation.

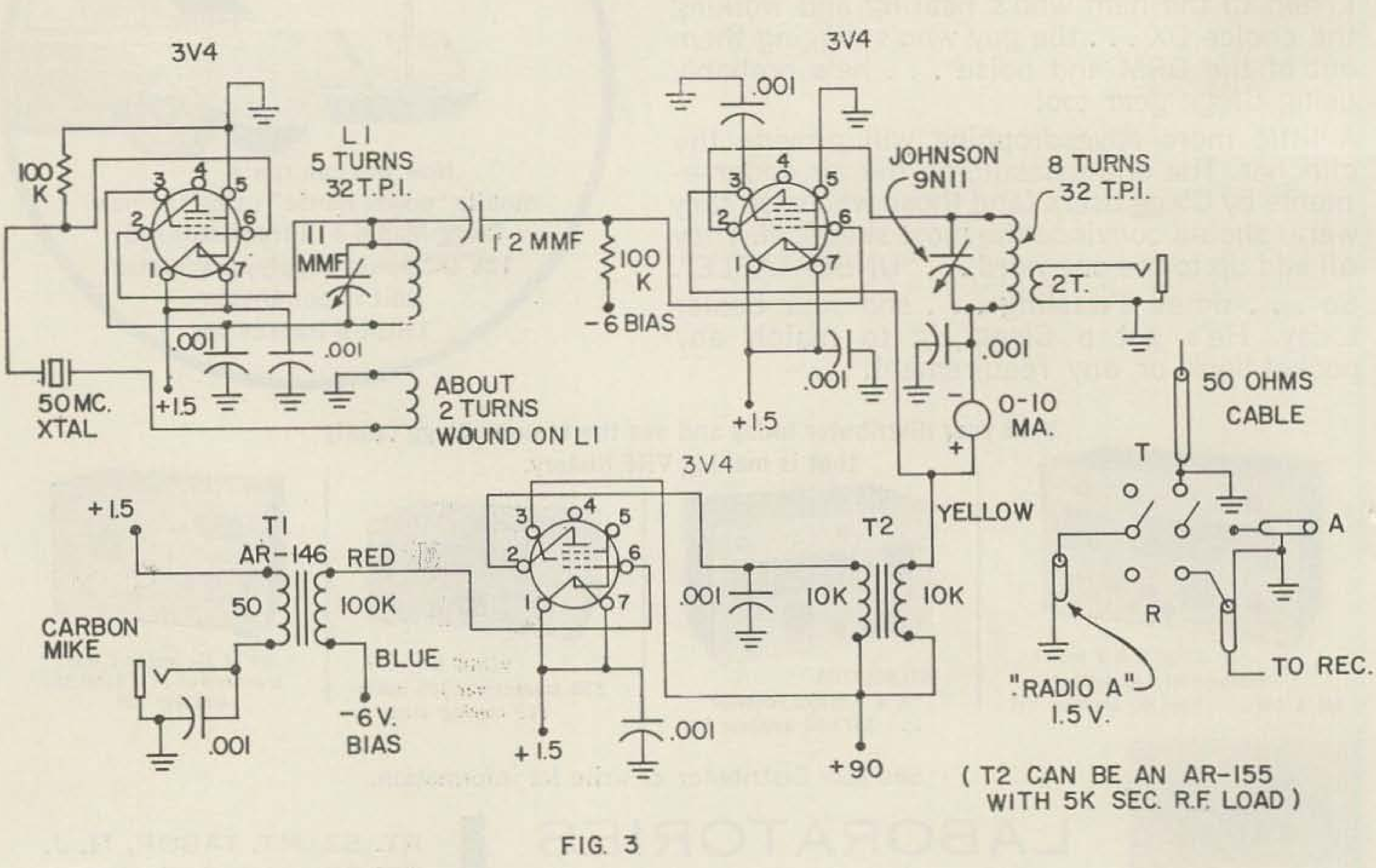


FIG. 3

Q.C.

UALITY ONTROL

at SBE

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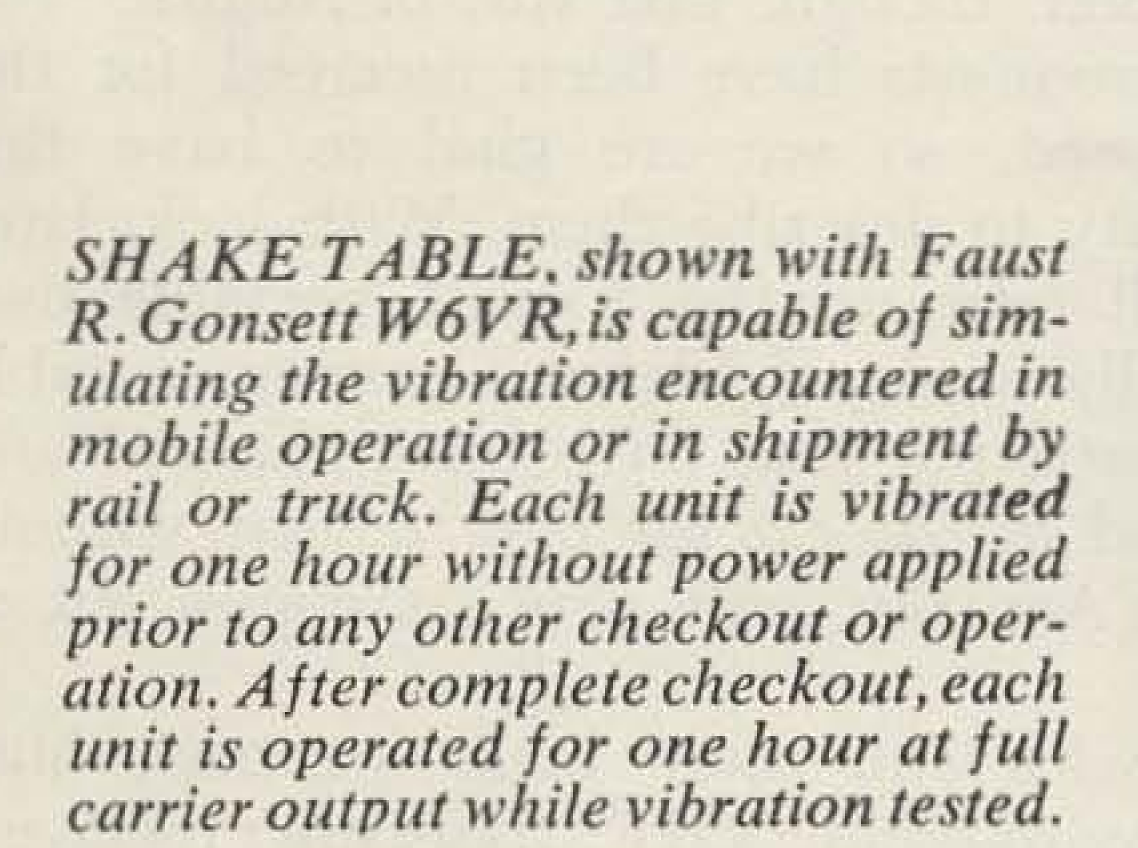
SHAKE TABLE, shown with Faust R. Gonsett W6VR, is capable of simulating the vibration encountered in mobile operation or in shipment by rail or truck. Each unit is vibrated for one hour without power applied prior to any other checkout or operation. After complete checkout, each unit is operated for one hour at full carrier output while vibration tested.



GONSETT'S OCTOPUS, shown here with Bob Gonsett, WA6QQQ and mascot K9-CINDY, simultaneously makes seventeen resistance measurements to check over 170 individual components prior to power checks. This has eliminated the familiar "60 cycle smoke signal test" and assures that there are no marginal components in the unit.

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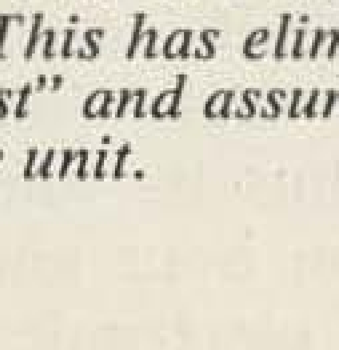


Faust Gonsett, W6VR
President

The receiver shown in Fig. 1 and the 3 tube transmitter of Fig. 3 were used, mounted in a 7X8X2 inch carrying case, weighing about 5 lbs. with batteries. The antenna was the "old faithful dipole" mentioned previously.

First, though, a word of caution about mountains, especially the "walk-up" kind. (After all, we need *all* the mountain-topping VHFers!) Mount Washington here in New England has *killed* over *30* of these walker-uppers! On a bright, sunny, fall day, two people (example) start out; "Let's climb Mount Washington," and the "fun" begins. With shorts, possibly a light sweater, 'I've seen them in shirtsleeves!) up they go. Some time later, on the same afternoon, the sun disappears behind clouds, which begin to move right onto the mountain. The temperature starts to drop like a stone. Next, anyone not already *in* shelter, and I mean good, inhabited shelter, finds cold, wet clouds blowing against them and *through* their clothes at some 20-40 miles per hour. This is *very* bad for the two in shorts, shirts, or light sweaters. The last time I closed down 2 meter operation on Mt. Washington, two young persons were lying dead not more than half a mile away. So, that's enough from the "A word to the Wise" Dept.

The bright side of the picture should be mentioned also. One August day, I started up the big Mount Monadnock, in New Hampshire, on foot with the dry cell receiver described within this article, the 320 milliwatt 3 tube transmitter, and a dipole antenna. There are three of these Monadnocks. "Little" Monadnock has lots of rhododendrons, but that's it. Pack Monadnock is FB for cars. Macadam all the way up to the 2280 ft. top. The big Monadnock, some times called "Man's Monadnock" just because you have to climb it, (I've seen swarms of ten year olds scrambling up) is 3,164 ft., and commands a "Royal Box" type of view (and VHF reach) over all of Massachusetts and Connecticut. It does take about an hour and a half, if you're the usual type of electronic engineer, but it is of course very well worth it. When I arrived at the bare, rocky top at 10 AM, a gentle breeze was blowing, and it was actually warm. The dipole was unfolded (not a "folded-dipole though) and with 10 feet of aluminum TV mast stuck in the rocks, on the air we went on six meters. Plenty of contacts were made with the Boston area, 45 miles away. The dipole was found, as usual, great for nulling *against* heavy QRM.

After lunch, a surprising contact was made. W1HDQ, our good old friend Ed Tilton, long time VHF conductor in QST, was jamming the receiver AVC circuit down from Canton, Connecticut, 90 miles airline. Not having a VFO, I could not raise him, but W1JRW did it for me. Note what happened then. Ed, with *many* years of mountain topping and portable rig experience, told JRW that "I don't think I will be able to hear a 300 milliwatt rig in New Hampshire, especially on 50.2 mc in the middle of a good Sunday." The results just go to show how a really portable rig in a superior location can surprise even the most experienced old-timer. He not only heard the little rig, but we had a solid half-hour QSO! Of course, the big Monadnock is particularly favorable, and I also took all possible advantage of the "favorable slope" principle, by moving the dipole around a *little down* from the top on the Connecticut side. This has often *added* 10 db and did at least as much then.

After signing with Ed, two more stations in West Hartford were contacted, and at QRT time around 2 PM, it was still warm up there. Don't forget, though, that was in August.

Many requests have been received for the circuits used, so we are glad to have this opportunity to describe them. With luck, later notes will take up the 5 watt portable unit using really non-spillable, non-gassing portable storage batteries, that have been charged and discharged *in the rig* for over a year without trouble. (Actually, only *dry* gas comes out of them.)

Also, with still more luck, low-cost, high gain, easy-to-build VHF transistor receivers will be written up to go with the 5 watt rigs.

. . . K1CLL

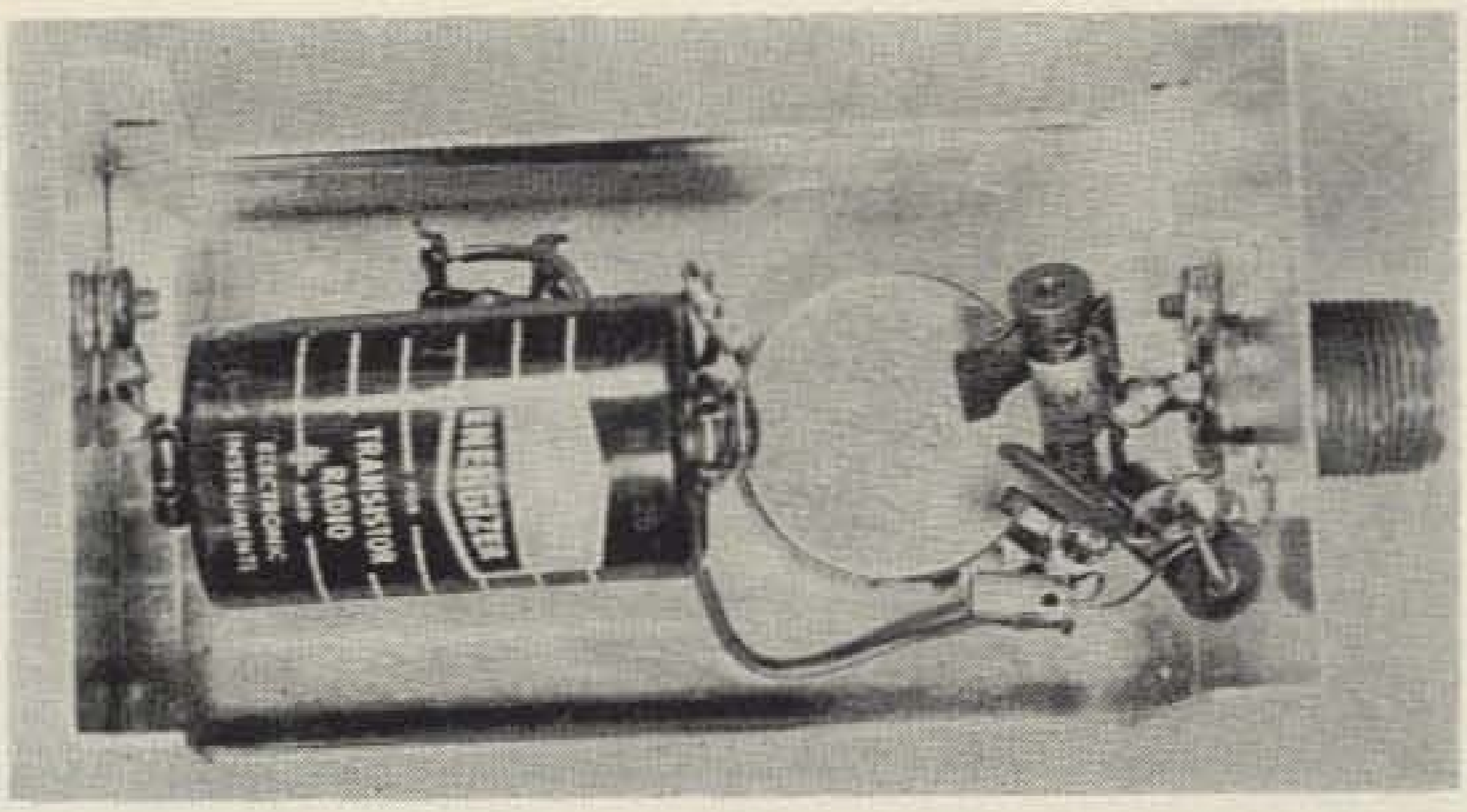
Dear Wayne . . .

The "old time" radio shack has given way to a new idea—the Studio Suite. This is composed of a great front room, draped with layer on layer of Collins Goodies. All lighted and brightly shining—but with all the stand-by switches in. Through a small door hidden at the rear of this Great Show of Might, can be seen a glimmer of another kind. The soft light of a two tube regen, bread-board mounted. Next to this on the rough bench, a simple TNT whose center-tap christmas tree bulbs brighten and dim with the sounds from an old morse telegraph key. And the room is alive with CW which seems to be saying that the rig here is home brew—been enjoying it since 1928.

To my fellow Old Timer, "73 Green" from
Lynn Wilson W4JXD

Simple Noise Generator

73 Parts Kit



George Rubis K9ONT
6875 Van Buren Street
Crown Point, Indiana

As anyone knows that has done any work at all on receivers, whether it is a conversion or simply substituting a "hotter" tube in the front end, we get to the point where we begin to wonder if the adaptation was worth while or have we been fooling ourselves.

A noise generator using one of the noise diodes (IN21 or IN23) can give an indication if any improvement has been made.

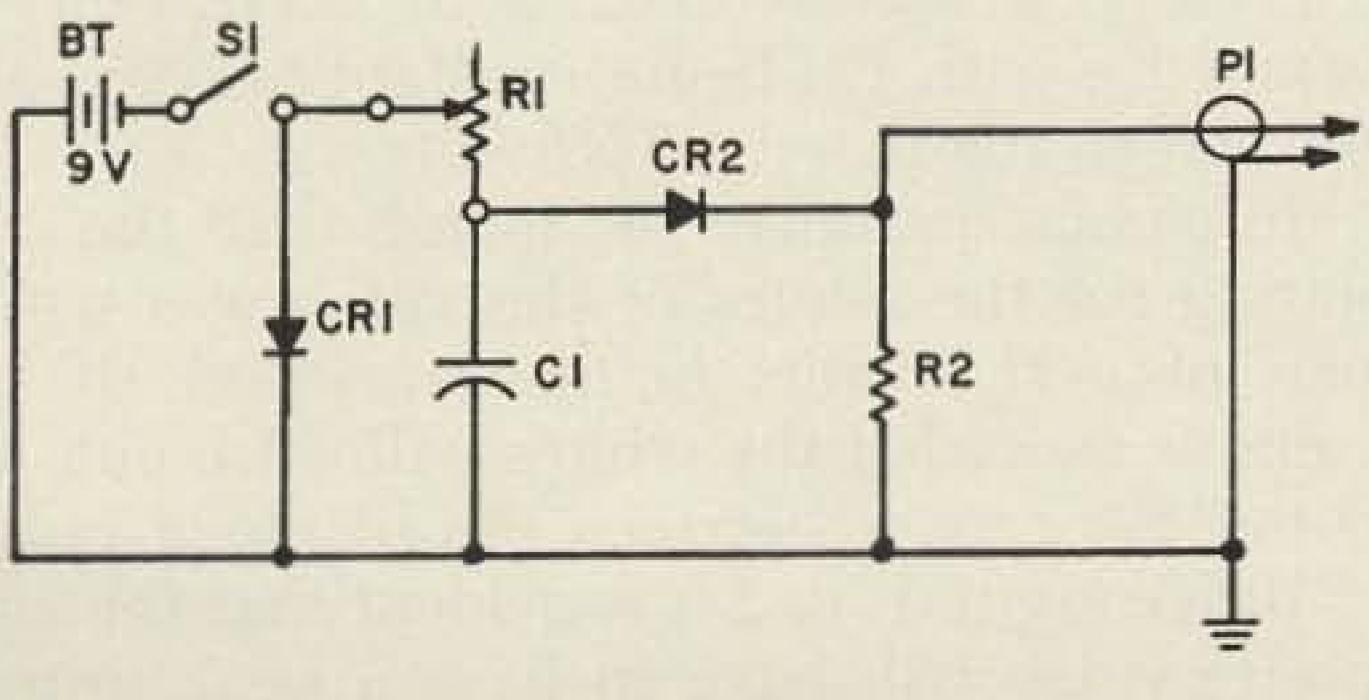
The circuit is straight forward, but with one addition that others that I have seen do not have. The voltage is regulated by a Zener diode.

The reason is obvious to anyone who has worked with the simpler type of noise generator. The results are not always consistent from measurement to measurement and from day to day. The voltage and current vary with the setting of the variable resistance and due to the normal aging of the battery.

The Zener Diode eliminates this by maintaining a constant line voltage. In our particular instrument it is six volts. Of course we must use a battery in excess of six volts. Nine volts is a good value. I have found that used transistor radio batteries still have enough life in most instances to last for many tests.

One of the main requisites of a noise generator is that it must be shielded throughout. Therefore we must give some thought as to the placement of the various components.

A Mini-box 2¼ x 2¼ x 4 is an ideal size. As for a connector I used the SO-239 coaxial. I find that this connector allows more flexibility than any other. If a direct connection to the receiver is desired merely attach it through the double connector type DKF-2 made by Dow Key. On the other hand if it is desired to have the controls of the noise generator close at hand merely connect a length of Coax of eighteen inches or so. I haven't been able to discover that it has affected any measurements to any degree.



To avoid excess wear and tear on the zener diode and the battery a 200 ohm resistor should be inserted between the 9 v battery and S1.

In the construction of this noise generator just remember a few basic rules. Keep all connections as short as possible. The noise diode and bypass condenser and resistor (50 or 75 ohms as the case may be) as close as possible to the output plug. Remember to use pliers to absorb the heat when soldering the leads of the diodes.

To mount the silicon diode, which has one large end and one small, we must improvise to a certain extent. For the small end a lug from one of the old tube sockets will do. For the large end use a small fuse clip.

Don't be too fussy about the variable resistor. For most purposes any value from 10M up to 50M can be used.

The battery you choose will determine the manner of mounting.

No need to give detailed instructions as to the use of this noise generator. There are ample instructions to be found in various magazines as well as handbooks.

. . . K9ONT

Parts List

2—¼ x 2¼ x 4 Minibox
Bt—9 volt battery
Cr1—6 Volt Zener Diode
Cr2—IN 21 or IN 23 Silicon Diode
R1—10M-50M Variable
R2—51 ohm or 75 ohm (according to your line)
C1—.001 to .005 disk ceramic
S1—S.P.ST. this may be on your variable resistance
P1—So-239

Parts Kit Available

The parts for noise generator are available as a complete package from 73, Peterboro, N. H. Order K9ONT Kit $5.00

Video Modulation

Robert Walker W8VCO
1849 Meadowlark
Toledo 14, Ohio

In recent issues of 73 I have read several articles on amateur television systems. I thought there might be some interest in video modulators. There are many systems in use today and the direct plate coupled modulator to be described is one of them.

There are many conditions to be considered. The prime concern will be the final amplifier stage. In our shack we are operating on 432 megacycles, and am using a 4X150-A in the final rf amplifier. To start with we had to know the operating characteristics of the 4X150-A. The curves given in the manuals that were available here in the shack were not accurate enough to be of any value. So we set about to run a set of curves for the final amplifier stage.

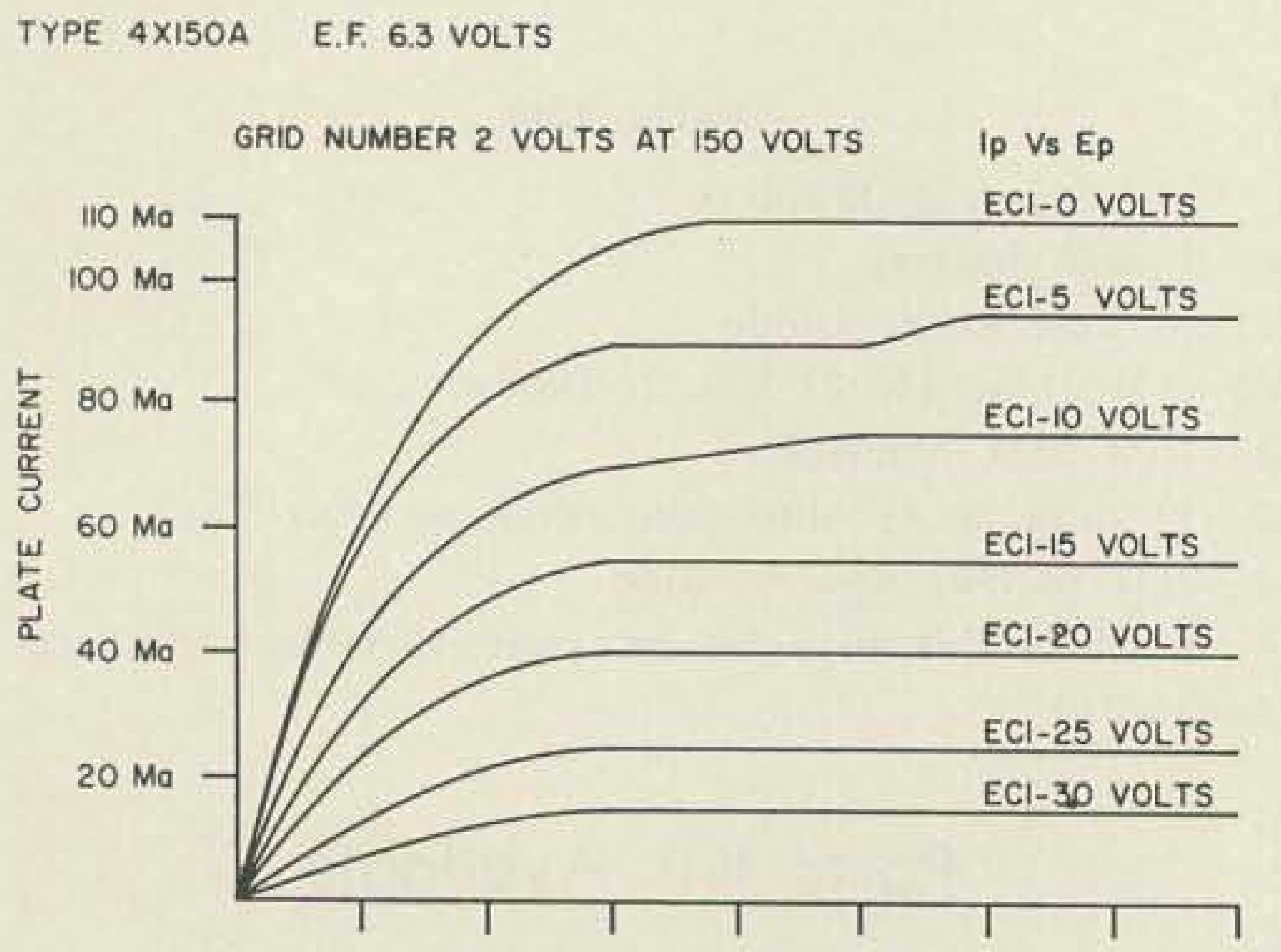


FIGURE 1

We plotted Ip versus Ep with various values of Eg, the screen grid voltage being regulated at a positive 150 volts. The curves shown in Fig. 1 are typical for the 4X150-A.

Actual operation of the final was run with 580 volts on the plate; 150 volts on the screen grid; plate current was running 0.080 milliamperes; and a bias on the grid of −8 volts. The cutoff point of this particular 4X150-A was with a grid voltage of negative 42.0 volts.

Now in order to modulate the final 100% with the composite video the synch tips (blacker than black) must run the carrier to a maximum value, in our case to 0.080ma of plate current; and the whites of the video to decrease the carrier to very nearly cutoff. This point being within 10% of the cutoff point of the carrier.

The next condition to consider is the amount of video required to meet these conditions. Thus Fig. 2 was evolved. This curve plots Ip versus Eg with Ep being constant at 580 volts, the screen regulated a 150 volts.

In actual practice we found that the best setting for the whites of the video was with a bias of −31.5 volts being developed. If this value is exceeded the whites will wash out, and cutoff the carrier between the blanking pulses.

Referring to Fig. 2 it is evident that the composite video will have to have a peak to peak value of −8 volts to −31.5 volts swing on the grid in order to produce 100% modulation. This means that a peak to peak value of 23.5 volts is required to drive the final amplifier from a maximum value to a minimum value for 100% modulation.

The type of video modulator selected was the direct coupled, with a common load resistor for the plate of the modulator and the control grid of the final amplifier. The modulator having a condition of operating as a triode. The 6L6 was selected for this particular function.

Fig. 3 shows the family of curves for the 6L6 triode operation. The load resistor is a 1,200 ohm with a rating of 4 watts. The bias on the video modulator is adjustable and is normally set in the vicinity of −22 volts.

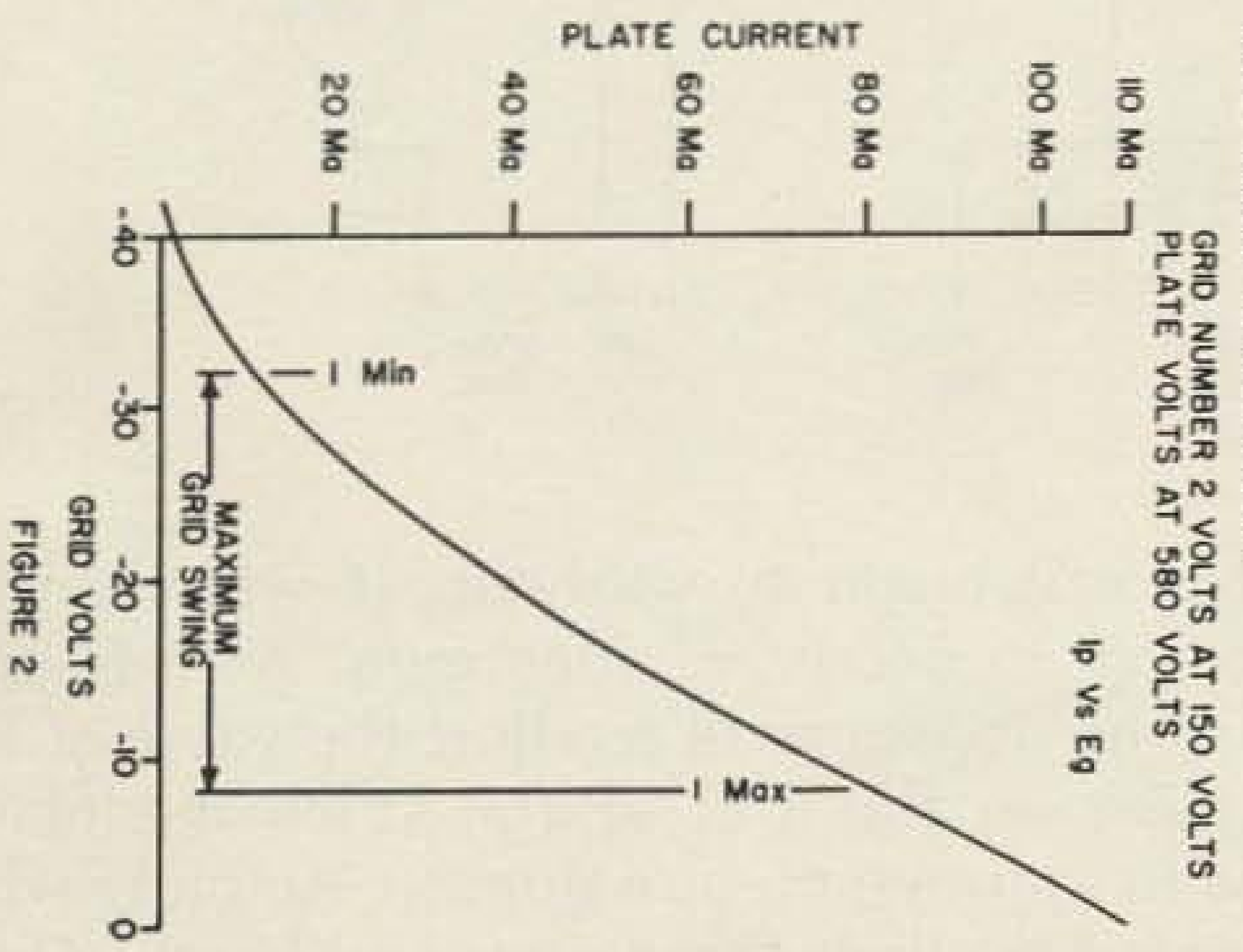


FIGURE 2

Theoretically the modulator should be operating at cutoff, but due to the conditions of the existing amplifier a little fudging is necessary. After this fudging the the video modulator will draw some idle current. This value being in the order of 0.022 milliamperes.

A 6AL6 was used to clamp the composite video signal on the control grid of the modulator tube. The ref-point of the synch tips must remain at a constant position and not drift.

Fig. 4 is the schematic for the video modulator. The average plate current of the 6L6 video modulator is 20 milliamperes plus or minus 2 milliamperes with video information on the control grid and rf excitation.

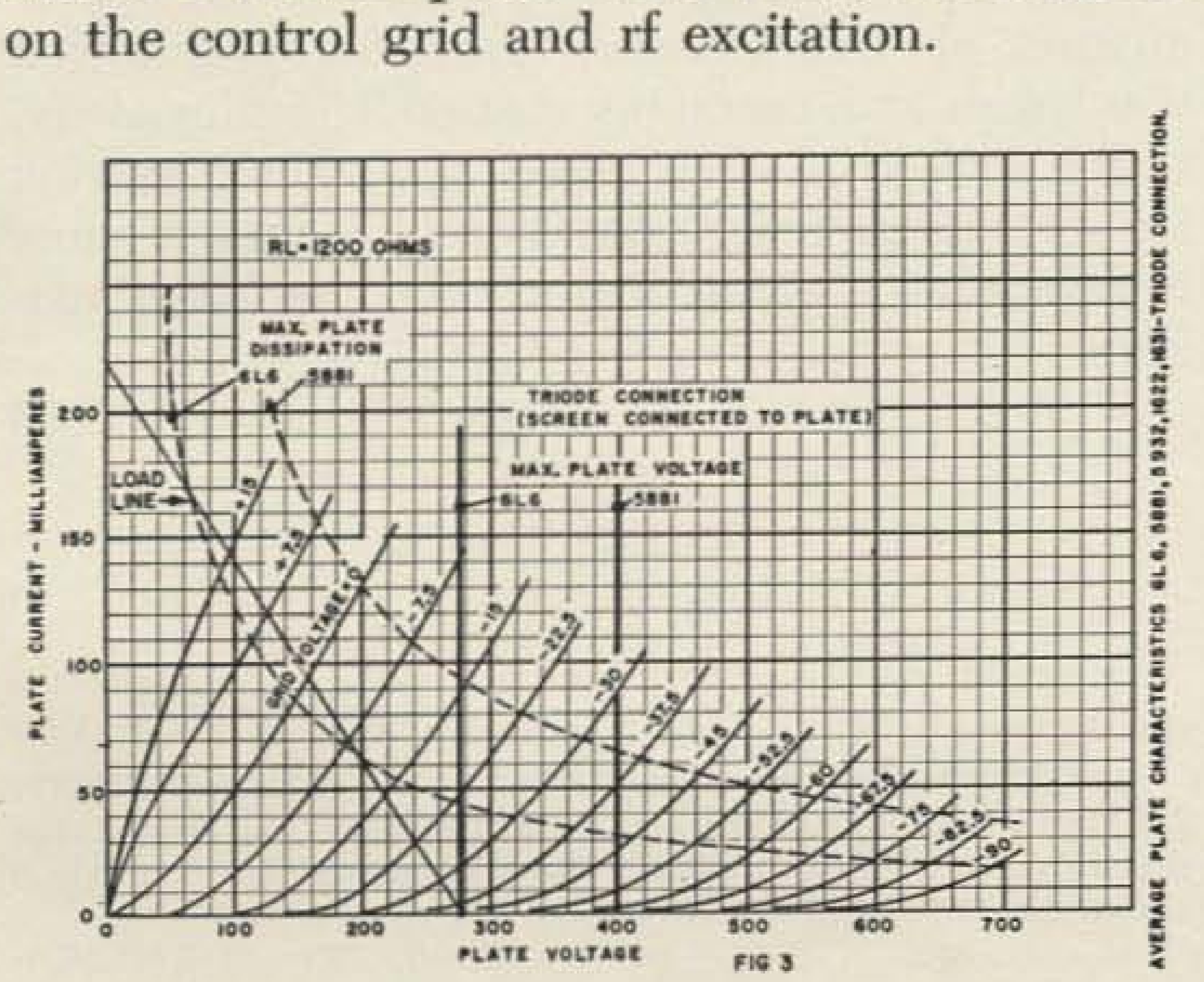
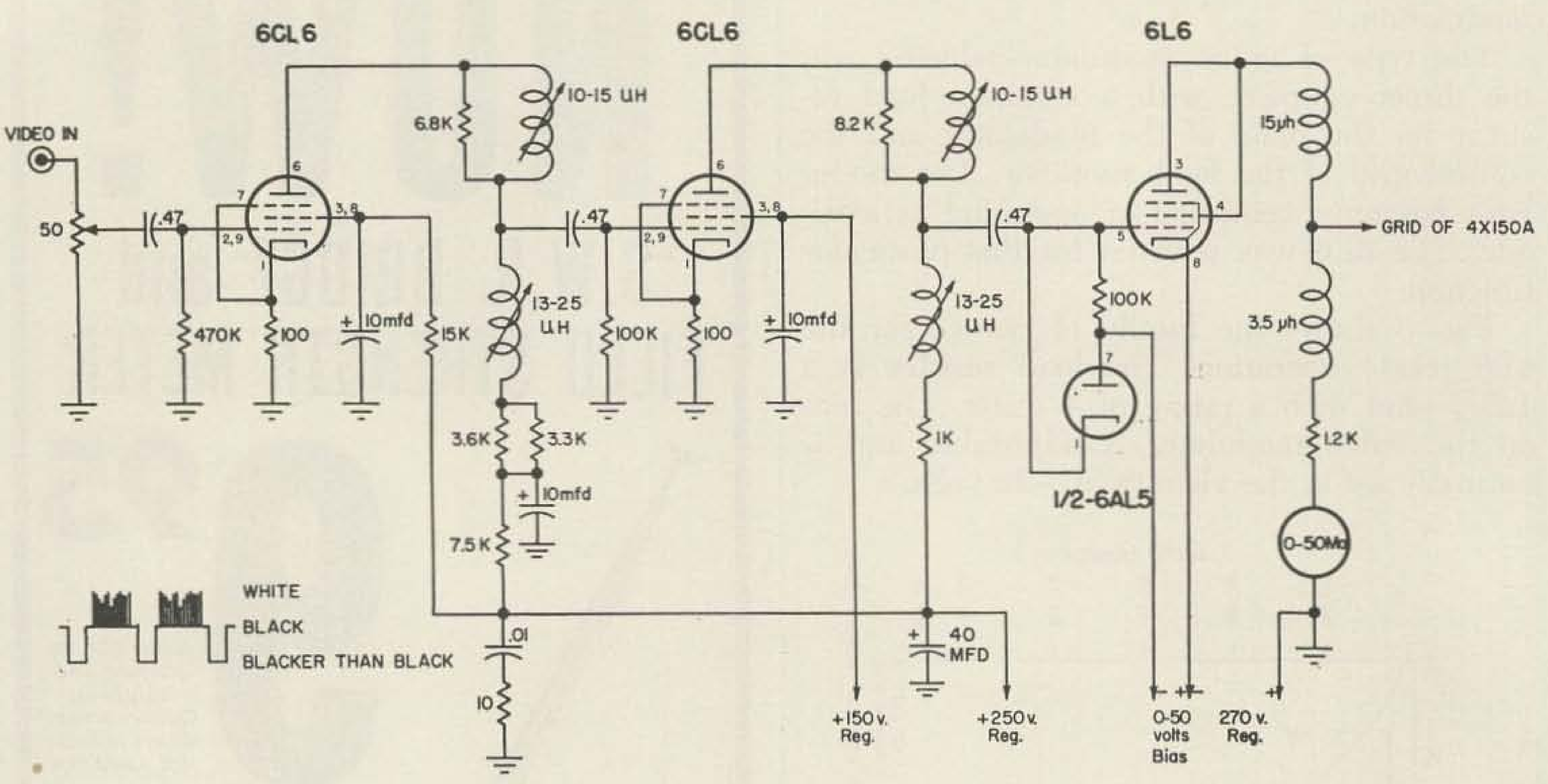


FIG 3

VIDEO MODULATOR

FIGURE 4



In the process of putting video on the air, it will be necessary to monitor the video in the transmission line. Fig. 5 illustrates a typical detector for the composite video information. The type UG tee connector was modified by removing the dielectric insert and installing a small loop. This which is placed in a plane parallel to the conductor. A 6AL5 is used to demodulate the video from the rf.

An oscilloscope or TV monitor may be used to indicate wave form or picture.

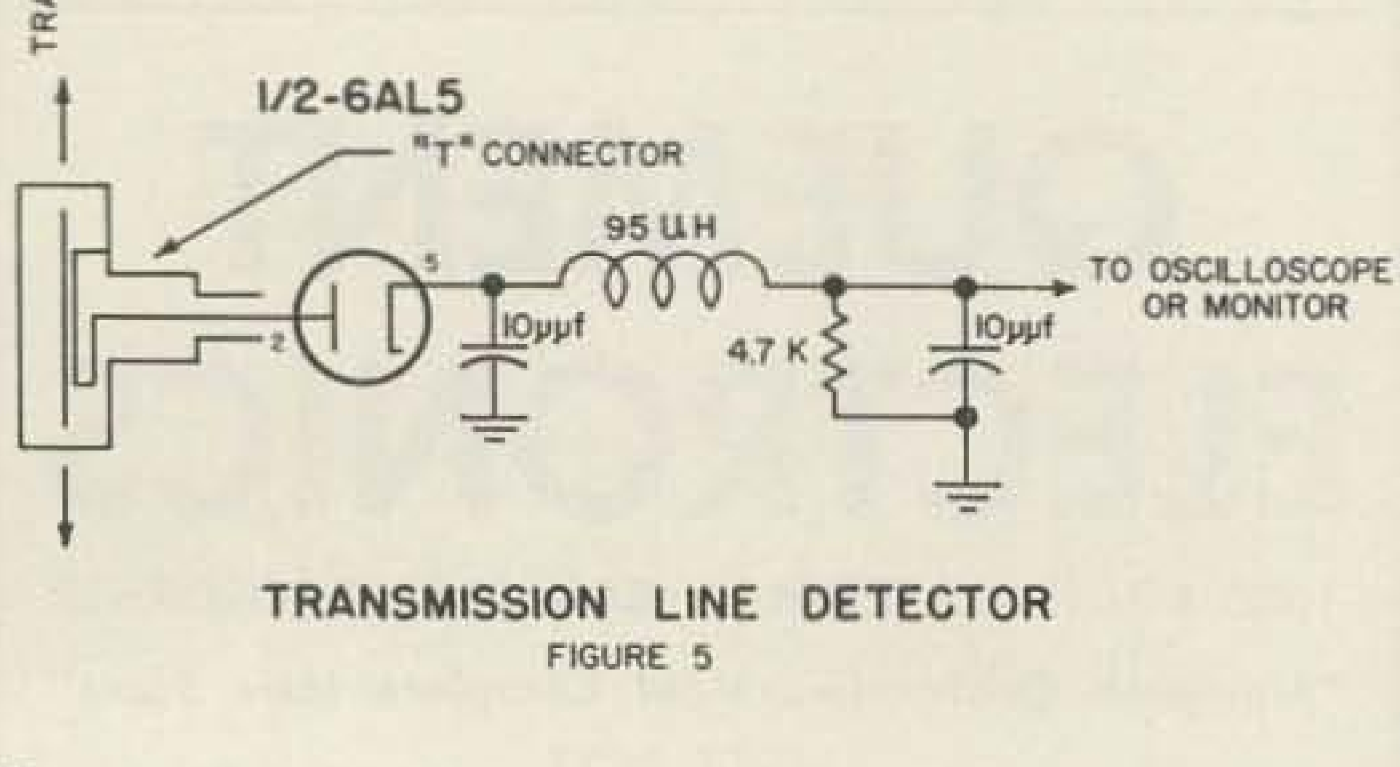
Normal procedure should be used when first tuning up the transmitter. Before applying video through the modulator, the bias on the 6L6 should be adjusted to −22 volts. Note also that the plate current meter should be indicating a current of approximately 20 milliamperes. Now begin to increase your video until you indicate video output. In doing this you will have to reduce grid drive, which may be accomplished by decoupling to the grid of the final amplifier. As the video is increased it is possible to overdrive with the same and the whites will begin to washout. It will then be necessary to decrease video gain. At this time it may be necessary to readjust the value of the grid bias on the grid of the video modulator stage to improve picture quality. Actually what is needed is about three arms and hands. Once the operating point is pretty well adjusted on the transmitter, back the video off and then increase the video so that the synch tips give maximum current and video itself is within 10% of carrier cutoff; usually when the video cuts off the carrier the whites will wash out.

If after making several repeats the preceding adjustments are completed and you are satisfied, then by merely adjusting video gain control you will be able to adjust for various levels of video information with ease.

So there it is, this our video modulator which we are at present using on our rig.

We have a complete system for the transmission of TV. Observe the photograph that was taken at a receiving station 15 miles away. If the article is what some of you are looking for, let's hear from you. We have much more information we could put into the 73 Magazine.

. . . W8VCO



TRANSMISSION LINE DETECTOR

FIGURE 5

Letter

Gentlemen:

I've heard that the Heath Twoer can be converted to 220 mc by doubling in the final amplifier and reworking the superregen coils. Perhaps some 73 reader can provide a conversion.

W. W. Warner K8RSC

The Magic T-R Switch

Jim Kyle K5JKX
1236 N. E. 44th Street
Oklahoma City 11, Okla.

Despite the multiplicity of circuits listed in the various handbooks, we still don't have a perfect T-R switch of the no-moving-parts variety to fill all needs.

Granted, some pretty good designs have been described and are in use—but none of them yet has been fully applicable to all ham uses. In the VHF region particularly, the perfectionist still insists on the relay, even if it is slower and clanks loudly in the background.

The major objection to the conventional T-R switch at VHF, of course, is that it reduces receiver sensitivity. It hardly makes sense to beat the bushes for a device capable of 1½ db noise figures, then put a 10 db T-R switch in front of it! And even if this could be overcome, there's still the question of transmitter noise showing up to hurt the S/N ratio.

What we need, of course, is a devise which will completely disconnect the transmitter from the antenna while the receiver is in use (and vice versa) without introducing any noise of its own, and without moving parts. In addition, it would be nice if this gadget could be built inexpensively.

Strangely enough, the microwave gang have had shuc a gadget around for 20 years (or more). It's a mystery why no one has thought of adapting it to this use previously.

We refer, of course, to the so-called "Magic Tee". This, in its original form, is a rather complicated mass of waveguide, which has the "magic" property of routing signals from any port to both adjacent ports, while retaining almost total isolation of signals between alternate ports.

The waveguide, of course, isn't much use at frequencies below the upper UHF range—but a coaxial analogy of the Magic Tee, known as the "hybrid junction" or hybrd rng," was described on page 353 of the third edition of *Reference Data for Radio Engineers* in 1949!

The basic circuit is shown in Fig. 1. Here's how it works: assume that you have connected a transmitter to input 1, and the other three ports are all terminated properly so that SWR on the lines leading away is 1.0 (this is important).

The signal from input 1 to input 2 may go direct via the quarter-wave portion of the ring, or "long path" through the ¾ wave leg, and two more quarter waves in series. The total length of the "long path" to input 2 is thus 5/4 wavelength, or one full wave longer than the short path. Energy repeats itself in both amplitude and phase every full wavelength (the half-wave "repeater" is actually a phase inverter) and so we can subtract one wavelength from the long path, which makes it exactly equal in length to the short path so far as the rf is concerned. And since the two paths are of equal length, they have no effect on the rf appearing at input 2 except to reinforce each other.

However, at input 3, the picture is a bit different. Energy arriving there from input 1 also comes through two paths; one is a half wave long while the other is a full wavelength. Thus the rf from one path is exactly 180 degrees out of phase with that from the other path, and it cancels itself out.

At input 4, the situation is he same as at input 2. The only difference is that both paths are now ¾ wave long.

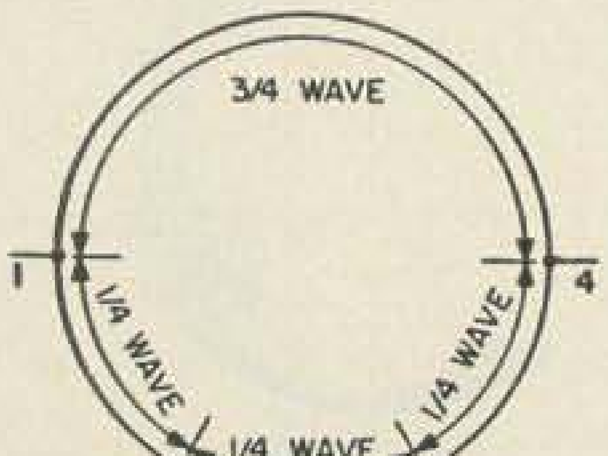


FIGURE 1

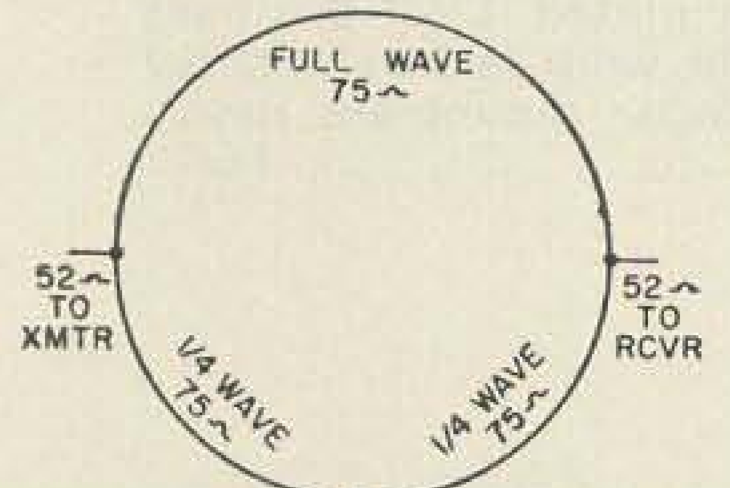


FIGURE 2

A bit earlier, we said that all lines must be terminated so as to have no standing waves on them. Here's why: if the line away from any port on the ring has standing waves, some power will be reflected back into the ring at that point—and this reflected power will no longer have the proper phase relationship to permit complete cancellation.

So here we have the ring and how it works; now what do we do with it?

The suggested operational circuit is shown in Fig. 2. (As this is written the author is on a temporary assignment far from his equipment and has had no opportunity to prove the idea in practice. It ought to work nicely—but if you try it, remember that all is experimental and don't use your 416B until you have tested with less exotic equipment!) Note that this has only three ports rather than four. The long path has been extended another quarter wavelength to preserve phase relations.

Note also the various impedance levels of coax specified. The discerning reader familiar with quarter-wave transformer action may have been wondering what of this nature happens in such a circuit; maintaining the impedance of the ring itself at 1.4 times that of the various feedlines keeps the quarter-wave sections under control. If you are using 52 ohm coax (as most of us seem to be) then 75 ohm is a natural. If you're using 75 ohm, you have troubles ahead since 100 ohm coax isn't an over-the-counter item. Best suggestion: transform down to 52 ohms befor reaching the ring.

Construction of the ring should not be difficult. When calculating length of each section, don't forget coax velocity factor. In fact, we recommend trimming each to length with a grid-dipper at the center of the most-used part of the band, for increased precision—because the cancellation will be total at only *one* frequency, and effective bandwidth of this device is one of its unknown quantities. It will certainly be sufficent for use, but may not permit much in the way of QSY.

Once built and connected in your transmitter-receiver-feedline hookup, it may require some adjustment. The transmitter and receiver must both present 50 ohm input impedances when viewed through the antenna terminal for proper operation—and many of them don't do this now.

Best way of adjusting receiver input impedance is to modify the L-C ratio of the antenna coil, measuring with an Antennascope and GDO to get into the right region. Once there, fire up the transmitter at low power and continue adjusting until you have a minimum of fed-through power from the transmitter showing up in the receiver.

Only perfectionists need worry about the transmitter input impedance, since its only effect would be a very slight reduction of received signal—probably not enough to be noticed even on a marginal signal. Best way of modifying this would probably be to prune the line from transmitter to Magic Tee, which would change the effective impedance seen by the Tee even though i twould have little actual effect on SWR.

So there you have it—a T-R switch offering theoretically total isolation at any one frequency, introducing no noise, and in addition capable of being built at home for pennies. Try it, and let us know how it works out.

. . . K5JKX

A Look at Antenna Gain

Jim Kyle K5JKX

It's common belief among VHF/UHF minded hams that the parabolic reflector is the ultimate in antenna design and that things such as the ancient collineararray are virtually obsolete.

So maybe it's time to do a little comparative checking into the relative gains of different types of antennas, and see just why some have better reputations than others.

The accompanying chart shows a comparison of db gain figures and effective aperture areas for several of the more popular types of antennas, as well as some unpopular types and one which is impossible. It leads to some interesting conclusions.

For instance, we note that for the same physical size, the old-fashioned collinear leads the league when it comes to gain, with the corner reflector running a very close second. So why is the collinear losing ground, and the corner reflector almost ignored?

A large part of the answer lies in the fact that the figures shown here are the *maximums* which can be achieved, and many of the more popular versions of these antennas fail to meet this level of performance.

In addition, a collinear of any appreciable size almost always runs into feed-line and phasing problems which limit its *attainable* gain to something in the neighborhood of 20 db.

The corner reflector's wide horizontal angle has helped keep it in the little-used stack—although K2TKN has employed this cnaracteristic to good advantage in a beacon-antenna design.

The biggest reason parabolic dishes have become so popular, however, is their independence of frequency. An 8-foot dish, for example, is equally adaptable to operation at 100 mc or 10,000 mc. The difference is that it will have only 6 db gain and something like an 80-degree beamwidth at 100 mc, while at 10,000 mc the gain has climbed to 46 db and the beam has narrowed down to about 4/5 of a degree wide—just wide enough to hit the moon!

None of the other antenna designs listed in the chart, except the horn, have this characteristic. And the horn is not particularly amenable to changes of orientation, so necesary in ham work.

Note that for those antennas in which size is not fixed precisely by the frequency of operation, two standard sizes have been employed in preparing the chart. This is to give you some idea of the way in which gain varies with physical size, and also shows you approximately how much space would be required for any of the designs. In the chart, the symbol A represents actual physical surface area, L represents total height, and N represents the number of elements employed in the array. Out of respect for the printer, wavelength is represented by W rather than the more usual Greek lambda!

. . . K5JKX

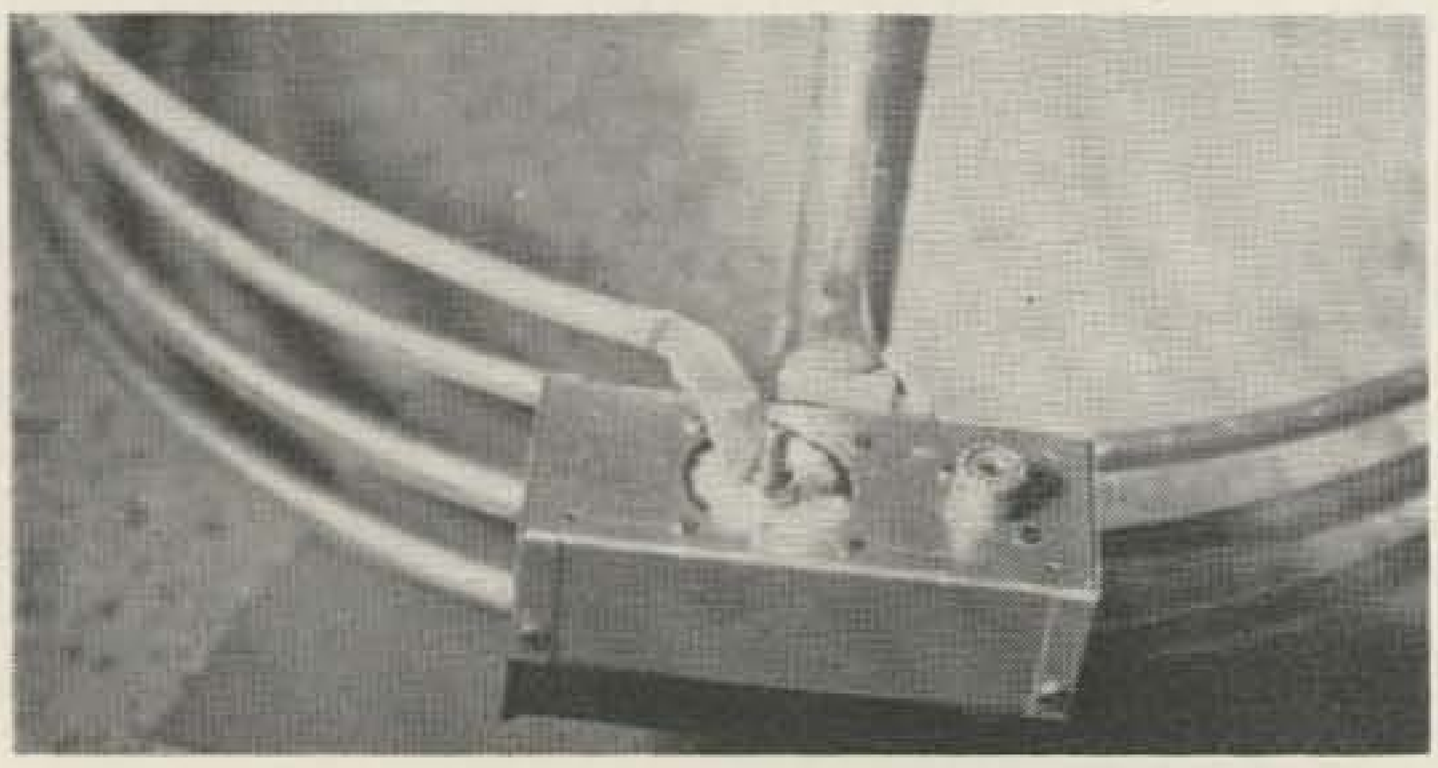
Table I. Comparison of Antenna Gains and Apertures

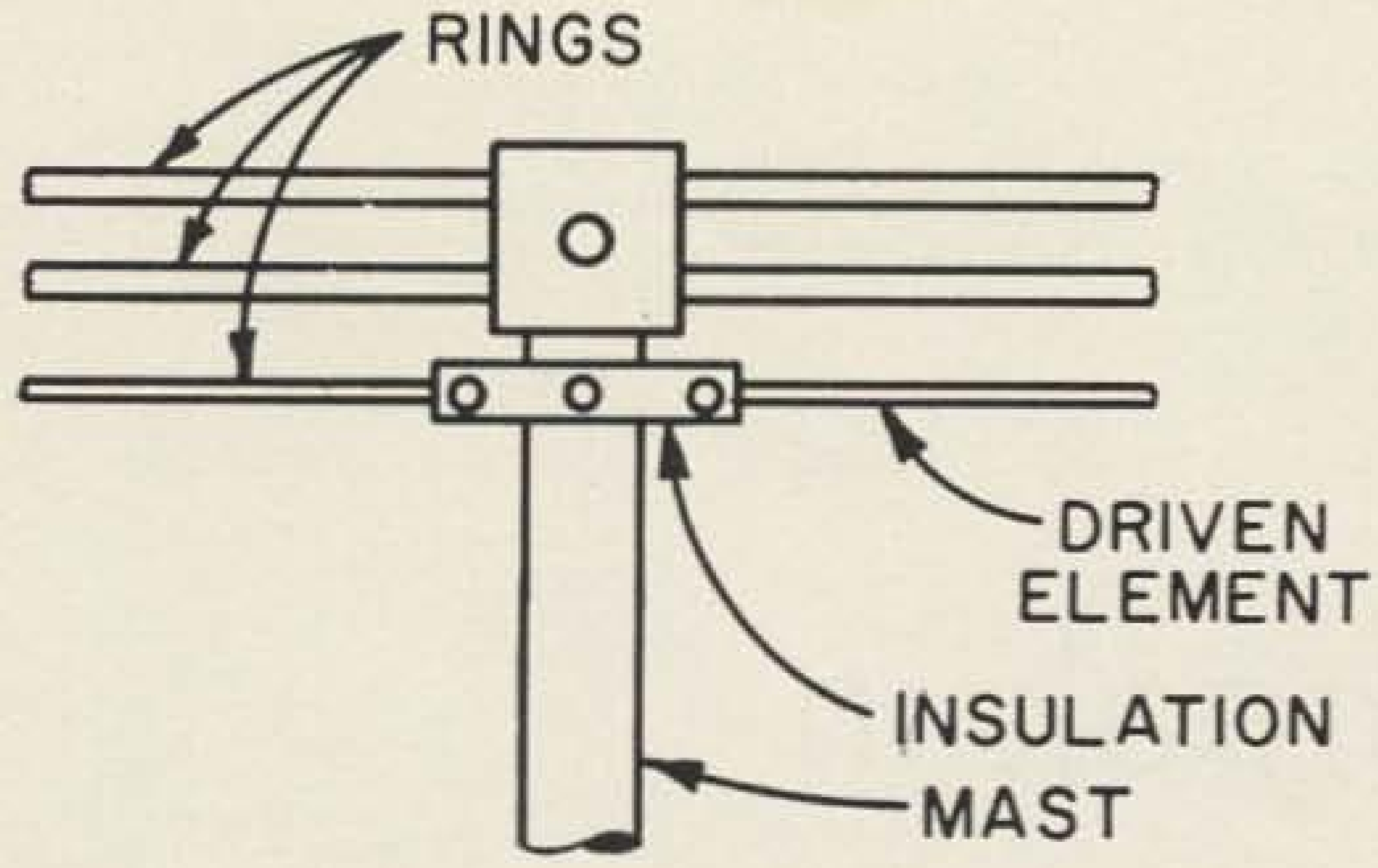
Type of Antenna	db Gain	Aperture
Isotropic point source	0	$0.07956W^2$
Small loop or halo	1.761	$0.1193W^2$
Half-wave dipole	2.148	$0.1305W^2$
Stacked haloes 4, ½ wave apart	10 log (2L/W) 4.77	LW/6.28 $0.2387W^2$
Parabolic reflector		
1 wavelength dia.	6.74 to 7.7	0.5A to 0.6A
2 wavelength dia.	13.0 to 13.7	
Optimum horn		
1 wavelength square	10	0.81A
2 wavelengths square	16	
Corner reflector		
1 wavelength square	10	0.71A
2 wave, 60° angle	13	0.5A
Broadside array (collinear)		
1 wavelength square	11 (max)	A (max)
2 wavelength square	17 (max)	

Modification of the Saturn 6

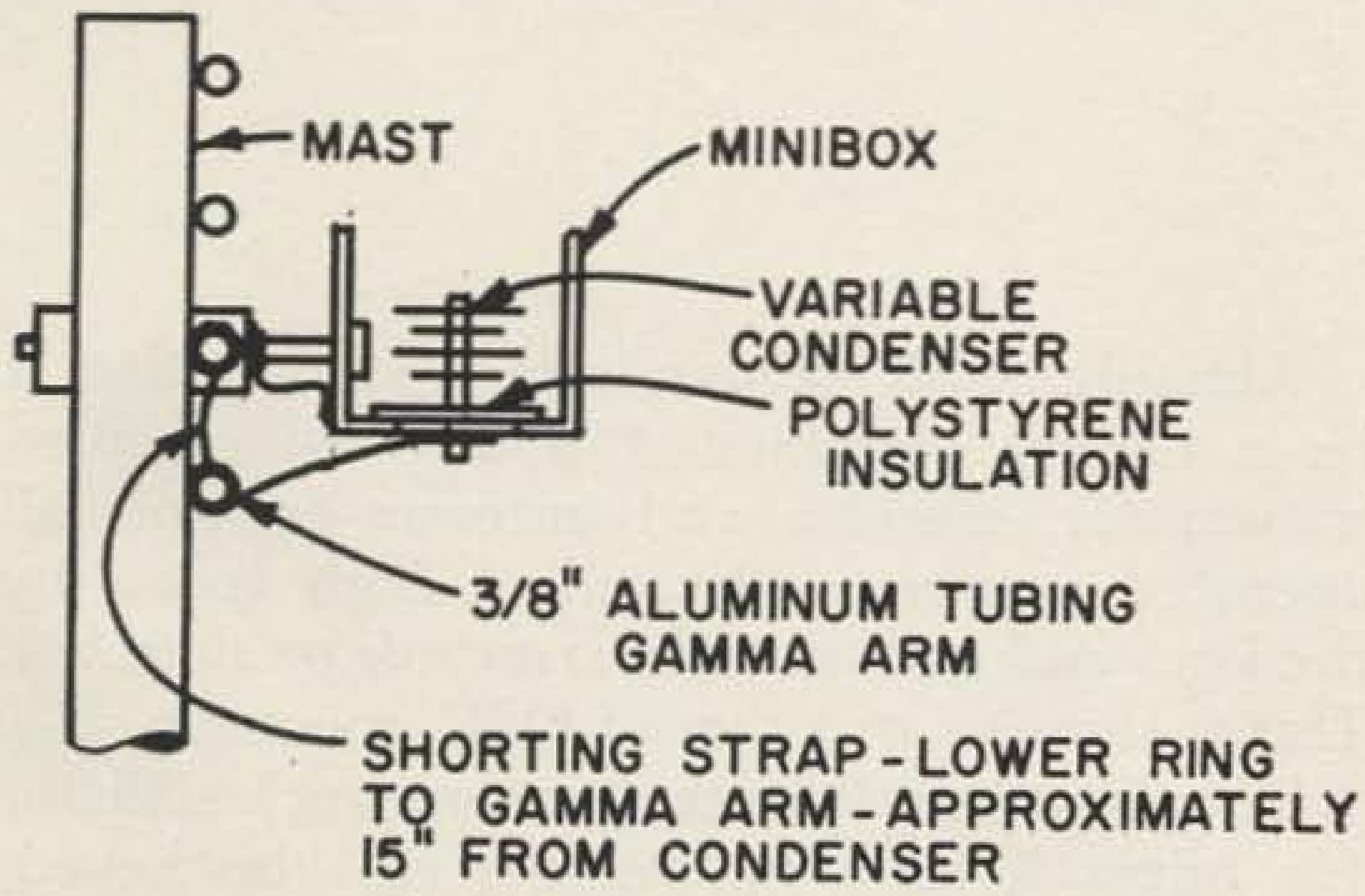
Ralph Bradford K5LPE
Ernest Williams W5CWS

The authors acquired a pair of Saturn 6 halo antennas with the idea of using them in club and Mars nets. They were tuned to the desired frequency and the Q section prepared as recommended by the manufacturer. Results were very poor. In good weather a high swr was obtained and during rainy weather the swr was even higher. Experimentation followed resulting in a modification employing a Gamma match. Bud Minibox 5″ 1 2-¼″ w 2-¼″ h was used as an enclosure for the variable condenser and coax connector. A 1-½″ hole and a ⅝″ hole were cut in the bottom of the U-shaped part of the box. A piece of 1/16″ poly-





ORIGINAL ARRANGEMENT



AS MODIFIED

styrene was attached to the box over the 1-½″ hole using 4-40 volts and epoxy resin. A small 50 mmfd variable condenser was mounted in the center of the polystyrene. The coax connector mounted in the ⅝″ hole. Two holes were drilled in the side of the same unit and connected across the two bolts holding the lower ring sections to the insulation material. The center bolt holding the insulation material to the mast must be grounded to the minibox. The coax connector is connected to one side of the condenser inside the minibox. A ⅜″ diameter piece of aluminum tubing is connected to the condenser on the outside of the minibox. This tubing is extended to a position under the lower ring of the halo and then bent to follow the curvature of the halo. It is 15″ long and is spaced ¾″ below the lower ring of the halo. Closer spacing of the tubing will require a different length of tubing. Do not allow this tubing to touch the minibox or mast. Using this modification, the authors have obtained a 1:1 swr and in rainy weather a 1.5:1 ratio.

Utopia Break-in

George Thurston W4MLE
3407 Prock Drive
Tallahassee, Florida

Ask any CW operator what he'd most like to have—all expense aside—and after he named his favorite dream receiver and a full KW to a stacked rotary 80-meter rhombic, he'd probably name complete break-in (QSK) as his secret desire.

The advantages of a system which will let you "hear through" your own sending to keep track of what's on the frequency are so obvious they don't need exposition. But for some reason, a superstition has grown up that this is next to impossible to achieve in practice.

Perhaps one reason it *seems* too difficult is that there persists a popular illusion that QSK is something you *ought* to be able to have for 10 minutes work and a couple of small resistors or diodes.

It *is* simple. But it's not all that simple, and you might as well resign yourself to a circuit using a couple of tubes or transistors, a power supply, perhaps a relay or two and a handful of small parts.

There are probably as many systems for QSK as there are operators using them. And one operator may regard as "complete" break-in what another operator may regard as semi-break-in.

For our purposes, we'll consider a complete-break-in system as any lashup which will permit a CW operator to go from transmit to receive and back again using only his key to do it—and which will permit him to hear signals in his receiver during brief pauses in his transmissions.

This includes even those systems which tend to blast the ears off the operator through receiver overload, and those systems which turn off the receiver for whole characters and words at a time, opening it up only during the longer pauses between words or sentences.

Actually, QSK demands of a station that it be a closely coordinated unit, with receiver, transmitter, monitor and antenna controls all operated automatically and at high speed by the key—*and with no other controls or switches.* This is the *sine qua non* of QSK operation.

This requires that the transmitter oscillator (or mixer if its a heterodyne rig) be keyed, so that there's no signal to block the receiver during pauses in the transmission.

The receiver must be keyed, so it will be "mute" during key-down, to avoid all kinds of squawks, grunts, clicks, screams, screeches and thumps which result from overloading it with the transmitter signal.

It requires a means of monitoring the keying, so that the operator can tell what he's sending.

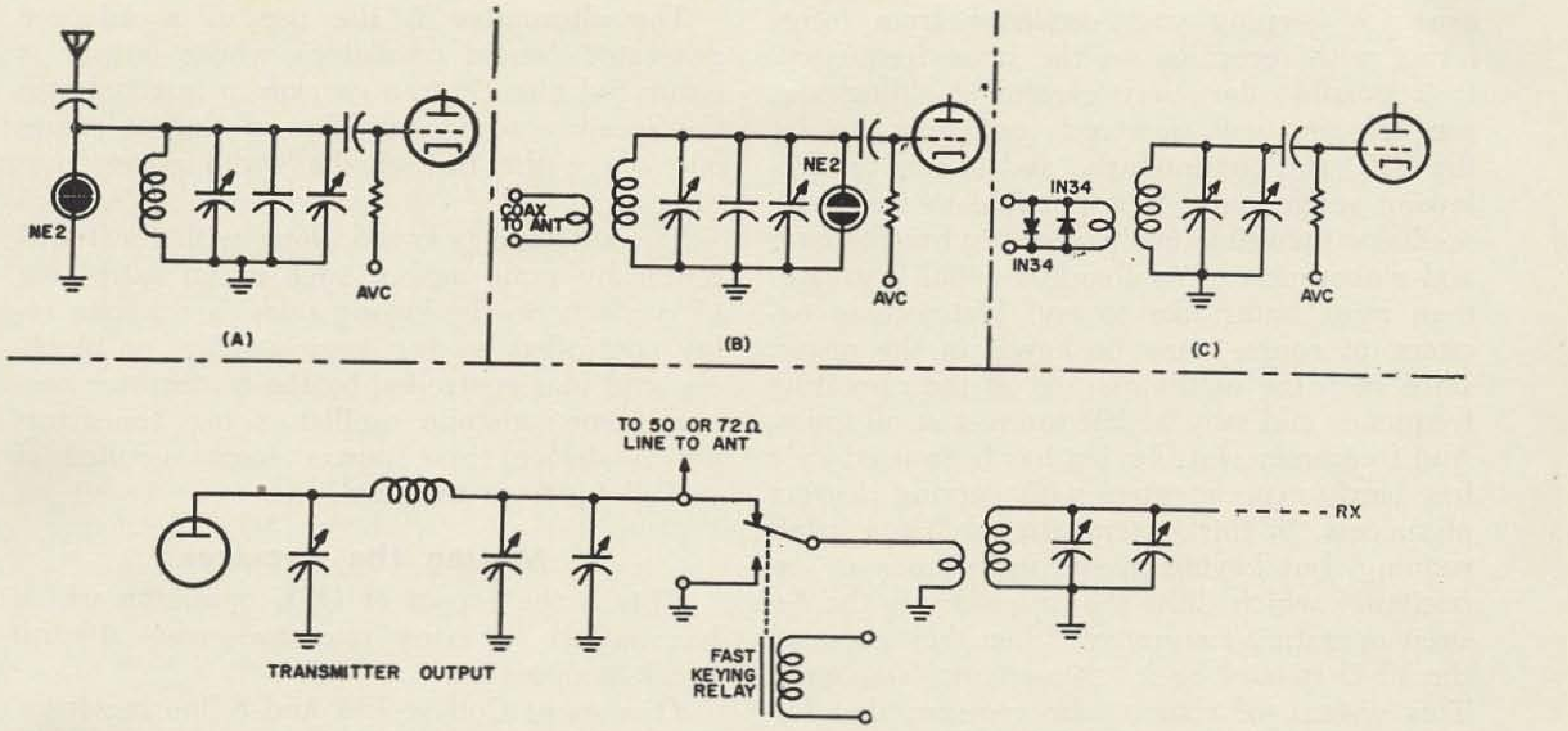
And it demands some means of protecting the receiver from damage by the transmitter's rf.

Receiver Protection

This is one of the simplest demands to meet. Most receiver front ends are pretty rugged these days and there are many ways of protecting them from rf damage.

One of the most common, and one of the best, is the TR switch, which permits use of the transmitting antenna for receiving. There are a million circuits (more or less) for TR switches, so we'll just mention the method here and let it go at that.

A method used in the popular surplus Command Receivers is to put an NE-2 or NE-1 across the antenna terminals of the receiver. Normally this has no effect on reception. But when the rf peak voltage is high enough to fire the tube, it appears as a dead short across the antenna, "clamping" the voltages which appear on the receiver antenna coil and first rf amplifier grid. The ARC-5 receivers had a high im-



pedence antenna connection. Most modern commercial receivers use 52 or 72-ohm inputs and rf voltages seldom get very high, even with a powerful local transmitter. The danger point is the *secondary* of the first rf transformer—at the grid of the rf amplifier. Good practice would be to install the neon lamp from grid to ground of the rf amplifier tube. (Fig. 1 A & B)

Another method is to use a pair of diodes (e.g. 1N34s) connected in parallel, back to back, across the antenna terminals. These diodes have no effect on reception because even their forward resistance is very high when measured at a few millivolts. However, when the transmitter goes on, rf potentials at the receiver antenna terminals get up to at least several volts—even on low impedence inputs. At these voltages, the diodes' forward resistances are very low. They're connected in reverse polarity to each other, so they "clamp" the rf input to very low voltages. (Fig. 1 C)

A very fast acting relay can be used to remove the receiver input from the antenna feedline and ground it. The relay handles no rf power, so any very light duty, fast acting relay, such as a keying relay, can be used. (Fig. 1 D)

All of these methods (except the relay) are potentially capable of producing TVI because of the clipping of the rf signal, which occurs at the limiting device. The usual anti-TVI measures should be effective.

Keying the Transmitter

Most modern transmitters interrupt the oscillator signal when the key is up. If yours doesn't do this, but keys a buffer or the final, you'll have to modify it so that the oscillator can be keyed. This is a problem you'll have to solve yourself, perhaps by referring to other articles on keying in the amateur magazines and handbooks. A word of advice, however. Grid-blocking keying methods are generally more easily adaptable to QSK systems than cathode or screen keyings.

On the subject of oscillator keying, it is worthwhile to mention that other systems do

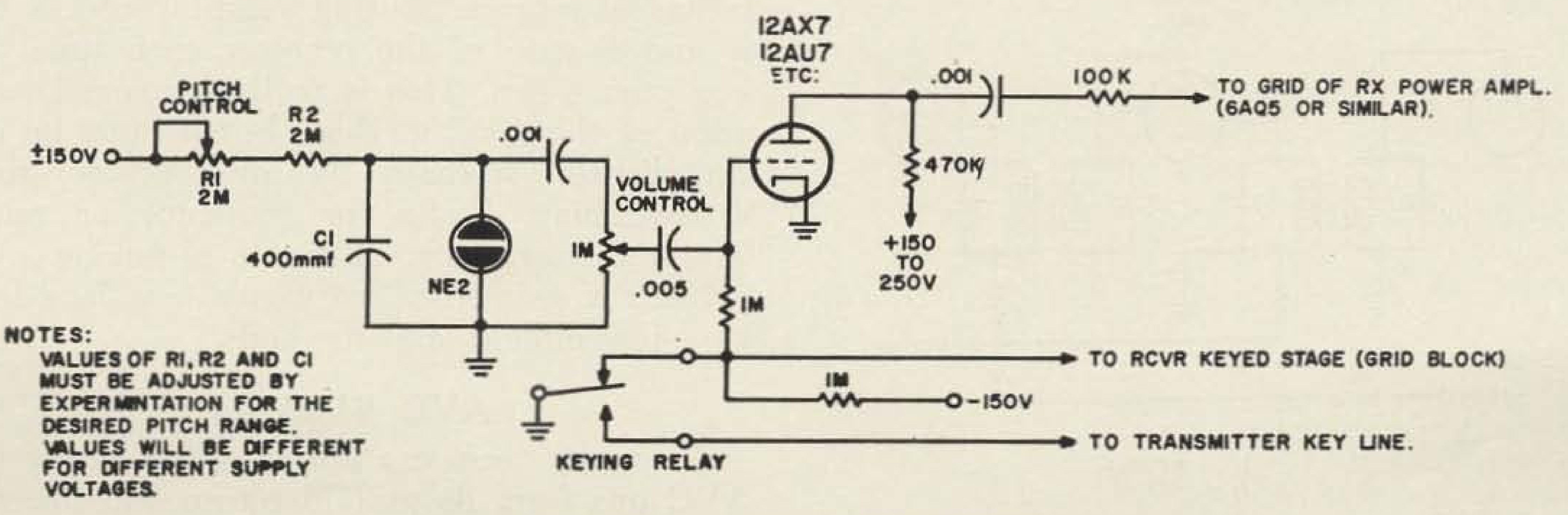


FIG. 2 SIMPLE KEYED SIDETONE GENERATOR.

exist for keeping your oscillator from interfering with reception on the same frequency. It is possible, but very careful shielding and use of very low powered oscillators, to let the VFO run continuously, and to key the following stages only. It is possible to make the oscillator inaudible in the receiver but the care and elaboration of mechanical detail is greater than most hams like to try. Heterodyne exciters, of course, may be keyed in the mixer, since both the oscillators are off the operating frequency and may be left running at all times. And frequency shift keying has been used by a few hardy experimenters with varying degrees of success. In this system, the oscillator is left running, but keying inserts inductance or capacitance which shifts the frequency to the desired operating frequency. When key goes up, the VFO swoops back to its resting frequency. This system, of course, also requires that following stages be keyed, and that time sequence keying be used to eliminate the chirp. I don't recommend the system (nor recommend against it). I mention it in the interest of completeness.

Monitoring

Two methods of monitoring are in common use in QSK stations.

One uses the receiver (or a separate receiver) to listen to the transmitted signal. This requires that the monitor be tuned to the operating frequency.

While a receiver makes a perfectly satisfactory monitor—and superior in some respects to other monitors—it requires constant retuning if you QSY much. It's almost helpless unless you constantly work directly on your own frequency, and when working DX this is often not desirable. A separate receiver, of course, permits working off your own frequency. But have you ever tried working a contest like FD or SS while tuning *two* receivers, plus your VFO, logging and hunting new territory at the same time?

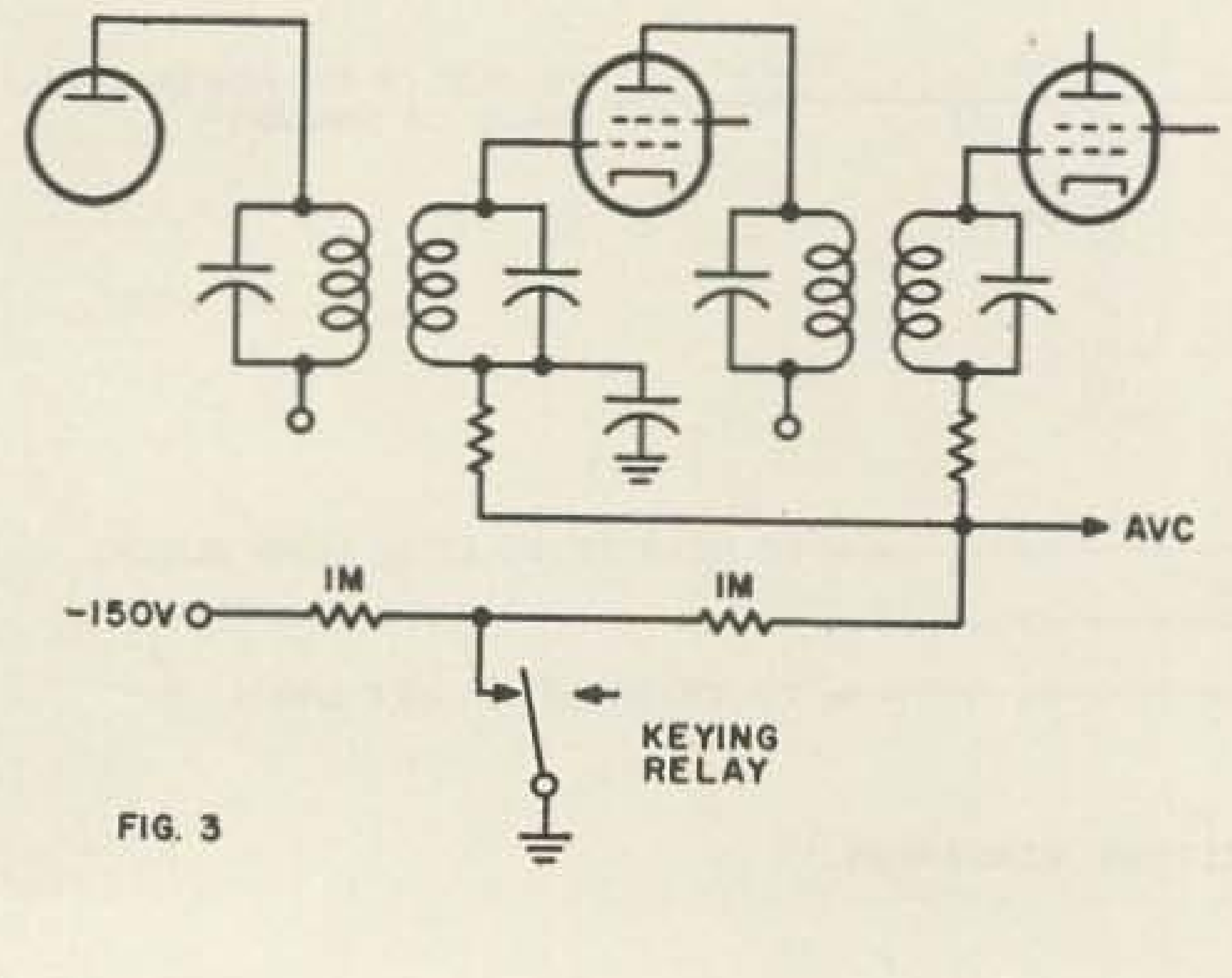


FIG. 3

The alternative is the use of a sidetone generator (audio oscillator) whose output is either fed directly to a speaker or injected into the receiver audio amplifier so that it comes out where the rest of the audio comes out. (Fig. 2)

The sidetone is keyed along with the transmitter by some means, such as an extra pair of contacts on the keying relay, a separate relay controlled by the keying relay, or blocking grid bias controlled by the transmitter keying. Some sidetone oscillators use transistors which derive their power from rectified rf picked up from the final.

Muting the Receiver

This is the aspect of QSK operation which has baffled so many operators who attempt break-in operation.

Owners of Collins 75A and S-line receivers, Drake 2-Bs and some others with good CW AGC circuits have this problem practically licked. They just let the AGC handle the receiver quieting and let it go at that. It works OK, if you use a sidetone when working off your own frequency.

Another common (though not painless) method often used is the "let 'er grunt" method in which the receiver is simply run at normal gain and the rf overload is relied on to do its own muting. This works with some receivers which overload nicely. (I once used a Hammarlund HQ-110-C which did fine this way.) Of course, both this method and AGC method provide their own monitor signals. The disadvantage, of course, is the same for both—you have to listen on your own frequency. Some receivers don't take kindly to this treatment and the resulting screams from the loud speaker can be heard all over the block—until drowned by screams from outraged neighbors. Hammarlund crystal filter receivers old and new usually fall into this category, and so do many other makes and models.

A third (and somewhat more sophisticated) means of receiver muting sharply reduces the rf and *if* gain of the receiver each time the key goes down. This is really a manual variation of the AVC method, but it must be accomplished externally by some device, such as switching diodes, or transistor or relay. There are a number of means of keying a receiver's rf gain (or "sensitivity") so let's look at a few circuits and methods.

AVC Blocking

On many receivers it is possible to lift the AVC bus from its ground return and inject a blocking bias voltage whenever the transmitter

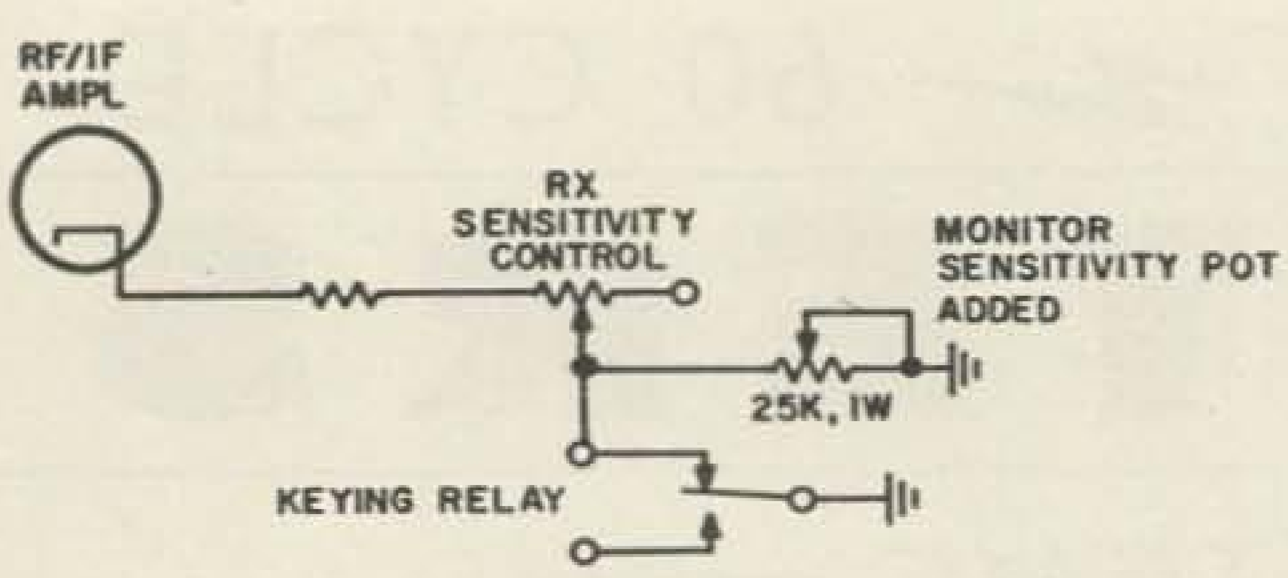


FIG 4

is keyed. This, often, can be adjusted so as to reduce the sensitivity to any desired degree, from a slight reduction to complete cut-off. (Fig. 3)

On some receivers, it is difficult or impossible to isolate the AVC bus in this way. In others, recovery time after the blocking bias is removed, may be too long for practical break-in.

RF Gain Keying

Many receivers use a pot on the cathode circuit of the rf and *if* amplifier tubes to vary the bias—and hence the gain—of the stages. With these receivers, a relay may be used to insert a high value of resistance in the cathodes when the key is down, thus reducing receiver sensitivity. (Fig. 4) This method has a tendency to be quite noisy, since it may respond loudly to the first few cycles and the last few cycles of the keyed characters from the transmitter. Some effort with timing circuits, however, will usually remove these clicks. Timing circuits won't, however, remove clicks generated within the receiver by the keying of its *if* amplifier strip.

As with other *if* muting methods discussed so far, it is necessary to listen on your own frequency unless other monitor methods are used.

With all methods of rf/*if* sensitivity keying, any clicks, thumps or spurious responses generated in the receiver by the keying will be amplified by following receiver stages and a very small click at the origin can assume ear-splitting proportions before it emerges from the phones or speaker.

T-R Switch

The TR switch was mentioned earlier as a means of antenna protection. It can also be a good receiver muting device *provided* the receiver is excellently shielded against pick-up of stray rf through anything but its antenna terminals.

To test this, disconnect the antenna from the receiver, replace it with a small composition resistor of the proper value (usually 50 to 75 ohms) and shield the resistor itself from rf by enclosing it in a small metal box or can.

Turn on your transmitter, tune in your signal and hold the key down (with antenna on the final and the rig tuned to a clear frequency or on top of a foreign broadcast or commercial station in an amateur band). (The chances are good that *any* output is going to QRM somebody. Why should that somebody be a ham when there are so many other handy signals around?)

If you can hear your transmitted signal only faintly (S-5 or less) chances are that you can use T-R switch receiver muting. If it is more than about S-5, either plan another kind of muting or prepare to do some fancy modifying, shielding and by-passing of your receiver to get ride of stray pick-up. (This could be worthwhile in itself, especially if you use a beam. Stray pick-up can play hob with your front-to-back ratio.)

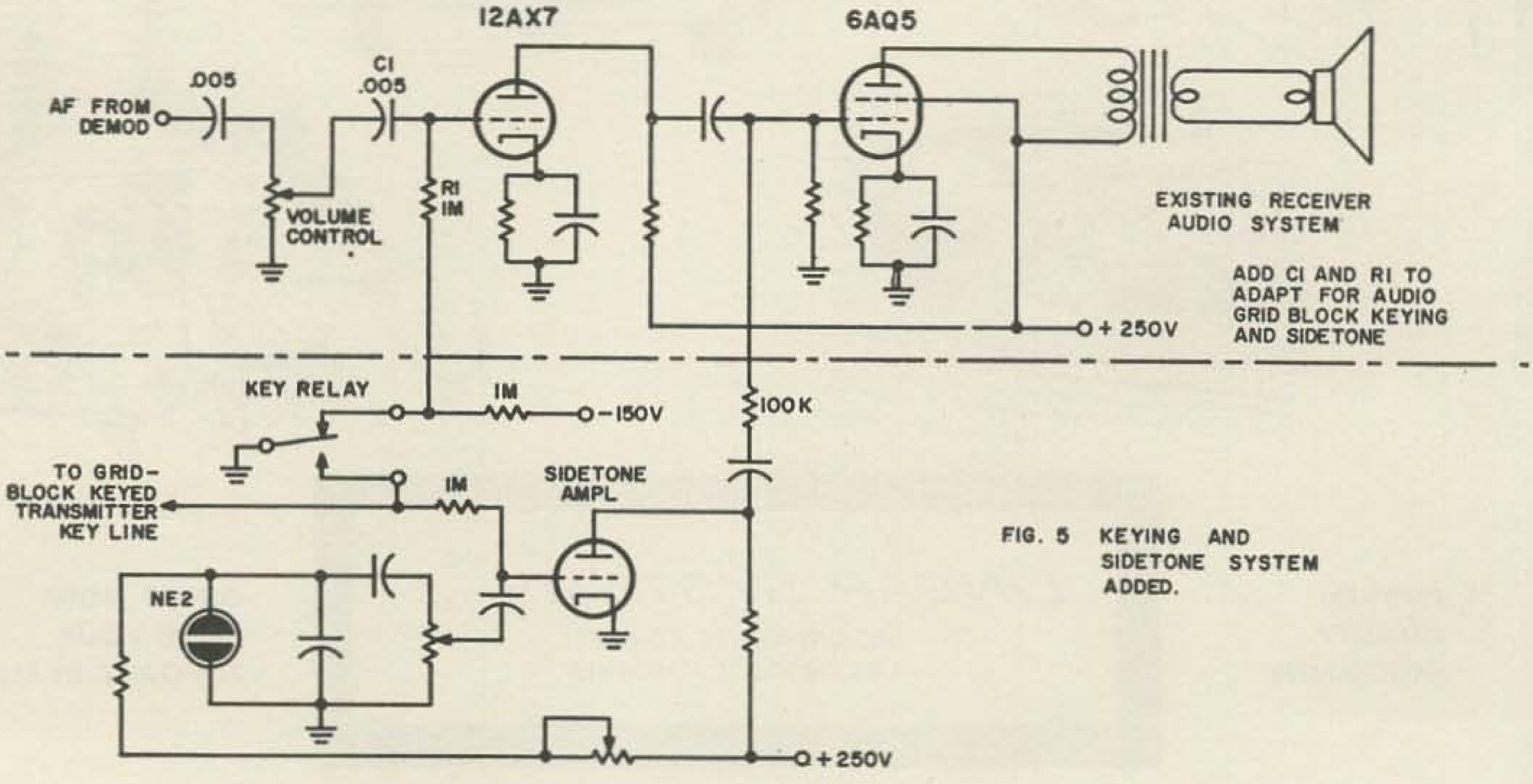


FIG. 5 KEYING AND SIDETONE SYSTEM ADDED.

If you plan to use TR switch muting, the best way is to grid-block key the tube(s) in the TR switch with a high negative voltage (150v or so). Naturally, this also takes care of receiver front end protection.

Audio Muting

It is quite possible, of course, to mute the audio portion of the receiver, thereby largely eliminating the problems of click and varying rf sensitivity of the receiver on various bands and with various antennas.

Audio muting, naturally, means that you *can't* listen to your own signal in the receiver. So you must provide a monitor signal from a sidetone generator. This can be injected into the audio amplifier at a point following the muting cut-off, or it can simply be fed to a separ[illegible]

which will permit you to hear the band at all times when the key is up.

(3) Some means of keying the receiver off when the transmitter is keyed on.

(4) Some means of monitoring your own sending.

There is a wide variety of choice in ways to accomplish each step. The over-all system must operate as a *system* and not as a melánge of separate and disjointed units.

The results are worth every bit of effort it takes to accomplish QSK. And the ability to work full break-in with *no effort* is a very large factor in enjoyment of all types of operating—rag chewing, DX, traffic and contests.

But a warning—once you get used to QSK, you never want to go back to cruder systems. You feel absolutely "blind" if you can't hear [illegible]

A Practical Vee Beam Design

Carlos Robertson K1MRK
39 Gleason St.
Framingham, Mass.

How would you like to put a kilowatt on 20 meters? "Great," you say, "but too expensive." Not necessarily. The following article will describe how to do just that. The amount of input power you will need to get an effective radiated power of 1000 watts will depend on several factors including the space available for an antenna.

Described is a Vee antenna that will:

1. Operate on all bands from 80 meters up,
2. provide gain compared to a half wave dipole even on 80 meters,
3. be easy to feed and load on all bands,
4. be simple to construct and get on the air,
5. be very inexpensive,
6. provide for switching the direction of the beam without resorting to rotators,
7. occupy no more space than an 80 meter half wave dipole.

If this kind of antenna is what you have been looking for, read on.

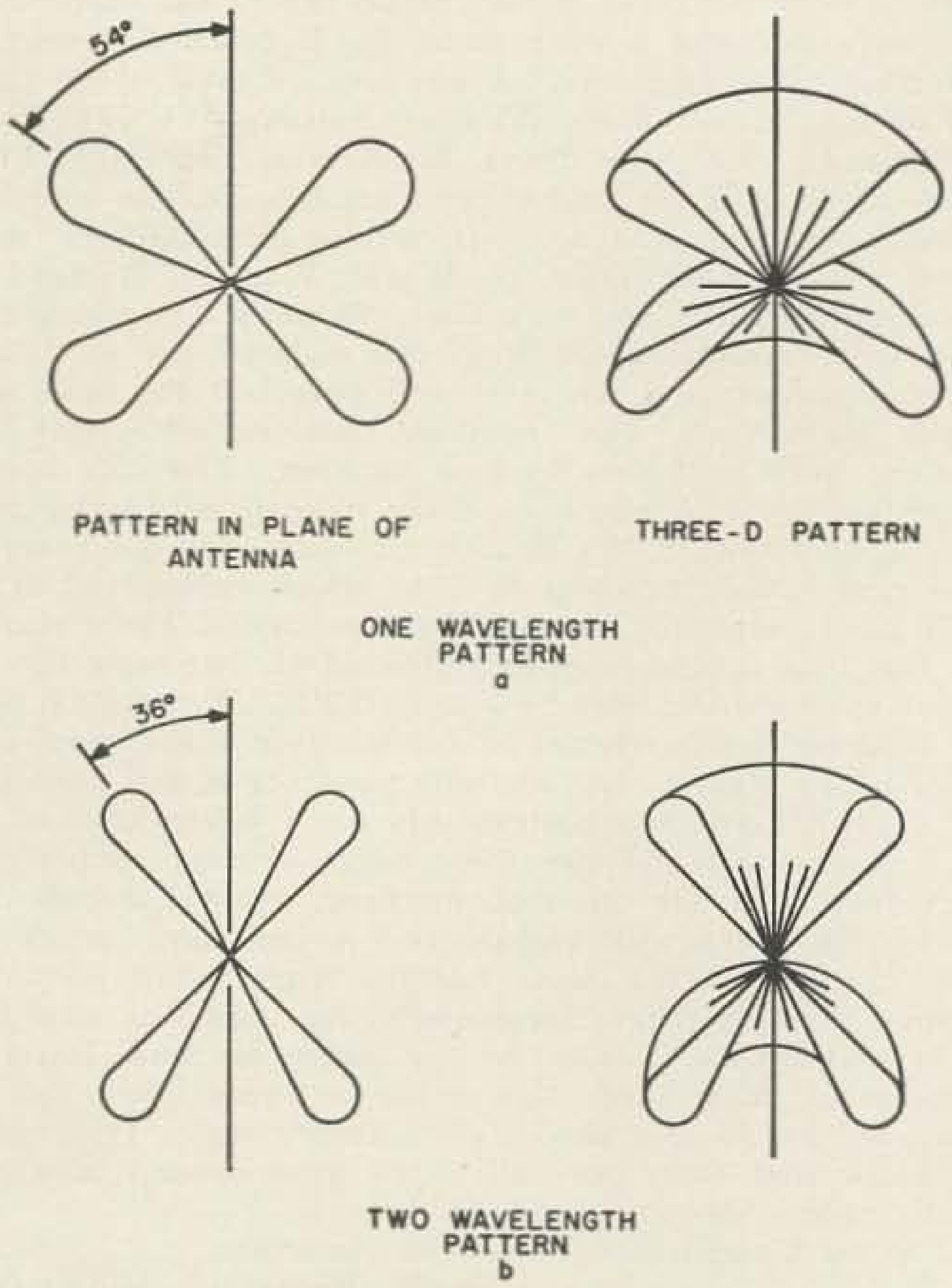


FIGURE 1

Depending on what you have available in the way of natural supports (trees, buildings, etc.) the materials for this antenna will cost less than $10.00. If you have to erect one or more supports the cost will, of course, increase. Even if you have to construct your Vee from scratch, the cost will be appreciably less than an equivalent store-bought beam, and you will have an all-band antenna in the bargain.

Just to convince you of the capabilities of the Vee antenna let me briefly tell you of the incident that sold me. Not too long ago I had occasion to spend about six weeks in sunny Southern California. Naturally the rig went along. All sorts of antennas were tried, with varying degrees of success (mostly poor). Finally, it was decided to try the little known Vee. One thousand feet of No. 26 enameled wire, one hundred feet of 300 ohm twin lead, a ball of twine, a couple of fish sinkers and a baseball pitcher completed the list of materials. Of course, the pitcher was only used to accurately throw the fish-sinkers over a tree limb. The sinkers were left attached so that they acted as automatic tension adjustment. The actual job of getting the wires up in the air was much more simple than trying to describe it.

At any rate, the following day a phone contact was made on 15 meters with a W2 in upper New York State. He gave me a signal report of Q5-S9. My rig was running about 100 watts inupt. We had a nice chat of 15 to 20 minutes with absolutely no signal difficulties on either end. Immediately upon signing the W2 was called by a K6 located about three miles from my QTH. The K6 said he was running the proverbial California kilowatt into a cur-

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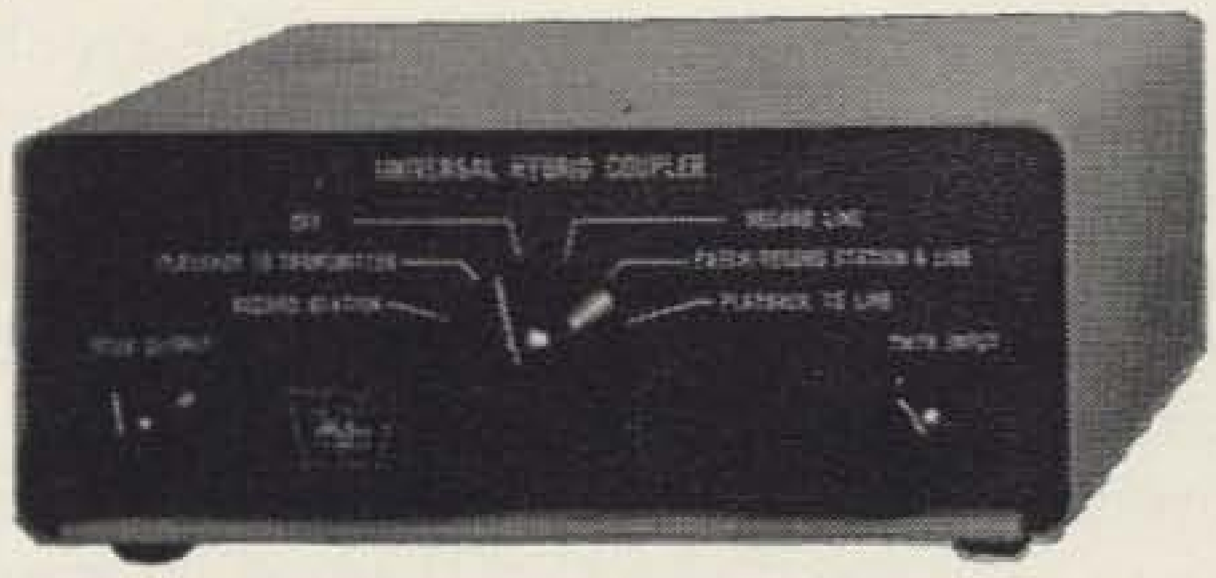

The Waters Universal Hybrid Coupler not only is a phone patch, connecting your transmitter and receiver to the phone lines, but will also work into your tape recorder. Works on AM, SSB (VOX), etc. $49.50.

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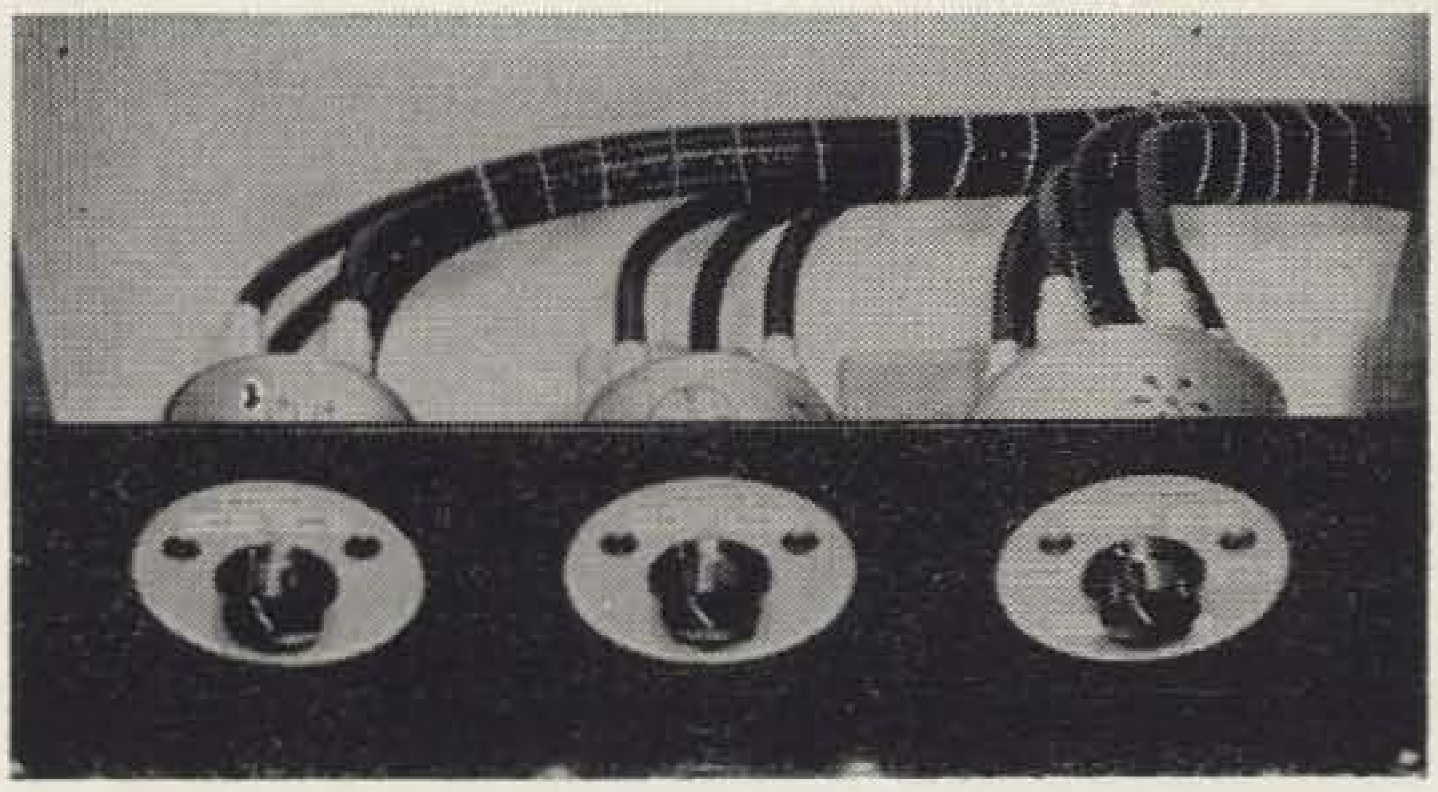
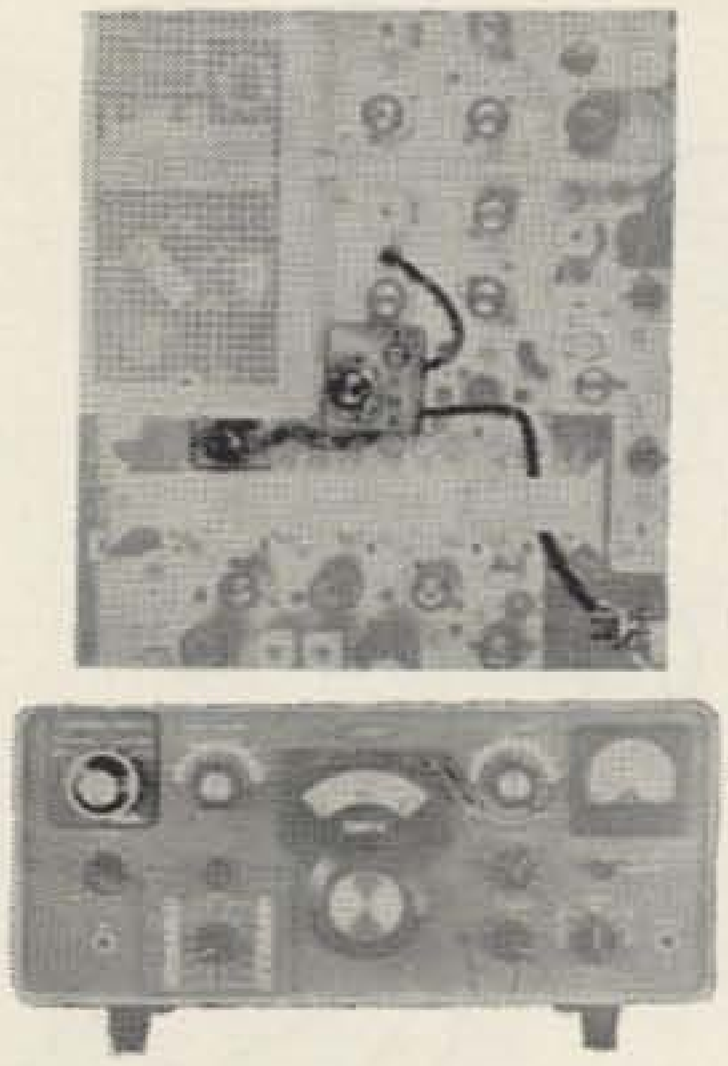
SWITCHES



Three types: one pole-six throw for antenna switching, $12.95; one pole-two throw in case you don't have so many antennas or want to use a dummy load, $11.45; transfer switch for switching power amplifier in and out, $11.45. All are canned for protection. All have SO-239 type connectors.



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WATERS MFG. INC.

WAYLAND MASS.

Antenna Length (wavelengths)	Power Gain	Ø of Max Radiation
1	1.2	54 degs
2	1.4	36
4	2.1	25
6	3.1	20
8	4.3	18
10	5.6	17
12	7.2	16

Power Gain of Single Long Wire for Various Lengths

Fig. 2

rently popular tri-band beam (of the $200 class) with an advertised gain of about 8 db. Well, you've probably guessed the result. The K6 received the identical signal report that I did—Q5-S9. If we can assume identical efficiency in the two finals you can see that my Vee was giving me an 18 db gain. This is equivalent the 10 db difference in iput power plus the 8 db gain the tri-band beam should have. This 18 db is the theoretical maximum gain figure for the Vee with 10 wavelength legs, which is exactly what my Vee was. That is not bad performance from a $4.00 antenna! (The pitcher was free.)

Before you decide to rush out to the local hardware store for a handful of fish sinkers, it would be well to take stock of the amount of real estate under your control. A ten wavelength Vee for 15 meters is approximately 450′ long by 250′ wide at the widest point. That is a considerable chunk of real estate and not every one will have two and one half acres for antenna farming. On the other hand, most everyone (except apartment dwellers) will have room for an 80 meter dipole. The last part of this article will describe in detail the construction of a Vee antenna that will fit into the space normally required for an 80 meter dipole.

Although the intent of this article is to inspire you to build and enjoy the described Vee antenna, it is not recommended that you skip the following few paragraphs. These paragarphs deal with the theory of how a Vee works as it does and also list some alternate ways of squeezing the last db from the system.

Single Long Wires

A single long wire antena will exhibit "gain" compared to a half wave dipole. This is illustrated in Fig. 1. Note that the pattern in the plane of the one wavelength antenna is not concentrated broadside as in the case of a half wave dipole. Instead, the lobes of maximum radiation are at an angle of 54 degrees to the axis of the wire. Each of these lobes contain a greater concentration of energy than the lobes of the half wave dipole. Hence, the full wavelength antenna exhibits "gain" as compared to the dipole. The radiation pattern of a two wavelength antenna is shown in Fig. 1b. Notice that as in Fig. 1a the lobes of maximum radiation are not at 90 degree angles to the antenna axis. In fact, the lobes are much closer to the wire axis than in the one wavelength example. You can see then, that as the wire is made longer, the axes of the lobes of maximum radiation lie closer to the axis of the antenna itself. The power gain and the angle of maximum radiation for various lengths of single long wire antennas is listed in Fig. 2.

The Vee Antenna

A Vee antenna is a bi-directional antenna consisting of two horizontal wires arranged to form a V. In its unterminated configuration it is bi-directional; however, by terminating each leg in a non-inductive resistance of the proper value, one lobe can be eliminated for all practical purposes and the antenna will then radiate in only one general direction.

The process by which a Vee antenna provides gain is similar to that of a single long wire. The Vee will always provide more than two times the power gain of an equivalent length single wire. This is due to the interaction of the fields of each wire of the Vee upon the other wire, The method by which the Vee forms a bi-directional radiation pattern is illustrated in Fig. 3. The lobes produced by each leg of the Vee are designated as follows: on wire AA′, the lobes are numbered 1, 2, 3 and 4; on wire BB′, the lobes are numbered 5, 6, 7 and 8. When the proper angle Ø, called the apex angle, is chosen, lobes 1 and 4 have the

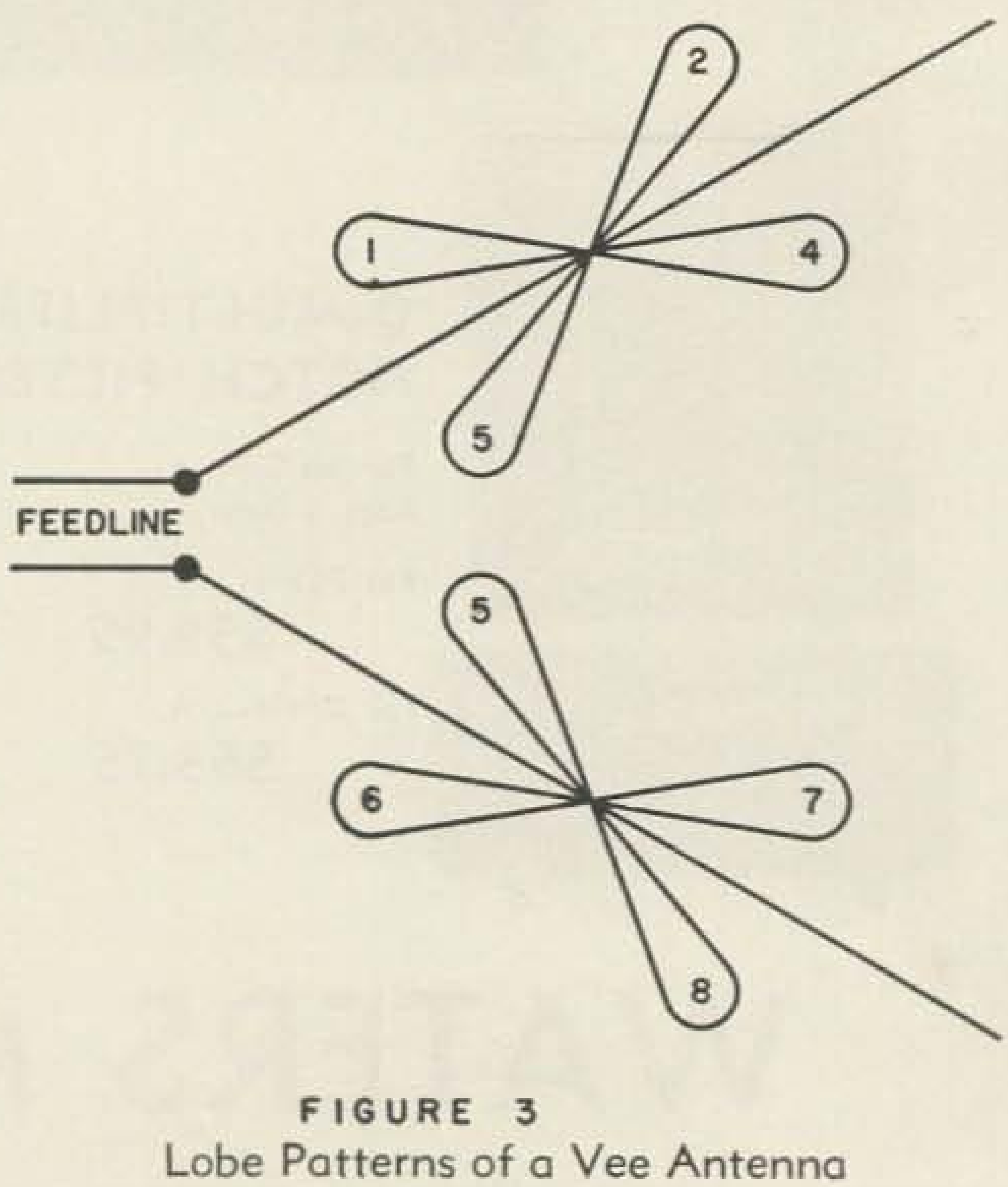

FIGURE 3
Lobe Patterns of a Vee Antenna

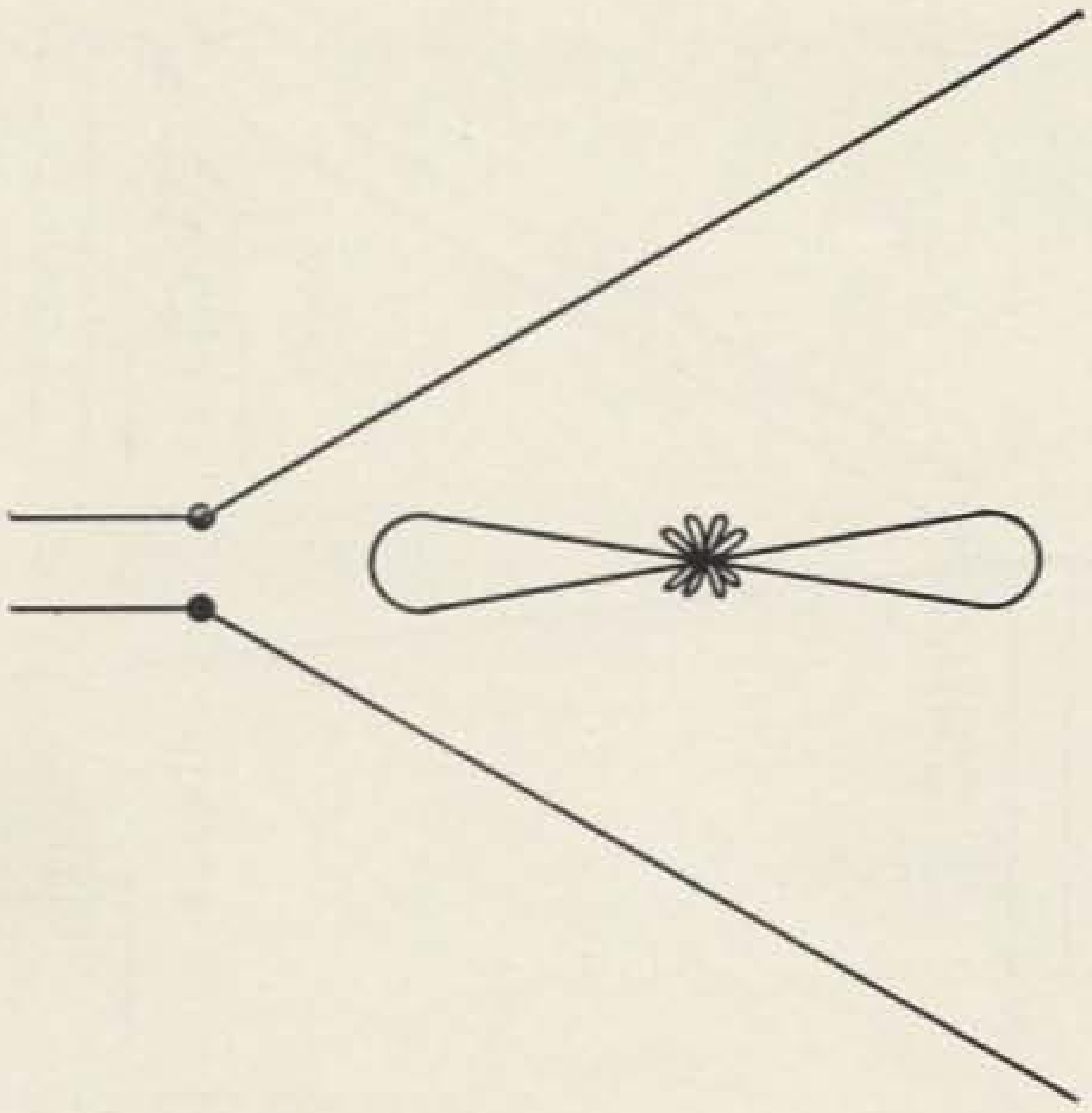

FIGURE 4

same direction and combine with lobes 6 and 7. This combination forms two stronger lobes that lie along a line bisecting the enclosed angle ϕ. Lobes 2, 3, 5 and 8 are largely cancelled since they are equal in amplitude, but opposite. There will be a certain amount of radiation broadside to the antenna due to minor lobes, but because of partial cancellation, these minor lobes will not be effective for long range communications. They are quite helpful however in short haul and local activity. The resultant radiation pattern for the Vee antenna is illustrated in Fig. 4.

As with other long wire type antennas the greater the leglength the greater will be the overall gain and directivity of the Vee antenna As mentioned previously the gain of the Vee is somewhat more than two times the gain of a single long wire of the same length due to the lobe combination and the interaction effects. The theoretical gain of the Vee for various leglengths is listed in Fig. 5. The actual length according to the published formula for determining wavelength is not at all critical within reasonable limits. The longer the leglength the less critical the actual length will become. If you use a length that is within 5% on a leglength of three wave lengths or more, there

Antenna Leglength	Power Gain
1	3.0
2	4.5
3	6.0
4	7.0
6	9.0
8	10.5
10	17.8
12	24.6

Power Gain of Vee Antenna For Various Leglengths

Fig. 5

will be no noticeable difference. Although the general broad statement that "the longer the length the better" is valid, there is a point of diminishing return. Practically speaking, leglengths of more than 15 to 20 wavelengths will not provide a significant increase in gain. This is because of losses incurred in the longer lengths. Eventually a length will be reached where the losses will cancel any gain, resulting in nothing more than wasted wire. Although the author has not done any conclusive work in the VHF-UHF regions, it is possible that by counteracting certain types of losses, greater leglengths than mentioned above can be used . This will have to wait for the future.

Apex Angle and Vertical Radiation Angle

The optimum apex angle for the Vee is usually chosen as twice the angle between the lobes of maximum radiation and the wire axis. In practice a slightly smaller apex angle is used when the leglength is less than about three wavelengths. When the Vee is to be operated over a wide range of frequencies, the apex angle to be used is found by averaging the optimum angles for the frequencies involved. Reasonably good results are obtained if the optimum apex angles for the highest and lowest frequencies to be used are averaged. The optimum apex angle for various leglengths is shown in Fig. 6.

The Vee does not radiate the major portion of its energy along the surface of the earth. The maximum angle of vertical radiation depends on the length of the legs and the antenna height above the earth. Generally, as the height is increased or the leglength increased, the vertical angle of radiation becomes less. The effective vertical angle of radiation can be changed to practically any angle desired by tilting the antenna properly. For example, if you want a lower angle of vertical radiation than obtainable with your particular height and leglength combination, simply increase the height of the apex until the desired angle is obtained. This trick is more useful with the shorter leglengths since the apex height for a 10 wavelength Vee would have to be increased appreciably to make much of a change in the vertical radiation angle. However, this is not too troublesome since a 10 wavelength Vee will give you a vertical angle of approximately 13 degrees with the antenna horizontal. This angle is admittedly somewhat greater than optimum for one-hop DX, but usually will be more than adequate. The approximate angle of vertical radiation for various leglengths is also listed in Fig. 6. These angles are valid for an antenna height of one-half wavelength.

Antenna Leglength (wavelengths)	Optimum Apex Angle (degs)	Vertical Radiation Angle (degs)
1	90	31
2	70	27
3	58	23
4	50	20
6	40	16
8	35	14
10	33	13
12	30	12

Optimum Apex and Vertical Radiation Angles for Vee Antenna

Fig. 6

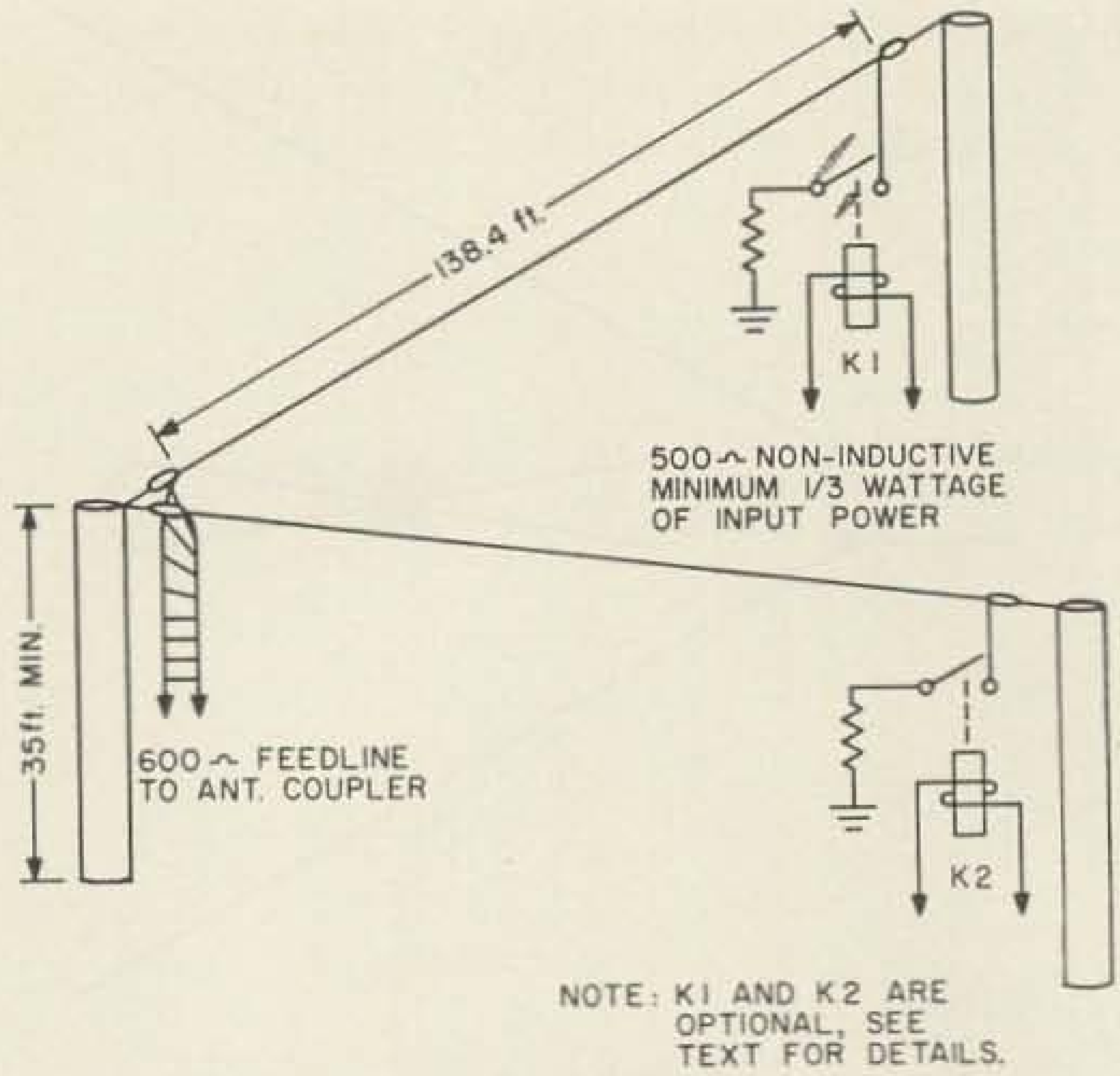

Figure 7

For Apex angle see Fig. 6

Radiation Pattern of Unterminated Vee Antenna

Band	Gain	Vert. Rad. Ø
80M	1 db	40 deg
40M	3 db	31 deg
20M	5 db	27 deg
15M	6 db	23 deg
10M	8 db	20 deg
6M	11 db	19 deg

Feeding the Vee Antenna

It is necessary to feed the two legs of the Vee antenna 180 degrees out of phase in order to set up the lobes as illustrated in Fig. 3. Balanced feedline should be used and if a wide frequency range is to be covered provision should be made to tune the feeders to the frequency in use.

Probably the simplest method of feeding the Vee is a 600 ohm resonant line which is attached to the apex of the Vee. If a non-resonant line *must* be used, a quarter wave matching stub is required. The Vee can also be fed at any point along either leg that is an odd number of quarter wavelengths from the open end of the antenna. In this case a quarter wave stub must be connected to the apex and a "Q" bar matching section should be used at the feedpoint. It's obvious that frequency coverage will be limited in these cases.

Radiation Pattern and Directional Characteristics

In its unterminated configuration the Vee is bi-directional. It can be made uni-directional by properly terminating the free end of each leg in a non-inductive resistance. The actual value of the resistance will depend on too many variables to state an exact value here. Each individual installation will require a slightly different value somewhere between 400 and 800 ohms. Theoretically the value is 600 ohms, but due to ground conductivity, wire size, apex angle, height, frequency, and several other factors, it will change. The exact value required for your installation can be found by the trial and error method. Use the value that produces the lowest SWR for the frequencies involved. The resistance finally chosen should be capable of dissipating at least one third of the input power. A good ground consisting of 6-8 feet of one-quarter inch copper rod driven into the ground directly under the terminating resistors is very important. There are several other methods of making the Vee uni-directional, but limited frequency coverage and increased constructional difficulties limit the usefulness of these methods.

Practical Design for an All-Band Vee Beam

Now let's consider a practical design for an all-band Vee Beam. The first order of business should be a listing of the characteristics the antena will have. The following are considered to be minimum requirements:

1. It must be an all-band antenna.
2. It should exhibit as much gain as practicable.
3. It should be easy to feed and load on all bands.
4. It should be relatively easy to construct.
5. It should be as small as possible, consistent with good gain characteristics.
6. It should be as inexpensive as practicable.

An additional feature, although not required, is the capability to switch the beam directions, or, more properly, to attenuate signals from one direction. This feature will allow the QRM reduction so often wished for in working DX.

Once the features of our antenna are defined, we need to make several arbitrary decisions. If DX is the major activity we will want to erect the Vee pointing the open end toward the DX areas. This will allow the beam to be switched to attenuate signals from directions opposite to the desired DX signals. This is true because the beam direction in the terminated configuration is toward the terminated ends. If, on the other hand, you are not particularly interested in DX, point the open end in the opposite direction. This way, if you should ever want to work DX, you need only to remove the terminating resistors and go to it. Remember, the unterminated Vee is bi-directional. Most hams (except apartment dwellers) will have the room required for an 80 meter dipole; therefore, this design is based on a leg-length that will fit into that space. As mentioned before, the half wavelength Vee theoretically is no better than a half wave dipole. In practice you will find that you will get better reports on 80 with a half wave Vee than with a half wave dipole. This is due to the partial combination of the major lobes even at this short leglength.

The pertinent dimensions and layout of the Vee are illustrated in Fig. 7. Before anyone notices, let me hasten to say that the apex angle indicated is not the same as the one that will result by averaging the highest and lowest frequencies. The angle indicated was chosen by the author to favor the 40 and 20 meter bands. If you have a different preference, by all means choose the apex angle that favors that band. To be sure, the other bands will not be optimum, but no all-band design will give perfect results on all bands.

The length indicated is calculated for 3.5 mc as the lowest frequency and, as stated, is not overly critical. The relays for switching the terminating resistors in and out are not required unless you want the luxury of beam switching from the operating position. If you do include them, be sure to adequately protect them from the elements and choose a relay that can handle at least 50% of the input power.

This is not an exhaustive treatise on Vee antennas. Unfortunately, space does not permit going into all the details of Vee design. Suffice to say that the author has a first-hand working knowledge of the Vee and as long as the real estate is large enough, there will never be a different kind at this QTH.

Coax Cable Losses

Most every serious or would-be serious VHFer knows by now that loss in the coax feedline to the antenna is one of the most insidious causes of poor station performance. But not so well-known are the maximum lengths of various kinds of cable usable to stay within specified loss figures on each of the VHF bands.

The accompanying chart shows the lengths, in feet, of the three most popular types of coax which produce the specified loss figures on the various VHF bands. For instance, on 144 lc the chart tells you that you will get 1 db of loss every 40 feet with the lowest-loss cable listed, which is RG-11. You get nearly 20 percent greater loss with RG-8, which gives 1 db of loss every feet.

Not listed are the newer "polyfoam" type of cables, since accurate loss information on them is slow in becoming available for calculations. One manufacturer has advertised his as having 35 percent less loss than RG-8; a bit of figuring shows that this probably means the losses are 65 percent as great, so you should be safe in using 1½ times as long a run of this cable as the listing shows for RG-8 on any given band.

. . . K5JKX

Table I—Lengths of Coax for Specified Cable Losses (in feet)

FREQUENCY In Mc	**TYPE** of cable	**LOSS** 1 db	2 db	3 db	4 db	5 db
50	RG-11	80	160	240	320	400
50	RG-8	67	133	200	267	333
144	RG-11	40	80	120	160	200
50	RG-58	33	67	100	133	167
144	RG-8	33	67	100	133	167
220	RG-11	31	62	93	124	155
220	RG-8	27	54	81	108	135
432	RG-11	21	42	63	84	105
144	RG-58	18	36	54	72	90
432	RG-8	17	34	51	68	85
220	RG-58	13	27	40	54	67
432	RG-58	9	18	27	36	45

Justaminit, - You Goofed!

How else would we have anything left to sell if you had really looked over our last bulletin and our FULL PAGE spread on page 16 of the JULY issue of 73 magazine????

OH — TRUE ENOUGH we sold lots and lots of those rock bottom values to the sharp bargain hunters. Luckily tho for you there are some left over. Don't run your luck too far however; better take some fast action today to get in on those "GOODIES" before they are all gone!!

OUR COMPETITORS say we are NUTS! Actually they may be right. Anyhow we want to see our shelves bare once again and we know no better way than to give (almost) the stuff away.

FINALLY because of these stupid prices we are asking for cash and no trade. All units are fully reconditioned and guaranteed. Some demonstrator and new closeouts are also on the list.

— 73 —
Stan Burghardt WØBJV

	Special Cash Price
Central Electronics 600L	$199.00
Central Electronics 20A	119.00
Central Electronics MM1	49.00
Central Electronics QT-1	5.00
Central Electronics Deluxe VFO	29.00
Collins 75S-1	329.00
Collins 75A4	395.00
Collins 312-B4	129.00
Collins 325-1	429.00
Collins 312-B2	69.00
Collins 270G3	10.00
Collins 270G1	8.00
Collins 32S-1 Transmitter	419.00
Drake Q Mul/Spkr	19.00
Drake 1A Receiver	139.00
Elmac PMR7	79.00
Elmac AF-67	79.00
Elmac A-54H	39.00
Elmac M-1470	29.00
Elmac PSA500	15.00
Globe 755A VFO	29.00
Globe Scout Deluxe	$79.00

	Special Cash Price
Globe AT-3	5.00
Gonset G-66 & G-77 Mobile Pkg.	199.00
Gonset GSB-101	199.00
Globe 755A VFO	29.00
Hallicrafters HT-37	375.00
Hallicrafters HT-41	235.00
Hallicrafters SX-99	84.00
Hallicrafters SX-99 & speaker	89.00
Hallicrafters SX-71	109.00
Hallicrafters S-53A	49.00
Hallicrafters S-40	49.00
Hallicrafters R-46B speaker	10.00
Hallicrafters R-42 speaker	10.00
Hallicrafters SX-101 Mark IIIA	225.00
Harvey Wells TBS50D with AC Supply	49.00
Heath DX-40 Transmitter	39.00
Hammarlund HQ-110C	165.00

	Special Cash Price
Hammarlund HQ-110	159.00
Hammarlund HQ-100C & cal.	125.00
Hammarlund HQ-129X & speaker	115.00
Hammarlund S-100 speaker	9.00
Heath Mohawk & speaker	199.00
Heath DX-40 Transmitter	39.00
Heath DX40 Xmtr.	45.00
Heath Cheyenne Xmtr.	69.00
James C-1050 supply	15.00
Johnson Invader 2000	695.00
Johnson Invader 200	449.00
Johnson Valiant	249.00
Johnson Ranger	149.00
Johnson 114-520 Automatic Key	10.00
Johnson 250-20 1/p filter	10.00

	Special Cash Price
Jones 263 micromatch	24.00
Knight VFO	25.00
Mon-Key Keyer	19.00
Morrow MB-6 & RVP-250	79.00
Mosley CM-1 & speaker	135.00
National NC-300	199.00
National NC-300	149.00
NC-400X	395.00
National SW-54	25.00
National NC-300TS speaker	10.00
National NC400X Receiver	395.00
P&H LA-400C linear amplifier	169.00
RME 4350A & speaker	129.00
Regency ATC-1	39.00
Swan SW-120	169.00
Swan 175w/DC pwr supp	249.00
Tecraft TR-20-50 6mtr xmitter	35.00
Vibroplex orig. STD & case	19.00

SPECIAL CLOSEOUT BRAND NEW EQUIPMENT

Item	Regular Net	Special Cash Price
Bud CR1741G Cabinet	16.20	10.00
Collins 75S1 Receiver	520.00	399.00
Gonset GR211 Receiver	76.98	49.00
Gonset GR212 Receiver	112.86	79.00
Gonset 3273 Deluxe phone patch	49.95	35.00
Johnson Invader 200	619.00	499.00
Multi-Elmac M1070 Kit	49.95	29.00
National NC270 Receiver	279.95	199.00
Swan SW120 Transceiver	275.00	189.00
Swan SW140 Transceiver	275.00	189.00
Topaz C10XL 800V Supply (Collins or Swan)	119.00	84.00

SPECIALS ON DEMONSTRATORS ALL LIKE NEW WITH GUARANTEE

Item	Regular Net	Special Cash Price
Clegg Zeus	695.00	565.00
Clegg Intercept	473.00	385.00
Clegg Thor w/ac	349.95	279.00
Clegg 99'er	159.95	129.00
Hallicrafters HA-6 6 meter transverter	349.95	249.00
Hallicrafters S-108 Receiver	139.95	109.00
Hallicrafters SX111 Receiver	279.95	199.00
Hallicrafters S119 Receiver	49.95	36.00

Item	Regular Net	Special Cash Price
Hallicrafters S119 Receiver Kit	39.95	29.00
Hallicrafters SX117 Receiver	389.00	295.00
Hallicrafters HT40 Transmitter	109.95	88.00
Hallicrafters SX-140K Receiver Kit	114.95	79.00
Hammarlund HX50 Transmitter	449.50	349.00

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The ON5 and PA9 Operation

Edgar Wagner 63BID
5, Ferncroft Avenue
London, N.W.3.

How it All Began

Ever since my wartime experience of Mobile operation in the Army, I have always been interested in Mobile operation. Thus, when early in 1962 I heard ON4PL Mobile on 80-metres, I naturally wanted to contact him and we had a pleasant QSO.

In May of that year I had to go to Belgium on a business trip, and so I decided to spend the weekend visiting ON4PL—Leon Peters. I had a very, very pleasant reception from him and his family who entertained me with a magnificent dinner well into the night after showing me all round the district, particularly the Barrage of Eupen where he had been operating Mobile when I worked him.

During the course of the evening we naturally discussed Mobile operation and he asked me what I though of the idea of organising a Mobile Rally at Verviers. He pointed out that Verviers was only a few miles from the German frontier and also from the Dutch frontier, so he felt that one could really organise an International Mobile Rally—certainly it was no distance for the Dutch stations to come, or for the Germans.

"Did I think any British stations would come to such a Rally?" I am afraid I replied emphatically "No," as, I pointed out, I thought it very unlikely that we would be able to get a license to operate in Belgium because we do not grant reciprocal licensing facilities to other countries. The Dutch and Germans would probably be allowed to operate in Belgium, but I could not see the fun for a lot of English stations to come over merely to watch.

After a little pause, Leon replied—"But supposing I could get you licenses to operate, do you think the British would come then?"

This changed the picture entirely and I enthusiastically replied—"In those circumstances I cetrainly think British stations would come."

And Here the Matter Rested

In the autumn of 1962, I got a letter from Leon saying that he was pretty confident that he could arrange for the British stations to be permitted to operate on the day of the Rally. I am afraid that I replied that I doubted if many British stations would go to the expense and trouble of taking their cars across to Belgium to operate for one day only. Naturally, Leon thought I was being very greedy but, nevertheless, with his typical indefatigable spirit he plunged once more into the fray and asked what would be the minimum period which I thought would attract British participants to the Rally. I suggested a week.

Towards the end of 1962, Leon again wrote that he was now confident that he could get us the licenses to operate in Belgium for about a week, that the date of the Rally had been fixed for the 28th April and that he anticipated that he would get the licenses from the 26th April until the 3rd May. This was highly satisfactory. I wrote back enthusiastically welcoming the idea, and said I would do my best to encourage a British contingent to go to the Rally.

At this stage I felt safe in telling the R.S.G.B., the Amateur Radio Mobile Society, ARRL and various magazines, with a view to giving the matter some publicity.

Although no firm details were yet available A.R.M.S. published the onnouncement in "Mobile News" and said they would give further details when they were available: other Journals also mentioned it.

ON4PL co-operating closely with ON4VY, President of U.B.A. and SWL Julian Counhaye, then put in some magnificent work and the whole matter was finalised, so that applicants from any country could get a Mobile Belgian License for this period on application being made to—ON4VY, Calls issued being in the ON5 series.

We are indeed indebted to the tremendous work and energy which these gentlemen put in to the operation.

I then did all I could to give the operation the maximum publicity. I naturally informed the R.S.G.B., through the Editor of their Mobile Column: I informed the Short Wave Magazine, and I wrote to the ARRL, CQ Magazine and 73 Magazine.

At this stage no exact detailed information was available but I wanted to get this first International Mobile Rally as much publicity as possible.

Later on I received copies of the full details of the Rally from ON4PL in French. I had a quick translation made and forwarded the original French version with the translation to the Mobile Column of R.S.G.B., A.R.M.S., Short Wave Magazine, CQ Magazine, 73 Magazine, the Irish Radio Transmitters Society, A.R.R.L. and as many other people as

TERRY
W9DIA

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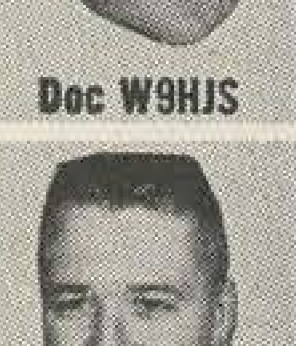

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I could think of, while also discussing it freely over the air.

As soon as it became clear that our operations in Belgium would be permitted, we decided to try and get Licenses in other countries also.

I wrote to Austria and received a very polite letter informing me that the Austrian regulations only permitted the issue of temporary Austrian licences to citizens of countries who granted similar facilities to Austrian nationals. They pointed out that no reciprocal agreement had been signed with Britain but added that if I could show *in practice* this facility was available even without an official agreement being in existence they would still be prepared to grant me a temporary licence. Unfortunately, of course, this facility is not available and, therefore, no Austrian licence was obtained.

Others made application for German licences and these were also not forthcoming.

I wrote to the Secretary-General of R.E.F. in France on the same basis and received again a very polite reply that since no agreement existed between Britain and France no licence could be granted to a British Subject. He added, that in the event of such a proposal being put forward by Britain he had little doubt that the French Government would be prepared to grant licences to British Subjects on a reciprocal basis.

Meanwhile, the Secretary of A.R.M.S., G3FPK, had got into contact with PAØZD and discussed the question of obtaining a Dutch licence in connection with the Verviers Rally. The suggestion was made that a block application should be made officially by A.R.M.S., through PAØZD, to the Dutch authorities. This, accordingly, was undertaken by A.R.M.S. who submitted the names, Call signs, etc. of all British Amateurs who wished to try and obtain Dutch licences, together with photostatic copies of the British licences.

This was the first time that A.R.M.S. has dealt officially with a Government Department, and all Members of the A.R.M.S. were naturally very interested to see whether this new departure of a joint application made by A.R.M.S. would bear fruit.

We are much indebted to Dr. Ten Herkel, PAØZD, for his efforts in this connection which resulted in our obtaining temporary Mobile licences to operate in the Netherlands from the 20th April until the 5th May.

We were allotted the special Call Sign of PA9 followed by the same letters as those which follow the figure in our own Call Sign.

One of the 80 metre capacity hats

So, all was set for the Operation ON5 and PA9! !

The Event Itself

Now that we had licences to operate in Belgium and Holland, I was not going to waste any time.

On the evening of the 20th April I flew over to Holland, using the air ferry service from Southend to Rotterdam. Unfortunately, I could not get an earlier plane and we landed in Rotterdam in the evening. I had selected a quiet hotel in the North of Holland—The Hotel Bellevue at Egmond-Aan-Zee, and had reserved rooms in advance. This was important because normally this is the Dutch Bulb Season and the hotels in Holland, particularly Rotterdam and Amsterdam, are very full at this time of year.

We arrived on the evening of the 20th April and went on the air, but without much success that evening. We operated intermittently from then on throughout the period.

The first weekend, the 20th and 21st, was very difficult because of the R.E.F. Contest. Nevertheless, we did achieve some entertaining contacts; On Monday I worked a couple

DL1KN with hat

of VKs. We operated around northern Holland, drove over the dyke which has been built across the north of what was once the Zuider Zee, and now called the "Ijselmeer."

The operation was interrupted for a couple of days while we went to Brussels on a business visit and the Belgium licence had not yet become effective.

We had the opportunity while in Brussels of making the acquaintance of ON4VY, the President of U.B.A. (the Belgian National Association) who had put in such tremendous work to obtain the Belgian Licenses for us. I was delighted to have the opportunity to meet Rene and his wife. Unfortunately, they could not dine with me that evening as they had other arrangements but they showed us a delightful little restaurant in Brussels where we had one of the most outstanding meals of the trip. Rene also showed us the official Station of U.B.A. which is situated in the headquarters of the Red Cross Society, with a magnificent view from the roof of the building.

On the morning of Friday, the 26th April, we moved off from Brussels and made a number of contacts, including some very entertaining ones while moving fast down the road from Brussels to Namur. I knew of a spot with a magnificent view over the River Meuse which I had visited the year before and which seemed to me to be a very good location to do some more transmitting. This spot is about half way between Namur and Dinant high up on a ridge above the little town of Profondeville.

The weather was now somewhat misty and we did not have much of a view "optically" but we did have quite a good view from a radio point of view, and work 9Q5 and 5N2 as well as a number of European stations. From here we went on to Verviers. We wanted to arrive early in order to meet everyone on the day before the Rally.

On Saturday, the 27th, we worked a bit of DX before breakfast, and were very glad to hook up with my very good friend, CN8BB, Roger Davize of Marrakech. He had, by the way, been my first contact with a Call of PA9BID/M, so I was very glad to work him from ON5ZE/Mobile.

We joined Leon Peters, ON4PL, during the morning, went for a tour of the town and arranged to lunch with his XYL, but just as we were returning to lunch we gave a CQ Call and another ON5/Mobile in Verviers came back to us. He was one of the American contingent from Germany who had arrived early. We found his QTH and immediately drove to meet him. He was DL4HU: he was on his own and we took him along to the house of ON4PL. Unfortunately, he had already had lunch but he sat and watched us consume an excellent lunch with ON4PL and his wife.

In the afternoon we went for a run and met all the local radio amateurs in the Verviers area as well as the SWLs who had put in a tremendous amount of work organising the Rally.

Saturday had been brillantly fine and sunny, and we all listened with interest to the weather forecast which promised the same weather for the Sunday, after clearance of early morning mist. The only part of this forecast which proved accurate was the early morning mist. We woke on the Sunday to find the mist covering the whole countryside: it never cleared. The mist developed into a drizzle, and the drizzle became a downpour: the weather got worse and worse.

The actual Contest for the Rally took place from 8-11 o'clock in the morning when all the Mobile stations worked the static stations in the Verviers area as well as any other Mobile stations. One was allowed to contact each of the fixed stations once every 25 kilometres. Activity took place on 80-meters and 2-metres. I myself operated on 80-metres. Soon the 80-metre Band was fairly crowded, particularly at the low end around 3.6 megacycles which, by the way, is where the Belgian 80-metre operators congregate. The Mobiles were either approaching Verviers from a distance or, in most cases, cruising round and round Verviers in circles, making the maximum number of contacts, and at 11 o'clock all the Mobiles concentrated at the Park de la Tourelle in Verviers.

Many countries were represented besides the Belgians. There were representatives from France, Germany (both German nationals and Americans and British operators from Germany), Holland and Britain. The British contingent was quite numerous, numbering between 17 and 20 Mobile vehicles.

The amazing array of 2-metre Antennas which were seen was one of the features. 3 and 4-element 2-metre beams were quite usual amongst the 2-metre Mobile contingent usually mounted on the roofs of their cars, while the 80-metre Mobiles had all sizes of capacity hats, loading coils, etc.

The instructions for the Rally had suggested a picnic lunch, and this we had prepared but, unfortunately, the drizzle had by now become a downpour making the picnic somewhat difficult, and most of the ~~operators~~ decided to eat in the Verviers Hotels and Restaurants.

After lunch, the Rally organisers had prepared a tour of the district starting at Verviers and ending at the Barrage of Eupen. A detailed route card in the form of a questionnaire, asking such questions as the type of Antennas seen on various houses, the lengths of certain long wires which were passed, the age of various village pumps, was designed to show us the most attractive parts of the district. Unfortunately, the weather was so much against this, the visibility was becoming worse and the rain continued, that many operators including myself, got lost early in the route and decided to make straight for the Barrage of Eupen. Here a large restaurant with magnificent parking accommodation was available, and we used the refreshment facilities. The Rally organisers had arranged a seperate room and here we all assembled for the prize-giving. The people of Verviers had been most generous and an enormous number of magnificent prizes were offered by the people of Verviers and the Rally organisers.

One prize was offered from America—a Mobiliers Microphone—by W80VJ.

So ended the Rally itself which had been a most enjoyable experience despite the efforts of the weather to spoil it.

I had the pleasure that evening of having

One of the cars with 2 and 80 metre antennas

ON4PL at the mike with ON4VY behind

Mr. Rene Vanmuysen, ON4VY, and his XYL, Leon Peters, ON4PL, and his wife, Vic Frisbee, G3KVF, (who also had an ON5 Call) and his wife and daughter, to dinner at Tiegelez-Spa, and we were able once again to thank ON4PL and ON4VY for their tremendous assistance in this matter. I am glad to say both have been made Honorary Members of the A.R.M.S.

We sincerely hope that the Rally organisers will see fit to repeat this performance on another year.

Although the Rally itself was now over, the Licenses, thanks to the generosity of the Belgian and Dutch postal administrations, still continued, and these I did not intend to waste.

I had a business visit to make in Luxembourg but, unfortunately, the authorities in Luxembourg had not prepared to grant Mobile Licences. We, therefore, made our visit to Luxembourg as short as possible, and returned to Belgium to continue our operations. We continued to Northern Belgium and then into Holland, and the operations from ON5ZE/Mobile and PA9BID/Mobile did not finish until the evening of the 5th May when I got the car air ferry back from Rotterdam to Southend.

Not only did we enjoy working from a different country and also working some quite entertaining DX, including PY7AKW in Fernando Noronha, and an aeronautical Mobile, K1SDS/AM, but perhaps one of the most pleasurable parts of the whole operation was contacting and meeting personally the radio amateurs of Belgium and Holland.

Besides the Belgian amateurs whom I have mentioned earlier, we also had the pleasure of meeting a number of amateurs from the Netherlands, PAØCS talked me in to his QTH in the Hague from Lisse on 80-metres, and we very much enjoyed the visit to his shack where we met his family and went to lunch at Scheveningen.

Dr. Hans Ten Herkel who had succeeded in obtaining the Licences for us in the Netherlands was not in the Hague himself at that time, but, fortunately, we were able to meet him later when he joined us in Rotterdam, and we very much enjoyed the visit.

Both PAØCS, Kees de Bruijn, and PAØZD, Hans Ten Herkel, are coming to the Sideband Dinner. I am glad to say that Dr. Hans Ten Herkel has also been made an Honorary Member of the A.R.M.S.

To round off my visit I returned to Egmond-Aan-Zee, and here again I met more local amateurs.

PAØJKO who only works on 2-metres saw my aerial and invited me to his shack where I met his wife and saw his charming home.

I also heard PAØUX who lives in Alkmaar, and I also had the pleasure of visiting him and his wife.

So ended a memorable and most enjoyable 2 weeks operation with new Call Signs in countries where we had never operated before.

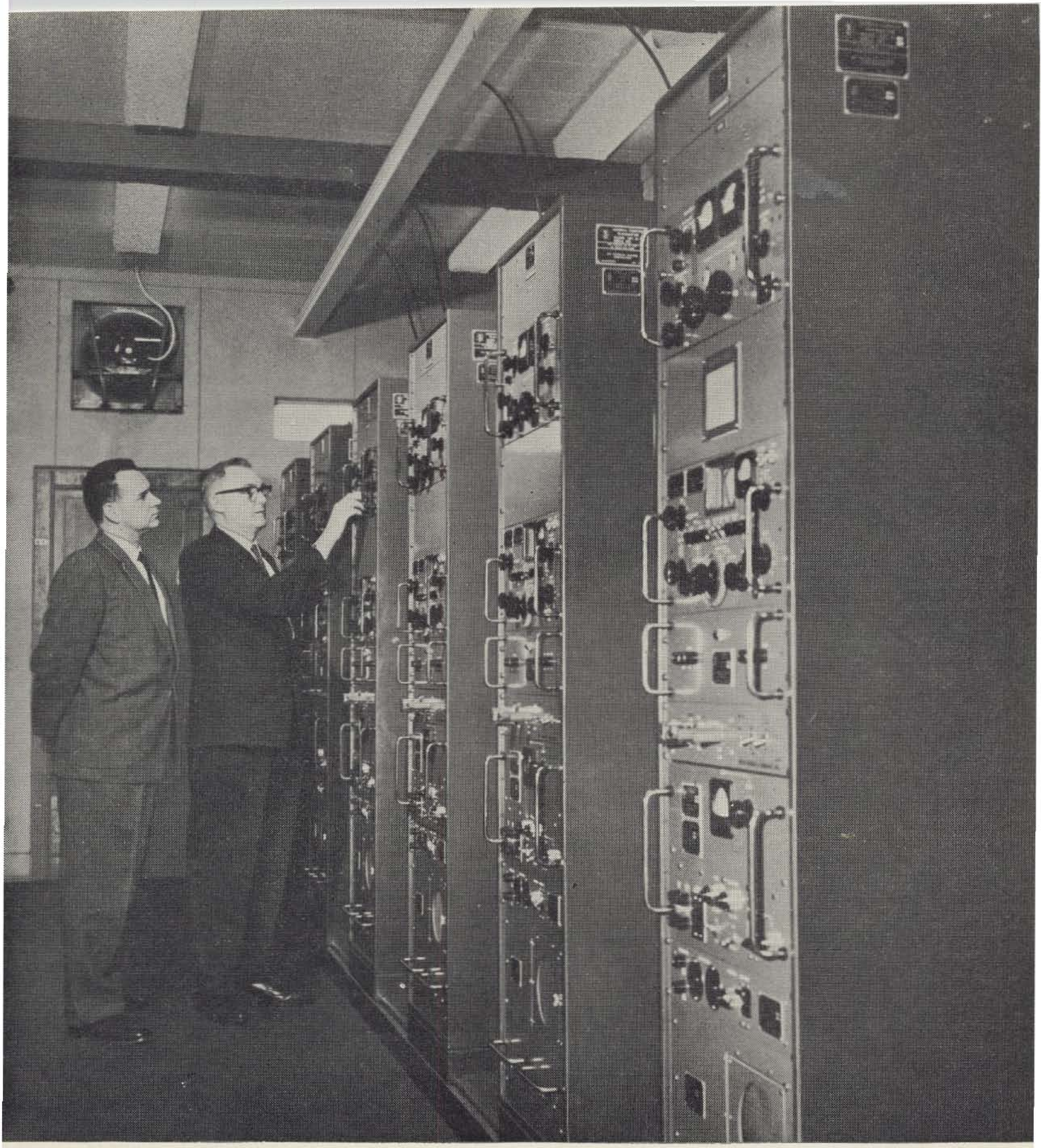
. . . G3BID

Letters

Dear Wayne:

Being a new reader of 73, I just ran across this Double Sideband article. Without getting into personalities and it is a little hard not to do, I would like to point out just one discrepancy. As a writer you know how easily it is to slant the arguments the way the writer feels, quote out of context and etc. A good portion of the "gain" of DSB over SSB was supposed to be obtained by processing the speech input, i.e. clipping, compressors and etc., something the supposedly can not be done with SSB! Bell Labs apparently never heard of this "fact" as there are thousands of phone calls going on over compressed SSB this minute! Wes Schum, W9DYV told me a number of years ago he had heard of this "fact" but that it was like the bumble bee who didn't know he wasn't able to fly. So Wes put a very nice clipper-limiter in his 100V-200V transmitters. I could also mention the thousands of Collins SSB transmitters in amateur, commercial and military service with their ALC which gives 10-15 DB of compression or adds that much to the signal however you want to look at it. I always like to advocate ALC when I get a chance because I know how easy it is to drive the average ham SSB transmitter into flat topping and distortion without it. It is very easy to add to many transmitters in use with only a few parts and no adjustments. This would be a good kit for you to handle. Speaking of your kits, I think it is a most excellent idea. It is impossible to find all the parts to build even the simplest project except in maybe 3 or 4 major centers in the country. Maybe this will promote a little more home construction. There are too many plug-in appliance operators now. I wish you lots of success. And don't let me forget to congratulate you and the XYL on the new arrival.

Wayne W. Cooper, K4ZZV/W6EWC



a cardboard mailing-tube

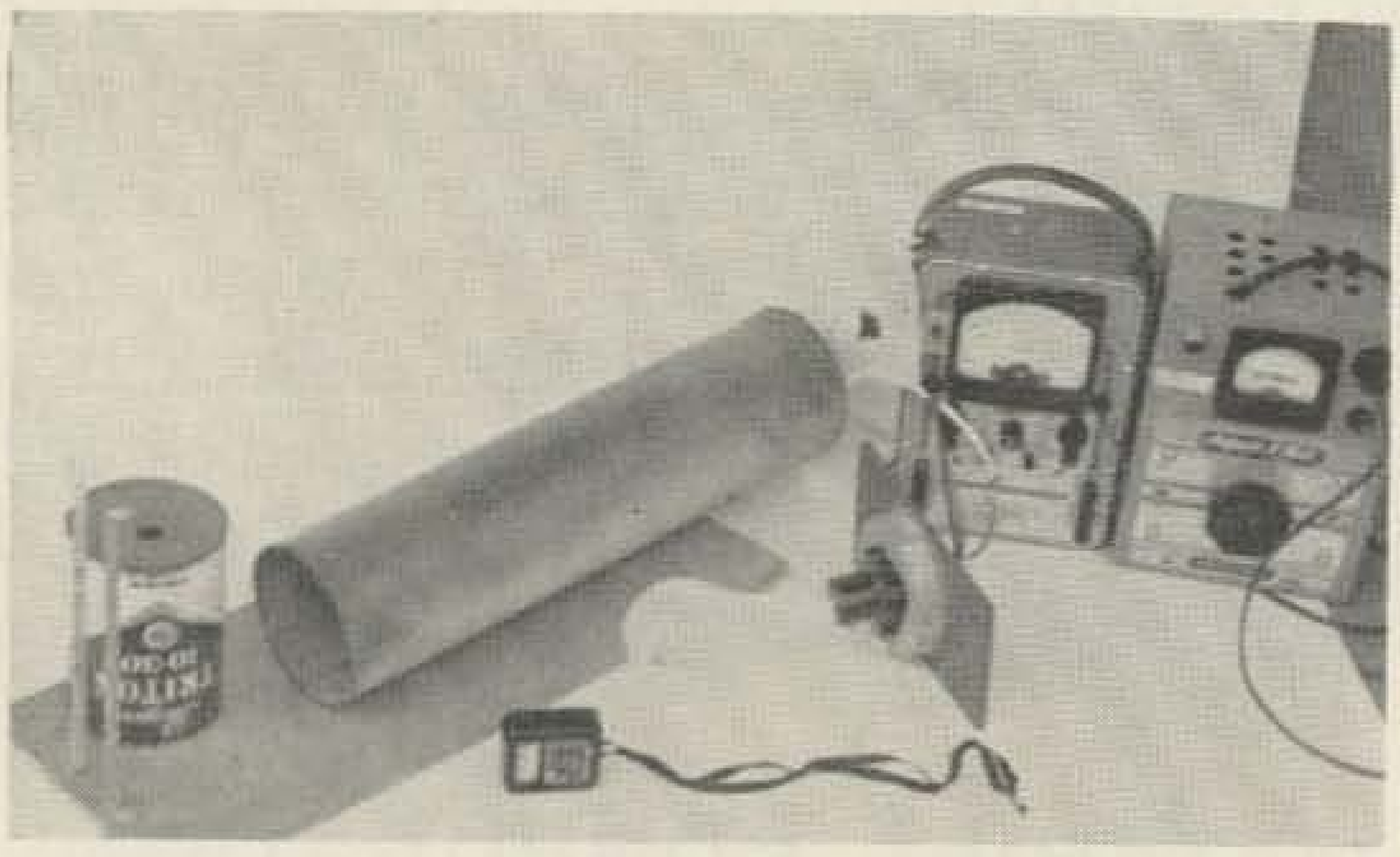
R F Wattmeter

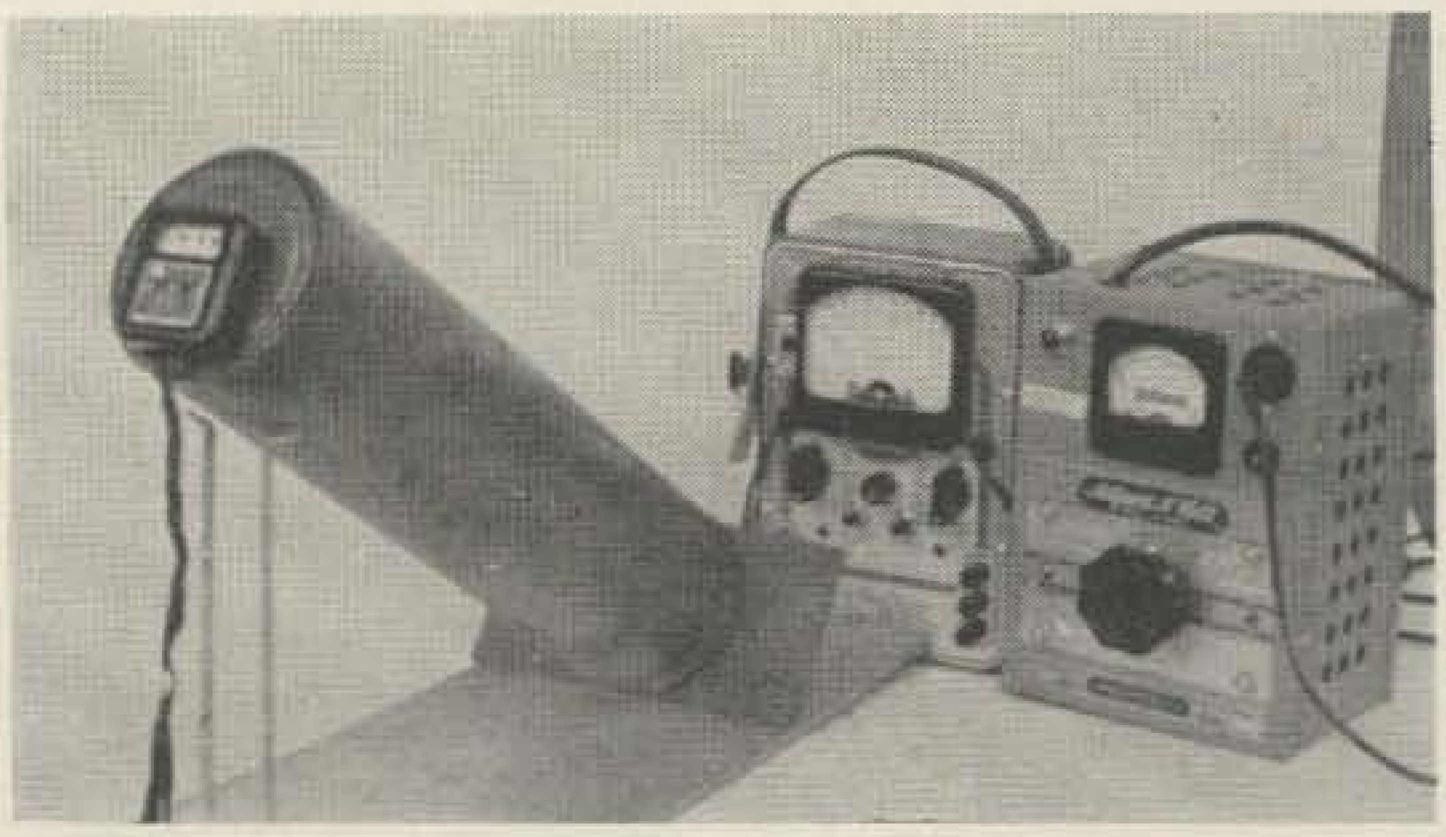
Bob Baird W7CSD

Hams since the year one have been connecting light bulbs up to the transmitter and giving them the old eye-ball. "Yup it looks like the rig is puting out about 100 watts" you'll hear them say. When you get right down to it the light bulb isn't such a bad idea. But the eye-balling leaves much to be desired unless you just like to kid yourself. Here's a way to get a little bit of accuracy out of the old light bulb.

All you need is a light bulb, a photographic exposure meter, and something to cover the two up with. The illustrations show what this writer came up with. In our case we used a 200 watt light bulb and a very old exposure meter that had been lying around a long time. If your rig is smaller and you have a brand new exposure meter, possibly a 50 watt light bulb and a shoe box will do as well. A little bit of trial and error is in order.

Once you have the right combination of light bulb and length to go with your rig and exposure meter the meter can be calibrated in watts. This is done simply by connecting the bulb thru a wattmeter (or volt and ammeter) to a variac or other adjustable voltage source. Adjust the voltage to minimum reading on the exposure meter and read the wattmeter. Adjust again for slightly greater readings and so on until you arrive at full voltage. Plot watts vs. exposure meter reading on a piece of graph paper and you are in business. When the light bulb is connected to the transmitter the degree of brilliance will now register on the exposure meter and you can transpose on your





graph and get a resonably accurate reading in watts.

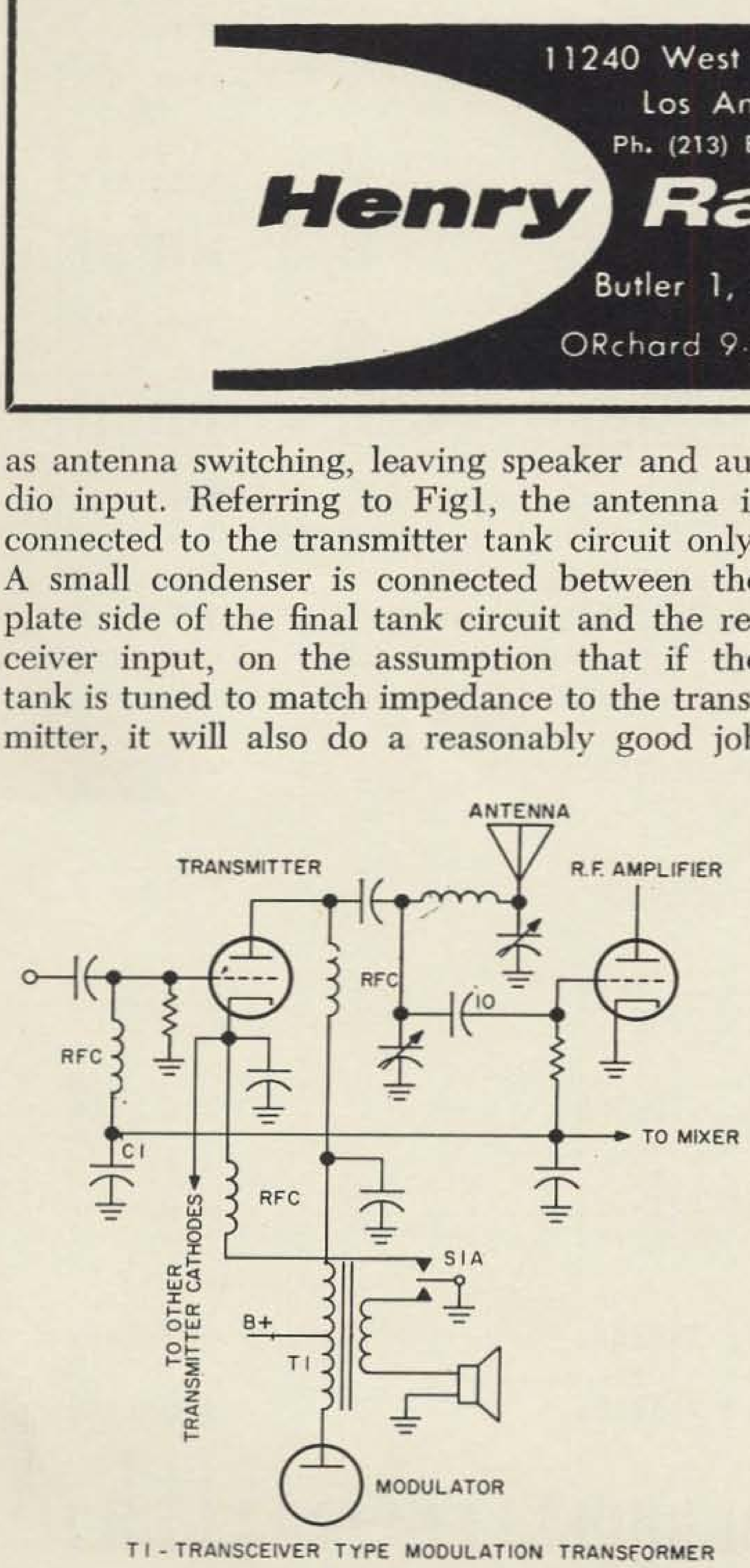
The model pictured uses a 22 inch mailing tube about three inches in diameter inside. The light socket is mounted on a piece of wood jigsawed to just fit inside the mailing tube. This assembly is backed up with a rectangular piece of masonite on the end. The next problem was to find a satisfactory end that could have a windowfor the exposure meter cut in it. It just happened that the oil can appearing in the illustration made a perfect fit after the rim was removed with a pair of tin snips. It might be in order to note that Royal Triton oil cans are made of aluminum, in case you have need for aluminum shielding for other purposes. In this case a fruit can of the proper size would have done just as well. The standard supporting the assembly was strictly an afterthought. You could use a stack of books or anything else convenient. Sloping the tube does make for easier reading of the meter and in our case the meter would stay in place due to its own weight when the tube was in the sloped position.

. . . W7CSD

Transceiving Complicated

Larry Levy WA2INM/1
Marlboro College
Marlboro, Vermont

I have just finished reading an article by Dean Cupp W4JKL (73, Nov. 1962, p. 65) about transceiving, and would like to expand somewhat upon some of his ideas. To start with, most transceivers in use use a 4 pdt switch or relay for function switching. One pole switches the audio, another the speaker, another the B supply, and the fourth the antenna. This can be simplified somewhat, so the function switching can be accomplished with a dpdt switch. With the proper circuitry, B supply switching can be eliminated, as well as antenna switching, leaving speaker and audio input. Referring to Fig1, the antenna is connected to the transmitter tank circuit only. A small condenser is connected between the plate side of the final tank circuit and the receiver input, on the assumption that if the tank is tuned to match impedance to the transmitter, it will also do a reasonably good job



T1 - TRANSCEIVER TYPE MODULATION TRANSFORMER
FIGURE 1

for the receiver. In practice, this works quite well. We have now eliminated one pole of the switch. Read on, and you will see what other foul and devious means are used to eliminate the other. The negative bias of the final amplifier is used to bias the rf amplifier and mixer to cutoff during transmit, as described in W4JKL's article. The cathodes of the transmitter tubes are connected together and wired to one side of one of the poles on the switch. The center contact is grounded, and the other side is connected to the speaker return. At this point, all of the necessary control functions are accounted for, with the exception of the audio input switching, for which the other pole of the switch is used. By using these methods, the number of switch poles has been reduced from 4 to 2 while performing the same functions. This should make it possible to use inexpensive dpdt relays for PTT control of compact transceivers, where two of these relays occupy too much space, and a 4pdt relay is too expensive. If PTT is not desired, the TR switch can be a dpdt switch mounted on the front panel. Alright, you've wasted enough time reading cacography like this, so drag out your soldering gun and start building.

. . . WA2INM

Transmitting Tube Guide

TUBE TYPE	CLASS OF TUBE	PWR DISS WATTS	FREQ OF MAX RATING	MAX USABL FREQ	MFR.	FIL./HTR. VOLTS	FIL./HTR. AMPS	CAP IN MMFD	CAP G-P MMFD	CAP OUT MMFD	MAX. HGT. IN.	MAX. DIA. IN.	TYPE OF OPERATION	OP. FREQ MC.	PLATE VOLTS	PLATE CURR. MA.	SCRN VOLTS	SCRN CURR. MA.	GRID BIAS VOLT	GRID CURR. MA.	RF DRIVE VOLTS	DRIVE POWER WATTS	LOAD IMP OHMS	3RD ORDER DISTORT	PLATE PWR OUT WATTS	
2C39A	UHF Triode	100	2500		ERS	6.3	1.0	6.6	2	.035	2-3/4	1-1/4	Class C	2500	900	90			-22	27	X	X	5000			17
													Class C	300	900	90			-40	30	X	X	5000			40
2C39B	UHF Triode	100	2500		GS	6.3	1.0	7	1.9	.035	2-3/4	1-5/64	Class C	500	900	90			-40	30	X	(osc.)	5000			40
2C40	UHF Triode	6.5	3370		GRS	6.3	.75	2.2	1.3	.03	2-9/16	1-5/16	Class C	X	250	20			-5	.3	X	X	6250		.075	
2C43	UHF Triode	12	1500		GRS	6.3	.9	3	1.8	.04	2-11/16	1-5/16	Class C	300	350	48			-50	40	X	3	3650		10	
2E22					T																					
2E24	Fil Beam	13.5	125	175	GRS	6.3	.65	8.5	.11	6.5	3-21/32	1-5/16	Class C	125	600	66	195	10	-50	3	71	.21	4570		27	
													Class C	160	350	85	170	10	-50	3	70	2	2075		16.5	
2E26	Beam	13.5	125	175	GRS	6.3	.8	13	.2	7	3-21/32	1-5/16	Class C	125	600	66	185	10	-45	3	57	.17	4570		27	
													Class C	160	350	85	200	7	-90	3	105	2	2075		16.5	
2E30	Fil Beam	10	165		G	6	.65	9.6	.11	14	2-5/8	3/4	Class C	165	300	50	250	5	-70	.7	75	1.7	3000		6	5
													Linear	X	250	20160	250	2/10	-30	1.15	87	.1	1900	X	8.5	
3-400Z	Triode	400			E								Linear													
3-1000Z	Triode	1000			E								Linear													
3A4	Fil Pent	2	10		RS	2.8/1.4	.1/.2	4.8	.34	4.2	2-1/8	3/4	Class C	X	150	18.3	135	6.5	-26	.13	X	X	4100		1.2	
3A5	Fil Tw Tri	2	40		RS	2.8/1.4	.11/.22	.9	3.2	1	2-1/8	3/4	Class C	X	135	30			-20	5	90	.2	2250		2	
3C22	Triode	125	1400		GR	6.3	2	4.9	2.4	.05	4-15/16	1-1/2	Max	X	1000	150			-200	70	X	X	X		X	
3C24					E																					
3CX100A5	UHF Triode	100			ES								Class C	X												
3E22	Twn Beam	35	15		R	12.6/6.3	.8/1.6	14	.22	8.5	4-9/16	2-1/16	Max	X	600	175	225	6W	-175	11	X	X	X		X	
3E29	Twn Beam	15	X		R	12.6/6.3	1.125/2.25	14	.12	7	4-5/16	2-3/8	Max	X	5000	300	850	3W	-225	1W	X	X	X		X	
4-65A	Beam	65	150		EPRS	6	3.5	7.5	.08	2.2	4-3/8	2-3/8	Class C	X	3000	115	250	22	-100	10	170	1.7	13000		280	
4-125A/4D21	Beam	125	120	240	AEGPRS	5	6.5	11	.05	3.2	5-5/8	2-7/8	Class C	X	3000	167	350	30	-150	9	280	2.5	9000		375	
													Linear	X	3000	28/130	350	0/3.5	-51	X	99	2.5	13850	X	260	
4-250A/5D22	Beam	250	75	120	AEGRS	5	14.5	13	.12	4.6	6-3/8	3-9/16	Class C	X	3000	345	500	60	-180	10	265	2.6	4350		800	
													Linear	X	4000	40/165	510	X/7.5	-100	0	100	0	X	X	450	
4-400A	Beam	400	110		AEPRS	5	14.5	13	.12	4.6	6-3/8	3-9/16	Class C	X	3000	350	500	42	-220	19	320	X	4400		800	
													Linear	X	4000	60/293	750	0/20	-150	0	148	0	7250	X	775	
4-1000A	Beam	1000	110		EPRS	7.5	21	28	.26	8	9-5/8	5-1/4	Linear-Max	X	6000	700	1000.	75W	X	X	X	X	X	X	X	
4C33	Triode	250	625		R	5	9.1	34	13	.7	4-7/8	2-1/16	Max	X	13000	30			-2000	4	X	X	X		X	
4CN15A	Beam				E																					
4CX125C	Beam				E																					
4CX250B	Beam	250	500		AES	6	2.6	15.7	.06	4.5	2-15/32	1-41/64	Class C	175	2000	250	250	19	-90	26	112	2.9	4000		390	
													Linear	175	2000	75/250	300	01-7	-47	-1/0	47	0	4200	-32	300	
4CX1000A	Beam	1000			E																					
4E27/8001	Beam	75	75		R	5	7.5	11	.06	4.6	6-3/16	2-11/16	Max	X	4000	150	750	30	-500	25	X	X	X		X	
4E27A/5-125B	Beam	125	75		EPRS	5	7.5	11	.08	4.8	6-3/16	2-1/16	Class C	X	3000	163	500	20	-200	6	190	1.6	9200			325
													Linear	X	2500	35/165	750	.2/19	-134	0	134	0	X	-25		265
4W300B	Beam	300	500		AES	6	2.9	17.2	.06	5	3-9/16	1-9/16	Same as 4CX250B Except Water-Cooled													
4X250B	Beam	250	500		AES	6	2.6	15.7	.06	4.5	2-15/32	1-21/32	Same as 4CX250B													
4X500A	Beam	500	120		AEPR	5	13	14.4	.1	6.9	4-3/4	2-5/8	Class C	X	3000	310	500	24	-150	16	230	5	4900		600	
6C24	Triode	600	160		R	11	12.1	4.6	4.4	3.2	8-23/32	1-29/32	Max	X	3000	500			-500	150	X	X	X		X	
6F4	Triode	2	1200		R	6.3	.225	1.9	1.8	0.6	1-3/8	21/32	Max	X	150	20			-50	8	X	X	X		X	
7C29	Triode	500	110		G	10	25.5	10.2	7.6	.45	5-3/8	2-1/2	Class C	110	2800	330			-250	75	X	X	4270		600	
10Y	Triode	15	8		R	7.5	1.25	4	7	3	5-3/8	2-1/16	Max	X	450	60			-200	15	X	X	X		X	
25T	Triode				E																					
35T	Triode				E																					
35TG	Triode				E																					
75TH	Triode				E																					
75TL	Triode				E																					
100TH	Triode	100	X		EGS	5	6.3	2.9	2	.4			Class C	X	3000	165			-200	51	385	18	9000		400	
													Linear	X	3000	20/108			-65	X	165	5	15500	X	325	
100TL	Triode				E																					
152TH	Triode				E																					
152TL	Triode				E																					
PL175A	Bm Pentode	400	110		P	5	14.5	15.1	.06	9.8	6-5/8	3-9/16	Class C	X	3000	350	600	36	-180	6	218	1.3	4400		786	715
													Linear	X	3500	75/350	750	1/24	-160	0	160	0	X	-31	869	790
PL177A	Bm Pentode	75	175		P	6	3.2	7.5	.06	4.2	4-3/8	2-3/8	Class C	X	2000	150	400	12	-125	5	165	.8	6600		250	220
													Linear	X	2000	25/175	600	0/7	-115	0	112	0	X	-30	225	210
PL177WA	Bm Pentode	75	175		P	6	3.2	7.5	.06	4.2	4-3/8	2-3/8	Ruggedized, otherwise identical to PL-177A													
HF200	Triode	150	30		A	10-11	4	6.2	6.9	1.2	10-1/4	5-3/4	Class C	X	2500	200			-300	18	455	8	6250		380	
													Linear	X	2500	90 car.			-140	0	130	4	X	X	320	
HF201A	Triode	150	30		A	10-11	4	8.8	7	1.2	10-7/8	3-1/16	Class C	X	2000	160			-350	20	500	9	6250		250	
													Linear	X	2500	30/180			-130	X	230	4	X		300	

Transmitting Tube Guide

TUBE TYPE	CLASS OF TUBE	PWR DISS WATT	FREQ OF MAX RATING	MAX. USABLE FREQ	MFR.	FIL/HTR VOLTS	FIL/HTR AMPS	CAP IN MMFD	CAP G-P MMFD	CAP OUT MMFD	MAX HGT IN.	MAX DIA IN.
5618	Pent	5	100	165	R	6/3	.23/.46	7	.24	5	2-5/8	3/4
5675	Triode	9	1700		R	6.3	.135	2.3	1.4	.09	2-1/4	13/16
5686	Beam	8.25	160		R	6.3	.35	6.4	.11	4	2-3/16	7/8
5763	Beam	13.5	50	175	RS	6	.75	9.5	.3	4.5	2-5/8	7/8
5866	Triode	135	150	200	A	6.3	5.6	5.8	5.5	.1	5-3/16	2-7/16
5867	Triode	250	100	150	A	5	14.1	6.3	5	.16	5-15/16	3-7/16
5868	Triode	450	100	120	A	10	9.9	8	7	.17	8-3/8	4-21/32
5876	Triode	6.25	3000		R	6.3	.135	2.4	1.4	.035	2-1/4	13/16
5893	Triode	8	2000		R	6	.28	2.4	1.7	.07	2-1/4	13/16
5894	Twn Beam	40	250	500	ARS	12.6/6.3	.9/1.8	11	08	3.4	4-5/16	1-15/16
5895	Fil Beam	8	186	300	A	6.3/3.15	.68/1.36	8.5	.05	3.3	3-15/16	1-9/32
6026	Triode	3	400		R	6.3	.2	2	1.3	.42	1-1/2	3/8
6079	Beam	500	75	100	A	10	9.9	24	.25	8.3	8-1/4	4-21/32
6083	Pent	45	60		A	12.6	1.35	24	.2	12.2	4-11/32	1-15/16
6146	Beam	25	60	175	AGRSTW	6.3	1.25	13	.24	8.5	3-13/16	1-23/32
6155/4-125A	Beam	125	120	250	AR	5	6.5	10.8	.05	3.5	5-1/16	2-7/16
6156/4-250A	Beam	250	75	120	AR	5	14.1	13	.14	4.6	5-1/16	3-27/64
6161	Triode	250	900	2000	R	6.3	3.4	11	6	.22	3-13/32	1-3/4
6252	Twn Beam	20	300	600	AT	12.6/6.3	.65/1.3	4.4	int. neut.	1.6	3-3/8	1-13/16
6263	Triode	13	500	1700	R	6	.28	2.8	1.7	.08	2-5/8	1
6264A	Triode	13	500	1700	R	6	.28	2.95	1.75	.07	2-5/8	1
6360	Twn Beam	14	200		A	12.6/6.3	.41/.82	5.1	int. neut.	1.4	3-1/16	7/8
6417	Beam	13.5	50	175	R	12.6	.375	9.5	.3	4.5	2-5/8	7/8
6524	Twn Beam	25	100	470	R	6.3	1.25	7	.11	3.4	3-9/16	1-11/16
PL6549	BM Pent	75	175		P	6	3.3	7.5	.09	3.4	4-3/8	2-3/8
PL6569	Triode	250	60		P	5	14.5	7.6	(G-G) .1	3.7	6-3/8	3-9/16
PL6580	Triode	400	60		P	5	14.5	7.6	(G-G) .1	3.9	6-3/8	3-9/16
6816	Beam	115	2000		R	6.3	2.1	14	.065	4.4	1-7/8	1-5/16
6850	Twn Beam	25	100	470	R	12.6	.625	7	.11	3.4	3-9/16	1-11/16
6883	Beam	25	60	175	RS	12.6	.625	13	.24	8.5	3-13/16	1-23/32
6884	Beam	115	2000		R	26.5	.52	14	.065	4.4	1-7/8	1-5/16
6893	Beam	13.5	125	175	R	12.6	.4	13	.2	7	3-21/32	1-5/16
6897	Triode	100	2500		G	6.3	1.05	6.6	1.95	.035	2-3/4	1-1/4
6907	Twn Beam	20	300	600	AT	12.6/6.3	.65/1.3	4.4	int. neut.	1.6	3-3/8	1-13/16
6939	Twn Pent	7.5	500		AR	12.6/6.3	.3/.6	6.4	.15	1.6	2-5/8	7/8
7004	Triode	300	175	900	A	3.4	19	9	4	.12	2-7/8	1-21/32
7034/4X150A	Beam	250	150	500	AEGRS	6	2.6	16	.03	4.4	2-1/2	1-5/8
7060	Tri-Pent	2.75	40		R	12-15	.28	Pent: 7.1	.044	2.5	2-3/16	7/8
7094	Beam	125	60	175	R	6.3	2.85	19.5	.6	9.7	5	2-9/16
7203/4CX250B	Beam	250	500		R	6	2.6	16	.03	4.4	2-7/16	1-5/8
7212	Beam	25	60	175	RT	6.3	1.25	13	.24	8.5	3-13/16	1-23/32
7213	Beam	1500	1215		R	5.5	17.3	97	.17	16	3-1/4	3-3/4
7270	Beam	80	60	175	R	6.3	2.85	18	.4	2.34	4-3/4	2-1/16
7271	Beam	80	60	175	R	13.5	1.25	18	.4	2.34	4-3/4	2-1/16
7357	Beam	25	60	175	R	6.3	1.25	13	.24	8.5	3-13/16	1-23/32
7360	Special	X	100		R	6.3	.35				2-5/8	7/8
7377	Twn Beam	16	1000		A	12.6/6.3	.3/.6	2.4	X	.8	2-1/2	1-3/4
7378	Beam	100	30		A	6.3	3.9	30	.9	12.7	5-5/8	2-3/4
7527	Beam	400	110		A	5	14.1	12.7	.12	4.9	6	3-7/8
7551	Beam	12	175		R	12-15	.36	10	.15	5.5	2-5/8	7/8
7554	Triode	2.5	5000		R	6.3	.225	4.4	2.4	.04	1-1/2	9/16
7558	Beam	12	175		R	6.3	.8	10	.15	5.5	2-5/8	7/8
7580	Beam	250	500		AER	6	2.6	17	.03	4.5	2-7/16	1-5/8
7650	Beam	700	1215		R	6.3	7.85	66	.011	5.31	2-11/32	2-1/8

TYPE OF OPERATION	OP FREQ MC	PLATE VOLTS	PLATE CURR MA.	SCRN VOLTS	SCRN CURR MA	GRID BIAS VOLT	GRID CURR MA	RF DRIVE VOLTS	DRIVE POWER WATTS	LOAD IMP OHMS	3RD ORDER DISTORT	PLATE PWR OUT WATTS	PWR IN LOAD WATTS
Max	X	300	30	125	2W	-125	3	X	X	X		X	
Class C	1700	120	25			-8	4	X	(osc.)	2400		.47	
Class C	X	250	40	250	10.5	-50	2	75	.15	3330		6.5	5.25
Class C	30	350	48.5	250	6.2	-28.5	1.6	37	.1	3610		12	
Class C	X	2500	205			-200	40	390	14	6100		390	
Class C (G-G)	X	2500	205			-200	40	[illegible]	79	6100		455	
Linear	X	2500	30/178			-86	X		16	4550	X	350	
Class C	100	2500	400			-200	69	380	23.5	3130		750	
Linear	X	3000	50/285			-110	75	232	16	3550	X	640	
Linear	X	3500	70/442			-114	115	282	29	2550	X	1220	
Class C	500	275	23			-51	7	X	2	6000			5
Class C	1000	350	35			-33	13	X	2.4	5000			6.5
Class C	250	750	180	250	14	-80	3.4	200	6	2080			96
Linear	30	800	45/152	280	0/28	-29	0	29	0	X	-35	90	
Class C	X	600	60	200	3	-80	2	210	.2	5000		25	
Class C	400	135	20			-26	20	X	(osc.)	3370			1.25
Linear	X	4000	75/370	600	1/26	-51	21	150	3.15	6300	-35	1032	
Class C	X	1000	177	250	28	-120	5	144	.65	2850		132	
Linear	X	1000	20/138	300	1/18	-37	2	48	.08	4000	-32	92	
Class C	X	750	120	160	11	-62	3.1	79	.2	3130		70	
Linear	X	750	12/110	195	.5/13	-50	0	50	0	4000	X	60	
Class C	X	3000	167	350	30	-150	6.5	X	2	8900		375	
Linear	X	3000	23/115	600	2/14	-108	0	108	0	15000	-30	228	
Class C	X	3000	345	500	60	-180	10	327	3.3	4350		800	
Linear	X	4000	33/155	600	0/23	-120	0	120	0	14750	-30	421	
Class C	600	1500	250			-150	50	200	75	3000			270
Class C	220	600	100	250	8	-60	1.4	X	1.5	3000		48	
Linear	30	750	28/89	225	1/12	-26.5	0	25.5	0	4800	-30	43	
Class C	500	350	40			-58	15	X	3	4450			10
Class C	500	350	40			-45	15	X	3	4450			10
Class C	X	300	100	200	3	-45	3	130	.2	6000			16
EXCEPT FOR HTR, IDENTICAL TO 5763													
Max	X	600	150	300	3W	-200	4	X	X	X		X	
Class C	X	2000	150	400	12	-125	5	165	.8	6600	G3=+70V	250	
Linear	X	2000	15/112	400	0/5	-85	X	180	.05	9500	G3=+70V	163	
Class C G-G	X	4000	250			-120	50	230	70	8000			820
Linear G-G	X	4000	24/250			-150	42	205	60	X	X		800
Class C G-G	X	3000	350			-90	82	215	87	4300			745
Linear G-G	X	4000	40/300			-100	65	230	72	X	X		910
Class C	1200	900	170	300	1	-22	4	X	5	2650			40
Linear	X	850	40/100	300	0/10	-15	0	15	0	3500	X	40	
EXCEPT FOR HTR, IDENTICAL TO 6524													
EXCEPT FOR HTR, IDENTICAL TO 6146													
EXCEPT FOR HTR, IDENTICAL TO 6816													
EXCEPT FOR HTR, IDENTICAL TO 2E26													
Max	X	1000	125			X	X	X	X	X		X	
Class C	462	400	100	250	5	-50	1.4	X	3	8000		25	
Linear	30	750	28/89	225	1/12	-26.5	0	25.5	0	4800	-30	43	
Class C	500	200	60	200	14	-20	1.5	50	1.2	6670		7.2	6
Class C	175	2500	260			-200	X	275	25	4800		475	
Class C	900	1300	350			-60	X	X	X	1900		155	
Class C	X	1250	200	250	20	-90	11	106	1.2	3150		195	
Linear	X	2000	21/235	300	9	-50	0	50	0	4380	X	290	
Class C	(Pent) X	300	20	125	6	-11	1.6	X	.025	7500		3.5	
Class C Max	X	1500	340	400	20W	-300	30	X	X	X		X	
Linear Max	X	2000	350	400	20W	-300	0	X	X	X	X	X	
Class C	175	2000	250	250	30	-90	11	109	1	4000		400	
Linear	30	2000	83/250	350	15 av	-55	0	55	1	4350	-30		295
EXCEPT for BASE & SHOCK RESISTANCE, IDENTICAL TO 6146													
Class C	600	1800	750	500	15	-30	40	X	50	1200		650	
Max	X	1350	340	425	20W	-300	30	X	X	X		X	
EXCEPT FOR HTR, IDENTICAL TO 7270													
EXCEPT FOR HTR, BASE, & SHOCK RESISTANCE, IDENTICAL TO 6146													
Bal Mod	X	150	1.5	175	ED=25	Rk=1200	Eaf=2.8p-10			5000	-47	4 V p-p-	
Class C	960	250	80	170	15	-15	1.5	X	1.4	1560		8	5
Class C	30	750	385	250	20	-90	7	120	1	6200		200	
Linear	X	750	73/435	310	2/38	-48	1.6	58	.09	1000	-27	228	
Class C	75	3000	350	500	30	-220	6	305	1.8	4350		800	
Linear	X	4000	80/270	705	0/14	-130	0	130	0	9150	-35	723	
Class C	175	300	80	250	5.1	-55	1.6	62	1.5	1880			10
Linear	X	300	20/62.5	250	1/7	-21	0	20	0	2500	X	10	
Class C	1000	175	19			-10	5	X	.2	4600			1.4
EXCEPT FOR HTR, IDENTICAL TO 7551													
Linear	30	2000	70/350	400	16 av	-77	.05	77	1	3050	-21		400
Class C	400	2250	450	400	7	-45	10	X	30	2500			650
Linear	30	2500	160/500	450	2.5 av	-37	.05	37	1	2700	-36		680

Transmitting Tube

TUBE TYPE	CLASS OF TUBE	PWR DISS. WATT	FREQ OF MAX RATING	MAX USABLE FREQ	MFR	FIL/HTR VOLTS	FIL/HTR AMPS	CAP IN MMFD	CAP G-P MMFD	CAP OUT MMFD	MAX HGT IN.	MAX DIA IN.	TYPE OF OPERATION	OP FREQ MC	PLATE VOLTS	PLATE CURR. MA.	SCRN. VOLTS	SCRN CURR. MA	GRID BIAS VOLT	GRID CURR MA	RF DRIVE VOLTS	DRIVE POWER WATTS	LOAD IMP OHMS	3RD ORDER DISTORT	PLATE PWR OUT WATTS	PWR IN LOAD WATTS
203A	Triode	100	15	80	R	10	3.25	5.7	14	4.4	7-7/8	2-5/16	Max	X	1250	175			-400	60	X	X	X		X	
204A	Triode	250	3	30	R*	11	3.85	12.5	15	1.3	14-3/8	4-1/16	Max	X	2500	275			-500	80	X	X	X		X	
211	Triode	100	15	80	R	10	3.25	5.4	14	4.8	7-7/8	2-5/16	Max	X	1250	175			-400	50	X	X	X		X	
242C	Triode	100	6	30	G	10	3.25	6.1	13	4.7	7-7/8	2-5/16	Class C	X	1250	150			-225	20	375	7	4150		130	
													Linear	X	1250	10/150			-95	X	200	4	3800	X	100	
250TH	Triode				ES																					
250TL	Triode				E																					
PL254W	Triode	100	175		P	5	7.5	3.4	2.5	.43	7-1/4	4-3/4	Class C	X	4000	125			-260	30	450	12	16000		400	
HF300	Triode	200	20		A	11	4	6	7	1	10-3/8	5-3/4	Class C	X	3000	250			-400	18	590	16	6000		600	
													Linear	X	3000	30/225			-115	X	225	6.5	5000	X	390	
304TL	Triode				E																					
450TH	Triode	450	40		AE	7.5	12	8.8	5	.8	12-5/8	5-1/8	Linear	X	4000	75/335			-85	X	235	17	3200	X	900	
450TL	Triode	450	40		AES	7.5	12	6.8	4.5	.7	12-5/8	5-1/8	Linear	X	4000	75/335			-175	X	183	17	3200	X	900	
UE572	Triode				U																					
592/3-200A3	Triode	300	110		EG	10	5	4.2	3.7	.36	6	3-13/32	Class C	X	3000	320			-250	60	520	30	4700		680	
													Linear	X	3000	25/245			-90	X	270	10	6625	X	475	
750TL	Triode	750	40		AE	7.5	21	8.5	5.8	1.2	17	7-1/8	Linear	X	4000	125/475			-230	X	490	19	2120	X	1150	
800	Triode	35	60		R	7.5	3.1	2.8	2.5	2.8	6-3/8	2-11/16	Max	X	1250	80			-400	25	X	X	X		X	
801A	Triode	20	60	120	GRS	7.5	1.25	4.5	6	1.5	5-3/8	2-1/16	Class C	X	600	65			-150	15	260	4	4600		25	
802	Pent	13	30		GR	6.3	.9	12	.15	8.5	5-3/4	2-1/16	Class C	X	600	55	250	16	-53	2.4	165	.3	5450	G3=40V	23	
803	Pent	125	20	60	GR	10	5	17.5	.15	29	9-1/2	2-9/16	Class C	X	2000	160	500	45	-90	12	175	2	6250	G3=40V	210	
													Linear	X	2000	80 car.	600	20 car.	-40	3 car.	110	3	12500	G3=40V	212	
804	Pent	40	15	80	R	7.5	3	13	.03	14	7 11/16	2-1/16	Max	X	1250	95	300	15W	-300	15	X	X	X		X	
805	Triode	125	30	80	GR	10	3.25	8.5	6.5	10.5	8-1/2	2-5/16	Class C	X	1500	200			-150	40	235	8.5	3750		215	
													Linear	X	1500	115 car.			-10	15 car.	140	15	6400	X	230	
806	Triode	150	30	100	R	5	9.5	5.6	4	.4	10	3-13/16	Max	X	3000	200			-1000	50	X	X	X		X	
807	Beam	30	60	125	AGRS	6.3	.9	12	.2	7	5-3/4	2-1/16	Class C	X	750	100	250	8.	-45	4	65	.3	3750		54	
													Linear	X	750	15/120	300	.25/10	-35	X	48	.5	3650	X	60	
808	Triode	50	30	130	R	7.5	4	5.3	2.8	.25	6-1/16	2-3/16	Max	X	1500	150			-400	35	X	X	X		X	
809	Triode	100	60	120	GR	6.3	2.5	5.7	6.7	.9	6-9/16	2-7/16	Class C	X	1000	100			-75	25	160	3.8	5000		75	
													Linear	X	1000	20/100			-10	X	156	1.7	5800	X	72	
810	Triode	125	30	100	GR	10	4.5	8.7	4.8	12	8-3/4	4-1/2	Class C	X	2500	300			-180	60	350	19	8335		575	
													Linear	X	2250	100 car.			-70	2 car.	200	4	11250	X	300	
811A	Triode	65	30	100	GRS	6.3	4	5.9	5.6	.7	6-5/8	2-7/16	Class C	X	1500	173			-70	40	175	7.1	4400		200	
													Linear	X	1500	16/157			-4.5	20 av.	X	8	6000	-25		160
812A	Triode	65	30		GRS	6.3	4	5.4	5.5	.77	6-5/8	2-7/16	Class C	X	1500	173			-120	30	240	6.5	4400		190	
													Linear	X	1500	14/155			-48	X	270	2.5	6600	X	170	
813	Beam	100	30	120	GRS	10	5	16.3	.25	14	7-1/2	2-9/16	Class C	X	2250	220	400	40	-155	15	275	4	5100		375	
													Linear	X	2500	25/145	750	1/27	-95	0	90	0	9500	X	245	
814	Beam	60	30	75	GR	10	3.25	13.5	.15	13.5	7-11/16	2-1/16	Class C	X	1250	144	300	22 max	-300	10	222	3.2	4400		130	
													Linear	X	1250	60 car.	200	33 max	-35	X	56	.85	10500	X	120	
815	Twn Beam	25	150	225	GRS	12.6/6.3	.8/1.6	14	.2	8.5	4-9/16	2-3/8	Class C	X	500	150	200	17	-45	3.5	112	.18	6670		56	
													Linear	X	500	22/150	125	32 pk	-15	X	60	.36	8000	X	54	
826	Triode	60	250	300	R	7.5	4	3	3	1.1	3-11/16	2-3/8	Max	X	1000	125			-600	40	X	X	X		X	
828	Beam	80	30	75	GS	10	3.25	13.5	.05	14.5	7-11/16	2-1/6	Class C	X	1500	180	400	28	-100	12	205	2.2	4200	G3=+75V	200	
													Linear	X	2000	25/135	750	1/30	-120	0	120	0	9250	G3=+60V	190	
829B	Twn Beam	40	200	250	GRS	12.6/6.3	1.125/2.25	14.5	.12	7	4-5/16	2-3/8	Class C	X	750	160	200	30	-55	12	140	.8	4650		87	
832A	Twn Beam	20	200	250	GRS	12.6/6.3	.8/1.6	8	.07	3.8	3-5/16	2-5/8	Class C	X	750	65	200	22	-50	4	130	.24	5930		35	
833A	Triode	450	30	75	AGRS	10	10	12.3	6.3	8.5	8-13/16	4-19/32	Class C	X	2250	444			-125	85	300	23	2530		780	
													Linear	X	3000	50/375			-70	X	200	20	4750	X	825	
834	Triode	50	100	350	R	7.5	3.1	2.2	2.4	.6	6-11/16	2-11/16	Max	X	1250	100			-400	20	X	X	X		X	
837	Pent	12	20	60	GR	12.6	.7	16	.2	10	5-3/4	2-1/16	Class C	X	500	60	200	15	-75	4	100	.4	4165	G3=+40	22	
838	Triode	100	30	120	GR	10	3.25	6.5	8	5	7-7/8	2-5/16	Class C	X	1250	150			-90	30	200	6	4165		130	
849H	Triode	500	30		A	10	11.5	10	11.5	1.8	14-3/8	8	Linear	X	3000	50/450			-140	X	600	55	2000	X	950	
851	Triode	750	3	15	G	11	15.5	25.5	47	4.5	17-5/8	6-1/8	Linear	X	3000	55/600			-135	X	245	3	2800	X	1200	
955	Triode	1.6	600		R	6.3	.15	1	1.3	.4	1-3/8	21/32	Max	X	180	8			X	2	X	X	X		X	
958A	Triode	.6	350		R	1.25	.1	.45	2.5	.6	1-3/8	21/32	Max	X	135	7			-30	1	X	X	X		X	
1000T	Triode	1000	50		EG	7.5	17	9.3	5.1	.5	12-5/8	5-1/8	Class C	X	6000	167			-400	X	X	8	18000		800	
													Linear	X	5000	120/570			-105	X	265	16	4625	X	1850	
1613	Pent	10	45	90	GR	6.3	.7	6.5	.26	13.5	3-1/4	1-5/16	Class C	X	350	50	200	10	-35	3.5	70	.22	3500		9	
1614	Beam	25	80	120	RS	6.3	.9	10	.4	12	4-5/16	1-5/8	Class C	X	450	100	250	8	-45	2	73	.15	2250		31	
													Linear	X	530	30/80	340	10 pk	-36	0	36	0	3600	X	25	
1619	Beam	15	45	90	GR	2.5	2	9.6	.29	12.5	4-5/16	1-5/8	Class C	X	400	75	300	10.5	-55	5	80	.36	2670		19	
1624	Beam	25	60	125	GRS	2.5	2	11	.25	7.5	5-3/4	2-1/16	Class C	X	600	90	300	10	-60	5	95	.43	3340		35	
1625	Beam	30	60	125	GR	12.6	.45	11	.2	7	5-3/4	2-1/16	EXCEPT FOR HEATER, CAP & BASE, IDENTICAL TO 807													
1626	Triode	5	30	90	R	12.6	.25	3.2	4.4	3	4-1/8	1-9/16	Max	X	250	25			-150	8	X	X	X		X	
4037	Triode	6.25	3500		R	6.3	.145	1.8	1.1	.05	3-1/8	1-5/16	Class C	500	275	23			-51	7	X	2	6110			5
4604	Fil Bm	25	60	175	R	6.3	.65	11	.24	8.5	3-13/16	1-21/32	Class C	175	400	150	190	11	-60	2	X	4.5	1335		30	
5513	Triode	1500	220		G	6.3	30	14.4	(G-G) .09	10.5	6-7/8	3-	Linear (G-G)	X	2000	60/967			-20	180	240	223	X	X	1125	
5556	Triode	10	6	30	R	4.5	1.1	2.3	6.7	2.2	4-1/2	1-5/8	Max	X	350	40			-150	10	X	X	X		X	
5588	Triode	200	1200	2000	GR	6.3	2.5	13	6	.32	3-13/32	1-3/4	Class C	1000	835	300			-70	40	X	32	1390		100	

Guide

TUBE TYPE	CLASS OF TUBE	PWR DISS. WATT	FREQ OF MAX RATING	MAX USABLE FREQ	MFR	FIL/HTR VOLTS	FIL/HTR CURR.	CAP IN MMFD	CAP OUT MMFD	CAP G-P MMFD	MAX HGT IN.	MAX DIA IN.	TYPE OF OPERATION	OP FREQ MC	PLATE VOLTS	PLATE CURR MA	SCRN. VOLTS	SCRN CURR MA.	GRID BIAS VOLT	GRID CURR MA	RF DRIVE VOLTS	DRIVE POWER WATTS	LOAD IMP OHMS	3RD ORDER DISTORT	PLATE PWR OUT WATTS	PWR IN LOAD WATTS
7801	Beam	52.5	3000		R	12.6	.5	28.5	.025	2.2	1-5/16	3/4	Class C	1500	650	65	225	2	-24	4	X	3	5000		14.5	
													Linear Max	X	750	70	250	2W	X	15	X	X	X	X	X	
7842	Beam	180	2000		R	6.3	3.2	33	.065	4.52	1-15/16	1-1/8	Class C	1215	900	170	300	1	-22	4	X	5	2650			40
													Linear	X	850	40/173	300	0/12.5	-15	15	46	.3	1980	X	70	
7843	Beam	180	2000		R	26.5	.52	33	.065	4.52	1-15/16	1-1/8	EXCEPT FOR HTR, IDENTICAL TO 7842													
7854	Twn Beam	60	175	500	A	12.6/6.3	.9/1.8	6.7	int. neut.	2.1	4-1/32	1-3/4	Class C	175	1000	240	262	16.5	-85.5	5.7	X	3.5	2100			163
7870	Beam	52.5	3000		R	6.3	1	28.5	.025	2.2	1-5/16	3/4	EXCEPT FOR HTR, IDENTICAL TO 7801													
7905	Fil Beam	10	175		R	6.3	.65	8.5	.14	5.5	2-5/8	7/8	Class C	175	300	60	185	4	-39	2.2	43	1	2500			7
7983	Tw Fil Bm	14	200		A	3.15	1.65	5.4	int. neut.	1.7	3-1/16	7/8	Class C	200	200	90	200	10.2	-40	3	110	X	1100			9.5
8000	Triode	175	30	100	GR	10	4.5	5	6.4	3.3	8-3/4	2-9/16	Class C	X	2500	300			-240	40	480	18	4200		575	
													Linear	X	2250	33/225			-145	0av	150	7.9	X	X	363	
8003	Triode	100	30	50	R	10	3.25	5.8	11.7	3.4	8-3/16	2-9/16	Max	X	1350	250			-400	50	X	X	X		X	
8005	Triode	85	60	100	GR	10	3.25	6.4	5	1	6-9/16	2-7/16	Class C	X	1500	200			-130	32	255	7.5	3750		220	
													Linear	X	1500	83 av			-80	1 av	90	5	X	X	180	
8042	Fil Bm	25	60	175	A	1.6	3.2	13.5	.24	8.5	3-7/8	1-3/4	Class C	60	600	150	180	15	-71	2.8	91	.3	2000		65	
8072	Beam	100	500		R	12-15	1.3	38	.13	6.51	2-1/4	1-15/32	Class C	470	700	300	200	10	-30	20	X	5	1170			85
													Linear	30	700	100/205	250	16 pk	-20	1	40	.3	1420	-30		80
8077/7054	Pent	5	40		R	12-15	.275	10.2	.063	3.5	2-3/16	7/8	Class C	40	300	26	175	5.5	-12	1	16	.015	5800		4	
8121	Beam	150	500		R	13.5	1.3	38	.13	6.5	2-5/16	1-7/16	Class C	470	1500	300	200	5	-30	30	X	5	2500			235
													Linear	30	1500	100/210	250	10 pk	-20	.05	40	.3	3800	-35		170
8122	Beam	400	500		R	13.5	1.3	38	.13	6.5	2-1/4	1-5/8	Class C	470	2000	300	200	5	-30	30	X	5	3330			300
													Linear	30	2000	100/335	400	10 pk	-35	.05	70	.3	3050	-29		380
8149	Bm Pent	35	175		T	12.6/6.3	X	X	X	X	X	X	Class C	175	380	180	368	12	-78	X	120	2	1830		40	
8150	Bm Pent	35	175		T	12.6/6.3	X	X	X	X	X	X	EXCEPT FOR BASE, IDENTICAL TO 8149													
8167/4CX300A	Beam	300	500		ERy								Class C	250	2500	250	250					2.8			500	
													Linear	250	2500	1250	350			0		0			400	
8289	Beam	25	60	175	W	6-10	1.165	13	.24	8.5	3-13/16	1-23/32	EXCEPT FOR HTR, IDENTICAL TO 6146													
PL-8295/PL-172	Bm Pent	1000	60		P	6	8.2	38	.09	18	5-1/8	4-1/32	Linear	X	3000	220/800	500	11/39	-115	0	115	0	G3=+35 V	-32		1590
PL8295A	Bm Pent	1000	60		P	6	8.2	42	.09	21	5-1/8	4-1/32	EXCEPT FOR OPERATING TEMPERATURE, SAME AS PL-8295													
PL8432	Bm Pent	1000	60		P	6	8.2	42	.09	20	4-3/4	3-17/32	Linear	X	3000	200/800	500	3/52	-115	0	115	0	X	-27		1540
9002	Triode	1.6	500		R	6.3	.15	1.2	1.4	1.1	1-3/4	3/4	EXCEPT FOR CAPACITANCES, IDENTICAL TO 955													

Propagation

EASTERN UNITED STATES TO:

GMT -	00	02	04	06	08	10	12	14	16	18	20	22
Alaska	14	7	7	7	7	7	7	7	7	7	14	14
Argentina	21	14	7	7	7	7	14	14	21	21	21	21
Australia	14	14	14	7	7	7	7	7	7	7	14	14
Canal Zone	21	14	14	7	7	7	14	14	14	21	21	21
England	7	7	7	7	7	14	14	14	14	14	14	14
Hawaii	14	14	14	7	7	7	7	7	14	14	14	14
India	7	7	7	7	7	14	14	14	14	14	14	7
Japan	14	14	7	7	7	7	7	7	7	7	14	14
Mexico	21	14	14	7	7	7	14	14	14	14	14	21
Philippines	14	14	7	7	7	7	7	7	7	7	14	14
Puerto Rico	14	7	7	7	7	7	14	14	14	14	14	21
South Africa	14	7	7	7	7	14	14	14	14	21	21	14
U.S.S.R.	7	7	7	7	7	7	14	14	14	14	14	14

CENTRAL UNITED STATES TO:

GMT -	00	02	04	06	08	10	12	14	16	18	20	22
Alaska	14	14	14	7	7	7	7	7	7	7	7	14
Argentina	21	14	14	7	7	7	14	14	14	21	21	21
Australia	21	21	14	14	7	7	7	7	7	7	14	21
Canal Zone	21	14	14	14	7	7	14	14	14	14	21	21
England	7	7	7	7	7	7	14	14	14	14	14	14
Hawaii	14	21	14	14	7	7	7	7	14	14	14	14
India	14	14	7	7	7	7	7	14	14	14	14	14
Japan	14	14	14	7	7	7	7	7	7	7	14	14
Mexico	14	14	14	7	7	7	7	14	14	14	14	14
Philippines	14	14	14	7	7	7	7	7	7	7	14	14
Puerto Rico	21	14	14	7	7	7	14	14	14	14	21	21
South Africa	14	7	7	7	7	7	14	14	14	14	14	14
U.S.S.R.	7	7	7	7	7	7	7	14	14	14	14	14

WESTERN UNITED STATES TO:

GMT -	00	02	04	06	08	10	12	14	16	18	20	22
Alaska	14	14	7	7	7	7	7	7	7	7	7	7
Argentina	21	14	14	14	7	7	7	14	14	21	21	21
Australia	21	21	21	14	14	7	7	7	7	7	14	14
Canal Zone	21	21	14	14	7	7	7	14	14	14	21	21
England	7	7	7	7	7	7	7	14	14	14	14	14
Hawaii	21	21	21	14	14	7	7	7	14	14	14	14
India	14	14	14	7	7	7	7	7	7	14	14	14
Japan	14	14	14	14	7	7	7	7	7	7	14	14
Mexico	14	14	14	7	7	7	7	14	14	14	14	14
Philippines	14	14	14	14	14	7	7	7	7	14	14	14
Puerto Rico	21	14	14	7	7	7	7	14	14	14	14	14
South Africa	14	7	7	7	7	7	7	14	14	14	14	14
U.S.S.R.	7	7	7	7	7	7	7	7	14	14	14	14

August Forecast

Good: 1-5, 13-19, 23-25

Fair: 6-9, 12, 20, 22, 27-28, 31

Bad: 10-11, 21, 28-30

Es: 1-2, 13-15, 18-19, 25-26

Es means the possibility of a high MUF and/or freak conditions.

Items of Interest

1. We are presently about one year from the minimum portion of the 11 year sunspot cycle. Monthly average sunspot numbers this year have been January 19, February 23, March 17, April 30. May is also showing an increase over March but this is temporary and the numbers should fall again. The last year comparable to the present was 1953 preceding the low of 1954. In 1954 the sun was nearly bare of spots for the first six months.

2. The useful frequencies of 1963 are almost identical to what they were in 1953 and signal qualities also show the same pattern. At this portion of the 11 year cycle, the Winters are bad and the Summers are quite good.

J. H. Nelson

New from Gonset

A HIGH QUALITY TRANSISTORIZED SSB TRANSCEIVER

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ULTRA-COMPACT • LIGHT WEIGHT • low in cost

Gonset has scored a breakthrough with the new "Sidewinder"—a 2 meter SSB, AM and CW transceiver that combines technical excellence with contemporary design and compact, sturdy construction.

The Gonset "Sidewinder" provides coverage of the entire 2 meter band in four segments 1 Mc wide. It has built-in VFO and the receiver is *completely* transistorized. There are a total of 21 transistors, 6 diodes and three tubes in the "Sidewinder," which operates on either SSB, AM or CW.

The power supply is designed for snap-on back or remote installation and is available either as a kit or a wired and tested unit.

CHECK THESE DELUXE FEATURES AT YOUR LOCAL DISTRIBUTOR!

• Receiver and transmitter utilize dual conversion. • Designed for mobile and fixed station operation. • Illuminated dial and "S" meter. • High voltage power supply is used only in transmit mode. • Highly Stabilized VFO. • Crystal lattice filter for both receiver and transmitter. • 20 watts PEP input SSB, 6 watts input AM, 20 watts input CW.

Transceiver: 8¾" wide, 4¾" high, 7" deep.
Weight: 7 lbs.-10 oz. Amateur net price **$349.95**

Power supply: 8¾" wide, 4¾" high, 5½" deep.
Weight: 11 lbs.-2 oz. Amateur net price—kit **$39.95**
Wired and tested unit **$49.95**

The new Gonset "Sidewinder" SSB Transceiver will be on display at your local distributor's in August.

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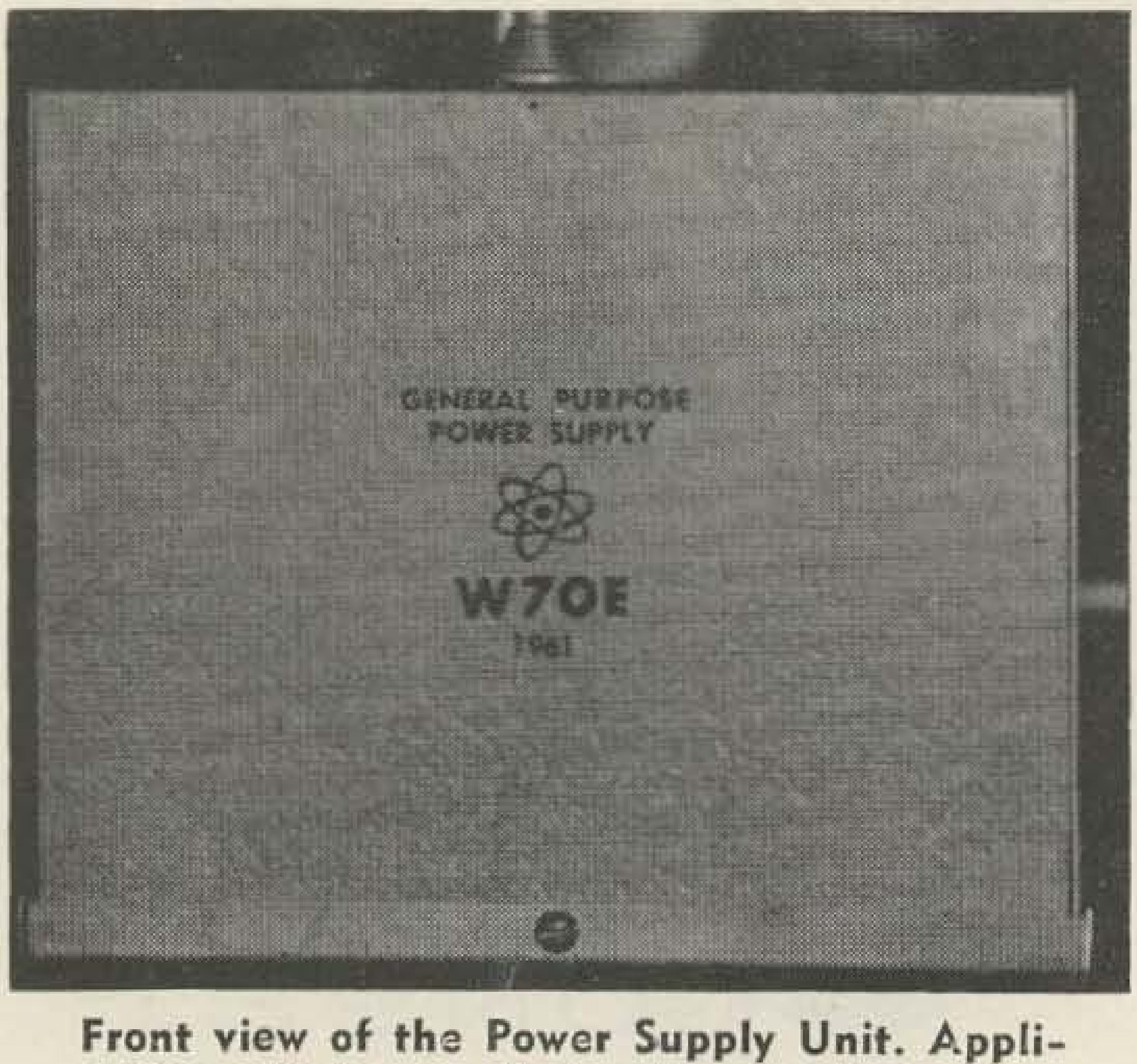
A Tubeless, General Purpose Power Supply

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

How often have you wished for a source of ac/dc voltage on your work bench for tube filaments, relays, vacuum tube plate circuits and similar applications? Many times, no doubt. And if such a supply is adapted to powering ham transmitters, VFO's, receivers, modulator units and such as well as having various applications in hi-fi/stereo work, audio amplifiers for sound systems and a variety of electronic devices, you have a pretty flexible and convenient "power-house."

Conventionally, any versatile power supply unit which provides voltages as above, will pretty well fill the bill; maybe you already have one which is satisfactory. On the other hand the radio ham generally takes what he can from the "power plug" on the back of his transmitter or receiver which may or may not be adequate nor convenient for the use he has in mind. Why not *build* a supply which is portable and immediately available when you are building, testing or trouble shooting a piece of gear? Such a construction project is simple, is moderate in cost and of untold convenience around the ham shack. Let's build one; here's how.



Front view of the Power Supply Unit. Application of the small decals contribute to a professional appearance for home-made gear.

For the unit described and illustrated here, I chose the various components shown, based on what I wanted the little power-box to deliver and making use of what my "junk-box" would produce, insofar as possible. If *your* voltage requirements differ or you want to make use of other items of comparable ratings which you may have on hand, adjust your values and your physical dimensions to conform. For the purpose of this article we will stick strictly to the unit which I assembled and which has proven to be one of the handiest pieces of gear in my shop.

In the initial design, I shied away from a vacuum tube as the rectifier for several reasons. I wanted as compact a unit as I could achieve (and a tube rectifier takes considerable space). Next, I wanted something without a filament to burn out at an inconvenient time and with no spare tube on hand. Last, while not too important with proper venting, I gave consideration to the heat generated by a tube. With these factors in mind, I came up with the relatively recent idea of using silicon rectifiers rather than a vacuum tube. After figuring the voltage and current values I wanted (600 volts at 200 milliamperes), a couple of 500 ma rectifiers in series (for adequate voltage capacity) seemed to offer adequate voltage and current carrying ability with a generous safety factor. Connection of these rectifiers is plainly detailed in the schematic wiring of Fig. 2. Be *sure* that the polarities of your rectifiers are exactly as shown or you could ruin one or more . . . I lost two the first time around by "missing the boat" on polarities. The balance of the wiring is conventional embodying the usual filter choke, filter condensers, bleeder resistor, fuses, terminal block, etc.

In duplicating the unit I built, the first step is to form a small sub-chassis to fit within the metal cabinet and provide a mounting for the transformer, choke, rectifiers, etc. I bent up this sub-chassis from a flat sheet of #16 gauge aluminum, 6" x 8", first cutting off all four corners at an angle of 45 degrees as shown in Fig. 1. Next, the transformer and choke were mounted, passing the wires from each down through grommet-bushed holes in the sub-chassis, then back up through similar grommetted holes at the proper points to reach their eventual terminations. This served to conceal a large portion of the wiring below the sub-chassis making for more professional appearance.

The mounting bases for the two pair of rectifiers can now be placed in position, using a short spacer between them and the sub-chassis. Mount the two filter condensers next . . . I used metal "wrap-around" clamps securing them through existing holes in the frame and core of the transformer. The bleeder resistor can then be mounted and with this the mechanical assembly of the sub-chassis is now complete and it can be set aside while you go to work on the cabinet.

The LMB chassis box which I used is an "L" shaped affair as shown in the photo. This shape makes it most convenient for mounting the terminal block, switches and panel lights on the end which is turned up from the base. By so doing, the cover and one end of the cabinet are readily removable with no wiring to trail between the two halves. Position your switches, fuses and indicator lights so that they will clear the transformer and mount the terminal block. Use small grommetted holes above the block through which to bring the wires to the terminal strip.

If you use terminal tie-points as I did, for the positive and negative leads of the filter condensers, mount them in appropriate positions now. You are then ready to assemble

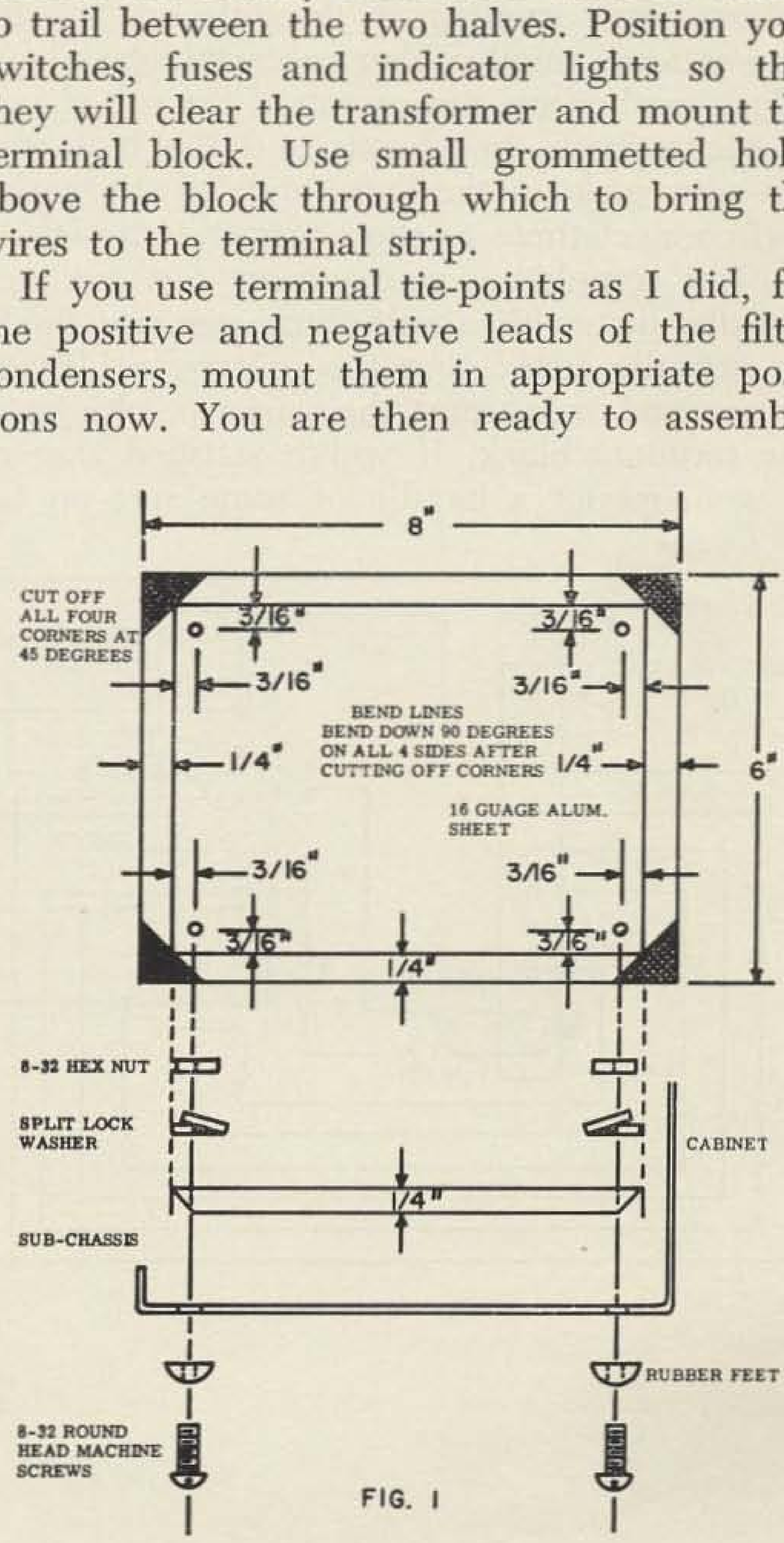
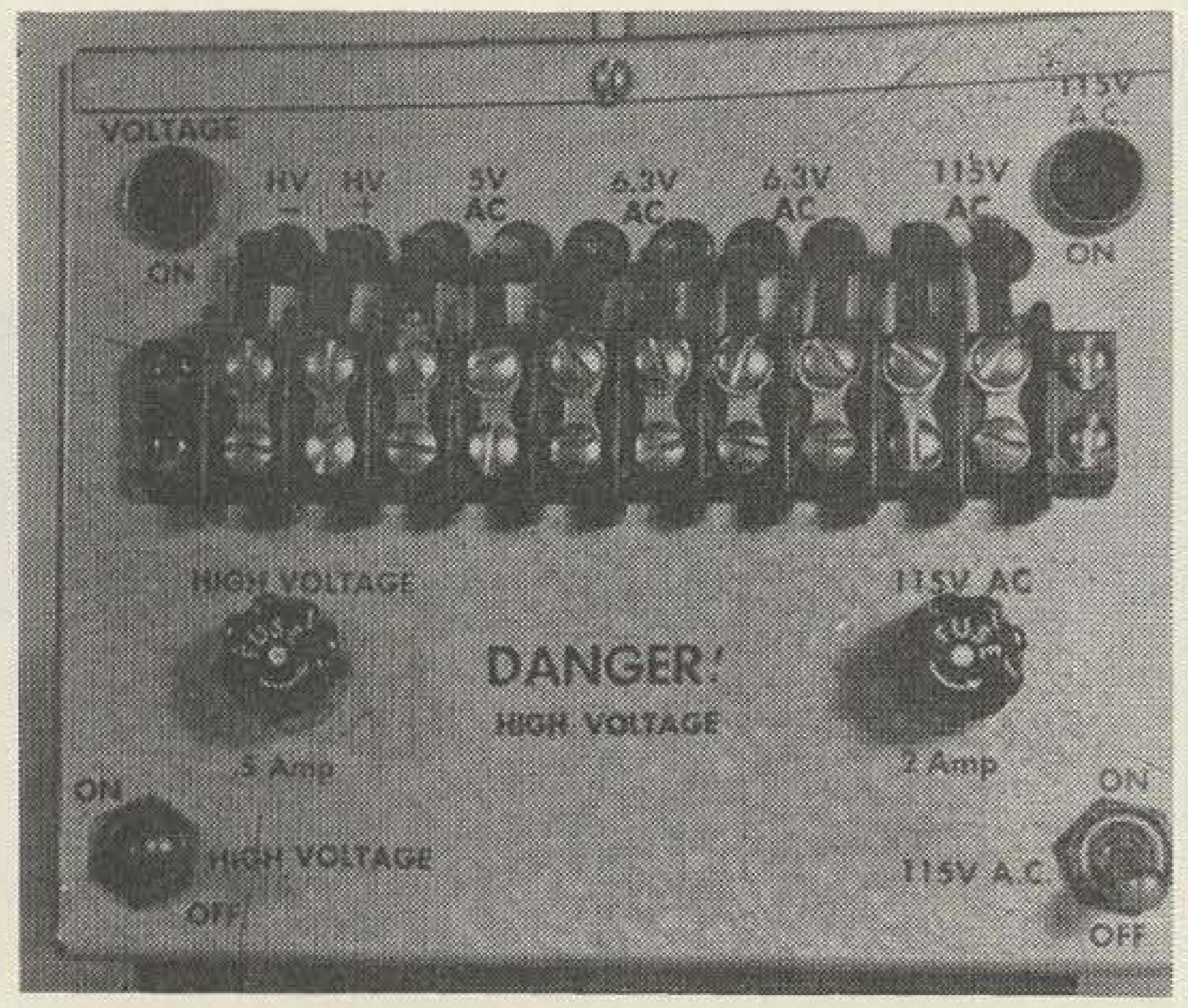
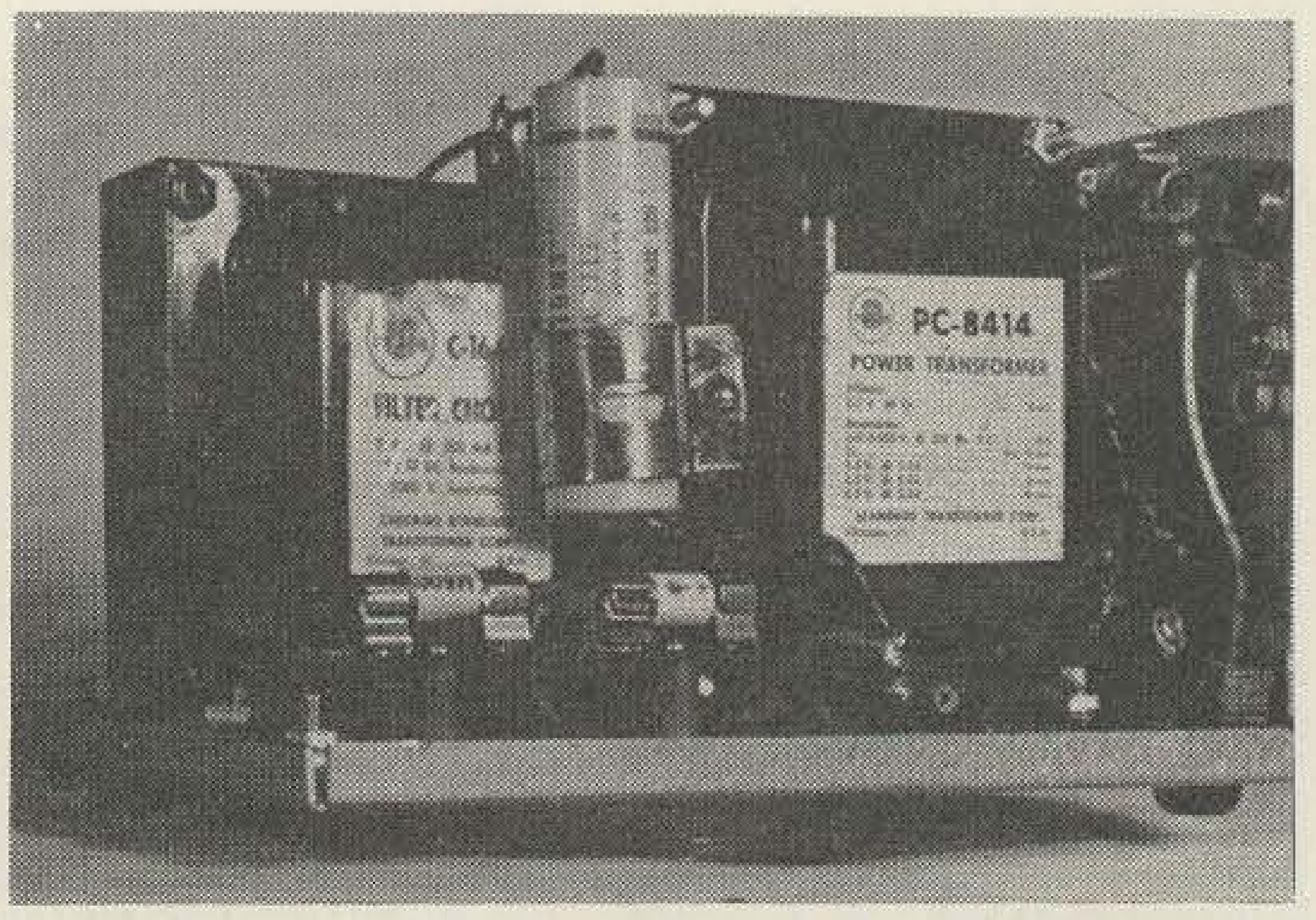


FIG. 1



The "business end" of the complete power supply unit using silicon rectifiers.



Internal view. The two silicon rectifiers conceal two identical rectifiers, one behind each of the two shown. The second filter condenser is located directly behind the one shown.

the sub-chassis to the cabinet base. Use 8-32 machine screws through the bottom of the cabinet and each of the four corners of the sub-chassis. Place the screw head on the bottom, first running it through one of the conventional small rubber cabinet feet and use a lock washer and nut on top of the sub-chassis to secure both the chassis and the feet. You can now pick up the loose ends of the wiring and connect them to their proper terminals.

After completing your wiring, test out your circuits, first with a volt-ohmmeter and finally by actually connecting the unit to a 115v ac source and measuring the various voltages at the terminal block. If you're satisfied that all is well, mount a handle of some sort on top of the "L" shaped cover; you'll find the unit much easier to move around if you do so. I used a handle I happened to have on hand from a piece of surplus military gear but you can pick up a satisfactory handle from your local hardware, building supply or variety store. Finish off the assembly by application of the neat little decal transfers available at all ham stores or electronic mail order houses, for professional appearance as well as ready identification of all external terminals, switches, fuses and indicator lights. Be generous with your decals; *know* what everything is and avoid the guess work when hooking various items to the unit.

If you prefer a *variable* dc output voltage, the internal bleeder resistor can be eliminated

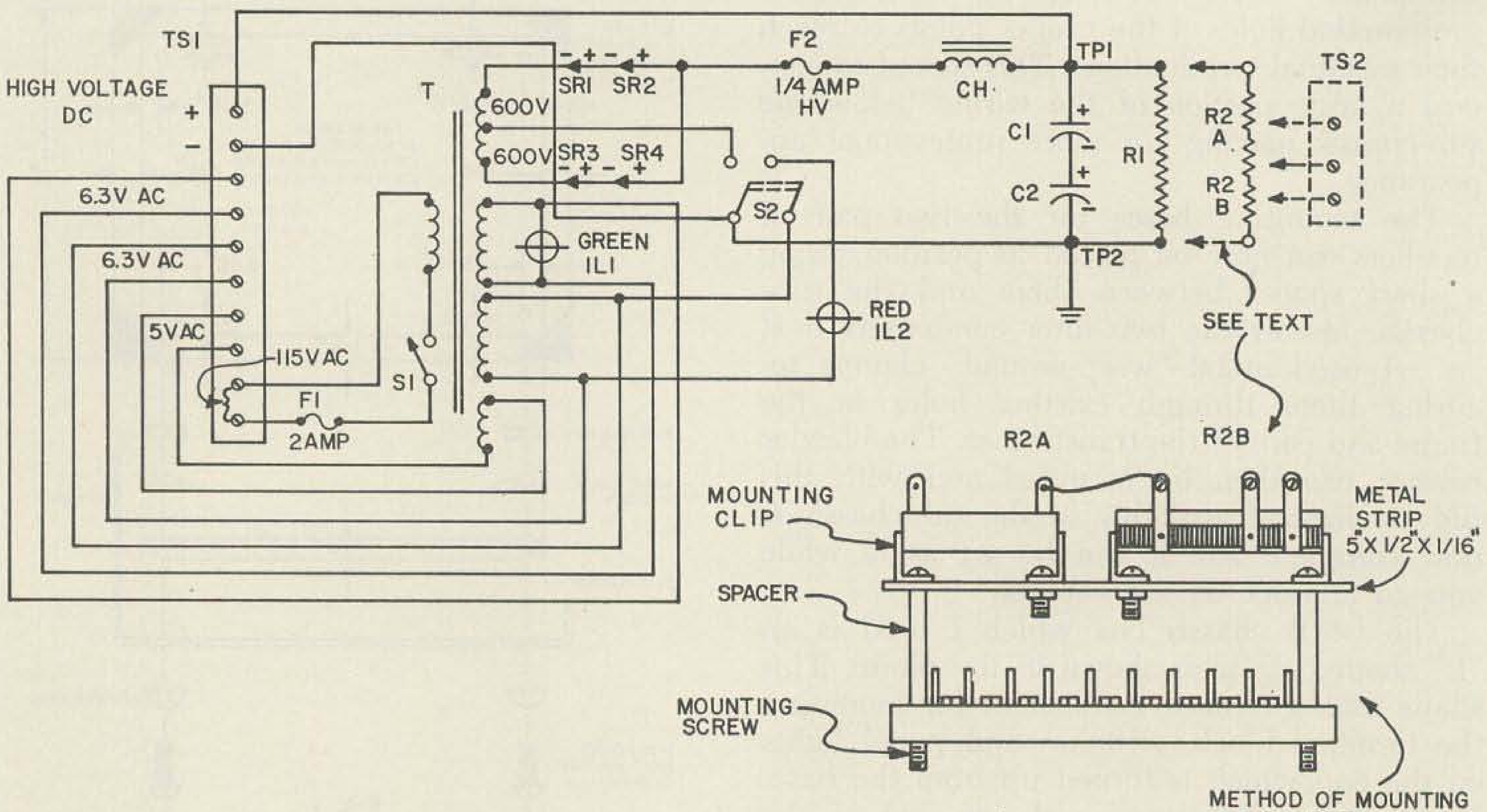


FIG. 2

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B & W	
LPA-1 Line (no cab)	$149
51SB adaptor	119
51SB-B adaptor	109
651 matchmaster	19
L-1000A Linear	199
5100 Xmtr	179
5100S Xmtr	189
5100B Xmtr	199
CENTRAL ELECTRONICS	
Mod A slicer	$ 19
Mod B slicer	29
GC-1 gated comp	29
MM-1 analyzer	49
10B SSB exciter	89
20A SSB exciter	129
100V Xmtr	475
200V Xmtr	595
458 VFO (C.E.)	19
458 VFO/10m.	39
MM-2 analyzer	69
MM-2 kit NEW	59
CLEGG	
99'er Xcvr	$ 99
Zeus Xmtr	495
NEW DISPLAY Zeus Xmtr	599
NEW DISPLAY Interceptor Rec	399
NEW DISPLAY Thor IV Xcvr	299
NEW DISPLAY 99'er Xcvr	139
COLLINS	
KWM-1 Xcvr	$399
KWM-1 console	69
KWM-1 Mount	29
KWS-1 Xmtr (ser. 0-500)	695
KWS-1 Xmtr (ser. 500-1000)	795
MP-1 DC Sup	139
KWM-2 Xcvr	849
PM-2 AC Sup	109
30L-1 linear	390
30S-1 linear	895
32S-1 Xmtr	469
32V-1 Xmtr	119
32V-2 Xmtr	169
75A-1 Rec	199
75S-1 Rec	349
75S-1/blanker	389
75S-1/500 cycle	399
51J-4 (rack) LATE	995
75A-2 Rec	229
75S-2/blanker	479
75A-3 Rec	329
75A-4 Rec (ser. 0-1000)	399
75A-4 Rec (ser. 1000-2000)	425
75A-4 Rec. (ser. 2000-3000)	449
75A-4 Rec (ser. 3000-4000)	475
310B-3 exciter	99
516F-1 AC Sup	79
516E-1 DC Sup	129
516F-2 AC Sup	79
NEW KWM-1 mount	50
NEW KWM-1 DX adaptor	35
NEW 75S-1 Rec	395
NEW DISPLAY KWM-2 #10549	925
NEW DISPLAY 75S-3 #12552	544
DRAKE	
1A Rec	$149
2A Rec	189
2B Rec	209
2BQ combo	29
NEW DISPLAY 2B Rec	245
NEW DISPLAY 2BQ combo	35
EICO	
720 Xmtr	$ 49
730 Xmtr	39
ELDICO	
SSB-1000 linear	$175
SSB-1000F linear	275

ELMAC	
PSR-612 DC Sup	$ 19
PMR-7 Receiver	79
PMR-8 Receiver	109
A-54 Xmtr	34
A-54H Xmtr	39
AF-67 Xmtr	69
AF-68 Xmtr	119
PSA-500 AC Sup	19
M-1070 DC/AC	39
GLOBE	
UM-1 modulator	$ 29
65B Scout	44
SD-75 Scout	79
VHF-62 Hi-bander	99
90 Chief Xmtr	29
90A Chief Xmtr	34
DSB-100 Xmtr	59
300 Xmtr	149
300A Xmtr	169
350 Xmtr	219
500 King Xmtr	269
500A King Xmtr	289
680 Scout Xmtr	39
680A Scout Xmtr	44
GONSET	
Comm II 6m.	$129
Comm III 6m.	149
Comm III 2m.	179
Comm IV 220mc.	199
Comm IV 2m.	269
3156B aircraft	59
G-28 10m Xcvr	119
G-43 Receiver	79
G-63 Receiver	129
G-66 Receiver	79
G-66B Receiver	89
3-way Rec Sup	24
Thin Pak	19
G-76 Xcvr	239
G-76 AC Suppy	69
G-76 DC Supply	69
G-77 Xmtr	119
G-77A Xmtr	139
GSB-100 Xmtr	249
GSB-101 linear	199
GC-105 2m Xmtr	179
Super 12 Conv.	39
Tri-band Conv (Cash As-is)	10
SPECIAL CLOSE-OUT—TGE FOLLOWING ITEMS ARE IN FACTORY-SEALED CARTONS	
G-76 Xcvr	$329
G-76 AC Sup	115
G-76 DC Sup	115
3311 88-108 mc FM Conv 12v B+	35
GR-111 Receiver	59
3357 6, 2, & 1¼ VFO	59
3275 6m Conv	29
3261 Super 12 Conv	59
HALLICRAFTERS	
HT-32 Xmtr	$369
HT-32A Xmtr	419
HT-32B Xmtr	495
HT-33 linear	249
HT-33B linear	599
HT-37 Xmtr	349
HT-41 linear	295
HT-40 Xmtr	59
S-40A Receiver	49
S-40B Receiver	59
SX-42 Receiver	129
SX-43 Receiver	89
SP-44 panadaptor	49
S-53 Receiver	44
SX-71 Receiver	109
SX-73 Rk-Mt	495
S-85 Receiver	69
SX-62 Receiver	179
SX-88 Receiver	295
SX-96 Receiver	129
SX-99 Receiver	89
SX-100 Receiver	189

HALLICRAFTERS—Cont.	
SX-101 Receiver	$199
SX-101 Mk III Rec	219
SX-101A Receiver	249
SX-110 Receiver	109
SX-111 Receiver	179
SX-115 Receiver	349
SX-117 Receiver	279
SX-140 Receiver	69
SR-34 (AC) XCVR	249
FOLLOWING ARE NEW DISPLAY	
HA-2 Transvertor	$249
HA-6 Transvertor	249
P-26 AC Supply	69
SX-100 Receiver	249
SX-111 Receiver	199
FPM-200 Xcvr	1495
HAMMARLUND	
HC-10 slicer	$ 79
HX-50 Xmtr	319
HQ-100 Receiver	109
HQ-100C Rec	114
HQ-110 Rec	149
HQ-110C Rec	154
HQ-120 Rec	69
HQ-129X Rec	109
HQ-140X Rec	139
HQ-145 Rec	169
HQ-145C Rec	174
HQ-145X Rec	189
HQ-150 Rec	159
HQ-170 Rec	219
HQ-170C Rec	225
HQ-180C Rec	309
NEW HQ-145C Rec	225
HARVEY WELLS	
TBS-50 Xmtr	$ 29
TBS-50C Xmtr	34
TBS-50D Xmtr	39
APS-50 AC Sup	19
T-90 Xmtr	59
R-9A Rec	49
HEATH	
MR-1 Receiver	$ 59
MT-1 Xmtr	59
RX-1 Receiver	189
TX-1 Apache	179
VF-1 VFO	17
VHF-1 Seneca	159
HA-10 linear	219
HG-10 VFO	29
HP-10 DC Supply	29
HX-10 Marauder	279
SB-10 SSB adaptor	59
HX-11 Xmtr	29
DX-20 Xmtr	24
HP-20 Supply	29
HR-20 Receiver	129
HX-20 Xmtr	179
DX-35 Xmtr	34
DX-40 Xmtr	39
DX-60 Xmtr	59
DX-100 Xmtr	119
DX-100B Xmtr	149

HUNTER	
NEW DISPLAY Bandit 2000A	$495
HY-GAIN	
RBX-1 NEW	$160
JOHNSON	
Adventurer	$ 34
Challenger	69
Invader 200	419
Invader 2000	879
275w matchbox	39
275w matchbox w/SWR	69
10m Messenger	69
Mobile Xmtr (Cash As-Is)	30
Navigator	99
Pacemaker	219
Ranger I	139
Ranger II	239
6N2 Thunderbolt	339
Thunderbolt	339
Valient I	239
Viking I	79
Viking II	109
"500" Xmtr	445
122 VFO	25
Mobile VFO	19
NEW FACTORY-SEALED	
Ranger I w&t	225
Valient I kit	250
KNIGHT	
T-50 Xmtr	$ 29
T-60 Xmtr	39
R-100 Receiver	69
T-150 Xmtr	89
LAKESHORE	
Bandhopper VFO	$ 59
Phasemaster II	119
Phasemaster IIB	179
LAMPKIN	
105B freq. meter	$149
LOUDENBOOMER	
Mk III linear/Sup	$299
MARSAN	
NEW CCTV-2 Camera	$350
7" Monitor	125
17" Monitor	175
MOSLEY	
CM-1 Receiver	$129
TT-31 portable ant	49
MORROW	
MB-6 Receiver	$ 59
MB-560 Xmtr	59
MB-565 Receiver	49
RVP-260B DC Sup	19
TRS-600S AC Sup	29

MORROW—Cont.	
RTV-630 Supply	$ 29
3-band Conv (Cash As-Is)	10
5-band Conv (Cash As-Is)	20
NATIONAL	
HFS Receiver	$ 89
HRO-50 Receiver	149
SW-54 Receiver	29
NC-57 Receiver	49
HRO-60 Receiver	279
NC-88 Receiver	69
NC-98 Receiver	89
NC-125 Receiver	84
NC-155 Receiver	149
NC-173 Receiver	89
NC-183 Receiver	119
NC-183D Receiver	189
NC-190 Receiver	159
NC-240 Receiver	69
NC-270 Receiver	169
NC-300 Receiver	179
NCX-3 Xcvr	289
NCXA AC Supply	79
P & H	
LA-400 linear	$ 79
LA-400B linear	99
6-150 SSB Xmtr	219
DI-1 Scope	59
POLYTRONICS	
62B Xcvr	$279
62 Xcvr	249
NEW FACTORY-SEALED PC-6 6m (AC)	$245
RME	
VHF-126 Conv	$ 99
4300 Receiver	99
4301 slicer	49
4350 Receiver	129
4350A Receiver	139
6900 Receiver	249
REGENCY	
ATC-1 Conv	$ 39
SONAR	
NEW 40m. Xcvr	$250
SWAN	
SW-120 Xcvr	$189
SW-140 Xcvr	189
SW-175 Xcvr	189
NEW SW140 Xcvr	225
TAPETONE	
345 Skysweep	$129
TMC	
GPR-90 Receiver	$329
GSB-1 slicer	69

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and a voltage divider resistor of suitable physical size and electrical capacity can be mounted externally directly on top of the terminal block, supporting it slightly above the block by suitable spacers. Flexible leads from the voltage divider can then be led to a three or four point terminal block, appropriately marked, mounting it directly below the main terminal block, where the word DANGER now appears in the photo.

You'll find this little "power-house" a mighty handy and versatile piece of gear for your many experimental and testing operations around your shack or shop. Your cost can run anywhere from about five to twenty five dollars, dependent on your voltage and current requirements, how much equipment you'll have to buy and what your "junk-box" will produce. You have a wide leeway in choice of components and your physical dimensions can be adjusted to suit, but be *sure* and follow the circuit wiring shown in Fig. 2. . . . W7OE

Parts List

TS1—Cinch-Jones #10-141 Terminal strip
T—Chicago Transformer Company, PC-8414 Power transformer
F-1, F-2—Buss type HKP insert fuse holders
S-1—Cutler-Hammer #8280 SPST toggle switch-K16
IL-1, IL-2—General Cement #7908 panel light brackets
SR-1, 2, 3, 4—Sarkes-Tarzian silicon rectifiers type M-500
S-2—Cutler-Hammer #8300 DPST toggle switch-K7
CH—Chicago Transformer Company #C-1646 Filter choke
C-1, C-2—Sprague TVA-1611 40 mfd 350 volt electrolytic capacitors
R-1—IRC type 2D, 25 watt, 50M ohm, wire-wound fixed resistor
R-2 (A & B)—IRC type 2DA, 25 watt adjustable resistor and IRC type 2-D 20 watt 25M ohm fixed resistor in series
TP-1, TP-2—Cinch-Jones type 51 single terminal tie-points
Cabinet—LMB Chassis Box type 865-EL

Confessions of an Electronic Genius

and how to become one yourself

Fred Blechman K6UGT
23958 Archwood St.
Canoga Park, California

Have you ever been asked to fix a single-sideband transmitter, even though you weren't really sure how a simple oscillator works? Well, I have. In fact, I'm always being asked questions I shouldn't be asked. Why? Because in the minds of some around me, despite my claims to the contrary, I am an electronic genius!

How did I achieve this status? How can *you* attain for yourself the dubious distinction of being an "electronic genius?" Well, if you promise not to blab it around, here's the story . . .

The Genius Is Born

I suppose it all started when I decided to build my own radio-control equipment for a model airplane. The fact that I knew nothing about electronics didn't stop me; I was surrounded at work by electronic geniuses who could solve virtually any problem involving the lowly electron. Or so I thought. Anyhow, the kit I bought was a real collection of mysterious goodies; wire, coils, tubes, phenolic, and those cute little cylindrical things with the pretty colored bands. I meticulously followed the instructions and sketches in the assembly of the receiver, a simple "single-tube superregenerative receiver," according to the description. Since I had no equipment to check out its operation, I took it to work for the electronic geniuses to fire-up. They performed their usual mystical rites with strange looking devices. The receiver refused to be impressed by the display . . . and just did not work!

The next two weeks were almost too painful to describe. Complete lunch hours were consumed in discussion, theory and testing by the geniuses. My greatest contribution was keeping my fingers crossed. The geniuses, individually and collectively, all had their chance at trying to seduce "Fred's Folly" into operation. Words like superheterodyne, intermediate frequency, converter and mixer were generously sprinkled throughout their discussions. "But," I kept repeating, "this is a super*regenerative* receiver!"

The geniuses thought I had flipped. "Regenerative receivers went out with the Model T" they said, patting me on the head sympathetically.

Well, they finally gave up, and I was about to take up basket weaving as a new endeavor, when a hot spell proved fortunate; I noticed one of the silver-colored cartridge-shaped things in the receiver was leaking at one end, apparently from the heat. Could this be a bad part? It was marked ".01 MFD 100V." When this unit was replaced, the receiver worked. I had fixed it! The geniuses just shook their heads. "You are truly an electronic genius" they confided . . .

The Genius Grows

The bug had bitten. More receivers, more transmitters . . . and many more problems. Somehow, never really knowing how or why, I always managed to stumble on a solution. Pretty soon I found myself fixing other guys' equipment; you've heard the expression "the blind leading the blind" . . .

About this time I decided to really find out what electronics was all about. Somehow I was not able to find anyone who was willing to sit down with me for twenty minutes and tell me all there is to know about electronics. So I attended night classes at the local high school, where I got to twirl knobs in the lab. I bought test equipment with knobs of my own to twirl. I repaired every radio the neighbors found in their attics. And, most important of all, I subscribed to "73."

My reputation grew. Radio repairing is, after all, mostly tube changing, dial-cord restringing, replacement of obviously cooked parts, and a generous seasoning of good luck. (Knowing what you're doing can replace the good luck; in my case the good luck was the essential ingredient.) "You," they would tell me, "are an electronic genius!" By this time I was able to identify at least three different kinds of parts.

The Genius and the Theory

I found myself more and more becoming a victim of the never expressed, but universally accepted, theory of the masses: "He who knows *anything* about electronics knows *everything* about electronics." There is, however, a lesser known corollary to this theory: "He who knows *anything* about any particular branch of electronics knows practically *nothing* about any other branch of electronics." I couldn't convince anyone that the latter theory more expressed my capabilities. "If it plugs into the wall, or uses a battery, Fred knows all about it," they insisted.

The Genius Takes to the Air

Then I got my ham ticket. That really did it! When my roof began sprouting weird antennas, and the neighbors' TV sets began acting in a strange manner, they were more convinced than ever that another Steinmetz was their private electronic consulting engineer. I was asked about everything from ailing TV sets (I carry service insurance on my own set) to improperly operating electric blankets (when mine quit recently, I bought a new one). And it doesn't end there; I've even found myself answering questions on the air about how to plate-modulate a transmitter, or how to eliminate chirp on CW. Sometimes I have some idea what I'm talking about, but certainly not always. However, if I tell them I don't know what I'm talking about then I am considered overly modest; if I offer no suggestions, the conclusion is that I don't care enough to even think about the problem. A dilemma. I have found it easier to give them an answer they don't understand than to try to convince them that I'm talking through my chapeau.

The Genius Goes Stereo

Take the other night, for instance. Andy, who has known me long enough to know better, brought over a stereo tape recorder he had just built from a kit . . . his first tussle with electronics. He said that the left channel was dead. Not being a tape recorder specialist, or any other kind of specialist, I did the only thing I could think of at the moment; I plugged in the "kluge" and turned it on. Music poured forth from both channels, loud and clear. "What did you do to it?" Andy asked.

"Nothing," I replied.

"There you go being modest again," he said. "All you electronic geniuses are alike."

Then we tried to record. No erase. So I unbuttoned the whole works and looked at the maze of wire and stuff and things inside the chassis. I noticed two shielded cables from the erase head terminating in two plugs on the chassis. On a wild hunch (my usual method) I swapped the two plugs in their sockets. This cured the trouble. To Andy this was sheer wizardry. When I tried to explain the four-track stereo tape system, and the operation of the record and erase oscillator, he absorbed about as much as a third grader trying to learn the Pythagorian Theorem.

That's about the time the left-channel playback went dead. I had no recourse but to resort to the scientific approach. Using the dirty wooden handle of a small, dirty paintbrush that happened to be laying on my dirty workbench, I pushed and shoved everything in sight under the chassis. Responding to this precision trouble-shooting technique, the left-channel burst forth in full bloom. More probing disclosed that a single strand of shielding had lodged itself against the grid of the left-channel pre-amp tube!

Now the left-channel magic-eye record level indicator tube was acting oddly. Andy was obviously *right*-handed! No amount of pushing and shoving with the paintbrush handle did any good. This exhausted my supply of magic tricks, so I suggested that we put the whole works back in the case and be glad that it hadn't gone up in smoke. All buttoned up, we gave it the final check. No one was more surprised than I when everything worked, including the left-channel magic-eye indicator! "You did something when I wasn't looking," accused Andy.

With a knowing expression, I replied, "The hand is quicker than the 'eye,' my friend . . ."

. . . K6UGT

Squelch for the Twoer and Sixer

Richard Koenig WØTWP
3 Ladue Ridge Road
St. Louis 24, Mo.

The amazing litle "Benton Harbor Lunch Bucket" is a very popular transceiver and is found in practically every ham shack for communications of one type or another.

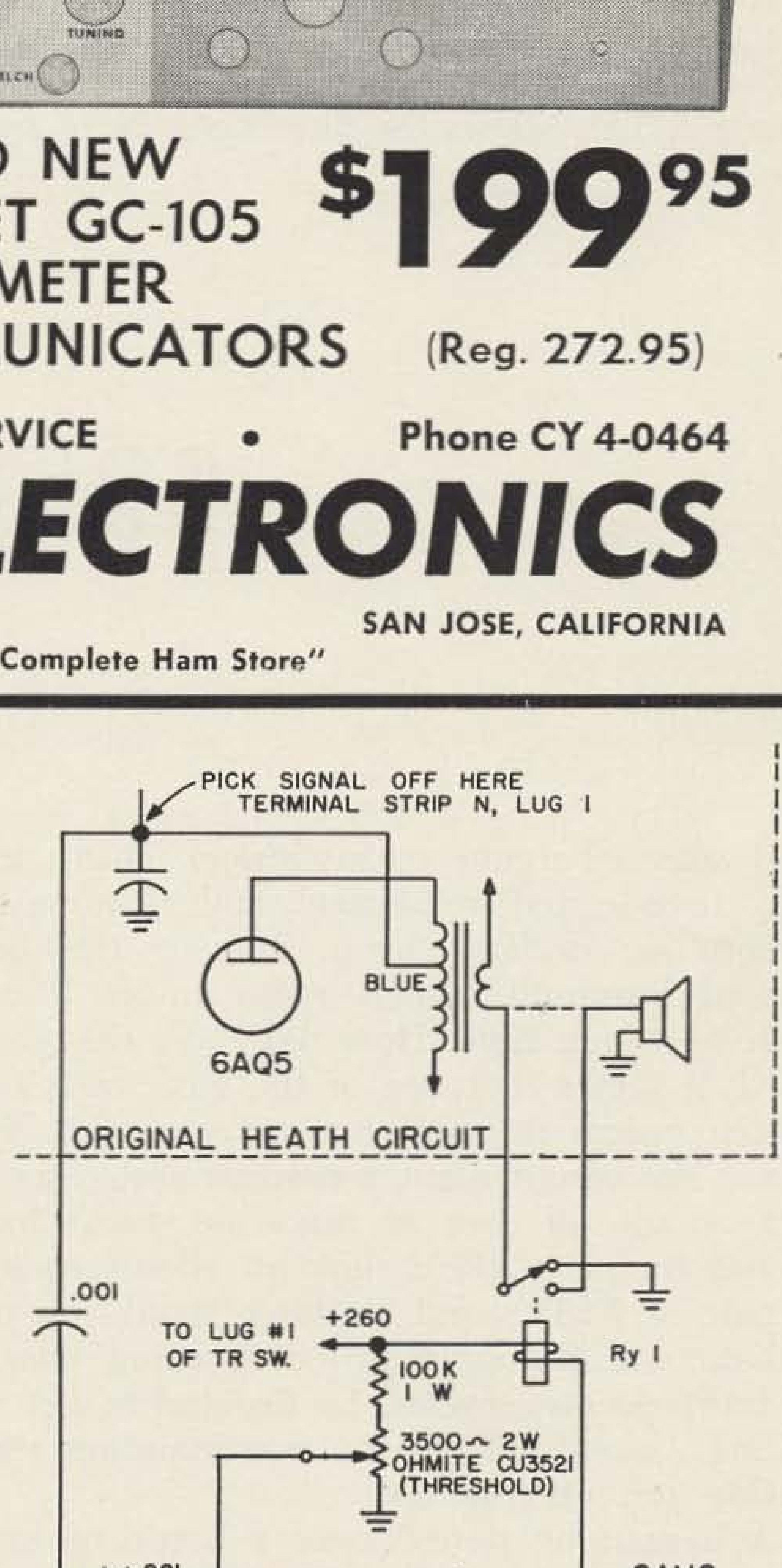
Although their performance is excellent, the characteristic hiss noise from the super regenerative receiver can be somewhat annoying while monitoring for any length of time. A good squelch, all will agree, would make the little beasts much more enjoyable during standby, while awaiting a signal.

This sensitive and 100% effective squelch has been used by the author and several friends with great satisfaction, both mobile and fixed. If you have a TWOER or a SIXER, we would like to share our enthusiasm with you.

Here is how it works. The annoying hiss noise, which has its main components above 8000 cycles per second, is considerably higher in audio frequency than the audio modulation frequencies of an incoming signal. This hiss, which drops in level when an incoming signal appears, is used to actuate the speaker killing circuit.

The receiver audio signal, taken from the audio output trasnformer primary tap, is passed thru a high pass filter, rectified and applied as a negative control grid voltage to a 6AV6 dc amplifier. With no signal present the high negative grid voltage, created by the high hiss level, reduces the plate current of the 6AV6, which opens the plate relay, killing the speaker. When a signal appears, the hiss level of the receiver decreases and lowers the negative grid voltage to the 6AV6. This causes it to draw higher plate current and closes the plate relay, actuating the speaker.

The squelch threshold control, R1, is adjusted to bias the grid circuit of the 6AV6 to hold the relay just open, with no signal present. For any chosen volume control setting, there is a point on R1 which will set the squelch at the edge of the threshold.



APPROXIMATELY 3 Ma. ACTIVATES Ry I

RY.—spdt relay 10,000 ohm P.B. type RS5D
CH.—.250 hy rf choke Suprex Varichoke V-70

Although very suitable for outboard arrangement, since only power and three leads are involved from the transceiver, the squelch has proved so satisfactory that it has been installed on the chassis of each set used in the pioneering and tests. The threshold control mounts on upper front panel, the relay on a piece of plastic mounted on speaker bracket and the 6AV6 on the chassis between the filter can and the 6AQ5. Well worth the effort.

The use of a Vector lug type socket for the 6AV6 enables all small components to be mounted and wired directly on the socket prior to mounting. A reminder may be in order to leave some length on the diode leads to protect them from heat while soldering. The 250 mh choke should have its ajustable core fully engaged. This allows the filter network to pass 8000 cps and higher. The dc output of the diode bridge rectifier, as measured at the + − signs on the schematic, should read approximately 12 volts with the volume high and no signal tuned in. (20,000 ohms per volt meter used)

For the best stability, the regeneration control of the transciever, R11, should be advanced to near maximum. L5 and L6 can be adjusted, with the meter connected, to make the no signal control voltage constant across the entire dial.

Due to its unique principle of operation, this squelch is not triggered by normal noise or automoble ignition, which proves to be a pleasant feature while mobiling or operating in a noisy area.

. . . WØTWP

$25 Cheap

Leonard Tamulonis W1MEL
73 Staff

It was a bargain at any price! Thirty feet tall, three-legged, solid steel, and all mine for twenty-five dollars cheap. It was the best darned windmill turned radio tower I had seen in a long time. How did I get this gem? Well, it seems that one of the local boys had gotten orders to paint his tower, or his XIL swore she would plant a petunia and clinging vine jungle all over it. Since he didn't have money for paint (he'd sunk his allowance into a pair of 813's) and couldn't stand the humiliation of trying to prune Morning Glories to fourteen megacycles, he decided to get rid of it . . . and li'l old me was standing right beside him when he did.

A bargaining period over a bottle of brew brought the price to the aforementioned twenty-five dollars, along with a fifteen meter beam thrown in with the tower for chuckles. Now came the problem of moving the thing.

Getting this cargo clear across town to the QTH was not going to be an easy matter, but a quick call to a friend in the concrete block business brought the loan of a twenty-foot open truck. Block and tackles, ropes, chains, cases of beer, and whatnot were all assembled, and we waited for the following Saturday morning when we'd rise bright and early to face the task of moving said tower to Fulton Street.

There were six of us that fateful morning . . . the other three had shown up to kibitz, watch, and generally make trouble. It was immediately decided to hook a block and tackle to the top of the tower, and string it to the top of a nearby tree. In this way all we had to do was tip the tower and slowly let out the line until the tower was gently set on the ground. But of course it never happened that way. After getting all set, the tower was tipped, and the block and tackle slowly let out. By some miscalculation Joe Gooberduck was stationed at the pulley rope. Now Joe is not the type to be put in such a position, because he's only five feet three, 113 pounds and underfed. So down came the tower, and up went Joe.

After the dust had cleared, Joe was nowhere in sight. He was stuck high up in the nether regions of the tree, with the pulley rope wrapped around his head. Someone eventually got up enough courage to get a ladder and let Joe down. We all stood back when he reached the ground, but since he was so small, all he did was go behind the garage and kick the fence a few times.

When the fun was over, everyone silently stood around and surveyed the situation. Fortunately the tower was not damaged to the extent that a little whanging with a sledge hammer wouldn't fix, so once more we all hitched up our belts and prepared to move the monster* onto the truck. After backing the truck into the yard,** two leverage poles were forced under the tower legs, and everybody strained . . . nothing happened. We all tried again, and this time we accomplished something . . . two backs were sprained. We gave up until the next morning.

We started again early the next day, and this time we succeeded in only crushing two fingers, and spraining one wrist.*** It was worth it though, we finally got the thing on the truck. All this was accomplished, mind you, in the fantastically short time of six and a half hours. We backed out of the yard,**** and started up the street. We didn't get to the corner, when a jar shook the truck. Low hanging telephone wires had done us wrong. The monster was sticking up over the roof of the cab, and had caught on some nice, expensive looking cables. A call to the telephone company, an explanation, and a flattening of the wallet soon set things straight.

We couldn't pull the tower much lower on the truck, so a man was put on the tower top to call warning of any coming obstructions. We started up again, and had not gotten as far as the next corner when I heard a scream. Our man on the tower got caught on a phone pole, and was hanging onto a cross member for dear life. He got down by himself, but he spent the rest of the day pulling splinters out of his legs, and nursing his newly flattened feet. This put a stop to riding on the tower . . . it didn't look very cute anyway.

We got the rest of the way across town without too much trouble, although we sure got stares from startled pedestrians. After all, it isn't every day you see a windmill covered with radio hams grinding down a busy street. We got stopped by a gendarme who wanted to know what a windmill was doing on a truck with all kindsa funny people crawling over

* We had come to the point of giving it an affectionate handle.

** Being careful to drive in the flower beds.

*** All mine

**** Again making sure to drive in the flower beds.

it. We started to explain, but when we told him we were radio hams, he just mumbled and went back to his beat. The ham faction is well known in this town.

Approximately five hours after blast-off we arrived at Fulton Street, where we thought we'd be safe. But, our haven was short-lived, because the neighborhood kids had their scouts out, and they all were waiting for us when we turned the corner. This isn't the safest way to travel . . . I mean with tykes gamboling in front of a ten-ton truck you are driving. Asking them to desist brought nil results, so all the neighborhood parents were put on alert, and *that* got results! In fact one of our windows still gets broken now and then by one tyke who still remembers, even though he's in his twenties now.

After some jockeying to line it up with the driveway, the truck was backed into the yard. Five minutes later someone remembered to open the gate. This was a silly thing to think of now, because the gate had been sort of opened by the truck. Anyhow, we backed the whole shebang into the yard, and unceremoniously slid the tower, beam and all into the nearest rosebush. After everything was unloaded, the truck was driven out of the yard and over the gate, leaving some nice big ruts in the lawn for the kids to play in.

We quickly fell to work in getting the block and tackle hopelessly tangled in the tower struts, and seeing how long it would take to get the beam bent beyond recognition (it didn't take too long). One of the kibitzers suggested reversing procedure in putting the tower up as opposed to the way we took it down. Who ever heard of something falling up? The tower was maneuvered so the base pointed to the foot of an old Oak, and a block and tackle was fastened to the mast-hole. One of the more nimble-footed members of our lot volunteered to climb the tree and tie the other end to a sturdy looking branch near the top. Of course something had to go wrong. No matter how sound our ideas may be, something always happened. This time, we found that the sturdy looking branch was stuck to the tree with a little bit of rotten bark. You can guess what happened . . . we spent the next few minutes picking pieces of rotten wood out of our noggins.

The rope was re-tied further up around the trunk and the tower was hoisted up and settled into position without any more trouble. Our tree climber untied the rope and shinnied down to join us. We all stood in a group and watched the beam swing merrily in the wind. I forgot about the co-ax.

Nobody noticed this little oversight, and I wasn't about to mention it, or I would have been hung from the elements. I prudently suggested we all go and open some cases of brew to cap off this little tower raising bee. The motion was seconded and passed, and we all adjourned to consume some light special.

The tower had been up for two hours when the telephone rang. "You're messing up Lawrence Welk. Get you're radio station off the air or I'll call the police!" My protests were given to a dead phone . . . the caller had hung up. Three more calls followed almost immediately, and they were all about TVI. I wasn't even on the air! I didn't have any co-ax on the beam! The mere presence of the tower revealed the fact that I was a radio ham. The calls continued all night long, and every night for the next week. I got so disgusted with the whole thing, I never put co-ax on the beam. I've been trying to get rid of my little advertiser ever since.

So there she sits today. Rusting away in the rear of the house with a free-wheeling 15 meter beam spinning away with the wind. There's a dandy squirrel's nest on the rotor platform, and a sagging 40 meter doublet hanging from the mast-hole. I still get an occasional phone call about TVI, but it's usually from some new neighbor who saw the tower, and mistook ignition interference for me on channel five. Anybody want to buy a tower . . . cheap? . . . W1MEL

Letters

Dear Wayne,

What are you going to do about the slanderous statements made by W4HMK/1 in June QST? I realize that he will be excommunicated, but shouldn't we retaliate?

Harvey Rock WA2BWQ

The QST financed Hiner "survey" is a great promotion idea. I'm now making plans for 73 to finance a similar survey and have been guaranteed that our *impartial survey will show that 73 is almost entirely responsible for all sales of ham equipment.*

Dear Wayne,

Regarding the ARC-3 transmitter conversion, June 1963: This article may cause some readers to assume that the automatic tuning equipment is useful primarily for commercial remote control service. Actually, it is very handy for ham operation, particularly when you consider that it comes installed, ready for use. Unlike the 522 or ART13, there are no preset channels, and as a result, no problems regarding VFO operation. Before removing the autotune, try it out.

James S. Hill W6IVW

Incentive Licensing and the Institute of Amateur Radio

Membership applications for the Institute of Amateur Radio have taken a sudden leap upward following the ARRL's decision to try to get the FCC to return to the old principle of restricted voice bands for the few. It has been slowly dawning upon tens of thousands of General Class licensees that this means that they will be virtually thrown off phone unless they decide to stand up and fight for their interests. The only other organization we have in ham radio is the Institute and they are turning to it in increasing numbers.

Now though the Institute was formed for peaceful purposes, the extent of the approaching disaster seems to call for drastic measures. Before the Institute can take a stand it must know the desires of the members so it can express these desires to the best advantage and coordinate the group effort for maximum effect.

Membership in the Institute is one dollar per year. There are at present somewhat over 2000 paid members. Members will receive an attractive membership card and may use the Institute insignia on their QSL cards.

Membership Application: Institute of Amateur Radio

Name .... Call ....

Address ....

City .... Zone .. State ......

Class License .... Licensed since ......

– I am opposed to restricted voice bands.

– I am not opposed to restricted voice bands.

(All present members of the IoAR are requested to send in this form so we can count your vote too.) Mark here if you are a member.....

International Crystal's

Add On Circuit

When the ads for the International Crystal Add On Circuits came out a few weeks ago our eyes lit up. Something new! We sent immediately for the spec sheet to see what was involved. We were skeptical of the idea, we have to admit, fearing that a unit built up out of individual circuits would be far more costly and poorer performing than regular commercial units.

We should have known better. International Crystal has been putting out circuits for quite a few years now and they have all been just about unbelievable in their performance and low cost. They must be using wetbacks or something on their assembly lines to keep costs down so far.

When the poop-sheet arrived we all poured over it and decided that we'd try a cascode grounded grid two meter converter. This seemed like the best test we could make since we had a Tapetone 417A converter and a new Amplidyne nuvistor converter on hand for comparison. We made out the list of circuits we needed and sent it down.

Within an amazingly few days a carton of small boxes arrived. About three hours later these had resolved themselves into a good looking two meter converter. The assembly was quite simple and the wiring could easily have been done by a female Novice.

It doesn't really make any difference how reasonable a converter is in price or how beautiful in looks if it doesn't do a good job of converting. We took the converter to our new VHF shack and set up a comparison test using a Waters coaxial transfer switch so we could get S-meter readings on the AOC converter and the Tapetone converter or the Amplidyne converter. In theory the 417A Tapetone converter should have been a little better than either of the others, but in direct comparison we found that the International Crystal Add On Circuit converter and the Amplidyne were about equal and both better than the Tapetone. This tells us two things: the AOC converter is indeed a hot one and our Tapetone converter needs some work.

After looking over the data sheets on the AOC's we discovered that merely by changing the crystal and retuning the slug-tuned coils we would have a 220 mc. converter. Since we're planning on using 220 soon the converter is back on the workbench being retuned and a new crystal is on order.

The basic idea of the Add On Circuits is that you can buy just the circuits you need to build the equipment you desire. Later, if you want to change it to something else or add an extra stage of amplification, it is very simple to do.

For instance, on the two meter converter we start out with a slug-tuned coil for the input, a 6DS4 nuvistor grounded grid stage, a double slug-tuned coil unit, a 6BH6 mixer unit, a crystal local oscillator unit, a coil unit, a 6DS4 multiplier unit, another coil unit and a power connection unit. Goes together like building blocks.

Just one use of these new circuits convinces us that International Crystal has a great idea there. We might expect a lot of imitators if they hadn't shrewdly kept their prices so low as to discourage competition. The bill on the complete two meter nuvistor grounded grid nuvistor cascode converter, including all tubes, hardware, chassis, etc., was only $68.35!

Drop a card to International Crystal, 18 North Lee, Oklahoma City 1, Oklahoma and ask for their spec sheets on the AOC's.

. . . Wayne

Knight-Kit Code Oscillator

Knights-Kits for all sorts of ham gear have been springing up in profusion. Allied Radio has been consistent in their program to produce low cost equipment in kit form which performs well. The new LC-1 code practice oscillator kit priced at only $7.95 is a good illustration. This kit includes a complete oscllator, cabinet, loudspeaker, hand key, plus a jack for earphones and a flashing light. The kit assembles easily, giving confidence to any neophte that he need not be frightened by the mysteries of electronics.

The oscillator is LOUD. This unit can be used for any size group that you will probably be able to gather for practice. Around the 73 Hq we not only use the LC-1 to pry our one lazy Technician into the General ranks, but it also serves to warn of impending meals and to wake everyone up in the morning. We get a lot of mileage out of things here.

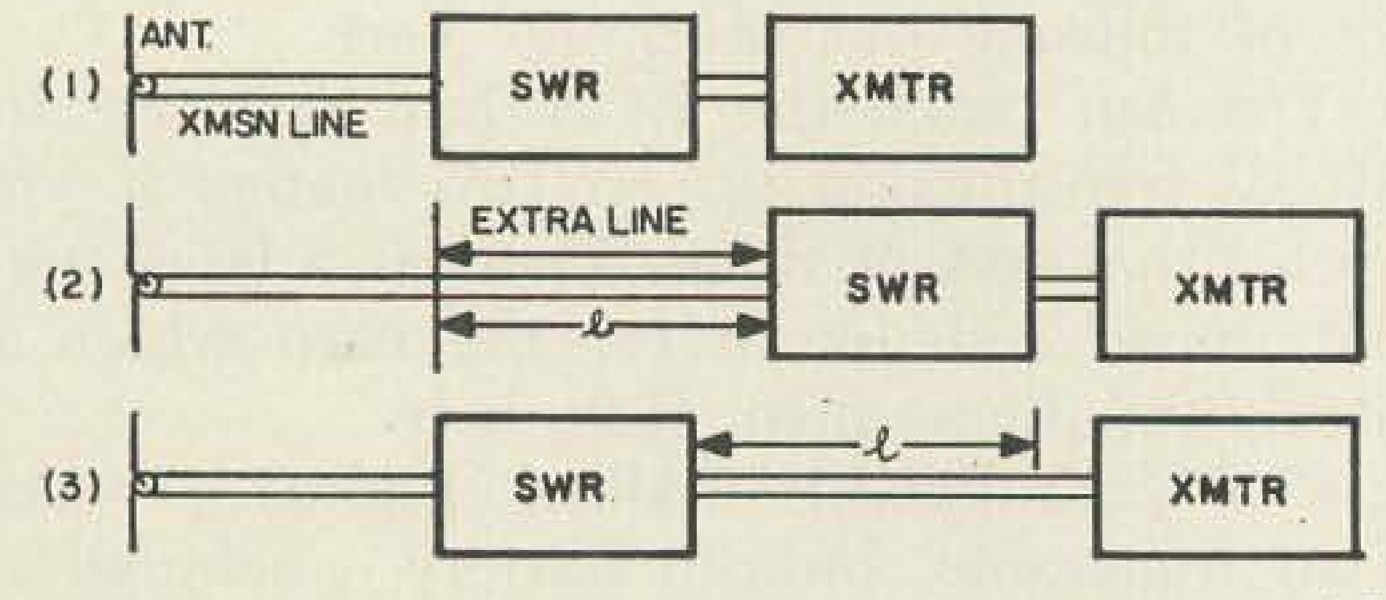
You can patch the LC-1 into your rig for MCW transmission up on two meters if you go for that sort of thing. There is a label with the morse code on it for the case which is handy for phone men. Heh, heh.

$7.95, Knight-Kit (Allied Radio). Works. Two transistors, built-in battery (included in kit), profusely illustrated instruction book, etc.

More on the use of The SWR Meter

Richard Williams W8JWP
3327 13 Street S.W.
Canton 10, Ohio

On a low loss transmission line which is perfectly matched at the antenna termination the rf voltage along the line is just that of the incident wave and is nearly constant along the full length of the line. However, if the antenna termination is not perfectly matched, a wave will be reflected back from the antenna end of the line and this reflected wave will have a voltage whose magnitude is something less than that of the incident wave. We now have two waves traveling on the line. In the case of an unmatch at the transmitter end we will have multiple reflections and will have many individual waves. However, all of the waves traveling in one direction can be added together to form a single wave traveling in that direction. Thus, we need only consider two waves, one traveling from the transmitter to the antenna end of the line and one traveling in the opposite direction. Both of these waves, when considered individually, have a magnitude which is relatively independent of the position on the line at which they are measured. However, when we add the two waves together to get the total rf voltage, we find that because the phase relationship which exists between the two waves is a function of the position on the line, that the *total* voltage is also a function of the position on the line (this is the voltage one would measure with a simple rf voltmeter inserted across the line). If the magnitude of the reflected wave is equal to that of the incident wave, there will be points one-half wavelength apart on the line where the *total* voltage is zero, even though the voltages of both the incident and the reflected waves at this point are *not* zero, and are, in fact, the same as they are at every other position on the line.



Mr. Wilds, in his article on p. 42 of the October 1962 issue of 73 makes the statement that since most of the inexpensive SWR bridges are voltage operated devices, that locating the SWR bridge at a voltage null point on the line will cause the SWR to appear to be deceptively low. This is not correct for a correctly adjusted bridge because the SWR reading which is obtained is proportional to the *ratio* between the voltage of the outgoing wave and the reflected wave and *not* to the *total* voltage existing on the line at the point where the SWR meter is inserted. If the SWR meter is operating correctly and if the length of the feed line between the transmitter and the receiver is not changed, the reading obtained on the SWR meter should not vary with its position in the feed line, assuming that the SWR meter itself does not introduce any discontinuities.

Mr. Wilds suggests the using of an extra piece of coax to determine whether the indicated SWR is different from the actual SWR. This is somewhat misleading, since if there is a mismatch between the transmitter and line as well as between the line and the antenna, changing the length of the transmission line between the antenna and the transmitter may very well change the *actual* SWR on the line. However, the extra–coax method is quite valuable as a test of not only the matching of the antenna to the line, but also of a test of whether the SWR meter is operating correctly, and of the match between the transmitter and the line.

The following procedure can be used to determine whether the fault lies in the SWR bridge or in the match between the transmitter and the line. For the most dependable results, it would be a good idea to try the experiment twice with two different lengths of coax, l, neither of which is a multiple of λ at the operating frequency.

First connect the circuit as shown in (1) and measure the SWR, then connect it as shown in (2) and (3) and get SWR measurements in both cases. If all three SWR measurements are unity, the line is well matched at the antenna termination, but no information is obtained on either the SWR meter or the transmitter–line match. If this is the case, and if it is desired to check the latter two items, a deliberate mismatch may be introduced at the antenna end and the measurements repeated again. Assuming now that SWR measurements other than unity are obtained, we can list the following conditions and their causes:

A. If the SWR obtained in all three cases is the same, the SWR meter is operating properly and the transmitter is matched to the line, but the antenna is unmatched.

B. If the readings obtained in (1) and (3) are the same and different from that obtained in (2), then the transmitter is properly matched to the line, but the antenna is unmatched and the SWR meter is not operating properly.

C. If the readings obtained in (2) and (3) are the same, but different from that obtained in (1), then the SWR meter is operating properly, but neither the antenna nor the transmitter is matched to the line.

D. If none of the readings agree within a few percent, then the SWR meter is not operating properly, the antenna is not matched to the line, and the transmitter is not matched to the line.

If the above tests indicate that the SWR meter is not operating correctly, then it should be adjusted according to the manufacturer's instructions, using a good dummy load and operating at the same frequency at which it is desired to make the transmission line measurements. After the SWR meter is adjusted correctly, if trouble is still encountered getting either an (A) or a (C) condition, the trouble may be in the introduction of discontinuities at the coax connectors which are used in inserting the short length, l, of coax into the transmission line, or the SWR meter itself may be disturbing the line. Once these problems are eliminated, the above procedure may be used to match *both* the antenna *and* the transmitter to the transmission line.

Mr. Wilds also makes the statement that by using the proper length of line it is easier to load up the transmitter. This is true insofar as getting the maximum power out of the transmitter is concerned, but the very fact that the line still is not flat means that an excess amount of power is being lost on the line due to the waves which are being reflected back and forth, and/or that power reflected back along the line is being dissipated in the transmitter tank circuit. The only way to get rid of these losses or to reduce them to a tolerable level is to have a reasonably good match on both ends of the transmission line. This is the only method of getting the most transmitter power into the antenna, and it has the added advantage of reducing TVI (either directly or by permitting the use of a low-pass filter in the line). . . . W8JWP

Vertical Antennas

Herbert Brier W9EGQ
385 Johnson Street
Gary 3, Indiana

Apparently an increasing number of new hams getting on the lower-frequency ham bands are putting up vertical antennas, but most old timers still prefer the horizontal antenna. Does this mean that the newcomers are being oversold on the vertical through lack of theoretical and practical knowledge, or are the old timers overlooking a good thing by passing up the vertical antenna? Let's try to find out.

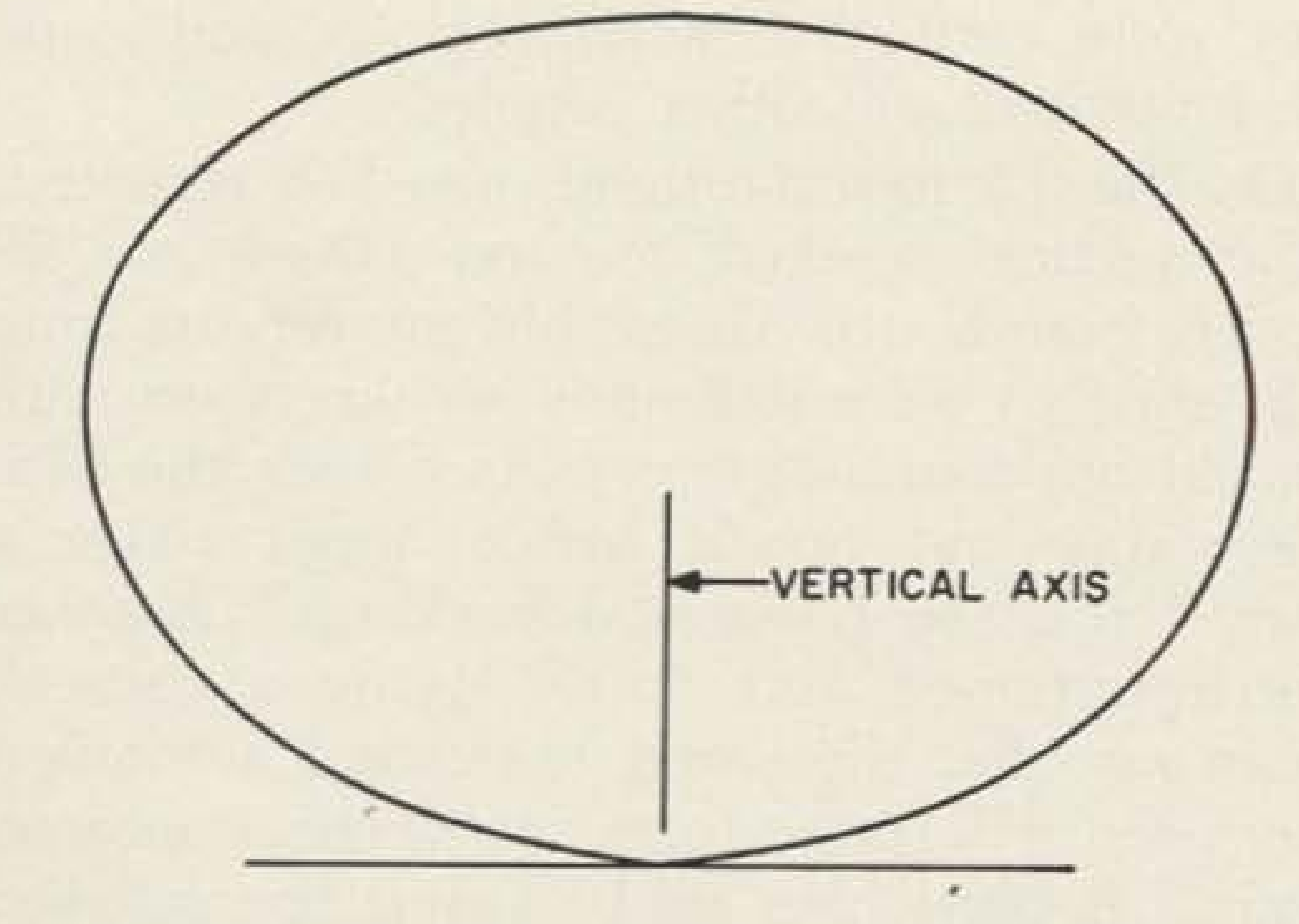
What Makes a Good Antenna

Obviously, how well an antenna performs is determined by the percentage of the power fed into it when it radiates in the desired direction. *Direction* in this connection means both the compass direction and the angle above the horizon at which the radiation takes place. The latter is important, because practically all radio communications over distances much in excess of 50 miles on the frequencies between 1.5 and 30 mc are accomplished by signals radiated by transmitting antennas at angles above the horizon striking the ionosphere between 65 and 250 miles above the earth and being refracted back to the earth miles away.

For example, between the U.S.A. and Europe, signals arrive at angles between 10 and 35 degrees on 7 mc 99% of the time. On 14 mc, the arrival angle is between 6 and 17 degrees 99% of the time. Nine degrees is the median angle for DX signals on 10 meters. Higher angles of radiation are, of course, useful over shorter distances, particularly on the lower-frequency amateur bands.

With these facts in mind, let's look at the vertical radiation patterns of the simple horizontal and vertical antennas shown in Fig. 1A to 1D and 2A to 2D. From these patterns, it is easy to see that a horizontal antenna requires a height of 65 to 70 feet (½ wave on 7 mc, 1 wave on 14 mc) to achieve the low angles of radiation most desirable for DX work. But a vertical antenna ¼ to ⅝ wavelengths long is a powerful low-angle radiator. (Even a ⅛ wave vertical is a low-angle radiator, but the losses introduced by the necessary loading coil and other factors touched on later decrease the efficiency of such short antennas.

Incidentally, Fig. 2A to 2D apply to vertical antennas operated against an artifical "ground plane." In its simplest form, a ground plane consists of three or more (usually four) ¼-wave wires arranged like spokes of a wheel under the base of the antenna. Strictly speaking, the artificial ground must be at least ¼ wavelength above the earth to function as a true ground plane. At lower heights, the effective ground establishes itself somewhere be-

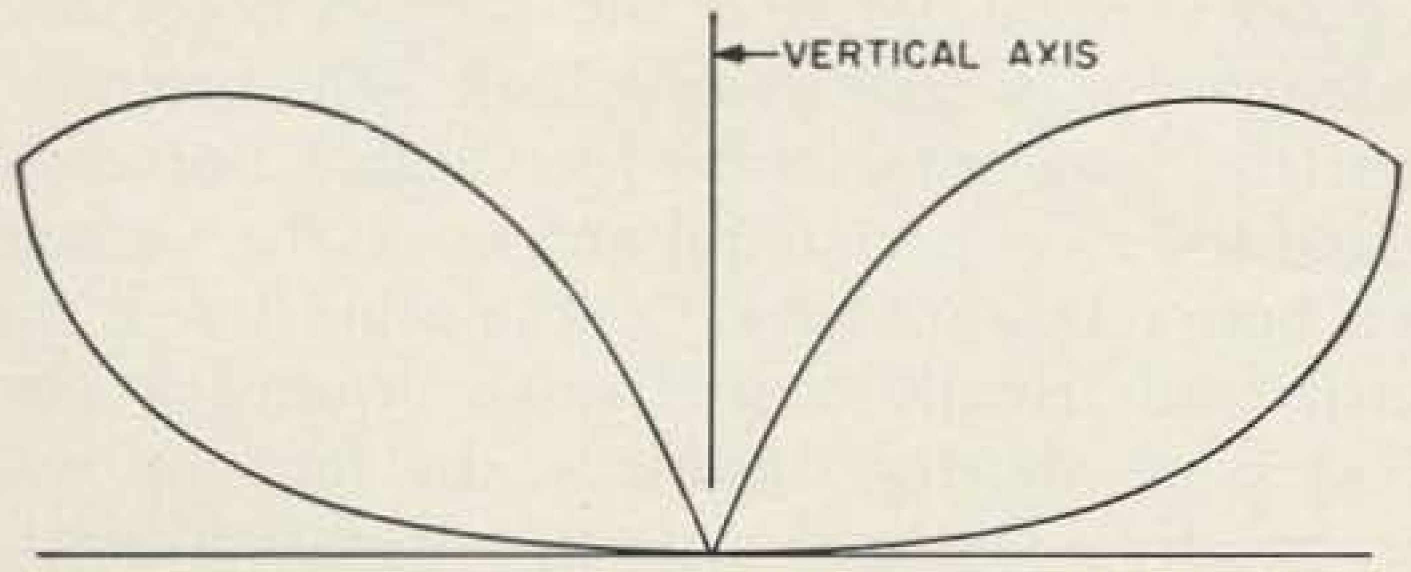


HORIZONTAL ANTENNA 1/4 WAVELENGTH HIGH

VERTICAL PATTERN OF HORIZONTAL ANTENNA 1/8 WAVELENGTH HIGH IS SIMILAR, EXCEPT LESS POWER IS RADIATED BELOW 45°.

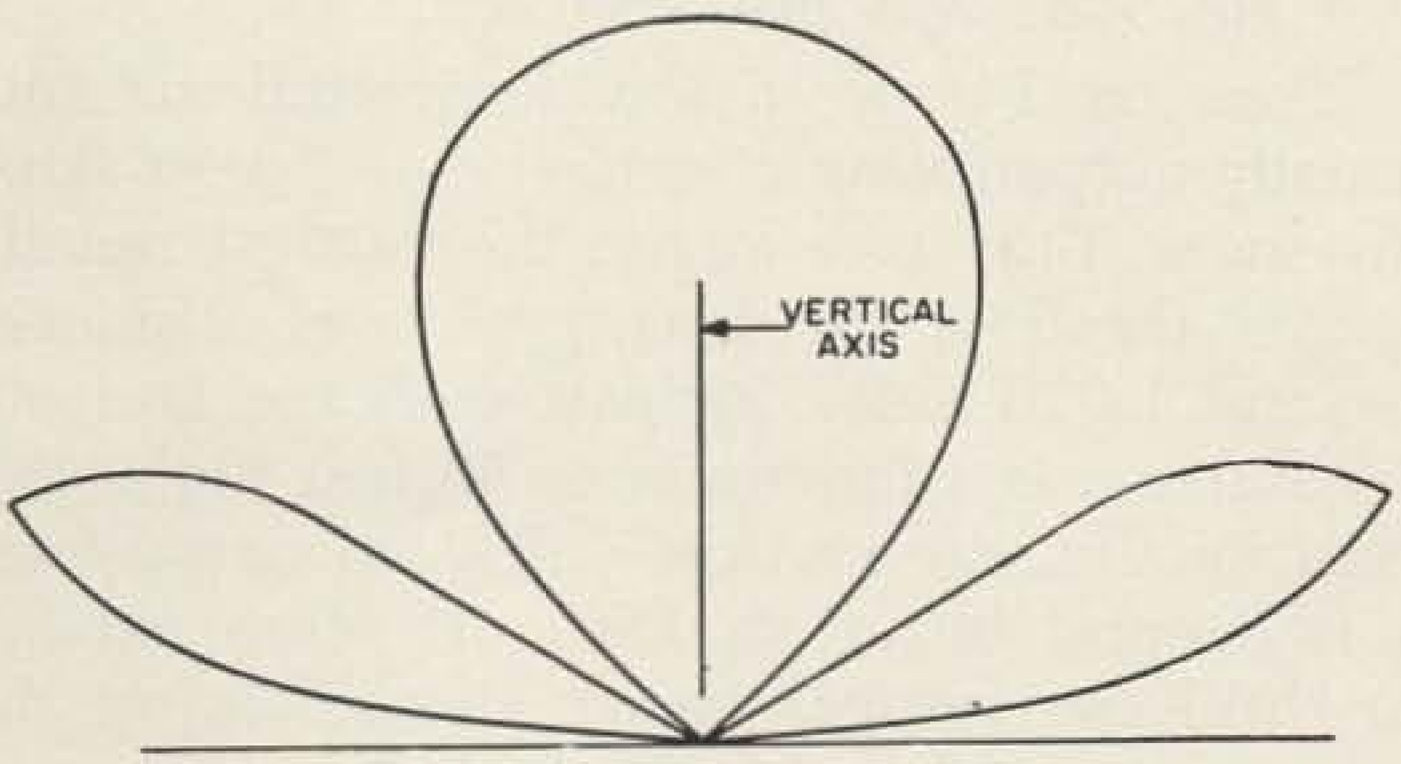
FIGURE 1A

Figures 1A, 1B, 1C and 1D. Radiation patterns in vertical plane of horizontal antennas 1/4, 1/2, 3/4 and 1 wavelength high respectively. Perfect ground assumed.



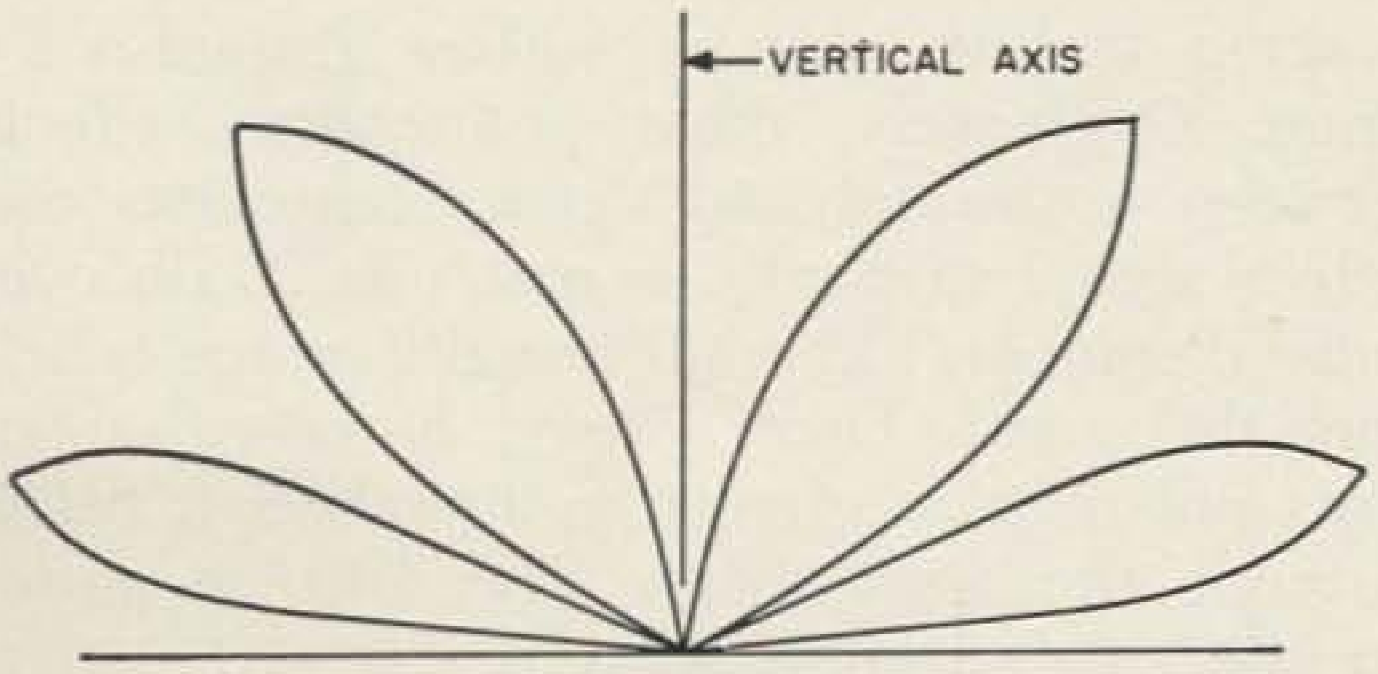
HORIZONTAL ANTENNA 1/2 WAVELENGTH HIGH

FIGURE 1B



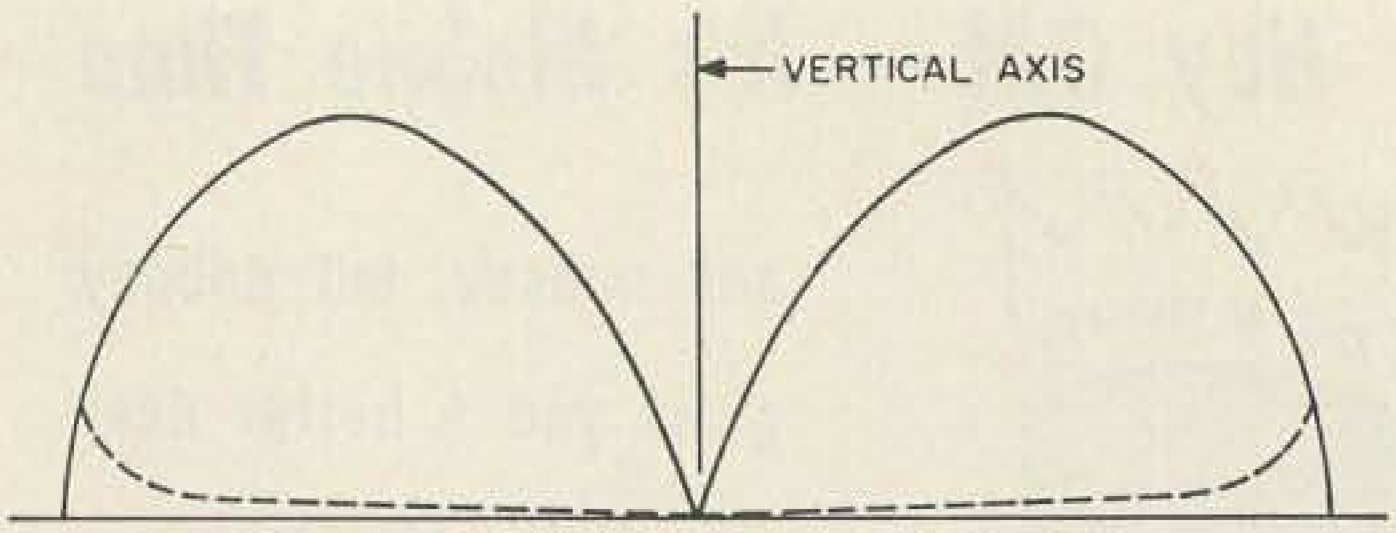
HORIZONTAL ANTENNA 3/4 WAVELENGTH HIGH

FIGURE 1C



HORIZONTAL ANTENNA 1 WAVELENGTH HIGH

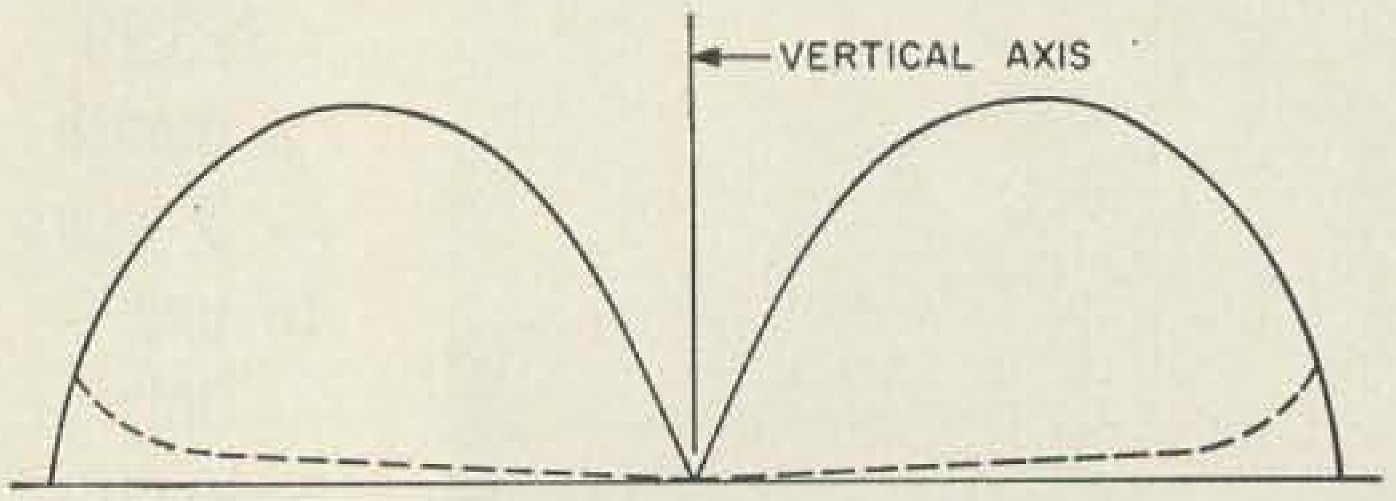
FIGURE 1D



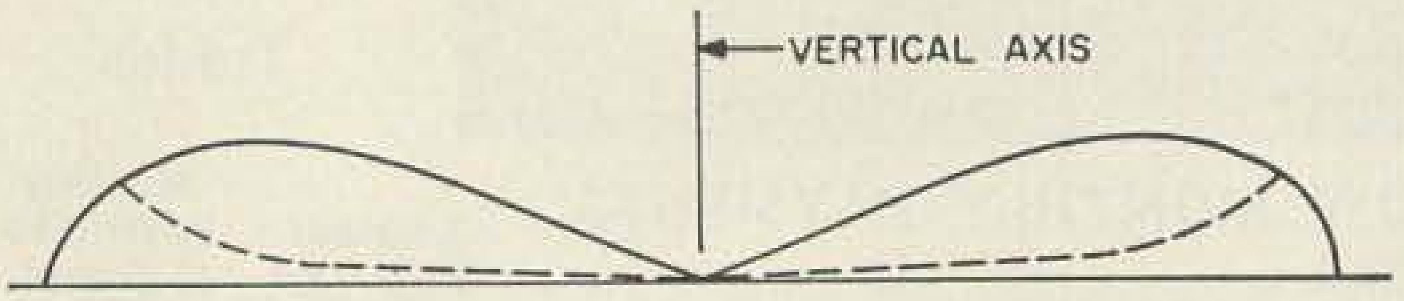
VERTICAL ANTENNA 1/8 WAVELENGTH LONG.

FIGURE 2A

Figures 2A, 2B, 2C and 2D. Radiation patterns in vertical plane and all compass directions of vertical antennas 1/8, 1/4, 1/2 and 5/8 wavelengths long, respectively. Antennas mounted a few inches above earth or ground plane. Power at angles below dotted lines absorbed by ground losses.

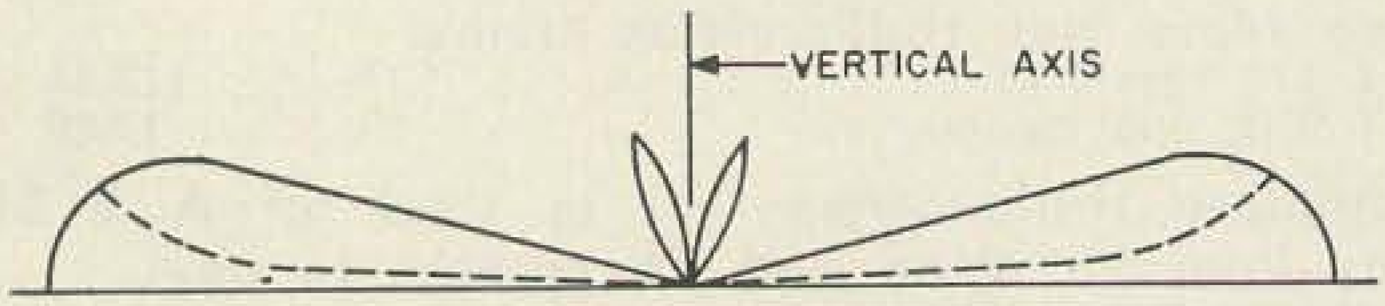


VERTICAL ANTENNA 1/4 WAVELENGTH LONG.
FIGURE 2B



VERTICAL ANTENNA 1/2 WAVELENGTH LONG

FIGURE 2C



VERTICAL ANTENNA 5/8 WAVELENGTH LONG

FIGURE 2D

tween the earth and the artificial ground; nevertheless, these lower quasi-ground planes usually work quite well.

From the above information, it is easy to see why the vertical antenna has the reputation of being a good DX antenna. But how does it live up to its promise?

The ARRL *Radio Amateur's Handbook* says, "If it were not for its ground losses, the omnidirectional radiation pattern and its low angles of radiation would make a vertical antenna an ideal high-frequency antenna."[1] Dr. Terman, in *Radio Engineer's Handbook* says that when proper precautions are taken to reduce ground losses, the vertical antenna is an efficient radiator.[2]

What Amateur Users Say

In the following paragraphs, the opinions expressed are based upon personal experience and observation and conversations with hams who had taken some pains to achieve reasonable results from their antennas, whether they were vertical or horizontal, as well as on the footnoted and other articles.

On the 3.5 to 4-mc band, one W8 reported, "The vertical worked fine on DX–I got S9 reports from South Africa, but my reports from U.S. stations were definitely weaker than with the old horizontal antenna. As I work the U.S. every day and South Africa about twice a year, I put the horizontal back up." Another ham questioned said, "after trying a vertical, I can say that the worst horizontal antenna I ever used will outperform any vertical antenna made." A third ham said, "I must be satisfied with my vertical; I took down all my other antennas." On the average, a 3.5-mc vertical antenna is superior to a horizontal antenna over distances in excess of 850 miles, especially if the horizontal is less than 60 feet high. Conversely, the horizontal may be several S units better over shorter distances.

On 7 mc there is little to choose between a good vertical antenna and a good horizontal antenna for working long-haul DX–provided that the horizontal is 67 feet high.[3] But compared to lower horizontal antennas, the vertical is a better DX antenna. On the other hand, the horizontal usually works rings around a vertical over shorter distances. In fact, it was practically a waste of time to call stations within 500 miles or so with my vertical antenna, although the 23-foot high horizontal usually did very well over these distances. But as soon as "skip" lengthened out, results with the two antennas was just reversed.

Even on 14 mc, a low horizontal antenna usually outperforms a vertical over "short-skip" distances. But, once again, the vertical usually forges ahead of the horizontal over distances beyond 1,000 miles, at least until the horizontal antenna is a minimum of 50 feet high. And occasionally, the vertical will even outperform a horizontal beam on DX–just often enough to thrill the vertical owner and shake up the beam owner. On the 21 and 28 mc bands, there is little to choose between the two types –if the horizontal is at least 45 feet high.

Incidentally, a vertical antenna is fine for working mobile stations within ground-wave range. Conversely, cross polarization effects between horizontal and vertical antennas can reduce signal strengths as much as 23 db over these distances, although the difference is seldom this great. Don't worry, however, about cross polarization effects on signals that travel through the ionosphere. The trip so mixes up the polarization that there are equal amounts of both in received signals, without regard to their original polarization.

Installing a Vertical Antenna

According to some ads, a vertical antenna and a few square inches of space will solve most ham antenna problems. True enough, a vertical antenna installed in a crowded space will accept rf power and radiate part of it, the exact percentage depending largely on the ground losses under and near the base of the antenna. In addition, a ¼-wave or shorter vertical antenna radiates its strongest signal from the bottom third of its length; consequently, objects such as trees, buildings, and utility wires within a wavelength or more of the antenna will absorb part of the power radiated. They will also distort the theoretical circular radiation pattern of the antenna.

In this connection, the possibility of getting the antenna above some of the "crud" is the main advantage to a ground-plane antenna on frequencies where line-of-sight communications are unimportant. On the VHF bands, however, antenna height is a major factor in determining the communication range.

Unfortunately, a ground plane antenna is not easy to erect on frequencies below 14 mc. Even if you can stand a radiator of the appropriate height on your roof, where are you going to find room for the necessary ground-plane radials? You can reduce their length by installing loading coils in them, or you can zig zag them around in the available space—at the expense of lowered antenna efficiency.

"But what about mobile antennas," you may reasonably ask. "They use the car body as the ground system, and there are lots of mobiles on 75 meters." Passing over the 3% efficiency of the average 75-meter mobile antenna,[4] it is certainly possible to put a wire mattress the size of an automobile under a vertical antenna to serve as the ground system. In fact, one well-known antenna manufacturer

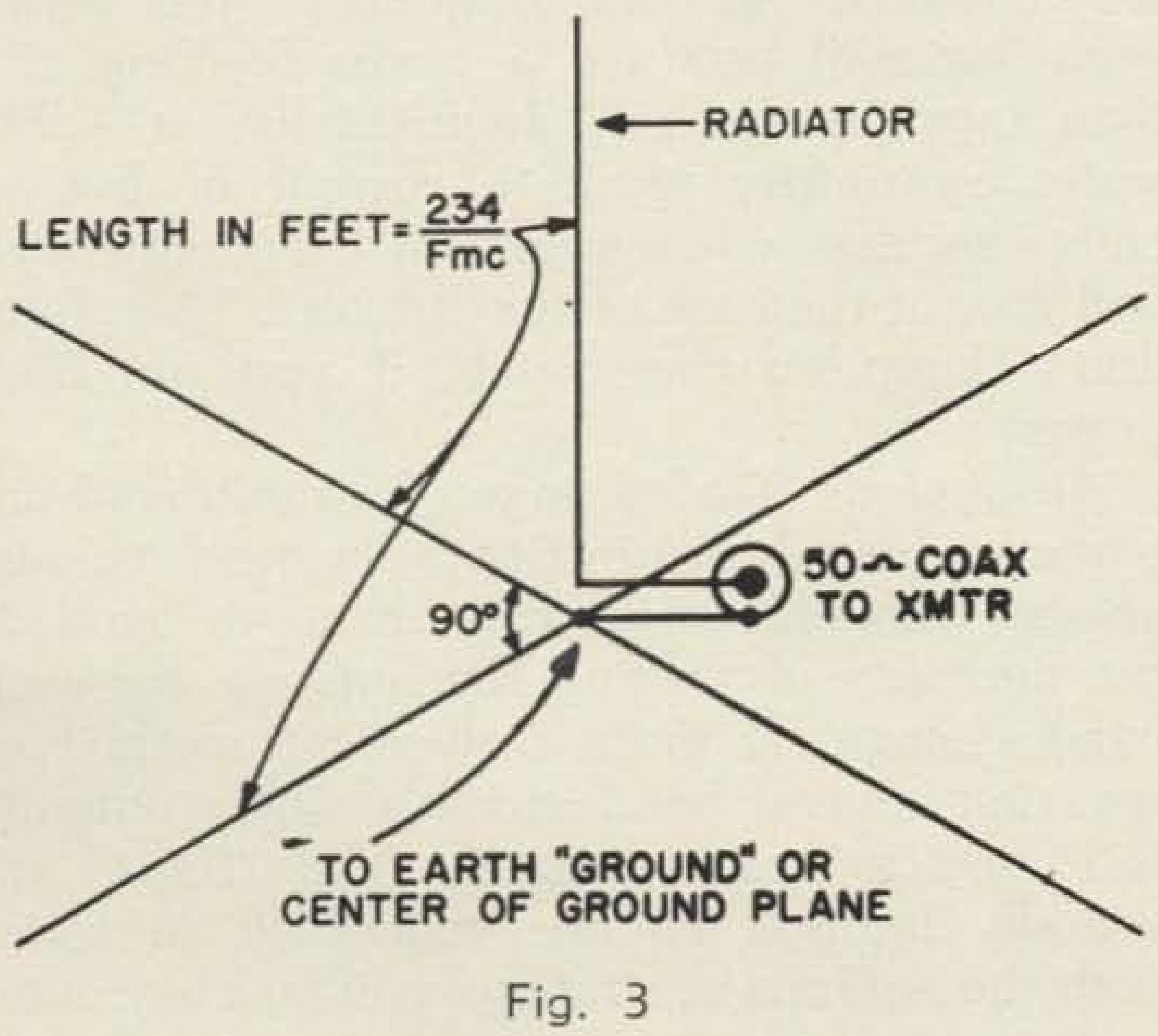


Fig. 3

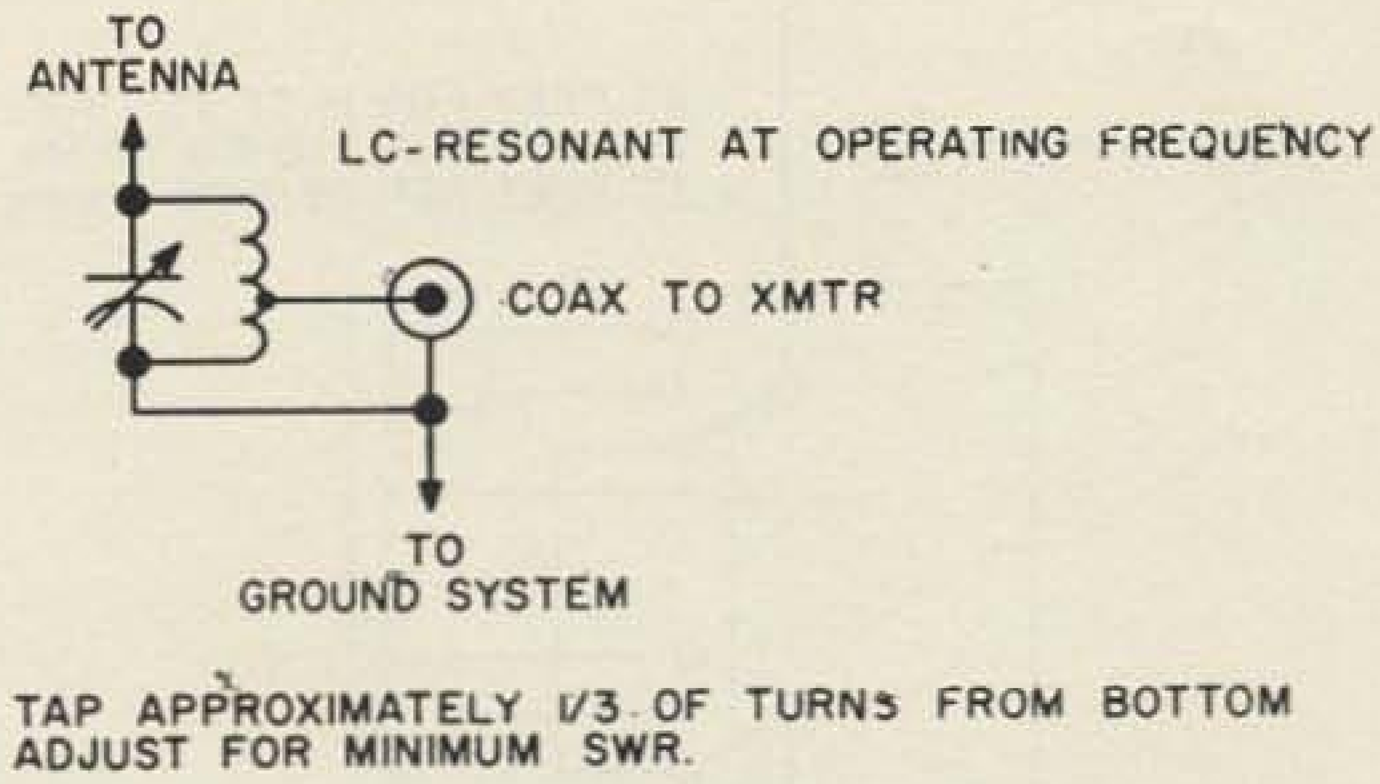


Fig. 4

will sell you the "mattress."[5] Its efficiency as a ground plane is proportional to its size compared to a full-size ground plane; therefore, its efficiency is high on 14 mc and above, and relatively low on 3.5 and 7 mc.

Lowering Ground Resistance

Returning to earth-mounted verticals, you could obtain a good ground connection in the center of a salt marsh by dropping a length of wire in the water. In rich, permanently-moist soil, driving an eight to 12 foot pipe about an inch in diameter into the earth will produce a fairly low-resistance dc or low-frequency ac ground return. In dry, sandy, or rocky soil four additional pipes in a 10 foot square around the first one, all five connected together with heavy wire is recommended. Such an installation is good for lightning protection, but it isn't a particularly effective rf ground.

Actually, rf currents are introduced into the earth for many feet around an antenna. As a result, these currents must travel long distances through the earth to reach the ground-return point of the antenna system. Furthermore, because of rf "skin" effects, the effective ground resistance increases with frquency.

To obtain a low-resistance, rf ground, in addition to the ground rods, you can bury four or more heavy wires a few inches in the ground like spokes of a wheel around the base of the antenna and tie them together at the center. For the best results, each buried radial should be at least ¼ wavelength long at the lowest operating frequency of the antenna. Also, the more radials you bury, the better the results, although the rate of improvement goes down after about 12 are installed.

Before treatment, the rf resistance of an average earth ground will be 50 ohms higher. With the installation of a buried radial system, this resistance can be reduced to less than five ohms. As a ¼ wave vertical antenna has an effective radiation resistance of approximately 32 ohms, lowering the ground resistance from

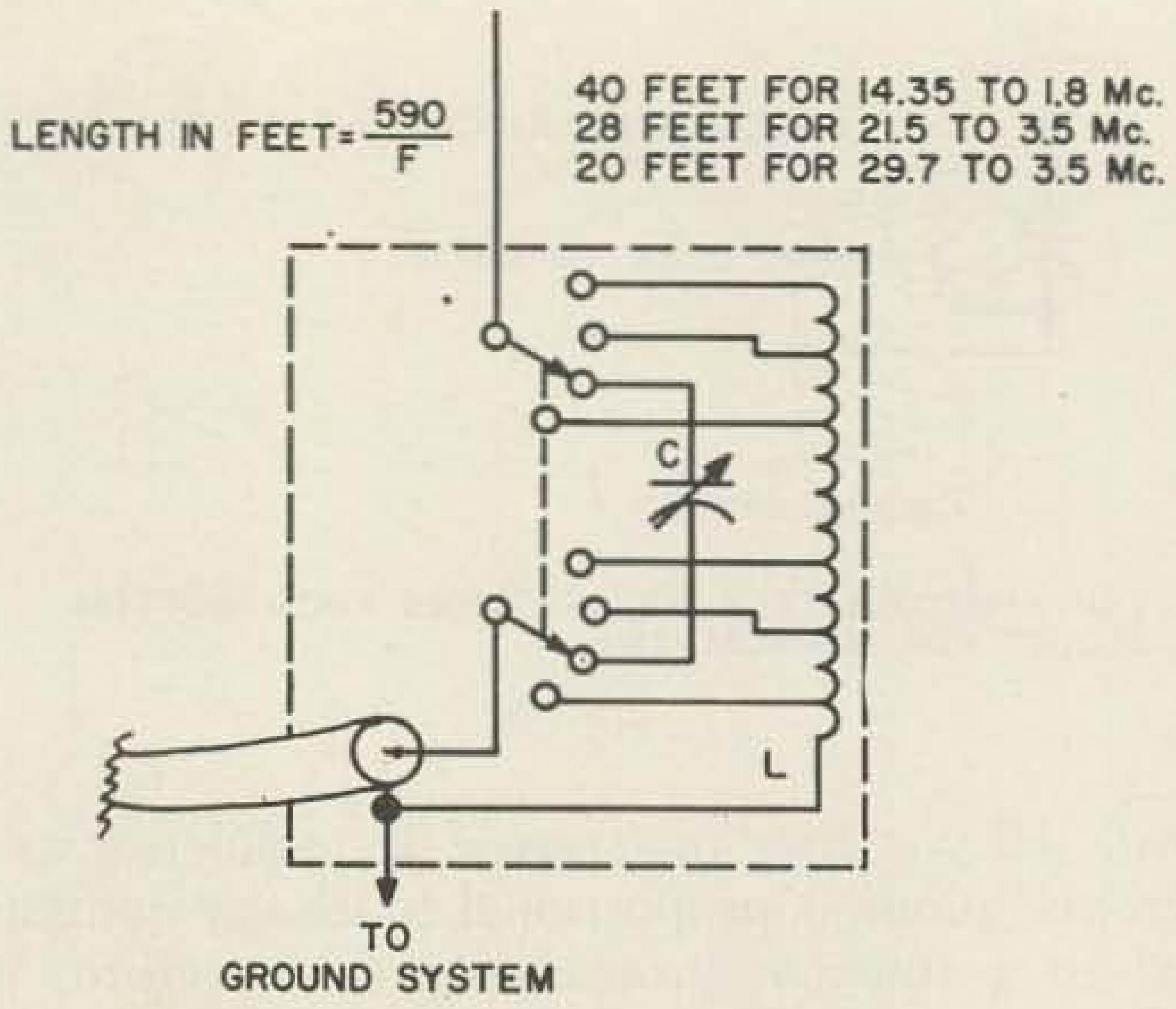


Fig. 5. Simple 3 to 5 band vertical antenna.

50 ohms to five ohms will increase the radiating efficiency of the antenna from 39% to 86%.

An even more dramatic improvement is obtained by reducing ground losses when a shortened antenna is used. For example, a ⅛ wave, loaded vertical (33 feet long on 80 meters) has a radiation resistance of 10 ohms or so. With such an antenna, reducing the ground resistance from 50 ohms to five ohms will raise the antenna efficiency from an anemic 17% to a respectable 67%.

By the way, if you don't have room for ¼ wave radials, shorter ones will still bring down the ground resistance. Increasing their number will help compensate for their lack of length. In one installation, sixteen 25 to 40 foot radials decreased the ground resistance from 50 ohms to 7.6 ohms at 4 mc.[6]

To give you all the bad news at once, even if all the local losses resulting from an imperfect ground were eliminated, this doesn't mean that the resulting antenna would necessarily be as good as one located where natural ground losses were less. Actually, the characteristics of the earth for miles around an antenna can affect its radiation characteristics.

Signals radiated at very low angles from an antenna graze the earth's surface, and over the best posible earth, energy radiated at angles below 3½ degrees is absorbed within a few miles. Over a lossy earth, energy at angles up to 10 degrees can be absorbed in this manner. The dotted lines at the bottom of the curves in Figs. 2A to 2D show the effects of this attenuation over an average ground. Fortunately, the power loss in this manner is not too high, simply because practical antennas just don't radiate a very great percentage of their power at very low angles. Nevertheless, the effect is present.

No dotted lines are shown in Fig. 1A to 1D, because, at the heights shown, horizontal antennas just don't radiate any appreciable power at angles below five degrees.

Practical Vertical Antennas

If you have stuck with me so far, you now have a pretty fair idea of the good and bad points of vertical antennas; so let's put up a few on paper.

Probably the simplest effective vertical antenna is the ¼ wave coaxial-fed one illustrated in Fig. 3. Fed with 50 ohm coaxial cable, the feedline swr will be approximately 1½ to 1 at the antenna's resonant frequency. If the antenna is being operated as a "ground plane," dropping the ends of the radials to produce a 30 degree angle below the horizontal (eight feet for a 16½ foot radial) should bring the line swr down to near 1 to 1.

Connecting a tuned circuit between the base of the antenna and ground as detailed in Fig. 4 will permit using the antenna on twice the frequency, also with low feedline swr. However, if the antenna is a ground plane type, you will probably have to add at least one pair of radials ¼ wave long at the new frequency to obtain mimimum swr there. In fact, this is one of the secrets of obtaing best results from a multiband vertical ground plane antenna—use a full set of four ¼ wave radials for the lowest frequency band and at least a pair of them ¼ wave long at each additional frequency band being covered.

Referring to Fig. 5, an antenna ⅝ wavelengths long at the highest frequency you wish to operate will perform efficiently over a 4 to 1 frequency range and fairly efficiently over an 8 to 1 range.

Careful positioning of the taps on the loading coil will produce minimum swr on all except the second highest frequency range of the antenna. At this frequency, the series capacitor will produce a lower feedline swr than taps on the coil. Incidentally, at 1,000 watts transmitter input, a current of five to eight amperes (depending on the frequency) will flow at the base of the antenna. Therefore, don't skimp on the switch, if you run high power.

An obvious disadvantage of a multiband antenna such as shown in Fig. 5 for quick-change artists, who like to flit from band to band, is the necessity of visiting the antenna for each band change. A more convenient method of covering several bands with a single antenna is to use a "trap" antenna. The "traps" are actually lumped circuits connected in series with the antenna at strategic points. They automatically change the electrical length of the antenna as the operating band of frequencies is changed.

While you can get into a debate over how efficient a multifrequency trap is, its operating convenience can't be disputed. The "trap" vertical is available from several manufacturers, as are the raw materials for the other antennas mentioned.

Conclusions

A properly installed vertical antenna is an excellent ham antenna. However, its low-angle radiation characteristics make it somewhat a DX antenna. As a result, its operating performance may not please 3.5 and 7 mc operators who prefer to make solid contacts over short and moderate distances to squeezing out the last mile from every call. But with the predicted course of the sunspot cycle, for the next several years, low-angle radiators are going to be at a premium for night-time operation on both 3.5 and 7 mc.

If you are unable to take the extra steps to reduce ground losses and to get a vertical antenna away from power-absorbing objects, experience indicates that you might do better with a horizontal antenna. But bear in mind that a low-loss ground under it never hurt a horizontal antenna, nor does stringing it amidst utility lines and metal-frame buildings help a horizontal.

. . . W9EGQ

Fig. 5 Notes

L 40 turns #12 wire 6 tpi, 2½ dia. taps adjusted for min. feedline SWR.

C used on 2nd highest freq.—250 mmfd variable for 7 mc, 150 mmfd for 21 or 14 mc (may be omitted and coil tapped on these bands at cost of somewhat higher swr).

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Say you saw it in

73

even if you didn't.

Further on The Window

In the past few months the old single-wire-fed Hertz antenna, so popular in the early '30's, has become an object of fresh interest.[1,2,3] The Europeans have appreciated it right along. The English, I believe, named it "Windom" after Loren G. Windom W8GZ, who introduced the design to the amateur fraternity in his famous 1929 QST article.[4]

Like the most recent author, Drayton Cooper W4WXY,[1] I have an affection for this elegantly simple way of radiating electromagnetic energy. The article left openings for further contributions in the following areas:

1) How to find the fundamental frequency of the antenna
2) How to find the correct point of feed
3) How to couple to a push-pull PA
4) A more complete bibliography

These topics are easily disposed of to complete the record.

At almost exactly the same time as Loren Windom's article in QST, Everitt and Byrne published a description of the single-wire-fed Hertz in Proceedings of the IRE.[5] This article does an excellent job of explaining topics (1) and (2) above.

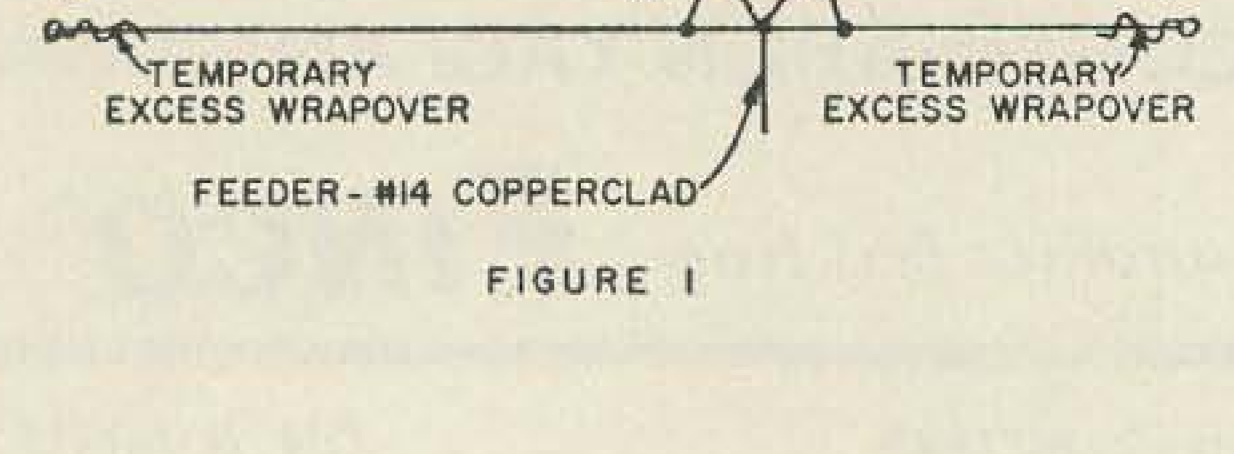

FIGURE 1

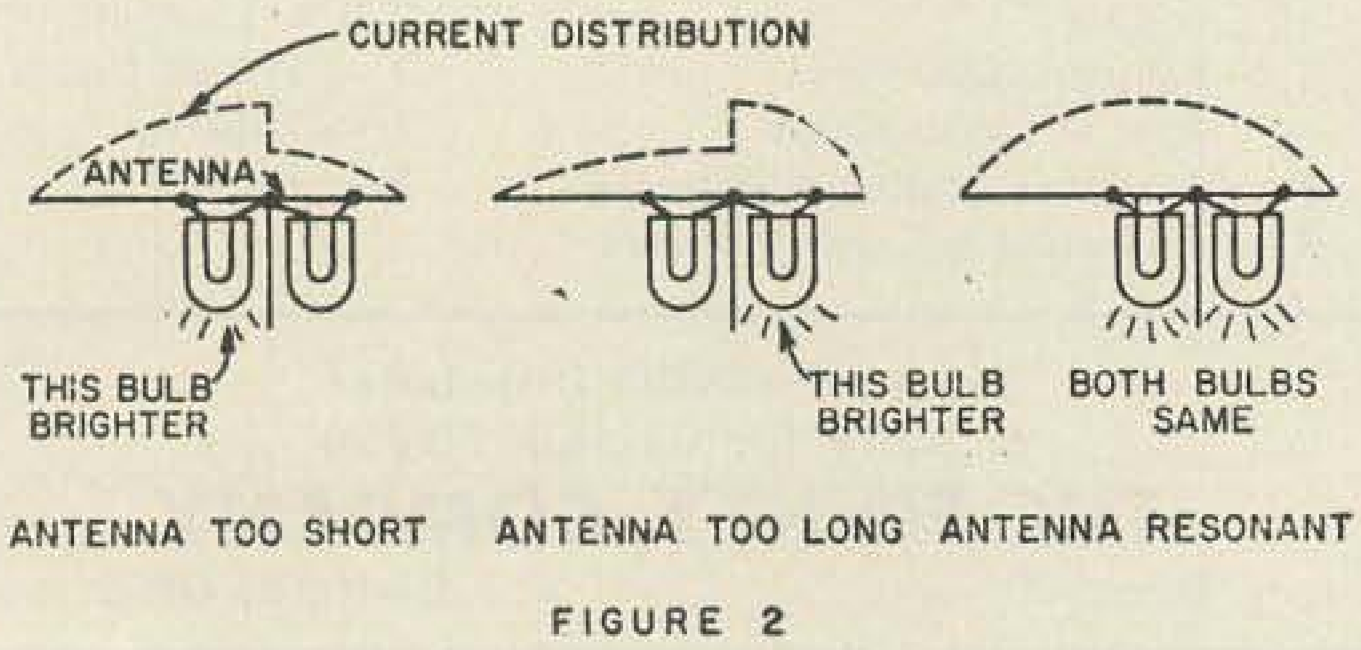

FIGURE 2

There is a very simple way to tune a single-wire-fed Hertz antenna. The practical technique was shown to me by Charles W. Sumner W4EJ in 1932. The technique as then employed was as follows for a 7-mc-fundamental antenna.

First, several Christmas-tree lamps were stripped of their paint. A matched pair was found by running them with a battery or a filament transformer. The glow was matched in dim light at an orange-red temperature. A lead 4 inches long was soldered to each terminal of each of the two bulbs selected. The bulbs were then attached across a small length of the antenna, with their common point at the attachment of feeder to antenna, as shown in Fig. 1. The antenna was then raised, preferably at dusk or at night, by means of rope and pulleys. Power in the order of 50 watts was applied. One bulb would usually be found to glow more brightly than the other. This indicated incorrect resonance, in accordance with Fig. 2. It was customary to leave about two feet of wire excess twisted at the insulator at each end of the antenna. A few inches of this added or subtracted at either end of the antenna (it makes no difference which end) tended to equalize glow of the lamps. Note that the feeder has not yet been matched and that this is unimportant at this point in the procedure. The length of the antenna was tailored in increments eventually down to about two inches until an equal lamp glow resulted. Fastidious operators would then interchange the lamp positions as a check that rf sensitivity was identical. Of course, the natural resonance of an antenna depends to some extent on its mutual couplings with other objects, including the earth and the feeder. Therefore the resonance as found by this method was often a few inches different from that given in the customary tables and formulas.

The bulbs should be removed when pruning has been completed. If you have meters and perhaps a transit—they're better. See the literature formulas.[4, 5]

Having resonated the antenna, the correct point of attachment of the feeder could be found. This was done by first dipping the plate current of the transmitter final amplifier with no load. The feeder was then coupled to the tank at some point, say 15 percent from the ground end of the plate tank circuit. The PA was redipped. It was carefully noted in which direction the dip had moved. The antenna was lowered and raised with new trial feeder positions until a point of attachment for the feeder was found which resulted in no change between tuning of the loaded and unloaded dip. If the transmitter happened to be a self excited oscillator such as the then popular TPTG or TNT circuits, then frequency of the oscillator output could be watched rather than tuning of the dip.

For a thorough job, another step is necessary to assure a "flat" line. There is always a remote chance that by the method above, a fortuitous resistive characteristic, dependent on feeder length, has been found. The proving-out step might be either of the following. (a) Carefully shunt three matched lamps at $\lambda/8$ intervals along the feeder. They should light with equal brilliance. (b) Temporarily add a $\lambda/4$ length of feeder. The tank tuning and loading should not change markedly. When you consider how many of these antennas have been put up by measurements from tables alone, "forced in" by matching networks at the transmitter, and with happy end-results, this last step may seem a gilding of the lily.

As W4WXY has already mentioned, it was important to have a good ground. Without it, rf might appear on nearly all the hardware connected to the ac Line in the shack. It was very annoying to receive small skin burns from metal receiver-tuning dials, for example. The best ground rods were, and still are, available from Graybar. One good type is 8′ x ⅝″ diameter, copperclad. If nearby, the home water pipe at its point of emergence from the ground is probably a better ground. A length of RG-8, or almost any coaxial cable, makes a good, low inductance ground lead. Only the outer conductor is used.

The wire for the antenna was usually No. 14. I made the mistake, one time, of using soft-drawn (magnet) wire. It just kept stretching and stretching. The best kind is copperclad. If you have a kink, scrap it and start over.

One seldom-mentioned advantage of the single-wire feed Hertz is that it is not immediately apparent to the public as a transmitting antenna. That is, the amateur is less liable to harassment from TV viewers who may mistakenly attribute their troubles to his activities.

Now as to topic (3) above—there is nothing to it. For coupling to a push-pull PA, just tap the single wire up, either way, from the center tap of the plate tank. Mutual couplings in the coil and the tank circulating current will do the rest. It may look a little strange on the diagram, but there is no problem.

Incidentally, it is not proper to couple direct from the plate tank to the antenna. For one thing, this may make the antenna a lethal structure. In the early '30's it was common to put a 0.001-mfd capacitor in series with the lead. The tank was often made of ¼-inch copper tubing. Coupling adjustments were easily made by moving a small battery clip, attached through the 0.001-mfd capacitor to the single-wire-feed. Probably persons other than myself have made the mistake of holding a metal key down with one hand and reaching with the other to this tap to increase coupling. It is a mistake not soon forgotten.

Resonance is not precisely the same for harmonic operation of the antenna as for fundamental operation. The reasons for this are mainly that end-effect and mutual couplings to external objects, including the earth, are different. Therefore, adjustments are optimized for the band of most interest.

Tap adjustment is considerably different for harmonic operation from that for fundamental (half-wave) resonance. This is because current distribution, and impedances along the radiator, vary in a different way. While orthodox operation, with "flat" feeder, does not generally occur when harmonic operation is employed on an antenna system which has been optimized for fundamental-frequency operation, it has been possible to load these antennas at harmonics in somewhat the same fashion that random lengths of wire can be loaded. Although such operation is not as tidy as at fundamental resonance of the antenna, there have nonetheless been numerous satisfied users. At frequencies below half-wave resonance, the antenna can be worked against ground as a top-loaded Marconi.

The long-wire directionality features of harmonic operation of the single-wire-fed Hertz are doubtful, because of feeder radiation and attendant pattern distortion. If realized, some idea of magnitude of these effects is given by the following table, which is for radiators in free space.

	Angle of main lobe with respect to antenna axis	Gain relative to isotropic radiator	Gain relative to $\lambda/2$ antenna
Fundamental	90°	2.1 db	0 db
2nd harmonic	54°	2.5 db	0.4 db
3rd harmonic	42°	3.0 db	0.9 db
4th harmonic	37°	3.4 db	1.3 db
6th harmonic	30°	4.3 db	2.2 db
8th harmonic	27°	5.2 db	3.1 db

These characteristics assume that the feed does not radiate. They are listed because W4WXY mentions long-wire features of harmonic operation. There are references in the ARRL Handbook, and other literature.[6]

When H. H. Washburn W3MTE was thinking about the Gamma match, prior to publishing his article,[7] he asked "Why not let the antenna balance itself?" He was referred to the single-wire-feed literature. No doubt he would have introduced his Gamma-match anyhow—but he probably felt encouraged.

I am indebted to Dr. Everitt and Mr. Byrne and also to Mr. Windom, for their correspondence in connection with the preparation of this article.

A bibliography for those who wish to read further completes this effort. No doubt some reader could add more from the archives of the old faithful single-wire-fed Hertz.

. . . W3AFM

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(W2NSD from page 6)

could come up with better reasons than individual amateurs in their comments.

The reaction, as reflected in QST, seemed to me to be one of hush-hush, hoping that the membership wouldn't notice what had happened. The docket was printed in the usual mice type and the editorials stepped up the stress on the ARRL being the representative of the amateur. Behind the scenes the policy seemed to be for the ARRL to oppose each and every rule change proposed by any individual or group. This had the result of dragging on rule making processes for unbelievable lengths of time.

There may have been some exceptions that escaped me, for I still was very loosely connected with the internal doings of our hobby at the time, but I got the distinct impression that for quite a few years the ARRL struck out just about 100% of the time. Every time they opposed legislation it went through, and every time they proposed changes they were defeated. The pendulum had indeed swung the other way for them. They lost on such matters as the forty meter phone band, RTTY on the lower frequencies, the forty meter Novice band, etc.

In view of these events I was rather surprised to find so little on the subject in CQ, the only other voice in the hobby. After talking with Perry I began to understand. He had tried time and time again to bring out some of the information , but had ben met by an unbelievable wall of emotional reaction from thousands of staunch ARRL believers who didn't want to know what was going on. To them it was as if God had been attacked. And among these thousands of fierce believers there were quite a few advertisers. The handwriting couldn't be clearer . . . shut up. This is why you have read virtually nothing about the ARRL in the amateur press, unless you happened to subscribe to W3NL's Autocall out of Washington . . . Andy didn't have to worry about advertising.

Aha, you say, now Wayne Green has revealed himself, he is really anti-ARRL. We knew it all along. Well, I'm not anti-ARRL, whether you want to believe this or not. Despite errors and biases on their part, our hobby would not have flourished as it has without their efforts.

Without their direction I doubt if we would have the thousands of amateurs eagerly sending messages through the immense traffic networks which we hear from 3600 to 3700 kc (and elsewhere). The whole framework of DX'ing and DXpeditions is founded upon the ARRL DXCC. Without this incentive we might throw thousands of DX hunters out of work. The ARRL QSL bureau has made it possible for thousands of DX stations to send QSL's to U. S. stations that otherwise surely couldn't possibly have afforded the tremendous postage expense involved. And so on . . . down through the long list of ARRL services.

And most important of all, ARRL is a gigantic publishing house, taking in well over a million dollars a year. Where would we be without the Handbook, How to Become an Amateur, etc.? Where would ham radio be without QST? Nothing like we have today, I suspect.

It is of course possible that I have misinterpreted some things down through the years. Perhaps you have some facts which will throw some light onto matters that I have either missed entirely or have not been fully informed on. I am much more interested in having all amateurs enlightened than I am in foisting off my own opinions on things.

The Trip

We've got about 80 signed up for the trip so far and have room for about six more. We'll all be leaving from Idlewild on Sunday October

6th in the evening and flying via Manchester to London by Sabena Airlines, arriving Monday morning. After four days of sightseeing and visiting the British amateurs we will zip on over to Paris (Thursday the 11th) for four days there. On the 16th we fly to Geneva (4U1ITU now can make phone patches) and the 19th to Rome. If you pay a visit to Smon and the Vatican you can count this as three countries. We fly up to Berlin on the 24th via Frankfort. Included here will be a tour of East Berlin (another country!) and then back to Idlewild on the 28th for a magnificent three week vacation.

The cost of the whole trip, including all fares is less than the usual round trip fare to Europe, which shows why it pays to travel in groups. Our group will be all hams and we'll visit as many amateurs as we can in Europe. If you're interested in going please let me know as soon as possible. You can cancel your reservation up to 30 days before the trip for a full refund of your $550.

No National Convention

An announcement came in the other day from the Cleveland Convention committee stating simply that due to unsolvable problems the ARRL National Convention would not be held there this year.

In QST (July page 16) we find that "insurmountable difficulties in compiling a program schedual adequate to meet the requirements for approval of the League" was responsible. This means that the committee was adament about some part of their program and the League refuser to approve the convention as an ARRL function as a result. The League insists on having the final say on convention programs as I have discovered in the past when I had been invited to speak by conventions and then, sometimes after I had traveled coast-to-coast, I would be uninvited because the League wouldn't permit it.

My recent mail has, I suspect, brought out the explanation of the difficulty QST was referring to. It apparently has to do with that purveyor of emotional trivia and manufacturer of certificates for sale: K6BX. Apparently the brutal and senseless assasinations of the ARRL in his columns have gotten far under the League's skin. Frankly I am surprised and disappointed if it is true that the Cleveland gang put this testy old man on their program. It is a shame if this was really the factor that broke up the National Convention. CQ can be proud.

(Turn to page 82)

W2SND from page 81

Swifties

The emergence of "Swifties," as reported recently in Life and Newsweek, has added a little sparkle to my QSO's. For those of you who read only ham magazines I'd better clarify.

Back when I was seven I got to reading a comic book called Jack Swift. In a short time I had been converted into a science fiction fan, a mental disturbance from which I have never recovered. The daily strip wasn't enough for a space hungry lad, so I rushed to the library in search of more Jack Swift. The closest they had was Tom Swift. Well, they had the same last name, so what the devil, I took out as many Tom Swift books as I could and read avidly. Frankly, it was a letdown from Jack Swift, but Tom had a stupid charm all of his own and I quickly read the entire series. You can't really expect a seven year old to be very selective in his reading.

"Now, to the meat of the matter," said Tom hungrily. Tom rarely spoke without dragging an adverb after him. To manufacture a "Swiftie" you start with a phrase for Tom to say, then use an adverb that ties in with the phrase. For example, here are some that I've perpetrated on unwary six meterites lately.

"I've installed a new squelch circuit," said Tom quietly.

"CQ Contest," said Tom gamely.

"I'm using a Thunderbolt here," said Tom finally.

"I have a Mohican," said Tom at last.

"I'm using super-modulation," said Tom broadly.

"I'm running a Thor barefoot," said Tom lamely.

That should get you started, let the fractured adverbs fall where they may.

Portable One

Many fellows ask how come I am able to continue to use my W2NSD call even though I am apparently a rather permanent fixture in New Hampshire.

Simple, if you are at all familiar with the FCC regulations. My fixed location is in Brooklyn at the old family homestead. As long as I have a fixed location for my license I can hold it there. When I desire to operate portable all I have to do is send in a notice of portable operation stating when and where I am going to operate. This notice is good for only one year, so I have to send in a new notice for each year of portable operation.

Much as I dislike New York I do have to go down there on business and it is nice to have a permanent residence, complete with a small station, when I am there.

The real bone of contention though is the present FCC system of impartially dealing out calls. I've had W2NSD for some 24 years now and I am darned used to it. In the not too distant past it was possible to get your own call, if it was available, when you moved to a new section. In years gone by I've had W4NSD two times and W8NSD once. Right now W1NSD is available and I'd like to have it for operation up here in New Hampshire, but the present FCC rules do not provide for this and the FCC policy is not to grant this courtesy.

Things went wrong when the FCC started to reissue the "W" calls after they reached ZZZ a few years after the war. Up until this time you could always tell just how long a chap had been licensed by his call. Then, much to the horror of the old timers, one day there appeared some mighty squeaky voices with W9A–calls. Things got back on the track again when the "W" calls got filled up and the FCC shifted to "K" calls. But along about this time they decided not to issue any calls out of order and we began to find some old timers who had moved to a new district with "K" calls.

You want to meet someone that is really bitter about all this? Just look around the band for an old timer that has been in ham radio for forty years and has just received his WB2 call! Come on FCC, stop being so mean . . . .

Field Day

There seems to be some sort of damned contest every other week. We no sooner got through with the June VHF QSO Party than talk began to mount about Field Day. I'm an avoider of national institutions and Field Day has always been high on my list of national institutions to avoid.

Then the summer-help contingent arrived, containing therein one boy fevering with chronic contestitus. This guy had to operate in Field Day, even if he could only use a one watt rig and a regen receiver after working hours. Something that has gone this far unchecked has to be humored, so I compromised by taking the Drake 2B and 200V up on 73 mountain to our VHF spot and letting him put up an inverted V.

Friday night, just before the contest, our Antenna Specialists Zeus alternator arrived and we were thus all set for emergency power. The Zeus, by the way, is an amazing package.

One man can struggle the thing around and two can lift it and carry it easily. The one we got is rated at 3000 watts! We had gotten the Zeus primarily for use in the mobile unit, but this presented an ideal opportunity to break it in with a good long hard test.

By Saturday afternoon everything was set up. We would make a two-man job of it with me spelling the Boy Contestant when he pooped out. The generator was started up and we were almost blasted out of the room by the ignition noise! A quick test showed that all of the noise was coming in through the antennas and not the line, so we quickly moved the antennas from the immediate field of the Zeus. The six meter antenna quieted right down at about 20 feet, which was simple with the Hi-Par Hilltopper on a broomstick stuck in the ground.

The Zeus ran perfectly for the 24 hours of the contest, using about 10 gallons of low test gas in the process. We made some 500 plus contacts. Maybe next year we'll try planning things two days ahead instead of one.

Our Boy Contestant looked a little disappointed when the final seconds of Field Day ticked by, then he brightened and said, "Hey, there's an ARRL CD Party in two weeks!" I killed him.

An Epic in Frustration

One basic flaw in my shady character is that I *like* contests. This is bad. It influences the very fibres of my life. It did not escape me when I was deciding to move to New Hampshire that this is a fairly rare state radiowise. I had one eye on Pack Monadnock, a famous VHF location, when I decided to look for a house and settled 3½ miles from it.

I firmly believe in high places for VHF contests. I've packed two meter gear to just about every hill in New England at one time or another. Many old timer VHF'ers may remember me operating from the top of the News Building in New York and from the top of the Municipal Building. My 1948 score of 146 contacts in 10 sections on two meters (using a 522 barefoot) stood for quite a while.

Along about three weeks before the June ARRL VHF QSO Party this year I got to brooding and decided that we would make an effort and get in the contest. Since the 73 Hq building just isn't high enough to make it (as I discovered in last September's contest), the next best thing seemed to be a portable rig up on Pack Monadnock. Since I had enough equipment to make do all we needed for this was a bus and a generator. It shouldn't be hard to get these two items in three weeks. It was.

While the dickering was going on over the generator I chanced to meet our Friendly (Porsche-pushing) Real Estate Dealer downtown. We got to talking about my persistent search for a piece of high ground to build on. He mentioned that he had a house up on Mount Monadnock for sale. I did a double-take and bore down hard for details.

By five days before the contest we owned a six room house over 2000 feet up on the mountain, and had managed to wipe out the bank account that the last real estate deal brought us. OK, I had the location, now all I had to do was bring up the equipment, set it up, put up towers, beams, etc. All this during the same week that we were closing the July issue of 73 and I had to leave on Friday for the Texas Convention!

The station planned would run 1000 watts on two and six meters and about ten watts on 220 mc. The antennas would be a 64 element two meter beam on a 60′ tower, a 16 element beam an another 60′ tower, and a 32 element beam for 220 fixed to the southwest on one of the towers.

The next four days were a frantic battle with the flies and mosquitoes, who were dead set against our antenna plans, and a myriad of equipment failures and low line voltage which threatened failure on the other end of things. By Wednesday I had worried my back out of shape again and could hardly walk, which eliminated my trip to Texas and disheartened Val, K1APA, who had planned to operate for the contest.

We were driven on by descriptions of the setup at W1BU (W1FZJ), where we were given to understand that Sam had set up little gadgets like a 128 element two meter beam on a 170′ tower, several fixed beams for six and two, 32 elements for six meters, and who knows what monstrosities on 220 and 432 mc.

As the contest started Saturday afternoon I had 500 watts on two meters, a Clegg Thor barefoot on six meters, and nothing working for 220. The antennas consisted of half of the 64 element two meter beam hanging from one tower (it was too windy to finish putting it up), the 16 element six meter beam on the lawn (pipe too small to support it, have to get heavier pipe), and the 220 beam spread out on the lawn. I was using a Hi-Par Hilltopper (6M) on a broomstick on the front porch and a Cushcraft Big Wheel for two sitting on a bench beside the Hilltopper.

And that was it. I operated through the whole contest with those two antennas out there on the porch.

Never Say Die.

The contest was a lot of fun, even so. From 2000 feet up you can work a lot of stations just with a piece of wet string for an antenna. Cushcraft's Big Wheel netted me 86 contacts with twelve sections on two meters. Conditions were not good on two so I didn't spend a lot of time with it. On six the Hilltopper turned in a sterling performance . . . 247 contacts in 31 sections. The transceiver operation of the Clegg Thor made a world of difference. If I had been rock bound I would have missed a great many contacts.

The next contest should be better. With a kilowatt and a 16 element beam on six I should get answers the first time instead of having to call ten or twenty times before getting through. I need the extra push here for we are over 200 miles from New York. I didn't hear one Boston station during the contest, so the only bulk supply of contacts is down New York way. Watch out in September.

Learning The Code

Perhaps the chaos in our Citizens Band can be taken as a warning to those well-meaning amateurs who are suggesting the elimination of the code requirement from the amateur license. Though the code serves only as a men from the boys separator for many seeking the amateur license, perhaps its continuance is validated by a monitoring of the CB frequencies, or even a monitoring of the far tamer, but still disturbing, six meter band.

Sometimes it is difficult to decide whether the arrogance of know-it-all youth is harder to take than the aggressive stupidity of crochety old men, both of which are prominently displayed on our bands.

Now about the code. An article came in recently from a chap with an approach to learning the code that was supposed to make it far easier and faster than any other previously used method. I've applied several earth-shaking new code methods to hopeful students in the past and have developed a great skepticism. In my experience a person is able to learn the code if he buckles down and studies it. It takes practice and more practice. That is the nice thing about the code . . . there *are* no shortcuts. This is a cohesive force for our hobby I expect. All of us have, at one time, been through this ritual of fire.

This new method . . . not very new really . . . is the learn while you sleep system. Now you can't ask for anything better than that, can you? Just think, all those thousands of hours that we used to just throw away can be used profitably to learn code, foreign languages, etc.

May I be blunt? Hogwash!

There is not the slightest scientific evidence, despite many enthusiastic tests, to indicate that there is any benefit whatever to be gained . . . except to the purveyors of while-you-sleep-learn tape machines and tape courses.

It is entirely possible that someday we may be able to develop a system of learning along this line, but before that can become fact we have to do a lot more research on the mind. Just a fraction of the investment in space exploration devoted to finding out how the mind works would probably put us and mankind ahead tremendously.

In the meanwhile I think we can safely apply the universal rule that you don't get something for nothing. This is a cliché, I'll grant, and is widely disbelieved . . . but you can live a very happy life steadfastly refusing the multitude of pitfalls masquerading as something for nothings. Like sleep learning.

The problem is this. We are able to recall and evaluate only material that we have sensed with the conscious mind. While we know that everything heard or sensed while we are unconscious is recorded, we are so far only able to play back these recordings under hypnosis. Some of these recordings have an amazing effect upon our conscious life, but still they are not available to us as memories or for conscious use. Someday we may discover the patchcords to connect the sense-recording system into our conscious mind and then we will be able not only to free ourselves from our many subconscious compulsions, but will sport total recall.

Bit of Battle

Just in case my rather careful examination of the League's shakey position on incentive licensing last month didn't alienate my previous good working relationship with ARRL, I would like to discuss their dismal stand against amateur television. In amongst several pages of patriotic enthusiasm over amateur radio, extending in oratory almost to Motherhood and Apple Pie, we find that the ARRL is opposed to permitting amateurs from experimenting with narrow bandwidth television on the upper reaches of the six and two meter bands because of the present heavy use of these bands and anticipated future use of these bands.

Let us ignore the blow to the solar plexus of our hobby which they are dealing with their opposition to amateur experimentation.

Let us ignore their opposition to amateur responsibilities in the Public Interest, Convenience and Neccessity. Let us ignore the incredible distortion of fact about activity on two and six meters. Let us ignore the many dire warnings we have had that unless there is more activity on the higher parts of these bands that we might well lose them. Let us ignore the important technical advance that might be pioneered by amateurs in the development of a good workable narrow bandwidth television transmission system. Let us ignore the fact that outside of two or three fixed FM net frequencies that the top two megacycles of both six and two meters are virtually vacant. Let us ignore the fact that the ARRL opposed this TV petition without consulting the 84,000 members that they are officially speaking for. Let us ignore the rumors that opposition to this originated with one man on the Executive Committee and was then rubber stamped by the directors. Let us ignore that a poll of the readers of 73 was made which showed overwhelmingly the support of the proposal and the lack of any poll by the League of its members to determine their feelings. Let us ignore the importance of this proposal to the development of amateur television which is being held back seriously by the present limitation to 420 mc and above. Let us ignore the parallel between the development of television which would in all probability take place were it allocated frequencies on the upper portions of two and six and the amazing development of RTTY when it was permitted to operate on the lower frequency CW bands over the determined opposition of the ARRL. We should also ignore the important technical developments which have resulted from RTTY being permitted to operate in our low frequency bands, developments which have had vast application in military equipment and which might never have been made if the ARRL had succeeded in preventing RTTY from being used on the low frequencies. Let us ignore the whole thing and drop a note to the FCC, Washington 25, D.C., telling them that you are not one of the 84,000 amateurs that the ARRL is speaking for in their opposition to amateur progress. Reference this to RM-399, the petition to permit narrow band-width amateur TV on the top ends of six and two meters.

Stuff in the Mail

A little package arrived the other day from an outfit called Science Hobbies. It contained an envelope with eleven semiconductors in it and a sheet of instructions on how to use them in a number of simple circuits. This seemed like a marvelous idea to me, but who the devil was Science Hobbies, were the semiconductors any good, would they be widely distributed, etc?

A flurry of letters clarified the situation. These silicon semiconductors are American made by a large manufacturer and though they are normally priced at $29.95 for the group, are being merchandised to sell for $2.98 as a package. The instruction sheet has circuits for making an automotive tachometer, a transistor regulated power supply, a 30 volt low current power supply, a 6 & 9v battery eliminator, a 1.5/9v battery tester, a dc voltmeter with overload protection, a photoelectric relay light energized, an audio oscillator, a photocell light meter, a transistor preamplifier, controlled rectifier, remote contactor, speech clipping and limiting, cathode biasing, and screen biasing.

Each semiconductor is color coded and all are different. For instance, in the automotive tachometer all you need is the yellow (twin anode 5-8 vdc diode), the green (single anode 8-25 vdc diode) and the blue (single anode 25-50 vdc diode) plus a 1000 ohm ½ watt resistor, a .47 mfd 10v condenser, a 0-1 ma meter and a 500 ohm calibration pot. Pretty simple, eh?

Since these semiconductor kits are obviously something that every amateur should be interested in I've made arrangements for the Bookshop to have them available (number 104).

Some of the construction projects look mighty tempting. I'll have Paul W1PYM, the keeper of our struggling kit department, work up a couple of parts kits for them.

Other Mail

Not all of the California schemes seem quite this practical. About 50 California hams took the trouble to send me a copy of a flier they received proposing that they join a club, dues only $10 a year, which would give them all sorts of unnamed benefits. The only specific things mentioned were a year's subscription to CQ (some benefit!) and free access to a ham station set up by a local distributor. The club was almost completely anonymous, with no names or calls being mentioned in the promotion piece. If this deal is legitimate then the chap who sent out the flier must be a nitwit.

(Turn to page 88)

(W2NSD from page 87)

Questions and Answers

The questions I get during talks at conventions and from visitors make it rather obvious that I am not going into enough detail on a lot of my editorial explanations of things.

Jim Demler WØDSU, here for the summer, had read the letter in VHF Horizons from me refusing to take advertising from them on the grounds that I didn't believe that their magazine would be successful. This was obvious to me and it really never occurred to me that many people could think differently. How did I know? Well, I know about what is costs them to print their magazine every month and approximately what their other expenses must be. All I have to do then is make a rough estimate of their income and see if the two match.

Making an educated guess, I calculated that they were taking in about $1000 a month, tops, in subscriptions, and maybe $600 in advertising. This would just barely cover the printing bill, leaving all other costs of running the business as a net loss. You don't run a magazine at a net loss for very long.

The basic miscalculation that I felt that they made was in believing that all VHF operators would welcome a VHF magazine. Unfortunately, a large percentage of VHF ops are running Twoers or equivalent and could care less about what the handful of VHF DX'ers are doing. As far as I know this estimate was accurate, if my information on the circulations of the VHF magazines is true. To the best of my knowledge VHF Amateur made it to just over 2000 circulation before giving up and disappearing into the back pages of CQ, as did VHF News before it. VHF Horizons made a more determined effort and, I believe, reached over 3500 VHF'ers. But you can't publish anything more than a bulletin with this order of magnitude or circulation.

Jim then wanted to know why, if these other magazines couldn't make it, we were going to start publishing a VHF magazine. First of all, as an ardent VHF man, I believe that communication is important to this field of interest and that there is a need for a monthly bulletin for VHF'ers. Secondly, with the setup we've got here we can pull the props out from under the normal printing costs of a magazine. We've got everything necessary for printing offset bulletins and small magazines: press, platemaker, huge process camera, art department, artist, etc. We can print a magazine and have it in the mail within three days, where the normal printer takes about two weeks.

We are particularly fortunate in getting Jim Kyle K5JKX, the previous editor of VHF Horizons, as our editor for VHF Magazine. Jim is not only the top writer in the ham radio field today, he also has a splendid background in VHF operating and a wide acquaintance among the top VHF operators.

We'll start off VHF Magazine as I did 73, cautiously and in the black. We're sort of figuring on hitting a peak of 5000 circulation, but are willing to be surprised. We'll try to have it chock full of good practical VHF information as well as the latest operating news that can be published. See page 93 for subscription information.

Inventive Licensing

During one of the many discussions of incentive licensing here at 73 HQ, Virginia made a point that might well be passed on. Basically it is this: There seems to be little correlation between formal technical training and inventive ability. Of what use is it for us to get the FCC to force everyone to learn enough theory to pass a harder exam? What can this accomplish? If we could present them with a test of their practical knowledge of the hobby, that might prove something. Virginia went through an embarrasingly long list of graduate engineers that we have met who have conclusively demonstrated themselves to be absolute dunderheads at ham radio. A look through the ham magazines showed us further that the bulk of the real advancements in ham gear have been made by formally untutored hams.

It has long be recognized in educational fields that the current emphasis on memorization is one of the best ways yet known to weed out the intelligent and inventive talent. Why apply a proven losing technique to ham radio by setting up a further memorization hurdle for all the General and Conditional licensees? The result of this would be the opposite of the claimed desire: we would lose a lot of the very fellows who are the most valuable to our hobby. Bah!

. . . Wayne

Buy 73 at Your Distributor

Roughly one third of the circulation of 73 is through the radio parts distributors. This is a good thing and we like to encourage it. About the only real drawback to it is that only a few distributors get enough copies each month to last all the way through the month. This means that quite a few amateurs miss out on copies. And even though we've tried everything we could think of to get all of the parts distributors to handle the magazine, there are still a lot of them that have never gotten around to placing an order.

If you find that your distributor has run out or doesn't stock 73 please let me know right away so I can put some pressure on him to do better by you. This will help a lot of other hams who might miss getting 73 too. Even if you are a subscriber I'd like to know if you have a dealer that doesn't have 73 available.

The next few issues will be selling out mighty fast, so maybe you'd do better to make sure you don't miss out by subscribing right now.

Name .... Call ....

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City .... Zone .... State ....

☐ $3.50 One Year ☐ $6.50 Two Years ☐ $9.00 Three Years

☐ $40 Life (yours or ours)

50c each enclosed for the following back issues ....

(All 1960 issue $1)
(Jan. '61 out of print) Class license ....

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Send to: 73, Peterborough, N. H.

73 Products

Peterborough, N. H.

73 PUBLICATIONS

6 UP Magazine. Published monthly for all VHF operators. Includes latest operating news, technical data, improvements on commercial VHF gear, skeds. Editor is K5JKX. Mailed first class mail to all charter subscribers. $2.00/year.

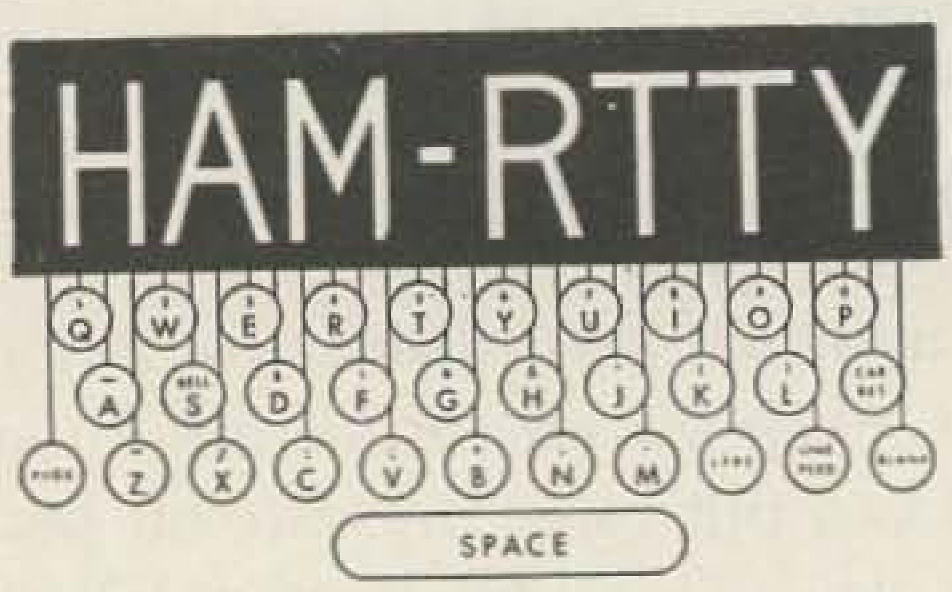
ATV Experimenter. Published semi-monthly for all amateurs interested in amateur television. Includes latest operating news, list of active stations, technical data, surplus conversions, latest FCC ham-TV news, etc. Editor is WØKYQ. $1.00/year.

Club Bulletin. Published ten times a year for all club officials and club bulletin editors. Includes news from club bulletins, latest FCC actions, info to help editors put out interesting club papers, info to help make clubs successful, etc. Editor is VE3DQX. $1.00/year.

Send subscritions to all 73 publications to 73, Peterborough, New Hampshire. Be specific, don't make us guess.

Bound Volume I & II, in stock $15.00 ea.

NEW RTTY BOOK $2.00



This handbook is written for the beginning RTTY op, but due to the profusion of info, pictures, circuits, etc., it will be valuable to all RTTY'ers and those who may RTTY themselves. If you don't know what RTTY means don't buy it. For $2 what can you lose? It's worth almost that much in paper.

BINDERS FOR 73 $3.00

Keep your issues of 73 all in good shape and keep them from straying. Specify year: '60-61, '62, '63. Red Leather binder with gold stamped "73" and year. Darbs.

BACK ISSUES 50c

You can enjoy back issues of 73 just as much as current. Send for one each month to pad out those dreary days. All back issues now available except January 1961. Early issues going to $1 soon. Supply very limited.

CARE AND FEEDING OF HAM CLUBS $1.00

K9AMD's interesting book on all aspects of forming and holding together a ham club. This is the result of exhaustive interviews with many club officers and will be invaluable to every club going.

SIMPLIFIED MATH 50c

This booklet takes you gently by the hand and leads you through the mysteries of Ohm's Law, squares, roots, powers, frequency/meters, logs, slide rules, etc., and does it by an amazingly new method.

AN/VRC-2 CONVERSION $1.00

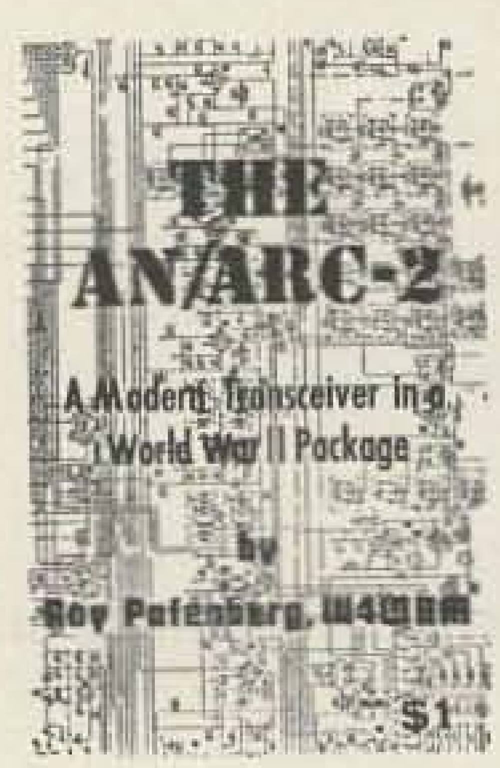
CONVERSION
OF THE
AN/VRC-2
by
Lloyd Hanson, W9YCB

Exhaustively complete instructions on converting the surplus and inexpensive VRC equipment for six meter wide band FM ham net operation. Get thyself on 52.525 mc and join the national wide band FM activities.

INDEX TO SURPLUS $1.50

This is a complete list of every surplus conversion article that has ever been published, with a brief description of the conversion. Invaluable bibliography.

AN/ARC-2 CONVERSION $1.00

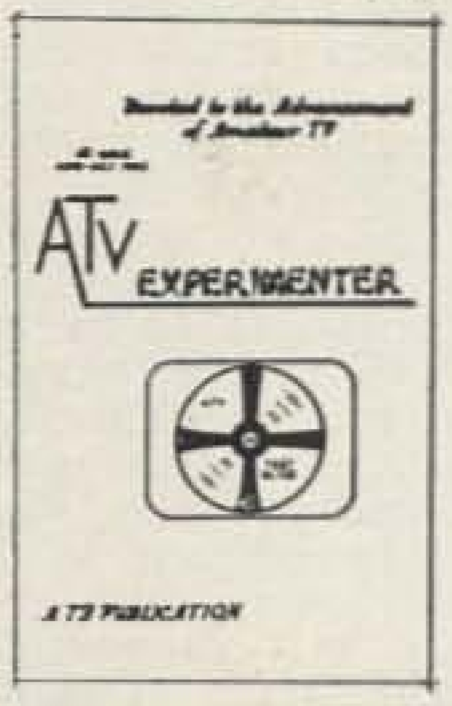


Complete schematics and thorough conversion details on this modern transceiver which covers 2-9 mc (80-40 meters . . . and 160). This unit now sells for $40 to $50 surplus and is easily converted into a terrific little transceiver.

HAM-TV $3.00

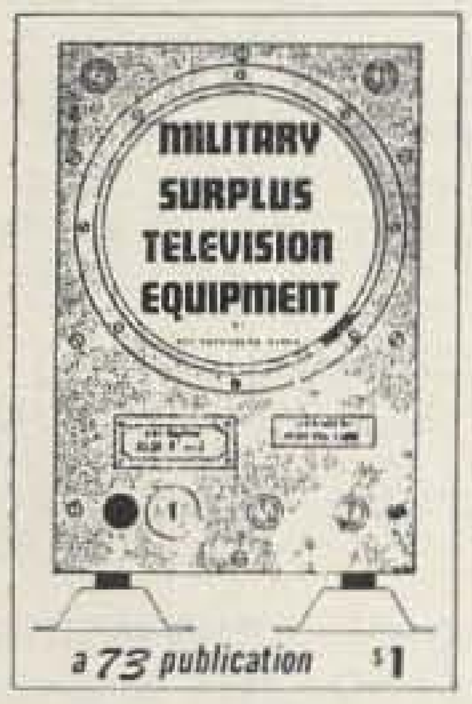
This book gives you a blow by blow description of how to get on the air on TV for under $50. This book is the reason that hundreds of hams are now going on TV. This is not the usual theory book, just a how-to-do-it manual.

AMATEUR TELEVISION EXPERIMENTER $1.00 per year

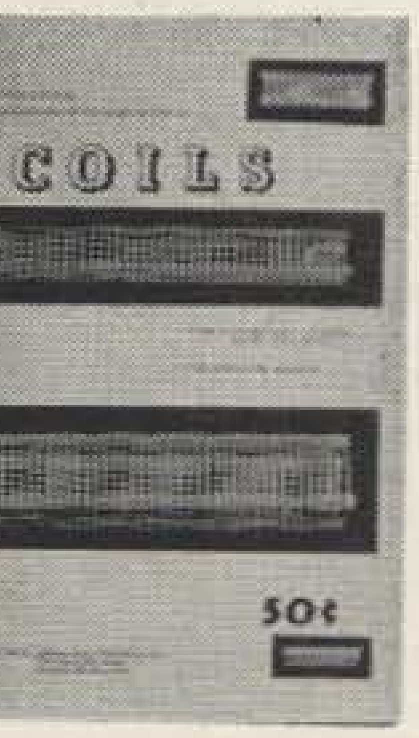


The first six issues of this invaluable bulletin are now in print. Each one is worth more than the year's subscription. Send $2 for complete set from #1 up through #12. Quantity limited so don't wait.

SURPLUS TV SCHEMATICS $1.00



TV'ers who are interested in saving a lot of construction time and still want to have elaborate TV gear will do well to watch those surplus ads and invest in this booklet, the only source of the diagrams you'll be needing.



COILS 50c

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CW $1.00

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WORLD GLOBE (plus subscription for one year) $16.95

Every visitor to the 73 HQ shack is taken aback by the beautiful world globe next to the operating position. We find this invaluable for figuring out beam angles and planning world tours. It is 18" in diameter, normally sells for $19.95 (via CQ), is nearly five feet around the equator. Canadians please allow a little extra for Diefendollar exchange.

In the interests of making home construction simpler for those readers with anemic junk boxes 73 has gathered together the parts required for building our less complicated projects. These kits are as complete as we can make them, containing good quality parts. Except where the chassis or case is integral to a unit we do not supply it. We will mention when we do supply a case or chassis. We do supply tubes, sockets, condensers, resistors, transformers, connectors, etc. The kits are kept in stock to the best of our ability, though sometimes the distributors who supply us delay us a bit.

3 NUVISTOR 2M PREAMP. Mar 63 p8
W9DUT Kit $18.50

1 TUBE ½W QRP 40M XMTR. Mar 63 p22
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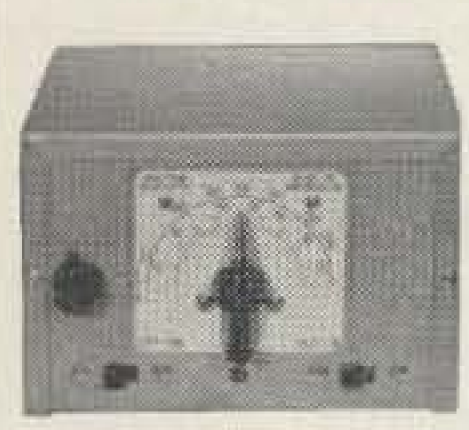

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