ENTERTAINMENT FOR HAMS

APRIL 1966 · 50 CENTS

73

73 Magazine

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Publisher

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Editor

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Cover by Wayne Pierce K3SUK.

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de W2NSD/1

never say die

100 Country Certificate

As announced last month 73 will make available a certificate for working 100 countries. Briefly, here is the dope. All contacts must be made after 1 May 1966 (0001 GMT). Certificates will be available for phone, CW and RTTY for each individual band for 100, 200, 300 and 350 countries. Countries will be those accepted by ARRL, RSGB, REF, DARC and other national amateur radio societies that we announce. We will have a complete list available for you about June first. Contacts made in any one calendar year count for the entire year and for the next four calendar years. 1966 contacts will be valid only through 1970. Cards may be sent to 73 with SASE for certification. We will try to establish local certification committees in various parts of the states and in other countries to simplify this problem. Each certificate application must be accompanied by one dollar or seven IRCs.

If you have any questions or ideas about this write to: GUS, 73, Peterborough, N. H. You can look for Ole Gus on 7025, 7245, 14065 and 14275. Gus can be reached by phone at 803-534-6485; collect calls will be refused.

May first is a Sunday . . . it should be an interesting day on the DX bands. You might spread the word ahead of time to make sure that as many of the DX stations are on that day as possible. It may sound something like a contest. You know that we will make a particular fuss over the first certificate in each call area and each country.

DX comments

Please don't feel annoyed if I make every effort not to get myself or 73 into the unenviable position ARRL is in with regards to their classifications on countries. They face insoluable problems in running DXCC.

For instance there is the little business of deciding what is and what is not a country. Any of you who have been following this situation know how ridiculous it has become. If you haven't been following it, trust me that it is ridiculous.

Then there is the interesting phenomenon of the DXpeditions which aren't really there. This may be an old time honored arrangement, but apparently it was considerably popularized by a gentleman (?) a couple years back who sat in air conditioned splendor in north Africa and signed a number of calls, all of which the ARRL has solemnly counted for DXCC. The feeling seems to be among one or two DXpeditioners that as long as ARRL is going to count it as if they were in a country and there is no one to stop them from signing the call from somewhere else, why go to all the bother of going to that country. Indeed, their logic seems quite valid.

We have also been treated to a new development . . . the DXpedition that can't seem to hear the top DXers calling them. I don't know how many of the top men were affected by this, but in a recent call Charlie, W1FH, explained that this finally broke him of the DX habit and he is off the treadmill.

Most of us have been aware of the ARRL's strong bias against phone operation, but I doubt if any of us thought that they would go so far as to completely cancel the phone DXCC award. This certainly is a major setback for the SSB gang.

(continued on page 114)

73 AFTER HOURS

April

April first is a traditional time for practical jokes and mischievous shenanigans. The urge to have fun is so great that even the editors of normally staid electronics magazines sometimes succumb to the desire to spice their usual technical and serious articles with a small touch of whimsy.

In line with this tradition, three years ago the April issue of 73 parodied QST. The cover of that issue was immediately recognizable as the style used by pre-war QST's and many older hams did quite a double-take when they saw *that* 73 on the newsstand or when it arrived at their house. Inside the magazine were a number of small touches of satire, too; the issue was tremendously popular with our readers.

However, the last two April 73's have been straight—at least as straight as 73 ever is. A few hams noticed this and suggested ideas for April. A number thought we should do a take-off on CQ. Well, to be perfectly honest, there isn't that much distinctive about CQ. The cover, with its (always) red logo could easily be parodied and it wouldn't be hard for a fertile mind to have some fun with the column headings and the columns themselves. But basically, we were afraid that a parody of CQ might have the same effect on hams that CQ itself does, and I'm sure that you'll agree that that isn't something we'd want to happen to readers of 73.

So nothing happened. Well, almost nothing. Someone always came up with an idea, but always too late.

Then Barry came to work for us.

Barry had a very fertile imagination. In fact, Barry had about as fertile an imagination as anyone really needs. Barry isn't working here now—I hear he went back to school—but while he was here, he suggested that we do a parody of Playboy.

Playboy? Ridiculous. How—or why—should a ham magazine do an imitation of a tremendously successful college boy-rising young bachelor junior executive magazine? And even if anyone had seen any virtue in his suggestion privately, giving other people credit for good ideas is not one of the big things here at 73, so we ridiculed him and went back to work. Then Barry left.

A few months later, I had a great idea. Why not do a parody of Playboy in April? It's so offbeat and far fetched that it could be a lot of fun. I suggested it to Wayne.

Ouch. After what he told me of my idea, I didn't speak to him for three weeks. Luckily, he was in Europe those weeks, so things weren't too strained.

When he came back, he told me that he had had the best idea while he was in Germany. Why not do a parody on Playboy in April? That was a satire that we could really have fun with.

I said, "Wayne, that's great!" And went out and bought a copy of Playboy (for research). Then I bought and analyzed some more copies (also for research) and discovered what it was that made Playboy so distinctive and popular.

Unfortunately, we couldn't use *them* in 73.

So I took another long look at the rest of the magazine and sent some ideas down to Wayne Pierce K3SUK, who does a lot of cartooning and art work for us. Well, Wayne invested in some research material, too, and you can see the results in this issue. We hope you like it.

Cover contest results

The winner of our cover contest was Bob Taylor with the uh, unusual, cover published last month. Bob makes those call letter sweatshirts that wow everyone at hamfests and club meetings. See December page 103 for more information on them.

(continued on page 118)

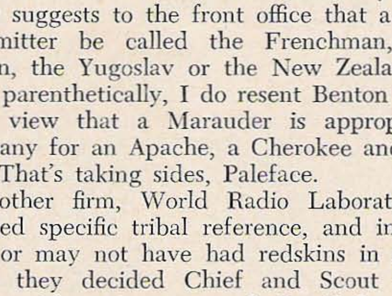
Ken Cole W7IDF
P.O. Box 3
Vashon, Wash. 98070

Barefoot and All That Jazz

A recent remark by a Six that he had run his Mohawk barefoot all winter brought no inquiry from the Bureau of Indian Affairs, and no atavistic response from the small percentage of my corpuscles entitled to take offense, but it left me wondering innocently why the Heath ethnology section honors the North American Indian so consistently and never suggests to the front office that a new transmitter be called the Frenchman, the Italian, the Yugoslav or the New Zealander. And, parenthetically, I do resent Benton Harbor's view that a Marauder is appropriate company for an Apache, a Cherokee and the rest. That's taking sides, Paleface.

Another firm, World Radio Laboratories, avoided specific tribal reference, and indeed may or may not have had redskins in mind when they decided Chief and Scout were names with customer appeal. But if these are simply brave labels and not subtly coercive allusions to frontier prowess, why not use Miner, Policeman or Nurse's Aid?

With these and other questions in mind I turned to the catalogs and soon decided that there's more to the naming game than meets the eye. Sometimes a change in nomenclature excites more interest than the thematic choices. Obviously in the Johnson Company (Thunderbolt, Viking, Challenger, Valiant, Adventurer) a major reappraisal was involved in retrenching to mere Courier and Messenger. I wonder what happened that day in Waseca, Minnesota? Nothing very decisive, apparently. Divisive, rather, for the Valiant Challenger clique seems to be sticking by its guns. Meanwhile, unimpressed by the arcing out front, sanguine craftsmen in the rear of the Johnson shop turn out handsome and expensive components for cold-blooded professional broadcasters who are responsive only to specifications. These artifacts bear no melodramatic names, but then no commercial multi-kilowatt transmitter is called Blockbuster, or Behemoth. Performance speaks louder than blurbs, but somebody isn't listening.



Hallicrafter seems to have had deeper doubts about labels with high muzzle velocity. Their Super Skyrider—Defiant—Challenger period was followed by a gentle turn toward cryptic letter and number combinations, however a company that starts with Sky Buddy and comes up roughly three decades later with Tornado! and Legionnaire! obviously thinks of itself as a swinger. So there is still a reasonable possibility that one day Hallicrafter will break out of its cryptogram phase with names pitched to shatter a brandy snifter at ten meters. But I trust not.

Sometimes, for one reason or another, it is impossible to detect a trend, and this would seem to be true in the case of Clegg. Their Interceptor is really not a name to conjure with, and Venus—an alias of Aphrodite—is a curious, mildly distracting choice. Come to think of it, why did they favor Venus? Why Roman rather than Greek? Rumors that an office party was responsible, like other involving deference to Geloso, owe more to frivolity than logic. Here is a puzzle. My own guess is that a subtle-minded executive topped off a perfect day with a double Martini (French vermouth, Dutch gin, Spanish olive, Italian name) and an amusing little memo scratching Aphrodite. And substituting Venus. Reluctantly I'll give him good marks for acumen, if not for chivalry, for it sounds quite odd enough to report, "I'm running a Venus barefoot." The Aphrodite theory may be deprecated by the company, but then I would point out that another Clegg product is called Zeus and the implication is that Venus wasn't arrived at by chance since simple consistency would have kept Clegg on Olympus, and very likely did until word came down from even higher that A. was out and V. was in. Too bad.

Turning without real regret from titular fantasies rooted in the ethnic, mythological and passably valorous, we find that a quality of menace is deemed attractive by some executives. Or, to be more candid, they have opted for the silly in preference to the ridiculous. Black Widow and Bandit are names that tie for a special award plus oblivion. And unless it was conceived as an incongruous tribute to a lovely airplane Spitfire takes second place. For coming up with Sidewinder Gonset wins a prize too, and if they decline on the shaky ground that this term is a slang reference to SSB then a palm will be added for mendacity. Sidewinder refers to a reptile. See the College Edition of Webster's New World Dictionary of the American Language. A secondary, colloquial meaning is also given and I am happy to quote it here: "A powerful swinging blow of the fist, delivered from the side." Aggrieved AM enthusiasts may see in this second definition a subtle technical validity.

Antenna namers fire shotguns from the hip and there is no coherency to the results. Hornet, Hustler, El Toro, Mark Something, Super Magnum (Antenna Specialists cum Smith and Wesson). Not until we come across Joystick and TrikStik do the hackles rise. These two unfortunate appellations are either offensively frivolous or Hugh Hefnerian. If the former then they don't deserve consideration, and if the latter a detailed analysis would be inappropriate in a family magazine. I'm referring to 73.

Well then, if clear-cut trends are difficult to visualize in the nomenclature favored by individual manufacturers certainly an inescapable message appears when one stands off a bit and surveys the industry. Take a deep breath and run the names trippingly off the tongue. Apache! Comanche! Thunderbolt! Thor! Viking! Tornado! (Move back.) Bandit! Warrior! Spitfire! Sidewinder! Black Widow! Challenger! Valiant! Mohawk! The message has Super Magnum impact, but I'm almost too nervous to read it. The mind reels before the panoply of menace and power, but do these sound like the names of refined electronic aids to friendly communication? Certainly not. A child would recognize them as automobiles. The Thunderbird yearns for a Thunderbolt; the Apache fits the Fury; put your Bandit in a Barracuda. Warrior and Mustang. Tornado and Tempest. Spitfire and Wildcat. Stuffy Marks this-and-that (issue of Britannia and King Arthur) can be accommodated by pseudo-Continental Monzas, Monacos and Rivieras. Inevitably a Galaxy (Space is In) presides in a Ford Galaxie.

Thanks to weak stomachs, or for some better reason, a few companies with familiar names have shown little inclination to go the frenetic route. National (*vale* SW-3 of hallowed memory) is one of these. Hammarlund is another, and indeed a short but impressive list of firms could be introduced as evidence that the emphatic banality of noisy labels is less than essential to the marketing of an inventory of quality.

In support of these holdouts one sees indications of relatively unadorned candor returning to our marketplace, of advertisements emphasizing specifications and price, and short on irrelevant fireworks. Granted this improvement is neither ubiquitous nor accelerating Thunderboltwise, yet how many of the latest of our sophisticated and eminently salable transceivers have names calculated to chill the blood? I can't think of any. Even hardnose linears are being given labels you can mention without reminding the kids of a TV program. Does this mean that the intrinsic discipline and rewarding efficiency of SSB have brought with them a bonus of maturity? Are our catalogs going to lose their links with comic books, TV and Detroit? I hope so.

Aggressiveness springs from insecurity, and the passage of time brings to most human endeavors a reasoned mellowing, a climate kind to merit. Defiant names fit weapons, not tools. Fifty years ago Fokker aircraft earned respect in aerial warfare; today in our country and in many others a Fokker design has won a tough competitive battle for success as a domestic route airliner. It doesn't have a horrendous name; it's called the Friendship.

Low cost, high power, single pole switching for our most popular VHF bands. It's good down to eighty meters, too.

A Simple Six and Two Amplifier

Bill Hoisington K1CLL
Peterborough, N.H.

Having been called on recently to build a commercial high power amplifier switching from 20 to 150 mc with complete frequency coverage for use as a laser modulator, I was very tempted to give it a whirl on the air as it was being tested through 50 and 144 mc. The customer was in a rush, though, so it was delivered, and another was built strictly for six and two, although it can be made to work down to 80 meters with a more expensive switch and more coils. The VHF model is probably of most interest, so I'll concentrate on it.

Circuit

There are three things that loom up large dollar-wise in this six and two meter amplifier: the tube socket, the blower and the tube. However, if you have a 4CX250 or two lying around and are thinking of the possibilities of a quarter kilowatt on six and two, this design allows you to switch bands with only one pole and one throw. You could also use a surplus, inexpensive, 4X150 in this circuit.

The circuit in **Fig. 1** has been used successfully up to 200 mc here. It is very hot on two meters and even more so on six. It can be seen to be a trough line pi network on two meters, changing to a good old coil type pi network on six. The switch is a slightly reworked (solder on some strap copper leads) knife blade copper switch with a porcelain base and it sure does the job. Used to sell for 50¢ in all the hardware stores. Maybe still does.

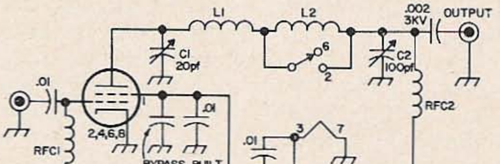


Fig. 1. Schematic of the 4CX250 amplifier for six and two meters using single pole switching.

Note in the circuit that the RF plate choke is at the low (for RF) end of the plate inductor, L1. This particular choke has a slight absorption spot near 70 mc which does not bother in any way on six and two meters, but can be a nuisance when working for complete coverage from 20 to 150 mc. On the job mentioned I switched chokes from the front panel to jump over 70 mc.

RF output circuit

I would advise getting a good socket with the screen bypass built in. This capacitor is in a circular form around the tube, and believe me, there is nothing like a round flat disc for VHF and UHF capacitors. During several weeks just spent on this unit running up and down between 18 and 170 mc many times with all kinds of coils, switches and capacitors, not once did it self oscillate. And this is with no neutralizing at all. The built in screen bypass is really doing its job of isolating the input from the output circuit. It also has another job to do as you will see.

A word about RF currents in screen-grid coaxial tubes is in order here. Electrons, as is well known, flow happily from the cathode of these tubes over to the plate, greatly attracted and speeded up on their way by the high positive plate voltage. Field theory says that an electron finding itself in a vacuum between two conductors, one positive and the other negative, will accelerate and slam into the

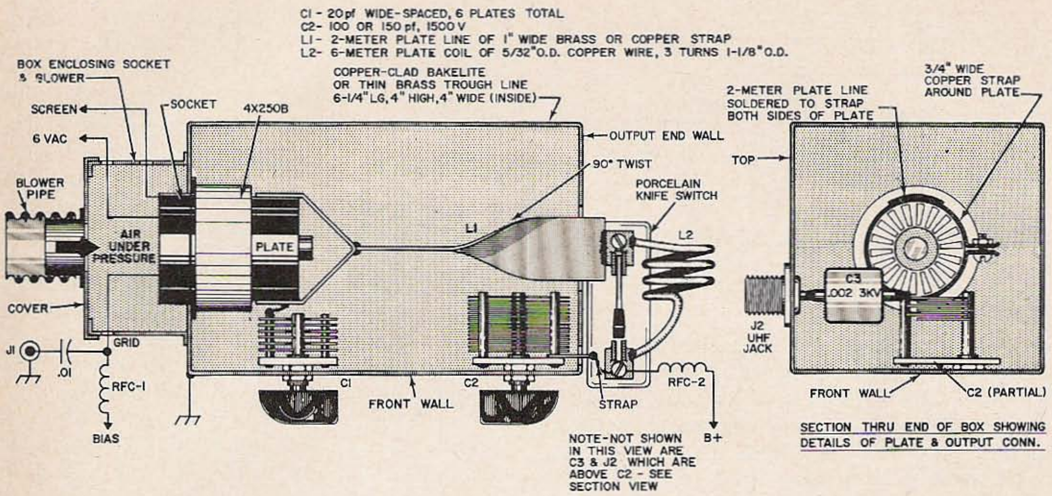


Fig. 2. Top and side views of the 4CX250 amplifier.

positive conductor at a remarkable number of miles per hour, if the voltage is high. In fact they will get well up towards the speed of light with many thousands of volts.

However, they do *not* travel at the speed of light in tubes in amateur use, and thus are subject to the much talked about transit time effect. The point here is that in order to know what is going on RF-wise in VHF and even more so in UHF, you should differentiate between the electron flow and the RF current flow. A positive *wave* from the RF drive on the grid causes electrons to go through the grid. With a few landing on it of course. At the moment they go through the grid they see the screen ahead of them with all that beautiful 250 volts positive on it and away they go like dogs after the electric rabbit. Same thing happens all over again as they go through the screen, only this time they see 1500 volts (minus the 250 of the screen) and really get moving. (This is where the blower comes in, by the way). Arriving at the plate these electrons, being little particles of negative electricity, cause the plate to go negative. Now, watch out. The wave-front created on the plate travels along the plate line L1 at almost exactly the speed of light, reaches the cold end of the trough line about a quarter cycle later and then starts back again, reaching the opposing conductor that is, the conductor in the tube that is RF-wise attached to the walls of the trough line, as is right and proper. But what is this opposing conductor? Is it the cathode? Nope. The grid? Guess again. It is none other than the highly by-passed screen. The RF waves in the trough line cannot get through the screen. The screen is thus the second most important element for the RF output, not the cathode.

The cathode leads need to be short for the input circuit however. So, the moral is, pay attention to the plate-screen RF circuit here for those hundreds of watts out you are looking for.

High power VHF trough lines

Getting down at last to the actual construction ("tin cutting") we see in **Fig. 2** a top view of the trough line, switch and 6 meter coil. The socket is mounted in the center of the front end which is 4 inches by 4 inches thin brass .022 to .025. A flat box is also mounted under the socket with a cover containing the blower pipe hole. This cover is fastened with four screws, which allows work on the socket later if needed. A well insulated and spaced low capacitance grid lead is brought out to RFC 1 and the grid input capacity. This must be air sealed of course, as well as all others going through the socket box, in order that the air from the blower will be forced *through* the socket, which is designed for that purpose. The air continues on through the plate fins after going through the socket.

The tuning capacitor C1 should be able to take care of the B plus voltage of some 1500 volts, or higher if you're that anxious. The RF voltage may be considerably higher than 1500 if the plate circuit is operated unloaded. (Not advisable for any length of time!) Do not make the usual pencil test unloaded without having that pencil on a stick! Insulated! The RF really rips out but plenty. Not just a little

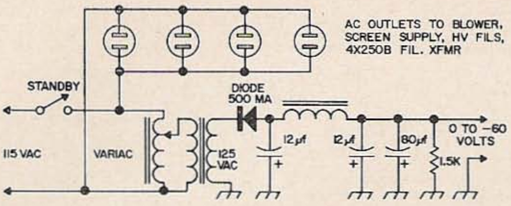


Fig. 3. Bias supply for the amplifier.

spark but a *roaring arc*. Don't say I didn't warn you.

The actual plate connection is a thin copper strap (soft copper) with its ends bolted together. The plate line, composed of two 1 inch straps at the plate which are joined together about 2 inches from the plate making a single strap from then on, is soldered to the plate strap in two places as can be seen in **Fig. 2.**

Fig. 2 also shows the positioning of the output capacitor C3 and output jack J2. C2 and C3 are actually *inside* the front trough line wall. The knife switch is mounted on a wood block about 1¼ inches which brings it up to level of the plate tank line (2 meters) which is positioned in the middle of the 4 inch high trough line. The flat handle of the knife switch may be extended through a front panel. Insulated! A panel is advised, as the switch, L2, C2, and one end of C3 are all at high voltage. I used bakelite shaft extenders and mounted the front panel, 3/16 inch white plastic, about one inch in front of the front wall of the trough line. RFC2 is 80 turns of No. 20 solid, covered wire, 2¼ inches long, wound on a ceramic form ½ inch O.D.

That about does it except for a few details. The output end wall and the socket wall are of thin brass, .022, some 4 by 4 inches square. The RF output jack is mounted on a strap which is soldered across the top of the trough line. You can also close the top in with a brass cover if you wish, and the efficiency will go up a percent or so on 2 meters. I have not done this yet. The output end wall has a large hole cut out in the middle (not shown) for the cold end of the 2 meter plate line to be led outside to the switch. Note that when using a pi network this is only cold to the extent of being near 50 ohms.

Again a word of caution. I tuned this rig up frequency-wise on low voltage, about 250 to 500 volts. I don't like to lose readers.

Driver and power supplies

So far I have only driven this amplifier with the "50 Watts For $50" rig to be described in 73 Magazine. The RF drive power, that is, grid input to the 4X250B, is listed as from 0 to 2 watts in the handbooks, so take your choice as to drivers. Even a Sixer should do it. I have used various powers on the driver and it seems to settle out around 10 to 12 watts DC power to the driver, with the untuned grid circuit, cable, and driver being used here. The cable connecting the driver at the moment is about 5 feet long. With an untuned grid circuit this cable can change the RF voltage on the grid up or down a considerable amount as can readily be seen. At or near a quarter wave length and tuned by the grid-cathode input capacity of the 4X250B there could be a lot more RF on the grid than with a half wave on the line where one could expect something like the exciter link voltage to be found on the grid.

Exciter drive power and modulation of the driver should be adjusted while listening to your own voice or with a scope. You'll soon see why when you do it.

Bias supply

We had some trouble at first with a large jump in grid bias voltage under RF excitation and modulation. This was due to the bias source not being "stiff" enough, and was remedied by the bias supply shown in **Fig. 3.** Using this supply the negative voltage was 70 without RF drive, 80 with drive, and about 85 when modulating the driver. The Variac shown in the primary of the bias supply is of course a better method of regulating such a supply than a potentiometer network in the DC output.

Screen supply

Nothing fussy about the screen supply. Just 0 to 300 volts, 50 ma, adjusted by another Variac. The "Turn-On" switch has a 115 volt outlet which goes to the HV Variac, which is in the primary of the HV transformer. This allows the screen and HV to be turned on at the same time.

HV supply

Again nothing special. I'm using my old KW job, tapped down to 1500 volts AC maximum. And of course, another Variac! Caution! Do not operate the tube with the screen on the plate off! All those electrons which are supposed to go to the plate land on the screen and wowie, what screen current! Very bad for a $38 tube.

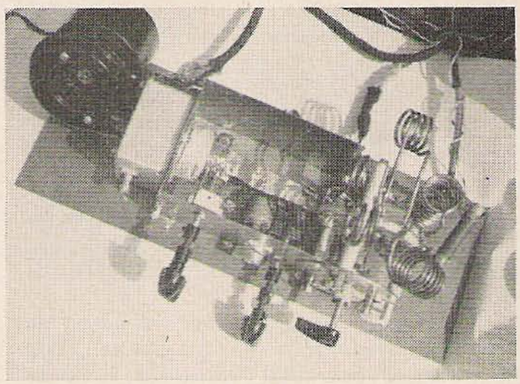
Results

First, be sure that there is at least 50 or so volts negative bias on the grid and that it can be varied. Set the screen for about 100 to 150 volts and the plate for say, 500 volts. This is without any RF drive. No plate current should show. Drop the bias down carefully. Plate current and screen current should begin to show. Adjust the plate current to about 100 ma for a start. Then apply drive on 6 meters using a dummy load, for example a 100 watt bulb in J2. Plate current should jump up to some 200 ma. A good plate dip should now show under resonance on rotating C1 with C2 at maximum. Adjust C2 for load, returning with C1. This pi network should adjust nicely from a large plate dip and little RF output with C2 at maximum, through a maximum RF out at the proper setting, and on to very flat or no tuning at all with C2 at minimum. This last is *not* the place to leave C2 and plate current will be heavy. A little practice will show you how to operate the pi net. The maximum RF output point is very noticeable over quite a narrow range at or near the proper setting for C2. On 2 meters of course there will be a great deal less of C2 for maximum output.

All Band Switching?

As mentioned in the introduction of this article, this circuit can be used in a real "all-band" amplifier—at least down to eighty meters. Perusal of many journals turned up several articles on the 4X150 series tubes, but most of these used on two meters called for large plumbing in the form of 1½" tubing which is not easy to work with. None of them, to my knowledge, used switching from two to six—or lower.

Being an ardent VHF-UHF contriver since the pre-WWII days on five meters, I have always been slightly annoyed by articles and rigs with the title "all-band" only to find the range to be eighty through ten. With this amplifier you can switch from two to eighty meters. You can also build it out of copper-clad bakelites and thin brass without going to plumbing. **Fig. 4** shows the circuit when going down to 20 mc, which I have done, or all the way down to 80 meters, which I have not done yet. Note particularly the shorting of all coils not used, by the multiple arms of the switch, and the switching in of additional loading capacitors as the wavelength increases.



Here's the continuous coverage 20-150 mc laser modulator that led to the simpler six and two amplifier.

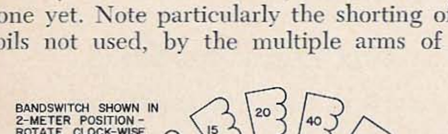


Fig. 4. "All band" version of the amplifier.

S1 is shown in the 2 meter position. The Radio Switch Corp. of Marlboro, N.J., makes excellent units of this type in a variety of sizes. Personally, I have always favored one complete operating position per band, but this rig may change that. A complete rig per band can get a little expensive, which is why I like Compactrons and the simplest type of rigs possible. I like to sit down at a table and have the 2 meter antenna connected to the 2 meter rig, the 2 meter converter, etc. Well, that is for you to decide, and this switching amplifier gives useful food for thought. If you get up beyond the 500 volt, 100 watt class, the modulators get cumbersome, so one big modulator could be switched. You have to suit yourself on this complex question.

Now check for good modulation using a tuned diode, transistor amplifier, and padded earphones as explained in previous articles. This little system allows you to hear yourself as others hear you!

There are several adjustments for an AM linear. The amount of RF drive is important; the fixed bias on the grid; the amount of driver modulation; the screen voltage; and the RF loading of the plate circuit. The effects of these are readily heard while listening on the "system". All handbooks on AM linears mention the adjustments as "critical". If you try to put one on the air without *listening to it yourself*, this could be true. But if you have the means to hear what is going out, then I do not agree. I have left the adjustments alone for weeks and still OK. Modulation reports, "Excellent," "modulation a little heavy but good," and so on. Don't forget that an AM linear is 66% efficient RF-wise under driver modulation. Not 33% as sometimes mentioned by handbooks. Some of them (handbooks) have only committed "sins of omission" by just mentioning the 33% and not saying anything about the 66%.

This article mainly concerns obtaining 6 and 2 meter RF with a low-cost simple switch. This it does! I have received various reports running from "an increase of 1 S unit," to "you went up 3 to 4 S units" comparing the linear with the 50 watt set. Also, I have by no means pushed it yet, running only about 200 ma and 1000 volts maximum so far. Will try high level modulation and more power later. After all, this bottle (ceramic it's true) is conservatively listed at 250 watts *output* in the tube handbooks, so, we'll see.

. . . K1CLL

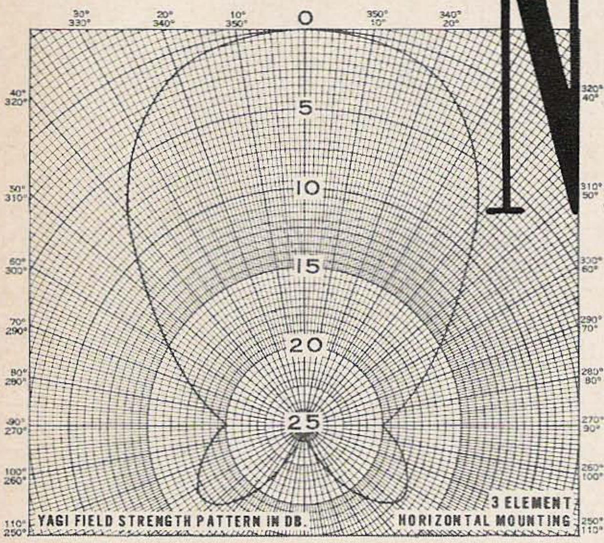
*A scope is recommended. Editor.

That Pretty Anodizing

Many fellows who build gear for themselves are very happy when they get hold of some of the beautiful anodized aluminum that is available. It makes attractive construction projects, but they unfortunately often work very poorly. The culprit is that beautiful finish. Aluminum anodizing forms one of the finest insulators known. It is almost glass-hard and has excellent dielectric strength. So when you used anodized aluminum, scrape it thoroughly any place you expect electrical contact to exist. Don't rely on toothed lockwashers. Remove the finish by sanding until you see that ugly bare aluminum.

. . . Jack Bayha W8BPY

Mosley TRAP MASTER



NEW

Beam / WITH Advanced Matching System / FOR Added Gain

The Classic 33 You've been hearing about it – maybe you've worked Carl Mosley WØFQY– 'The Old Man Himself' using it. Now here it is . . . A Revolutionary New 3-element beam featuring an advanced Mosley-engineered matching system called 'Broad Band Capacitive Matching' with coax fed balanced element for more efficient beam performance and extra gain over comparative 3-element beams. A New Tri-Band beam rated for 1 KW AM/CW & 2 KW P.E.P. input to the final amplifier SSB on 10, 15, & 20 meters; with a full 8 db. gain on all three bands over reference dipole (10.1 db. compared to isotropic source); a maximum front-to-back . . . .
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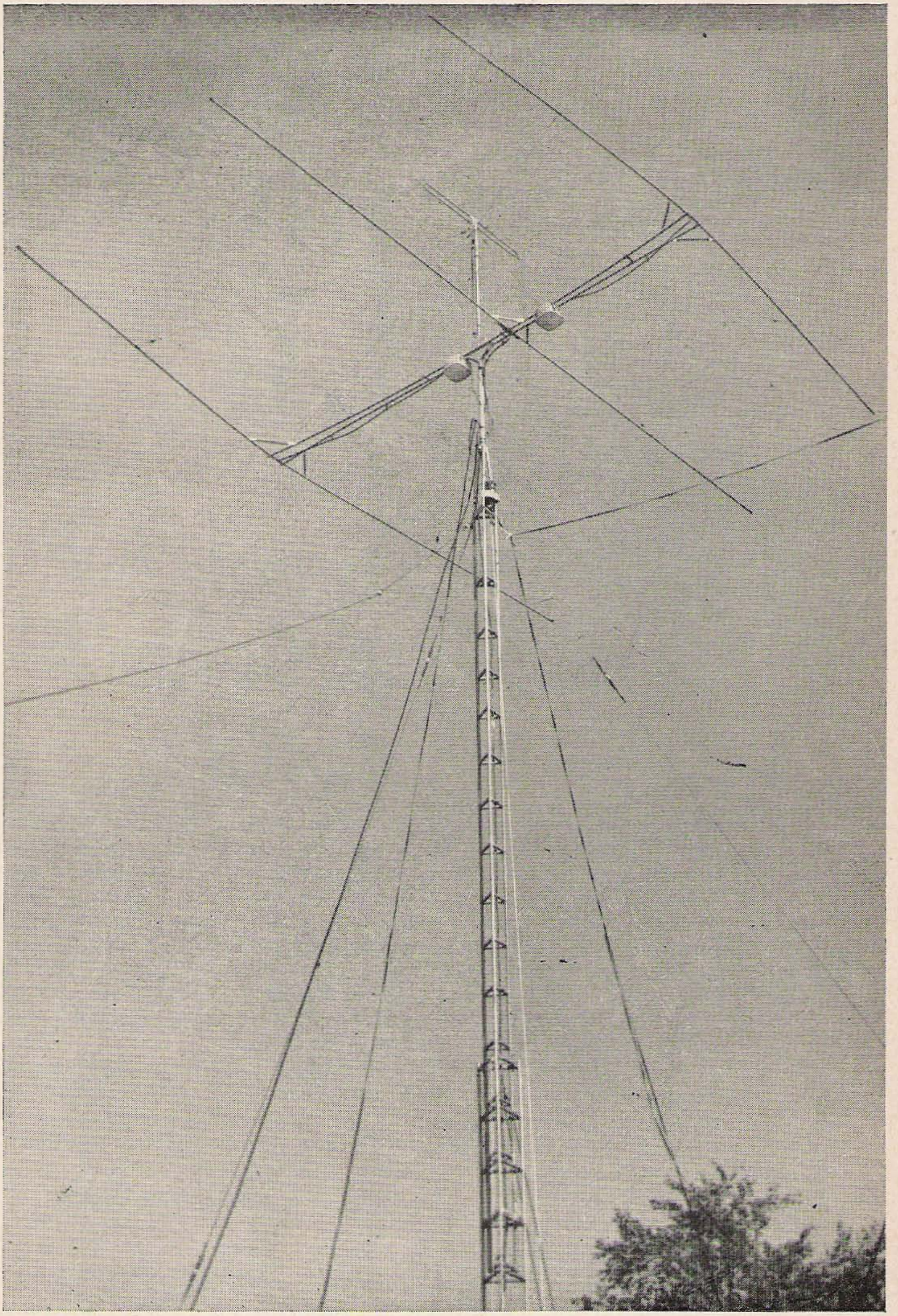


Hartland Smith W8VVD
467 Park Avenue
Birmingham, Michigan

The Bee Eliminator

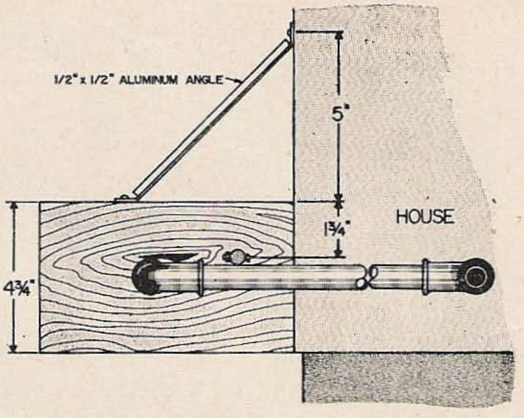


Fig. 2. Side view of winch.

Tired of having to promote antenna raising or lowering bees whenever you want to try a new beam or repair an ailing sky wire? The Bee Eliminator will free you forever from the need for borrowed muscles when it is tower wrestling time. Constructed of readily available material, this simple device offers the advantages of a tilt-over tower at a fraction of the tilt-over tower's cost.

The prototype illustrated in the accompanying photo and sketches consists of a U-shaped wooden support and several pieces of ½" galvanized pipe fashioned into the drum and crank of a hand operated winch. The dimensions shown are not critical and so they may be altered to suit your own requirements.

If you can't mount the winch at the corner of the house, as in the author's case, increase the length of the side boards from 8" to 20" to provide plenty of knuckle clearance for your cranking hand. A reduction in the crank's length is not recommended, since the shorter you make it, the harder you'll have to work when raising the tower.

A 14" steel rod acts as a safety stop to prevent the crank from running backwards when the winch is unattended. The stop should always be pushed to the right, except when you are actually turning the crank. Small bolts in the ends of the rod keep it from accidentally sliding out of the U-frame.

Provided there is no more than a 400 pound strain on the pulley attached to the tower, you can use the Bee Eliminator without modification. Greater loads, however, will require ⅜" nylon rope, heavy duty pulleys and added bracing of the winch box. Manila rope should be avoided because it lacks both the strength and excellent weathering properties of polyethylene and nylon. . . . W8VVD

W8VVD is a self-employed mail order dealer of 8 mm film and supplies. He's written many articles for all of the electronics magazines.

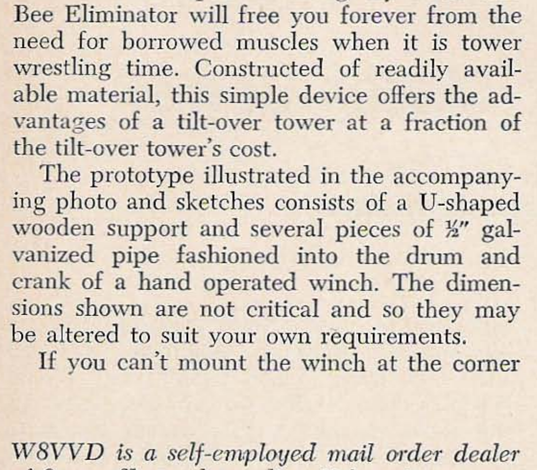


Fig. 1. Top view of winch.

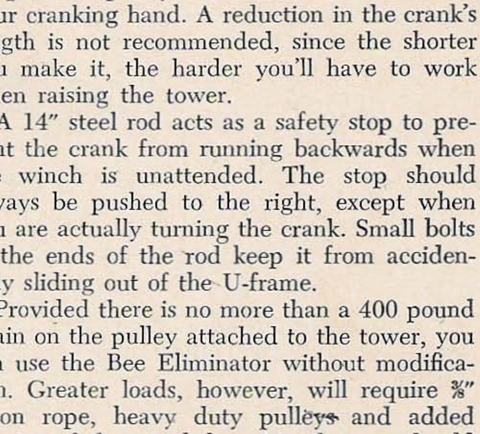


Fig. 3. Method of stringing rope between tower and winch.

Carmen Diodati K3PXT
93 N. Hilltop Drive
Churchville, Pa.
Photos by W3IKH

The Six Meter Jewel

A complete six meter VFO controlled fifty watt transmitter.

"Well, the rig here is home brew." A request for additional information reveals the following: Power supply, modulator, exciter and vfo are on separate chassis complete with interconnecting cables.

Since many hams do not have rack mounted equipment, the resulting conglomeration of cables and chassis is usually not scenic. The average ham, by nature a procrastinator, never quite gets around to removing the haywire appearance which is normally generated in his anxiety to get the new rig on the air.

If signal reports are satisfactory, appearance be darned! The rig works swell (the ultimate goal) so why worry. If anything goes wrong with the rig, we'll take care of it then.

Pictured here is a 6 meter gem designed and constructed by W3GMA and K3PXT. Two identical units have been constructed, the only variation between the two is a result of parts available.

As to function—K3PYB, harmonic of PXT, can attest to 7 states the first day of operation, and has since worked 23 confirmed states with very little effort. Signal reports were: You're 5-9 plus, lots of QRM on your frequency om, but you're pounding right through, absolutely no difficulty copying your station, beautiful clean crisp signal, etc. In general reports have been such that MYL is kept busy sewing on the shirt buttons.

K3PXT is an employee of the Frankford Arsenal, Metrology and Calibration Group. The Jewel is a club station (K3WBI) project for some of the club members.

The cost of this unit is negligible since most of the parts have been salvaged from discarded idiot boxes. Parts not available from passe boob-tubes were purchased surplus.

Most important is the feeling of pride with the statement, "Well the rig here is homebrew," while surveying the neat compact rig that you have built and are operating.

Circuit description

The power supply uses a single transformer for both low and high voltage. The low voltage section uses two 6AX4's in a full wave rectifier circuit. Capacitor input insures minimum hum in the audio circuits. The high voltage circuit consists of a 5U4, combined with the rectifying elements of the 6AX4's as a bridge

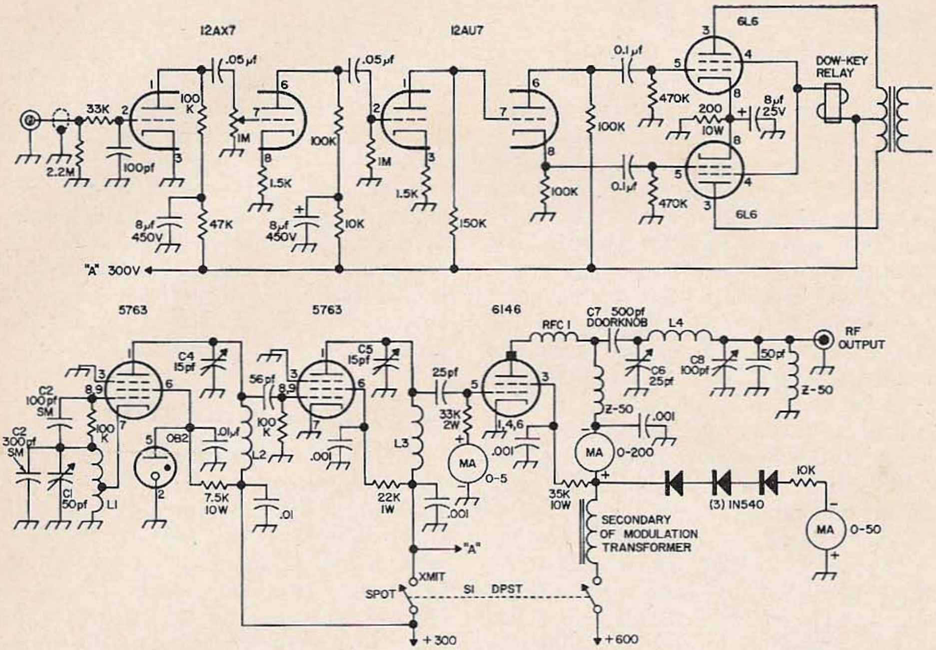


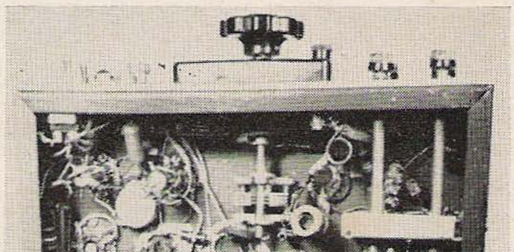
Fig. 1. The Six Meter Jewel rf section and modulator.

circuit. Choke input provides good regulation for the 6146. A dpst switch removes the dc voltages from the plates of all tubes for standby operation, while simultaneously deenergizing the Dow Key ant relay.

The rf section uses a 5763 as an electron coupled Hartley oscillator which tunes from 8.3 to 9 mc. The tuned circuit of the oscillator is loaded with a high C to L ratio for good stability. A voltage regulator supplies the screen grid (oscillator plate) which is electron coupled to the plate circuit. This electron coupling isolates the oscillator from the following stages. The combined high C to L ratio, voltage regulation and electron coupling results in a very stable vfo with effectively negligible frequency shift.

The plate circuit of this stage is a frequency tripler, capacitance coupled to the following doubler stage. The doubler is in turn capacitance coupled to the input of the final at the operating frequency, with a very healthy 4 to 5 ma of grid drive throughout the entire 6 meter band. The output of the final utilizes the very flexible pi-coupled network for greater harmonic attenuation, and relatively constant impedance throughout the entire band. An additional advantage to this method of coupling is that it may be used at some future date as the input to an amplifier for additional power, when deemed necessary.

The modulator section is straight forward, using three stages of RC amplification before a direct coupled hot cathode paraphase amplifier, which feeds a pair of old reliable 6L6's, operating class AB1, for plate modulation. The umbypassed cathodes of the amplifier combined with the direct coupled paraphase amplifier, results in excellent frequency response. Most important, however, is the elimination of an interstage transformer's space and cost.



Bottom view of the Six Meter Jewel.

Construction

The complete transmitter is constructed on a 12 x 10 x 3" chassis. The front panel is 12 x 8". Its sole purpose is to mount the meters. The meter at the left is the modulation indicator which at the time the pictures were taken was not wired in because of the author's inability to scrounge the necessary diodes at the time. This meter is used to ascertain that modulation does not exceed 100%, thus avoiding splatter and distortion. The center meter is the final amplifier plate current and the meter to the right is the final grid. Using the proper shunts, multipliers, and switch, one meter can be used to monitor these circuits. The individual meters provide simultaneous monitoring of the important circuits and an instant indication of any difficulties that may arise during transmissions.

The oscillator dial (lower center) is a National Velvet Vernier drive. This unit requires no mechanical change and is mounted directly to a Hammerlund MC 50S variable capacitor. The dial is marked 0 to 100. A calibration chart may be used for frequency identification, or the spot switch technique of zero beating the receiver can be used to determine frequency within the calibration accuracy of the receiver. The latter method, of course, is the most practical.

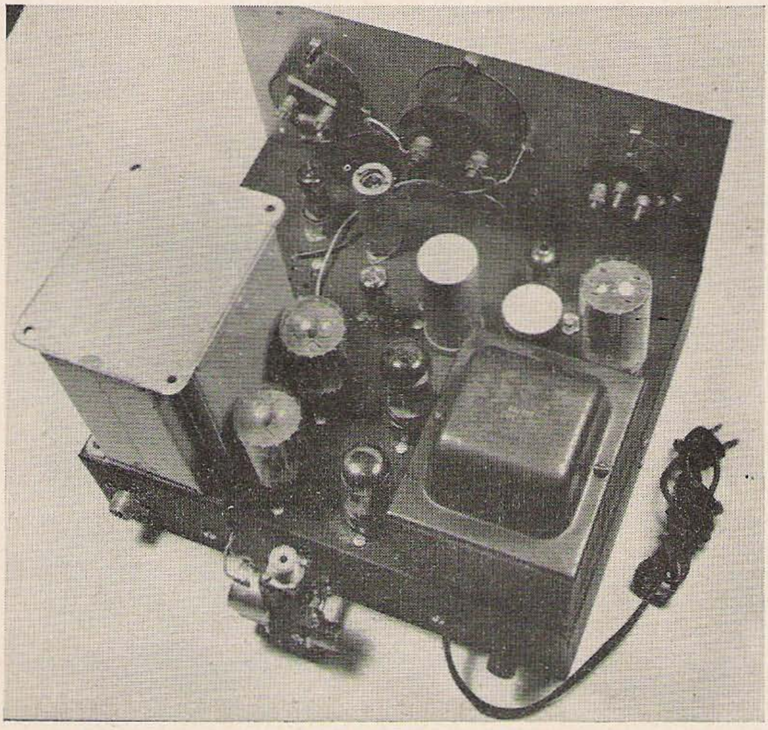
The 6146 final is mounted in a horizontal position beneath the chassis. Small holes spaced ½ inch apart on the top and side of chassis provide sufficient ventilation for cooling. This method of mounting the final makes efficient use of space that would normally be wasted.

In general, the layout is simple. There is no crowding of component parts, ample room for wiring and soldering, nor is the rig constructed elevator fashion (level on level) as can be seen from the photos; practically all component parts are easily accessible for trouble shooting when required.

Calibration and adjustment

The rf section is adjusted for proper frequency stage by stage with the aid of a grid dip meter. The over modulation indication meter is adjusted as follows: speaking normally into the microphone adjust the modulation control until the needle deflects sharply upwards at speech peaks. The upward swing of the meter now indicates that modulation is in excess of 100%. Now slowly turn back the modulation control to the point where meter movement no longer occurs at peaks.

The meter effectively eliminates the need for a scope for modulation adjustment and permits easy adjustment for obtaining 100% modulation with no fuss.



Top view of the Six Meter Jewel.

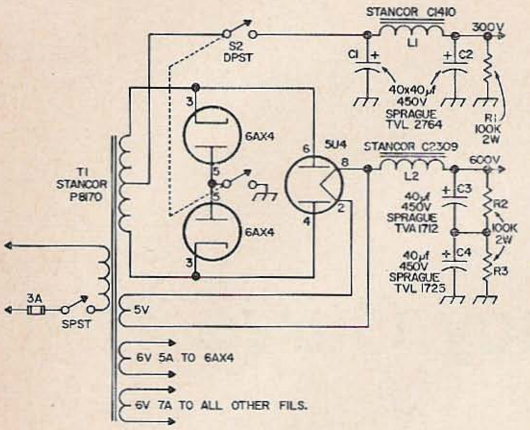


Fig. 2. Power section of the Six Meter Jewel.

The filaments should be set to on, at least a half hour before operation to ascertain minimum drift of the oscillator, however, the longer the filaments are on the more stable the oscillator. Set the Trans. Rec. switch to Trans. and adjust the tripler tuning and doubler tuning for maximum grid drive. Adjust the plate tuning for minimum plate current and the plate loading for maximum indication. Alternate between the two until a plate current of 120 ma is obtained.

When changing frequency, it is not necessary to retune the transmitter unless the grid current drops below 3 ma; it is only essential to redip the plate tuning and adjust the plate loading.

Conclusion

This rig as constructed is ideally suited for the ham who has a limited operating space, its size is such that it is easily transported from Qth to Qth during periods of mobility (vacations, etc.).

It is the writer's intention to construct transmitters of this type for several bands, each transmitter completely independent, yet capable of driving an amplifier for greater power when deemed necessary.

Most important a breakdown in one transmitter will not curtail operating activities for more than a single band. Meanwhile we'll look for you on 6 meters.

. . . K3PXT

Coil Table

L1. Oscillator, 9 turns number 20 on 3/4" ceramic form. Tapped third turn from cold end.
L2. Tripler, Like L1, but no tap.
L3. Doubler, 5 turns #18, 1/2" diameter, 5/8" long.
L4. Plate, 5 turns #14, 3/4" diameter, 5/8" long.
RFC1. 6 turns #22, 1/4" diameter, spaced wire diameter.
RFC2, 3. Ohmite Z50.

A formula for optimum spaced—optimum gain parasitic antennas

The Ascendency Curve Yagi

Robert Cooper K6EDX/W5KHT
c/o Valley Vision, Inc.
P.O. Box 4079
Modesto, California

When the Japanese physicist, Doctor Yagi, released his design formulae for the now famous antenna design which carries his name, a new era in directional, narrow band, relatively high gain antenna performance was born.

In the nearly three decades that have followed many an ardent antenna man has attempted to improve or refine the basic yagi formulae and some have met with varying degrees of success.

Most recently, although the period extends back more than ten years, the very long-many elemented version known variously as the Long John and long yagi has captured the spotlight in amateur antenna design circles.

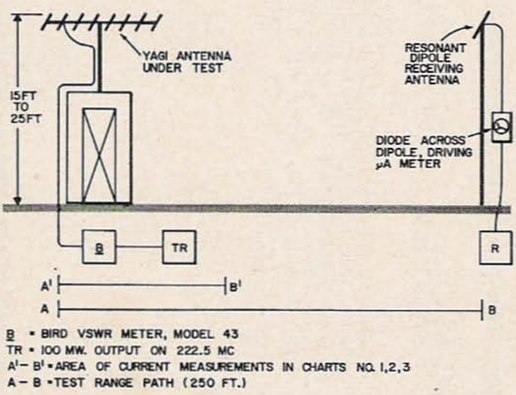


Fig. 1. Test set up for the antenna measurements described in the text.

This antenna design, sporting six or more parasitic elements, has developed along the theoretical lines of "if a little bit is good, a lot is better"; referring to the total number of in line elements in the antenna plane.

Unfortunately this is not always true. The mere presence of additional elements is no guarantee that performance of the antenna will improve. And in fact the converse has been found to be true if the designer is not extremely careful as to where he places his elements and how they inter-act with other elements in the same or similar planes.

Very briefly, the basis for any parasitic antenna is the driven element or dipole. With the addition of a *longer-than-driven element* element (the reflector) the radiation pattern of the dipole changes from bi-directional to uni-directional. And the characteristic feed impedance of the driven element changes; it lowers.

With the addition of the first *shorter-than-driven element* element (the director) the radiation pattern of the antenna changes still further, narrowing in the front (i.e. through the director element). And the characteristic feed impedance changes once again; still lower.

Beyond this point (the three element beam) the addition of parasitic elements usually takes place ahead of the first director. And with each additional director, the theory is that the forward horizontal and vertical radiation patterns sharpen resulting ultimately in a highly directional antenna that radiates essentially only in the forward direction over a comparatively narrow horizontal and vertical field.

However as additional directors are added to the antenna, each one has a corresponding "field effect" on those elements already present and many of these elements will in turn have an affect on the characteristic feed impedance of the driven element; lowering this impedance still further.

At some point in the addition of directors the feed impedance fluctuations stabilize and only the forward pattern (and to a small extent the side lobes) are further affected as additional elements are mounted.

Inter-element relationships

The primary consideration, then, in the careful design of any optimum gain parasitic antenna is the careful derivation of the final operating position of the various parasitic elements. Inter-element relationships is of primary concern.

A number of text books and published sources contain reference data for the design of optimum gain yagi antennas. If you will carefully analyze these standard sources you will quickly discover that no two are alike and many differ widely in approach.

Most however claim to have reasonably coinciding results.

Anyone who has worked with parasitic antennas is aware that two widely diverse sets of dimensions for two antennas, each to perform over the same frequency range, will deliver two widely diverse sets of performance parameters.

Our aim here is simple. To illustrate under carefully controlled laboratory conditions the inter-element relationships found in parasitic element antennas of up to eight elements, and to suggest that any VHF-UHF antenna enthusiast following the procedures outlined here will have as a finished product a yagi antenna that squeezes an extra 10 to 20 percent forward gain into the troposphere, with each parasitic element delivering *true optimum performance.*

Measured inter-element relationships

All design work, measurements and results were gathered under reasonably *pure* laboratory antenna test range conditions using the equipment set forth in **Fig. 1.** The results here have been duplicated over a wide range of frequencies covering 50 to 950 mc and comparative analysis has been performed using both commercial and so-called standard handbook design yagi antennas in the amateur 144

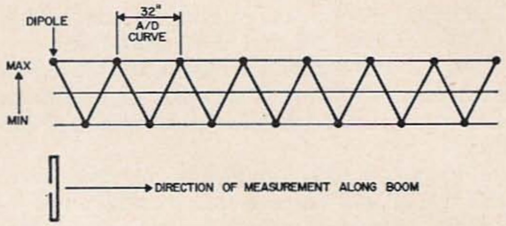


Fig. 2. The measured current peaks found in front of the driven element (dipole) of the test 222.5 mc yagi when the driven element was mounted by itself on the test boom. Note the 32 inch (0.6 wavelength) symmetrical current (power) peaks as the test receiving dipole and meter were moved away from the driven element.

and 220 mc bands.

In each instance the test results indicated an improvement in forward gain over conventional existing antennas or designs varying from a low of ten percent on the better designs to a high of 20% on those not so good.

Reference is first made to **Fig. 2.** This illustrates the principal of measured wave fronts or *current points* as found along the forward (right angle) path of fire from a gamma matched and resonant 222.5 mc driven element, suspended on the test range.

A floating reference pick up dipole feeding a micro-ammeter field strength indicator was moved along the horizontal radiation plane of the driven element and measurements made of the physical distance between corresponding current peaks. These distances are plotted on chart number one, and they correspond to 0.6 wavelength in free space at the operating test frequency of 222.5 mc. (*Note:* 0.6 wavelength is an observed phenomenon and should not be confused with 0.5 wavelength current peaks normally *assumed* in antenna theory discussions.)

In step number two a reflector element, 5% longer than the driven element at the test frequency, was mounted on the same boom with the driven element, and a down-test range field strength meter was observed while the reflector was positioned for optimum forward gain.

In step number three a 2.5% shorter-than-driven element director was mounted on the same boom and the identical down range field strength indicator was utilized to position the director in the position on the boom where optimum forward gain could be measured.

In both steps, the addition of the reflector and the addition of the first director, the gamma-matched driven element was re-tuned for optimum loading and minimum VSWR as indicated on a Bird thru line meter with a

250 milliwatt element. In each case the VSWR was lower than 1.2 to 1 after adjustment.

Fig. 3 references the physical spacing of each element, with its neighbor or neighbors, starting with the addition of the reflector element.

Fig. 3 should be studied at this time. Here the reader will observe that as additional directors, beyond the first, are added, and the down range relative field strength of the antenna increases, various changes take place in the physical spacings of the already positioned elements and the gamma-match setting.

After the second director is added (i.e. the four element parasitic) the gamma setting becomes uniform indicating that in this particular design approach any five or more element beam (using three or more directors) will load with the same gamma (or other form of matching) setting as a four element (with two director elements).

In **Fig. 3** pay particular attention to the addition of the fifth director.

Keep in mind that in each case the addition of each element was made solely on the basis of locating the element where (after all other inter-element relationships were compensated) optimum forward gain resulted.

With the addition of the fifth director, the human urge to want to locate it approximately 14-18 inches ahead of the fourth director was great, even though the antenna test range measurement equipment indicated that optimum gain was actually nearly 34½ inches ahead of the fourth director.

To the eye, the fifth director seemed to want to locate where the *sixth* should go, and a gaping hole existed in the boom position where the fifth should be!

This particular episode cost us more than a week of back tracking and re-building, but the results always came out the same, regardless of such variously tried changes as height of the antenna above ground, vertical or horizontal polarization, and so on.

The real surprise after this stage of development came with the addition of the sixth director. Our assumption was that it should locate another 34½ inches (approximately) ahead of the fifth physical director. We tried this and the field strength diminished. Attempts to position it in the general area of 14-18 inches ahead of the fifth director (as the other prior directors had spaced out) met with a very slight 4% improvement in down range field strength.

On a hunch the sixth director was placed in the "hole" where the fifth should have located, and after some small amount of inter-element juggling, the antenna gain jumped and the final positioning shown resulted!

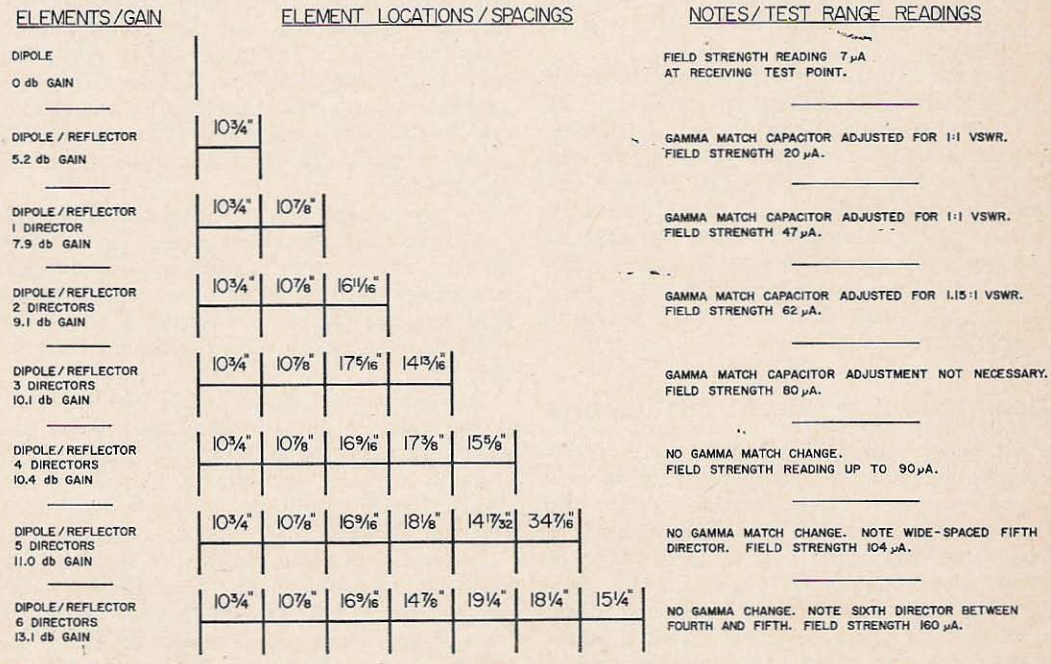


Fig. 3. Results of adding elements to a dipole. Gain is referenced against original tuned dipole.

I suspect that others have found that the fifth director in a controlled environment yagi belongs well ahead (relatively) of the fourth for there are such designs in print today in reference books. However I also suspect that other designers, upon noting this fifth-positioning, have also assumed (as I did) that the sixth would also locate the same approximately elongated spacing distance ahead of the fifth.

My extensive experiments indicate this is a mistake for in truth the sixth goes where the fifth should have gone.

This is relatively simple to verify. Remove the last director (fifth to be added—sixth in line) after the sixth to be added (fifth in line) has been positioned. Performance drops much out of proportion to the gain of the theoretical last director's influence.

Inter-element relationships

In **Fig. 2** measured current points were plotted as a function of physical distance along the path of fire of the driven element.

In **Fig. 4** these same measure points are referenced against the final positions of the parasitic elements in the six director (eight element) parasitic antenna. Note carefully where each element falls relative to the rise and fall of the current peaks plotted *before* the elements were added and positioned.

Note, if you will, that director elements 1, 3 and 5 fall on the *descending* (down) side of the current slope while director elements 2, 4 and 6 fall on the *ascending* (up) side of the same curve.

Refer to **Fig. 5.**

Here the relative position of these director elements is shown as a percentage of the physical distance from the top (or start) of the current curve in which it falls.

In the eight element yagi, for example, director number one is 34% *down* (or physical distance ahead) of the driven element, which represents the start of the first curve.

Director number two is 86% *up* (on the ascending side) of the same curve.

Director number three is 32% *down* the second curve.

Director number four is 92% *up* the second curve. And so on.

In each case the optimum spacing of the elements, and their final optimum gain settings, is a clearly recognizable pattern or positioning that corresponds precisely with the originally measured 0.6 wavelength repeating current peaks emitted by the driven element standing alone.

It is a relatively simple matter to reduce these observations to a formula which will allow the builder to duplicate these performance parameters on nearly any VHF-UHF frequency.

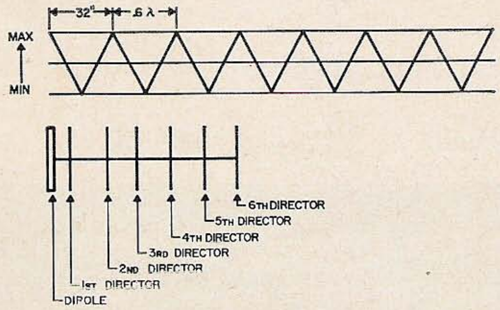


Fig. 4. Current peak on driven element alone relative to position of directors.

Spacing of Director Elements

No. elements in yagi	D1	D2	D3	D4	D5	D6
3	34%					
4	34%	86%				
5	34%	88%	138%			
6	34%	85%	133%	195%		
7	34%	85%	142%	188%	—	295%
8	34%	86%	132%	192%	249%	297%

Spacings given here are for any number of total elements up to 8, with a 0.2 wavelength reflector spacing (for maximum gain). Note the "ghost element" in the 7 element yagi.

Spacing for 100 mc Yagi

8 Elements	D1 to D2	to D3	to D4	to D5	to D6
	25.52"	35.66"	33.28"	42.94"	40.79" 34.34"

Fig. 5. Element to element spacings are given with the first D1 measurement the distance from the driven element to the first director. The total boom length required is 18.1 feet. The driven element length is 55.20 inches and the reflector to driven element spacing is 23.85 inches.

Calculating ascendency curve

(A) Determine the center frequency of the range you wish to cover. Calculate the *ascending-descending curve* (0.6 electrical wavelength in free space) by the following formula:

$$\frac{492}{\text{Freq. in mc}} \text{ divided by } 5 \times 6$$

Convert to inches by multiplying the result of above by 12.

(B) This figure, the A/D Curve, will determine the placement of all of your director elements. The spacing for the reflector will be equal to the figure determined in (A) above, divided by 3. This is 0.2 wavelength spacing.

(C) The placement of all director elements can be determined by following the table below. In this table, everything is given in percentages in terms of the percentage of the A/D curve (0.6 wavelength) derived from (A) above. For example, as shown below, in an eight element (6 director) yagi for 100 mc, the first director will be 34% *down* the descending side of the first A/D curve, as measured from the driven element forward. 34% of the A/D curve of 5.963 feet at 100 mc is 25.52 inches. The first director, then, falls 25.52 inches ahead of the driven element, at 100 mc. The second director falls 86% along the same first A/D curve, or 61.18 inches ahead of the driven element. And the third director falls 132% along the A/D curve, or on the *down* side of the second A/D curve. At 100 mc, with a 5.963 foot A/D curve, 132% along the curve flow falls 94.46 inches from the driven element. And so on. Just remember that all calculations are in terms of the basic A/D Curve, which is computed from (A) above.

(D) Element lengths, from experience, is as follows. If the yagi is to perform over a ½ megacycle (or smaller) bandwidth, make the reflector 5% longer than the driven element and the directors correspondingly 2.5% shorter, each that amount shorter than the preceding director (or driven element in the case of the first director). If the yagi is a broadband affair, to work over a 6 megacycle wide television channel, make the reflector 5% longer than the driven element and each director 5% shorter than its predecessor element.

(E) The formula for calculating driven element length is as follows: (assuming use of 1 inch or smaller diameter tubing for the driven element at frequencies lower than 450 megacycles)

$$\text{Length in inches} = \frac{5540}{\text{frequency in mc}}$$

Finally, for reference sake, and purification of the presentation, **Fig. 6** illustrates the current peak readings made *after* the eight element yagi was completed. For reference sake the dashed line is included as the original readings taken with the driven element *alone*.

Here it is clearly evident that current relationships in the transmitted wave front are largely distorted and re-played with the addition of the parasitic elements to the single

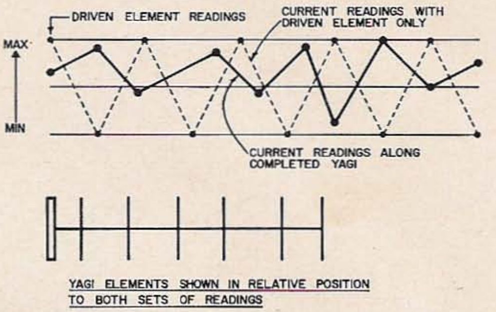


Fig. 6. Current peak readings made after the eight element yagi was completed.

element driven-element antenna. Interestingly enough, the roles of the odd numbered directors (1, 3, 5) and the even numbered directors (2, 4, and 6) have *reversed* in this antenna field comparison. Whereas the odd numbered directors formerly fell on the *descending* side of the *driven-element only* current curves, they now fall on the *ascending* side of the new curve. And the opposite is quite true for the even numbered directors, falling as they do now on the *descending side* of the new set of curves.

The logical extension of this approach to yagi antenna design is simply this. That in any parasitic antenna configuration, the current distribution within the field of the antenna is extremely critical. *The proper phasing of these antenna currents is of even greater importance.* Experience with other yagi design formulae indicates that some benefits are to be derived from almost *any* design, although it would seem logical that hap-hazard design approaches to extremely long yagis is an excellent way to end up with less forward gain and directivity than you might reasonably expect from a well designed three element antenna.

Yagi gain, then, appears to be a matter of degrees. The amateur who wishes to verify the design parameters of an existing yagi antenna needs only to set up a reasonably pure test range, and feeding his test antenna with a low power signal (100 milliwatts is fine for this purpose), observe the cumulative results as elements are added to, or moved or removed from the antenna under test.

Removal of any director element and a corresponding *rise* in indicated field strength at the test receiving site, or no change at all is a good indication that all is not well in the current phasing region of your parasitic yagi antenna!

. . . K6EDX

Paul Franson WA1CCH
Peterborough, N.H.

The Uhfit

A UHF wavemeter, detector, field strength meter, monitor, multiplier, filter, converter etc.

The other day, a visitor told me that he wanted to get on 432 mc, but hadn't because it's too expensive, too hard, too much trouble, too complicated, too difficult to find equipment and too time consuming.

That's ridiculous. Anyone who can solder can sit down for a few minutes with a few scraps of metal and a few other parts and build himself useful pieces of UHF equipment. This article describes one I call the uhfit (for UHF unit).

The uhfit can be used for finding bands, tuning transmitters and antennas, monitoring signals, filtering out unwanted signals (and filtering *in* wanted ones), mixing for converter use, multiplying signals for local injection or test generator use and many other tasks.

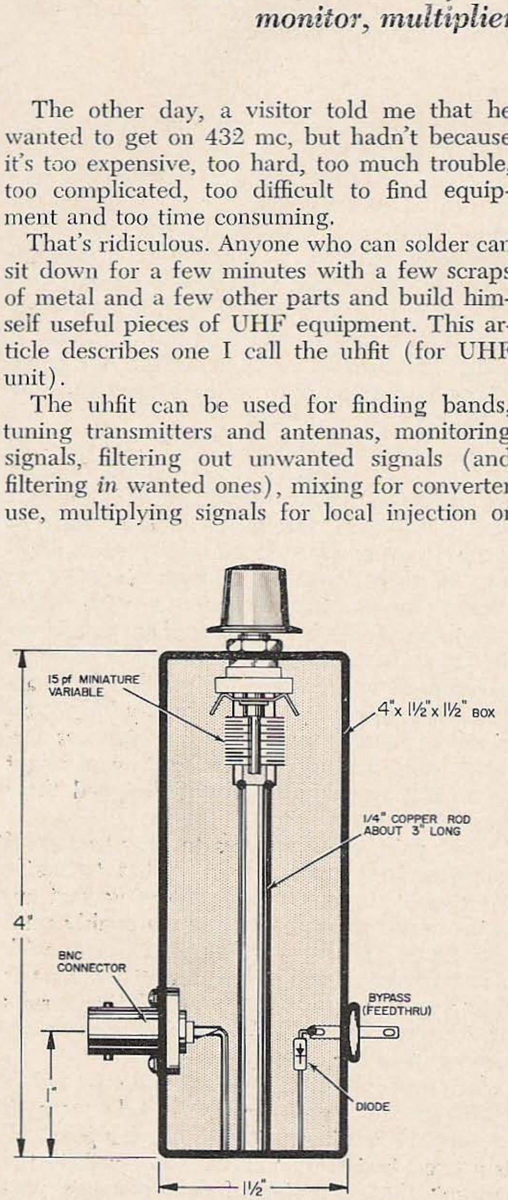


Fig. 1. The Uhfit—a UHF multi-purpose unit. This is the basic wavemeter-field strength meter. Modifications for other uses are described in the text.

So what is the uhfit? It's a simple tunable trough line cavity tuning 210 to 470 mc. Various "accessories" such as antenna jacks, diodes, wire links, transistors, feedthrough capacitors and other components are added for specific purposes as outlined in this article. The uhfit covers the 220 mc band for individualists, UHF aircrafts, the 420-450 mc ham band, the 460 mc citizens band and lots of whining radar.

Construction of the uhfit

The uhfit is most easily made from copper clad laminate board with the copper on the inside, but it can also be made from other materials. Probably brass makes the prettiest box; copper is nice but a bit soft. You can even use old tin cans. Tin isn't the best of conductors, but good solder is 63% tin and not many people bother to lose sleep over that. An advantage of solid metal over the copper clad board is that you can put a cover on the uhfit for neatness, higher Q (probably), and to keep the bugs out. There will be a small change in frequency range if you use a cover. I built my uhfits from the copper clad board and didn't put a cover on because of the mechanical problem of getting a good electrical contact.

The center conductor is a piece of copper or brass rod about 3" long. You can often find pieces of it in old TV sets as shaft extensions and most hardware stores carry it too. Be sure to tin the ends of the rod and the matching part of the box before you try to stick them together. The best soldering tool for this—or any soldering—is an Ungar 47½ watt long chisel tip.

The variable capacitor is not too critical. I used a small Johnson or Hammarlund miniature variable in mine, and some surplus capacitors are real nice. If you use a smaller capacitor, the minimum frequency will be higher, but the maximum won't change very much since most of the small capacitors have about the same minimum capacitance. Conversely, if you use a slightly larger capacitor, the minimum frequency will be lower than 210 mc, but the maximum frequency will decrease quickly since miniature capacitors over about 15 pf aren't very small. See the section on other frequencies if you want to fiddle.

We're now to the point where you have to decide what you're going to use the uhfit for. Chances are you'll want and need the basic wavemeter-field strength meter most, so I'll describe that first.

Fig. 1 and **Fig.** 2 show this basic uhfit use. In addition to the trough line cavity, you'll need an rf connector, some heavy wire, a diode and a feed through capacitor. I like BNC connectors. They are excellent electrically, easy to connect and disconnect, and plentiful. You can pay 35¢ apiece for them surplus, but most hams don't. Fairly modern surplus seems to be covered with them and a good scrounger can get all he needs for very little. If you want to use other connectors, RCA phono type are probably as good as any for this use.

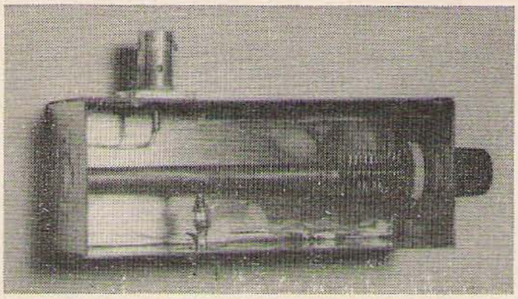
The feedthrough bypass capacitor is not critical. Values from 100 to 2000 pf seem fine. There are many different types available from surplus, new, and from old TV tuners. Be fairly gentle with them since they're fragile. If you want to buy a new one, the Centralab MFT-1000 for 30¢ from most distributors seems about as cheap as any.

I used a 1N82 diode in some of the uhfits, a 1N295 in others, and some unmarked detector diodes in others. I also tried many miscellaneous computor types out of curiosity and satisfied my curiosity. Stick to diodes designed for VHF and UHF use. Transistors Unlimited and others sell them at very reasonable prices. Solder these diodes quickly as they're not fond of heat. VHF transistor collector-base and emitter-base junctions can work well, too, if you happen to have more VHF transistors than VHF diodes.

The loops for the antenna input and the diode aren't critical for most uses. You can even eliminate the loops and tap directly on the center conductor if you prefer, though that will broaden the tuning and change the frequency range somewhat.

Using the uhfit wavemeter

It's very simple to use the wavemeter once you have it calibrated. For that, see the section on calibration. Connect an antenna—usually a short piece of wire—to the antenna jack and a meter to the bypass terminal and case of the uhfit. Use a sensitive meter or meter and amplifier (see the article in the January 73 for some excellent amplifiers) for low power oscillators and transmitters or a low range voltmeter or milliammeter for high power transmitters, but don't try to get too much or you may bake the diode. Then just tune the wavemeter for maximum output. You'll quickly notice that tuning is very sharp. In fact, you'll probably try to figure out a vernier arrangement or at least use a big knob after you've used the uhfit for a while.



The Uhfit. Note that the diode is tapped on the tuning line. It was later found that a link was better for most uses.

The uhfit as a field strength meter

The same arrangement is used here. Connect an antenna to the antenna jack and tune for maximum meter reading. Use any old piece of wire for rough tuning or a carefully made, balanced, isolated, matched dipole for antenna measurements.

The uhfit as a monitor

The uhfit can be used as a monitor of signal strength by connecting it to an antenna near your transmitter antenna. Then a meter in your shack will tell you instantly if something goes wrong with the transmitter, transmission line, or antenna.

You can use it as an AM monitor by connecting a pair of headphones to the output jack if your signal is strong. If not strong enough, use a 1 k to 1 M load resistor across the output jack and amplify the signal there with an audio amplifier such as one of the Lafayette $5 transistor ones. The feedthrough capacitance and load resistor should be compatible in regards to time constant; if that statement doesn't mean anything to you, don't worry about it unless the audio sounds "bassy". Then try a larger load resistor, or smaller feed

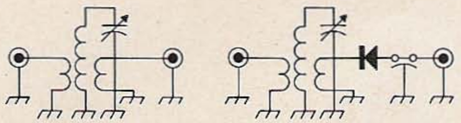


Fig. 2. Two uses of the Uhfit: a high Q tank to help eliminate unwanted frequencies, and the basic wavemeter.

through or check your transmitter which may *be* bassy. You can also use the uhfit as an audio detector for the horizontal plates of your scope.

You can monitor SSB signals with the uhfit if you happen to have a very stable oscillator to inject a carrier, but I wouldn't build the uhfit just for that.

The uhfit is good for monitoring CW if you have enough voltage output to key a small transistor oscillator.

ATV? Sure. Use the same scheme as monitoring AM if you like to listen to video signals. Come to think of it, they tell me that some devoted RTTee's can copy teletype in their head. Maybe ATV'ers see the pictures when they hear video. . .

More useful might be to connect the output of the uhfit to the Z axis of your scope. You might have to reverse the diode if you don't like negative pictures. For horizontal and vertical sweep, you might be able to use the scope itself since you may be synched on the 60 cycle AC line in one way or another in this age of interconnected power lines. You'll probably have to clip off some sync pulses with diodes or transistors and reduce the feedthrough capacitance. I haven't tried it.

You can also use the uhfit as a simple AM receiver for nearby planes or hams. Don't forget that that's not legal in the VHF contest anymore, though.

RF filter

This use of the uhfit requires a slight modification from the above uses. It's shown schematically in **Fig. 2** as a hi-Q tank. Use another rf connector and loop instead of the feedthrough and diode. Then the filter can be used in receiving to help keep unwanted signals—especially images and strong locals—out of your converter. Use large coupling loops for minimum degradation of your noise figure, and small loops for maximum rejection of spurious signals. These small filters don't work as well as large, silver plated coaxial ones, of course, but they do a pretty good job.

The same considerations apply for transmitting. The filters will help prevent UHF TVI or AFI (air force interference, very bad) if you use a varactor multiplier on 432 mc without an amplifier. Don't try to feed too much power into the uhfit. of course.

The filter is also good for tuning up transmitters. Put it between the transmitter or multiplier and the dummy load to make sure that the power you're measuring is on 432 mc and not 288 mc or somewhere else.

Diode multiplier

In the basic uhfit, use a varactor or UHF diode (such as the Amperex 1N3182 at 85¢) and rf connector instead of the detector diode and feedthrough. Here's one case where it's good to tap onto the line instead of using a loop. Feed rf into the varactor rf connector (input) and tune the capacitor to twice or thrice its frequency. This provides a low level multiplier for local injection in a converter or a test signal. A resistor of 47 k to 1 M from the low frequency side of the diode to ground improved results for me.

Mixer-converter

To make a simple converter from the uhfit, you'll need two loops with rf connectors, and one loop with a UHF diode and a low capacitance feedthrough capacitor (say 50 pf). You can easily make a capacitor of that value from a small piece of double copper clad fiber glass laminate or what have you. While it isn't critical since this converter isn't going to set the moon on fire, a convenient arrangement is to put the other loop behind the center connector.

One rf loop is for the antenna. The other is for the local injection. The loop with the diode is the mixer and the output from the feed through is your *if*. Resonate a coil of wire with the feedthrough capacitor at the *if* you choose and use a loop of wire to couple to your *if* receiver.

For narrow band work, you can use a simple crystal controlled local oscillator and multiplier. The best *if* for this would be a low noise six or two meter converter. For ATV, use a simple one transistor local oscillator and your TV set as an *if*. For wide band, modulated oscillator use, a superregenerative receiver such as the Sixer or Twoer or a cheap FM receiver is a good *if*. Good FM tuners (like my Scott) do too good a job of rejecting AM and you lose part of the modulation.

No one claims that this type of converter is the ultimate. However, with fiddling and/or a transistor preamplifier or two, it can do a very good job.

Tunable oscillator

The uhfit can also be used as an oscillator in a simple adaptation of the UHF dipmeter in the December 73. Simply use two feed-throughs (as in that article) and connect the collector lead about an inch or two up on the center line. Use a small loop for output. That gives you a simple UHF signal source, tunable local oscillator or low power transmitter. If you want to modulate the oscillator, you'll get mostly FM. Transistor oscillators love to FM. Don't expect too much.

Different frequencies

If you want to cover lower frequencies, your best bet is to make the box larger, the line longer and use a larger capacitor. I didn't try to get lower than two meters.

Higher frequencies are more fun. For 1215 to 1300 mc, make the box about one-third as long, but the same width and depth. Use a brass screw or brass core from a broken coil form with suitable nut or bushing as a capacitor. It provides just the right amount of capacitance as it goes into the open top of the line. Be careful that it doesn't short or you'll have a half wave instead of quarter wave line and twice the frequency.

For fixed frequency use in converters, etc., a glass or ceramic piston trimmer is far easier to tune than a variable air one since they provide at least a ten to one bandspread.

Calibration

Calibration of the uhfit is easiest with a tunable calibrated oscillator such as the UHF dipmeter in the December 73. Of course, you need a wavemeter to calibrate that. . . Chances are that someone around you has one or the other. If people who volunteer to help calibrate wavemeters or dipmeters will send me their names and addresses, and those who want help will send a self addressed envelope or postcard, I'll try to get you together properly.

And finally, I make no claim for any originality for any of this, though none is taken from any rememberable source as I have a spongy mind. I also don't claim that the uhfit is the ultimate in UHF equipment, but it's simple, cheap versatile—and fun! Why else build anything, . . . WAlCCH

Lewis Fitch W4VRV
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Columbus, Ohio 43212

A Home-Brew Permeability Tuned VFO

For something like twelve years, I've been trying to build a good VFO. Unfortunately, such is the nature of Genus Hammus that after I built each one my requirements became stricter. A friend once told me that what I wanted was a crystal—with a knob on it. Actually, I've tried that, but the range is too limited. I replied, wittily, that all that I needed to build what I wanted was: a case built like a battleship, a device with power gain that produced no heat, and a variable reactance that wasn't subject to vibration.

To some extent the features that I wanted are incorporated in the present VFO, and the result is pretty good. I built it out of scrap material using hand tools and a quarter inch power drill. The VFO drifts only a few cycles from turn on, has plenty of bandspread and is practically insensitive to vibration.

The oscillator uses basically the Clapp circuit. The capacitive swamping is not as heavy as usually used, but this seems to have no bad effects in this case.

Circuit

The circuit as shown has been tested with various inductances and capacitances and oscillates up to 25 mc. It would probably work above that frequency.

The transistors are 2N708's. These are NPN silicon high frequency transistors operated in this circuit at very small fractions of their ratings. At least one manufacturer sells these at less than $1.50 each. Other similar transistors will undoubtedly work in the circuit, but the 2N708's are about as inexpensive as any readily available which have good high frequency characteristics.

The oscillator is followed by an emitter follower. This is followed by a class A amplifier which is followed by another emitter follower for low impedance output to a cable. The VFO shown will produce a useful voltage across a 50 ohm load. A 75 ohm load gives a little more voltage still.

It is not, of course, necessary to use the permeability tuning shown with this circuit, but the series capacitance should be kept fairly high for oscillation to start readily if a variable capacitor and fixed inductor are used.

Mechanical details

The circuit is built on Vector board using flea clips. Standard components were employed throughout, and no difficulty was encountered due to any unwanted couplings. The transistors are soldered in (after mounting *all* the other components to the flea clips). The silicon transistors are very tolerant of heat, but the iron should not be applied to the leads for more than about five seconds. That will be more than enough. No heat sinks were used.

The box used in this case to house the unit was made from ¼" aluminum, top, bottom, front and back, with ⅛" aluminum sides. This is undoubtedly overdoing the rigidity bit, but it was available. A sufficiently rigid enclosure can be made from ⅛" aluminum (rack-panel type) with angle stock at the corners (do it yourself stock available in hardware store or from Sears, Roebuck). A Minibox might do, but I've never found them rigid enough for VFO's. Look at the construction of a BC221, for example.

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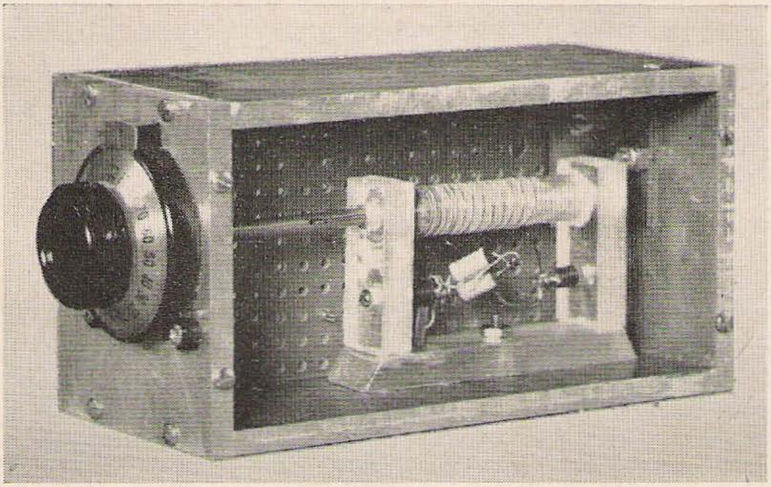
The heart of the VFO, L1, a permeability tuned coil wound on thick plastic stock.



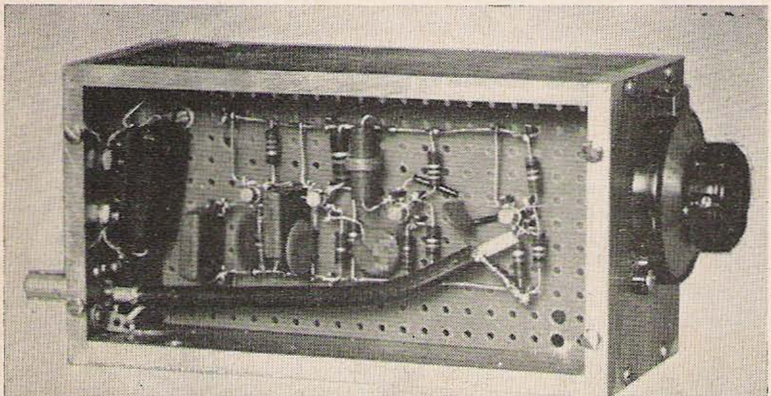
Use batteries for the power supply. The VFO frequency varies with voltage and even with a well regulated laboratory type AC supply some FM could be detected as a rough note at the 5th harmonic. Batteries smoothed it right out. Three "D" size flashlight batteries should last quite a while since the drain at 4.5 volts is 3 ma. This figures out to a total power input to the VFO of 13.5 milliwatts, which is one of the main reasons for the stability. There's practically no internal heating.

The inductor

To keep changes in the box from stretching the coil from the inductor is constructed to be supported by the box at only one point.

The slug, which gave the inspiration for this mode of construction, is from an old ferriloopstick broadcast coil ¼" in diameter, with a 4-40 screw on one end, and a hole the right size to take a 4-40 screw in the other.

The bass and uprights were constructed from rectangular plastic stock ⅝" x ½". The coil form itself is ⅝" round plastic. A hole ¼" in diameter was drilled through the center of the coil form and then smoothed slightly by wrapping fine sandpaper around a smaller drill and working it back and forth until the slug slid easily through the form. When plastic is drilled with a high speed drill it tends to grab and melt and otherwise behave badly, so the drilling should not be rushed. The centering of the hole exactly is not extremely important, but it should be straight and as parallel to the form as possible. One end support was then glued on with polystyrene cement and the ¼" hole continued through the coil form through the support. (Let the cement harden thoroughly first.) Both supports are then glued to the base and the coil form glued to the other support. After drying, the hole is drilled back through the first support and coil form and through the remaining support. This



View of the transistors in the VFO. Note the solid construction.

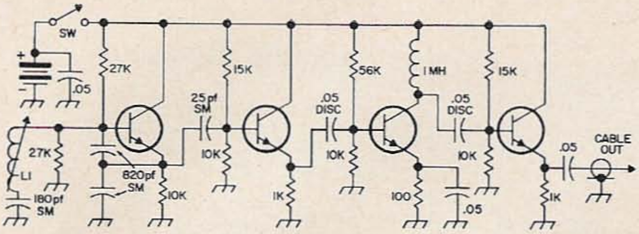


Fig. 1. A Home Brew Permeability Tuned VFO. See text for L1. All transistors are 2N708. Battery voltage is not critical; a 4.2 volt mercury battery is recommended for best performance.

way, all the holes line up exactly.

A 4-40 nut is then put on the screw in the slug and the slug is slid into the form. The nut is then heated with a soldering iron until it melts securely into the support. Another 4-40 screw, at least two inches long is then threaded an inch or so into a nut, and ¼" or so of its threaded end is liberally smeared with epoxy cement. The hole in the slug is also smeared on the inside with epoxy cement for about ¼". (A toothpick serves well.) The slug, in the coil form, should then be positioned so that when the nut on the two inch screw is melted into the remaining end the screw will go into the hole for about the ¼" that has been glued.

Once assembled in this fashion, the nuts, screws and form will be in alignment, and the slug should revolve freely for ¼" or more of travel inside the form. Unfortunately, once assembled in this fashion, it is impossible to take the assembly apart without breaking something, so be careful!

This may sound involved, but once the drilling of the form and supports is completed and the plastic cement has hardened, the remaining steps take about as long as it takes to tell about them. The important thing is the order of assembly—which should be fairly obvious.

The coupling from the dial to the inductor is a piece of tubing with an inside diameter that the 4-40 screw on the slug will slide inside. The tubing is slotted (with a coping saw) on one end, and built up with wire on the other to fit the ¼" hole in the dial. A short strap is soldered into the slot in the screw on the slug. This strap rides in the slot as the slug rides in and out and serves to transmit the circular motion from the dial to the slug. This method of construction also avoids transmitting any lateral motion to the slug due to the expansion of the case from heat.

The winding was put on the form and cemented with Q-dope. Since I was only interested in proving a point, rather than absolute linearity, only an approximation was made to a winding that would give the ultimate in linearity. Even so, one revolution of the screw gives 35 kc at one end of the range (5 mc) and 50 kc at the other end (5.8 mc) with the winding as shown. Further adjustment of the spacing of the winding before gluing would have improved that. This particular frequency range mixes with my 9 mc filter output for eventual use at 50 mc.

The winding in use is twenty-seven turns of #22 enamelled wire. The first ten turns are close-wound, and the next seventeen with gradually increasing spacing. The spacing between the last few turns is about 3/16".

Results

The resulting tuned circuit is temperature sensitive because the dimensions of the ferrite slug are temperature sensitive. However, the input to all four transistors is around a tenth of a watt, and the oscillator shows no discernable drift caused by internal heating during operation.

Uncompensated for temperature, the VFO was taken from a cold car into a heated room, hooked to a counter and turned on. The drift was down in frequency and steady, about ten cycles per minute. The VFO was turned off and left in the room for a couple of hours. Turned on again, after reaching room temperature, the total drift was 150 cycles in 24 hours from a cold start. If the temperature where the VFO is to be used is not steady, some form of temperature compensation should be employed. Negative temperature coefficient capacitors should do nicely here.

As currently constructed, the VFO has several drawbacks. There wasn't enough heavy aluminum available to build the box big enough to put a good turn-count dial on it. A ten turn Revodex dial has been tried, but is not entirely satisfactory. The output voltage is only a volt or so rms. For use with a mixer, this is enough voltage, but if the VFO is to drive a crystal oscillator stage, another stage of amplification will be needed. The input resistor in the grid circuit of such an amplifier stage could be 100 ohms or so, thereby removing the necessity for neutralization.

. . . W4VRV

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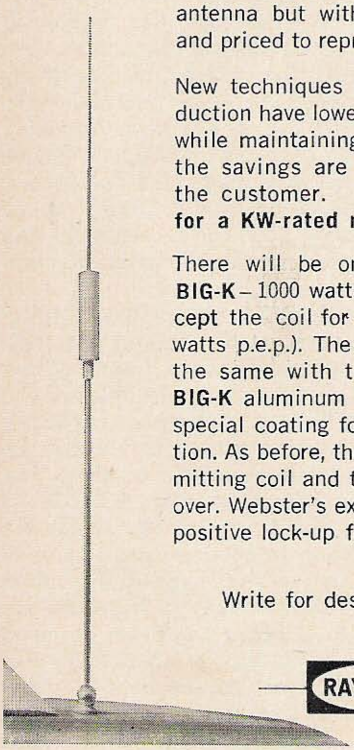

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RAYTHEON RAYTHEON COMPANY

213 East Grand Avenue, South San Francisco, California 94080

Gary Glassmeyer K6REU
1027A Buchon
San Luis Obispo, California

A Receiver VFO Controlled CW Transmitter

After working a contest or two it doesn't take a wise amateur long to understand that time is a premium. A kilowatt helps to bring contest points, but with the advent of highly selective receivers and crowded ham bands high power often goes unheard. Like snatching cola bottles out of the cases as the delivery truck drives by, contest operators have to be fast, smooth, and on frequency. And needless to say if we have our transmitter exactly on frequency at all times and are taking up only one frequency on the band there is that much more room for QRM free operation of other stations. With this in mind I realized that I needed a rig that was not commercially available.

There are a few store bought rigs that have transceive operation but most are designed exclusively for SSB or are designed for SSB and include CW operation as an add-on feature which has been given little consideration. Shortly before beginning construction on the rig described herein I practically gave away a $2000 transceiver with atrocious VOX keying and a transmitter that was always 1.3 kc off frequency.

A glance at the block diagram of my transmitter (**Fig. 1**) will bring to visualization what is happening inside the transmitter. The variable crystal oscillator generates a signal which can be varied several kc either side of the frequency which brings the transmitter in exact coincidence with the receiver. This we will call the center-frequency. In my particular case I am using a Drake 1-A receiver with a 4.6-4.0 mc vfo. This signal source is tapped directly at the grid of the mixer tube it is feeding and cabled out of the receiver by means of high impedance microphone cord and phonograph connectors. Capacitive coupling is used to bring the rf to the signal grid of V2. If you don't like the idea of delving into your receiver to pull out the sample of rf needed to excite the mixer you can easily modify your existing vfo, or any external vfo to operate on 4.6-4.0 mc, or whatever frequency you desire, other than one in the ham bands, and still have the advantage of a fine heterodyne, grid-block keyed exciter. Many will be interested in using both the receiver vfo and a separate one for cross-band operation, chasing DX etc.

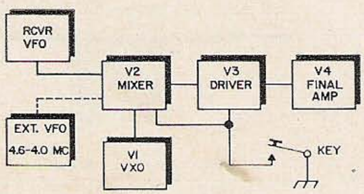
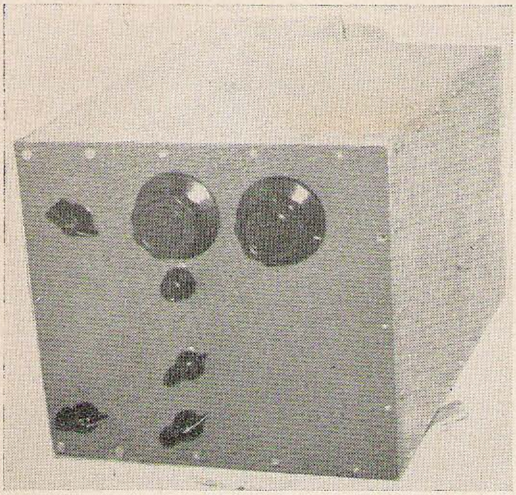


Fig. 1. Block diagram of the receiver VFO controlled CW transmitter.

By applying the VXO output to the injection grid of V2 we get the desired operating frequency along with various image signals and harmonics of the two inputs. When figuring the proper VXO crystal center frequency for use in conjunction with your receiver be sure that none of the harmonic or image frequencies fall much closer than 10%-15% of your operating frequency. To determine the VXO crystal center frequency if your receiver vfo is above the received signal frequency, subtract the received frequency from the vfo frequency. If it is below, add the received signal frequency to the vfo frequency. For example in the case of the Drake 1-A, when its vfo is tuned to 4.6 mc the received signal frequency is on the low edge of the ham



Front view of the transmitter.

bands, in order to determine the VXO crystal center frequency on 40 meters we add 4.6 mc and 7.0 mc to get 11.6 mc. As the vfo is tuned lower in frequency the transmitter frequency will raise, 4.6 mc gives a transmitting signal of 7.1 mc, and 4.2 mc brings us to the top edge of the band.

V3 serves as both an amplifier and a device to filter out undesired signals with both grid and plate tuned circuits.

At this point it might be interesting to note that the sub-assembly chassis that V3 is on was originally a Geloso all-band vfo, and the 5763 was used in it as an amplifier stage. The tube socket that V2 is in was original and held a 6CL6 previously. V1 was mounted in an empty space forward of the 6BA7. Other components supplied by Geloso are, the slug-tuned coils, their associated trimmer condensers, the VXO tuning capacitor, which was first a vfo grid circuit part, and assorted resistors and by-pass capacitors which just happened to be heeded in the new circuits. For those who have an unused Geloso vfo kicking around you might employ it's compact chassis in the construction of your version of this transceiver. If you don't you might go out and buy one, they are relatively cheap. The V2 plate circuit slug tuned coils were left untouched as far as taking off any turns or re-winding them. However, they were taken out of the single ended circuit and used in a pi-network with a 140 pf capacitor added on the plate side to tune them to resonance, and a fixed 100 pf capacitor placed

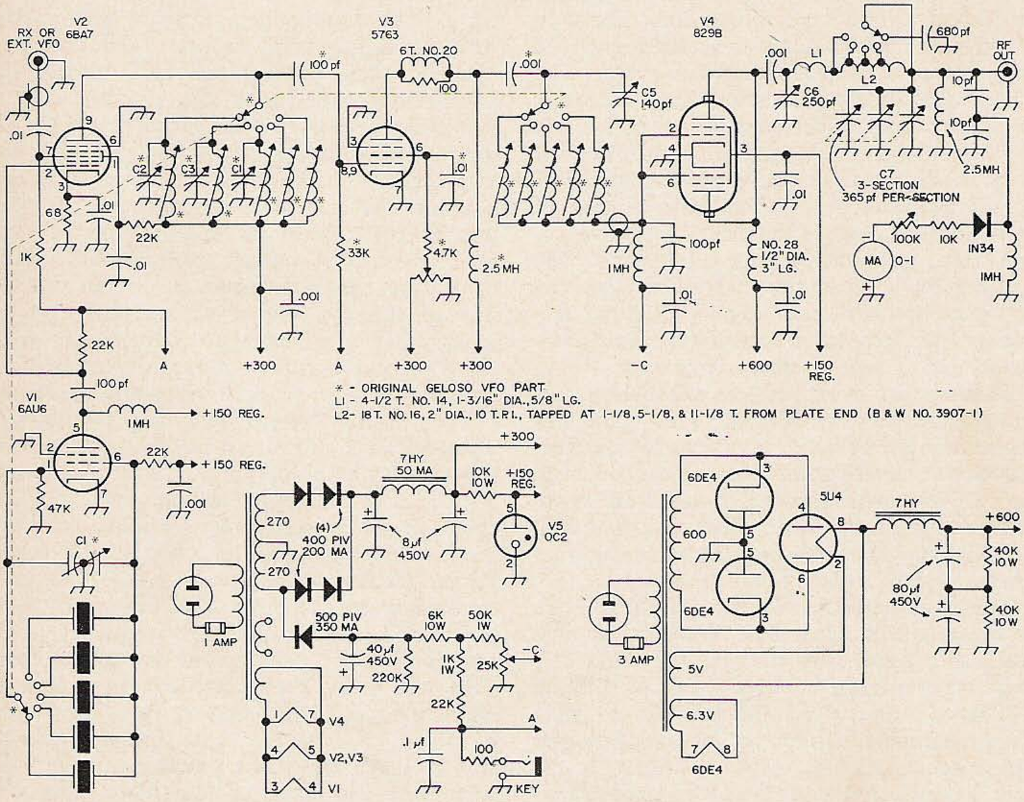
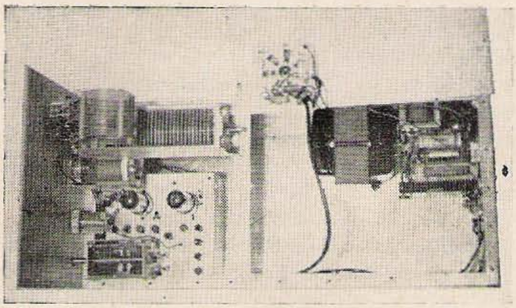


Fig. 2. Schematic of the transmitter. Note that many of the parts used came from a Geloso VFO, but can easily be found elsewhere.



Inside of the transmitter.

in the output side. These fixed 100 pf's are soldered directly across the final's grid to ground, this helps to stabilize the amplifier. The coils were re-adjusted to bring them to resonance in their new application. Mr. Geloso used five other slug-tuned coils, three of which were selected to determine vfo fundamental frequencies, the other two were used in the plate circuit of the vfo tube. All were re-wound and grid-dipped to the middle of each ham band in use. On 80, 40, and 20 meters three air trimmers which were all ready on the chassis were tied across these coils for padding. The vfo tuning condenser had three ganged sections on it, two were wide spaced, one with a few more plates than the other, and the third had a thick, closely spaced plates. The thick plated section was ignored and not used, the larger value wide space job needed a few of its plates jerked to make it equal in value to its counterpart. This is easily accomplished by merely pulling on them with a pair of needle-nosed pliers. The resultant product, if everything goes well, can be used to vary the load on the VXO crystal and thereby encourage it to oscillate on a slightly different frequency, and give us a transmitted signal several kc either side of center frequency.

Probably by now you are wondering just how far can we vary this little VXO gem. This depends on the crystal frequency and the effective circuit capacitance. We purposely control the grid-to-ground and screen-to-ground capacitance to get the desired effect with the modified Geloso vfo condenser. Its value is somewhere around 10-50 pf per section.

The final amplifier, V4, uses an 829B with its sections in parallel, 600 volts on the plate and has a pi-network tied on the end. This stage was designed to drive a pair of 4E27A/5-125B's in grounded grid and has no wide range matching condenser in the pi-output end. Fixed micas are switched in place by the tank coil switch and were chosen experimentally. However I've calculated the necessary values to be used for matching a wide range of impedances and they are drawn into the schematic.

The 600 volt power supply is external and is actually the rectifier power unit, PP-115A, out of a TRC-8 450mc transmitter available through surplus channels. A suggested power supply is shown in the schematic and is taken out of the Radio Amateur's Handbook. Voltages of +250, +150 regulated, −40 to −60, and 6.3 ac are derived from the built-in supply in the bottom rear of the rig. Silicon rectifiers were used to save space, eliminate heating, and besides they are cheap.

Extensive shielding was used in cabinet construction, a trapped lady bug would never find her way out of the enclosure, neither will any frequencies in the VHF range. Sheet metal screws are spaced no farther than two inches apart to maintain a tight electrical seal. Reynold's do it yourself angle stock was used to support the finely perforated sheet aluminum which was procured locally. The chassis is a 3x7x17 inch Bud which turned out to be a little bigger than neccessary, but gave me plenty of working room and space for additional things such as a T-R switch, low-pass filter, or maybe a simple SSB generator. ⅛ inch aluminum plate was used for the front panel and helps support the frame.

Other than peaking all L/C circuits to resonance before trying the rig out, adjustment of the final's grid bias voltage is all that is necessary to get it in operation. No tune-operate switch was incorporated in the rig, nor was any plate, grid, or relative output indicator. In order to tune, merely turn the V3 screen voltage potentiometer-drive control so that the screen is on the ground side of the pot, and peak the driver plate tuning, C5, and final plate tuning along with the pi-output capacitor for maximum reading on your s-meter or relative output indicator (which is also thrown into the schematic). Then advance your drive control to just below the point where full output is realized and re-peak the final plate tuning. With the receiver in a high selectivity condition, and the bfo on zero, (the position where you hear the lowest pitched back-ground noise), key the transmitter and turn the VXO frequency control until the transmitter frequency falls exactly into the peak of the selectivity skirt. This will bring the transmitter in exact coincidence with the receiver providing you have the VXO on the right side of zerobeat. If you don't, give it a crank down through zero beat and back on the other side and once again into the selectivity skirt.

. . . K6REU

SMALL PAIR BEATS A FULL HOUSE

One particular pair, **SB-34** sideband transceiver/exciter and **SB2-LA** gallon linear amplifier—are small enough to beat a full house. Or, for that matter, any no-room-for-passengers KW mobile installation.

Proof. Photograph shows **SB-34** and **SB2-LA** together as a complete 1KW, 4-band sideband station (including receiver of course)-beating a full house handily. The two units placed end-to-end occupy less than 2 linear feet—just over 1 foot in depth, less than 6 inches high!

But SBE didn't set out to produce a miniature transceiver at the expense of undue component crowding—transistors and diodes aided by advanced bilateral circuits did it with room to spare.

SB-34 specifically, is advanced equipment—predominantly solid-state—in pace with the trend toward elimination of all tubes in a host of electronic gear. The SB-34 SSB transceiver costs only 395.00 (**with** 12V DC and 117V AC built-in power supply) and uses 23 transistors, 18 diodes, a zener, a varactor—and only 3 tubes!

Highlights: **SB-34:** 4-bands: 3775-4025 kc, 7050-7300 kc, 14.1-14.35 mc, 21.2-21.45 mc. • 135W p.e.p. input (slightly lower on 15) • Built-in dual 117V AC/12V DC supply (negative ground) • Collins mechanical filter • Panel selectable USB-LSB • 11¼"W, 10"D, 5"H. Weight: 19 lbs.

SB2-LA: 80-40-20-15 meters • Input SSB: 1KW p.e.p. AM: 300W. CW-FM-FSK: 400W. • Built-in 117V AC power supply • 12"W, 12½"D, 5¾"H. Weight: 40 lbs.

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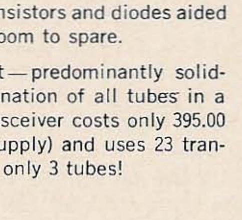
Heavy-duty transistorized inverter for mobile operation of SB2-LA linear amplifier at 1KW input. Input 12-15V DC, negative ground. Output @ 13.5V DC input, 150 volts AC peak square wave at 250 cycles. 6"W, 12"D, 3¾"H. Weight: 17 lbs.



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The Matchmaker Circuit

An idea article

How'd you like to build an automatic antenna tuner that would follow your VFO up and down the band? Remotely, even 'way out in your back yard? Well, this *Matchmaker* circuit, as I call it, makes this possible.

This is not a construction article. Because few builders follow the original design anyhow, changing and substituting parts to suit the junkbox being standard ham procedure, I am just going to explain the circuit, its applications, and the few precautions needed.

The circuit is an adaptation of the VSWR bridge circuit, and depends on Ohm's law (E/I equals R) for its operation. That is, regardless of power (watts), the *ratio* of voltage (E) to current (I) is always the same for a given resistance. In the Matchmaker this resistance is that of the feedline.

The schematic of the bridge is shown in **Fig. 1.** There are two separate measuring circuits, you will note (separated by the dashed line), arranged to produce two outputs of opposite polarity, which are compared on a zero-center meter. One measures a portion of the line voltage, the other measures the voltage across a 1-ohm resistor in the line, which is equivalent to the current. A variable capacitor adjusts the portion of line voltage measured to the right ratio for the feedline used.

This circuit is inserted in the antenna tuner between the coax line from the transmitter and the tuning units. Then, when the tuning unit is adjusted so that the antenna exhibits an impedance equal to that to which the circuits has been adjusted, the output of the two measuring circuits will be equal and cancel each other, so the zero-center meter will read zero. Furthermore, if the antenna impedance is too high, the meter will go off center one way, and if the impedance is too low, it will go off center the opposite way. Which way it goes will depend on diode and meter polarity.

This feature makes an automatic antenna tuner possible. If a resistor of, say one-half megohm is connected in place of the meter and the voltage across it fed into a dc amplifier such as shown in **Fig. 2,** the output can, through relays, control a tuning motor. In **Fig. 2,** if the input is positive, the plate current to V1 increases and V2 decreases, so the balanced polar relay actuates the "Forward" motor relay. If the input is negative, the action reverses, and the "Reverse" motor relay closes. These motor relays are three-pole, single-throw types, with two poles connecting the motor field properly for forward or reverse, while the third applies power to the motor.

The relatively simple circuit of **Fig. 2** may not be sensitive enough with available polar relays, so I would like to suggest a system such as **Fig. 3** for those who understand transistors. No values are given for the components of either circuit because so much depends on what you use for tubes, transistors, relays, etc. Nor can polarities be assigned, for the same reason. Just be sure the motor turns the tuning unit the right way to reach the null and stop in tune.

The values given in **Fig. 1** are about right for medium power (150 watt) transmitters. For lower powers, the two 200 k resistors can

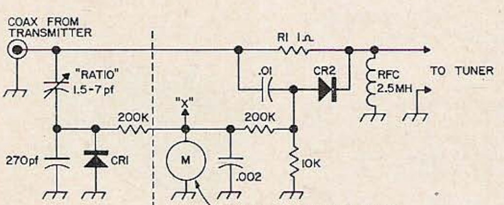


Fig. 1. Schematic of the Matchmaker bridge.

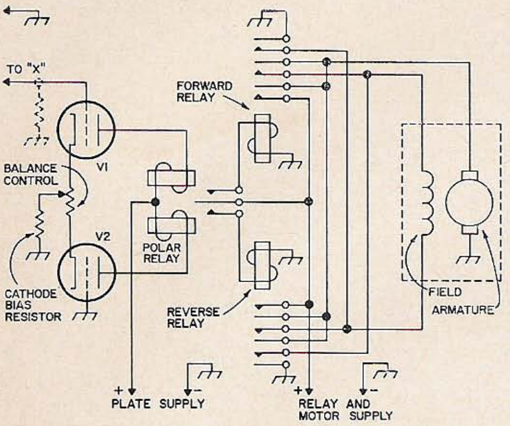


Fig. 2. Automatic antenna tuner.

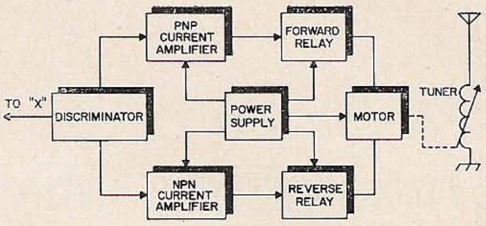


Fig. 3. More complex and sensitive antenna tuner.

be reduced to 50 k, and for higher powers they can be increased to higher values. R1, the one ohm resistor, may best be made up of ten one-watt, non-inductive, ten-ohm carbon resistors, connected in parallel in birdcage fashion. (In case you don't know, carbon resistors have color bands all the same width, while the wirewound (inductive) type have the first color band extra wide.) It helps if you can put CR2 and the .01 µf capacitor inside the "birdcage" of resistors. Other combinations of resistors for R1 are permissible. The total wattage can be decreased for lower power or increased for higher power.

CR1 and CR2 can be 1N34A's or any similar type of germanium diode good for 20 to 30 volts at one or two ma. The 2½ mh choke serves as the dc return for CR2. Short leads to the coax input connector are necessary, and compactness and some shielding from the rest of the tuner are desirable. Otherwise no particular precautions are needed in construction.

Adjusting this "Matchmaker" can be done either of two ways. A non-inductive dummy load with a resistance equal to the feedline impedance is connected temporarily in place of the antenna tuner. Then power is fed through the line at an appropriate frequency and the variable "ratio" capacitor is adjusted carefully until the output at point "X" is zero as read by a zero-center meter as in **Fig. 1**, or by a VTVM or VOM. Or an SWR indicator of correct impedance can be connected in the coax line and the antenna tuned up for minimum SWR, and with normal power supplied the antenna, the "ratio" capacitor is adjusted as above.

It is only fair to state that the Matchmaker circuit is not the complete answer to a wide-range automatic antenna tuner because it fails to distinguish between resistive, inductive, and capacitive impedances. While there are circuits that will do this, they get a bit involved, and anyway the circuit shown will easily 'track' with a vfo over an amateur band if the LC values are properly selected to avoid reactive nulls in the tuning range. Band-switching of the tuner is not too difficult if multiband operation is desired.

Interesting circuit, isn't it? Even used as an indicator it will tell you if the antenna impedance is too high or too low. Changes in power input merely change the magnitude of the error reading, never the zero point, so AM, CW, or SSB have no effect on its null point.

OK, engineers! Build yourself an automatic tuner!

. . . WØOPA

"Yes, he's home—but you can stay the whole weekend—he's in another of those wonderful contests . . ."

Bob Heil K9EID

Six to Two Transmitting Mixer

This simple unit will put a low power six meter signal of any mode on two. Perfect for SSB or Sixers.

The trend today in VHF amateur equipment is toward use of commercial SSB exciters and adapters. But one thing missing among the many lines of equipment manufactured is a unit that will allow the amateur to use his 50 mc equipment on two meters.

Yet this can be done very easily and effectively without any modification of the six meter transmitter if you use a transmitting mixer and use the exciter to drive the mixer. Receiving can be easily handled by a simple converter which takes its local injection from the oscillator in the transmitting mixer unit via the oscillator output jack.

The mixer shown here (**Fig. 1**) gives tremendous supression of unwanted signals. It uses a 6360 tube as a mixer and a second 6360 as a class AB1 amplifier to give an output of 15 to 20 watts PEP. This is plenty of power to drive a linear or to use barefoot and many wonderful contacts have been made with this unit without any additional amplification.

Construction is very simple and easy if you follow the photos. Proper shielding between stages is very important to tame the unit so that it won't take off on its own as some mixers do. The shields can be made very easily from sheet copper or copper clad board.

L2, L3 and L4 can all be made from one piece of B and W stock by removing a single

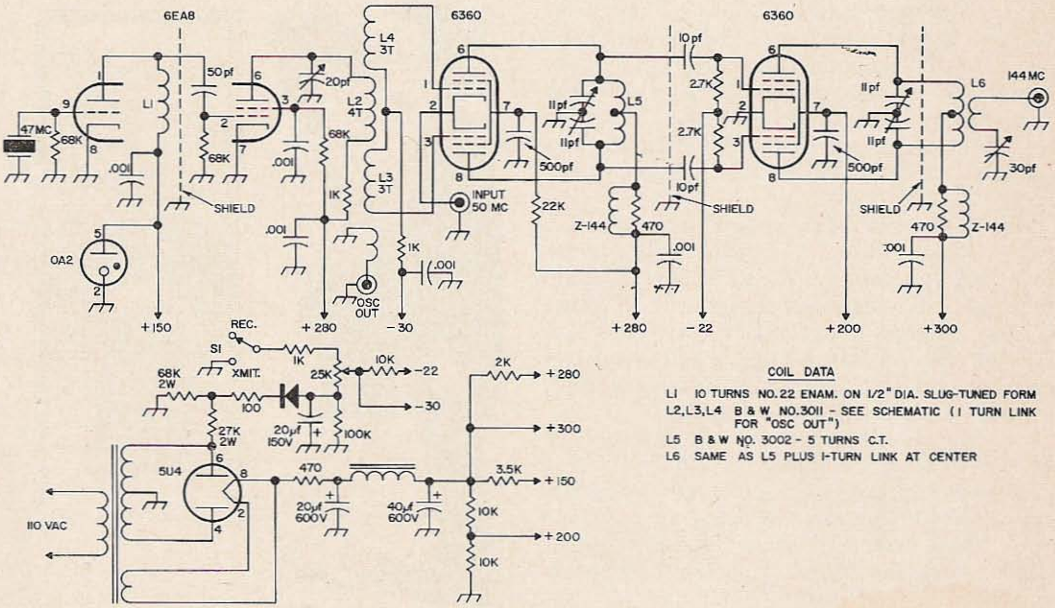
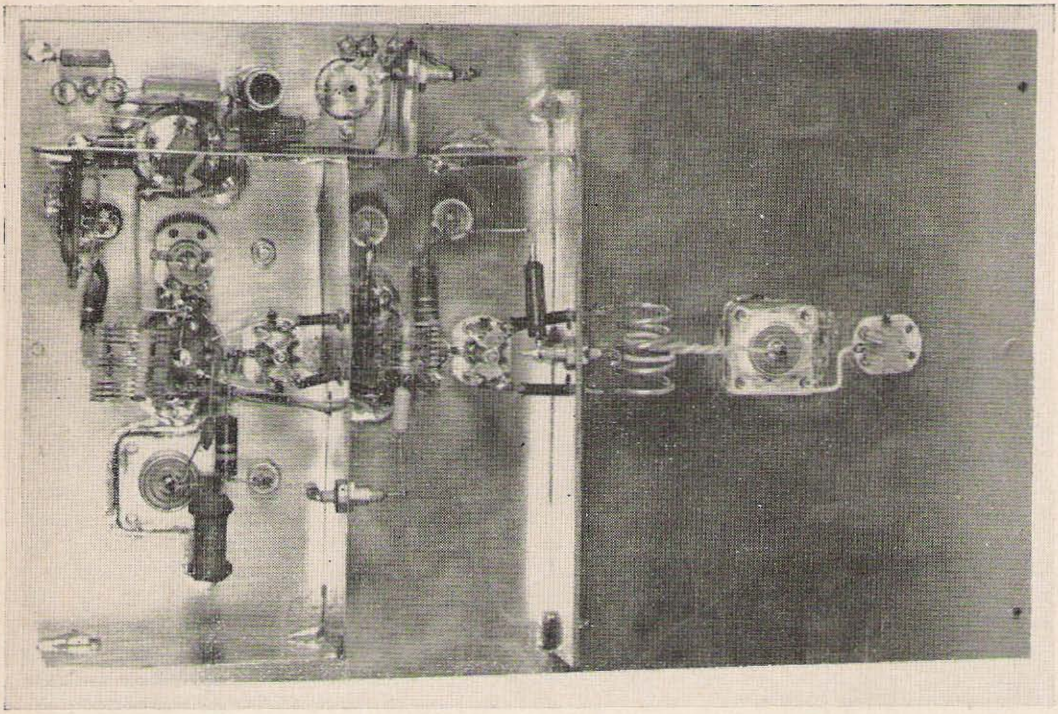


Fig. 1. Schematic of the six to two meter SSB mixer. B & W 3002 is two inches (5 cm) of ½ inch (8 mm) 8 turns per inch number 18 wire. It's the same as PIC 1728 and Air-Dux 408T. B & W 3011 has a diameter of ¾ inch (2 cm) and is 16 turns per inch (6 per cm).



Here's the bottom of the six meter to two mixer. The copper clad chassis plate is 5 x 6 inches (125 mm x 15 cm).

turn between windings. This makes a neat, easy-to-mount assembly.

This particular unit was built on a chassis which was designed so that a final amplifier could be added later. The room available will accomodate a 5894, 829B, etc. The chassis could be made smaller if desired.

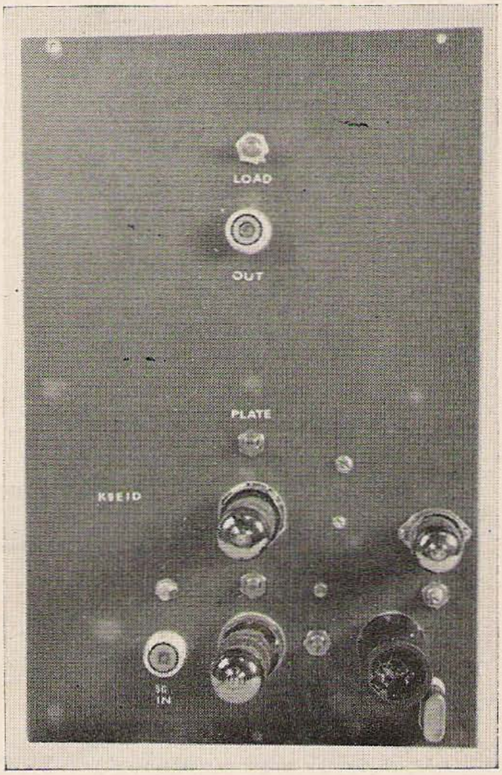
The power supply shown uses a power transformer from a junked TV set. It works well and is easy on that ole pocketbook! The bias circuit is a clever system since it needs no additional transformer. The switch in this supply can be on the antenna relay and allow the mixer to be cut off during the receiving cycle. Just remember that it should be open on receive and closed on transmit.

The voltages shown are operational voltages during transmit with S1 closed. These voltages will vary somewhat with different transformers in the power supply. The power supply is built on a separate chassis to minimize heat in the mixer unit.

This unit performs very well with six meter SSB transceivers. It is a very easy method of putting an SSB signal on two meters and it could also be used to put any six meter AM signal on two.

Have fun building and operating this fine unit. . . . K9EID

Top of the mixer. Tubes, clockwise from bottom center, are: OA2, 6EA8, 6360 and 6360.



Silas Smith WA8CHD
G 4475 N. Vassar Road
Flint, Michigan

A Slotted Line for 1250 mc

Here's an easy-to-build instrument for measuring frequency, VSWR and impedance.

The SWR bridge is a very useful—and sometimes badly neglected—tool. Especially on 1250 mc with only two or three watts of power, you should measure your SWR and do something about it if necessary. I recently joined the 23 cm boys, though I have only worked 1234 mc so far. My first attempt to communicate with W8VKQ on the other end failed but after two evenings of diligent work with a meagre amount of test equipment we made contact. It would have been a lot easier with test equipment good in the 1250 mc range since most hams are not equipped to measure frequency and adjust their rigs at these frequencies.

After that experience, I made the slotted line indicator described in this article. The cost is next to nothing and it's easy to build, but it does a good job. The unit is built around a one inch thin well copper tube 10¼" long (**Fig. 1**). This tube has a ⅛" slot cut lengthwise for 7½", about ¾ wavelength at 1250 mc. This is long enough to get a fair sampling of the standing wave or null points.

Three other pieces of 1" copper pipe are needed. Two are 5/16" long and one is 1⅝" long. The two 5/16" pieces each have ¼" cut out and are reshaped to fit inside the 1" tube. These two pieces were each soldered to 1/16" plates as in the detail in **Fig. 1**. This process makes two cup-like structures which should fit within the end of the 1" pipe. Drill nine holes in each cup: four holes for attaching the cup to the slotted line, four to fit the BNC connector mounting plate and one ⅜" hole to pass the main body of the connector. File two notches for the connector ears. You can fasten the cups to the slotted tube with small sheet metal screws, threaded holes or nuts soldered to the back of the holes.

The 1" x 1⅝" piece of pipe is for the probe carriage. It is cut lengthwise on one side, slipped over the 1" tube, centered, and a ⅛" hole drilled through it over the slot in the 1" tube.

The probe is built from ⅜" and ⅛" brass tubing from your hobby shop. At the probe end is an insulator from a coax fitting and on the

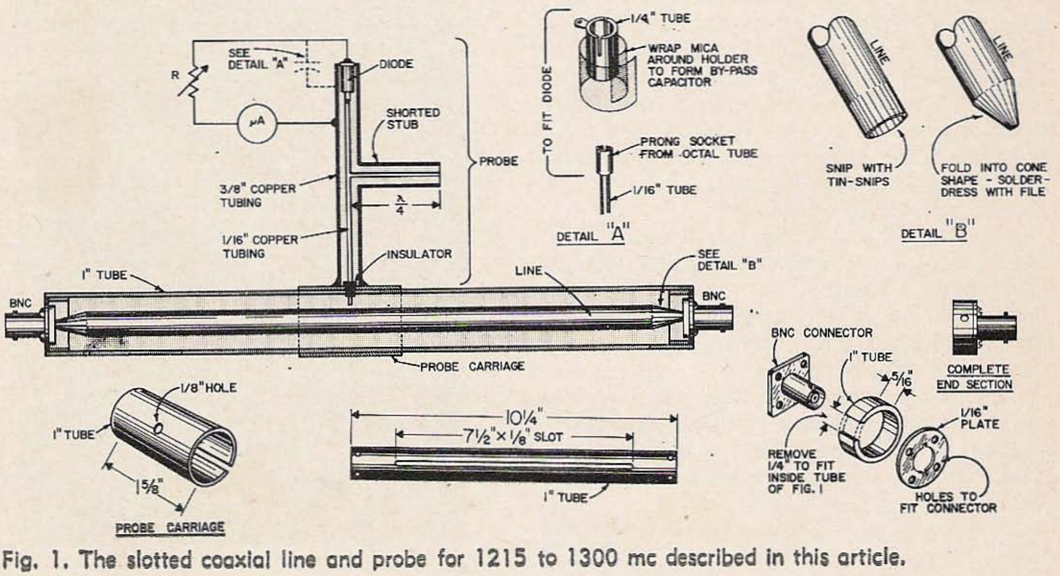


Fig. 1. The slotted coaxial line and probe for 1215 to 1300 mc described in this article.

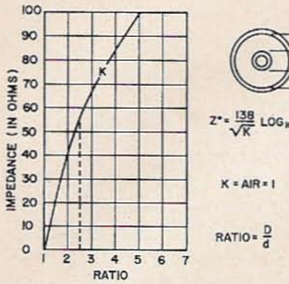


Fig. 2. Ratio of outer tube to inner line for various impedances.

other end is a jack made from an octal tube socket. A small piece of ¼″ brass tubing is used to make the diode socket (see detail A). A piece of 22 gauge wire is inserted in the probe end of the 1/16″ tubing and soldered. A 1N21 diode works very well.

Use **Fig. 2** to choose the proper size for the line in the center. Each end of this line should be tapered and soldered to the coax fitting as in detail B. The center conductor should be 7/16″ for 50 ohms or 5/16″ for 73 ohms.

The meter used should have a range that permits a full scale reading and should be calibrated with some scale.

Uses: Measuring frequency

Frequency can be measured with the slotted line in two ways: the distance between null points at one half wavelength ($\lambda/2$) or the distance between peaks. See **Fig. 3**. Measuring between the nulls is preferable since the peaks are very broad. If your line is flat, the peaks and nulls may be very small, so you may have to induce a mismatch in the line. Likewise, you may have to induce a mismatch to get the two nulls to fall within the 7½″ of the line. The easiest way to induce a mismatch is a short in the line.

Measure the distance between the nulls carefully with a centimeter rule. Twice this distance divided into 30,000 will give you your frequency in megacycles. It would be a good idea to check this against a standard or at least avoid operating too close to the edge of the band.

Measuring VSWR

Measuring voltage standing wave ratio (VSWR) with the slotted line is easy, too. We are looking for a ratio of E_{min}, the minimum voltage on the line, and E_{max}. The ratio:

$$\frac{E_{max}}{E_{min}} = VSWR$$

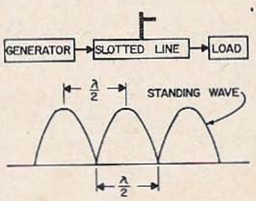
However, there is a slight complication of vectors in E_{max} and E_{min}, so that to find them, you must first determine the highest voltage read on the meter, E_1 and the lowest voltage read on the meter, E_2 with the same setting of the shunt resistor, as the probe carriage is slid along the line. Now, $E_{max} = E_1 + E_2$ and $E_{min} = E_1 - E_2$ so that

$$VSWR = \frac{E_1 + E_2}{E_1 - E_2}$$

An even simpler method is to set the meter to full scale (100) at the highest reading, and reading the VSWR directly from **Fig. 5.**

Impedance measurements

It's a little harder to measure impedance, but even it's not bad if you do it step by step. First, consider the high impedance on your line when your antenna is open or shorted. Perhaps you don't think of it as a change in impedance. This is what we are looking for. Remember that there is a definite relationship between impedance and frequency. **Fig. 6** shows the voltage relationship between a short and open. On a short set the probe for a null point, usually the first null from load end of the slotted line. This will be our reference point. You will note that when the load point is open there is a shift of 90° or a quarter wavelength either side of the reference point. This adds up to one half wavelength. Any impedance between infinity and zero ohms will lie somewhere along the half wavelength of the line. It will be noted that an open is equidistant from the reference point toward the generator and toward the load, however the line has moved toward the load (capacitive reactance). To measure this reactance, we replace the load that we measure with a short. We set our probe to the first minimum reading from the load end of the slotted line. Mark this spot with a scribe. This is our reference point. Now we remove the short and add our load under measurement. It will be noted that the voltage has moved upward. Move the probe toward the load. If the volt-



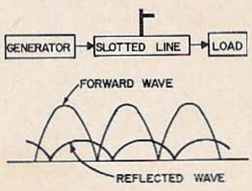


Fig. 3, Left. Measuring frequency. Fig. 4, Right. Measuring VSWR.

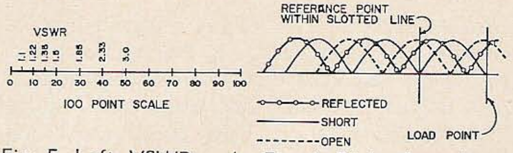


Fig. 5, Left. VSWR scale. Fig. 6, Right. Impedance measurements.

age goes down, you are heading in the right direction. If the voltage starts to go up change direction toward the generator. Move the probe as above to the new null point and note the direction that the probe has been moved.

Here's a step-by-step example. First, you'll need the frequency and wavelength, VSWR, direction of probe, distance between reference point and new null, and impedance of the slotted line.

Let's say as we measured the frequency, the distance between the null points was 12 cm. This is half the wavelength, so the wavelength is 24 cm. The frequency is 30000/24 or 1250 mc.

Let's say we read 80 as a maximum and 20 as a minimum on a point scale in measuring the VSWR:

$E_{max} = E_1 + E_2 = 80 + 20 = 100$
$E_{min} = E_1 - E_2 = 60$

$$VSWR = \frac{100}{60} = 1.66$$

Or set E_1 to 100 by adjustment of R, then E_2 would read 25 on the meter, a VSWR of 1.66 by **Fig. 5**.

As in **Fig. 6**, the probe was moved toward the load.

Let's assume the distance from the reference point to the new null was 2 cm. What part of a wavelength is 2 cm? Wavelength is 24 cm, so 2/24 = .083 wavelengths.

This is a movement of .083 wavelengths toward the load.

The slotted line used has an impedance of 50 ohms.

We are now ready to plot this information on the Smith chart (**Fig. 7**, better get out your magnifying glass).

Draw the VSWR circle at the prime center with a radius of 1.6.

Draw a line from .083 wavelength toward the load from the prime center.

At the intersection of the circle and line, follow the constant resistance circle to .74 and the capacitive reactance circle to .31. Our load impedance is then:

$Z_L = Z_O\ (.74 - .31j)$
$Z_L = 50\ (.74 - .31j)$
$Z_L = 37 - 15.5j$

Well, there are some of the things your slotted coax line can do besides telling you that you're on the air. A commercial version would cost $750. I guarantee that you'll get your dollar's worth out of this one as it costs less than $1 to build. I hope that it helps you get on 1250 mc.

. . . WA8CHD

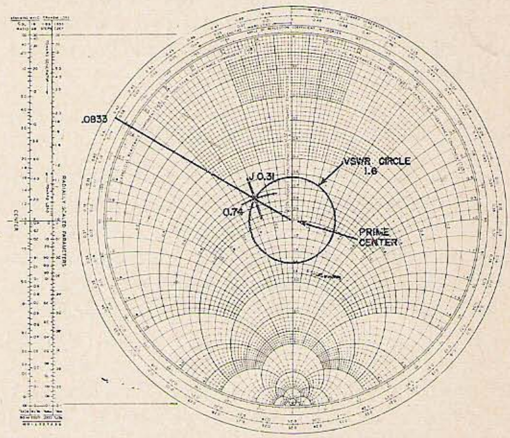


Fig. 7. Smith chart for determining impedance.

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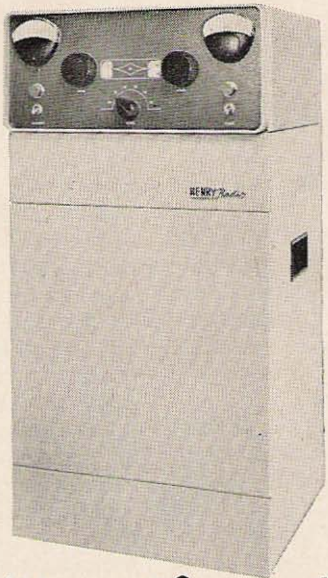

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"Worlds Largest Distributors of Short Wave Receivers"

A Short Look at Current Propagation

Dear Paul:

Your recent letter mentions that some newcomers would like to know more about our propagation charts and you also ask for a preview on conditions for 1966 and the next few years. I will answer both questions in the following two part discussion dealing with the propagation charts first.

The basic data for the propagation charts comes from numerous ionospheric sounding stations scattered throughout the world. These sounding stations are managed by various governments, universities, and other research units. Our own Bureau of Standards plays a considerable part in the program.

Most of these stations measure the highest frequency that the ionosphere will return from a point directly overhead. They call this the "critical frequency" at "zero distance." The measurements are made on a 24 hour per day basis and have been in progress for many years. With this basic information, which incidentally also measures the height of the ionosphere, it is possible to construct a world-wide map of ionospheric "critical frequencies" versus time of day, month of year, and year of the sunspot cycle. By graphical techniques we convert the "zero distance" frequency to an "any distance" frequency. I might mention here that it is a pretty tedious job.

Sunlight and darkness control the critical frequency. It is "usually" highest around noon and lowest just before sunrise at any given point over the earth's surface.

When making frequency predictions we must first determine those points over the earth's surface where the radio signal makes its first and last contact with the ionosphere for any given circuit. These points in space are known as "control points." On a circuit 3600 to 4000 km long there is one control point for operation on the F^2 layer of the ionosphere. Also only one for shorter circuits. Circuits longer than 4000 km operate on two control points—these are the DX circuits and the control points are about 2000 km from each end of the circuit. A really long haul DX signal will be reflected by the ionosphere several times, performing a series of hops over the earth's surface. When the signal contacts a control point it makes up its mind then and there if it is going to go any further or not. If the frequency is too high for the control point, the signal will pass through the ionosphere and be lost in space. If it is too low it will be absorbed.

The control point demanding the *lowest frequency* in the chain of hops is the boss. Frequency propagation charts are constructed with this in mind. The signal will usually be best when there is only a moderate difference between the two control point frequencies. When one control point demands 8 mc and

John H. Nelson is a well known HF Propagation Analyst for RCA Communications. Among his articles are "Sunspots and Radio Weather" in the June 1948 RCA Review and "Observed Diurnal Variations in Frequencies and Signal Qualities" in the December 1954 RCA Review. He writes the monthly propagation column in 73.

"I dont suppose you know anything about what happened to my coil stock."

the other demands 33 mc the circuit will be poor. This is because the amateur has to use 7 mc and as his signal approaches the 33 mc area it becomes absorbed by sunlight.

This latter situation prevails at *certain times* of the day on such DX circuits as Eastern U.S.A. to Japan, Philippines, India and Australia. It also prevails on Western U.S.A. circuits to Europe, India and Africa. Another factor that might be mentioned is that the longer the circuit (in the northern hemisphere), the closer the signal will pass to the North Pole. Here the signal must pass through the auroral zone. This is bad because of severe absorption.

The hours of the day during which the signal will suffer significant absorption is indicated on my charts with a symbol.

Now for the second part of your question. The new sunspot cycle began to show a significant increase in sunspot numbers in September 1965 but it is increasing quite slowly. The low part of this cycle has lasted much longer than the low of 1954 and 1955 and is increasing more slowly. This indicates a strong probability that the forthcoming cycle will be of only moderate intensity.

One of the strange features of the present sunspot situation and the current frequency behavior pattern is that in spite of the slow increase in sunspot numbers there has been a disproportionate rise in useful frequencies during day time hours. However, no important change has occurred in night time frequencies when compared to the past two winters. This is quite puzzling.

So far, the present sunspot cycle has produced only one really large sunspot. This spot crossed the sun during the first ten days of September. It did not do much damage to radio signals but did produce numerous solar flares. Today, December 5th, 1965, using a six inch telescope, I can find only one tiny spot on the sun.

The number of sunspots will increase throughout 1966, 67, 68 bringing with them an increase in critical frequencies. The ultra violet light radiated by sunspots creates a more dense ionosphere which, of course, has a higher critical frequency. DX fans will benefit by this but it is doubtful if the phenomenal results of the last sunspot cycle will be duplicated.

DX conditions will generally improve throughout this forthcoming rise, but it might be well to apprise the new-comers that they are going to come upon some strange situations during the next few years.

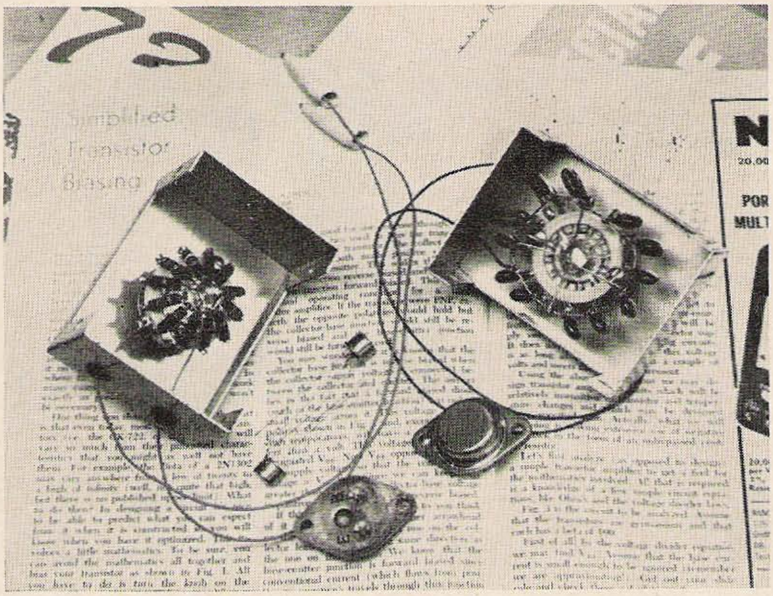
Quite a number of the fast growing sunspots during the rising portion of the sunspot cycle develop great solar flares. The flares produce such intense ultra-violet radiation that our atmosphere becomes so strongly ionized that it absorbs all HF signals, resulting in a complete absorption blackout. This happens only during daylight and usually lasts around half an hour. To experience one of these blackouts is dramatic to say the least. Signals change from perfect to absolutely nothing in two or three seconds.

There will be cases of night time blackouts during which DX signals will be useless for two or three consecutive nights whilst during daylight hours the signals will be very good from sunrise to sunset. This will not happen very often however. In general we are going to find that DX signals will be much better than they have been for the past three years. The tendency will be towards more severe disturbances but of short duration.

I have studied sunspots and their effects on HF radio for 20 years and have observed thousands of spots through a six inch telescope. It is a very complex research program. The references in this letter regarding ultra-violet are not based on my own work. The astronomers tell us that it is UV that produces the ionospheric effects that I mention, the theory being that UV has strong ionizing capabilities.

With best regards to yourself and Wayne, I'll close now, with the sincere wish for an abundance of UV for your DX fans.

. . . John Nelson



James Ashe W2DXH
R.D. 1
Freeville, N.Y. 13068

Here's a new look at an excellent old idea. No experimenter should have to work without Diddleboxes.

Diddleboxes

Sometimes my circuits don't work quite right and I have to try fitting in different components to remedy the situation. Pots and variable capacitors will do, but fixed components seem to be better suited for these tests. For instance, it's quite easy to burn up a two watt pot because at ten percent of rotation its power rating is down by ninety percent! And the thing always has to be measured to complete the test.

Decade substitution boxes go right back to ancient history. I've seen them in very old catalogs. They're wonderful things. You can jump from one ohm to one megohm at the flick of a switch, and it's the easiest thing to tack on or trim off a few ohms by turning one or two knobs.

But I reasoned that, since I'm going to choose the nearest resistor, why not start out that way? There is no need to play ohmic arpeggios on a megohm scale, the circuit will never notice my virtuosity. Another point is that a simple rotary switch with twelve resistors will have far less parasitic inductance and capacitance than the extensive system in a decade box. Sounds like a good thing, and that is the way it has worked out.

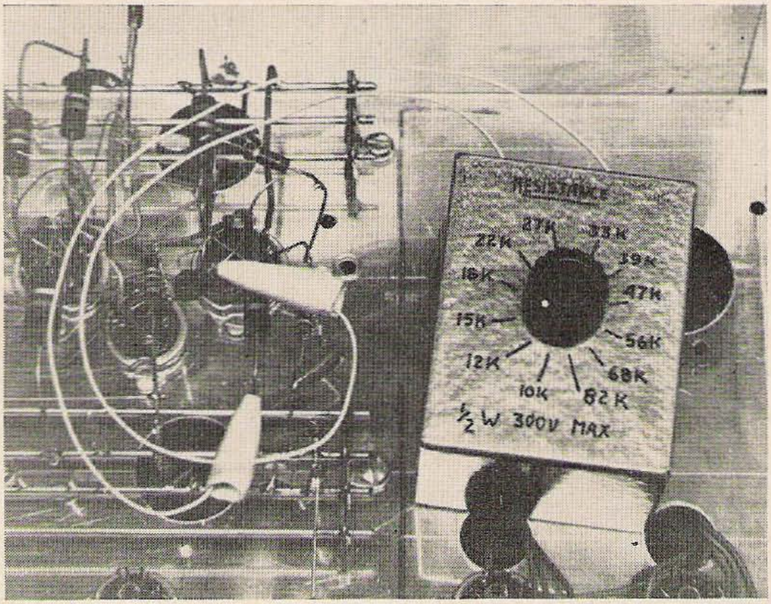
W2DXH is a self-employed technical writer interested in design and construction, moonbounce and space communications. A number of his articles have recently appeared in 73 and more are upcoming.

There was some difficulty in finding good 12-position switches. But I found two suppliers who could provide satisfactory single pole 12-position switches: CTS and Mallory. The CTS switches come in a very convenient build-it-yourself style and I have found them useful for many applications besides diddle boxes. It might be nice someday to build from 16-pole switches, because then each decade could overlap the adjacent ones. This has not proved to be much of a handicap.

The three photographs show nearly the entire story of building diddleboxes. Note that the wires are kept as short as possible, and that the capacitors have a shorted ring in common. This reduces parasitic inductance and capacitance.

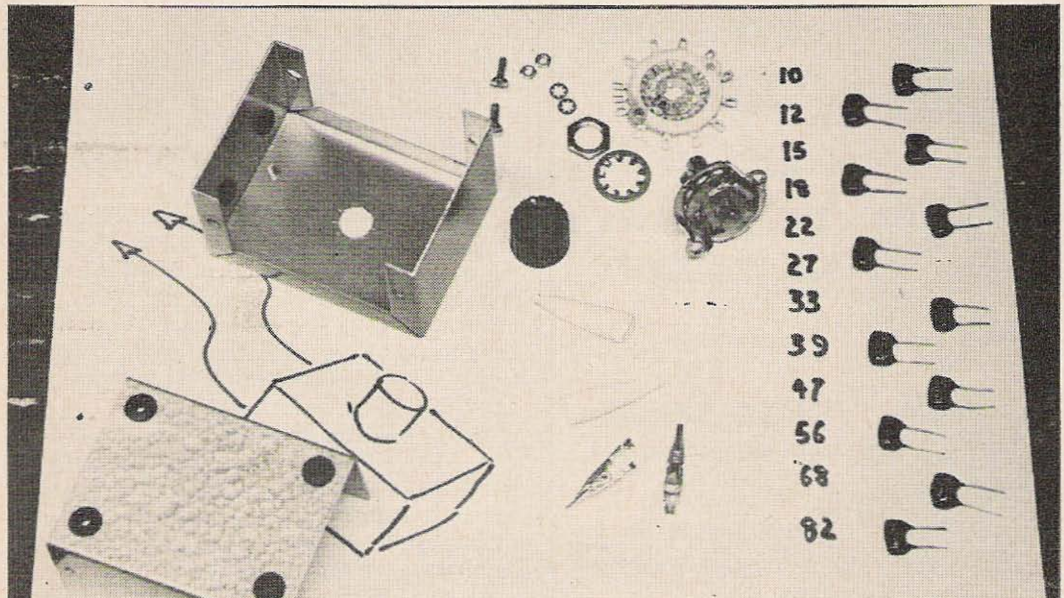
The leads go out through quarter inch grommets. I have been most satisfied with

At the left are two Diddleboxes opened up to show their construction. To the right is the Diddlebox covering 10 k to 82 k in use on a breadboarded circuit. At the bottom of the page are all the parts for a Diddlebox except the wire for the leads.



Mueller #34 Microgator clips, with a tiny plastic cover. I trim the last eighth inch off the cover so the jaws are clear. A tentative idea of putting phone tip or banana jacks in the boxes for test lead attachment has never been carried out.

I have been very successful in marking painted or unpainted panels with India ink. The secret is to scrub thoroughly with strong detergent and a cotton rag to get off all the grease, rinse without touching, and let dry in a warm place. The clean surface takes ink as well as paper does, although it has a very different feel under the pen. Untouched, freshly enameled surfaces do not seem to require this treatment. After lettering, some nail polish or a coat of good, clear enamel makes things permanent.



My boxes contain 10% components, selected for on-the-nose accuracy by a good impedance bridge. They're all well within 1%. If you don't have a bridge, 5% and 1% components are available from surplus sources. It's worth some time and expense making sure they're right, because you will be using them for years. A key point is don't roast them. Use a transistor heat sink if you must, and work rapidly. You'll come out way ahead in the long run.

There are two basic kinds of switches. Shorting switches make before break, nonshorting switches make after break. Each has its place in certain types of circuits. For instance, shorting switches are preferred for selecting meter shunts, because the shunting resistance will drop way down between ranges. If you used a nonshorting switch for this job, you might find yourself pinning the needle between positions.

From a diddlebox testing viewpoint, circuits fall into two general classes: those which give problems and those which don't. The ones which don't are low-frequency and pulse circuits in general. They don't care if one or two components have remarkably long leads during testing. There is little danger of feedback throwing these circuits into oscillation. The substitution test procedure is peaceful and easy. This is the way I like it!

High frequency and short risetime circuits are harder to work with. I believe there is no substitute for a good understanding of how the circuit works. Then you can tell what it's likely to do when you put the long leads in. Two suggestions that have worked for me are: put something in series with the diddlebox, such as an RF choke or a small resistor, or revise the circuit so it is less affected by the long leads.

Over the past few years I've accumulated a number of diddleboxes. Not all of them are the single-decade type I've described here. One has a supply of bypass capacitors. Another quite large box holds some electrolytics. Most of the resistor and some of the capacitor boxes are in pairs. Certain symmetrical circuits, such as bistables, require this.

My experience with diddleboxes has been very favorable. I haven't lost one yet! I think this is because of a certain policy of working out what ought to happen before doing a test. I try to set it all up so only a few seconds are required to get the answer.

At three to five dollars per box, I believe a set is as good and as basic an investment as a VTVM.

. . . W2DXH

Wayne Pierce K3SUK

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	301-S	143.5-148.5	30-35
6M	301-B1	50-51	.6-1.6
	301-B2	51-52	.6-1.6
	301-C1	50-54	7-11
	301-C2	50-54	14-18
	301-J	50-52	28-30
20M	301-G	13.6-14.6	.6-1.6
CB	301-A1	26.5-27.5	.6-1.6
	301-A2	26.8-27.3	3.5-4.0
40M	301-K	7-8	.6-1.6
CHU	301-L	3.35	1.0
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	301-M	2-3	.6-1.6
Aircraft	301-N1	118-119	.6-1.6
	301-N2	119-120	.6-1.6
	301-N3	120-121	.6-1.6
	301-N4	121-122	.6-1.6
	301-N5	122-123	.6-1.6
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Modernizing a 432 mc Converter

Bring your old converter using Philco MADT's up to date at low cost.

Back in the old days (December, 1960) when Philco was in the transistor business and not making Fords, Philco Application Lab Report 684, titled "R F Amplifier and Frequency Multiplier Performance of the 2N1742 VHF MADT Transistor at 420 Megacycles" was written by J. Specialny, Jr. A later version of that was reprinted in an early issue of 73 (with the circuit diagram in the following issue), and many of these converters are in use or on shelves in ham stations.

One reason for their being on shelves is that the 2N1742 had a relatively low gain, and a noise figure of 9 or 10 db at 432 mc. The T 2028 was an improvement, and the 2N2398 better still, but they are not on par with the more modern pnp mesa transistors available from TI and Motorola. The TI-XMO5 and TI-XMO6 are particularly good, and the price is right. If you buy ten dollars worth, the chances are you'll get a dozen which are capable of under 4 db noise figure at 432 mc, and the rest will be pretty good, too.

Another reason for shelf service is that it is pretty easy to kill a VHF transistor. If it didn't short out, it still might deteriorate in performance due to an overdose of rf. I think techniques in coax switching have improved in the last few years among hams, but there are still shacks where the receiver takes a beating every time the transmitter is put on. I have shown a silicon diode limiter on the input of the modernized converter for this reason. If the right diode is used, there is no loss in performance from this. Many of the early varactors are suitable. The easiest way to spot them is to measure the breakdown voltage at about 1 ma. Diodes having a breakdown below 10 v which are sold as microwave varactors are probably suitable, but those having breakdown voltages higher are likely to be more lossy at zero bias. In any event, a serious VHF ham should be able to check his receiver performance or noise figure, and detect either gradual deterioration or catastrophe. The same kind of check will show whether hooking the diode up makes things appreciably worse. In my case, no difference could be measured.

The first RF stage was changed from grounded-base to grounded emitter. At UHF the grounded-base connection is regenerative, and with the higher gain of the newer transistors, stability is a problem. I set the first stage up grounded-emitter because it is more stable (even without neutralization) and because there is a slightly lower noise figure, in theory. The second stage was left unchanged (I used a TI-400 for that, which is not as

W1OOP is well known for his ham activities (building modern equipment that works, 432 mc, VHF contests) and writing. Few ham authors are more competent, clear or clever, and I cry when I see his articles in QST. He's a design engineer at Microwave Associates and he claims that he and his six hams work on test equipment. Test equipment. Hank studied Greek (among other things) at the Roxbury Latin School before he got his class A license in 1944, which probably explains something.

1. 73, March and April 1961.

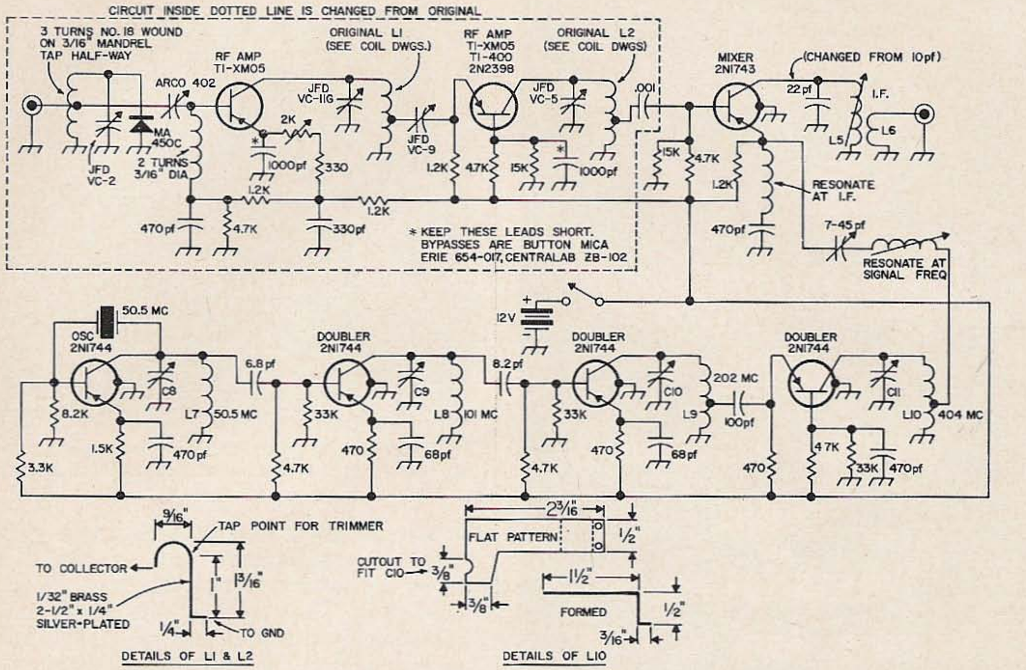
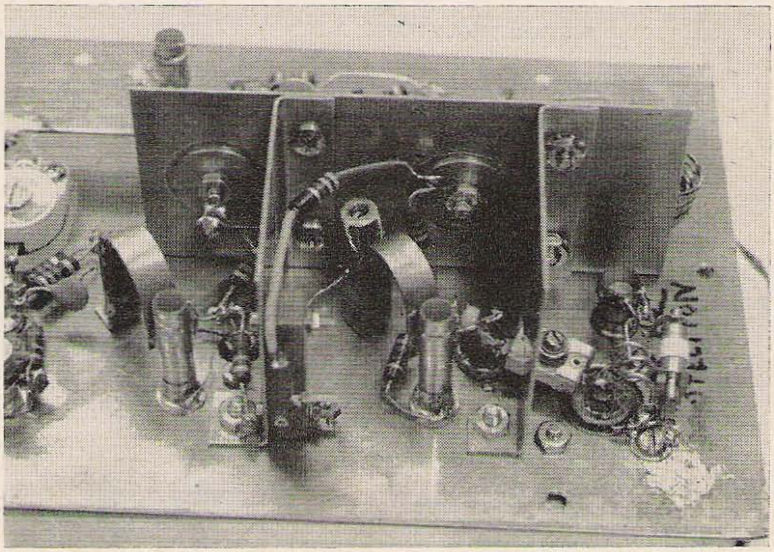


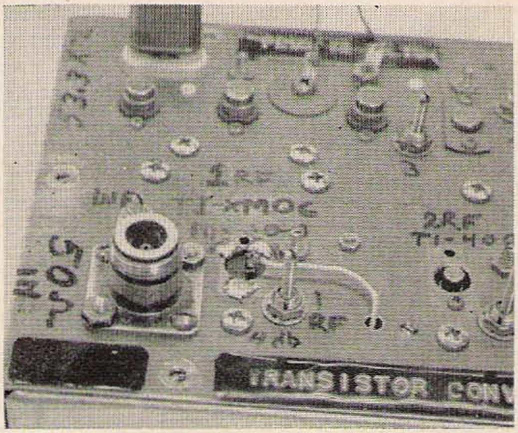
Fig. 1. 432 mc converter. This is a modern version of the 432 mc converter described in the March and April 1961 73's. While the only changes are in the rf amplifiers, the rest of the circuit is included so that you can make the converter without referring to those early issues.

"hot" as the XMO6 that I used in the first RF). When a TI-400 was also in the first RF the noise figure was a little bit worse than with the XMO6. The main point is to keep the grounded electrode lead *short*. *Don't* use a socket. ANY length is undesirable. The first stage emitter was run to the tab of a mica button feedthrough which was soldered into a hole in the chassis, with about a sixteenth of an inch of free lead. The button bypass should be about a thousand pf.

When I try to use a lower capacitance bypass the stage goes into some sort of HF parasitic oscillation. The emitter return ran outside the chassis a ways, then came back in to go to the pot in the bias circuit. It seems that



Philco converter as modified. Input is at right with protective diode across the first coil. The transistor is just visible to the left of the first shield. It's a small plastic half sphere.



Top view of the front end of the converter showing the emitter return from the first rf amplifier.

for any transistor type there is a best current to run at, and it may vary by two to one among transistors of a given type, thus the adjustment. Turn pot for best signal-to-noise ratio; the input tuning and the Arco trimmer are also adjusted for best NF or best s/n on a weak signal; grab the aligning tool and have a ball.

The W3HIX converter shown in the pictures belongs to W1YWQ. It is set up for 5.6 mc *if* and the noise figure measures about 4 db. The image ratio is 21 db, so there is under one percent image noise power contribution, not enough to matter. I would advise 14 mc *if* for easy tuneup in 432 converters, but this one works very well.

The diode I used was an MA-450C. These are no longer made. The modern type would probably be an MA4321B (wire lead) but if you tried to buy only one you might decide that the money would be just as well spent on a good coax relay. I use two in cascade in the receiver line, and get less signal with the relays in the transmit position than with the patch cable disconnected and the end connector exposed.

. . . W1OOP

Coil and Parts Data

L1 and L2 are on diagram.
L3, the coil marked "resonate at if" in the emitter of the mixer, is 14 turns #28 on ¼" iron slug form.
L4, marked "resonate at signal frequency" is about one turn #22 3/16" diameter.
L5, 18 turns #28 closewound on ⅜" form with iron slug.
L6, 3 turn link on L5.
L7, 10 turns #20 tinned copper ½" ID, ⅝" long.
L8, 3 turns #20 tinned copper ½" ID.
L9, 5 turns #18 tinned copper ¼" ID, ½" long. Tap at 1¼" turns from ground.
L10 is on diagram.
C8 and C9 are 1-18 pf piston trimmers.
C10 and C11 are .5-8 pf piston trimmers.

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Shown to the left is "Butch" Greve, W9EWC (Eat Wisconsin Cheese), operating his new SWAN 400 mobile rig. Butch, who started operating in 1925, has confirmed hundreds of countries and holds many DX Contest Certificates. The W9EWC home station is located at #1 Cheddar Lane, Hilbert, Wisconsin. When Butch is not Hamming, he is busy manufacturing the famous Wispride Cheese.

TERRY SEZ . . .

Terry Sterman
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Neil Johnson W2OLU
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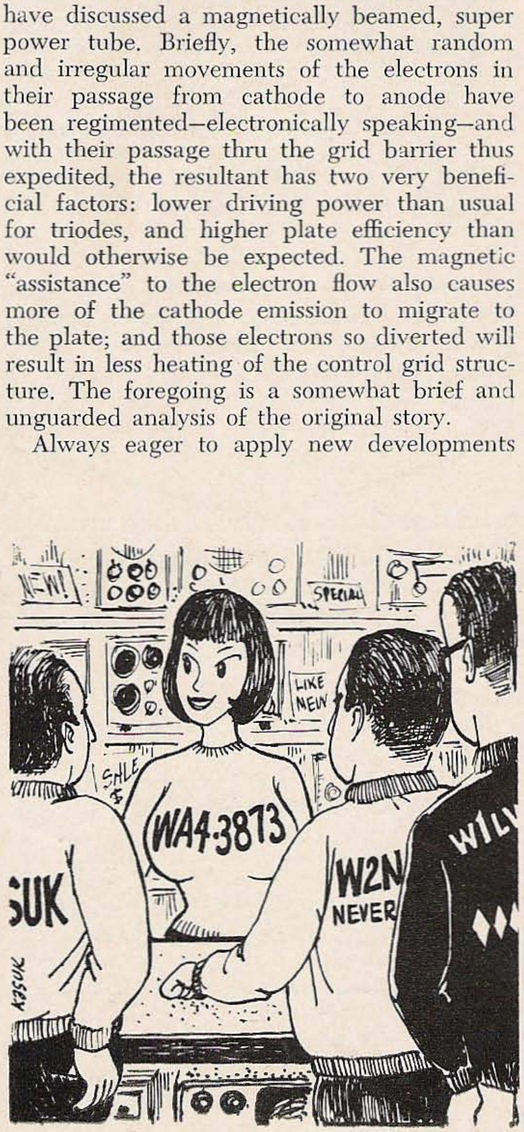
Power Control Through Magnetic Beaming

In a recent article in the Cathode Press, members of the staff of Machlett Laboratories have discussed a magnetically beamed, super power tube. Briefly, the somewhat random and irregular movements of the electrons in their passage from cathode to anode have been regimented—electronically speaking—and with their passage thru the grid barrier thus expedited, the resultant has two very beneficial factors: lower driving power than usual for triodes, and higher plate efficiency than would otherwise be expected. The magnetic "assistance" to the electron flow also causes more of the cathode emission to migrate to the plate; and those electrons so diverted will result in less heating of the control grid structure. The foregoing is a somewhat brief and unguarded analysis of the original story.

Always eager to apply new developments



to amateur radio, I began experimentation with a receiving type tube and a permanent magnet. The vacuum tube was a type 6CL6, connected as a high-mu triode; the magnet utilized was a Lafayette "power magnet" their stock number 14R3302. The circuit utilized was as shown in **Fig. 1.** For some inexplicable reason, our magnetic "beaming" did not seem to speed up the electron flow; but it was possible to decrease the flow of electrons by tremendous ratios. The failure to obtain the expected positive results might lie in the fact that most receiving tubes are made with magnetic materials in their anode structures; or it might possibly be that the grids in the tube under test were quite closely spaced. Whereas the grid wires in the power tube under original discussion were relatively wide apart in their spacing.

In our first experimental setup, the magnet sat atop the tube, with the glass tip of the 6CL6 projecting thru a hole in the central top of the magnet. By simply rotating the magnet, our previous "normal" plate current of 10 milliamperes was reduced to a low current of 30 micro-amperes, for a ratio of 330 to 1. See **Fig.** 2 sketch.

Our next attempt at controlling the magnetic flux was to insert the 6CL6 tube inside the curved part of the magnet. The soft iron bar, or "keeper" was kept separated 3/16" from the pole pieces of the magnet proper by spacing with Teflon blocks. We began this experiment with a "norm" of 9 ma of plate current—i.e., with no magnet. Through rotating the tube and by sliding it back and forth inside of the magnetic field, it was possible to reduce plate current to 2 micro-amperes, using "magnetic cut-off." This gave us a control ratio of 4500:1. See **Fig. 2.**

Somehow we kept obtaining the impression that we were not quite "on the ball" in applying our theories, so the Teflon spacer blocks (thru which the magnetic flux had to pass to

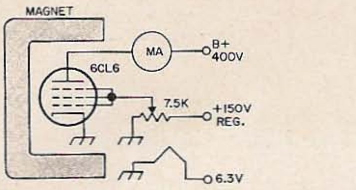


Fig. 1. Circuit for magnetic control experiment.

circulate from pole pieces to the magnetic keeper) were increasd to 9/16 inch and while going through the same routine, the 9 ma normal current was decreased to approximately 1 micro-ampere, for a ratio of roughly 10,000 to one.

Still feeling somewhat frustrated, we hit upon the idea of leaving off the "keeper" and so the magnet was employed without any auxiliary agent, other than the vacuum tube under investigation. This setup resulted in the 9 to 10 ma "norm" of plate current being reduced to ½ micro-ampere. This would signify a control ratio of approximately 20,000 to 1. This was the result of careful placement of the tube within the magnetic field, but it was no "freak" for the experiment was readily reproducible.

While our original goal of increased sensitivity was not reached, it is felt that the method outlined does have promise for certain amateur applications. With a power ratio in the neighborhood of 43 decibels, it is evident that we do have quite a range of control here. Designing a suitable electro-magnet should not be too difficult a matter, and such circuitry could be used for on-off power control (keying?)—possibly for incremental power control. This suggests, possibly, some form of modulation. Lack of time at home, plus a heavy work schedule, has kept me from pursuing this idea any further at this time. Rather than let the idea die, it is being passed along to the fraternity for whatever modifications, applications, additions and results they might obtain. Good hunting!

. . . W2OLU

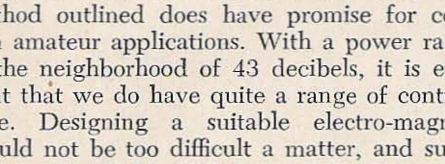


Fig. 2. Experiment 1 gave 10 ma "normal" flow and 30 μa at "magnetic cutoff," i.e., when magnetic flux cuts electron beam at 90 degrees.

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Vertical Antenna Band Changing Unit

In these days of the waning sunspots, increased attention is being directed toward efficient low angle vertical antennas for the 80 and 40 meter bands. One of the more popular antennas is the 40 to 45 foot radiator with an appropriate tuning network at the base to enable operation on 80, 40, and 20 meters. Such an antenna was very adequately described in the August '63 issue of 73.

While this type of antenna is convenient to use from the standpoint of three band operation in one antenna, it is very inconvenient to make the trek to the base of the antenna to change bands, particularly when the snow is knee deep. This is the situation which brought about this very simple and inexpensive remote bandchanging setup.

First consideration was given to motor driven switches, but they were ruled out due to their tendency to get stiff during very cold weather. This left relays as the only practical answer to dependable all weather operation.

Briefly the operation is as follows: When K1 and K2 are both de-energized the coax from the transmitter is connected to the 20 meter tap on the coil. When only K1 is energized, the coax is connected to the 80 meter tap and the antenna is also changed to the 80 meter tap on the coil. When both K1 and K2 are energized, the coax is connected to one side of the capacitor "C" and the antenna is connected to the other side of this capacitor.

Figs. 1 and 2 should be very self-explanatory but a few points should be kept in mind. First, low voltage DC relays should be used to minimize the possibility of voltage breakdown in the buried control cable. Only two wires are necessary as the relay coils are operated against ground. It will be necessary to tie one or two wires of the antenna ground system to the house ground to insure a good low resistance return for the relay coils. Two conductor #14 house wiring suitable for direct burial is excellent for this purpose, particularly on a long run where voltage drop might become a problem. The relay contacts should be capable of handling at least 5 amps.

The interconnections between relays, coil and antenna should be kept as short as possible. Also, an antenna current meter may be inserted at point "X".

The purpose of this article is only to describe a remote bandchange-over unit and should not be used to construct the whole antenna system itself. For this, the reader should refer to Brier's article on Vertical Antennas in the August 1963 issue of 73.

Good luck and may you keep your feet dry! . . . W7BWB

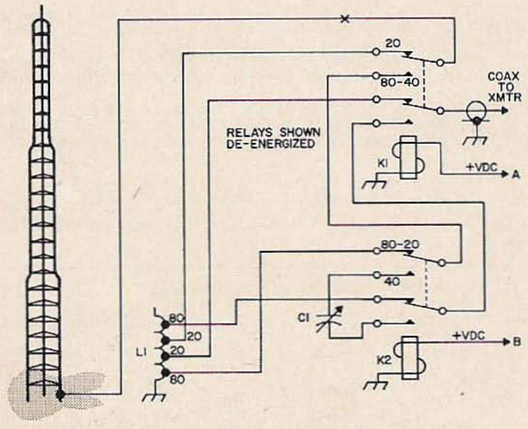

Fig. 1. Changeover unit diagram.

Parts List

K1, K2—Low voltage DC relays with hi-current contacts
T1—Suitable voltage for above relays; approx 1 amp
D1—100 piv 2 amp silicon diodes
SW1—2 pole 3 position rotary switch
C2—500 µf 50 volt Electrolytic

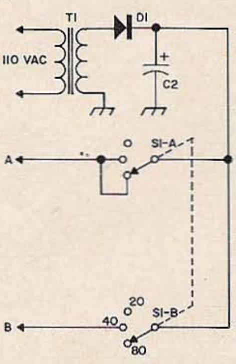

Fig. 2. Power supply and control.

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Choosing IF and Mixer Frequencies

When building receivers or converters, one of the most important steps is the choice of suitable *if* and mixer frequencies. Most amateurs follow the simple rule of thumb that the intermediate-frequency must be greater than 5% of the center frequency in an r-f stage. In amateur band receivers this difficulty is usually solved with a first *if* of around 1600 kc in a dual conversion arrangement.

However, when the desired signal and high-frequency oscillator are mixed to obtain an output at the intermediate-frequency, the mixing process inherently generates harmonics of the two incoming signals. Consequently, spurious signals occur at these harmonics and the various combinations of their sums and differences. If these spurious signals are not considered when selecting an *if* frequency, some may fall within the *if* passband where they cannot be filtered out. In many cases this will result in undesirable distortion of the *if* signal, or at the very least, annoying "birdies."

Many charts and graphs have been published which may be used for this purpose, but in most cases they are so complex they do not simplify the task. The information shown in **Figs. 1** and **2** is identical to that normally available, but it is arranged in a form that is easily used. With these graphs it becomes readily apparent when a particular mixer frequency will produce undesirable "birdies." Although these graphs include only those signals generated by the first six harmonics of the two mixing frequencies, harmonics higher than this are usually of such low magnitude that they cause no problems in amateur applications. Because of the different relationships in the mixing process, two graphs are required, one where the *if* is at the difference of the two incoming signals, the other at their sum.

The only information required to use these charts is the ratio of the lower frequency (F_s) to the higher frequency (F_h). This ratio indicates the entry point to the chart.

For example, assume that we are selecting an *if* frequency for a 6 meter converter. If we were to select an *if* of 30 mc, a 20 mc local oscillator would be required for the desired difference frequency output. Computing the ratio of F_s/F_h, $20/50 = 0.4$, we would look at this point on the difference frequency graph of **Fig. 1**. Here we find that there are two spurious signals that fall in the center of the *if* passband, $4F_s - F_h$ (80 mc–50 mc = 30 mc) and $3F_h - 6F_s$ (150 mc–120 mc = 30 mc). Obviously this is a poor choice.

How about a tunable *if* from 7 to 11 mc? This would require a local oscillator of 43 mc; compute the ratio F_s/F_h at both ends of the band: $43/50 = 0.860$; and $43/54 = 0.796$. Looking at the chart we see that no spurious signals are present at these frequencies, but note the birdies that fall between these two limits at 0.8, 0.833 and 0.857. With an *if* that tunes from 7 to 11 mc to cover the 50 to 54 mc band, this indicates that birdies would appear at 53.75, 51.62, and 50.18.

Consider the ever-popular 14 to 18 mc tuner commonly used by amateurs with VHF converters. To tune the six meter band, a crystal controlled local oscillator at 36 mc will mix with signals in the 50 to 54 mc range and provide the required output. Let's compute the F_s/F_h ratios and see what kind of birdies we

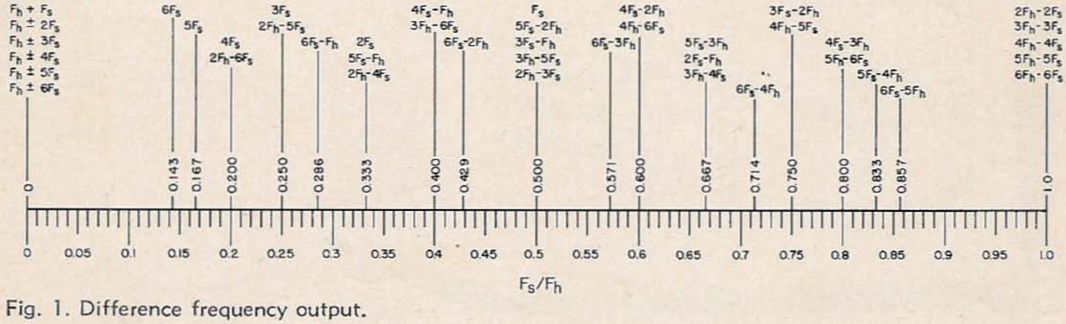

Fig. 1. Difference frequency output.

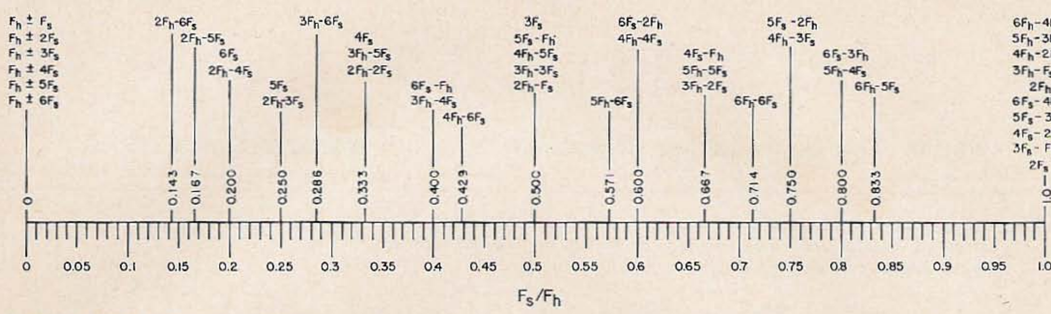

Fig. 2. Sum frequency output.

have; 36/50 = 0.720 and 36/54 = 0.667. Looking at the chart of **Fig. 1**, we can see that there are three prominent birdies coinciding with the ratio 0.667. Since in all probability we wouldn't be interested in operating at a band-edge anyway, these birdies are probably not significant. However, look at the 0.714 point on the graph; a big fat birdy corresponding to 50.4 on the dial!

To obtain an *if* tuning range large enough to cover the entire six meter band and yet avoid spurious signals it is necessary to locate an area between two birdies that is wide enough to cover the entire band. One way of doing this is to operate at the upper part of the graph between 0.857 and 1.0. We may rearrange the F_s/F_h ratio so that when we know the required ratio (greater than 0.857 in this case) we can find the required local oscillator frequency:

$$F_s = 0.857\ F_h$$

From our example in the 6 meter band,

$$F_s = 0.857 \times 54 \text{ mc} = 46.278 \text{ mc}$$

To prevent a birdy from appearing at 54 mc on the converter dial, the local oscillator frequency should be slightly higher than this minimum to ensure that the spurious response is well outside the *if* passband. Using a local oscillator of 47 mc and a tunable *if* from 3 to 7 mc would meet these requirements.

These examples have all assumed the use of a crystal controlled local oscillator, but in some cases a tunable oscillator may be desirable. As an example we might consider an *if* of 7 mc and a tunable local oscillator from 43 to 47 mc. Compute the F_s/F_h ratios at the ends of the band: 43/50 = 0.860 and 47/54 = 0.870. Note in these two equations that the local oscillator frequency (F_s) is different because it is tunable. Looking at the chart in **Fig. 1**, no birdies appear between 0.86 and 0.87 on the chart so this is a perfectly satisfactory choice. Going back for a moment, you will remember that a tunable *if* from 7 to 11 mc resulted in birdies; here we can see that a tunable oscillator and an *if* output of 7 mc does not. Obviously in some cases a tunable oscillator is a definite advantage (not withstanding the problem of oscillator stability).

These examples have assumed that the local oscillator is lower than the signal frequency, but a similar method is used when the local oscillator is higher. The only thing to remember is that the lower frequency is always divided by the higher frequency to obtain the necessary ratio. In some cases the use of a higher oscillator frequency will move the ratio to a point on the graph that is free of spurious signals. In commercial amateur band receivers this technique is sometimes used in the 3.5 to 4 mc band.

Choosing an intermediate-frequency where the desired bandwidth is not too great presents fewer difficulties than where a wide bandwidth is required. This is evident on 144 mc where the entire two meter band is a relatively small percentage of the operating frequency. In this case it becomes quite easy to sandwich the desired tuning range between the spurious signals on the graph. For instance, a tunable *if* from 27 to 31 mc (local oscillator at 115 mc) would be quite suitable for the two meter band because the F_s/F_h ratios would fall between the birdies at 0.75 and 0.8 on the graph and no spurious responses would fall within the tuning range of the converter.

The sum frequency graph of **Fig. 2** is used in exactly the same way as **Fig. 1** except that it is oriented toward those cases where a sum-frequency mixing process might be desirable. Usually this will occur when mixing a very-low-frequency signal up to some standard intermediate frequency.

These graphs have proved to be particularly useful when selecting a common intermediate-frequency for several different VHF converters or when choosing *if*'s for homebrew amateur band receivers. Without a graph of this type it becomes a hit or miss situation with a good probability of difficulties with unwanted spurious signals.

. . . WA6BSO

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Mobile Burglar Insurance

About the most popular items on the ham market today, judging from the offerings of the major radio manufacturers, are the small relatively inexpensive transceivers now beginning to dominate the market. Not the least important aspect of this popularity is the mobile capability designed into these units. Most of us want the option of going mobile even though the probability of our doing so, except for the annual vacation, is normally quite remote. A strong argument against going mobile is the very real possibility of having the gear stolen. It isn't unusual for the radio equipment to be worth more than the automobile in which it is installed (my case); and it's a brave man, indeed, who will sleep soundly in his motel bed while the family bus is parked outside with nothing more than the car door locks to protect that new transceiver.

This article will provide some ideas for automobile burglar alarms guaranteed to discourage all but the most determined burglars. One system has been installed in my old hack for the past four years and not once has my "S" line been stolen; but what is more important, I've been able to sleep soundly at anybody's motel without the slightest worry over having the old bus and its contents disturbed.

The heart of all the simple alarm systems is the automobile horn. Using the dome light

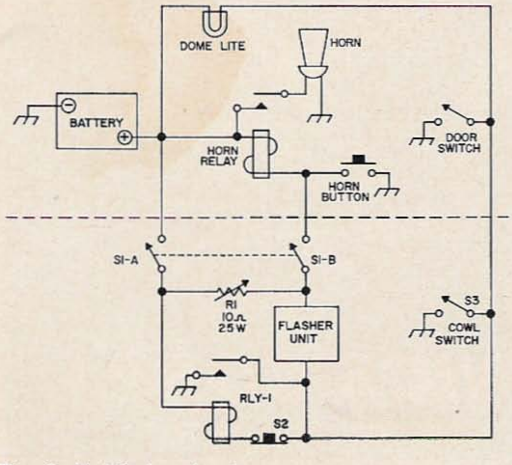

Fig. 1. Mobile burglar insurance.

switch as an actuator the horn is made to blow whenever the door is opened. Nothing could be more elementary than this system since it involves but a single switch and a piece of hook-up wire. A recent magazine article covered this design and I'm sure its author must be a real writing "Pro" to have expanded such a simple idea into an interesting article.

A major improvement on this basic system can be accomplished with the addition of a few simple parts. With this improvement the horn will blow in a series of staccato blasts when the door is opened, and unlike the basic system which will cut-off when the door is closed, this one will continue to operate until the deactivate switch is pushed. Moreover since the horn blasts are not continuous there will be less than half the drain on the battery when the system is actuated. This could be important if you happened to be unavailable when the alarm is touched off. Additionally, it is unlikely anyone will mistake this pulsating signal for a stuck horn button.

Fig. 1 is a schematic of the alarm which I have been using. As can be seen it is quite simple and essentially differs from the basic alarm only in the addition of one relay and a turn signal flasher unit common to almost all automobiles. In theory the unit operates in this manner: With the system actuated, that is with switch S1 in the closed position, the door is opened providing a ground for the horn relay through the flasher unit. At the same time Rly1 drops into closed position providing a ground for the horn relay independent of the door switch which initiated actuation of the alarm. Current through the flasher unit causes it to heat and break the circuit rhythmically which in turn controls the operation of the horn relay and the horn. All would be beer and skittles if this were all there is to it but unfortunately there is more. The horn relay is supposed to be a 12 volt unit (12 volt cars) so anything added in series with the relay coil such as a flasher unit would theoretically prove impractical. However, most automobile accessories are designed to operate on low voltage and this is the case with the horn relay; it will pull in at a bit less than 12 volts quite nicely, even if not so quickly as at the rated voltage. But since the alarm will operate just dandy so long as the relay pulls in at all this is no real disadvantage. The flasher unit is an unknown quantity itself unless we dig rather deeply into the complexities of the particular automobile for which it was designed. Certainly it is a low voltage high current device. What current any particular unit is designed to operate on cannot always be determined and for this reason we need R1 which by-passes enough current around the horn relay to insure operation of the flasher. The unit which I have in use is a 12 volt unit which I picked up indiscriminately in a parts store; its resistance is something less than a half ohm and seems to require about 3 amps to operate. In my unit when R1 is set at about 3 ohms the flasher operates at about the right frequency. I haven't tried a 6 volt flasher unit; it might very well work better.

Because flasher units are such unpredictable beasts even when used as directed R1 may prove something of a problem. I used a small choke which just happened to be of the right resistance. I would suggest, as a first step, hooking the flasher unit and a heavy duty variable resistor together at one end. The resistor should be about 10 ohms. Take the assembly out to the car and locate the hot wire going to the horn button. This wire will usually enter the steering column through a plug and jack arrangement. Pull the hot wire out of the connection and touch to the car chassis to see if the horn blows; if it does you've got the right wire. Now hook this wire to the end of the flasher unit connected to the resistor. Through a lead hook the free end of the resistor to the battery or a 12 volt source such as the ammeter. Now ground the end of the flasher unit which was not soldered to the resistor. The horn should begin to blow continuously. Now adjust the resistor until the flasher unit and the horn begins operating at the desired frequency. **Fig. 2** shows the test hook-up. The value of R1 has now been determined. The wattage of R1 will have to be rather large but since the horn operation is intermittent something less than half of the steady current value is sufficient. Should the resistor burn out the horn will blow steadily rather than in blasts so the basic integrity of the alarm is still maintained. About 15 watts will suffice for my installation.

Rly1 can be any garden variety of 12 VDC relay, of which there must be millions cluttering the junk boxes across the country. The only requirement is that it must have a set of

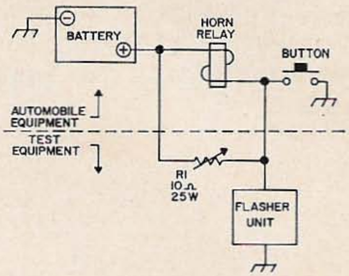

Fig. 2. Showing temporary hook-up of flasher unit and resistor R1 for determining final value of R1. R1 should be about 10 ohm, 25 watt and can be either a slide resistor or a rheostat.

normally open contacts. S3 may be omitted if the engine compartment is locked from inside the car. The function of this switch is to prevent the imaginative thief from getting at the battery and disabling the entire electrical system before attempting entry into the car. Location, type and mounting of S3 must depend on the type of car, inclination of the builder and generosity of the junk box. It may be a push button type with normally closed contacts which may be mounted wherever the engine hood will hold the switch depressed when the hood is down. Alternatively, a simple toggle switch may be used with a string tied between the switch and the hood in such manner that when the hood is raised the switch is actuated. A mercury tilt type switch could also be used.

Switch S2 is strictly a convenience item whose only purpose is to provide an unobtrusive but readily accessible switch for silencing the alarm once it has been set-off. S1 will perform the identical function but in addition it will also disable the alarm whereas S2 will leave the system armed. I would suggest a microswitch mounted within the door and actuated by the door latch. If used, S2 should be a push button type with normally closed contacts.

Resistor R1, the flasher unit and Relay Rly1 should all be mounted on a small chassis and installed within the body of the car wherever space can be found. Switches S2 and S3 are mounted in accordance with the discussion above. Either Switch S1 or Switch S2 (if used) must be mounted in an accessible place. I mounted S1 (S2 not used) just behind and under a member of the radiator grillwork.

This completes the set-up. If installation of the alarm is made as directed above I defy any burglar to make off with either your mobile equipment or automobile short of using a blow torch.

. . .WA6UVS

No ham interested in working DX should ignore this article. It states some very interesting and important conclusions.

A Look at Antennas for DX

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The basic question in DX work is, how does one get the best signal between two distant points on the earth? Answering this question, from the antenna standpoint, is the subject of this article.

The earth is shaped somewhat like a globe, as shown in **Fig. 1**. Also shown is a shell surrounding the globe, which represents the ionosphere. A radio wave starting at point "A" gets to point "B" by a series of reflections, alternately off the ionosphere and the surface of the earth. Notice that the smaller angle "a" is, the fewer reflections it takes to get a signal between the two points. This is the single most important fact to keep in mind when choosing an antenna system for DX work. It is a fact of nature that a signal loses about 5 db of strength on every "skip," so if you want to work the DX reliably you must radiate your signal at a low angle. In fact, where DX is concerned, your antenna's radiation angle is more important than its gain.

Angle "a" in **Fig. 1** is the angle between the local horizon (or a line tangent to the surface of the earth) and the main radiation lobe of the antenna. It is called the "radiation angle" in antenna literature. The size of this angle is determined primarily by the type of polarization used, and by the height of the antenna, although some other factors do come into play, which will be discussed later.

K6ZGQ is an electrical engineer (BS USNA 1963, MS Stanford 1965) in the Air Force who is interested in just about all facets of hamming.

So now that we know we want an antenna system with a low radiation angle, what do we do about it? Let's explore first the effect of polarization on radiation angle.

Vertical antennas

Vertical antennas of different heights mounted with their bases at ground level, and operating over a *perfectly* reflecting earth, will display radiation lobes as shown in **Fig. 2**. These are diagrams for the best results that can be achieved with vertical antennas of a given height, where low angle radiation is concerned. Notice that the radiation lobe always has a maximum value at a radiation angle of zero degrees, which looks very good for DX

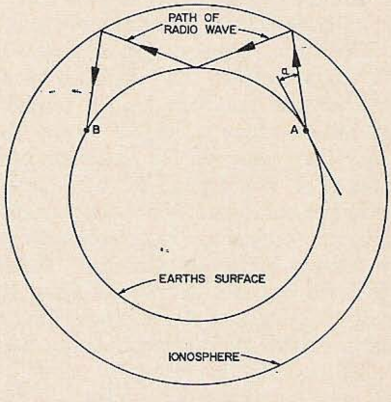

Fig. 1. The path of a signal between two distant points. For clarity, the distance between the Earth's surface and the ionosphere is greatly exaggerated.

TRANSCEIVER HIT PARADE

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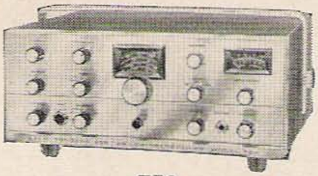

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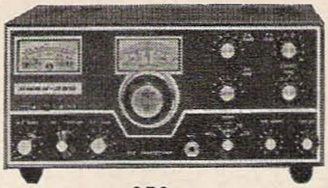

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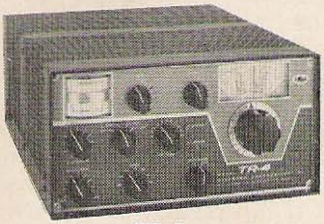

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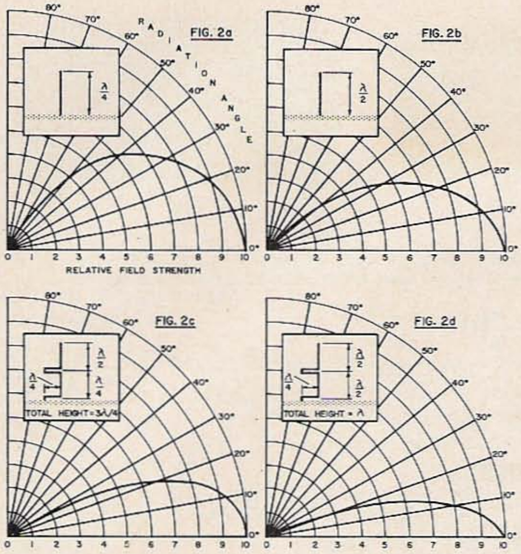

Fig. 2. Radiation angle diagrams for optimum vertical antennas, assuming perfectly reflecting ground. A. Simple quarter wave vertical. B. Half wave vertical. C. One and one-half vertical dipoles fed in phase. D. Two vertical dipoles fed in phase. The last two are known as collinear arrays. The stubs are to provide proper phase in feed currents. These four antennas represent the best radiation angle results that can be obtained with a vertical antenna of a given height. The patterns are actually symmetrical around the 90° axis, of course.

work. Unfortunately, the sad fact is that the surface of the earth is not perfectly reflecting, nor is it even close to it. The effect of the actual surface of the earth is to not only raise the radiation angle, but also decrease the signal strength by several db, for average soil.

In fact calculations carried out by the writer utilizing a digital-analog computer setup show that for equal heights above ground, *horizontal polarization is always superior to vertical polarization at low radiation angles by at least 3 db,* where DX frequencies are concerned. Anyone wishing to investigate this profound statement further is directed to references 1 and 2. A typical result derived from the computer work is shown in **Fig. 3** for a vertical antenna composed of two half-wave dipoles arranged colinearly and fed in phase, as shown in **Fig. 2D**. Notice that the signal is reduced by about 6 db, and the radiation angle raised to about 15 degrees, compared with a perfect ground. This plot was made for average soil. Dry and rocky soil would give even worse results, while wet loam or sea water would give a definite improvement.

To further deflate the esteem of the vertical antenna for DX work, let's explode two often quoted myths about the vertical. First, although a good ground system is very helpful, even mandatory, when using a vertical, *no significant improvement in low angle radiation can be expected by improving the ground in the near vicinity of the antenna.* In other words, no amount of salt on the ground around the antenna, and no number of quarter-wave radials, will significantly improve DX operation. The reason for this is that the reflections off the ground that produce low angle radiation occur at good-sized distances from the antenna, and if improvement is desired it would be necessary to provide a ground of superior conductivity around the antenna for a distance of at least one-quarter mile—a very expensive undertaking. Even then the null at zero degrees would still exist, for it only disappears with a ground of infinite conductivity.

Second, *it is not true that a vertical antenna has an inherent 3 db gain over a horizontal by virtue of its operating over its "image."* Although the image effect is present with a vertical (and does produce a 3 db gain over the same antenna in free space), it is no less present with a horizontal antenna, so neither has a definite edge here. The image effect can be visualized simply by picturing the ground as a mirror. An antenna above ground will see an image directly below it in the mirror. By use of the antenna and its image diagrams, such as **Figs. 2** and **4** can be

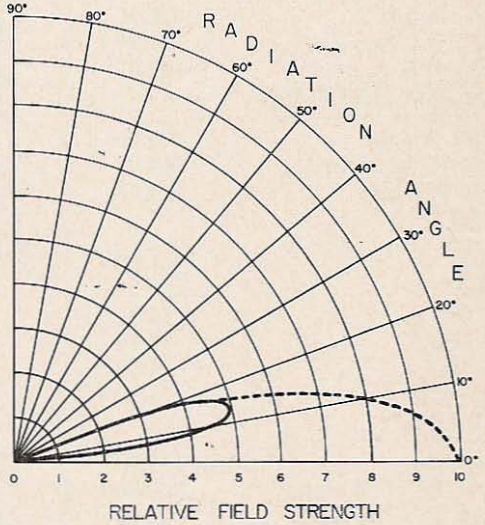

Fig. 3. The typical effect of average soil on the vertical radiation pattern of a vertical antenna. The pattern here is for the same antenna as in Fig. 2D. The dotted line represents ideal conditions (i.e., perfectly reflecting ground), while the solid line is for real ground. The actual pattern is symmetrical around the 90° axis, of course.

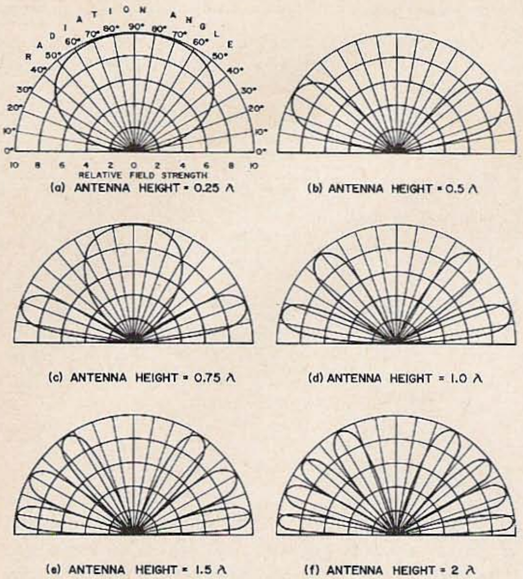

Fig. 4. Radiation angle diagrams for a non-directional horizontal antenna of various heights above perfectly reflecting ground. Only an antenna with extreme vertical directivity will greatly change these results for low radiation angles.

derived. See Reference 1, pp. 808-810 and 882-888, for further information on the image concept.

Horizontal antennas

Now let's see what the horizontal antenna can do for us. **Fig. 4** shows radiation diagrams for a horizontal antenna of different heights above perfectly reflecting ground. Note that there is always a null at zero degrees and that the lowest lobe moves to lower angles as the height is increased, although the number of lobes increases. Contrary to what may be believed by some, no antenna type (with all its elements lying in one horizontal plane) can greatly change the results shown in this figure, as far as the radiation angle is concerned. If you want a low radiation angle you must put your antenna high in the air. A happy fact about the horizontal antenna, though, is that the effect of the actual earth is not to greatly change the diagrams of **Fig. 4**. The lobes will have slightly diminished length and the nulls will fill in to some extent, but the effect is small enough that we can use **Fig. 4** with good accuracy for practical antennas.

Now let's get down to brass tacks. Just exactly what are the best radiation angles for DX work? **Fig. 5** shows this information for the usual DX bands. Notice that as the frequency increases, the best angles get smaller. Also note that there is a lower limit on the radiation angle that it wouldn't be wise to exceed. In other words we don't want our antenna too high, which is fortunate from an economic standpoint.

Let's take 20 meters for an example, see **Fig. 4**. An antenna height of one wavelength (about 70 feet) will give us maximum radiation between 8 and 22 degrees for the lower lobe, within the optimum range. Moving the antenna to one and one-half wavelengths height, which will increase the expense considerably, will move the lowest radiation angles down only a little. On the other hand, moving the antenna to lower heights will raise the lowest radiation angles considerably. *This is the reason that the 20 meter boys with their beams at 70 feet do much better than those of us with lower antennas,* and have little trouble competing with antennas at greater height. The point of this is that an intelligent height of one-half wavelength or less, however, the quad produces slightly lower angle radiation than the yagi will. This is due to the fact that the quad has a built-in stacking effect, since its elements do not all lie in one horizontal plane, as with a yagi. The obvious conclusion is that if you are limited to heights of one-half wavelength or less, the quad is a good antenna to look into. Above this height, however, the yagi might be better, since its construction is simpler and it can give greater gain.

As far as gain is concerned a 2 element quad has a maximum gain of about 5.7 db, while the 2 element parasitic displays about 5.4 db; the quad has a slight edge. When going to more than 2 elements, though, the parasitic yagi always has the greater gain. At the 3 element level, for example, the yagi has about 1.3 db more gain. See **Fig. 6.**

One other advantage of the quad is that it is a little less susceptible to certain types of noise when receiving than the yagi. This is probably due to the fact that the quad is a type of loop antenna. And while speaking about receiving noise we may as well take one

Band	40 meters	20 meters	15 meters	10 meters
Optimum Radiation Angles	10-35°	7-22°	6-20°	5-14°

Fig. 5. The best radiation angles for working DX in four popular amateur bands.

more pot-shot at the vertical and point out that the vertical is much more susceptible to man-made noise than is a horizontal antenna.

Another fact about the quad, which has to do with its having less gain than the yagi, is that it is inherently a low Q antenna. This means that it will operate over an exceedingly wide bandwidth with a reasonably low SWR.

The DX man torn between the quad and yagi would do well to read references 3 and 4, which cover the antennas exhaustively and are excellent, readable books.

The multi-band beam

There is a happy coincidence about using a multiband beam for the DX bands. Since the optimum radiation angles decrease as frequency increases, it is necessary to raise the antenna (in wavelengths) as the frequency is raised, if it is desired to keep the radiation angle in the optimum range. But if the antenna stays at a constant height, measured in feet, it will automatically be raised in wavelengths as the frequency is raised. The result is that a multi-band antenna for 20, 15 and 10 meters mounted at 70 feet will give near optimum radiation angle results on all three bands. This can be seen by comparing **Figs. 4** and **5.**

There is also an undesirable feature attendant with many multi-band beams. Most designs use traps and matching networks which are inherently lossy. This means that a lot of the rf is soaked up in the traps, rather than being radiated toward the DX station. The result is that multi-band beams are seldom, if ever, as efficient as a single band array.

Stacking antennas

There is another way to reduce the effective radiation angle. This is by stacking identical antennas above one another. Unfortunately, this is difficult at DX frequencies because the stacking distance must be in the vicinity of three-quarters to one wavelength to be effective. At 20 meters, for example, the minimum distance between antennas is about 55 feet. At 10 meters, though, stacking is a definite possibility for the ambitious DXer. Both antennas are fed in phase with equal currents.

To use **Fig. 4**, then, one measures from ground to the midpoint between the two antennas to find the effective height. With the midpoint at one wavelength, the upper lobe (**Fig. 4D**) would largely disappear, and the lower wave angle would decrease slightly. The result would be about a 4 db increase in signal strength at the DX location.

Number of Elements	Maximum Gain of Yagi	Maximum Gain of Quad
1	0 db	0.9 db
2	5.4 db	5.7 db
3	8.5 db	7.2 db
4	9.3 db	8.0 db
5	9.9 db	8.5 db

Fig. 6. The maximum gain obtainable from quads and yagis with different numbers of elements. The gains noted are relative to a dipole.

Conclusion

The attempt of this article has been to give a brief overall picture of the DX antenna problem. It was particularly desired to point out the superiority of the horizontal over the vertical, as well as emphasizing the importance of small radiation angles. To the writer's knowledge a discussion of the DX antenna problem such as was given here has not appeared in any other amateur journal. Anyone seriously interested in pursuing the subject further will find the answers to his questions in the listed references. These were selected for their accuracy and readability. Good DX!

. . . K6ZGQ.

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Someone Should Do Something About...!

One of the more interesting facets of amateur radio is the opportunity to participate in unique organizations loosely identified as "radio ham clubs". Upon considering that each member has progressed through a filtering process designed to eliminate all but the most dedicated, it is interesting to observe the results. First he has had to culture an interest in a very demanding hobby, subject himself to an agonizing period of learning rules, theory, customs and morse code. Next under protest, he has indulged in outrageous expenditures for equipment. Then he has been further motivated to seek out the companionship of similar individuals. Finally, he not only endures, but delights in, attendance at regular club meetings.

These meetings follow proceedings that have been universally adopted. One familiar with these rituals can freely move from one geographical location to another and find solace. Unfortunately, these rites are not documented and the uninitiated must learn them the hard way. The constitution of any given club is usually of little benefit, for example, and reference to it can only result in confusion.

The most important things to bear in mind are that the members attend these meetings for entertainment (viz: night out from the XYL), and the club president is charged with providing some type of diversion, such as a speaker. In fact, some observers are of the opinion that this is his only purpose, and his re-election is dependent upon his degree of success in this vein.

All radio club meetings are called to order 45 minutes after the announced time. This allows a period for members to indulge in a quaint pastime known in amateur radio as the "eyeball QSO". This informal preliminary event is comprised of impromptu discussion centered on three (3) general areas of exaggerated claims:

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1. Lamentation of the heavy demands placed upon one's station by rare DX operators desiring a QSO.
2. The amount of high power one is utilizing, including various precautions to insure that a minimum of 1 KW output is always maintained.
3. The vast superiority of one's equipment; the extent of the claims being in proportion to his desire to unload it.

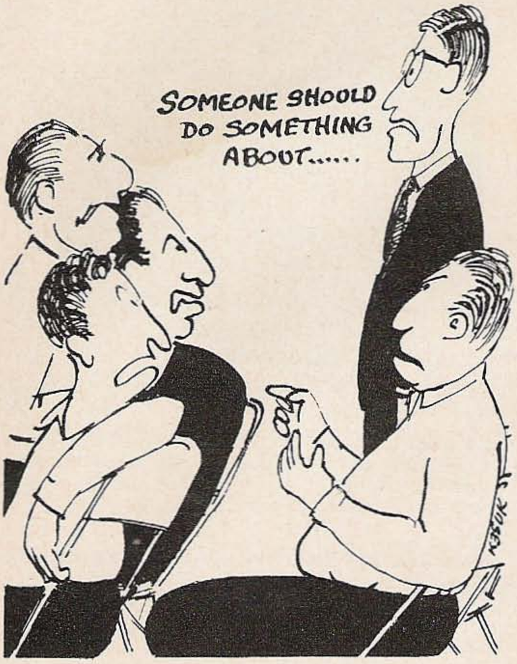
Of particular note are the audience participation entertainment meetings where a special game is played. The neophyte would be advised to surpress his urge to fully participate in this game until the rules are fully understood. It begins with the president announcing, "Tonight will be a business meeting!", meaning he couldn't obtain a speaker.

Upon this signal, the members are alerted to critically observe the proceedings, concentrating upon finding the "debate item." As the chairman routinely calls upon each committee head for a report, some of the more dedicated members warm-up for the main debate event with comments and questions somewhat relevant to the report. Candidates for team captain can thus identify themselves.

The main debate item is usually selected between 15 and 20 minutes after the call to order, when boredom has set in. While the scope of these items are vast, there are certain criteria which must be met in order to enjoy full participation.

1. Under no circumstances must the debate item result in any additional work for anyone except the president.
2. It must not encompass anything of real consequence. Abstract and theoretical subjects are ideal.
3. It must not be so complex as to allow for more than two points of view.

After several false starts, the debate begins to unfold. The teams can be identified as play continues. The chairman must make an important decision which has a significant impact upon the organization of the two teams. If he elects to assume the neutral role of an umpire, the teams are divided by an imaginary front-



to-back line down the center of the audience. On the other hand, when the chairman declares himself a player, the division is automatically front vs. rear. Because the chairman holds a strategic position in the room (and often is a little more informed on the background of the subject), his unfair advantage is offset by limiting his team to those on the rostrum and—depending upon the size of the audience—from one to three of the front rows.

The tap-off is initiated by a potential team captain who arises and demands "that something be done!" concerning a certain item. It is imperative that he not be specific about what should be done or by whom, thus preventing a premature completion of the game. Heroically seizing the initiative, a candidate team captain for the other side recognizes the challenge and rises in reply. It is not pertinent that his retort reveal any great enlightenment—delivery is the critical aspect of winning these coveted positions. When the debate item is acceptable to the audience, they so signify by responding to the call-to-arms, and the main event can proceed.

Observing protocol, members from each team rally to their selected captain and alternately rise to repeat his argument, interspersing their commentary with items usually unrelated to the subject. The individual member can find great comfort in addressing the captive audience and is willing to endure listening to the others in return for his opportunity to get a few things off his chest. (Most covered topics: CB, deplorable state of amateur radio, TVI). Besides, 50% of the audience is on his side before even he starts.

Veteran observers are quick to point out the upswing of interest in the game since the wide acceptance of VOX keyed transmitters. Before this dastardly technical advancement, an operator could pour out his feelings into a microphone for all the world to hear (in reality, it would only be one other ham who was partially copying R3 X S4 with heavy QRM), and he could rave on until he got good and ready to manually throw the transfer switch. He now feels frustrated by automation since every time he pauses to take a breath during his discourse, he is vulnerable to being cut-off. An individual with this particular problem can be rapidly identified in everyday life by his continual interjection of the phrase, "AWWWWWW," after every sentence.

In the unfortunate situation where the audience seating arrangement is such as to make the imaginary division line indistinct, an individual not quite sure of which side he has been assigned may be prompted to arise and summarize the two positions, and either offer a compromise or request a motion. This is an obvious delay of the game and he is penalized by a loud admonishment by both sides as he slinks to his seat. Outcast, he remains silent and makes note not to sit in the middle next time.

The game is completed when an arbitrary time limit is reached, usually 10:45 PM. The finale is quite rapid with the chairman dissolving the two teams by requesting volunteers to work on the problem. This is the signal that the game is over and everyone is to remain silent.

Any important items are disposed of rapidly without comment within the next 5 minutes so the meeting can be adjourned to a nearby tavern for a victory celebration by both sides. The team captains shake hands and agree, "It was good to clear the air!" Midnight having been established by XYL's, Inc. as the "time-to-be-home-from-the-radio-club-by," the "eyeball QSO" is resumed with the sky-the-limit for exaggerated claims, until the magic hour.

As the members happily return to their homes with fond memories of a battle well fought, mentally rephrasing what they said or wish they had said during their speech, the true value of the radio club can best be appreciated.

. . . K3BNS

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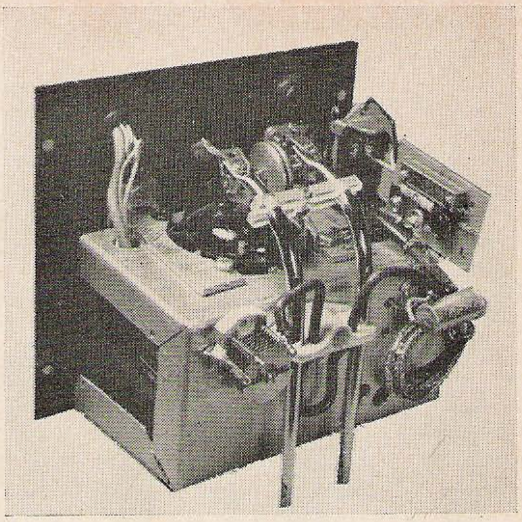
The Tranx Circuit

Switch your linear with a tranx circuit



Here's the tranx circuit installed on an 832A linear for two. The circuit is built on the small piece of insulating board at the right. The pickup loop is below the electrolytic just beneath it.

Many excellent articles on the construction of linear amplifiers have appeared in late issues of *73 Magazine*; one problem common to these linears when used with a transceiver is the problem of switching. The linear amplifier should be inserted between the transceiver and the antenna during the receive period. Since switching the linear (in and out of the transmission line) manually is dangerous during mobile operation, automatic switching performed by a relay is prefered in the interest of safety and convenience.

Often the relay for performing the switching is activated by closing a separate set of contacts added to the transmit switch on the transceiver, or the relay may be activated by the high voltage in the plate lead of the transceiver's transmitter section. Both of these methods require modification of the transceiver and both methods require the addition of long leads from the transceiver to the linear amplifier to operate the relay. The alternate method is to install a "tranx circuit" within the linear amplifier. The tranx circuit, short for transmitter-operated control, will trigger the relay as soon as a signal above a preset level appears in the transmission line to the antenna. The advantages are obvious—the transceiver need not be modified; it keeps its portability. Also, no high voltage leads are required to trigger the relay, and thus the safety is increased to both the operator and innocent bystanders. Use of the tranx circuit also allows remote triggering of a linear amplifier when contained in the trunk compartment of a vehicle. The only interconnecting lead between the transceiver and linear amplifier is the coax.

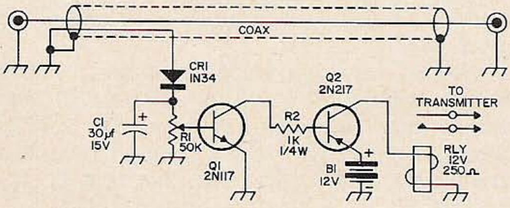


Fig. 1. Schematic of the tranx circuit. Other general purpose transistors can be used.

Tranx circuit theory

The tranx circuit is essentially a dc operated amplifier which picks up a small amount of radio frequency energy from the transmission line between the transceiver and antenna during transmit conditions and switches the linear amplifier into the circuit. During receive conditions, the radio frequency signals in the transmission line are not strong enough to activate the dc amplifier of the tranx circuit to the point of triggering the relay, which means the linear amplifier will remain out of circuit and inactive.

The circuit

The tranx circuit consists of two basis circuits, a rectifying-filtering circuit and a dc amplifier. The positive cycles of the RF picked up by the pickup loop charge C1 through CR1. After charging C1, emitter-base current from Q1 and current through R1 will discharge C1. The discharge time of C1 gave about 0.5 second delay after the signal was turned off before the relay dropped out of the hold position.

The dc amplifier circuit is comprised of an NPN transistor directly coupled through a limiting resistor, R2, to a 150 mw general purpose PNP transistor. The dc output of the PNP transistor is connected directly to a twelve volt dc relay of the type often found in surplus equipment designed for twelve and twenty-four volt operation.

Under transmit conditions, the charge across C1 attracts electrons from the emitter through the base of Q1. Electrons then flow through

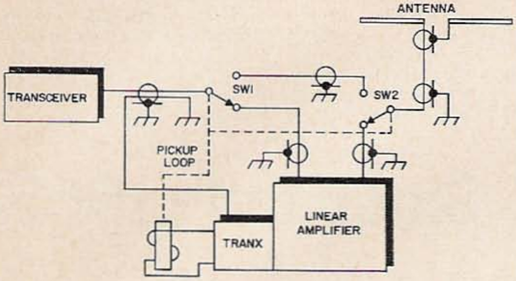


Fig. 2. Arrangement of the tranx circuit as used with a transceiver.

the collector of Q1 and limiting resistor R2, into the base of Q2, which forward biases the emitter-base junction of Q2. With the emitter-base junction of Q2 forward biased, electrons will flow from the negative terminal of B1 through the relay (closing the relay contacts) and return to the positive terminal of B1 through Q2.

Sensitivity

The only difficulty encountered with the tranx circuit came from the preliminary choice of R1 which was used to control the maximum sensitivity of the circuit. The circuit lost sensitivity when R1 was reduced below the value shown in the schematic. When R1 was increased, the circuit had a tendency to remain activated, that is, the relay would not release within a predetermined length of time after the transmitter was turned off.

Bench tests (using a VTVM and 147 mc RF source) showed that the sensitivity control could be adjusted so that signals from one volt to one hundred volts peak to peak would trigger the circuit.

Observations from field tests

The tranx circuit worked successfully when used in conjunction with a Heathkit Two'er and a twelve inch pickup loop in a mobile installation. A fifteen foot length of coax was the only interconnecting lead between the Two'er and the linear amplifier. The tranx circuit keyed easily with the rf from the Two'er, and no adverse effects (such as the generation of TVI) were observed. The current drain was also very low. Under idle conditions, the tranx circuit required about fifty millamperes. Long transmitting periods produced no noticable increase in the temperature of the transistors. However, the grid tuning would cause the relay to drop out of the hold position if not correctly tuned.

. . . K7VMV

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Practical Double Sideband - 1966

Although it is not my intention to reopen the present DSB-SSB controversy, I have thoughts and suggestions which should alleviate much of the misunderstanding regarding double sideband. I have also suggested several ways of overcoming design problems of a workable modern DSB transmitter.

The main complaint most SSB operators have against DSB is the width of the transmitted signal. However, it should be remembered that a DSB signal is essentially an AM signal without a carrier, and incidentally, without heterodynes! It also should be realized that a DSB signal is two SSB signals on the same reference carrier, one upper and one lower sideband. Most complaints of splatter or distortion on DSB signals are the fault of the complainants receiver. Cost unfortunately has little to do with any patricular receiver's ability to reject local co-channel interference. All one has to do is place an attenuator pad in the receiver front end to restore that 'clean' sound to any 'suspected' local DSB signal.

Circuitry

The basic practical high level balanced modulator is shown in **Fig. 1.** Its operation will not be discussed since there are so many excellent references available such as the *New Sideband Handbook* by Don Stoner W6TNS. Basically though, the audio is fed in push-pull to the output screen grids, the rf input is in push-pull and the rf output is in parallel. The bias, shown as battery for simplicity, should be adjustable and is designed to keep the balanced modulator tubes operating within their maximum plate dissipation. It will also serve to correct any irregularities in the output waveform.

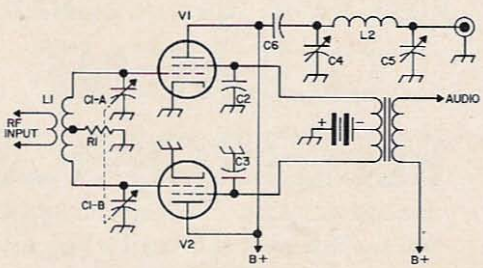


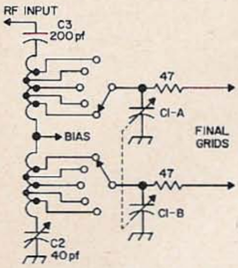
Fig. 1. High level modulator for DSB.

Design problems

Probably the biggest problem in designing a bandswitching DSB transmitter is the actual bandswitching circuitry in the final grid. Leads must be kept as short and symmetrical as possible. The most practical found by the author is diagrammed in **Fig. 2.**

The circuit is, in practice, driven by an untuned buffer stage which is controllable as to drive. C2 acts as 'drive peak' control and also balances the rf applied to both balanced modulator tubes. If careful, symmetrical construction in used carrier should be in the order of 30-40 db. The switch wafers should of course be ganged to switch the exciter stages and the final output circuitry too!

The choice of a suitable modulation transformer seems to cause some amateurs a great deal of trouble. I have found that 400 cycle power transformers are probably the best choice for several reasons. The first consideration is that the transformer must have a turns ratio of around 5.2:1 in order to develop sufficient screen voltage from the modulator. Incidentally, the transformer is connected as step-up. That is, the 117 volt primary is connected to the audio and the secondary (center-tapped) goes to the screens of the high-level balanced modulator, refer to **Fig. 1.** Another reason for choosing this transformer is the fact that it will reject any low frequency components. This will reduce intermodulation distortion and will, in effect, place the two sidebands farther apart since the information is to be transmitted at higher audio frequencies. It is also advantageous to roll off the high frequencies. This will keep the signal from becoming too broad. A low pass filter such as



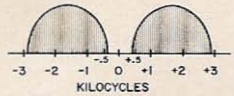


Fig. 2, Left. Bandswitching final grid circuitry for a DSB transmitter. Keep leads short and symmetrical.

Fig. 3, Right. DSB spectrum.

the Stancor C-2340 should give the desired response, 300-3000 cycles. Spectrum-wise the signal should look like that in **Fig. 3.**

Another object of concern are the ratings of such a transformer. As hinted earlier the 117 volt 400 cycle seems about best to match the output of such tubes as 6AQ5, 6V6 etc. as modulators. As a 'rule of thumb' the secondary of the transformer should be able to supply (assuming 117 volt input) about twice the combined screen voltage of each balanced modulator tube normally operating AM phone. A transformer with a secondary delivering 300 each side of the center tap has proven to be an excellent choice for modulating such tubes as the popular 6146 and 6DQ5.

Most manufacturers of transformers make 400 cycle equipment under military contract. Although these transformers are not available from distributors they may be found as surplus or alternatively by writing any of the larger manufacturers.

Another very definite design problem is mode switching. With proper design it is possible to obtain 350 watts PEP on DSB, 150 watts CW, and 100 watts AM all from a pair of 6DQ5's.

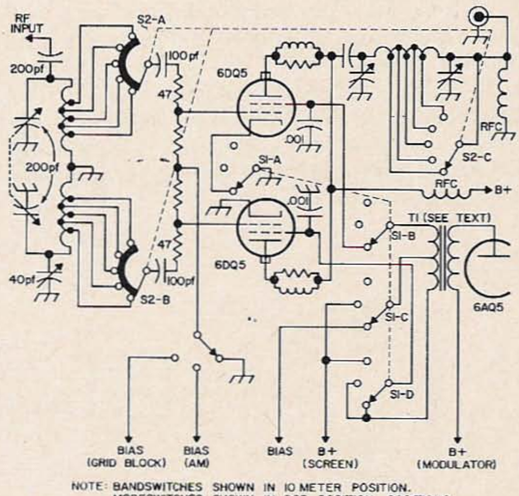
As with any problem in order to solve it you must first understand the basics. In switching between modes you are, in effect, simply changing conditions of the balanced modulator tubes. By this I mean you are changing bias, modulators and circuit configurations. In order to change your DSB high level balanced modulator to AM you must: lift one cathode of an output tube, remove screen voltage from this same tube and then switch the modulator transformer into the other tubes screen circuit in a fashion which will modulate its screen voltage and then supply a proper amount of grid bias to keep the tube from taking off in the absence of drive. For CW the following should be done; one cathode of an output tube should be lifted from ground, the screen voltage from this tube likewise should also be lifted. The remaining tube should have grid-block keying bias applied and fixed screen voltage. Circuitry for such switching is shown in **Fig. 4.** By the time all the band-switching and modeswitching circuitry is incorporated in the overall schematic it appears quite complicated. However, it is a simple matter to resolve any and all of the circuit into simpler portions.

Since the mechanical design of a DSB transmitter or any transmitter is an involved procedure it will not be covered in detail. The most important factor in designing a DSB transmitter is a symmetrical mechanical and electrical construction in the balanced modulator circuitry.

The transmitter should be carefully constructed using all current construction procedures. Keep all ac wiring close to the chassis to avoid hum pickup. Shield all critical audio leads and properly bypass all high voltage leads. As a last word on electrical design let me say that good signals require good power supplies.

Assuming that a DSB transmitter has been built you will want to check its operation on an oscilloscope. The familiar bow-tie pattern is the desired shape when rf is applied directly to the vertical plates and audio is applied to the horizontal plates through a voltage divider as shown in **Fig. 5.** The desired waveshape is also shown.

If difficulty is found in attempting to obtain a bow-tie pattern it may be because there is too much or too little drive or the bias on the



NOTE: BANDSWITCHES SHOWN IN 10 METER POSITION.
MODESWITCHES SHOWN IN DSB POSITION. POSITIONS CLOCKWISE ARE DSB - AM - CW.

Fig. 4. Practical double sideband modulator-output.

balanced modulator screens is too high or too low. In particular, the bias on the secondary of the modulator will affect the crossover point on the pattern. Drive will cause the pattern to bulge or become concave depending on whether too much or too little drive is applied. If in doubt regarding your particular pattern consult one of the many excellent handbooks available. Incidentally, a single audio tone is all that need be applied to obtain a bow-tie on DSB whereas the familiar two-tone test is used on SSB to obtain the same pattern.

That's it! I have presented a few practical hints for building a DSB transmitter. This modes popularity is still growing as witnessed by several new transmitters appearing on the market. The mode is extremely practical from

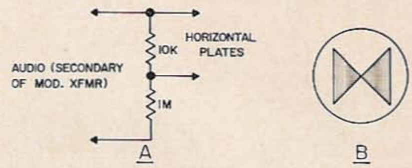


Fig. 5A. Source of horizontal sweep for a bow tie pattern shown in 5B.

practically all aspects and above all it is extremely simple as compared with SSB.

In closing, if any readers are interested in complete construction details of a bandswitching 350 watt DSB transmitter drop a note to my QTH and I'll do my best to try to write such an article.

. . . VE7BBM

A. Thivierge VE2HE

A Semi-Switchless Directional Coupler

Ever since I built my first "Monimatch" SWR indicator, I have felt that simultaneous monitoring of the *Forward* and *Reflected* components would be desirable. I would all too frequently find myself trying in vain to tune for minimum *Reflected* only to find that I had the switch in the *Forward* position! Or (that was before I grew a third hand . . .) I would get annoyed at flipping the switch back and forth tuning for a healthy *F* reading . . . and get a healthier *R* reading. I considered using two meters, but the thought of such lavish extravagance was swiftly brushed aside everytime Junior needed new shoes. If other hams have run into the same problem (no, not Junior's shoes . . .) here is one answer to our common plight.

I use a zero-center microammeter. The connections to the *Reflected* diode are reversed to produce a negative output. No confusion now: positive reading for *Forward* and negative for *Reflected*.

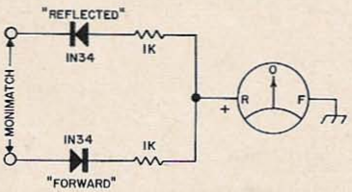


Fig. 1. Use of a zero center microammeter for the Monimatch.

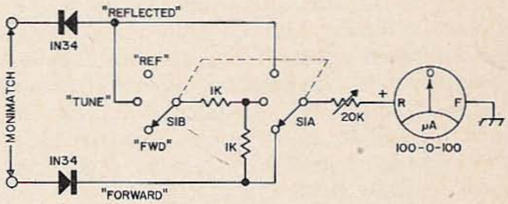


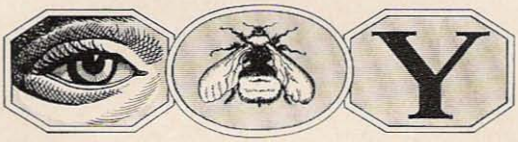
Fig. 2. Final circuit which gives conventional **Forward** and **Reflected** readings as well as the special **Tune** position.

The next logical step quickly suggested itself. Since the outputs from the coupler are of opposite polarities, why not mix them in a common load and read the resultant? It works. Se **Fig. 1.** Two 1 k resistors in series are bridged across the *F* and *R* terminals of the Monimatch and the microammeter connected to their junction point reads the algebraic sum of the two voltages: *A maximum positive deflection indicates minimum SWR.*

The necessary connections are made through a three position two pole switch. See **Fig. 2** for complete wiring. This provides a center *Tune* position giving the configuration shown in **Fig. 1** as well as the conventional *Forward* and *Reflected* positions.

Simply switch to *Tune* and manipulate all loading and matching controls to obtain a maximum positive deflection. You may then switch to *F* and *R* in the normal manner to verify the results of your knob twiddling. But after a while you won't bother.

. . . VE2HE



NO FROSTING ON THIS CAKE

(SWAN CONTINUED)

My ad in the January issue created quite a stir, and many letters were received from hams all over the country. The upshot is that I feel prompted to define Swan's value a little more, specifically for you fellows who are wondering what to purchase.

I recommend and sell Swan in greater numbers than any other transceiver because of the inherent soundness of the product and because of its obviously greater value. Let me explain. In evaluating any modern sideband transceiver consideration must be made for the total frequency coverage over the maximum number of amateur bands, the flexibility of the equipment to reach outside the bands for MARS and CAP work, the degree with which the product will operate satisfactorily on CW and AM as well as sideband, ratio of rejection of the unwanted products vs. the effective power output, and of course the mechanical convenience of operating the equipment. Price of course is an object and so is the record of service-free hours that can be expected. After all, we cannot all afford Cadillacs. It seems to me as I write this that there are an awfully lot of Chevrolets on the road and that a modern Chevrolet is certainly giving its owner a great deal of satisfaction. I liken Swan to Chevrolet. It has the power, the flexibility, the operating convenience, and a record of reliability which places it in the front for value. Swan gives you full 80-10 coverage, 3.7mc total, and the chance to operate on MARS or other external frequencies with the purchase of a small and inexpensive accessory. The power that you get is greater than practically any other transceiver out. Priced with the AC power supply at only $480.00, you get your choice of CW, AM, and sideband. If you want to try something interesting, compare these facts on frequency, power, and price with the other tranceivers and then sit back and judge for yourself what you ought to do. You will be picking—Swan.

A NEW SWAN PRODUCT

For those of you who are interested in *VHF*, I have a pleasant surprise—Swan is bringing out a 6-meter sideband transceiver. It will look essentially the same as the Model 350, it will have the same dimensions, it will provide 240 watts of PEP input to a pair of 6146B's, and it will provide full 6-meter coverage in increments of 500kc by means of a lockable band set capacitor. Provision has been made in its design for a 500KC crystal calibrator accessory. This transceiver has an RF gain control. Full AGC and a crystal lattice network of 10.7mc and will operate on upper sideband and AM. It is meant to be used with any of the standard Swan power supplies. Best of all, the price of this new Model 250 is expected to be only $295.00 with delivery starting in early May. Get your order in soon!

If you evaluate the pleasures that you will receive from your ham radio in terms of maximum contact time vs. hours expended you will begin to understand why 6-meter activity is becoming so very popular.

Here is the rig which is bound to make history and, in typical Swan manner, you get maximum value. No frills—the pleasure is in the eating, oops I mean the operating. Now you know why I say there is no frosting on *this* cake!

HERBERT W. GORDON COMPANY

Woodchuck Hill, Harvard, Mass., 01451
Telephone 617-456-3548

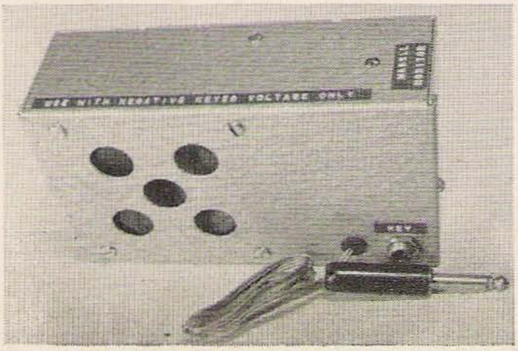
Ron Gunn WA6KLL
358 Albatross Ave.
Livermore, Calif. 94550

Two Buck Monitor

Gather round, all you poor harassed ops who are getting hot on your cw or want to and who own a monitorless transmitter or sideband transceiver. Some of those rigs are pretty hard to hook a monitor to so you can tell what you're sending. You can install a noisy relay to operate the monitor, but there is a better and cheaper way in most cases so why not use it? Let's live modern and come up with a two buck monitor scheme that will plug right into the key jack and let you know how your keying sounds. Not only that, but it has no other wires or leads than the line to the key jack and a place to plug in the key itself.

The really best way to monitor your sending is to listen on the station receiver but if you own a transceiver, forget it. The next best way is to have an audio oscillator that is keyed along with the transmitter. The best bet in audio oscillators today is the 98¢ transistor module variety that is in practically all of the mail order catalogs. These units are the most in simplicity. Wire up a small 6 volt battery and a speaker to them and they will operate for months, and drive you out of the room with their volume to boot. And you can use the unit for a code practice oscillator if you're really rusty, then plug it into the rig when ready to go.

Now the trick is to hook this thing up to your transmitter when the key is operating a circuit that is from 30 volts and up, and of any polarity. Well, if the voltage is high enough to be downright dangerous, don't be a hero, install a double pole relay and live a while. But if the voltage is a couple of hundred or less, science has found the answer, and the quantities they make these things in has driven their price down to less than four bits. I am speaking of the fantastically efficient, tiny and enormously valuable silicon power diode.



External view of the Two Buck Monitor.

These units have a forward drop (conducting mode) of less than 0.6 volt at full rated current. As far as any circuit we might want to operate thru it is concerned, it isn't even there. The reverse resistance is another story, however. When the cathode of one of these diodes becomes positive, the series resistance jumps to many megohms.

Our problem then is to hook up the two circuits we are interested in without their interacting. By interacting I mean preventing the voltage in the keying circuit from changing the solid state components in the monitor into low grade resistors. The two circuits I speak of are the keying circuit itself (necessary!) and the monitor circuit we would like to operate at the same time.

First, determine the polarity of the transmitter keying circuit. If the transceiver is block-grid keyed, it will be negative. If it is a modulator balance/unbalance scheme or a tone oscilllator, it may well be postive. If you have to install the keying yourself or it is obvious from the schematic, fine. If not then plug in a phone plug with the plastic handle

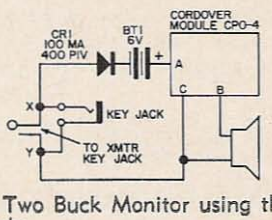
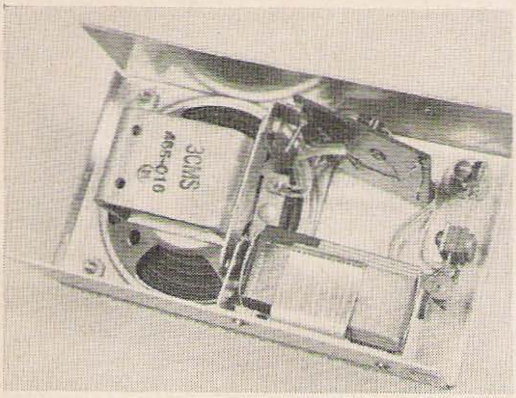


Fig. 1. The Two Buck Monitor using the Cordover CPO-4 module.



Inside of the Two Buck Monitor. The cordover module is just above the battery.

removed and determine what polarity is on the tip with a voltmeter. Be right or the two circuits will interact as explained above—once. The odds are 50-50.

Now gaze upon **Fig. 1.** In it is shown a scheme for isolating the two circuits in question from each other while operating them off of the same key. The silicon diode mentioned above has solved our problem. When the key is up, and our schematic assumes that we use block-grid keying (negative), the negative voltage at the key goes to maybe a couple of hundred volts. This voltage would instantly ruin the monitor except that we have installed the diode in series with it and have polarized it such that the negative voltage on its anode has cut it off and the monitor never sees any voltage thru it. When the key is down the keyed circuit sees ground and the rig turns on. At the same time the monitor circuit sees a continuous circuit thru the key, the now forward biased diode and the battery. It has also been turned on.

Now, if you happen to have postive voltage at the key jack, just disconnect the monitor part of the circuit at the key (points x and y) and reverse them. Then be sure to label the monitor either postive or negative as the case may be. The wrong polarity will ruin it. Mine has the statement "use with negative keyed voltage only" on it as can be seen in the photo.

If you go hog wild as I have and get a pretty box, etc., the cost will be more than a couple of bucks, but the basic parts are not far from it. By the way, if the contacts on your bug are the least bit dirty, the monitor will tell you quick. It is very sensitive to resistance in the keyed circuit and will greet you with a different note on your dahs than you get on your dits. Your V may sound like it's straight from Beethoven. The cure? Clean the points, of course. . . . WA6KLL

M. B. Crowley EI4R
78 Church Street
Listowel, County Kerry
Eire

Controlled Audio AVC System

The two essential requirements of the Audio derived avc system are (1) fast rise time, (2) controlled decay time.

Lack of fast rise time means that on the first syllable of a modulated wave or the first dot or dash of a CW signal, an annoying blast of sound is received because the incoming signal has not had sufficient time to generate and apply bias to the controlled valves then running at maximum amplification.

Slow decay time, to the users' choice, is desirable, but fast enough to allow the controlled valves to reach full sensitivity reasonably quickly at the end of transmission, and ready for the next weak incoming signal as required, and also slow enough to allow the user to read the value of the incoming signal from his S meter needle before same returns to zero.

The last two requirements are conflicting in that too slow a decay time enabling the S meter needle to remain reasonably steady will not allow the set return to full sensitivity quickly enough, or vice versa, with the set quickly sensitive, the meter is unreadable, due to its fast movements.

Elaborate circuits have been devised to overcome these failings but complicated systems are enough to make set owners shy free of incorporating them in their receivers; therefore, a simple system that has the necessary requirements and gives steady meter reading is desirable. Such a system is now outlined in circuit, where it is noticeable that the reasonably slow decay time for the avc line and the very slow decay time for the meter, are now separate functions.

The incoming signal is applied to the grid of first section double triode, which has an unbiased cathode resistor allowing this section to work undistorted with strong or weak signals. The amplified output of this valve is passed via .01 mfd condenser to the cathode of the second half of valve which cathode is connected to earth via a crystal diode with the negative blocking end to cathode. The cathode and grid components of this section are so interconnected that a negative mean level of bias maintained on the grid, following slightly below the signals on the cathode. Thus the tips of the rectified audio voltage at the diode are passed from the cathode to the grid to charge the 25 μf condenser and also from cathode to anode to the avc line through the 10 k resistor to charge the .1 μf condenser. The time constants of the controlled grids is made deliberately small (e.g., through 50 k

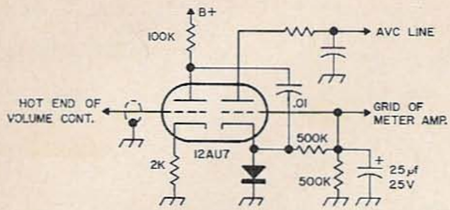


Fig. 1. Controlled audio AVC system.

resistors with grids bipassed with .005 μf condensers) thus allowing the avc line decay time (about two seconds) to depend on the value of the .1 μf condenser in this circuit. The decay time can be varied to suit users' choice by increasing or decreasing the value of this condenser.

Any movement of electrons in a diode, valve or valve portion acting as a diode, due to the constantly changing polarity of anode in respect of the cathode resulting in reversal of electron charge movement with the valve or diode will cause noise in such circuits as detectors mixers or any non linear device, which will add to the overall noise background of the receiver. The peculiar arrangement in the circuit of the diode and its associated components were arranged in an effort to cancel out the reversal of valve space current, either from the anode to cathode or grid to cathode. The eventual negative charge on the valve grid by the storage charge of the 25 μf condenser will cancel out reversal of electrons from anode and grid to cathode. The cancellation of this noise source to the anode which is connected to the controlled valves, which can amplify any source of noise, leaves us with a much quieter receiver, an advantage not to be ignored. The 25 μf condenser is also connected to the meter circuits and has a slow time constant allowing the meter to remain steady long enough for comfortable reading.

The components of the circuit are not in any way critical in values leaving some latitude regarding choice of components. Most any crystal diode in good working order will suffice. For greater values of avc levels, a 12AT7 value may be used to replace the 12AU7 without changing any components. Placement of valve and parts is not critical, but if placed away from the audio source, a screened lead from audio source to the valve input should be used to prevent grid hum through the set. A simple type of dc bridge amplifier such as the common 6C4 circuit can be used. Maybe your S meter is sensitive enough without an amplifier. This is left to the reader's choice.

. . . EI4R

Richard Jacobs WAØAIY
1015 Glenside City
University City, Mo.

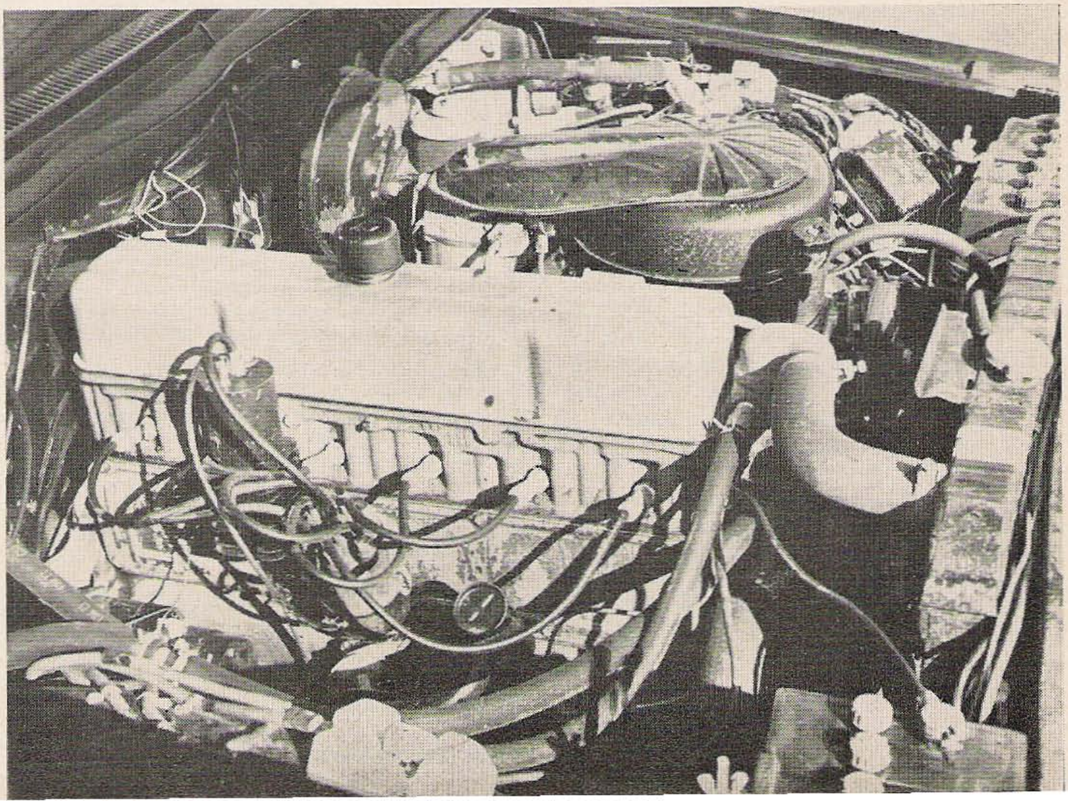
One-Way Dual Battery

Use a unique one-way dual diode circuit and never worry about your car battery again.

Sometime ago I decided that I wanted to be able to operate my amateur gear without ever having to worry about the car's battery going dead. Having experienced the unpleasantness of not being able to park for a while during the winter, with the engine off and the heater on, or transmitting to my heart's content, I considered at first having a spare battery in the trunk and hooking it up by cables to the charging system under the hood. As I thought about it further, however, I realized that with this system I would need heavy cables so that no voltage would be lost, I would lose a bit of trunk space, I would have to do a lot of work (I don't like doing more than I have to), and I could just as easily run down one battery as two—thus gaining only a few more minutes of total electrical power.

I had to have some way to increase my automobile's stored electrical energy (battery power) and at the same time arrange it so that I wouldn't have to switch between the batteries when I was using the system or connect them for charging—automation was my answer.

Deciding on the ultimate solution, I decided to use a dual-diode, dual-battery circuit, which permits two batteries to be installed



View of the engine compartment of the car showing the two batteries and part of the diode heatsink.

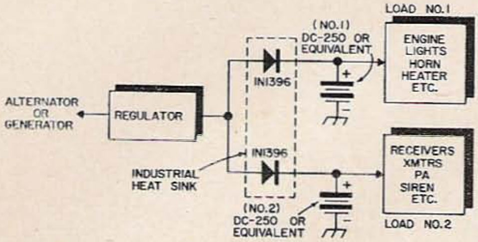


Fig. 1. Schematic of the one-way dual diode, dual battery system.

under the hood and enables charging of both batteries simultaneously but eliminates forever one's not being able to get his car started in the winter or after he has talked too long and run down the battery. As can be ascertained from the diagram, the car's electrical load (lights, horn, starter, heater, etc.) are on one battery; and the amateur load (receivers, transmitters, PA system, electronic-siren, police and aircraft receiver, etc.) are on the second battery.

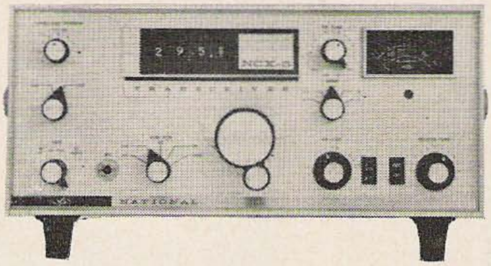
Since the diodes conduct in only one direction, current output from the alternator flows freely through the diodes to the batteries but since the diodes will not conduct in the reverse direction, one load cannot take current from the other battery.

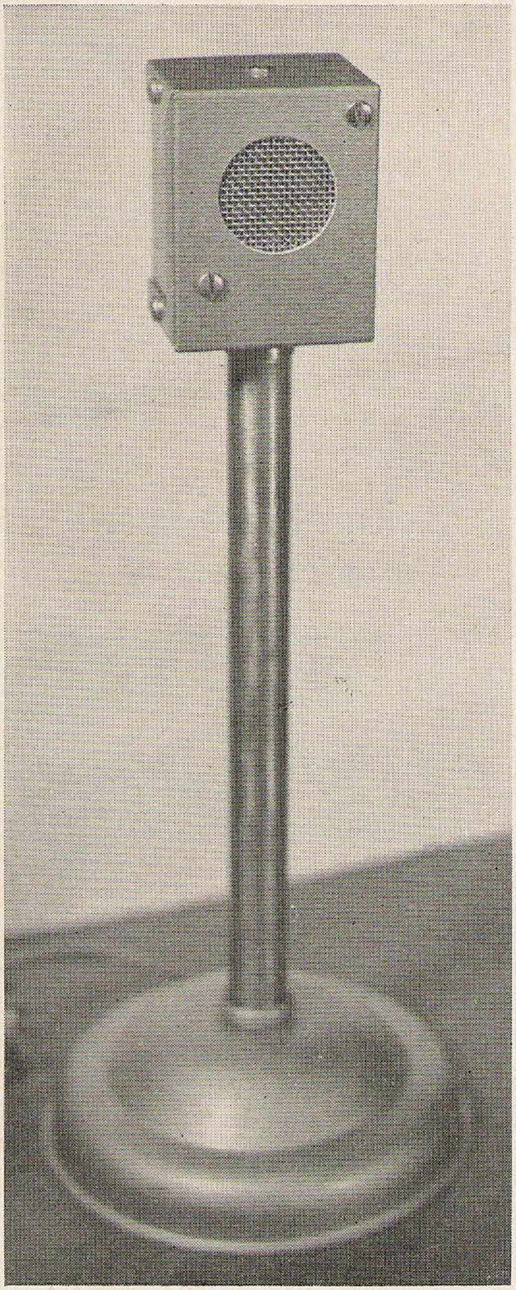
I used Westinghouse 1N1396 diodes which are rated at 50 PRV @ 70 amps and mounted the two on a Westinghouse industrial heatsink which is available from that company's Youngwood, Pennsylvania plant. The heatsink is mounted under the hood and has provided several years of maintenance-free service. Incidentally, to store the most power possible, I replaced the original battery with a Delco high capacity DC-250 and got an identical one for the other side of the engine compartment.

Since there is a slight drop in forward voltage with the diodes in the charging circuit, it is a good idea to have the voltage adjustment on the regulator turned up to compensate for this.

One never knows the feeling it is not to ever have to worry about another dead battery. If one leaves the heater on too long in the winter or the air-conditioner on too long in the summer with the engine off, he can always "jump" the power from his #2 (auxiliary equipment) battery. If he likes to yak from his mobile and talks too long on his #2 (auxiliary equipment) battery and drains it completely, he can do it knowing that he will still have his fully charged #1 (automobile equipment) battery with which to start the car. You can't beat it!

. . . WAØAIY





A Dynamic Microphone at Low Cost

Richard Genaille
719 Quarterstaff Road
Winston-Salem, North Carolina

For many years radio amateurs have obtained, by various and sundry means, the popular Western Electric F1-Transmitter Unit for use as an excellent carbon microphone at the home station or for mobile and portable work. While the F1 Unit performs admirably, it also has certain disadvantages, such as the need for providing operating current by the use of an external battery or by modifying speech amplifier circuitry to utilize tube cathode current. Excessive carbon button current very often results in packing of the carbon granules and unsatisfactory operation. Very often an operator will complain of hearing carbon mike hiss on your signal.

On the other end of the F series type telephone hand-set, of which the F1 Transmitter Unit is a part, is the unit known as the Western Electric HA-1 Receiver Unit. To most hams this part of the telephone hand-set has had little significance other than to be the part that you normally would listen to when using the hand-set. Unknown to many hams is the fact that the HA-1 Receiver Unit can be used as a microphone with excellent results in providing good voice communications quality. It is a controlled diaphragm magnetic

Attention MARS Members:

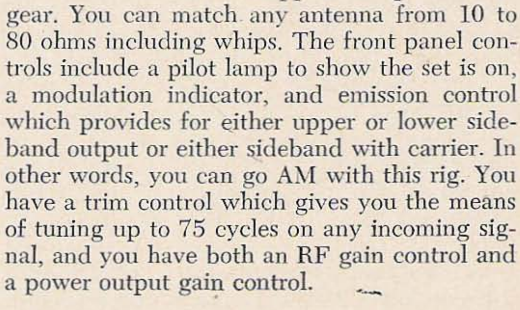
A Very Limited Offer

An unusual opportunity exists for hams who have an interest in MARS or CAP to purchase a brand new RCA SSB-5 transceiver. This 4-channel transceiver covers the range of 3-15 mc and provides a means of switching any one of 4 discrete frequencies within this spectrum with a flick of a switch. All circuits from the crystal to the output pi are switched by this control, and when you tune up for any one specific frequency you tune the entire transceiver with a separate set of adjustments for each channel. There are provisions for 4 antennas and you get a choice of a 6-pole lattice filter for either upper or lower sideband. The unwanted carrier and/or opposite sideband is rejected by more than 50db while permitting more than 125 watts of PEP output.

Here is a device, the best of its kind for MARS operation, currently selling for $742.50, absolutely new. I have a total of only 46 of these units available for sale which I will sell to the first 46 customers who send in their money. This is what you will get for $249.50: The transceiver; one crystal of your choice between 3 and 15 mc (this crystal will always be 1400 KC higher than the frequency you want to operate on); either 110 AC supply or a supply that will operate on 12 volts DC for use in a motor vehicle; the crystal lattice selectable sideband filter that you wish, either upper or lower, or you may buy the other filter for an extra $50.00; interconnecting cables; and the instruction manual.

The transceiver weighs only 16 lbs, the AC supply 23 lbs, the DC supply 8 lbs. It measures 12½" x 7½" x 13". The receiving section itself has extremely good sensitivity, being better than 1 microvolt for 50 milliwatts output with a 10db signal plus noise to noise ratio.

By the way, you get the push-to-talk microphone and the built-in speaker as part of the package. You have automatic speech clipping up to 12db, and each crystal of the 4 that you can use is housed in a thermostatically controlled oven which is supplied as part of the gear. You can match any antenna from 10 to 80 ohms including whips. The front panel controls include a pilot lamp to show the set is on, a modulation indicator, and emission control which provides for either upper or lower sideband output or either sideband with carrier. In other words, you can go AM with this rig. You have a trim control which gives you the means of tuning up to 75 cycles on any incoming signal, and you have both an RF gain control and a power output gain control.



This is late, modern equipment, new, checked out, guaranteed and sold on a money-back basis; $742.50 worth of new sideband gear for $249.50 special only at

HERBERT W. GORDON COMPANY

Woodchuck Hill, Harvard, Mass., 01451

Telephone 617-456-3548

type receiver unit similar in operation to a permanent-magnet type loudspeaker. As is already well known in amateur circles, a permanent-magnet loudspeaker can be used as a dynamic microphone, although the fidelity is not as good as is obtainable with a properly designed microphone. Likewise, the HA-1 Receiver Unit can be used as a dynamic microphone, but with superior results. It has a more desirable frequency response for amateur communications work than most of the low-cost crystal microphones presently flooding the market, is physically rugged and is not easily affected by shock, heat or humidity. The HA-1 can now be obtained, without recourse to "various and sundry means," at a nominal cost. With a small amount of effort, a few additional components and some miscellaneous hardware, you can make up a good communications quality dynamic microphone which you can use at your station as either your main mike or as a rugged mike for mobile and portable work. Here is how it is done.

Since the output impedance of a typical dynamic type unit such as the HA-1 is quite low, it is usually desirable to provide some means of impedance matching to a high impedance microphone input. This is most often accomplished by the use of a small matching transformer normally mounted inside of the case in which the dynamic unit is installed. To determine the characteristics of the transformer required for matching the HA-1, an impedance curve was plotted for the HA-1 Unit using measurements made with a Knight-Kit Sine Wave Audio Generator and a Knight-Kit Vacuum Tube Voltmeter. From this impedance curve it was found that the impedance of the unit varies from about 60 ohms at 300 cycles to near 400 ohms at 5,000 cycles. For normal voice work we are primarily interested in those voice frequencies which lie between 500 and 2,500 cycles. To obtain the necessary impedance match for the HA-1 Unit to a high impedance connection and to keep the dimensions of the matching transformer as small as possible, a U.T.C. Sub-Ouncer miniature transformer was selected for the job. The particular model, the SO-1, is physically small enough to locate within the metal box which will ultimately be used as the mike "head." It has a primary impedance of 50/200 ohms and a secondary impedance of 62.5k to 250k ohms. The response of the SO-1 is plus or minus 3 db from 200 to 5,000 cycles. This small transformer is the only item required for the microphone construction that costs in excess of one dollar. The entire microphone, stand and all, can be constructed for no more

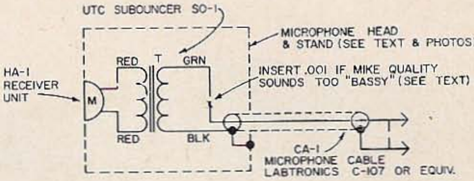
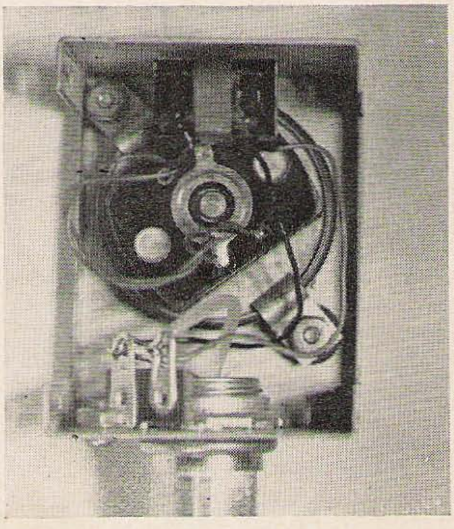


Fig. 1. Schematic of the low cost dynamic microphone using the HA-1 receiver unit.

than about $6.50 if all of the material, including the HA-1 Unit, is purchased new.

The interior of the microphone "head" and the completed microphone with stand are shown in the photographs. Needless to say, one does not have to adhere strictly to the miscellaneous hardware used by the author as there are probably many variations of mounting that would be entirely satisfactory. The HA-1 Receiver Unit and the SO-1 matching transformer are mounted in the 2¾" x 2⅛" x 1⅝" aluminum Minibox. A hole approximately 1³⁄₁₆" in diameter is cut in the section of the Minibox which is to serve as the front of the mike. For appearance's sake, a small piece of aluminum screen wire is placed over the hole on the inside of the Minibox section. The HA-1 unit is positioned centrally over the wire screen and hole and fastened securely with small cable clips. The SO-1 matching transformer is mounted by means of a small copper strap as shown in the photograph. The author used a small dab of nail polish to prevent the transformer from sliding out from under the strap in the event that the microphone is dropped. A lug type terminal strip was



Inside view of the microphone head showing method of mounting parts.

mounted inside the Minibox to facilitate interconnection of the transformer secondary leads to the conductors of the microphone cable. The schematic is shown in **Fig. 1.** The transformer primary leads are soldered to the HA-1 unit directly, taking care not to use excessive heat when soldering. The black secondary lead is used as the ground lead and is connected to the shield of the mike cable as well as to the microphone case. The green secondary lead connects to the mike cable inner conductor and is the grid connection. The mike stand proper is made up of a Sylvania #P3305 Pendant Canopy, sometimes known in electrical supply houses as a canopy cover, into which is clamped a 9" length of ½" thinwall electrical conduit. A Thomas & Betts "Socks" conduit connector is pushed on the opposite end of the piece of conduit and is inserted into a hole, large enough to admit the connector, which has been drilled in the bottom of the Minibox. A hole large enough to accommodate a ⅜" rubber grommet was drilled in the canopy cover mike stand base. The mike cable is passed through the grommet and up the piece of conduit into the Minibox where it is then connected as mentioned previously. The sharp-eyed reader will probably notice a hole cut in the rear cover of the microphone case and covered with aluminum screening. This hole was cut by the author since it seemed to improve voice quality in the author's unit. The decision to include this opening was made after trying out the microphone with and without the Minibox sections completely assembled. The only explanation coming to mind for this behavior is possibly that of sound wave reinforcement of cancellation due to the waves striking the rear of the HA-1 Receiver Unit diaphragm. If after testing the microphone it appears that the quality is a little on the bassy side, a characteristic common to many dynamic microphones, a small capacitor on the order of .001 μf can be connected in series with the grid side of the mike cable. Less capacitance will provide more restriction of the lower frequencies. The addition of this capacitor may be accomplished at the speech amplifier input grid end of the circuit or within the microphone head.

Your completed dynamic microphone should, after following the preceding instructions, look like the completed unit shown in the photograph unless you chose to assemble the components in a different manner. You are all set to connect the mike cable to your transmitter audio section and to receive compliments on your low cost dynamic microphone.

. . . Genaille

Use this simple scheme to couple two antennas to your receiver for better reception.

Diversity the Easy Way

Alexander Labounsky WA2MTB
Wayaawi Avenue
Bayville, N.Y.

The active VHF enthusiast is primarily interested in consistency and faithfulness in reception of DX. In fact this idea of strength and continuity ranges through the expressions of many in our history. Through poetry Browning tells us:

Then, God for King Charles! Pym and his snarls
To the Devil that pricks on such pestilent carles!
Hold by the right, you double your might;
So, onward to Nottingham, fresh for the fight.
March we along, fifty-score strong.
Great-hearted gentlemen, singing this song!

(From *Cavalier Tunes*, Robert Browning.)

Diversity, the technique using the best possible signal obtainable from one antenna instantaneously and automatically selected from a multiple antenna array, each antenna separated horizontally by a large distance, certainly is a worthwhile method for realizing the subject specifications for VHF reception.

WA2MTB is a student interested in experimenting.

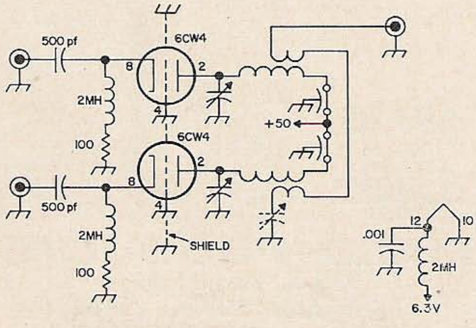


Fig. 1. Schematic of the simplified diversity adapter.

Although this technique has not been described as much as it should have been in the leading amateur radio journals, significant advances have been made in this field by many individuals and by the "pros" in the realm of high fidelity FM broadcasting. Requisite reading on diversity is the article[1] by two engineers of Hermon Hosmer Scott, Inc.

When diversity is mentioned, many think of the relatively expensive mean by which it may be accomplished, and installed. That mean is the use of two or more VHF antennas separated by at least three wavelength horizontally connected to separate, individual radio receivers employing "interstation noise suppression" (squelch) with each audio output paralleled. But this requires at least two, identical VHF receivers!

Instead of the obvious expense that is incurred by use of the above, paralleling the antennas together and feeding the resultant transmission into *one* VHF receiver would be a wonderful substitute if a method for paralleling antenna lines could be found which would not attenuate incoming signals. To avoid the use of matching transformers, et cetera, at the very input of the receiver, the author inadvertently stumbled upon a magnificent breakthrough for the posed problem.

Diversity a la amateur radio is shown schematized in Fig. 1. This diagram, designed for two channel diversity operation, is illustrative of two grounded-grid rf preamplifiers with their respective outputs wired in series for insertion through coaxial cable to the input of the VHF receiver. If built to achieve a very low noise figure, it should exhibit additional gain though the resultant output is lower than it should be due to a lack of sophisticated output, impedance matching networks between the outputs of these two rf preamplifiers and the output jack on the unit in **Fig. 1.**

Standard circuitry is used throughout and, likewise, standard VHF wiring procedure should be carefully followed. It should be kept in mind that all wiring is to be as short as possible in the critical wiring areas. If operation is desired on frequencies above 220 megacycles, the builder may, of course, resort to standard trough lines as substitutes for the output tuned circuits.

A word on antenna spacing, each antenna, kept as high as possible, should be spaced a minimum of three wavelengths, horizontally; the larger this spacing, the better. Those who are affluent enough to own sufficient land or who reside on a rural (antenna!) farm, will find no difficulty when installing diversity equipment on the 50 megacycle band.

This author, using diversity on the amateur bands, has, also, used the technique successfully on the FM broadcast band, specifically in receiving Jack Parr's WMTW-FM of Mount Washington from the author's QTH. For the serious DX-phile, the proposed method contained herein is inexpensive, easily installed, and most effective in catching DX, particularly when an airplane flies overhead.

. . . WA2MTB

[1]Von Reckinghausen, Daniel, Borish, Martin L., "Space Diversity Techniques Improve FM Reception," *Audio*, p. 48, November, 1960.

Eric Hansen W6HOG
1010 Pine Street
Menlo Park, Calif.

SSB and the National NC-300

I am sure that there are many who have the National NC-300 Receiver and are using it to copy SSB and CW. This receiver has many good features and with very little effort can be made to perform exceptionally well in this mode of operation. There are two shortcomings, both of which will be dealt with in this article. In installing the modifications no holes have to be drilled and the front panel is not destroyed. The complete modification can be performed in less than three hours. The first change was to alter the time constant of the avc circuit. The discharge time was lengthened considerably to provide for smoother operation when receiving CW or SSB transmissions. The avc attack and release times have been set so as to give optimum performance while receiving AM, SSB or CW stations. The product detector and bfo oscillator circuits are modified next. In this change the dc voltage ratios and the signal injection voltage ratios are altered. With this change the action of the product detector is smoother and the amount of distortion is greatly reduced.

Another modification was wired into the receiver which made the unit more desirable for SSB use and can prove to be very useful when in the CW mode. This change is also covered at the end of the article.

1. Remove the cover from the bfo can (T6) Clip out the 100k resistor (R39) located between terminals B & C and replace cover.
2. Connect a .5 uf @ 50 volt mylar capacitor across R-19 which is located on a terminal strip near L9.
3. Remove R-30 (68k) and replace with a 27k ½ watt resistor. This resistor is located on a terminal strip close to the empty hole by V6.
4. Remove C-55 (5 pf ceramic) and replace with a 5-80 pf trimmer (Arco 463). This capacitor is connected between pin 5 of V6 and an adjacent terminal strip.
5. Remove the wire connected between pin 1 of V8 and terminal C ~~of~~ T6.
6. Connect a 100 ohm resistor from pin 1 of V8 to terminal C of T6.
7. Connect a 220k ½ watt resistor from pin 1 of V8 to ground.
8. Connect a combination of a 330 ohm resistor and a .1 uf 200vdc capacitor from pin 2 of V8 to ground.
9. Remove R40 (68k) connected from pin 5 to pin 6 of V8.
10. Remove C-78 (.047µf) which is connected from pin 6 to V8 to ground and replace with a .02µf 600 vdc paper capacitor.
11. Remove R-54 which is connected between pin 6 of V8 and a terminal strip.
12. Remove R-38 which is connected between pin 7 of V8 and ground.
13. Connect a combination of a 200pf ceramic capacitor and a 10k ½ watt resistor from pin 7 of V8 to ground.
14. Solder a 2-lug terminal strip to the case of the output transformer (T2) located near V8. Place the strip on the side nearest V8.
15. Connect a 100k ½ watt resistor from pin 5 of V8 to one of the insulated lugs on the

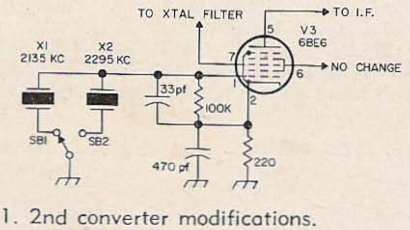


Fig. 1. 2nd converter modifications.

terminal strip just installed.

16. Connect a 56k ½ watt resistor from the lug on the terminal strip with the 100k resistor just connected to it, to the other insulated lug on the terminal strip.
17. Connect a 10k ½ watt resistor from the lug with the 56k resistor only on it to pin 6 of V8.
18. Connect a wire from the junction of the 56k and 100k resistors to pin 6 of V10 (6AQ5). Replace C-41 (.01) with .22µf at 35v.
19. Turn the receiver on with the rf gain fully clockwise and the mode switch in the AM position. The calibrator is then turned on. Tune in the calibrator for maximum deflection of the "S" meter. Place the mode switch in SSB and rotate L6 until the beat note is zero-beat. This operation sets the bfo in the proper position on the *if* slope.
20. With the receiver in the SSB mode of operation and the rf gain fully clockwise, adjust the variable trimmer on V6 from minimum capacity up to the point where distortion is heard while receiving a strong SSB or CW station. Back the capacitor off about one-half turn and leave at this setting.

This completes the wiring changes dealing with the product detector, CWO oscillator, and AVC circuits. The receiver *if* stage should be aligned for optimum performance as some of the components that were changed will tend to load the *if* strip differently than before. If the following selectable sideband modification is going to be installed do not realign the receiver at this time as this will be necessary after the sideband change also. Whether the receiver is aligned or not the trimmer capacitor in step 20 will have to be set as this sets the level of the signal fed from the *if* strip to the detector. The receiver should be placed in the SSB mode when receiving CW or SSB stations because in this position only is the avc employed. If it is desired to eliminate the avc action when receiving a station the mode switch should be placed in the CW position. The "S" meter will become more "bourbon" and will read much higher than before. By retarding the rf gain control one-quarter turn, the meter will read correctly.

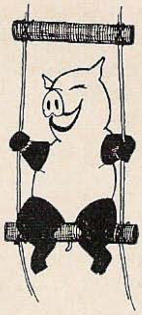
Selectable sideband modification

Following is the modification for installing a switch in the NC-300 in order to provide for upper and lower sideband selection without touching the CWO control. This is accomplished thru the addition of two crystals, one on each side of the *if* bandpass

1. Remove the wires from the phone jack on the front panel and connect the blue and green wires together. Do not remove the black wire from the xmt-rec switch. If desired, the phone jack may be mounted on the rear of the chassis and re-connected so the front panel will not be disturbed. Remove the phone jack from the front panel.
2. Install a spdt rotary switch in the hole where the phone jack was removed. If a rotary type switch is used, the hole will not have to be enlarged.
3. Disconnect the wires connecting T5 to the rest of the circuits.
4. Remove T5 and replace with a plate upon which are mounted 2 crystal sockets which will hold crystals X1 and X2.
5. Remove R9 which is connected to pin 1 to V3.
6. Remove the wire connected to pin 2 of V3.
7. Connect a combination of a 33pf capacitor and a 100k ½ watt resistor from pin 1 to pin 2 of V3.
8. Connect a combination of a 220 ohm ½ watt resistor and a 470pf capacitor from pin 2 of V3 to ground.
9. Connect a wire from pin 1 of V3 to one end of each of the two crystal sockets.
10. Connect the common terminal of the spdt switch installed earlier to the black wire, the other end of which is connected to the xmt-rec switch.
11. Connect one of the switched terminals of the spdt switch to one of the crystal sockets.
12. Connect the other terminal of the switch to the remaining crystal socket.

The wiring changes required to provide for selectable sideband are complete. In most receivers it will be found that the correct setting for the CWO control is half-way between the center and the position marked "2". The *if* strip in the receiver should be peaked up due to the fact that the crystals will be on a slightly different frequency than the coil network that was removed. The 2295 kc crystal will provide lower sideband on 80 and 40 meters and upper sideband on 20,15 and 10 meters. The 2135 kc crystal will provide upper sideband on 80 and 40 with lower sideband on 20,15 and 10 meters.

This completes a series of modifications that I believe you too will agree makes the National NC-300 a real fine-business single sideband receiver. . . . W6HOG



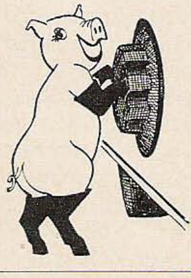
Wayne Pierce
K3SUK

This jovial fellow with a twinkle in his eyes is Wayne Pierce, K3SUK, the artist responsible for this month's cover, "Little Annie Hammy," "Ham Word Play," and most of the cartoons and other artwork in this issue. Wayne is well known to 73 readers. His first 73 cover was November 1962 and he's done many more since then, including the January 1964 Callbook spoof, the October 1964 cover and lead article, "A Ham in the White House?", and the February 1965 TVI cover. He's also provided clever illustrations for many articles, excellent cartoons and an occasional piece of art.

Wayne has been a junior high school art teacher in his hometown of Oxford, Pennsylvania since graduating from Kutztown (Pa.) State College in 1959. He's married and has a two-year old son.

Most of Wayne's ham operating activities are confined at present to CW on eighty and forty meters with some six meter phone work in the Chester County RACES for the local civil defense.

He's also a sports car and putters around with his MG TF-1500 when the weather cooperates.



NEWS FROM THE INSTITUTE OF AMATEUR RADIO

Compiled by A. David Middelton W7ZC, Secretary

Basic structure of IoAR

The basic element of IoAR is its Members who may be either licensed Amateurs or persons seriously interested in Amateur Radio.

There is only one class of Member. All Members may vote. There is a special reduced STUDENT membership rate for those who have not yet reached their 20th birthday.

Only *licensed* Amateurs may hold office in IoAR and all officials must be members of IoAR. Nominees for any office must have held an Amateur license for 18 consecutive months and have been a member of IoAR for 6 consecutive months prior to the date of nomination.

All Members will be polled on all matters of importance concerning IoAR and Amateur Radio. The majority vote of the Members will determine IoAR policy. Members have the right to amend the Constitution and By Laws.

IoAR regulations provide for both local CHAPTERS and AFFILIATED CLUBS. Both must meet certain simple requirements as to membership in IoAR.

Regulations provide for IoAR Field Organizations, under the administration of the Secretary, to be comprised of REGIONAL, STATE and AREA officials who assist HQ in coordinating the activities of Members residing in their respective geographical areas.

The IoAR is governed by a Board elected by Members. This Board consists of not less than five Directors (to be elected in '66, two more to be added in '67 and in '68, bringing the total to nine) a Secretary and a Treasurer. The latter two have no vote on the Board. An executive Committee to handle day-to-day IoAR problems (not policies) consists of the Secretary and not less than two directors. All have a vote.

The Board will select one of its members to be its Chairman for one year, the post charging each year. Directors may serve no more than two full consecutive terms of three years in the same office.

There is NO work-affiliation restriction placed on IoAR Directors or other officials. IoAR *welcomes* in its elected officers the skills, talents and demonstrated ability available only in the vast pool of technologically-trained licensed Amateurs directly connected with the electronics industry at all levels.

Pasadena IoAR member fights GI Blues

One amateur, (a veteran of the Armed Forces) fed up with "draft-card burning" and beatnick picketting, decided to DO something to make Christmas brighter for those many GIs stationed far from home and family.

A. E. O'Brien, WA6YZN, of Pasadena, secured the cooperation of the business men in the Foothill Rosemead Shopping Center and set up a ham station in the office of his brother's travel agency.

Message blanks were made up and distributed to all merchants in the Center. Daily collection of messages was made and through the cooperatoin of the Mc Can 7, the Mc Can 4 and the Mission Trail nets traffic was cleared to all parts of the world. Other nets also participated in this Christmas message operation.

OB's traffic report for the holidays follows—538 messages originated at WA6YZN—all on official message blanks with complete address of sender and addressee.

147 messages relayed by WA6YZN from other nets.

40% of all traffic was to Armed Forces.

Many overseas GI phone patches were made but not included in the totals above.

Continuous operation from 0530 Dec. 23 to 1830 Dec. 25th by OB himself!

The equipment used was a SR500, the very same piece of equipment used by Scott Carpenter in Project SEA LAB off La Jolla.

IoAR congratulates WA6YZN for his one-man effort that brought much happiness to lonely GIs and their families at Christmas.

Congressman replies to IoAR news letter

In January IoAR HQ transmitted its first *news letter* to the Senators, Congressmen and other governmental officials. This letter format was sent via First Class mail, in the desire to obtain greater reader interest and attention by the recipients. Previous releases (in card format) drew many favorable comments from key personnel in Washington's legislative circles.

Here is a direct reply to our January letter.
Secretary, IoAR—

This will acknowledge and thank you for the December issue of your "Amateur Radio around the USA and Across Borders".

I have long been an admirer of the very useful

IoAR—Totally Dedicated to the Betterment and Preservation of Amateur Radio.

function of amatuer radio operators and add my compliments for the many humanitarian deeds your members perform.

With best wishes, I remain

Sincerely yours,

Febr. 2, 1966. s/James F. Battin,
Member of Congress
2nd. District, Montana

Building-writing contest for young members

The "News from the IoAR" column in March 73 carried full details on the first IoAR-Member competition involving the building and article preparation of electronic gear.

This competition is solely for IoAR Members who were born after July 15, 1946. If you are in this age bracket you are invited to construct an original piece of equipment, write an article describing it and submit it to IoAR HQ where it will be judged.

A total of three prizes will be awarded. 73-space rates will be paid the author/winner in each of three categories; equipment having more than 5 transistors or tubes, an item having more than 3 transistors or tubes, and one having less than 3 transistors or tubes.

See "News from the IoAR" column in 73 for March 1966. If a copy is unavailable, send SASE to IoAR HQ for reprint of the News.

Amateur radio in experimental satellite

With the successful operation of the amateur built equipment aboard OSCAR 4 designed and built by the TRW Systems Radio Club—(see February 73 page 110) it is gratifying to see still another entry into the Amateur satellite field.

ARIES is the name of this latest effort on the part of organized Amateur Radio to build satellites!

The following is a quote from a comprehensive technical and news bulletin from the ARIES group— "It is the desire of the San Fernando Valley Radio Club (SFVRC) that ARIES, acting in the manner of its namesake, aid in the exploration of space communications as its predecessor, a now extinct star, aided the ancient mariner in his quest for knowledge of his environment.

"The pioneers of the OSCAR program have blazed a trail for the American Radio Amateur in the realm of space communications. Consistant satellite communications still require "better than average" equipment, and state-of-the-art techniques. What is needed now is a concerted effort on the part of many amateurs pooling their talents to develop both equipment and techniques for the exploitation of this new means of communication."

QTH? Lost members! Where are you?

IoAR HQ needs the correct up-dated QTH for the following Members:
Carr, Clarence R., K9HUK.
Ritter, David L., WA6KXE.

Important IoAR Addresses

For all correspondence except that regarding membership and supplies:
Institute of Amateur Radio
Springdale, Utah 84767

For membership correspondence and IoAR supplies:
Institute of Amateur Radio
Peterborough, N.H. 03458

Prominent Amateurs join IoAR

Among the steadily increasing number of Amateurs joining IoAR is Senor Luis Salido, XE2IL, of Navojoa, Sonora. Luis, one of the most active participants in organized Amateur Radio in Mexico, is a "prime-mover" in Liga Mexicana de Radioexperimentadores, Red Nacional de Radio Asistencia and Club de Radio Experimentadores de Sonora. IoAR welcomes XE2IL, a neighbor from south of the border!

Another internationally-known Amateur also became an IoAR Member when Mr. John Gayer, HB9AEQ, of Geneva, Switzerland, founder and past president of the International Amateur Radio Club joined us and will carry first hand knowledge of IoAR back to Geneva with him.

Mr. Gayer now supports IoAR's efforts as many IoAR Members have long done for IARC!

INSTITUTE OF AMATEUR RADIO
MEMBERSHIP APPLICATION
(Use separate sheet if desired)

Name .... Call ....

City .... State .... Zip ....

....$5 for 1 yr. IoAR Membership.

....$2.50 for 1 yr. IoAR Student Member.

....$7.00 for 1 yr. IoAR Mem. plus 1 yr. 73.

....$4.50 for 1 yr. IoAR Student Mem. plus 1 yr. 73.

....I am a new Member of IoAR. Age .....

....I am a Charter IoAR Member and desire to have my membership continuous.

....This is a renewal of 73 but a NEW IoAR Membership.

Please send check or money order (cash sent at sender's risk) to:

Institute of Amateur Radio, Inc.
Membership Department
Peterborough, New Hamp. 03458

Adam Leller K9SGZ
Valpariso Technical Institute
Valpariso, Indiana

Multi-Channel Transistored Pre-Amp

This article will describe a transistorized version of a pre-amp which was offered by W9CWG in an early issue of 73. Since that article was published, several people have written to Wig requesting such a unit, so one was thrown together in a few spare moments. The unit uses inexpensive 2N404 (or 2N3628) transistors, but other types may be substituted without too much bother. Almost any PNP audio or switching transistor will work fine, with only minor changes in biasing required.

The circuit starts off with a cascaded emitter follower input, using negative feedback through C_1 to raise the input impedance to such a level as to allow the use of a crystal microphone. This circuit will have about .5 megohm input impedance at 1000 cps, depending on the beta of the transistors used. Following the input stages, the signal passes through a common emitter amplifier which will have about 20 to 30 db gain, depending on how many output stages are used. If it is noted that the circuit has more gain than is required in an individual application, the capacitor C_2 may be omitted, which will reduce the gain to about 10 db. If this is still too much gain, all of the circuit between the points marked "X" may be omitted, which will give about 2 or 3 db overall *loss* from input to output. Following this amplifier stage, the output is coupled through emitter followers to individual output gain controls. These outputs will allow use of low impedance loads, such as 500 ohm inputs to commercial Two-Way equipment.

The unit I built is wired on a masonite board about 4 by 6 inches. Circuit layout is not critical, but the completed amplifier should be housed in an enclosed box to prevent rf problems. If rf problems are encountered, an rf choke in series with the input lead, connected right at the base of the input transistor Q_1, along with about a .001 μf capacitor from Q_1 base to ground should cure the problem. Once the circuit layout is determined, holes may be drilled in the board (with an ice-pick, if no drill is available) to mount the components and the circuit wired on the back of the board using point-to-point (haywire) wiring techniques. Keep all leads very short around Q_1 and the input circuitry and no problems, hardly at all, should be encountered. A hint here, if battery power is to be used switch the battery on and off with an unused set of contacts on the antenna relay or such. This will save the battery and since the unit does not require a warm-up time will offer no problems, other than perhaps the need for an rf bypass capacitor on the supply voltage line inside the enclosure for the pre-amp.

All components are standard parts, and are not critical. Just empty the junk box and you should have enough parts to throw together this little gadget. It may be used on a 6 or 12 volt automobile battery system with no circuit modifications, so should lend itself nicely to mobile applications using converted two-way FM equipment. . . . K9SGZ

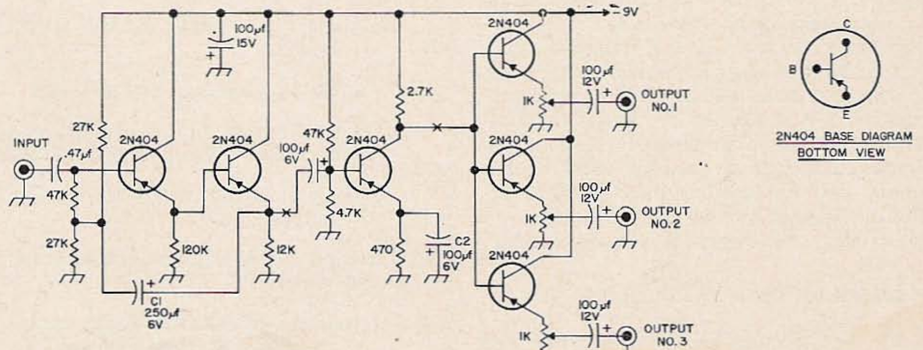
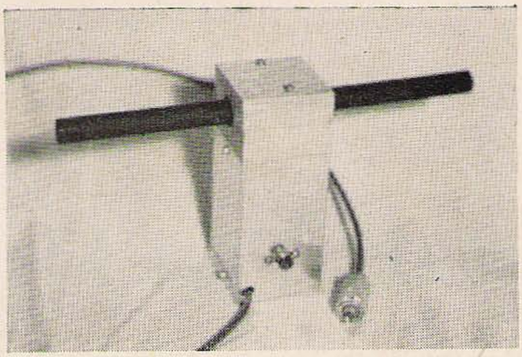


Fig. 1. Three channel output transistorized pre-amp. A good transistor to use in place of the 2N404 is the silicon 2N3638, a 2N404 replacement at the same low price (less than 50¢).

Walt Rogers W1DFS
24 Orient Avenue
Melrose, Mass.

Ferrite DF



The Ferrite DF built into a Minibox.

Radio aids to navigation, or radio D-F as they are more commonly known, have been in use for marine and air operations for a number of years. The needs and techniques of these services are much more sophisticated than necessary, for the amateur to benefit from the principles of radio D-F. However, very little has appeared in amateur magazines lately in the way of a simple unit that we all could use.

Briefly, direction finding (D-F) depends upon the use of the directional characteristics of the antenna. In order to establish a fix, or point, it is necessary to have two bearings. While a sensing antenna giving only one direction would be handy, the balancing and maintenance of signal conditions at the D-F installation must be unmodified after a balance calibration. Also a single direction will not give the distance, so as to get a firm fix. Thus for the sake of simplicity in use, only the bi-directional design is presented here.

The unit to be described, using a ferrite antenna, has less output than others, but is a far more convenient package. Less signal is secured from the ferrite antenna primarily due to its limited size as compared to a normal half-wave antenna at these frequencies. The efficiency is up, however, when it is tuned to resonance. Most receivers have enough spare sensitivity so that the strong signals can be received very well and many of the weaker signals well enough to get good readings.

Construction of the unit is quite straightforward and one should have no trouble duplicating it. The Ferrite D-F is made from a tuned ferrite rod, tightly coupled to a short piece of coaxial cable which goes to the receiver. This tight coupling to the coaxial feedline is necessary in order to obtain maximum signal transfer. The rod is a much more effective core material than air and therefore fewer turns are needed on it. The number of turns listed in **Fig. 1** are for the ferrite rod. A grid-dip meter would be a help in determining that resonance can be obtained over the 75/80 meter band before completing the assembly. A small aluminum box was used to minimize hand effects and provide a convenient mounting. The wood pieces were made to clear the turns on the coil and with a few turns of plastic tape fit tightly on the rod.

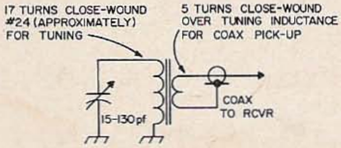


Fig. 1. Schematic of the Ferrite DF. Core of the coil, naturally enough, is a ferrite rod.

In operation plan to run the rf gain on full and after locating a signal and turn the rod broadside to secure the sharpest null. The D-F tuning capacitor should be set for maximum signal. To aid in obtaining the fix it is a good idea to establish which way is true North. Remember, magnetic North is usually not true North and a declination correction must be made. All good maps give this correction, but better still, take a look at the North Star in relation to the radio shack's orientation and use this as a bearing reference at home. Get a bearing from another station and mark a line from his location and one from yours—where they cross, that is the fix.

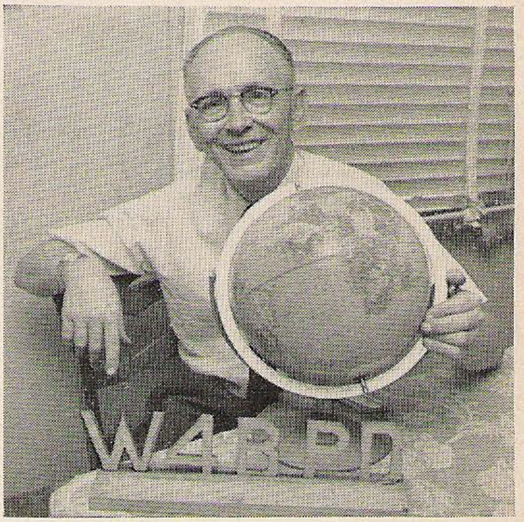
On mobile work it is suggested that road maps be used. After getting a reading drive approximately perpendicular to this line (roads permitting) and after a while take another reading. The crossing of these lines is the fix. For close up readings a modified field strength meter with a sensitivity control could be used, but this is another story.

The next time you become annoyed at a dead carrier or some other form of interference on the band get out the Ferrite D-F and with the aid of a few fellow hams hunt it down. At the next meeting of your radio club suggest a hidden transmitter hunt to the Activities Chairman if you want some real fun.

. . . W1DFS

Gus Browning W4BPD

Gus: Part XI



Last month I stopped when Rundy was getting ready to move on to Qatar, just up the Persian Gulf from Bahrein Island. We had our licenses all in order for all the MP-4s all the way up to and including Muscat. We had all our police permits in order and our airline tickets in our pockets. We had been in Bahrein about 6 or 7 days and had made many thousands of QSO's. As I mentioned in last month's article we stayed in the only hotel there, the Speedbird Hotel, and boys, if you want to be sure you have a place to stay when you go to Bahrein I strongly suggest that you make reservations well in advance. Lord knows where you will stay if you get into Bahrein and cannot get into this hotel. You know you are right in the middle of Moslem country there so pork is taboo. One of the bell hops there told me about some British sailors who stopped there a few days. These fellows ordered pork chops at the Speedbird and quite naturally they were told that there was no such item to be had. Well these fellows went back to their ship and got some pork chops from the freezer and brought them to the hotel and went back into the kitchen and gave them to a cook and told him to cook them. This cook was a little young and not too experienced with the fact that this was pork when in the middle of frying them the head cook came in. He sniffed around and his nose told him there was pork in that frying pan. He made the young cook remove the pan from the stove, take it out in the yard and bury it, chops and all. Then this young cook was fired on the spot!

The little planes that fly up and down the Persian Gulf are some sort of small four motor jobs. I am not sure just what kind of plane it actually is but it seems like it was a DeHaviland. Down to the airport we went and we were off to Qatar. When you take off from Bahrein that's when you can see all those oil derricks. It looked like I was over Texas with the exception that there was desert all over the place. Millions of years ago there must have been something other than deserts there to put all that oil under the ground. They tell me it usually rains about once during the year, but boy with all that oil under the ground who needs rain! The plane hugged the coast and in a very short while we landed at Qatar. Rundy told the taxi driver to take us to the hotel. At that time there was only one there and boy it was an eye-opener! I've forgotten its name but it looked like one of those Hilton jobs, real fancy, completely air conditioned, and about $22.00 per day. We checked in and set up our antenna. This was very easy. We just ran it from the top of the hotel down to a fence post in the direction of the big swimming pool. Just a few hundred feet from the pool was the Persian Gulf, very blue and calm looking. We saw a number of Arabian dhows with their very odd shaped sails going up and down the Gulf very slowly. The seamen on the dhows were a tough looking lot and truthfully I would not make a trip on one of those things. I would be afraid that I would never get to the place I was headed for.

We loaded the antenna up to the rig and the first CQ was sent out from MP4QAR and boy, business was FB too. You know things usually go like this when you first set up and start operating from a relatively rare spot. You call that first CQ and maybe one station comes back to you. Then sometimes you have to call another CQ to get the boys going. Well that time only one came back but when you sign with him that's when things began to pick up. By that time maybe 6 or 8 fellows are on your trail, and when you sign these 6 or 8 calls about 50 other fellows hear them and most of them join in even if, up to then, they have not even heard you. That's when you start having trouble picking one out of the pile. Now boys, don't fool yourself that there is always one fellow who is louder than everyone else in the pile—this is just not so. Nearly all the time everyone is at least within one S point of each other. The fellow you work is the fellow in a clear frequency, not the fellow who is slightly louder than the pack. So boys I strongly suggest when you are trying to work a rare one pick yourself a clear frequency, do some very close listening first, then jump in with a De-W??? about 3 times and BK. That's the way the smart boys operate.

Some of the fellows have a sort of trade mark—W3CXX just sends XX XX XX, DL7AA sends Gus Gus Gus, W6SC, when on SSB, sends South Carolina, South Carolina, and about one of the best of all is W4CCB who just sends Coca Cola bottle. If you can think of a good trade mark start using it and if it clicks, stick with it from then on. I am trying to come up with a good one for me to use when I get started again back at W4BPD but so far I am stuck—how about some suggestions, boys!

Incidentally, I am writing this portion of my story while I am in the Central Hotel in Ouagadougou (pronounced Waggadou-gu) Upper Volta. The rates here for a single air Ouagadougou (pronounced Waggadou—gu) is about 8 or 9 dollars. Coca Cola here is 40 cents per bottle, a good dinner is over $4.50, breakfast with only one egg and a small piece of bacon and a cup of this very black, very strong coffee is about $1.50. You don't live here cheap unless you can live on bananas and oranges. Another thing I have found is that you just don't hop on a plane here anytime you want to go. You have to wait, and I mean sometimes one full week to get a plane that will take you some place you might want to go. This is a bad place to be stuck, too. For two cents I would connect up the rig and do some bootlegging right here but then there are these red caps who probably would broadcast this news to the wrong people and you would be in dutch with a capital D!

Oh yes, the YLs here wear these topless dresses, not all of them, but a pretty good number. I hardly pay any attention to these things any more. I wonder if the topless bathing suits ever really became the style over in the USA would such things ever go unnoticed. I, for one, think they should try it out and see. I have been thinking a lot lately what it is I miss most being away from the USA. Of course number one is being with Peggy and seeing my own children and those five little grandchildren (it's five in 1965, maybe later on there will be more of them). The next biggest thing I miss is getting a nice slice of good white, soft bread and a big cold glass of milk, those good tomato sandwiches my wife makes covered with mayonnaise, real southern fried chicken, someone I can talk to (it's 99.9999% French here) seeing my favorite TV program, operating a big ham station with a big beam and seeing all my friends. Those are the kind of things you miss most of all when you are away from home as long as I have been.

Well as usual, I completely wandered off the subject. Rundy and I were operating at the real fancy, air conditioned hotel in Qatar and we had a ball the first few hours. We went down and had our lunch and back we came to the rig. It was going like blazes when there was a loud knock on the door. Yes, you guessed it, it was the police. There they were, all three of them, wanting to know what we were doing with all that radio equipment all set up and operating. Rundy produced our licenses and told them we were permitted to operate in Qatar or any of the other Persian Gulf countries. After a while they more or less agreed with him but in the end it seems like we both had to go down and check in with the police and explain again to them just what we were doing there, how long we would be there, and all the information on our equipment. We all shook hands and we returned to our room. From then on we had no more police trouble while we were in Qatar. Boys, see the local police *first* because if you don't they will be seeing you!

Rundy and I packed up and away we went to the Trucial States. The plane landed at Shariah where one of Rundy's friends met us. We decided that since every operation up to that time had been from Sharjah that we would go to the Shiekdom of Dubai some 30 miles away from Sharjah thinking maybe somehow it would count for a new one if ARRL could ever be convinced as to just how these shiekdoms were governed. As for Rundy and me, we both still think that each of the seven should be different countries. There was sort of an outline of a road there, but it was very vague in spots and almost disappeared at others. But we did find Dubai all OK. It was a real Arabian settlement. I think it used to have a hotel there but I guess the hotel business sort of disappeared. The building that was once a hotel was almost deserted. The two top floors were completely empty and all the rooms were bare to the wall. A friend of Rundy's owned the building and gave Rundy and me permission to move in any of the top floors. We picked out a nice large room on the top (fifth) floor and the owner of the hotel loaned us two cots and the bed clothes. Most of these Arabic buildings in and around that part of the world have a flat cement roof. This one was like that with an added cement fence around the edges of the floor. This proved to be a fine spot to install an antenna. We rounded up four nice long bamboo poles about 40 feet long and got them up on the roof, and while Rundy was looking up a friend to borrow an extension cord from, I was left to put up the antenna. We had secured the assistance of a young Arab fellow about 18 years old and he would hold up the poles while I would fasten the guy wires to the cement rails around the roof. We were up there working up a storm in that hot blazing sun about 3 PM when the PA system on one of the nearby mosques cut loose with that long wailing call to prayer for the Moslems. This fellow who was helping me asked me to hold the pole a few minutes and he whipped off a prayer rug that was over his shoulders all the time.

He spread it out quickly on the roof, faced Mecca and did his praying. I wonder just how close they are when they think they are facing Mecca. Maybe someday I will get some cheap compass manufacturing company to make me some compasses, each one of course calibrated for four different countries that has no north on them but Mecca instead. Perhaps I could pick up a few hundred bucks like that. I would have some real fancy ones made up for the shieks and some extra large ones for the mosques built in the floor, and perhaps even hand calibrated ones if someone wanted to be exact.

Conditions were wonderful in Dubai all the time. Up to about 2 AM the bands were wide open to almost everywhere. They would open again about 5:30 AM. By about 10 AM they were just about flat—and that's when we slept. Rundy rambled out one day to locate and pay his respects to the local shiek. I was on the air yakking to someone a few hours after Rundy had left and believe it or not Rundy broke in with a "Hello Gus," with some sort of a MP4T call sign. I said where in the world are you? He said he was out at the shieks. Then he told me that the shiek had a SSB rig so he could talk to the other shieks.

It looked to me as if everyone eyed us with suspicion every time we went down the street, but after a while I figured that this was their normal look. I often wonder if they ever trusted even each other—I kind of doubt it myself. I did not see what they call 'European toilets' anyplace there. All they had were what they call 'Arabic toilets'—a place outlined for your feet to be placed and just a hole in the cement, a water spigot nearby and usually a small worn piece of cloth hanging on the spigot. Oh yes, remember—your left hand—and that's the hand I usually eat with.

I saw many people, usually the older ones, on the street smoking their hubbly bubbly. That's those pipes where the smoke goes through the water and sort of goes blubb blubb everytime you take a draw on it. I even tried taking a few puffs myself just to show the people I was a regular fellow. I even found some Cokes there too, never quite cold, but they sure did come in handy with that hot weather.

I went all over the town of Dubai and I tried my best to figure how these people made a living. There were only a few trees here and there, no large groves of trees indicating that olives, dates, oranges, etc. were being grown, at least not for market. A few Arabian dhows were being built down at the docks, a camel caravan or two came in each day from across the desert, one small ship docked and stayed over night. That was it! Rundy and I were treated very well while we were there and I hope some day to return and see more of this very intriguing part of the world.

We drove back to Sharjah in the Jeep over the desert and departed for Kuwait. Arriving there one of Rundy's representatives met us at the airport then took us to his house—a real nice Arabic type with the big high cement wall all around it. We never heard or saw any females while we were there. It seems as if the house was divided in the middle and all the females stayed in the other side, which must have been soundproofed because I never heard any sounds from there.

While the plane was coming in to Kuwait I saw more doggone oil wells than I have ever seen in my life. The desert seemed to be covered with them. We tried our best to get a license to operate from Kuwait but there was no possibility of this because we heard that someone from Kuwait was in the USA and tried to get a license and he was refused. When this fellow returned to Kuwait there was an American who was operating there and his license was cancelled immediately and he was told he had 48 hours to dispose of his radio equipment! Just what ever happened to his equipment I have never heard. Mind you this man had been in Kuwait something like 10 years. I understand the present status of Americans there has somewhat improved and it may be possible now to get a license.

Every day I would go out for a walk and I noticed an old fellow who was always sitting at a little sidewalk cafe smoking his hubbly bubbly. He would smile at me and I would smile at him. One day I had my camera with me and I walked up to him and by hand motions asked him if it was OK to take his picture. He smiled and nodded. When I had put my camera back in its case, he motioned me to have a seat and out came a cup of that awful strong Arabic coffee for me. Well, to be sociable I drank it in small sips and when I had finished he offered me the stem of his pipe for a few puffs, which is what I did. This delighted him. He saw I was one of the boys, I guess. He spoke not one word of English and quite naturally I spoke no Arabic. But we did become good friends somehow or other. The next day when I passed him he motioned for me to have a seat at his table and out came a Coca Cola! I tried to tell him the last day I passed him, after drinking his Coke, that tomorrow I was leaving for the USA. I had no idea that he understood me at all. The next morning I passed him on my way to the airline offices to inquire about whether they had a bus or not and he handed me a carton of Kent cigarettes as a going away gift. I never did spend one single cent on this man. He was just a good friend and wanted to show me that he was sincere. I have found that a big smile goes a long way anywhere in the world, a pay on the back and other ways of showing that you are a friend sure does pay off almost everywhere.

After spending one or two nights with Rundy and drinking his Cokes I departed for Rome where I was going to pick up my deposit that I had put down when I entered Italy from Monaco. Boy, it was the usual run around and I could see that I was going to have to spend three or four days or more trying to get my money. At 11:45 AM I was sitting up in my hotel room trying to figure out what to do. I phoned TWA and asked about a seat on the next flight to New York City (this was Dec. 23rd!). They informed me there were no seats until after the 1st of January! I did a lot of fast telephoning in the next 10 minutes. All flights to NYC were fully booked. The last phone call to Pan-Am was the same, but apparently someone had cancelled a few minutes earlier and they said if I could be at the airport in 45 minutes I could have that one seat. Here I was with a TWA ticket, so I quickly loaded all my junk into a taxi and away I went to TWA to get them to initial my ticket over to Pan-Am. This involved a long drive across Rome to their office and away we went for the airport which is located about 20 miles from the city. This was a fast trip let me tell you. The taxi driver could speak English so I told him 'double fare' if he got me to the airport in time. He got me there exactly at departure time for the plane. I ran out on the apron where the 707 was getting ready to leave. They had already pulled the ramp away from the plane. I hollered "wait a minute" and they pushed the ramp back in place. I arrived in New York about 7:30 and was in Columbia, South Carolina by 10:30 that same night. Peggy still had her TV-radio shop open and when I walked in the first thing she said to me was "I was not expecting you until sometime in January!" This was the end of DXpedition number one. I was back home, safe and sound and I think a lot wiser than when I had left there about 8 months earlier. I had lost about seven pounds, had a little suntan left from the Persian Gulf sunshine, most of my clothes were pretty well worn out also. It was nice to be back home with all my family again. I had taken a few thousand color slides and quite a number of rolls of 8 mm color movies. The news got around and a number of service clubs wanted me to come to their meetings and give a talk on my DXpedition. Many people came out to our house to see some of the items I had picked up here and there. Those carvings from Africa was usually the center of attraction. The usual talk of another DXpedition made the rounds and everyone wanted to know when I was going on the next trip.

On my first trip I had made up my mind that I would never, under any circumstances, black ball anyone, regardless of how rotten they were. I would work everyone I heard regardless of what country they were in. I would operate as near as possible around the clock, not just when the W's were coming through. I would never use this W1, W2, W3, etc., business. I would never have a list of certain stations to work in preference to others even if they were good contributors. I would send no QSL cards direct to anyone. I would try to improve my operating habits and stay on one certain exact frequency all the time. I would give signal reports nothing else and try to work as many as possible in every place I operated. Also, I would try never to get mad at anyone at anytime!

Well that's it boys. This concludes DXpedition number one. I will start on trip number two next month.

Caracas convention

If you are one of the fellows who missed attending the International DX Convention and the 32nd anniversary celebration of the Venezuela Radio Club, you missed one of the finest gettogethers I have ever had the pleasure of attending. For about 10 days and nights it was one continuous round of celebrations, meetings, eye-ball QSOs, party gatherings, drinking and hamming.

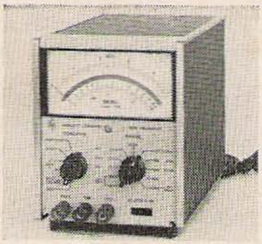
The Venezuela Radio Club will have one of these every year from now on. I suppose it will be the week-end after the Miami Hamboree which is usually near the last week-end in January. The air fare from Miami to Caracas and return was only $199.00. Why not plan to make both the Miami and Venezuelan Conventions next year. Take off a full month from the cold Yankee weather, go swimming, hiking, meet the world's friendliest batch of hams and come back home with a sun tan.

You like to see FB antennas? Well this is one spot where everyone has a beam—3 elements, 4, 5, etc. Equipment—every station I saw was loaded with the very best. There were no hay-wire outfits down there. These fellows are the most serious batch of DXers I have ever met. When they go after DX it's no holds barred. But they are real gentlemen and when one of them is in QSO with DX the others stand by and let him finish. This cooperation is necessary as Caracas is in a valley almost completely surrounded by mountains.

I think I can speak for everyone that attended the convention when I say "Peggy and I had the best doggoned time we have EVER had at any ham gathering"—and this covers a lot of territory. We both send the YV boys our many, many thanks.

. . . Gus

NEW PRODUCTS



H-P AC/DC VOM

If you need a volt-ohmmeter better than most of those available to hams, the new Hewlett-Packard Model 427A might be of interest to you. It's an AC/DC voltmeter with 2% full-scale accuracy. The 427A is all solid state and operates off a single 22.5 battery, or from the AC line. It is priced at $195.00 and more information is available from H-P, 1501 Page Mill Road, Palo Alto, California 94304.

Semiconductor Chart

Semitronics has just brought out a Semiconductor Interchangeability and Replacement Guide in the form of a two color, 22"x26½" wall chart that's just what you need to cover up that big blank space above your transistor work bench. It will give you all sorts of useful information. You can get a free copy from your Semitronics dealer, or one for 25¢ from Semitronics, 265 Canal Street, New York, N.Y.

Ionospheric Radio Propagation

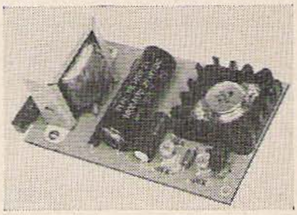
This book by the chief of the Ionospheric Research Section of the NBS is just what every ham interested in propagation needs. In addition to the traditional areas that are covered, *Ionospheric Radio Propagation* includes two new chapters, one on VHF and one on LF and VLF propagation. The book is 470 pages, illustrated, and available for only $2.75 from the Government Printing Office, Washington, D. C. 20402.

New Meshna Catalog

John Meshna makes one of the most interesting surplus catalogs around. His latest one is about 85 pages and contains pictures and descriptions of a fantastic amount of surplus gear. Even if you don't buy anything from him (which is unlikely after you've spent a number of hours reading the catalog), you'll find it worthwhile to send 20¢ for a copy. Meshna, 19 Allerton Street, Lynn, Mass.

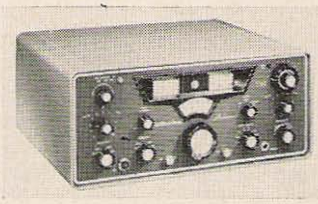
Lafayette Two Band FM Receiver

One of the few FM monitor receivers that covers both the low and high FM bands is the inexpensive Lafayette HA-520. It uses a Nuvistor rf stage, tuned rf amplifiers, squelch, slide rule dial, ten tubes, etc. Price is $89.95 from Lafayette, 111 Jericho Turnpike, Syosset, L.I., N.Y. 11791.



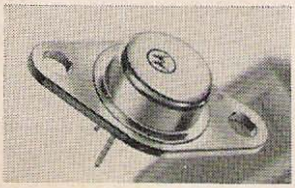
ESSCO Regulated Power Supply

ESSCO, who makes a line of real nice solid state RTTY equipment, has just introduced a low cost regulated solid state power supply, the PS-3. It provides 6 to 12 volts DC at up to 500 ma with 3% regulation and .05% ripple or less. The PS-3 is perfect for transistorized VFO's, transmitters, converters, RTTY equipment, etc. Size is 3"x5". The PS-3 is $26.95 and a kit version, the PS-3K, is $16.95. ESSCO, 324 Arch Street, Camden, N.J. 08102.



Hallicrafters Hurricane

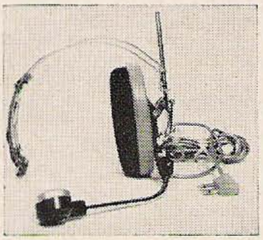
2000 watts PEP SSB is what you get with the Hallicrafters Hurricane SR-2000 five band transceiver. I guess that's about all the power you're likely to need in a transceiver and the Hurricane offers a lot more besides: low distortion, high sensitivity, receiver incremental control, AALC, 1 kc calibration, *if* noise blanketing, etc. Yet price is only $995.00. A companion power supply/speaker, the P-2000AC is $395.00. You can get more information on the Hurricane from your dealer or from Hallicrafters, Fifth and Kostner Avenues, Chicago.



Motorola Transistors

Motorola has just reduced prices on their rf transistors up to 91% and now they're up to more mischief. This time they've brought out some silicon high voltage transistors perfect for voltage regulators, audio amplifiers, high voltage converters, line relays, CRT drivers modulators, etc., all using regular AC line voltages. Maximum CE voltages of the 2N3738 and 2N3729 are 225 and 300 volts respectively, prices are $2.25 and $2.45 and they have a minimum f_T of 15 mc. Think of the fun you could have with these transistors for very compact, very high power, power converters: rectify the 115 vac, filter a little and use it to operate a high frequency oscillator that can use a very small toroidal core: the output will need very little filtering at those frequencies. More information on these transistors from your Motorola Dealer or TIC, Motorola, Box 955, Phoenix 85001.

Sony Headset-Microphone Special



You know that you should use a handless mike for mobile, don't you? But you haven't gotten one because the price was too steep. Well, it isn't any more. Harvey Radio has a Sony combination headset and microphone for only $8.95. The mike is dynamic and the headphone is low impedance. The whole assembly is very sturdily built and comes with a carrying case. Send Elliot WA2HDP at Harvey Radio, 103 West 43rd Street, New York, N.Y. 10036 your $8.95 so you won't get killed mobiling.

Mark Antennas

Mark Products has a new catalog out that describes Mark's complete line of fixed and mobile antennas, mounts and accessories. You can get your copy of catalog AM-661 at Mark Distributors or from the factory at 5439 West Fargo Avenue, Skokie, Illinois 60076.

Letters

Headquarters
United States Military Assistance Command, Vietnam
APO San Francisco 96243

Dear Mr. Green:

After many years with no amateur radio activity in the Republic of Vietnam the recent activation of an amateur radio station here has caused a great deal of interest in the ranks of amateurs worldwide and especially among those amateurs now in, or about to come to Vietnam. ARRL bulletin #40, other published notices, and on-the-air discussions have caused this headquarters to receive an unprecedented number of requests for information concerning authorization to operate here. Answering these requests imposes an added burden that can be ill afforded. It is the purpose of this letter to explain the current status of amateur radio in the Republic of Vietnam and ask that you publish this information in 73 Magazine.

For many years the Republic of Vietnam has been torn by strife and it was in this setting shortly after independence was attained that amateur radio was banned and an exception to amateur operation was filed with the ITU. Until late in 1965 there was no legal amateur operation in this country. At that time the Government of Vietnam extended the privilege of amateur operating authorization to Deputy Ambassador William J. Porter, K1YPE, as a courtesy to a high ranking United States diplomatic representative. Simultaneously, action was initiated to withdraw the exception to amateur operation filed with the ITU to enable other countries to recognize his operation.

Ambassador Porter has been authorized by the Government of Vietnam to use the call XV5AA and there is no restriction on third party message and phone patch traffic. However, since other governments have not yet been notified of this action by the ITU, until they are Ambassador Porter is using the portable call K1YPE/XV5 for U.S. amateur contacts at the request of the FCC. His use of this call will cease when the ITU notification is received and he will then commence using the call XV5AA. He is already using XV5AA, however for contact with non-US amateur stations.

There have been some questions received concerning the prefix used for Ambassador Porter's call sign. The exclusive use of 3W8 for amateur stations seems to have been implied by certain published listings in which only 3W8 appeared, but this is incorrect and other listings correctly show both 3W8 and XV5.

While the Government of Vietnam has authorized Ambassador Porter to operate, this action does not represent a general change in the policy which strictly prohibits all other amateur radio operation. In addition, all personnel under military jurisdiction are subject to Military Assistance Command, Vietnam (MACV) Directive 105-6, 14 Dec 65, which prohibits amateur operation in Vietnam.

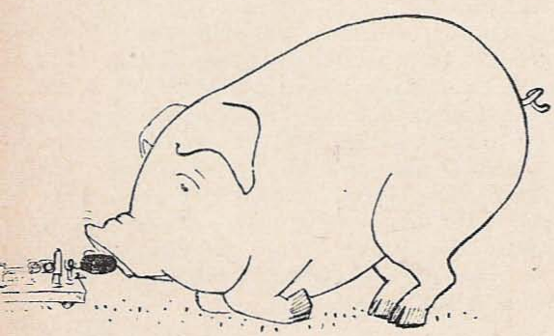
There have been many requests for amateur operation and all, with the exception of Ambassador Porter's have been turned down. Ambassador Porter will continue to encourage the Government of Vietnam to grant additional amateur operating authorizations when in its opinion conditions in the country make that practical. It should be remembered that it has not been the practice of most governments to permit amateur activity in time of war.

Ambassador Porter has found there is almost a complete lack of knowledge in this area on the subject of amateur radio. He has stated his desire to help amateur radio get a start in the Southeast Asia area and as the situation permits he hopes to carry on his educational program to bring about a better general understanding of amateur radio activity. This, however, will take time and for personnel in Vietnam now, or going there, Ambassador Porter has already accomplished something of immediate benefit: With his help a MARS system was authorized late in 1965, after three years of effort. There are Army, Navy, and Air Force military unit MARS stations in operation, but individual member and club stations are prohibited. The support for MARS operation rests in large part with licensed amateurs volunteering to operate the stations. As a result many amateurs can satisfy their desire to operate by offering their assistance to the local Army or Air Force MARS Director or Navy MARS Cognizant Officer.

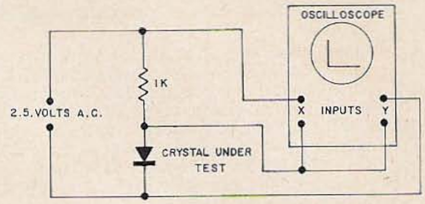
The MARS net structure consists of one in-country net in which all stations may participate to exchange message and phone patch traffic in-country and each station participates in an Army, Navy, or Air Force Pacific area MARS net.

The MARS operation is expected to expand, but amateur operation is expected to remain in the present status for some time. In view of this, individual amateurs are urged to refrain from writing for late information concerning amateur operation in Vietnam. If there is any change in the policies concerning amateur operation in the Republic of Vietnam, this headquarters will disseminate the information promptly.

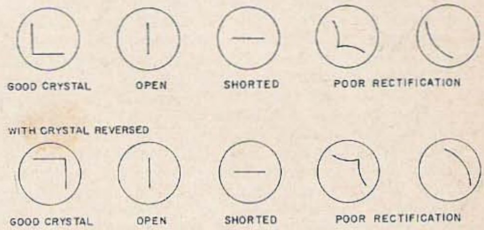
Sincerely yours,
Walter E. Lotz Jr.
Brigadier General, USA
Assistant Chief of Staff, J-6



Diode Checker



SCHEMATIC DIAGRAM OF CRYSTAL TESTER



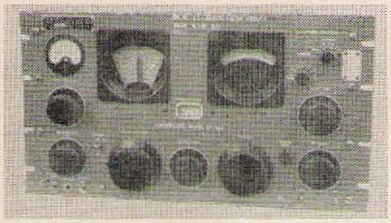
This isn't a new idea, but it may be new to some of you. It's a simple method for checking all types of semiconductor diodes. The schematic shows the connections. What we are doing is checking the front-to-back ratio of the diode to give an indication of its merit. To calibrate the scope, connect a one kilohm resistor in place of the diode and adjust the scope's gain controls until you get a straight line at a 45 degree angle to horizontal. Then place a diode in the circuit and compare it to the diagram.

. . . K8ABR/4

Built-In Speaker for the TR-3

Like to have a speaker in your Drake TR-3 and avoid the inconvenience of having to connect an external speaker when you move the rig? You can mount a Quam #3AC5 speaker on the top cover near the front centered over the RF Tune control shaft between the Plate and Load shafts. The speaker is 3½ inches deep and has the same impedance and power capabilities as the TR-3. It sounds fine, too. You don't need to drill any holes since small bolts can be inserted through the holes in the top cover. Use a cable with a phone plug to attach the speaker voice coil up. The cable can be routed to the back and held in place with cable clamps.

. . . K5SGP



HAMMARLUND SP 600 JX/R-274 SUPER PRO RECEIVERS

ANOTHER FIRST FOR SELECTRONICS. We just obtained a small quantity of these famous receivers that have been depot reconditioned and repacked to look and operate like new complete with manuals and spare parts.

Frequency range: .54 to 54 MC in 6 bands
Audio Power Output: 2 watts @ 600 ohms.
Power Required: 95 to 260 watts at 130 watts (Power supply is self contained)
Tubes: 20
Mechanical: Rack mounting 19"W x 10½H x 16½D
Weight: 66 lbs.
Performance:
- **Sensitivity:** 2.3 microvolts or better on all bands for ST N to N ratio of 10 db. (We have checked several at 50 MC and the sensitivity was better than 1 microvolt)
- **IMAGE Rejection:** better than 74 db on all bands.
- **I.F. Rejection Ratio:** at 600 KC is 2700 to 1
- **AVC Action:** output will hold within 12 db when input is increased from 2 to 200,000 microvolts.
- **Frequency Control:** continuous tuning plus a separate crystal control oscillator in which 6 crystals can be used for spot frequency operation.

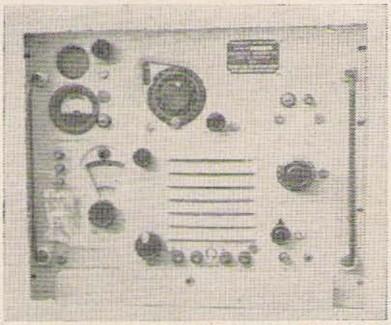
Shipping Weight: 200 lbs.
PRICE: $399.95

BRAND NEW PANADAPTOR PANORAMIC MODEL PCA-2 TYPE T-200

Here is another scoop by SELECTRONICS: A BRAND NEW GENUINE PANORAMIC RADIO PRODUCTS INC. PANANADAPTOR. These units are small and of a modern decor, so that they will blend with any station. They come complete with instruction manual.
SPECS:
Power Rec'd.: 115V 50-60 cycles
I.F. Range: 450-470KC
Screen Size: 2" dia.
Sweep Width: ± 100 KC to 0 KC
Tubes: 11
Size: 11"W x 6½"H x 10"D.
Shipping Weight: 20 lbs.
Price: $79.95

BRAND NEW FR-4/U/URM-79 FREQUENCY METERS

Here is a real hot item for you discriminating hams or labs who are interested in the ultimate accuracy in frequency measurements. All units are brand new in original crates with spare parts, instruction manual and two calibration books. The spare parts even include a spare crystal oven and crystals, and all tubes.
SPECS:



Frequency range: 100 KC to 20 MC (7 bands) usable to 1000 MC.
Oscillator freq.: 100 KC to 250 KC (proxy) 1250 KC (crystal), 15 to 20 KC (interpolation), 10 KC blocking)
Frequency stability: .0001%
Accuracy: .001%
R.F. Output: 100 microvolts min. in 51 ohms
Audio Output: 2 MW min. in 600 ohms.
Method of Interpolation: Visual, with built in oscilloscope
Tubes: 30
Harmonic selector: 9th thru 26th
Power Required: 115 or 230 V, 50 to 1000 CPS, 136 watts.
Weight: 146 lbs. in case
Size: 22"H x 26¼"W x 20¾D
Description: a portable hetrodyne type frequency meter for portable or fixed use. May be removed from the case and rack mounted, or used in the case with the tilt base as a table model.
Shipping Weight: 160 lbs.
Price: $350.00

DIRECT PLUG-IN REPLACEMENTS

PREMIUM 5R4 SILICON PLUG-IN REPLACEMENT RECTIFIER RATINGS: 4000 PIV @ 1 amp. D.C. These are a direct plug-in replacement unit that will eliminate tube replacements, greatly reduce heating, and provide instant warm-up. All units are properly compensated, potted and power tested at 1 amp. average D.C. current.
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5U4/5Y3/5Y3GT/5V4/5V4GT/5AU4/5T4/5W4/5Z4/5AW4/5V3/5AX4/5AZ4/5Y3G (1800 PIV)
Our #SA will replace any of the above tubes.
PRICE: $1.95

80/5Z3 Our replacement #SH
PRICE: $1.95

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PRICE: $1.95

NEW FLANGLESS TYPE SILICON DIODES
SILICON RECTIFIERS: All are the newer axial lead flangeless types. All are rated at 1.5 amp. D.C.

50—200 V	@ .06
200—400 V	@ .14
400—600 V	@ .24
600—800 V	@ .36
800 V	@ .44
1000 or better	@ .54

POWER TESTED SILICON RECTIFIER UNITS
(all 35 amps)

50 V	@ .84
100 V	@ .92
200 V	@ 1.94
300 V	@ 2.50

RG 59 A/U COAX CABLE
500' reels @ $15.00 per reel
GR—1211 75KC to 40 MC UNIT OSCILLATOR IN SIX BANDS PRICE: $150.00

ALL MERCHANDISE GUARANTEED—ALL PRICES F.O.B. PHILADELPHIA, PA.

SELECTRONICS

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(continued from page 2)

And CQ's latest blast has set shock waves of indignation rippling with their attack on DXpeditions and proposal for the elimination of all further DXpeditions. I doubt that they would publish such opinions if there were any active amateurs on the staff. There aren't, are there? For that matter, are there any active amateurs on the staff at QST? The only one I've ever heard there was Dick Baldwin and he seems to have been fired from the magazine. Oh yes, Ed Tilton gets on the VHFs now and then.

Get a balloon?

This Oscar business is all OK, I guess, but they seem to be having an awful lot of trouble with it. Not only are the specs for a satellite very exacting, but we have to thumb a ride from Uncle Sammy . . . and Sam doesn't always go to our stop on the line.

The Air Force has been doing some research lately on UHF repeaters sent up by balloon and having considerable success over a 500 mile range. This sounds pretty good to me. If they can get 500 miles range on phone with the gear they're using we should be able to double it or better using CW.

If anyone or group is interested in building some ham repeaters for our VHF bands 73 will be happy to provide the balloons and gas to send them up. I would think that they should be sent up from the west coast on weekends. We might be able to get quite a bit of activity on 432 and 220 if we lofted a series of repeaters to crossband repeat to two meters from them. Are there any clubs that are interested in coordinating such an effort?

Your help requested

CQ has had some very strong things to say about the Institute of Amateur Radio. I would like very much to hear from any of you (or your friends) who have held back joining the Institute as a result of the editorials in CQ. If their editorials or word of their editorials have reached you and influenced you to refrain from joining the Institute then it is of great importance to let me know about this.

A careful and full accounting of every dollar spent by the Institute has been published in the Institute bulletins and all members are aware of exactly where the money is going and what it was spent for. There are none of those incredible ambiguities you find in the ARRL financial report.

Manufacturers help

DXpeditions do help bring interest to ham radio. Those of us at home get a big kick out of working them and getting a "new one." I'd like to see more manufacturers lend a hand to fellows who are putting on good clean DXpeditions. Hammarlund has been doing it almost single-handed of late and getting precious little credit for all their effort and expense. It seems to me that they have leaned too far backwards and as a result few fellows realize what a terrific help they have been.

History

While out in California I got together with a real old timer and got an interesting earfull of the early history of ham radio. His version is so different from that taught by the League that I don't know what to believe anymore. Perhaps some of you that were there then and had an inside track on what was really happening can clue me.

For instance, is it true that the main reason that Maxim started the ARRL was to promote his ego? I know that many of the directors seem to run for this reason today, but I hadn't realized that it might have been that way in the past. Maxim had a famous father and grandfather (Maxim silencer) and could have had that psychological problem.

And was it true that Maxim dug up Warner in a saw mill and that he got 25¢ personally out of each subscription to QST for several years?

I do know that the League keeps pointing out that if it wasn't for them we wouldn't have ham radio today and when anyone is discourteous enough to ask them to explain this they refer vaguely to the hams getting back on the air after world war I. Now I hear that it was the Army and Navy that put the pressure on at that time for us and that we have no debt to the League at all!

And did the League indeed have stock in one of our leading equipment manufacturers? This might explain why they specified their parts by number in virtually every construction article for some years.

Then there was the time we lost big parts of our ham hands at an ITU meeting with no observable battle put up by our leaders. Some of those that were there wanted to know why our leaders turned up with expensive cars and big new houses if it wasn't from some sort of payoff by commercial interests.

Judging from the number of scandals which seem to have been covered up there is an interesting story to be told. Perhaps one of you old timers will write that story for us youngsters, changing names just a bit to protect the guilty. I do think that we should have some sort of history other than the sugar coated rewrite that appeared in QST.

. . . Wayne

Little League

One reader wrote, "Quite frankly I have been very skeptical of many of the things Green has been writing about the League in 73. His accusation that they had refused to let 73 exhibit at the National Convention in Boston seemed so ridiculous that I decided to check this for myself and see whether Green has been telling the truth or exaggerating about the state of affairs at League HQ. I was unable to get through to Huntoon, but I did reach an assistant and he confirmed that the League has indeed instructed the Boston Convention Committee not to permit 73 to exhibit at their convention."

This chap goes on to say that he is going to do everything in his power to keep his friends from attending the convention. Several other fellows have written similar letters and some manufacturers have indicated that they want no part of the show if that is the way it is going to be run. I disagree. A convention is primarily for the benefit of the hams that attend and I think we should all support the Boston Convention for the good of amateur radio in spite of the pettiness the League has demonstrated.

Pandora's Box explodes

The FCC ruefully admits that it never dreamed that they would get things in the mess they are now as a result of Part 15, the rule which permits those 100 mw transceivers which have been causing further chaos with already chaotic CB. FCC staffers admit that it is already way too late to try to stop the flood of these transceivers and they are talking seriously of moving them into some other band below 30 mc to relieve the CB congestion.

Those of us using six or ten meters have more than adequate reason for alarm. Virtually every other VHF user has a lobby in Washington to forcefully present the many reasons why this screaming mob should not be integrated with their service. They have millions of dollars to spend for their protection. Amateur radio has only the Institute of Amateur Radio, backed by a few hundred amateurs who care enough to try to keep ham radio going, to hold up its end of this battle.

Perhaps we need to lose one of these major bands in order to wake up the thousands of amateurs who are mistakingly depending on the sleeping giant in Newington for protection. Fellows, the League isn't even a registered lobbyist for amateur radio . . . how can they possibly help you? They are good at proposing rule changes to force the old timers off the air, but they can't walk into a Congressman's office and ask for help.

On the other hand, perhaps those 100 mw gadgets are fun enough for us?

Chuck and Ted

Details will be following, of course, but the report now seems confirmed that Chuck Swain K7LMU and Ted Thorpe ZL2AWJ have been lost at sea during a hurricane after leaving Wallis Island on January 27th. I guess most of us expected some sort of miraculous escape such as Danny pulled off a few years ago down in those waters when he ran onto a reef with the Yasme.

Don Miller rushed out to Samoa to help with the search, but after over two weeks of scanning every possible area where they might be there has been no sign of them. Apparently they had left their ham gear behind on Wallis Island, which explains why none of us heard a QRRR.

(continued from page 4)

Second place went to Bill Richarz WA4VAF and Bryant Holmes WA4WOL. Their cover will appear in the near future.

We had an incredible number of entries in the contest and had a terrible time deciding the winners from among them all. There are a few others we may be able to use or that furnish good ideas for an artist to work on (some weren't finished artwork). Incidentally, we can always use good covers and cover ideas. Payment for covers is $25 and up. Ideas get less, of course.

Articles and other contributions

We always need good articles, too. We have a large backlog, but eat up 25 to 35 per month, so can't get too complacent. Among the articles we especially need are detailed ones on newcomers' gear. These should have layouts, lots of good large pictures, parts lists with prices and sources, and complete information so that an absolute beginner can use the article. We need receivers, transmitters and accessories for 80, 40, 15 and 2. Modern equipment is preferred; no 6SN7's and 6J5's. In fact, there's really no reason for not using semiconductors in the receivers and power supplies and possibly in the transmitters.

We'd also like articles on a 6 meter SSB KW linear (with maybe 572B's, 8236's or 8163's), 160 meter gear, a low noise (transistor) 1296 mc converter, test equipment, microwave equipment, simple transistorized SSB exciters, transmitters and transceivers using McCoy or CC crystal filters, circuits using cheap new transistors, and projects that use (or can use) printed circuit boards that can be made available to readers such as the keyer in the January issue. This list is by no means exhaustive. You can send a query on your project or just send the article itself (which I prefer). We like lots of good big pictures and try to use them. Polaroid shots usually are poor as they can't be blown up.

We also need *good* cartoons and cartoon ideas. For some reason, we seem to get a lot of non-ham and non-funny cartoons.

Comments

We're always anxious to receive comments from our readers about 73, and about particular articles in 73. Have you built a project from an article in 73? Why not send us a picture of it and your comments about any problems or modifications—or just how it worked. Your experiences can be very helpful and reassuring to others who want to build the equipment. . . . Paul

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AMPS	400 PIV	600 PIV	800 PIV	1000 PIV
3	☐ 25¢	☐ 35¢	☐ 45¢	☐ 69¢
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- ☐ 15 NPN TRANSISTORS, 2N35, 170, 440, no test $1
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- ☐ 4 — 2N996 PNP PLANARS, 100MC, TO46 case $1

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- ☐ 1 85W SILICON PWR TRANSTR, npn, like 2N1212 $1
- ☐ 4 2N43 OUTPUT TRANSISTORS, by GE, pnp, TO5 $1
- ☐ 4 2N333 NPN SILICON transistors, by GE, TO5 $1
- ☐ 10 2-6Amp RECT's, studs, silicon, 50 to 400V . $1
- ☐ 6 TRANSISTOR RADIO SET, osc-ifs-driver, p-p .. $1
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- ☐ 4 2N35 TRANSISTORS, npn, by Sylvania, TO22 . $1
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- ☐ 3 INFRA-RED DETECTORS, with leads $1
- ☐ $25 SURPRISE PAK: transistors, rect, diodes, etc. $1
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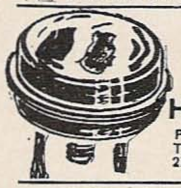

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WANTED GOLDKIT THRILLER transceiver in good shape. Box 731, Jacksonville, Florida.

WANTED GOLDKIT THRILLER transceiver cheap. Box 84, Brunswick, Georgia.

WANTED British DX transmitter EL 37 in good condx. Box 45, Jax, Fla.

CLEGG 22' $175, Drake R4 with speaker $300, #19 teletype machine includes table, power supply, TD unit, $150—you pick up. WA8BLS/4, 6420 5th Avenue, N., St. Petersburg, Florida 33710.

KNIGHT GRID DIPPER $15, Transtenna 102A T-R $30, Vibroplex vibrokeyer $8, 73 Bound volume #1 $8. Tony Casciato, 1107 Cottage St. SW, Vienna, Va. 22180.

COLLINS 62S-1 $575, KWM-2 with Waters Q-Multiplier $675, 516F2 $50, Package $1250. All factory new condition. Measurements Corp. Model 59 GDO $95. J. W. Gregory K4OCK, 6495 Killian X Drive, Miami, Fla. 33156, MO 1-7576.

GR 650A RLC Bridge $85, ART-26 $50, ARC-1 $15, Allstate CB rigs new $30 each, LM with calibration book and PS $50, New 4-400 $25. R. Wurtzinger, 830 N. Waller, Chicago, Ill.

KNIGHT R-100A receiver with crystal calibrator $85. Eico 723 transmitter $35. Plus shipping. J. Buck, 4860 West Richfeild Rd., West Ridgefield, Ohio 44286.

CUBICAL QUAD W2AU for 10-15-20 meters, never used, complete instructions $40. Pick up deal only. Sorry. James J. Doran, 178-09 132nd Avenue, Springfield Gardens, L.I., N.Y.

WANTED: Linear with power supply to follow 20A. Good quality homebrew OK. Or will swap 20-A deluxe VFO, 2-B with calibrator plus cash for Swan 350 or 400 plus VFO and AC supply. Paul Wentzel KØGBC, RFD #2, Box 451, Spearfish, So. Dak. 57783.

HA-1 KEYER and Vibroplex. Almost new. Swap for Tri Band Beam or $70. WA1BWS, Roger Burnham, RFD #1, Danby, Vt.

HAM AUCTION May 2, 1966. Check gear in at 6 pm. Auction at 8 pm. River Park Amateur Radio Club, 5100 North Francisco Avenue, Chicago, Illinois.

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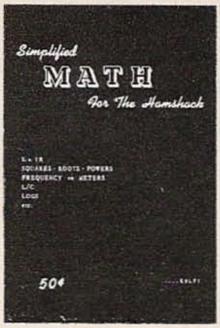
600 PIV TOPHATS, includes bypass capacitors and resistors 10 for $3. Postpaid USA. Tube pullouts: 4CX250B $6.50, 4-125A $5.00, 6146 or 6883 $1.25, 5763 or 6CL6 $1.00, 4X150 $4.00, 2C39 $2.00, 304TL $15.00, 4-250 $10.00. All material guaranteed. Minimum order $3.00. East Coast Electronics, 123 St. Boniface Rd., Buffalo, N.Y. 14225.

RTTY CHANNEL FILTERS tuned to specific frequency .0005. $3 each. Two tuned filters mounted in an octal can $9. 5 88 mh toroids $2. Postpaid. Bob Jeffrey W6OKK, 6639 Outlook Avenue, Oakland, California.

AN/URR-13A receiver $88; General Radio 1551-A $139.50; Teletype MD 14 reperforator $47.50; Infrared Sniperscope Md M3 $125; NiCad battery-cells. P. E. Boniface, P.O. Box 44, Hawthorne, Mass. 09137.



MATH SIMPLE?

Yes, K8LFI gives you the simplest, most easy - to - understand explanation of Ohm's Law, squares, roots, powers, frequency, meters, logs slide rules, etc. A postpaid steal at only 50¢

73 MAGAZINE
Peterborough, N.H. 03458

GROVE'S GIANT SALE!

WALKIE-TALKIE #13-103— 3 transistor	2 for $14.99
WALKIE-TALKIE #13-105B— 5 transistor	2 for $25.88
WALKIE-TALKIE #13-106— 6 transistor	SALE $15.99
WALKIE-TALKIE #13-108— 9 transistor	SALE $24.95
WALKIE-TALKIE #13-114 10 transistor	SALE $27.95
WALKIE-TALKIE #13-110H— 12 transistor—2 channels	SALE $29.95
WALKIE-TALKIE #13-132— 16 transistor—2 channels—1½ watts	SALE $68.88
WALKIE-TALKIE #13-130— 1 Watt—BRAND NEW MODEL!	SPECIAL $57.88

MICROPHONE SALE!

TURNER 454X SSB	SALE $14.49
TURNER 454C SSB	SALE $14.49
TURNER 254X	SALE $12.99
TURNER 358D	SALE $13.69

FIELD STRENGTH METER—transistorized	SALE $14.99
AUTO RADIO—AM/FM/FM—afc— Pushbotton—6v or 12v, Positive or Negative Ground	SALE $49.99
SWR BRIDGE—Field Strength Meter— #FS45	SALE $ 8.99

PENNY BARGAINS!!

IF's—455KC (¾ inch)	SALE	19¢
RELAYS—Kellogg Swb—6/35VDC— 4PDT	SALE	99¢
OUTPUT XFMR—10,000 Ohms— PP Audio	SALE	99¢
POWER XFMR—550V CT— 90 MA Fil	SALE	99¢
TUBE TESTER XFMR— (Lots of Fil windings)	SALE	49¢
FILTER CHOKE—Shielded— 3Hy-320 MA	SALE	99¢
110V TIMER—60 cy—asst'd— 59¢ ea.	3 for	$1.49
CLOCK TIMER—Telechron w/Sleep Selector	SALE	$2.49
GNS—Tuneable Generator Suppressor (Reg. $3.95)	SALE	$1.99
COAXIAL LIGHTNING ARRESTOR (CBLA2)	SALE	$2.88

Amateurs! Order right from this ad AND tell us your additional needs in transformers! Largest stock of surplus xfmrs of any dealer! Loads of goodie chassis full of chokes, diodes, other parts. We've got the fun-type goodies for you. Include Call when writing.

SEND FOR FREE GROVE 1966 CATALOG!

Send check or money order, include postage, excess refunded. Minimum order $5.00—50¢ service charge under $10.00. 50% deposit on COD's.

GROVE ELECTRONIC SUPPLY COMPANY
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Then why not send for a free sample of the VHF'er Magazine. It's devoted entirely to serious VHF and UHF hamming. It contains articles by well-known and capable VHF'ers. All who want to improve their knowledge of VHF are invited to subscribe.

Subscriptions are $2 a year (foreign $3)

The VHF'er

Parks Laboratories, Rt. 2, Beaverton, Oregon

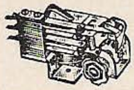
GOODY GOODIES

Specially selected as "BETTER BARGAINS" for the coming hamfest season. Clean 'em out, I'll buy more and different items.

CO-AX RELAYS

SPDT,100 w on 2 meter. Has 2 12v DC coils in series, rewire in parallel for 12v. In steel box 3x3½x1¾". With 3 connectors take PL-259. NEW — $3.95
With 3 BRAND NEW PL-259 — $5.00

SPDT,250w to 250 MC,100w to 1000 MC,SWR at 1000 MC 1.3:1, Open frame, takes UG-88/U, BNC, and 2 special UHF. — $3.00
With new UG-88, & 2 specials — $5.00
W/UG-88, 2 specials on 9' RG59 — $4.50



Impulse ratchet relay, SPDT, 24v AC coil. Each pulse sets, and resets (reverses), mechanically. A **MUST** for RTTY automatic keyers. BRAND NEW — $1.75

HEAVY DUTY, 1 KW, CERAMIC, ROTARY, RF SWITCHES.

3 deck 8 position	5 positions wired. No stop. ¼" shaft, with bar knob.	$2.50
2 deck 6 position	Continuously shorting. No stop. ¼" shaft.	$2.50
2 deck 12 position	Non-shorting, no stop. ¼" shaft.	$2.50

CRL type 850 Ceramic capacitors, 5 KV 25, 40, 67 or 100 mmf. Choice, $1.00 4/$3.75

A-27 Dummy antenna, 80w to 4500 KC. Steel box, 3"w x 5"d x 4¾"h, with cover 3x5x1½". Has MILLEN or CARDWELL 12 to 151 mmf, 3500v variable, two 12 ohm, 40w vitreous resistors, leads, binding posts, etc. 6 LBS. NEW — $5.00

12-151 mmf Variable capacitor, 3500v, MILLEN or CARDWELL, removed from A-27. Ideal for input of Pi-net. Two metal end plates, ¼x1" shaft. — $3.95

SURPRISE PACKAGES.
Our very first try, at these, only because we recently received a lot of mixed parts, from a large manufacturers' line termination, sweetened with some of our odds & ends, leftovers, etc. NO HEAVY 400 CYCLE TRANSFORMERS or 24v DC RELAYS, or EXPORT PACKED MDSE. Does have resistors, condensers, APC, tube sockets, fuses, fuse clips, leads, switches, pots, jacks, plugs, connectors, in pliofilm bags. 80% new, 20% take-outs, clean, good. 5 pounds — $1.65

HAMFEST Schedule
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De Kalb, Ill. May 1.

All orders except in emergency shipped same day received. For free "GOODIE" sheet, send self addressed stamped envelope. PLEASE, PLEASE include sufficient postage and insurance. Any excess refunded with order.

B C Electronics
Telephone 312 CAlumet 5-2235
2333 S. Michigan Avenue — Chicago, Illinois 60616

SWAP COAST GUARD BC 653-A transmitter with a 500 v and 1200 v generator complete, 140 lbs of choice parts, pair 814's final G. mod. Need good communications receiver. Write E. R. Albertson, P.O. Box 392, Evadale, Texas 77615.

BC-348 Double conversion miniature tubes, with power supply, new panel. Diagram included, $45. Two new 4CX250K tubes with home brew socket, $10. J. E. Richardson, Box 54, Pottstown, Pa. 19464.

EICO 723 60wt CW Xmtr w/spare tubes. Good novice rig. Wkd 20 countries. $40. J. F. Robinson, K1ZJW, 32 Old Colony Way, Scituate, Mass. 02066.

ELECTRONIC LIGHTER. No Flint, Wick, Battery or Moving Parts. PHOTO OF SHACK with call, name, address, on labels. Wagner Co., 6200-C Whitewood, Library, Pa. 15129.

HEATH HW-32 20-meter USB transceiver. 200 watts input, ALC, AVC, VOX, and PTT. Like new, $85. 16810 Weddington, Encino, Calif. 91316 213-784-2588.

WANTED: Military or Commercial Surplus . . . Airborne, Ground, and Testsets. Try the big boys, then write or call collect area 703-560-5480 and give us YOUR price . . . We Pay Cash and Freight . . . RITCO POB 156, Annandale, Va.

FOR SALE: R23/ARC5 190-550KC receiver good operating with tubes . . . $15.50; also R445/ARN30 Tunable late type command receiver 108-132MC, same setup as command sets . . . good operating with schem. . . . $26.50. RITCO POB 156, Annandale, Va.

BARGAINS! Transmitters, Receivers, Test equipment offered, wanted in ham's trading paper. Next 12 interesting issues $1. Sample copy free. "Equipment Exchange-Ham Trader," Sycamore, Illinois.

HALLICRAFTERS SX-117 with HA-10 plus xtal for 4-4.5 mcs, mint condition, only $270, will ship. Contact WA4MZZ, Box 182, Louisville, Georgia 30434.

QSL CARDS? Largest variety samples 25¢. Sakkers, W8DED, Holland, Michigan.

CHRISTIAN Ham Fellowship being organized for Christian Hams for fellowship, tract ministry, missionary efforts among hams. Christian Ham Callbook $1 donation. Write Christian Ham Fellowship, c/o W8DED, Box 218, Holland, Mich.

WRL BLUE BOOK prices save money. Take 10% off these prices without trades. Communicator IV's, 2M or 6M—$199.00; HT37—$269.00; SX99—$99.00; SX101A—$209.00; SR150—$389.00; Galaxy 300—$189.00; Galaxy III—$219.00; SB33—$209.00; NCX3—$219.00; RX1—$149.00; TX1—$139.00. Hundreds more. Free list. LEO, WØGFQ, Box 919, Council Bluffs, Iowa.

COLLINS STATION 75A1 Receiver with RME DB23 preselector $175. 32V3 Transmitter with spare 4D32's $200. Or make offers. WA4WHI, 10235 S.W. 58 Ct., Miami, Fla. 315-667-9906.

TUBES: 4CX1000A's, Brand New, $100.00. Insurance and shipping paid. WA5MCL, 130 Grecian, San Antonio, Texas 78223.

DAYTON HAMVENTION April 16, 1966—Dayton Amateur Radio Association's 15th annual Hamvention, Wampler's Ballarena, Dayton, Ohio. Participate in the technical sessions, forums, banquet, "Home Brew" contest and hidden transmitter hunt. Bring XYL. FCC general class examination 09:00 Saturday. For information write Dayton Hamvention, Department C, Box 44, Dayton, Ohio 45401.

NOVICE CRYSTALS 80-40M $1.05 each. Also other freqs. Free list. Nat Stinnette, W4AYV, Umatilla, Fla. 32784.

BC 348—Double conversion—miniature tubes with power supply, new panel. Diagram included—$15.00. Two new 4CX250K tubes with home brew socket—$10.00. J. E. Richardson, Box 54, Pottstown, Pa. 19464.

COMPLETE STATION—HX-50A-160 latest modifications, with 8236 final for 270 P.E.P.—$375.00; Drake 2A with Calibrator, speaker and extra xtals.—$160.00; Seneca VHF-1 6N2 with handbook 6146 modulator and power supply—$165.00; Viking 6N2 Converter—$40.00; BC-342N with stability, S-meter and speaker—$65.00. Jim Bellows, K8NIE, 2700 Parsons, Midland, Michigan 48640.

VIDICONS . . . RCA & GEC, Heath test equipment, Wineguard UHF converter, Surf Board, CDR rotor, HO-13 Hamscan, 2 meter halo, RG-17u, Radar Sentry, plus more . . . WB2GKF, Stan Nazimek, 506 Mt. Prospect Ave., Clifton, New Jersey 07012.

2 METER FM mobile unit wanted, Motorola preferred. Give details, including chassis numbers, price. Jim Hill, W6IVW, 26107 Basswood, Palos Verdes Peninsula, Calif. 213-3784411.

COMPLETE STATION! Eico 720 Transmitter, 722 VFO, Hallicrafters S-108 Receiver, Heath Calibrator, Novice Crystals. 6 months new, good condition (61 countries, 44 states). Best offer over $200. WB2SSB, Joseph Sanger, 22 Teakwood Lane, Roslyn, L.I., N.Y.

CALL SIGNS! Now, You can proudly display your call, custom made in thick sand cast aluminum. Polished border and letters on a deep black background. Exclusive quality admired by all. Satisfaction guaranteed. Only $7.95 postpaid. Or send $1.00 deposit, balance C.O.D., to Robert Young, 2021 25th Street West, Birmingham, Alabama 35218.

NOW! A publication devoted entirely to government surplus electronic equipment. Many schematics and other data each issue. Sample copy 25¢ or $3.00 per 1-year subscription. National Surplus Digest, P.O. Box 36, Sweet Valley, Pa.

I DON'T ENJOY WORKING SSB. Have near new Heath HW-12 with HP-13, DC supply and xtal calibrator. Highest bidder. James Bean, KØLRO, Belcourt, N. Dak. 58316.

GOODY BAGS, 20 pounds excellent parts $5. Catalog—RTTY, UHF, Receivers, parts—send SASE. 0-322/GPA-30 unused, $9.50 fob. BVE Enterprises, POB 411V, Paramus, N.J. 07652.

HALLICRAFTERS FPM-200 transistorized transmitter-receiver-transceiver. Completely self-contained, compact station incorporating advance features not found in any amateur radio at any price. 41 transistors, two VFOs for transmitting and receiving on different frequencies. AM, SSB, CW-VOX. Complete coverage from 10 through 80-meters, plus WWV. 16" wide, 5" high, 11" deep. Complete with AC unit and self-contained mobile bracket. Can be moved in seconds. This magnificent piece of equipment sold for $2650. Absolutely perfect condition. Will sell for less than half-price. WA6TLS, 7549 East Fourth Place, Downey, California.

NEW TOOOOOBES: 6146B—$4.00; 6CW4—$1.40; 417A—$3.95; 6360—$3.45; 6146—$2.55; 3-400Z—$30.80. NEW, boxed, guaranteed. NO pulls, seconds or JAN. Free Catalog. VANBAR dist. Box 444X, Stirling, N.J. 07980.

BACK ISSUES

Back Issue Bonanza

Curl up this winter with 20 assorted fascinating back issues of 73. They'll keep your mind, imagination and soldering iron warm through the cold nights. Our choice (but an excellent one, of course) at this low price. 20 for $5.

Cheapskate's Assortment

Eight fabulous back issues of our choice for a puny $2.

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Individual back issues are 50¢ apiece except all of 1960, February, March and April 1961, and June and November 1962, which are $1. January 1961 and December 1962 aren't available.

Bound Volumes

1962 and 1963 bound volumes are beautiful and $15. We're going to make up more 1964 and some for 1965, but it'll take a while.

Binders

Binders are available through 1960-61, 1962, 1963, 1964, 1965 and 1966. They're $3 apiece and if you order them Nancy will hate you 'cause they're hard to wrap.

73 Magazine **Peterborough, N. H. 03458**

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The Best Air-to-Ground Radio Receiver: URR-13 is continuous tuning AM superhet 225-400 mc plus 1 xtl-control channel. 2 stages RF, 5 stages IF, Silencer, Noise limiter, 3 stages AF, 120 v 50/60 cy pwr sply. With tech. data, aligned, OK grtd, fob Los Angeles	149.50
TWO LV XFRMRS each 115v 60 cy. connect for 115 or 230v. Gives 4 separate 6.3vct 35A secs., connect for 25.2vct rms 35A or 12.6vct 70A or 6.3vct 140A. 2 weigh 54#. RailEx or Truck collect, remit for two	14.50
All-Band SSB Rcvr Bargain: Hallicrafters R-45 ARR-7, 550 mc to 43 mc continuous: Voice, CW, MCW, aligned, qrtd, w/book; 2-RF, 2-IF's. S-meter; noise lmtr; 3 xtl, 3 non-xtl select. choices. Less pwr sply	149.50
60 cy pwr sply: $30. SSB product detector	20.00
TIME PAY PLAN: Any purchase totalling $160.00 or more, down payment only	**10%**
Panadapter 455 kc for above, 60 cy	89.50
R-23/ARC-5 Command rcvr 190-550 kc	14.95
A.R.C. 12 #22 Command rcvr 540-1600 kc	17.95
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LM-14 freq. meter, .01% 125 kc-20 mc	57.50
TS-323/UR freq. meter 20-480 mc, .001%	169.50
H.P. 524D/525A,B,C/540A: Count to 5GC. Period Mult. adds accuracy at low freq.	2175.00
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TS-418A/U sig. gen. to dbm 0.4-1.0 gc	395.00
Hewlett-Pack. #616A Sig. Gen. 1.8-4.0 gc	795.00
Borg-Warner High-Power sig. generators	PUR
SLRD sig. gen. 275-2750 mc, 20 watts	PUR

AND MUCH MORE! We have many other Signal Generators, many Meters, VTVM's, Line Voltage Regulators, Regulated Power Supplies, Precision Bridges, ac & dc Voltage Dividers, Galvos, Calorimetric & Indicating RF Wattmeters, other Spectrum Analyzers, Etc. . . . **WRITE . . . WIRE . . . PHONE . . . YOUR SPECIFIC NEEDS!**

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Little Annie Hammy
BY WAYNE PIERCE-K3SUK
THIS MONTH WE FIND OUR PRECIOUS HEROINE'S LONGTIME PAL, PERCY, ON THE VERGE OF STEPPING INTO THE WONDERFUL WORLD OF HAM RADIO... WE OPEN OUR STORY WITH PERCY ON ANNIE'S PRECIOUS LITTLE DOORSTEP...
DING DI DING DIT DING DI DING DING DING
HOW TO
GOLLY GEE 73! IT'S TIME FOR OUR LITTLE CODE PRACTICE AND THEORY SESSION COME IN, PERCY
HI, ANNIE... JUST ONE MORE SESSION OF THE CODE AND I THINK I'LL BE READY FOR THAT NOVICE TICKET ...AND I'VE READ UP ON ALL THOSE LITTLE RESISTOR AND CAPACITOR THINGS...
OH, PERCY! I'VE ALWAYS THOUGHT OF YOU AS BEING REAL HAM MATERIAL!
LATER
THAT WAS WONDERFUL, PERCY! A WHOLE COLUMN OF 'W2NSD/1' AT 5-WPM WITHOUT A SINGLE MISTAKE... AND YOU DIDN'T GET HYSTERICAL ONCE!
WEEKS LATER...
ANNIEBAAAABY!
I'M A HAM!
I'D SAY HE'S MORE OF A PORKCHOP

JUST THINK, ANNIE!
'CQ TIBET... CQ TASMANIA... CQ PETERBOROUGH... WATSA, OLD MEN?... HOW COPY, GUS? SURE, I QSL... QRU?... QRS?... ROGERDODGER... QRZQRZQRZ QRZQRZQRZ? .....'
OH, PERCY... YOU'RE A REAL HAM! WHY DON'T YOU COME ALONG TO THE HAM CLUB WITH ME TONIGHT AND MEET THE LOCAL FELLOWS?
OH BOY! WHOOPIE! HOT DOG! GEE WHIZ!
CLOUD/9
THAT EVENING...
PUNKDUCK HOLLOW RADIO
MEETS FIRST THURSDAY AFTER 73
MEMBERS ONLY
NO CBERS
GDO
FELLOWS... MEET PERCY!..... HE'S THE TOWN'S NEWEST HAM ...HE JUST GOT HIS TICKET TODAY!
THE AMATEUR IS FRIEN
HI PRCY BT GLD TO MEET U BT NME HR IS CLYDE ES I'M A CW MAN MYSLF SK
UR LOYA
CW FOR-EVER!
AWWWH... HOPE TO HEAR YOU ON GOOD OLD 75 'PHONE WHEN YOU GET THAT BIG TICKET... AWWWH... THAT'S WHERE YOU'LL HEAR ME! HAR HAR HAR...
WHATDIDHESAY?
YOU HAVE TO SORT OF WHISTLE WHILE HE TALKS... HE'S A SIDEBANDER...


MEET OSCAR...HE'S A VHF OPERATOR...
THIS IS CHARLIE... HE'S A DEDICATED RTTY HAM... WRITE HIM A NOTE – HE'S NOT MUCH FOR TALK
AWWRIGHT, YOU LIDS... LET'S GET THIS MEETING STARTED!
GREEN FOR
AWWRIGHT... LET'S GO WITH THE ROLLCALL ... DON'T NOBODY BREAK IN OUTA TURN OR IT'S THE WOUFF HONG...
YOU CAN MEET SOME MORE OF THE FELLOWS AFTER THE MEETING... ISN'T THIS A WONDERFUL GROUP? ALL REAL HAMS – EACH WITH HIS OWN TALENTS CONTRIBUTING TO THE WHOLE OF THAT GREAT SERVICE – AMATEUR RADIO... PERCY? PERCY!
I WANTA GO HOME...
I DON'T WANTA BE A REAL HAM! I DON'T WANTA GET INVOLVED.. I JUST WANTA WORK AUSTRALIA ONCE OR TWICE A WEEK AND BUILD A TRANSMITTER OR TWO AND JUST FOOL AROUND WHEN I FEEL IN THE MOOD AND... AND.. .....
I'LL NEVER GET THAT WRAPPED UP IN HAM RADIO... THOSE GUYS HAVE GONE THE LIMIT!
WANT TO STOP IN FOR A CUP OF HOT CHOCOLATE?
THANKS, BUT I WANT TO GET HOME AND GET STARTED ON SOME AWARDS... I MADE FOUR DOZEN CERTIFICATE FRAMES THIS WEEK...
QRT

Propagation Chart

April 1966

J. H. Nelson

EASTERN UNITED STATES TO:

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

CENTRAL UNITED STATES TO:

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

WESTERN UNITED STATES TO:

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

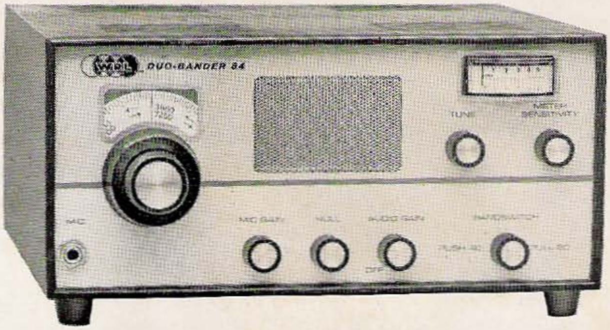
Very difficult circuit this hour.
* Next higher frequency may be useful this hour.

Good: 1-3, 7-9, 13-15, 24-26
Fair: 4, 6, 10, 12, 16-19, 21-23, 27-28, 30
Poor: 5, 11, 20, 29
VHF DX: 1, 5, 21, 25-28

INDEX TO ADVERTISERS

HERE IT IS!

COMPACT
5″ HIGH
11¼″ WIDE
10″ DEEP



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IDEAL SSB TRANSCEIVING ON 80 AND 40 METERS

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COMPACT - 80-40 METER SSB TRANSCEIVER. A LOW COST RIG - WITHOUT SACRIFICE OF POWER AND PERFORMANCE. INCLUDES BUILT-IN SPEAKER AND GIMBAL MOUNT!

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