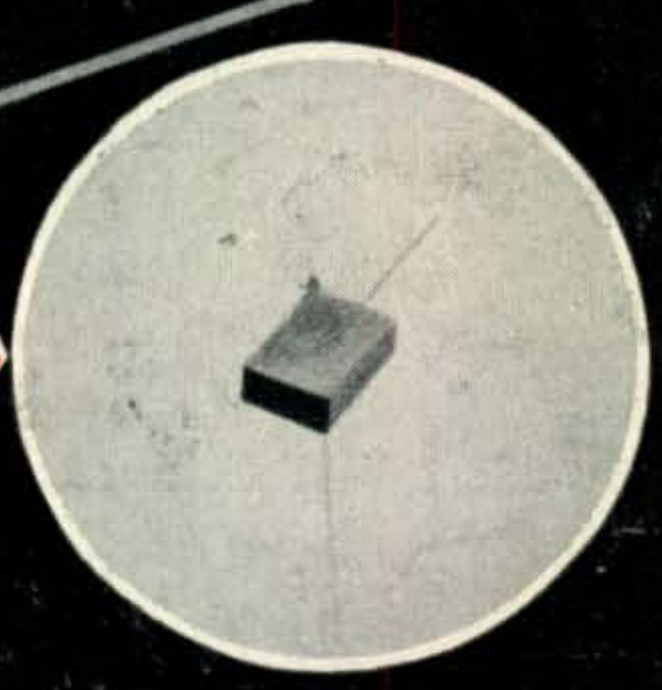
February 1965
50¢

CQ

Using....

OSCAR III

SEE PAGE 38



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Plus:

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A HOMEBREW SLOT ANTENNA

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MODIFYING THE HT-32

ANTENNA ZONING: HOW IT WORKS

DESIGNING A KW PLATE TANK

CQ REVIEWS: THE COMPREAMP

The Radio Amateur's Journal

OPEN, SESAME!

Collins 62S-1 VHF Converter can be your "Open, Sesame" to a whole new world (and beyond!) of excitement and pleasure. ☐ The 62S-1 gives you a full 8 mc of bandwidth. You can transmit and receive on 6 and 2 or HF without changing cables. All you do to get on VHF is flick the switch. You're away from the crowded lower bands. You'll be able to share in some of the new VHF adventure . . . moon bounce, Oscar III . . . ☐ You can use Collins 62S-1 to cover 49.6 to 54.2 and 143.6 to 148.8 mc (crystals for amateur bands provided). If you have the KWM-2 or S/Line, you don't need an additional power supply. One more feature . . . the 62S-1 is compatible with most equipment operating in the 14.0 to 14.2 mc range. ☐ Visit your Collins distributor and ask him to demonstrate the 62S-1 VHF Converter. See how easy it is to get more fun out of ham radio by going to VHF with the 62S-1. Now's the time to do it!

COLLINS

For further information, check number 55, on page 110

EVERY PR CRYSTAL is UNCONDITIONALLY GUARANTEED

Unconditional Guarantee is proof of the maker's absolute confidence in his product... and PR Crystals have been UNCONDITIONALLY GUARANTEED SINCE 1934. You're not taking the slightest chance when you put PRs in your rig, for you'll have the finest radio frequency control that money can buy! PR Crystals are made to PERFORM... under good conditions and bad. They have that extra measure of stability and dependability BUILT-IN, that guarantees years of outstanding performance. Get PRs today from your jobber.

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Fundamental, PR Type Z-2

Frequency Ranges in Kcs.: 1750 to 2000 (160M); 3,500 to 4,000 (80M); 7,000 to 7,425 (40M); 8,000 to 8,222 (2M); 8,334 to 9,000 (6M).

Rugged. Low drift, fundamental oscillators. High activity and power output. Stands up under maximum crystal currents. Stable, long-lasting; ± 500 cycles. . . . . **$2.95** Net (All Z-2 Crystals calibrated with a load of 32 mmfd.)

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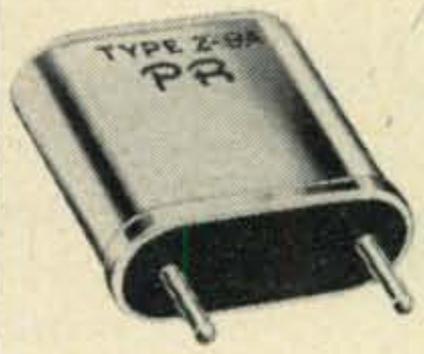

Hermetically sealed; calibrated 24,000 to 24,666 and 25,000 to 27,000 Kc., ± 3 Kc.; .050" pins. . **$3.95** Net

6 Meters, PR Type Z-9A

Fifth overtone; for operating directly in 6-meter band; hermetically sealed; calibrated 50 to 54 Mc., ± 15 Kc.; .050" pins. . . . . **$4.95** Net

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Official assigned frequencies in the range. Calibrated to .005%. 1600 to 10000 Kc. . . **$3.45** Net

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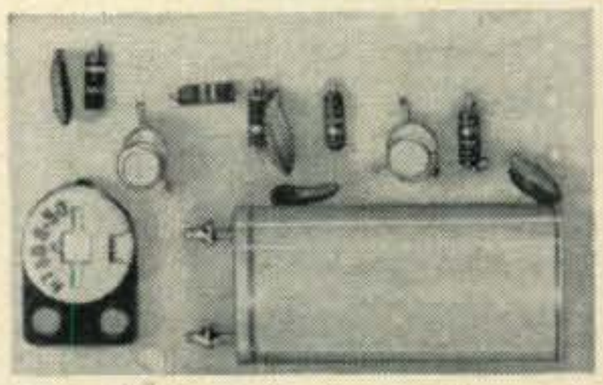
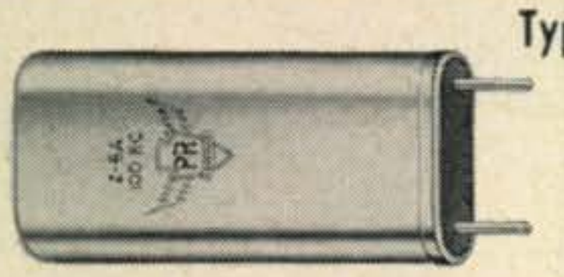
Suitable for converters, experimental etc. Same holder dimensions as Type Z-2. 1600 to 12000 Kc., (Fund.) ± 5 Kc. **$3.45** Net

12001 to 25000 Kc. (3rd Overtone) ± 10 Kc. . . . . **$4.45** Net

PR-100 Transistorized Oscillator



With PR-100 you can check harmonics at 100 Kc. intervals through 54 Mc. A precision oscillator, fully wired, ready to install. Includes a Z-6A Crystal. Power requirements: 12V DC @ 14 Ma. Oscillator output connects to receiver antenna, high side. Base is 1-7/8 x 2-13/16 inches. Negligible mounting space required. Weighs 2 ounces. . . . . **$12.95** Net



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To determine band edge. To keep VFO and receiver properly calibrated. .050" pins. 100 Kc. . . . . **$6.95** Net

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COMMERCIAL CRYSTALS AVAILABLE FROM 100 KC. TO 70 MC. PRICES ON REQUEST.

For further information, check number 1, on page 110

When you're No. 1, you have to try *twice* as hard

Every year for 31 years, Hallicrafters has engineered more high performance amateur radio equipment than any other manufacturer in the world. For the last 30, we've had to fight every inch of the way.

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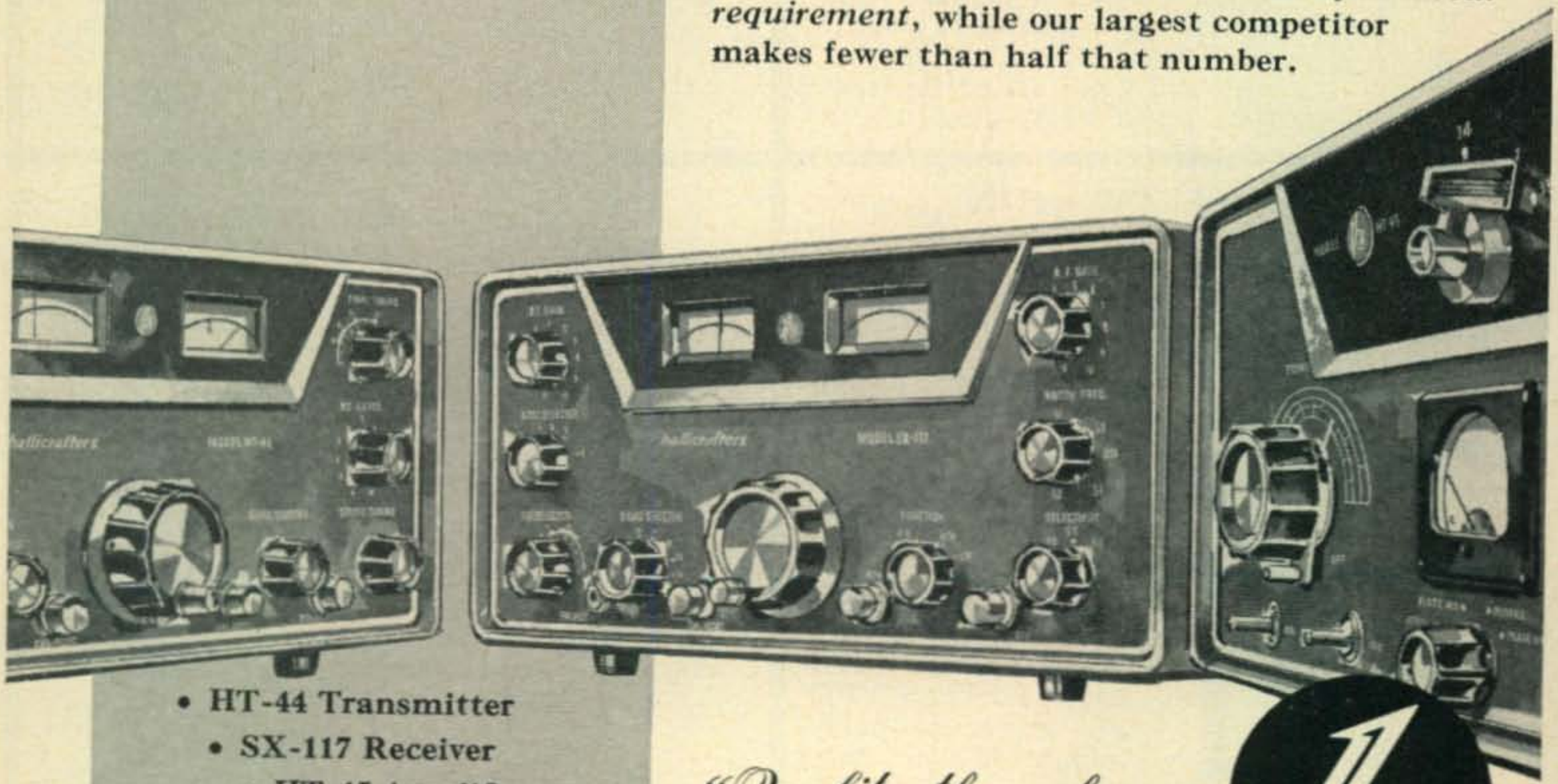
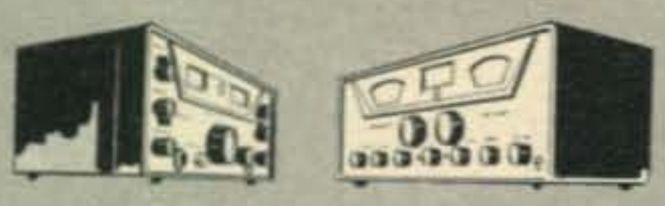
Early in the game, we learned that staying ahead of the crowd would depend on two things: Dedication to the needs of *all* amateurs; and very superior, *progressive* engineering.

So it's no coincidence that our SR-150 and SR-160 amateur transceivers *alone* offer *both* Receiver Incremental Tuning and Amplified Automatic Level Control. Or that we manufacture 19 products to answer *any amateur requirement*, while our largest competitor makes fewer than half that number.



- HT-44 Transmitter
- SX-117 Receiver
- HT-45 Amplifier



- SR-150 Transceiver
- SX-122 G.C. Receiver

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FEBRUARY 1965 VOL. 21, No. 2

CQ The Radio Amateur's Journal

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DEPARTMENTS

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ZERO BIAS

LAST month's ZERO BIAS discussed a proposal by *Popular Electronics* to allow operating privileges on part of the 2 meter band to CBers. In a nutshell, we don't like the idea, and held little back in telling you so.

Also, January ZERO BIAS proposed the inception of an "Engineers" class of license for the express purpose of promoting technical advances in amateur radio above 420 mc. We proposed that the license be "code-free," and that a very stiff technical exam (similar to the Extra-class exam) be administered to preclude the possibility of the license's turning into a "CB-type" license.

A further proposal was made, too: Extend "Engineers" class privileges to holders of the First Class Radiotelephone license who desired to experiment amateur-style on the ham bands above 420 mc.

Early response to our January ZERO BIAS is rather confused, to say the least. As this is written (January 8) over 40 letters have been received, expressing comments ranging from "Bravo!" to "Go soak your head!" Well, we're not about to soak our thick Scotch head, but this month, let's try to answer a few of the more pointed comments received.

From K2DDK: "Here we go again!

"CBers on the ham bands (even "420 mc and up") is something I'll fight all the way. Why? Because 1) the ham bands are for hams, 2) give any special group an inch and they'll take a mile.

"You think not? The Technician class license is an excellent case in point. In its original concept it was an excellent idea. Take all those who are technically inclined but lack code qualification and put them '220 mc and up' with all privileges. Sound familiar?

"Then what happened? I'll tell you. They squawked that they had a license they 'couldn't use' because 1) no commercial gear was to be had, 2) there wasn't enough activity on 220 mc and higher. They felt cheated. The commercial manufacturers, on the other hand, saw a vast untapped market in this 'new breed' but hesitated about the production troubles and expenses involved in turning out gear for 220 mc and higher. They would much rather put out gear for 6 and 2 meters where their problems are fewer and their profits could be higher. The combination of these two groups (out essentially for the same thing) produced the opening of 6 and later ½ of 2 meters to the Technicians.

"Even now, pressure is being brought to bear to hand over the other half of 2 meters to the Techs. And many long range planners in their ranks have eyes on 10 meters as well. Where will it end?

"And now you want to let another vast hoard of interlopers into our bands. No thanks, one group masquerading as technicians (small 't') is enough to contend with. Let's not fight for incentive licensing with one hand while the other hand opens the floodgates to half-hams. We must all be full-hams if we are to survive in this changing and crowded world.

"The idea of letting half-qualified persons in the ham bands has merit . . . when suggested by the editor of *Popular Electronics;* but not when uttered by the editor of *CQ!* Just whose side are you on, anyway?"

Obviously (from January ZERO BIAS), we're very much against CBers on the ham bands, too, Al, but it seems that you've been very quick to classify anyone with poor or no code copying ability as a "CB-Type." Perhaps a quick poll on 75 or 20 phone some weekend just might turn up a fair number of "CB-Types," by that standard.

"Give . . . [them] . . . an inch and they'll take a mile," you say. Funny, my ham radio history book doesn't say anything about any group taking anything. As far as the Technicians are concerned, never has there been any serious Technician lobby for expansion of their privileges. Any expansions of privileges have come either by way of ARRL petition or FCC rule making. Gripes should be directed to them.

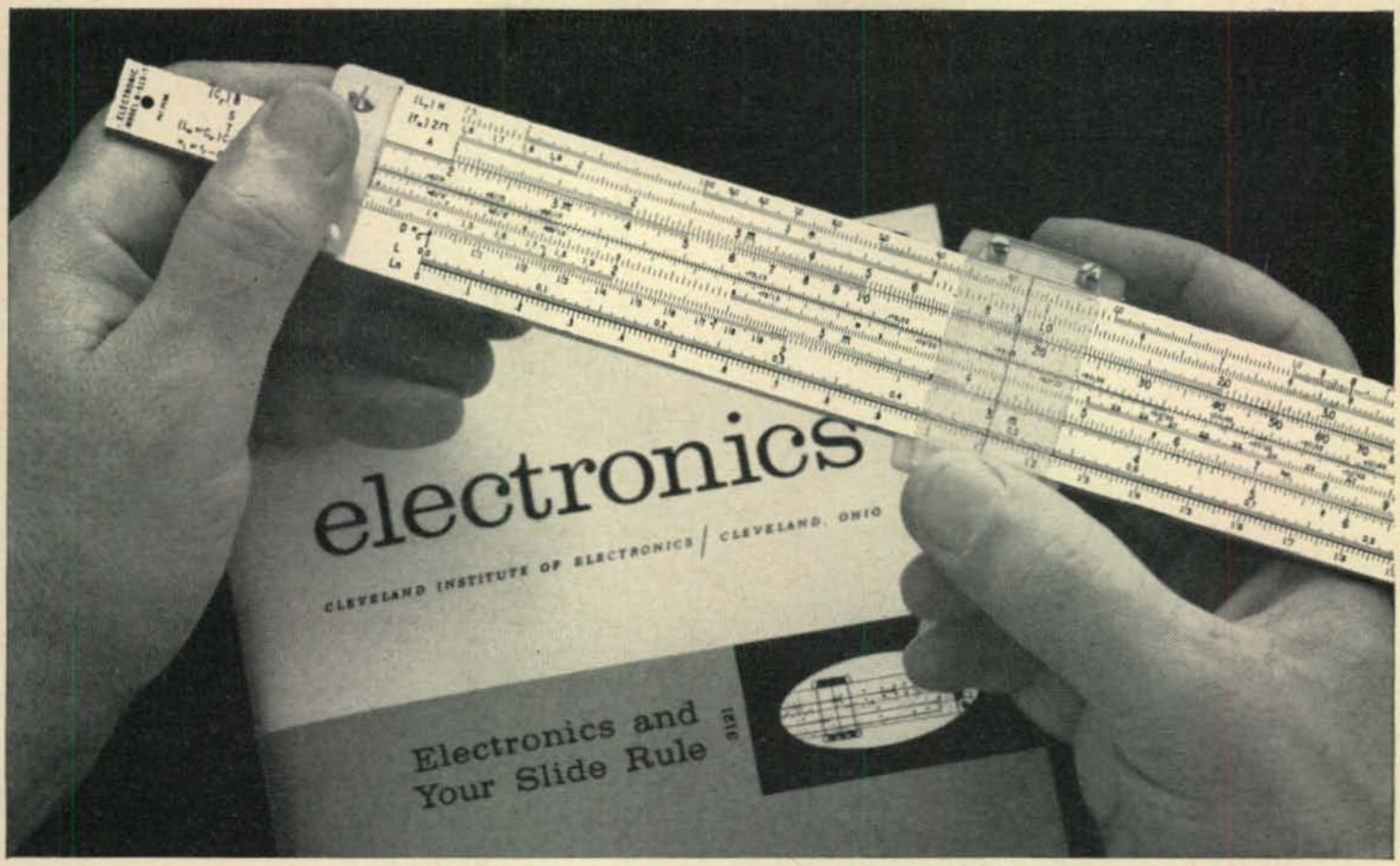
Let's not allow our prejudices to blind our reason. Ham radio has always been a progressive hobby; let's not close our eyes to a changing amateur situation.

From WA4EFS: ". . . The five word per minute requirement for the technician license is incredibly simple and I fail to imagine how anyone with the intelligence to experiment could encounter difficulty in this regard. However, it is conceivable that some may object to this requirement on the grounds that it is a disciplinary one and unnecessary to their purpose . . ."

Lloyd, it is not our feeling that 5 w.p.m. is impossible to attain for a large number of fellows but rather that it is just enough of a deterrent from obtaining a Technician license to cost amateur radio the services of a potentially valuable investigator. We are among those who feel that in *some specialized cases only* the code requirement is an unnecessary disciplinary requirement.

From WB2GFY: "I think the suggested new class of licensee should know the code and be familiar with emergency procedures."

Excellent suggestions! To require at least the knowledge of the code (though not necessarily at speed) is not too much to ask of anyone. The reason is not so much to limit the number of applicants, but rather to aid the licensee in conducting whatever experiments he may find interesting. Emergency procedures, of course, are basic to any of the radio services, and though it is hardly likely that much emergency work would be done above 420 mc, the possibility exists and should not be overlooked. Dick, K2MGA



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Once you've seen CIE's Electronics Slide Rule, you'll know why hams across the country call it the most useful, practical tool they've come across in years. It's perfect for adjusting your rig . . . for designing test circuits . . . for figuring coil windings, db's, operating frequencies, resistor sizes and power ratings, proper inductor and capacitor sizes . . . for accurately matching antenna to final.

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With NEW

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"Tig-Array", a direct descendant of the World Famous TA-33 Trap-Master and features top three band performance on 10, 15 and 20 meters, rugged Trap-Master construction and power rated to 750 watts AM and CW, 2000 watts P.E.P. on SSB (input to final amplifier).

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If you own one of the famous TA-33 Juniors . . HERE IS GOOD NEWS . . a version of "Tig-Array's" radiating element is available as a modification kit to . . BOOST THE POWER RATING TO EQUAL THAT OF NEW "TIG-ARRAY" yet will not effect the function of your TA-33Jr.

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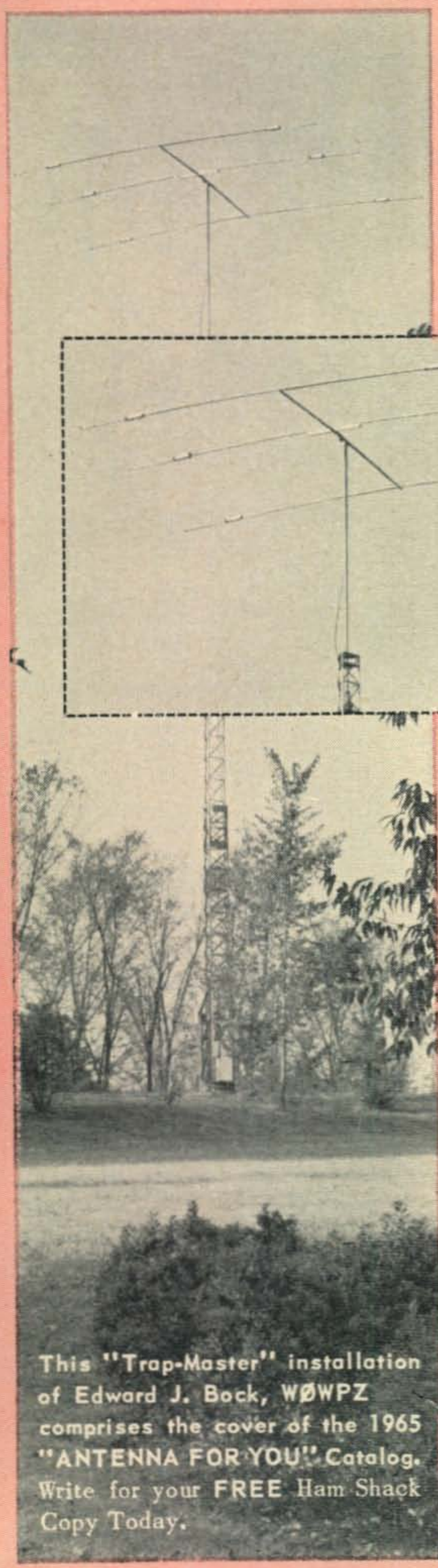
For further information, check number 6, on page 110

IS THIS THE ANTENNA FOR YOU?



It is if you want Results!

Your Letters are PROOF.

Dear Sir:

I came on the air April 11, 1963 using the TA-33 Sr. beam. By Sept. 2, 1963 I had worked WAS, WAC and 53 countries including 5-8 from Saudi Arabia and 5-9 from Ethiopia. I am convinced the TA-33 is the reason for my success. Thank you for a wonderful beam.

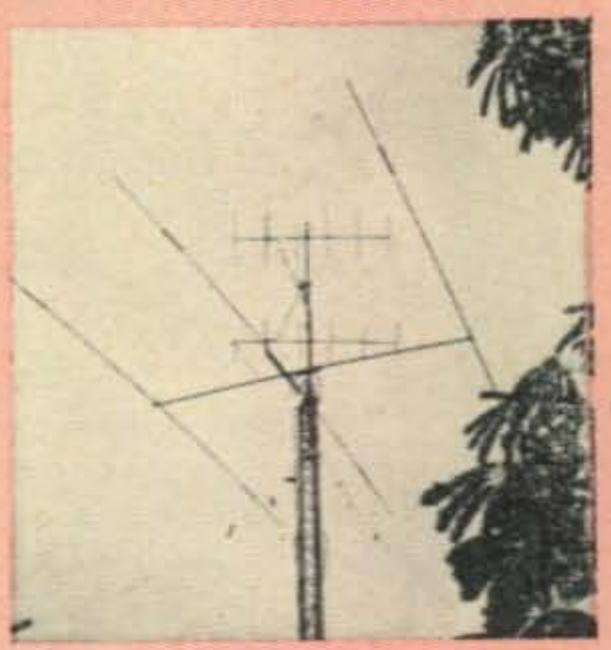
Sincerely,

James A. Ogden - W9FFS

Caseyville, Ill.

Dear Mr. Mosley:

I'm inclosing a snapshot of a TA-33 Jr. which just went through the eye of Hurricane Cleo. Cranked down to 20 ft. the beam withstood the 120 m.p.h. winds With No Damage. You are to be congratulated on a fine product.



73,

Jim Wilson - WA4RXG

Ft. Lauderdale, Fla.

This "Trap-Master" installation of Edward J. Bock, WØWPZ comprises the cover of the 1965 "ANTENNA FOR YOU" Catalog. Write for your FREE Ham Shack Copy Today.

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For further information, check number 7, on page 110

Call Letters by the Hundreds

Editor, *CQ:*

I wish to applaud you in your recent action concerning the publication of hundreds of call letters, wasting two or three pages of *CQ* [ZERO BIAS, No. '64]. Excellent editing on your part. Please don't let your recent success make you lax, however; 3,895 call letters, filling four pages slipped by in December (pp. 59-62).

Joe Sullivan, WA4JRN
4219 Vassie Drive
Tuscaloosa, Alabama

Hmmm, does look a little strange, doesn't it? Really, though, it's not quite as contradictory as it might seem. For five years now, *CQ* has submitted to popular demand to publish a complete and accurate listing of holders of our various awards, and the current standings in some of them. The popular interest in this now-traditional item is surprising-even to us. For instance, space and time precluded its publication in the November issue, as usual, and the mail complaining of its absence was enormous! Of course, we had already planned to have it in December.

It was my feeling that it was much more to the reader's interest to publish our Honor Roll than a random listing of call letters of which only about 10% served any specific purpose. Looking back on November's ZERO BIAS, it does appear that I was venting my rage on *all* tabulations, but this was not intended. After all, such a blanket condemnation would cover contest results also—certainly a peculiar state of affairs for a magazine sponsoring some of the largest ham contests in the world.

Joe, it wasn't the call letters themselves, but rather the nature of them, the reader interest, and the attitude with which they were submitted that determined whether or not they would be published.—*K2MGA*

Re: Editorial Policy

Editor, *CQ:*

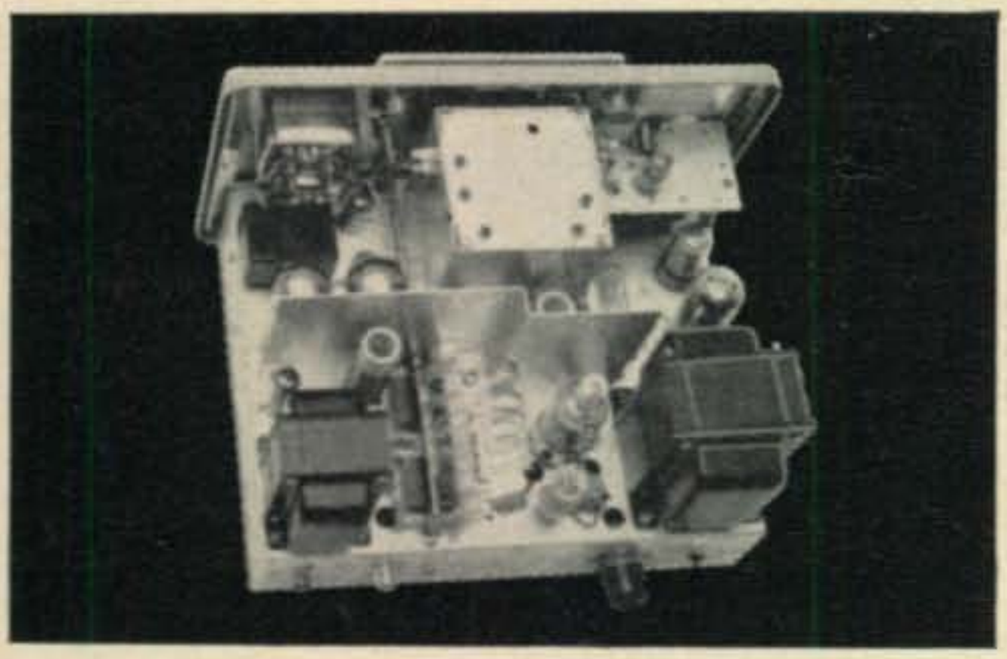
We had dropped our subscription to *CQ* in 1959 because we did not agree with the thinking of your editor at the time, Mr. Wayne Green. We also felt at that time the articles in *CQ* had little to offer us.

However, last April I did renew *CQ* and enjoy reading it every month. The articles are interesting and informative. The main reason my interest in *CQ* was renewed was its editorial stand in support of the League and against Mr. Green. In printing of the true facts and exposing the half-truth's and lies that have been printed in "Green's Comic Book" you have my full support.

Keep up the good work.

Arthur R. Rauch, W2DID
451 Smith Street
Central Islip, New York

For further information, check number 8, on page 110



Some may call it "ancient modulation", some simply call it AM phone—but whatever you call it, AM still represents a major portion of today's amateur activity—and the "Ranger II" is one of today's most popular AM rigs! For AM or CW operation, for 160 through 6 meters—the "Ranger II" offers the "biggest-little" 75 watts you'll find on the air! Rated at 75 watts CW and 65 watts high-level AM, the "Ranger II" delivers communications quality audio with the necessary punch to break through today's QRM! An excellent "first" transmitter for the Novice or the new General, the "Ranger II" will drive any of the popular kilowatt level tubes and will provide a high quality speech driver system for high powered modulators without modification! What else? The "Ranger II" offers attractive styling in a compact cabinet and is available at a reasonable price.

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FEATURES

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EASY TUNING

Basic tuning controls are located on the VFO dial escutcheon—QSY within the phone or CW portion of a band is usually possible by merely changing the VFO frequency setting.

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Drop us a card and we will send you Amateur Catalog 962 which gives the full "Ranger II" story, as well as detailed information on our complete line of amateur transmitters and accessories.

E. F. JOHNSON COMPANY
WASECA, MINNESOTA, U. S. A.

For further information, check number 9, on page 110

Editor, *CQ:*

I tried to purchase a copy of the November 1964 edition of *CQ* but the newsstands were sold out. Due to this I decided that a subscription would be in order.

Yesterday I visited the local "ham emporium" and persuaded the clerk to sell me his November copy. After reading your editorial I was sure that I had taken the right step in subscribing.

The leave taking of K6BX is one of the most positive steps taken in the last five years to make amateur radio better for us all. I am now looking for my USA-CA book which I started a few years ago and will try to bring it up to date. I was very much interested in this program until I happened across one of K6BX's hate sheets and decided that any project he was involved in was not for me.

Congratulations on your decision and also on your fine magazine. The quality of articles and the magazine in general during the past few months has been excellent. The November issue was about the best *CQ* I have seen in the past twelve years.

Your editorial policy of "loyal opposition" to the League is very heartening. I believe that the ARRL has provided strong and positive leadership for amateur radio and directly owe my license to the services they provide. Kudos to you and the staff of *CQ*.

Gordon F. Fox, W1YNE
151 Whipple Road
Esmond, Rhode Island

Code Practice

Editor, *CQ:*

For the benefit of the western United States amateurs, this station wishes to announce that it has finally got its code practice broadcast underway.

We will be on the 80 meter band, 3790 kc to start with, Monday, Tuesday, Wednesday, and Thursdays of each week beginning at 0300 GMT or 7 P.M. PST and running through 0430 GMT. The broadcast will start out at 6 w.p.m. and continue through 35 w.p.m. with 10 minutes at each speed. Text for these broadcasts will be taken from ARRL publications and the publication and the page number of the text will be announced at the beginning and end of each tape. We hope to be able to add 40 meters to our schedule in the near future,

Please keep up the good work on a fine magazine and we wish to thank you in advance for letting us use your magazine to promulgate the above information.

J. (Dean) Rose, WAØDLG/6
c/o Amateur Radio Station K6NCG
U.S. Naval School Command
Box 105, Bldg. 318 Treasure Is.
San Francisco, California

S-Line on 160 M.

Editor, *CQ:*

"Rough Uncle George" made a boo-boo! Re: my article in October '64, on Putting the S-Line on 160; I have found the gain to be down badly on the 3.6 to 3.8 mc band.

This was first brought to my attention by Rex, G2CDN, and other G's as this is their phone band!

With the recent announcement of an up-converter for about $25.00 by Drake, I would no longer suggest my method. I am working this problem out in my own receiver and may have to change switch wafers.

My apologies to anyone needing 3.6 to 3.8 mc such as the boys near London. Replies came from all over, many quite happy; but this slipped through unnoticed.

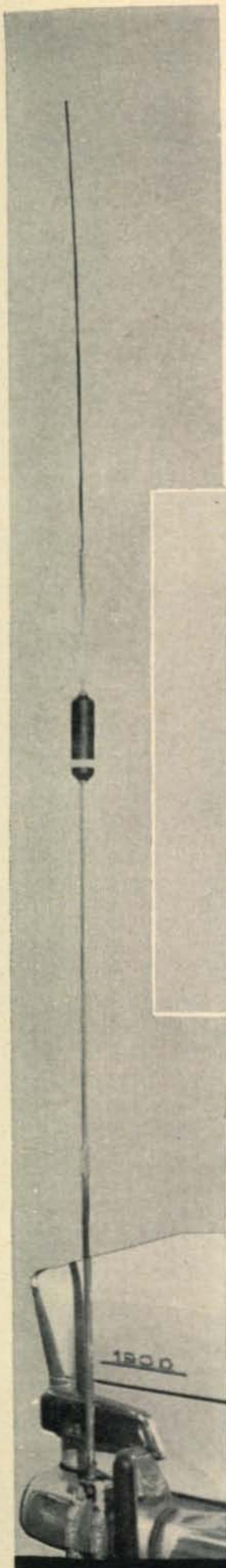
E. E. Baldwin, WØRUG
5050 Table Road
Longmont, Colorado 80501

Lethargy and Frequency Conferences

Editor, *CQ:*

Congratulations to W6SAI on his very profound and pertinent article "Concluding Thoughts on a Forthcoming Frequency Conference," Part II in the November issue. I agree with his point of view 100%. I would now like to add some of my own comments and observations concerning the strength of ham radio in the United States. In my candid opinion, there is a great amount of apathy among amateurs towards their hobby, not only among the old timers who have lost interest with age, but among the younger fellows as well.

I have operated in three different states in three different call areas during my six and one-half years as a ham, exclusive of portable operation. In Oradell, N.J., a suburb of New York, I operated as K2RHJ for about five



Here's *Waters* NEW

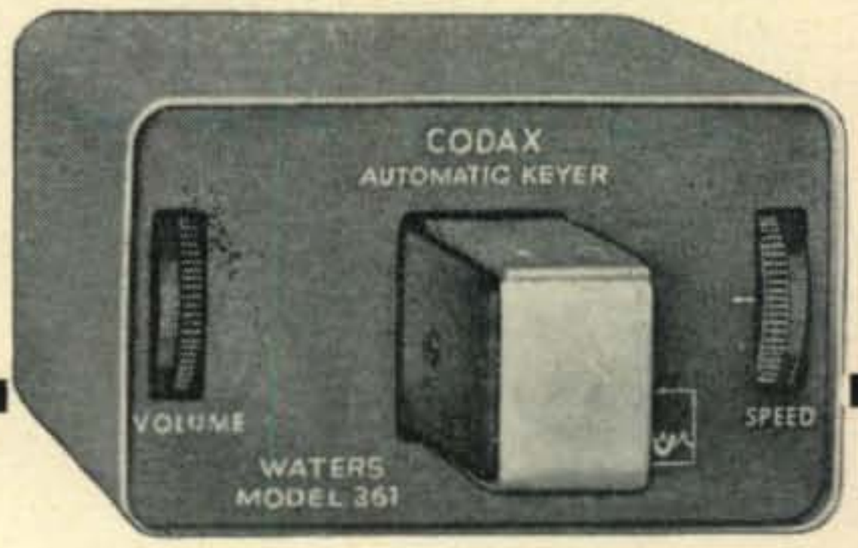
AUTO-MATCH!

4db Stronger Mobile Antenna

The new Waters AUTO-MATCH—engineered to endure! Operates with only a coil change on every ham band with maximum radiation efficiency improving signal strength up to 4 db's! Top-Center loading coils are interchangeable and are molded in low-loss, waterproof Epoxy . . . Tapered radiator tip is stainless steel and adjusts to all frequencies . . . High Q stable inductance handles 500 watts of RF and at resonance presents an "Auto-Match" of 50 ohms . . . The lower mast is of aircraft aluminum tubing . . . upper mast of solid tapered-drawn aluminum rod. Built-in foldover drops AUTO-MATCH to car-top level. And AUTO-MATCH fits any standard base or bumper mount. Built to last for car after car and rig after rig you'll enjoy years of efficient mobile operation with AUTO-MATCH. At your distributor now.

PRICES

Mast 370-1	$12.95	Coil 370-20	$13.45
Radiator Tip 370-2	$ 9.95	Coil 370-15	$12.75
Coil 370-75	$15.95	Coil 370-11	$11.95
Coil 370-40	$14.95	Coil 370-10	$11.95



NEW!

Waters CODAX™ Automatic Keyer

CODAX—new rhythm-smooth automatic keyer by Waters—never anything like it! Feather-touch double paddle adjusts on each paddle for preferred gap and tension with spacing and timing from 5 to 50 WPM fully automatic. Self-powered, CODAX simply plugs into mike jack to work USB, LSB or AM. Circuitry is solid state digital with hermetically sealed "Reed" relay. Own signal can be monitored as well as station being worked. CODAX brings new adventure to CW. At your distributor now.

Model 361 ..... $92.50

WATERS
MANUFACTURING INC.
WAYLAND, MASSACHUSETTS

For further information, check number 11, on page 110

years, and I would like to commend this area on the great amount of actual amateur service performed. There are several active clubs in the state, including several good high school organizations and the well-known NJDXA.

Activity is always good and it is not confined to one or two bands, but all bands are used, including 10, 6, and 2! Out of some thirty hams in Oradell, about 50% are regularly active and the rest are active as their schedules permit. Only one or two are completely inactive. Also, in terms of public service, there are several active nets in the area which handle large volumes of traffic, particularly in New York City, from stateside and abroad. In short, the amateurs in this area make good use of ham radio, both for their own enjoyment as a hobby, and for the good of the public at large.

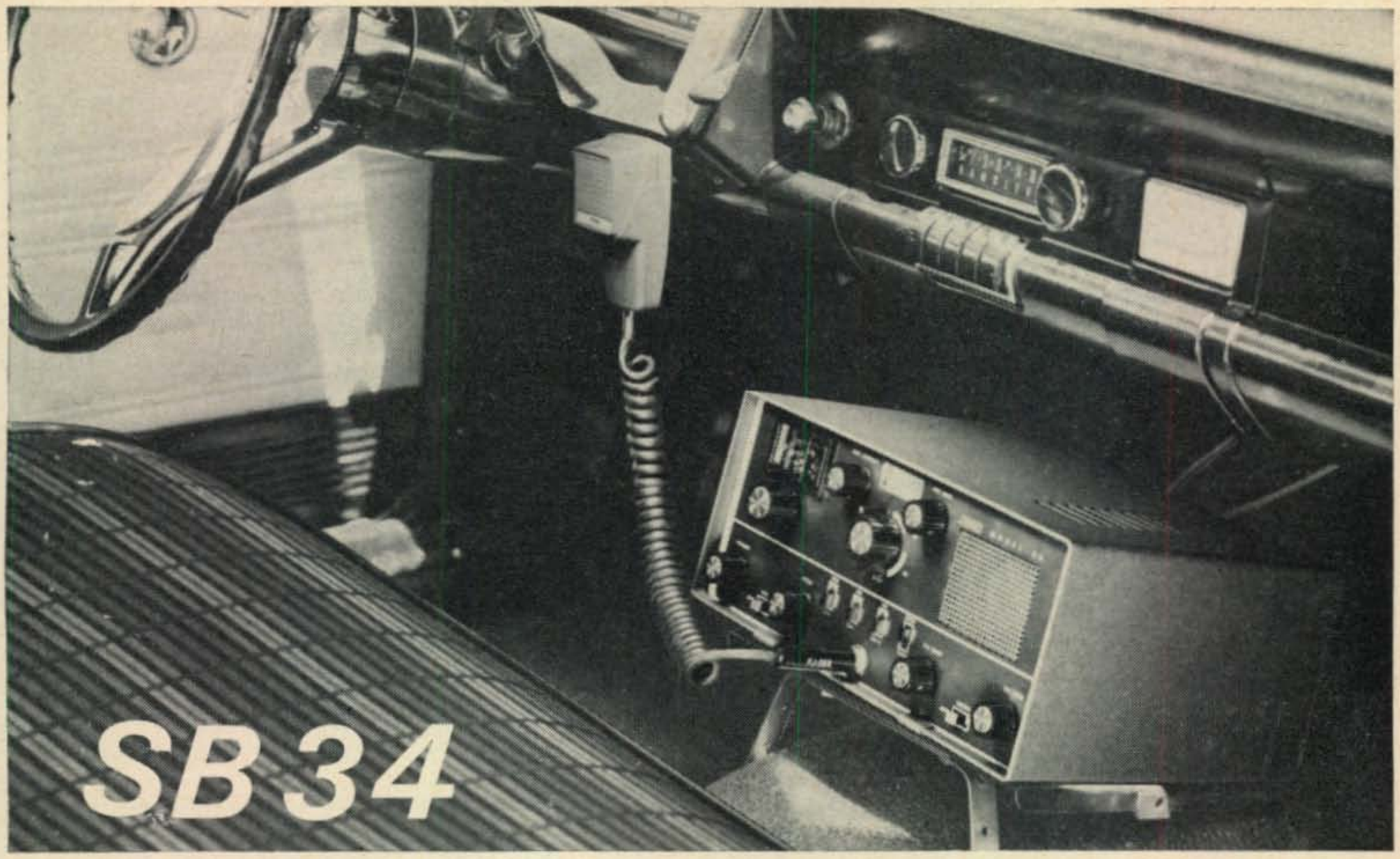
The above is unfortunately not the rule all over the United States, but is rather becoming the exception. I operated from Morgantown, W. Va. for a little less than a year as W8EXK and still do operate from there whenever I'm in the area. Out of some thirty hams or more in Morgantown, only about five or ten are regularly active including WA8IMX, WA8IMY and myself. The rest are either too engrossed in CB, or just do not care about what happens with ham radio. Some have retrogressed so far that I would bet a few could not even pass the General exam again if they had to. Of the amateurs that do operate in the state, the majority operate only one band, namely 75. Ten is *completely* inactive and 6 and 2 have only a handful of stations active in the entire state, although this is an area whose geography lends itself beautifully to v.h.f.! We who are active in Morgantown try to work as many bands as possible, but we all receive complaints from hams about how hard it is to work W. Va. although there are a good many hams in the state. The Morgantown ARC is a fairly active group, however, and last Spring produced about 15 Novices from its classes. With clubs like this perhaps things will take a turn for the better in this area, and the enthusiastic hams will counterbalance the deadwood.

The same is true in my home state of Maine, where I operate as K1YHK from Lincolnville Beach. I belong to the Knox County Amateur Radio Club which has some 30 to 50 members on paper only. At the last meeting, five showed up. The meeting was well-advertised, but the majority of members just showed no interest in doing anything for the sake of public service or for the sake of ham radio. The little operation there is in the state is not half what it could be and is confined to only one band, again usually 75. There is no 10, 6, or 2 meter activity to speak of in this area. An attempt by local hams to spur some activity on 10 meters by forming a local rag-chew net failed when no one showed up.

I could go on further, but I think I have made my point clear enough. The hams in this country are going to find themselves in a sorry state when the powers that be decide that certain bands should be taken away from them because of inactivity, or when the exam requirements are tightened up as they should be. Perhaps an incentive licensing program of some sort should be initiated, but whatever the solution, something should be done quickly to revitalize ham radio and clear out the inactive and disinterested. Just because the U.S. has two-thirds of the hams in the world does not mean that we can be complacent and apathetic towards preserving our hobby. The officials and representatives at the ITU conference aren't going to look very favorably upon our large, but disorganized and disinterested ham population when it come to frequency allocation. The frequencies we now should be using could be put to better use in their eyes. We should forget petty differences and unite behind the ARRL and supporting organizations as a nation should unite behind its leaders, and enthusiastically support the work they are doing to preserve our frequencies and to re-establish the enthusiasm and integrity of ham radio.

Congratulations also on a fine ham publication, and I hope you will continue to spark the interest and imagination of hams all over the world with your top-grade articles and editorials.

Eric R. Lindquist, K1YHK, W8EXK, ex-K2RHJ
Sea Bluffs
Belfast Road
Camden, Maine 04843



...but where's the power supply ?

The power supply—and it's universal for both 12V DC and 117V AC—is neatly tucked in a corner **inside** the exceptionally small cabinet that mounts easily in the front section of the car—and leaves plenty of room for the driver and other members of the family.

And **SB-34,** 4-band SSB transceiver, goes mobile on a moments notice!

Two power cables come with your SB-34. Use one when you are operating the '34 as a fixed station on 117V AC. Use the other for 12V DC mobile. No strapping—no conversions. There's even a handle on the case for easy carrying.

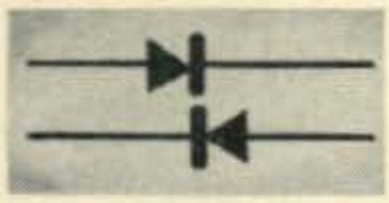
Convenient certainly—but dollar-saving too because the very low price **includes** this universal supply—saves you the cost of a separate inverter. And it's assuring to know that '34 is easy on the battery—that the all transistor receiver draws only 500ma on standby.

THE BIGGEST SSB TRANSCEIVER VALUE!

EXPANDED FREQUENCY COVERAGE

PANEL SWITCH SELECTS USB OR LSB

SOLID-STATE DIAL CORRECTOR



NO RELAYS— SOLID-STATE SWITCHING

DELTA RECEIVER TUNING

COLLINS MECHANICAL FILTER

Please send data sheet on **SB-34** transceiver

NAME

NUMBER STREET

CITY STATE

SBE

317 ROEBLING ROAD, SOUTH SAN FRANCISCO, CALIF.

Suggested price.

$395

HIGHLIGHTS: 135 watts p.e.p. input (slightly lower on 15). **Freq. range:** 3775-4025 kc, 7050-7300 kc, 14.1-14.35 mc, 21.2-21.45 mc. 23 transistors, 18 diodes, 1-zener diode, 1-varactor diode, 2-6GB5's PA, 1-12DQ7 driver. **Speaker built in** (external speaker provisions)

Pre-wired receptacles on rear accept VOX and Calibrator—both optionally available.

SIZE: 5"H, 11¼"W, 10"D. Approx. 20 pounds.

Export sales: RAYTHEON Raytheon Company, International Sales & Services, Lexington 73, Mass. U.S.A.

For further information, check number 13, on page 110

Re: January Zero Bias

Editor, *CQ*:

The only place for the ham to contribute his technical abilities, as far as new concepts go, are in the v.h.f.-u.h.f. bands. With low band crowding, these frequencies are going to become more and more important to us. To give any part of what may be hardly used bands in the v.h.f.-u.h.f. spectrum to CB'ers would be like giving 20 meters to TV! Unless a radio service can do our job better than we are doing it, then they have no right to consider taking our valuable spectrum space and wasting it! Surely, Mr. O. P. Ferrel's suggestion was made in jest.

Maury Swartz, WA4LYL
623 Penn. Avenue
Norfolk, Virginia 23508

Editor, *CQ*:

Is it so difficult to pass a General exam? I was 55 years old with less than six months part time on my own, no outside help made General the second time (code licked me the first time.)

I was working long hours and still was up before 5 A.M. to go to Boston for exam.

Perhaps, as you suggest, an Amateur Extra exam to qualify for 420 mc and up will sort the men from the little boys such as I hear on CB. ("Get off this channel, I had it first").

James M. Stevenson, WA1BJT
102 Malden Street
Worcester, Massachusetts

K2BVC Honored By Club Award

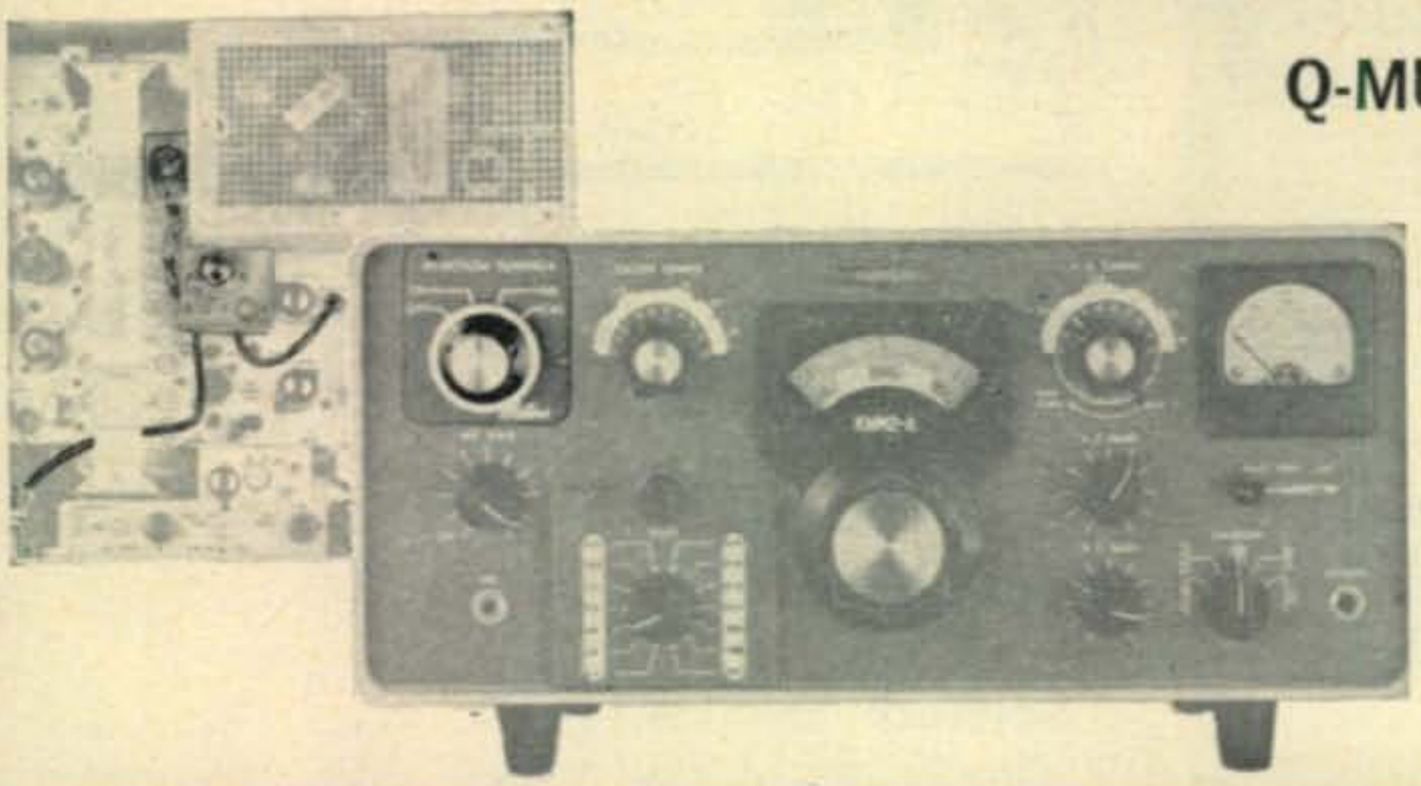
The Communications Club of New Rochelle, N.Y. has established the Lawrence Kohlman Memorial Award in tribute to the late K2BVC, prominent v.h.f. operator who was killed in an automobile accident last July. The award is to be made to that member of CCNR who—in the judgment of the Officers and Directors—has best-exemplified in his own activities those of Larry, and will be awarded from year to year when the Club's management group deems it has been earned.

This year's initial award of the new citation, in the form of a suitable plaque, was made at the CCNR Annual Meeting and Dinner, and was presented by Mr. and Mrs. Lawrence Kohlman, Sr., before some 100 members and guests. Recipient was Rob Escallon, WB2FXB.

In presenting the award, reference was made to the way he has served both the amateur radio service and CCNR, and his "unstinting willingness to help other amateurs." WB2FXB holds public service citations from both County and National Red Cross; is net manager of the County emergency net; and has been cited for his operating skill at K2US by several amateurs contacting the station during the Fair. In addition, he has been a bulwark of CCNR activity in v.h.f. areas such as Field Day, Sweepstakes, etc. CCNR was second nationally in FD '64, first in multi-op class in the Fall VHF SS.

In addition to his parents, many friends of the late K2BVC were present at the Dinner, both from CCNR and outside of its membership.

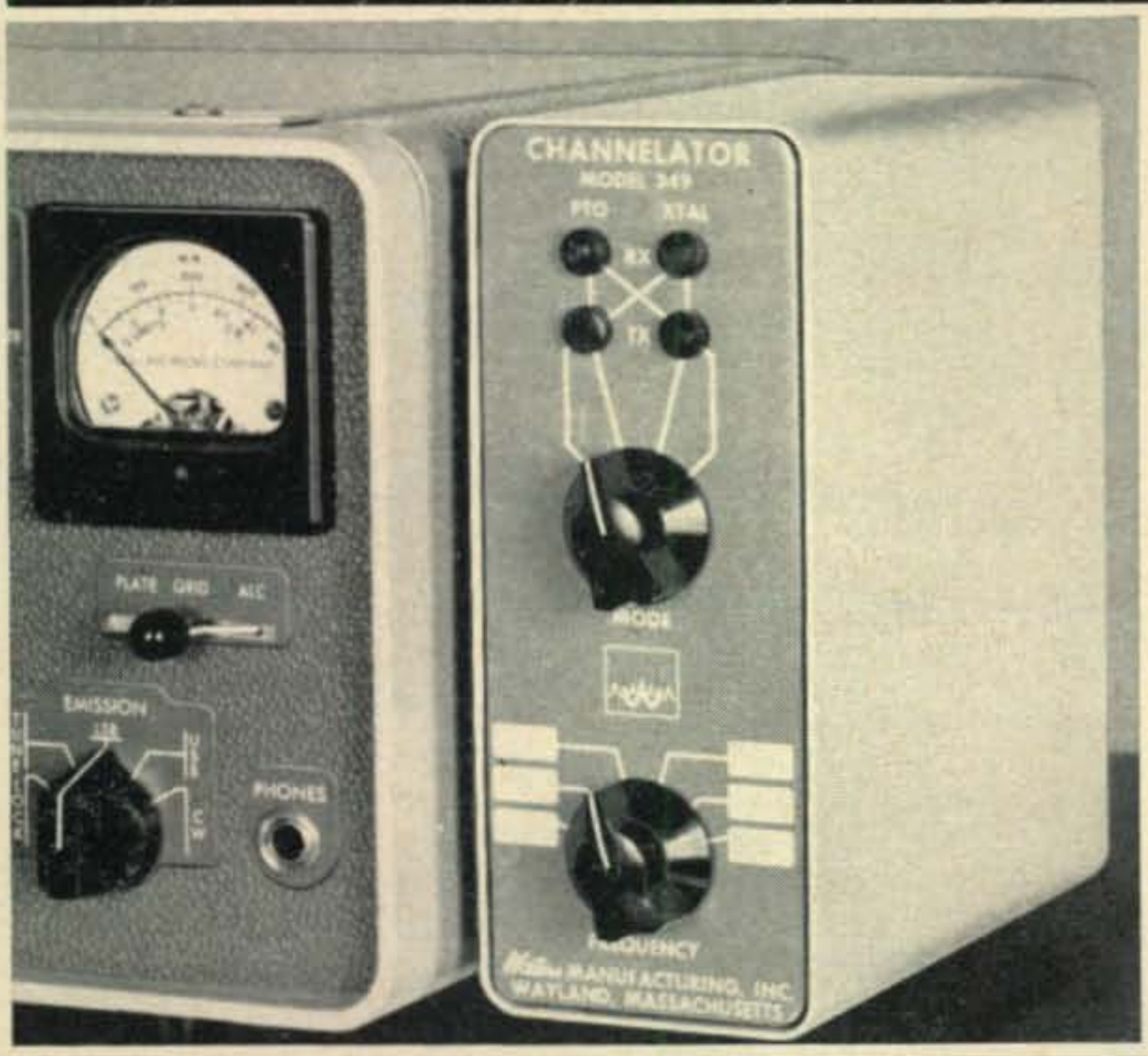
Waters "Convenience Engineered" accessories for your KWM2/2A



Q-MULTIPLIER/NOTCH FILTER™

The Waters Q-MULTIPLIER/NOTCH FILTER eliminates heterodynes and other unwanted signals with over —40 db notch tunable over the entire IF passband. Assembled and ready for installation, the Q-Multiplier/Notch Filter becomes an integral part of your KWM2/2A with escutcheon plate and knobs matched to the Collins panel; no drilling. **$53.75**

For **Collins** 75S-1 ..... **$39.95**



CHANNELATOR™ Crystal Frequency Control

The CHANNELATOR resolves KWM2/2A transceiver tuning problems. Instantaneous switching to any of six pre-selected, exact crystal frequencies; covers complete PTO range. A built-in heterodyne frequency meter and "pullable" crystals permit exact frequency adjustment for Net or Round Table operations. You can operate normal PTO or "split channel." The Channelator installs in minutes—all cables and plugs are furnished—no drilling; operates from any fixed or mobile KWM2/2A power supply. PRICE, (less crystals):

$79.95

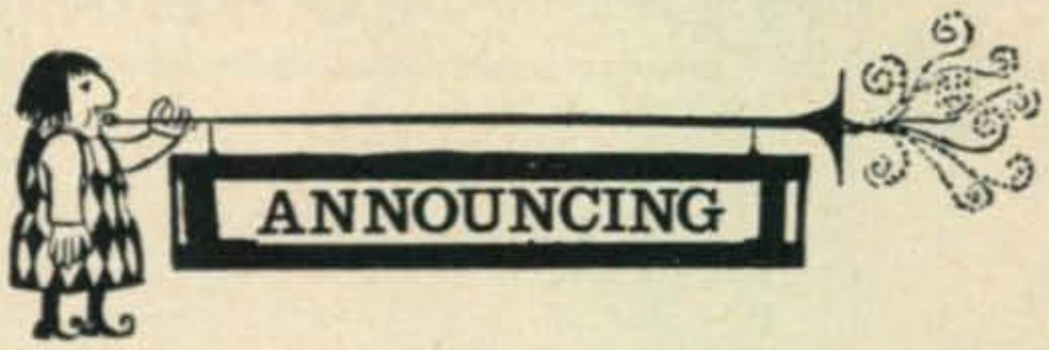
CRYSTALS . . . any frequency
USB or LSB **$6.00**

EVT™ ELECTRONIC VERNIER TUNING

EVT™ Electronic Vernier Tuning gives you 20-to-1 tuning ratio in your KWM2/2A. A stable, solid-state varactor tuning device, EVT attaches to your PTO *without* wiring changes. Precise, slow-rate tuning makes small frequency changes easy, especially when "mobiling" in traffic. Tuning range is ±500 cycles from any PTO setting. Zener regulator maintains well-known Collins stability. EVT may be used with **any** power supply. **$23.95**

WATERS
MANUFACTURING INC.
WAYLAND, MASSACHUSETTS

For further information, check number 15, on page 110



Cleveland, Ohio

We received the following News Release from the Mueller Electric Co.

"Mueller Clips Used In Dastardly Deed"

"The Mueller Electric Company product-use file (the one labeled Ridiculous, not the one named Sublime) recently gained another entry when a New York Police Lieutenant phoned while tracing all parts used in the bazooka device which tossed a 9" shell in the general direction of the UN Building."

"As you read in the headlines, the shell didn't quite reach the UN, but the time-trigger, connected by means of Mueller Clips, worked perfectly. 'Ah well,' stated Scott Mueller, General Manager, 'another testimonial we may never get!' . . . doubtlessly thinking of occasions when life at Mueller is spiced by calls from police officers. Added Ed deConingh, Chief Engineer, We question their judgment in all but clips, but the affair gives poignant new flavor to our old slogan, 'Wherever electrical current flows, you will find Mueller Clips serving mankind.' "

Ft. Lauderdale, Florida

The ninth annual Auctionfest of the Broward Amateur Radio Club will be held Saturday, March 6th, 1965 at the Armory, SW 24th Street (Route 84) and SW 4th Avenue, Ft. Lauderdale, Florida, from 8 until 5. For further information contact Fred Schmidt, W4NYF, 405 NW 30 Ter., Ft. Lauderdale, Florida 33311.

Toledo, Ohio

The Toledo Mobile Radio Association will hold its 10th annual Ham Auction on Valentines Day, Feb. 14th, 1965, starting at 11:00 a.m. EST. It will be held in the new auditorium of the Lucas County Recreation Center in Maumee, Ohio. Check with W. E. Smith, K8LFI, for more details. His address is 5030 Janet Avenue, Sylvania, Ohio.

Wheaton, Illinois

The third annual mid-winter Ham Swap and Shop will be held at the DuPage County Fairgrounds, at Wheaton, Ill., on Sunday, February 21st, 1965. All amateurs and enthusiasts are invited to attend and to bring any equipment that they wish to swap or sell. $1.00 donation is payable at the door. Write to John Koranek, K9GTT, 505 East Illinois Street, Wheaton, Illinois for particulars.

Urbana, Illinois

Three members of the staff of the University of Illinois are planning an expedition in conjunction with a pending NASA rocket launch. They are W3ZHT/9, WA9DNF ad W9YRV. Amateur radio maritime operation on 40, 20, and 15 meters is planned.

An escort carrier, the USNS Croatan will leave Baltimore on January 25th, 1965, traverse the Panama Canal on Feb. 2nd, operate in the Pacific off Lima, Peru, from Feb. 10th to March 4th, then steam to arrive at Valdivia, Southern Chile, on March 28th. From there they will return to Baltimore on April 14th. Look for these three, for some interesting maritime mobile contacts.

New York, New York

Although the announcement reads "We regret to advise that Bernard Cohen, Secretary/Treasurer of Marty Nettan Sales Inc., (prominent metropolitan amateur equipment sales reps) Manufacturers representatives, passed away at the premature age of 30 years," it can not begin to tell the story of the man. For those of us in the New York area who had the privilege of knowing, working and in my case sharing a first job with him, will miss his quick wit, warm personality, and most of all his friendship.—*K2EEK*.

EVERYTHING YOU WANTED IN A SSB TRANSCEIVER WE PUT INTO OUR SWAN-350

THE SAME OLD SWAN RELIABILITY AND PERFORMANCE!

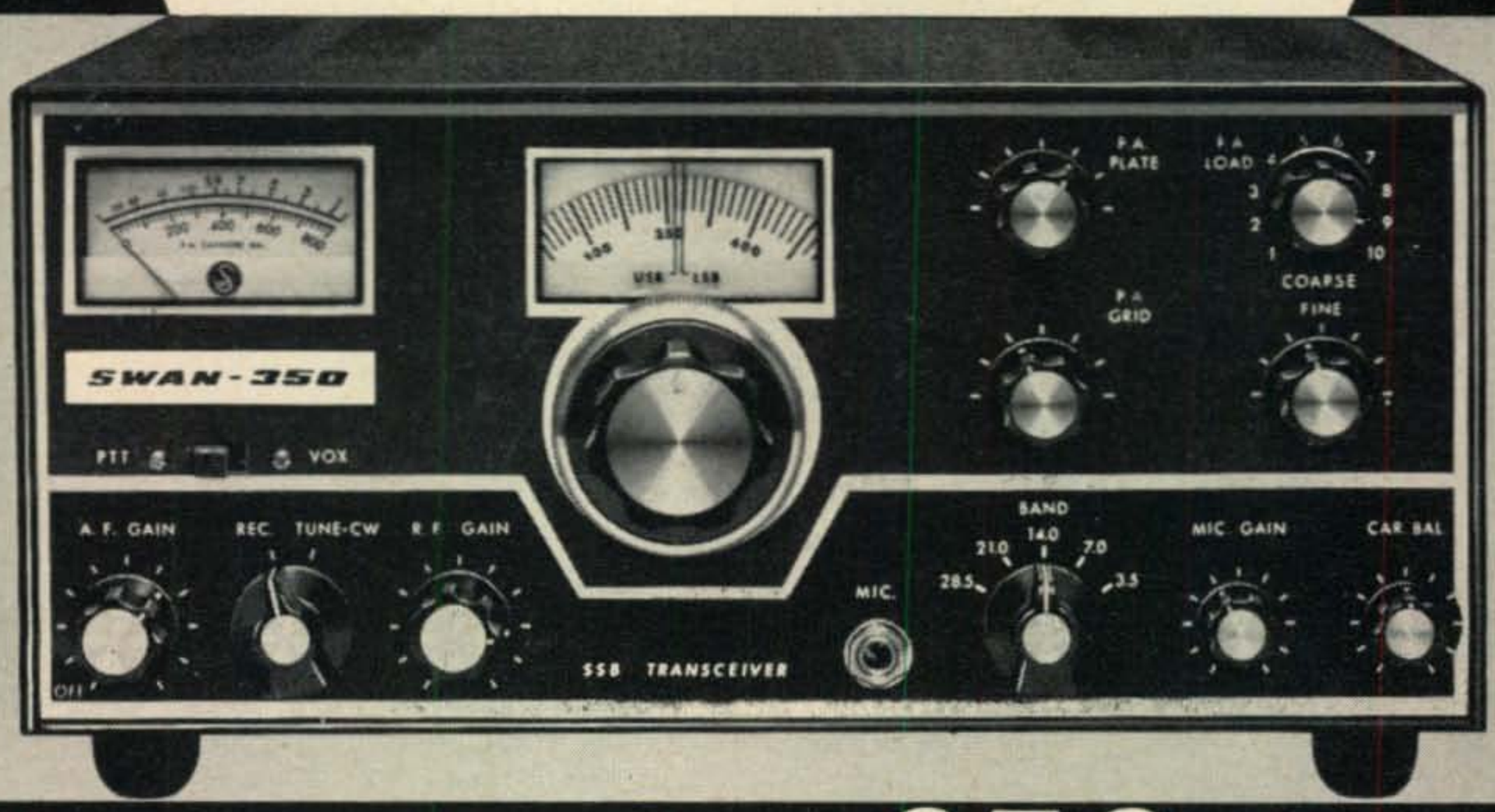
WIDER FREQUENCY RANGE — 5 BANDS!

MAXIMUM POWER — 400 WATTS!

FINEST VOICE QUALITY — R5!

PRECISION DUAL-RATIO TUNING

A REASONABLE PRICE — $395



THE NEW SWAN 350 TRANSCEIVER

5 BANDS — 400 WATTS — $395

HOME STATION — MOBILE — PORTABLE

- 3.5 - 4.0 mc, 7.0 - 7.5 mc, 13.85 - 14.35 mc, 21.0 - 21.5 mc, 28.5 - 29.0 mc (10 meter full coverage kit available.)
- Transistorized VFO, temperature and voltage stabilized.
- Precision dual-ratio tuning.
- Crystal lattice filter.
- ALC . . . AGC . . . S-Meter.
- 5½ in. high, 13 in. wide, 11 in. deep.
- 400 watts SSB input
  320 watts CW input
  125 watts AM input
- Sideband suppression: 40 db
  Carrier suppression: 50 db
  Third order distortion: 30 db
- Lower sideband on 80M and 40M.
  Upper sideband on 20M, 15M, and 10M.
  (Opposite sideband kit available.)

ASK THE HAM WHO OWNS ONE!

ACCESSORIES:

- AC power supply, matching cabinet with speaker. Model 117-C ..... $ 85
- 12 Volt DC Power supply. Model 412 ..... $130
- Plug-in VOX. Model VX-1 ..... $ 35
- Accessory kits to be announced.

SEE THE NEW SWAN-350 and THE DELUXE SWAN-400 AT YOUR DEALERS NOW!

SWAN ELECTRONICS CORP.
Oceanside, California

For further information, check number 17, on page 110

The Amateur Radio

Club Forum

By AL SMITH, WA2TAQ

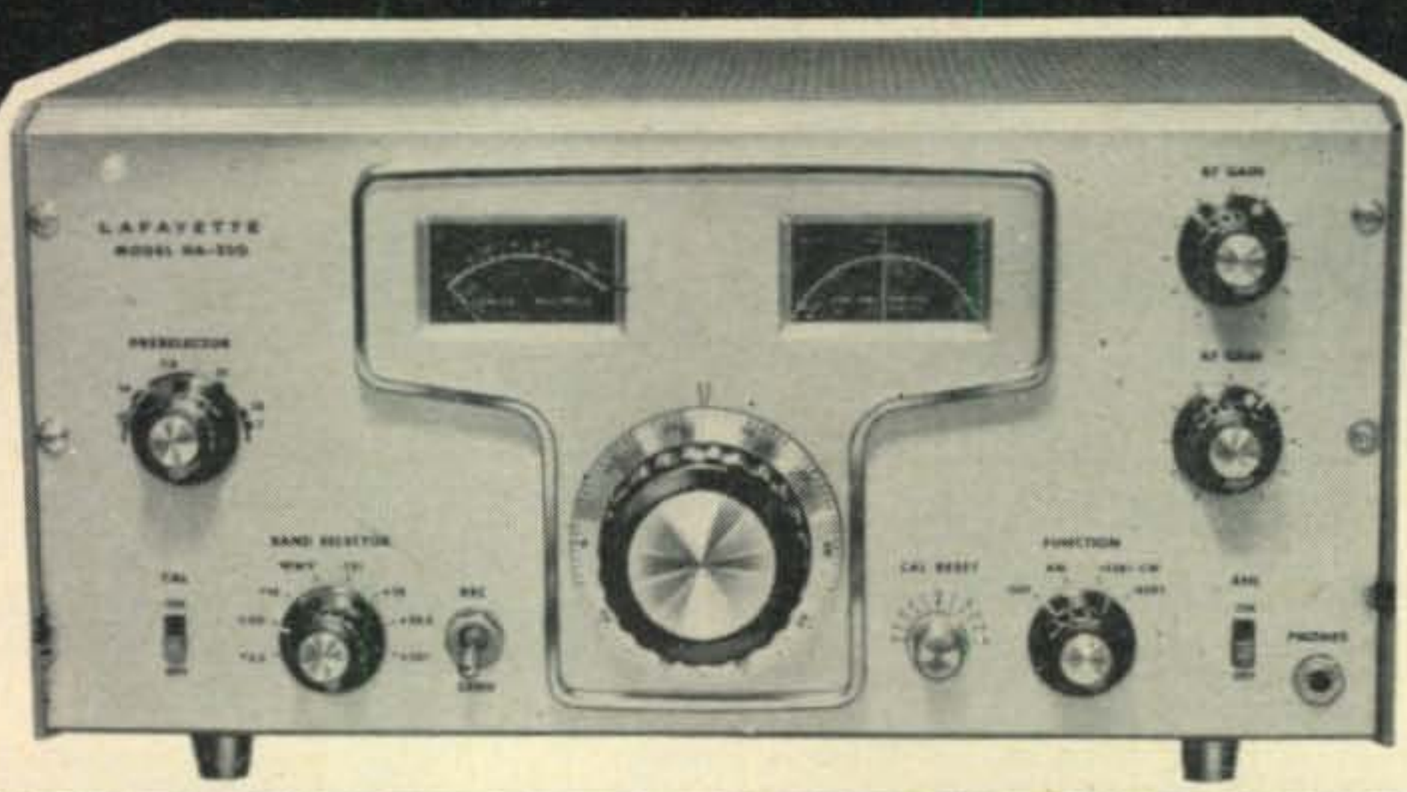
WHY an amateur radio club? That sounds like a good question, now let's see if I can come up with a good answer. Actually this question was thrown at me along with another at a most inopportune time right in the midst of trying to get our club set up for Field Day.

Being president of a club puts one in a position of supposedly knowing it all, at least the younger generation seems to think so. During Field Day I was continually asked important questions like "do you think the soda will be cold soon," or "do you think any hot dogs will be left for supper?" One question, however caught me a little unawares, and perhaps a bit befuddled, because I had the worry of getting the club on the air on time, plus the fact that at this point I had enough questions at hand to start my own quiz program. At any rate one of our budding Novices yelling above the noise of two generators asked me thus: "My Father wants to know why we are doing all this work, and he wants to know why we have a club?" I walked friend Novice about twenty paces away from the din of the generators, which gave me a few seconds to think and gave this reply: "Field Day is a drill to make us proficient in setting up communications under adverse conditions, and we have a club so that we can work together to help ourselves, and provide service to the public." The lad QSLed the message, trotted back to Dad, and I trotted back to work.

Much later when the confusion of the day subsided somewhat, and the boys were busy calling CQ FD I had time to reflect on my answer to the Field Day and club question and satisfied myself as to the answer I gave. Actually the reason for both a club and Field Day is to provide a better public service. I believe investigation will show that a great majority of those amateurs doing the public service work are also active in amateur radio clubs. Yes the Ham club is the backbone of most activity in amateur radio.

Most are aware that we are radio amateurs primarily for "Public Interest, Convenience, or Necessity" This phrase is well known by its initials "PICON." It is a fact that our amateur activities must be done in the public interest as with all radio service from the smallest commercial station to the largest television channel. We are not on the air just to chew the rag and it's not just a right to be a radio amateur, but a privilege extended to us by our government. Now just how can we earn that privilege? There are many ways such as joining RACES, ARPSC, or other such groups. But how about the many that may not have the equipment or the time to go on the air when these groups drill? How can they earn their way, what can they do to justify

NEW! LAFAYETTE



10-80 METER DUAL CONVERSION AMATEUR RECEIVER Model HA-350

Uses Mechanical Filter For Exceptional Selectivity— Offers 2KC Bandwidth!

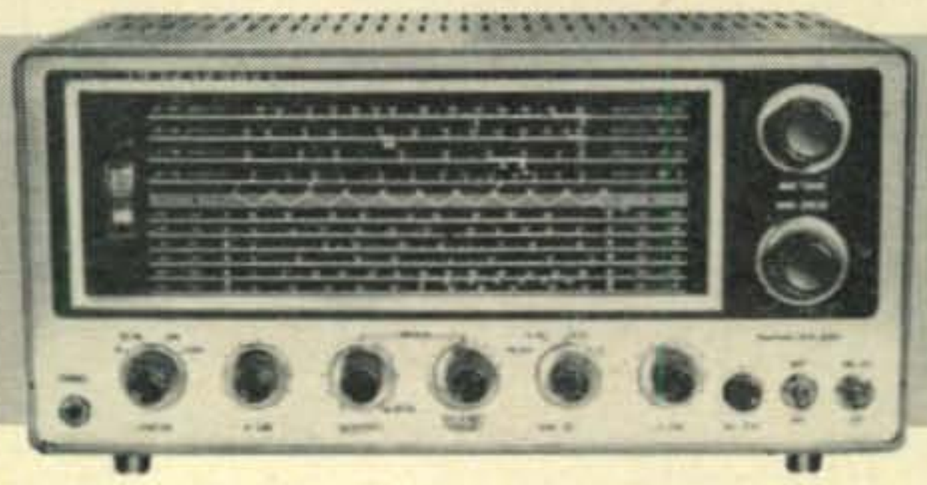
189.50 99-2524WX

Lafayette's newest! A dual conversion superheterodyne communications receiver covering the 10 through 80 meter amateur bands and offering a high order of electrical and mechanical stability for superior AM, CW and SSB operation. Check some of the exceptional features!

- Sensitivity 1 μv or Better
- 7 Band-Switching Positions—3.5, 7, 14, 21, 28, 28.5 and 29.1 MC, plus WWV on 15 MC
- Covers 600 KC for Each Band
- 12 Tubes
- Crystal-controlled 1st Oscillator
- Transmitter-type for 2nd Osc.
- Preselector Tuning
- Crystal-controlled BFO (Dual frequencies)
- All Heterodyning crystals supplied
- Selectable Sidebands
- Geared Tuning Mechanism
- 100 KC Calibrator Circuit (crystal optional extra)
- Separate Diode AM Detector and CW/SSB product Detector
- Coax Antenna Input
- 8 and 500 ohm Outputs
- Imported

NEW! LAFAYETTE Professional-Quality 8-TUBE AMATEUR RECEIVER Model HA-230

Model HA-230
89.50
Wired
99-2522WX



Model KT-340
74.50
Semi-kit version
99-2521WX

4 BANDS:

550-1600KC 4.8-14.5MC
1.6-4.8MC 10.5-30MC

Features "ALWAYS ON" FILAMENT VOLTAGE ON MIXER AND OSCILLATOR STAGES FOR FREQUENCY STABILITY . . . LONGER TUBE LIFE . . . FASTER WARMUP!

- 8 Tube Superhet Circuit
- 1 RF + 2 IF Stages For High Gain
- Illuminated 10½" Slide Rule Dial
- Built-in Q Multiplier For Crowded Phone Operation
- Calibrated Electrical Bandspread on 80 thru 10 Meters
- Effective Automatic Noise Limiter
- Stable Oscillator And BFO For Clean AM, CW and SSB Reception
- AVC-MVC Selector On Front Panel
- Built-in Edgewise S-Meter
- Imported

FREE! *Lafayette 516—Pg. 1965 Catalog No. 650. Write: Lafayette Radio Electronics Corp., Dept. CB-5, P.O. Box 10, Syosset, L. I., N. Y. 11791*

For further information, check number 19, on page 110

their existence as radio amateurs? One answer is to join their local amateur radio club. How is this public service? First as mentioned before we have Field Day which is probably the biggest single public service effort on the part of hams. Club classes and projects to help us to brush up on our technical ability so that we'll be able to take over as proficient radio operators if our country needs our help. Establishing emergency amateur radio stations in such places as hospitals, and Red Cross agencies. These are just a few ways to earn our daily bread.

Why not look over the amateur radio clubs in your area and seek to join the one that best suits your needs. If there are none nearby, then why not get the ball rolling and get one started. It's not very difficult and assistance is available from the ARRL communications department, and the AMATEUR RADIO CLUB FORUM will be glad to offer help. As time goes on the Forum hopes to have such things as sample By Laws, and Installation Ceremonies available to club member readers of *CQ*. The Forum is here to serve our many amateur radio clubs and so that we can do our job better why not let us know your needs.

To cite an example of things accomplished by clubs we can look back to the National Convention held this past August in New York City. This successful venture came about as a result of radio clubs. The affair was sponsored by the Hudson Amateur Radio Council which is made up of some forty Amateur Radio Clubs in the Hudson Division. Without such club organizations these conventions could not be possible. By the way if an Amateur Radio Convention comes your way, be sure to take it in, you can get a wealth of information not to mention the displays of up to the minute ham gear. The various forums on Traffic, AREC, v.h.f., u.h.f., DX, and many other subjects can be very entertaining and educational. It's usually a long time between conventions and hamfests, and clubs help fill the gap by providing programs of interest at meetings. Films, Guest speakers, and technical demonstrations are just some of the things to keep up member interest.

Worth repeating is the service *CQ* has set up for radio clubs. Those who read the January issue have the word but we'll tell you again that amateur radio clubs on our special list will receive the new *CQ* Bulletin sent only to radio clubs on no set schedule but will bring News Flashes and important current items effecting amateur radio. To get on our list have a club officer write to this department on club stationery (if you have same) requesting to be placed on our special club list.

Incidentally did you know that *CQ* Magazine extends a special subscription rate to qualified Amateur Radio Clubs. For further information write to *CQ* Circulation Dept. 14 Vanderventer Ave., Port Washington, N. Y.

I hope you like the Forum so far, if you have anything you'd like me to write about why not drop me a line or send me a radiogram.

73, Al, WA2TAQ

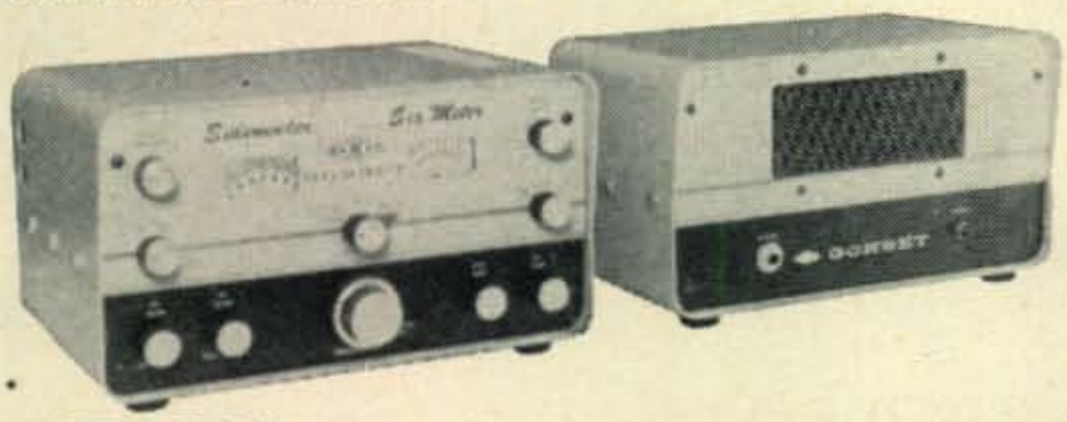
POWERFUL BIG NEWS

NEW!...2 METER–6 METER RF POWER AMPLIFIERS

More power in the VHF band!... and there is *plenty* of it in the new Gonset 2 and 6 Meter RF Power Amplifiers. Model 903A (2 meter) and Model 913A (6 meter) has a power input of 500 watt in all modes of operation. A 4X150A is used in the final, and the equipment is rated for CCAS* service. Only 5 watts is required to drive the 903A and 913A to full rated output. Output impedance is 50 ohms nominal with an input impedance of 50 to 75 ohms. The all solid state power supply is self-contained within the amplifier chassis. All stages are metered and all controls are on the front panel for ease of operation. The new linear amplifiers may be used with any of the famous Gonset Communicator series, as well as being ideally compatible for the new Gonset Sidewinder series.

Amateur Net Price $299.00

**Continuous Commercial and Amateur Service.*



NEW!...GONSET SIDEWINDER 6 METER SSB-AM-CW TRANSCEIVER

The new Gonset Model 910A *Sidewinder* offers coverage of the entire 6 meter band in 1 mc segments. Like its mate—the Model 900A 2 meter *Sidewinder*—this ultra-compact transceiver features all-transistor receiver and power supply and partially transistorized transmitter (except mixer, driver, and final stages). Designed for mobile or fixed communications, the unit operates with separate AC (shown above) or DC power supplies.

...COMES IN POWERFUL LITTLE PACKAGES from GONSET

SIDEWINDER SPECIFICATIONS:

TRANSMITTER:	
Power Input:	20 watts PEP (SSB) 6 watts AM 20 Watts CW
Spurious Suppression:	—40 db
Carrier Suppression:	—50 db on SSB
Unwanted Sideband Suppression: VFO or Crystal Control	—40 db
RECEIVER:	
Frequency Stability:	Highly stable incremental tuning utilizes same VFO as transmitter
Sensitivity:	½ μv or better for 10 db $\frac{S+N}{N}$
Selectivity:	Lattice crystal filter for both receiver and transmitter
Spurious Rejection:	—50 db or better
Image Rejection:	—50 db (both receiver and transmitter utilize double conversion)
AMATEUR NET:	$399.50
AC Power Supply	$ 67.75
DC Power Supply	$ 79.50

ANOTHER NEWSWORTHY NOTE: *the Gonset GSB-201 Linear Amplifier was recently increased from 1500 to 2000 watts PEP (SSB). For those who operate on 10 to 80 meters—the GSB-201 is a natural companion for any of today's exciters.*

WOULD YOU LIKE TO BE PLACED ON OUR NEW PRODUCT MAILING LIST?

We'll send you complete information on the products above and keep you informed of new Gonset developments from time to time. Merely write Dept. **CQ-2.**

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1515 SOUTH MANCHESTER AVENUE, ANAHEIM, CALIF.
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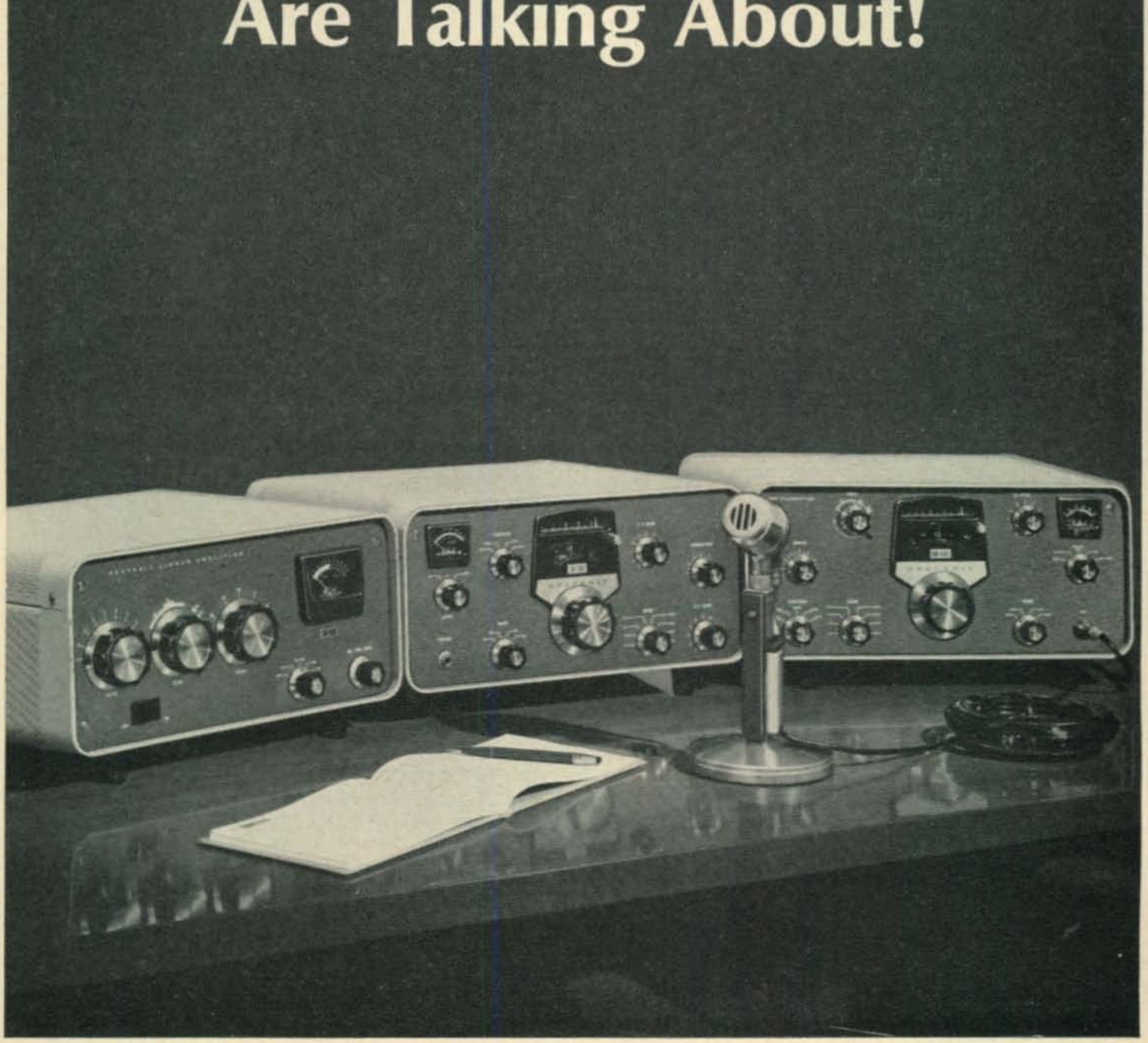
For further information, check number 21, on page 110

For Once You Can Afford The Rig Other Hams Are Talking About!



1 Deluxe HEATHKIT® SB-200 KW Linear Amplifier!

• 1200 watts P.E.P. input SSB—1000 watts CW • 80 through 10 meter band coverage • Built-in SWR meter—Antenna relay—Solid-state power supply • Automatic Level Control (ALC) • Shielded, fan-cooled amplifier compartment • Pre-tuned cathode input circuit for maximum efficiency & low distortion • Circuit-breaker power supply protection—no fuses • Designed for 120/240 volt operation. Neat, compact and transportable (only 35 lbs.). The sturdy, yet lightweight construction of the SB-200 is achieved through the use of a heavy-gauge one-piece aluminum chassis that is partitioned for extra strength and isolation of circuits. Easy assembly is assured with clean, open circuit layout and high quality, well-rated components. The modern low-profile styling of the SB-200 makes it a neat, compact desk-top linear that is ideal for use anywhere!

Kit SB-200, 42 lbs.....$200.00

Note: Unit suitable for overseas operation.

SB-200 SPECIFICATIONS—Band coverage: 80, 40 20, 15 & 10 meters. **Maximum power input:** 1200 watts P.E.P. SSB, 1000 watts CW. **Driving power required:** 100 watts. **Duty cycle:** SSB, continuous voice modulation; CW, 50% (key down time not to exceed 5 min.). **Third order distortion:** 30 db or better at 1000 watts P.E.P. **Output impedance:** 50 to 75 ohm unbalanced; variable pi-output circuit. SWR not to exceed 2:1. **Input impedance:** 52 ohm unbalanced; broad-band pre-tuned input circuit requires no tuning. **Meter functions:** 0-100 ma grid current, 0-1000 ma plate current; 0-1000 relative power, 1:1 to 3:1 SWR, 1500 to 3000 volts high voltage. **Front panel controls:** Load; Tune; Band; Relative Power Sensitivity; Meter Switch, Grid-Plate-Rel. Power-SWR-HV; and Power Switch, on/off. **Tube complement:** Two 572B/T-160-L (in parallel). **Power requirements:** 120 volts AC @ 16 amperes (max.), 240 volts AC @ 8 amperes (max.). **Cabinet size:** 14⅞" W x 6⅝" H x 13⅜" D. **Net weight:** 35 lbs.

2 Deluxe HEATHKIT® SB-300 Receiver!

• Complete coverage of 80 through 10 meter amateur bands • All crystals included, plus provision for VHF converters • Hermetically sealed 2.1 kc crystal bandpass filter • Built-in 100 kc crystal calibrator • Smooth, non-backlash vernier dial mechanism • 100 cps stability after initial warmup • 1 kc dial calibrations—100 kc per dial revolution (provides bandspread equal to 10 feet per megacycle) • Provision for transceive operation with SB-400 Transmitter • Prebuilt linear master oscillator (LMO), wiring harness and two heavy-duty circuit boards for fast, easy assembly.

Kit SB-300, less speaker...22 lbs.....$265.00

SBA-300-1 Optional AM Crystal Filter (3.75 kc) 1 lb.....$19.95

SBA-300-2 Optional CW Crystal Filter (400 cps) 1 lb.....$19.95

SBA-300-3 6 meter converter, 2 lbs.....$19.95

SBA-300-4 2 meter converter, 2 lbs.....$19.95

Export model available for 115/230 VAC, 50-60 cps; write for prices.

SB-300 SPECIFICATIONS—Frequency range (megacycles): 3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5, 28.0 to 28.5, 28.5 to 29.0, 29.0 to 29.5, 29.5 to 30. **Intermediate frequency:** 3.395 megacycles. **Frequency stability:** 100 cps after warmup. **Visual dial accuracy:** Within 200 cps on all bands. **Electrical dial accuracy:** Within 400 cps on all bands. **Backlash:** No more than 50 cps. **Sensitivity:** Less than 1 microvolt for 15 db signal plus noise-to-noise ratio for SSB operation. **Modes of Operation:** Switch selected: LSB, USB, CW, AM. **Selectivity:** SSB: 2.1 kc at 6 db down, 5.0 kc at 60 db down (crystal filter supplied). AM: 3.75 kc at 6 db down, 10 kc at 60 db down (crystal filter available as accessory). CW: 400 cps at 6 db down, 2.5 kc at 60 db down (crystal filter available as accessory). **Spurious response:** Image and IF rejection better than 50 db. Internal spurious signals below equivalent antenna input of 1 microvolt. **Power requirements:** 120 volts AC, 50/60 cps, 50 watts. **Dimensions:** 14⅞"W x 6⅝"H x 13⅜" D.

3 Deluxe HEATHKIT® SB-400 Transmitter!

• Built-in power supply • Complete transceive capability with SB-300 Receiver • Linear Master Oscillator frequency control • Built-in antenna change-over relay • All crystals supplied for complete 80-10 meter coverage • Automatic level control for higher talk power, minimum distortion • 180 watts P.E.P. SSB, 170 watts CW • Crystal filter type SSB generation • Operates SSB (upper or lower sideband) & CW • VOX & PTT control in SSB operation, VOX operated CW break-in • Crystal controlled heterodyne oscillators • 1 kc dial calibration—100 kc per dial revolution • Dial bandspread equal to 10 feet per megacycle • 500 kc coverage per bandswitch position • Switched 120 V AC for external antenna relay • Sturdy, lightweight, heavy-gauge aluminum construction throughout • Neat, modern "Low-Boy" styling! • Variable loading!

Kit SB-400, 33 lbs.....$325.00

Export model available for 115/230 VAC, 50-60 cps; write for prices.

HDP-21, Special SSB Mike, 4 lbs.....$29.40

SB-400 SPECIFICATIONS—Emission: SSB (upper or lower sideband) and CW. **Power Input:** 170 watts CW, 180 watts P.E.P. SSB. **Power output:** 100 watts (80-15 meters), 80 watts (10 meters). **Output impedance:** 50 to 75 ohms—less than 2:1 SWR. **Frequency range:** (mc) 3.5-4.0; 7.0-7.5; 14.0-14.5; 21.0-21.5; 28.0-28.5; 28.5-29.0; 29.0-29.5; 29.5-30.0. **Frequency stability:** Less than 100 cps per hr. after 20 min. warmup. **Carrier suppression:** 50 db below peak output. **Unwanted sideband suppression:** 55 db @ 1 kc. **Intermodulation distortion:** 30 db below peak output (two-tone test). **Keying characteristics:** Break-in CW provided by operating VOX from a keyed tone (Grid block keying). **ALC characteristics:** 10 db nominal @ 0.2 ma final grid current. **Noise level:** 40 db down from single tone output. **Visual dial accuracy:** Within 200 cps (all bands). **Electrical dial accuracy:** Within 400 cps (all bands). **Audio input:** High impedance microphone or phone patch. **Audio frequency response:** 350 to 2450 cps at 6 db. **Power requirements:** 80 watts STBY, 260 watts key down @ 120 V AC line. **Dimensions:** 14⅞" W x 6⅝" H x 13⅜" D.

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NEED A VFO?

BY R. T. HART,* W5QJR

This article describes a v.f.o. that incorporates several unique features to enhance the stability of transistor circuits and may serve as a general guide to the design of variable frequency oscillators.

Too many hams have given up building their own equipment because they feel they can't make it good enough to be compatible with all the fancy commercial equipment on the air. The biggest concern is v.f.o. stability for s.s.b. operation and for c.w. where very selective receivers won't tolerate drift. Any ham can build a good v.f.o. and properly adjust it for stability using the simple techniques pointed out in this article.

Choosing The Circuit

All of the common types of oscillators are good if built and adjusted properly. The individual builder may prefer one over another for personal reasons. For this article I have chosen the standard Hartley to illustrate a procedure for obtaining stability. The general technique applies to any oscillator circuit.

Component Selection

Vacuum tube circuits are commonly preferred over transistors due to their characteristically high impedance and subsequent high Q circuits. However, transistors may be used with success, as demonstrated in this article.

All of the components must be chosen for thermal stability. The extra expense is a small price to pay for a good unit. The tuned circuit must not be compromised. Slug tuning is preferred over capacitor tuning, since a circuit using variable capacitors can be temperature compensated for only one frequency by using temperature compensating capacitors. The coil form should be made of a material that is mechanically stable with temperature. A paper base phenolic material is preferred over ceramic for this reason.

Mechanical Construction

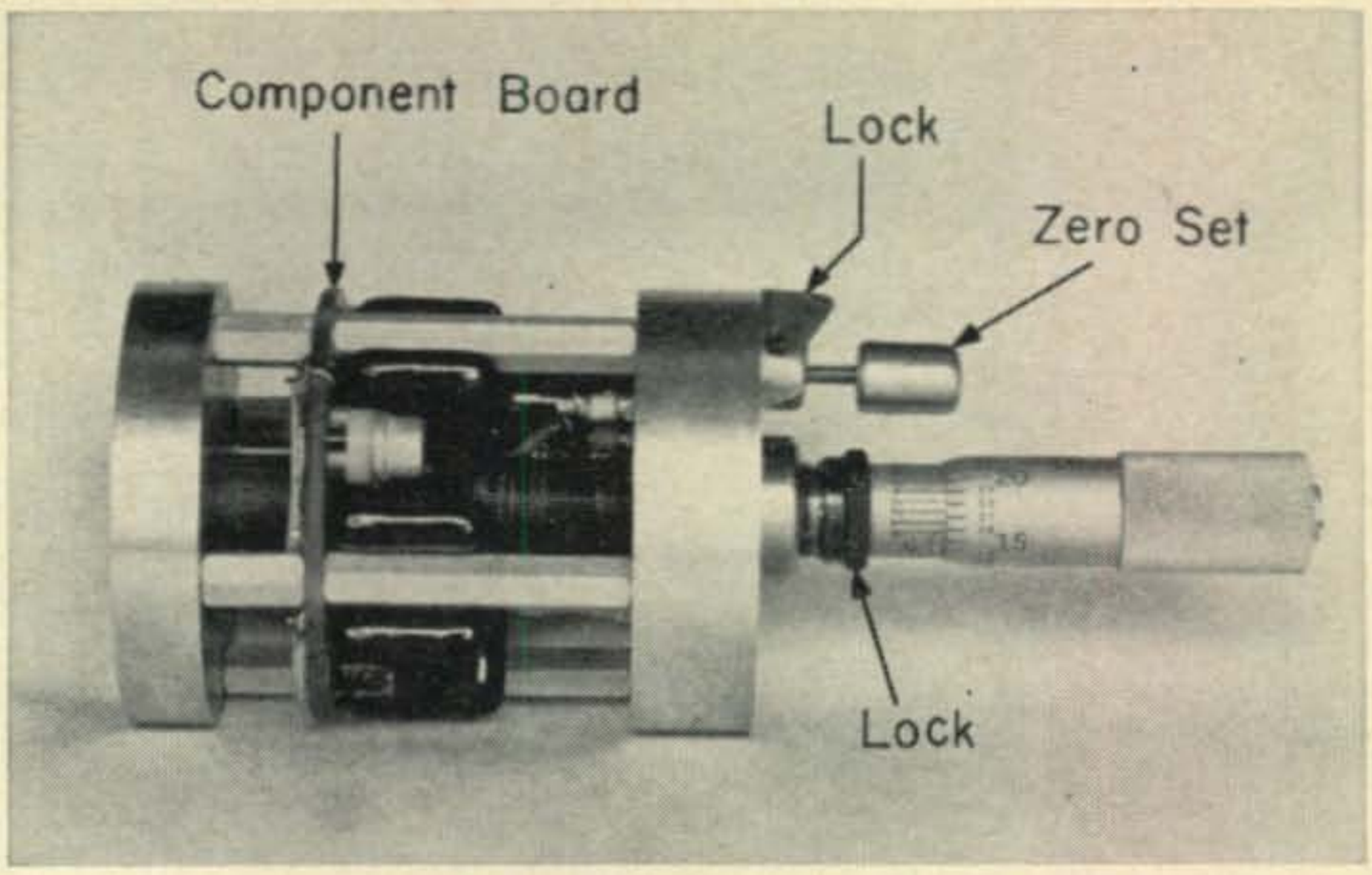
The unit must be rigid to prevent components flexing and the subsequent frequency change associated with stray capacity between components. The variable tuning arrangement must be isolated from shock and vibration. In the unit shown, a micrometer head is used with a brass slug for tuning. This allows the home builder a simple arrangement as well as high accuracy. The major requirement is to build the v.f.o. as a complete unit, rather than on brackets mounted to a panel. The unit should be well shielded and all leads isolated to prevent stray r.f. energy coupling to the circuit.

An Example Unit

The unit shown includes a transistor operating as a Hartley oscillator followed by a broad band buffer amplifier for isolation, as well as providing adequate signal to a diode network that acts as an a.g.c. circuit to maintain amplitude stability. This is very important for transistors since their characteristics vary with temperature and the a.g.c. circuit offsets the variation.

The basic oscillator circuit is conventional

*Test Director, Space Systems and Antenna Division, Collins Radio Company, Dallas, Texas.



Photograph of the v.f.o. construction using a micrometer head for tuning. The transistorized oscillator and broad band buffer are constructed on the phenolic base near the rear of the unit. The micrometer head is available from the Starret Company of Athol, Mass, and is listed as #263P.

with the exception of a capacitor across the feedback tap. This capacitor is chosen to form a filter network that effectively multiplies the *Q* of the tuned circuit. By definition, a low *Q* tuned circuit has a broad band characteristic and will contain many harmonics. These harmonics affect the frequency stability, since they cross modulate with each other and with the fundamental to produce currents that are not necessarily in phase with the normal mode currents. Small changes in the circuit components affect the harmonics, and these in turn affect the fundamental frequency by distorting the waveform. The highest *Q* circuit will produce the most stable oscillator.

The most critical aspect of any oscillator is choosing the proper amount of feedback. In a Hartley this is accomplished by choosing the proper location of the feedback tap. In a Colpitts, the capacitors should be carefully chosen for the proper ratio. In either circuit, a simple test will verify proper operation. This test consists of measuring the frequency of the oscillator as a function of the supply voltage. If the feedback is chosen properly, a small change in supply voltage will have no effect.

While adjusting the oscillator shown, the effects of choosing various taps is presented in fig. 1. A frequency counter was used for this test, but similar results may be obtained using a good receiver and monitoring a harmonic of the oscillator for accuracy. The oscillator shown was designed for a center frequency of 1.5 mc for a mobile transceiver, but the example applies to any frequency. The calibration on the curves is in cycles per second above and below center frequency. Curves *A* and *B* are examples using the wrong tap for feedack. Note that on all curves, if the voltage is held constant, the frequency will drift at a rate proportional to the slope of the curve. With the tap set on Curve *B*, the drift rate was approximately 1 kc per hour. With the tap as at A, the frequency drifted in the opposite direction. Curves *C* and *D* indicate the drift rate will be zero if the supply voltage is maintained where the curve is flat. The builder has the choice of the tap for a desired operating voltage or selecting the proper voltage from data obtained on his unit from this test. Merely regulating the supply voltage will do no good if it is the wrong voltage.

As previously mentioned, the *Q* of the circuit affects the performance. Curves *E*, *F*, and *G* show the effect of various capacitors shunting the feedback tap and effectively increasing the *Q*. With the proper capacitor and proper tap, an improvement of almost ten to one was achieved. Curve *H* illustrates that proper feedback should also be chosen to achieve stable operation in crystal oscillators. The one shown was not properly set up.

The feedback should be adjusted at the center of the oscillator tuning range. It should then be checked at each end to insure proper operation.

[*Continued on page 102*]

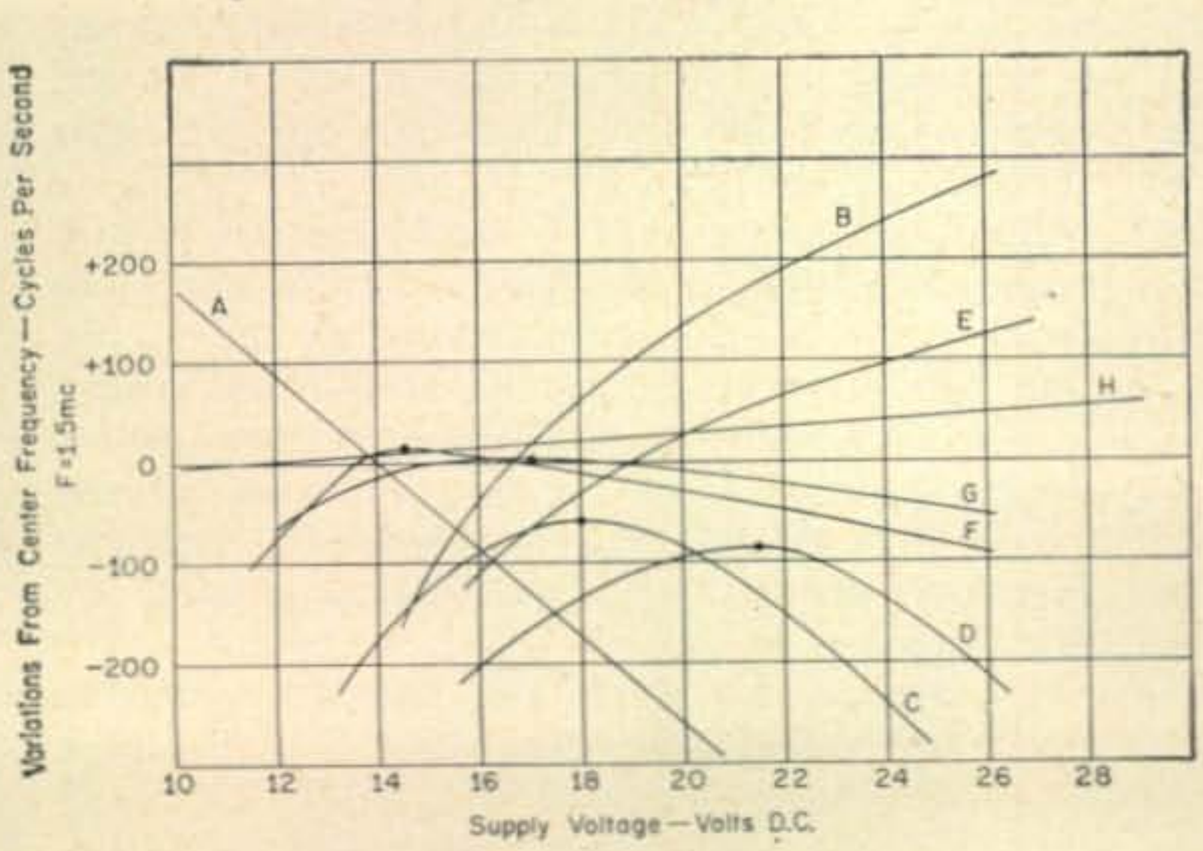
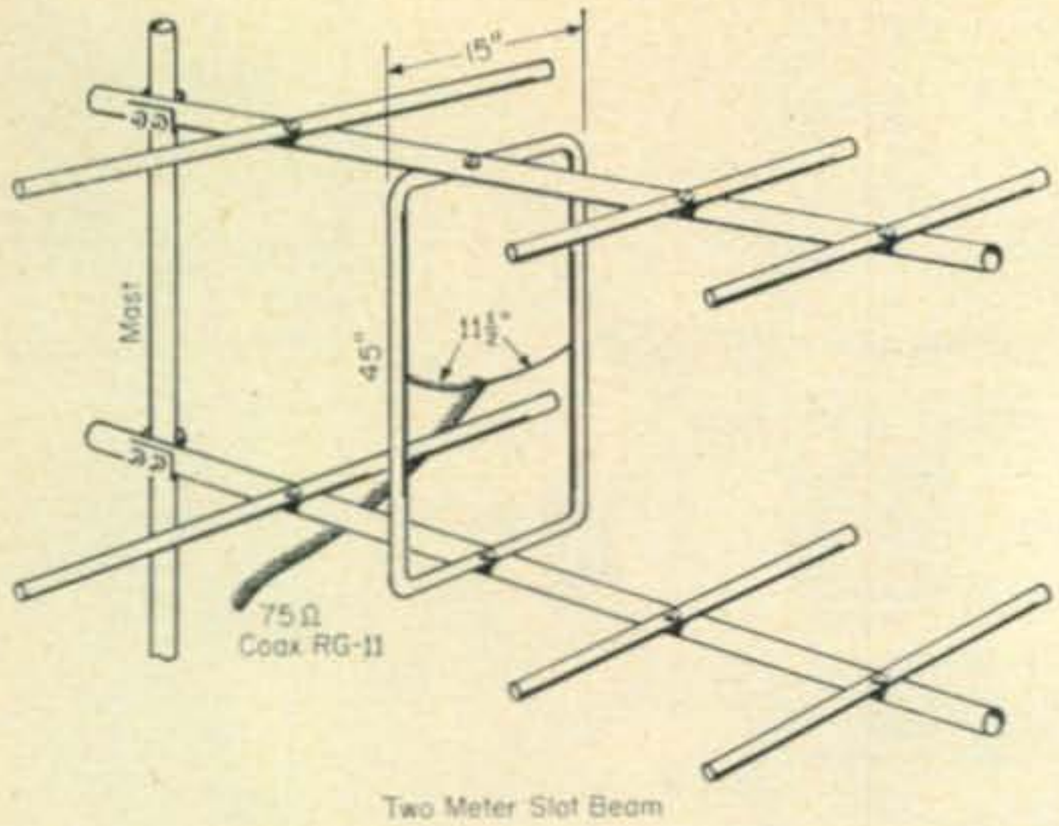
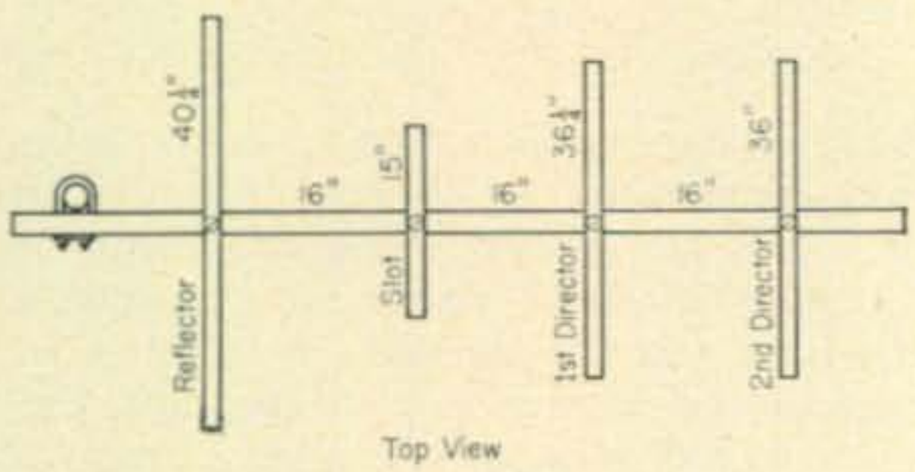


Fig. 1—The above graph portrays the results of frequency stability versus supply voltage and frequency stability versus the value of capacitor C_1 shown in the circuit in fig. 2. The curves are defined below.

A—Inadequate feedback. Drift rate, 1,050 cycles/hour.
B—Excessive feedback.
C—Correct feedback for 18 volt supply (no filter).
D—Same as C with tap moved slightly. Use 21.5 volts.
E—Same tap as B with C_1 equal to 0.01 mf.
F—Same tap as B with C_1 equal to 0.015 mf.
G—Same tap as B with C_1 equal to 0.02 mf.
H—Simple crystal oscillator.
The 0 located on each curve represents the best operating point along that curve, or the spot where the drift rate is zero.



Two Meter Slot Beam



Top View

Fig. 1—Two views of the slot antenna for two meters. Aluminum and all hardware was salvaged from TV antennas.

The Homebrew Slot Antenna

BY R. M. BALDWIN,* K4ZQR

Improve your signal on two meters with this simple slot antenna.

ARE you tired of picking up the pieces of your bedspring after every windy day? Do you want to be asked when you made the switch to a kw rig? Then try a Home Brew Slot for two meters. Chances are you may be able to substantially improve your signal and at the same time decrease your wind loading.

Our British cousins are hard to beat on a lot of things concerning amateur radio, and on this side of the pond we have the highest respect for their Eddystone dials and G4ZU beams, to name a couple of examples.

One statement by W1HDQ in a magazine article[1] struck me as significant and worthy of investigation. Speaking of two meters, he said, "There is almost complete standardization on one type of antenna for home station work, the skeleton slot, an array just coming to the attention of American v.h.f. men." Since the article provide the details of the slot element which consist of two horizontal dipoles stacked approximately ⅝ wavelength apart, I figured perhaps with this help, maybe I could brew up a beam.

The driven element of the slot is an elongated rectangle with rounded corners, and it helps if you will first visualize two stacked dipoles ⅝ wavelength apart. Now bend the ends of each dipole toward the other dipole leaving about 15" of each dipole horizontal. The ends you bent do not reach far enough to connect the two dipoles, but if you now insert a phasing line while still maintaining ⅝ wavelength spacing, you form a complete loop which is 15" across the top and bottom and 45" on each side. Feed this at the exact mid point of each side with 75 ohm coax by fanning out the center lead 11½" to feed one side, and the braid 11½" to feed the other—and you have the driven element of the skeleton slot antenna. This is all the detail provided in the article, but it was the important part.

Construction

A trip to our local radio store netted several channel 9 Yagi's for free. How they acquired them, I don't know, because we have no channel 9 here. Any old TV antenna, however, will provide a source of aluminum.

Make the driven element first by using TV antenna elements which are around ⅜" in diameter. You will, of course, have to use several to make the slot. When joining them together, crimp the end of one for a force fit into the end of the next piece and then drill the two and drive in a self-tapping screw. If you want to get fancy, you can make a bending jig to round the corners of your slot. I just bent mine with pliers, and while there are some irregularities, you can't see 'em when it's up in the air. Complete the driven element by drilling two mounting holes in the center of each 15" horizontal side, and thread two self-tapping screws with lock washers into holes at the mid point of each 45" side. These are for attaching the coax later.

The boom material I used was 1⅛" stuff from the booms of the channel 9 TV antennas. If you can't scrounge enough stuff for the booms, you may have to buy some aluminum tubing. Minimum length for each boom is about 54"—which allows for 16" spacing between all elements plus enough boom behind the reflector to attach the two beams to the mast with TV U clamps.

Dimensions of each element are given in fig. 1 and are figured from handbook formulas.

[*Continued on page 102*]

*409 Kaelin Drive, Louisville 7, Kentucky.

[1]Tilton, E. P. "World Above 70 Mc.," *QST*, November 1963, p. 55.

NOW

DIRECT CRYSTAL CONTROL TO 160 mc With AOC Plug-In Transistor Oscillators

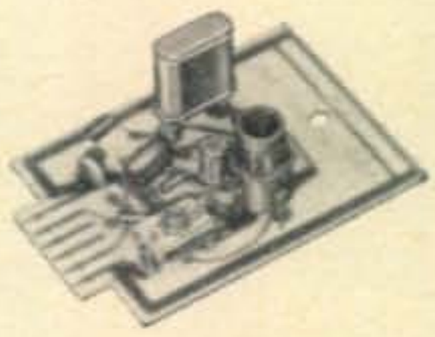
- Portable Signal Standards
- Signal Generators For Receiver Alignment
- Band Edge Markers
- Frequency Markers For Oscilloscopes
- Quick-Change Plug-In Oscillators
- Accessory Cases

HIGH FREQUENCY (20 mc – 160 mc)

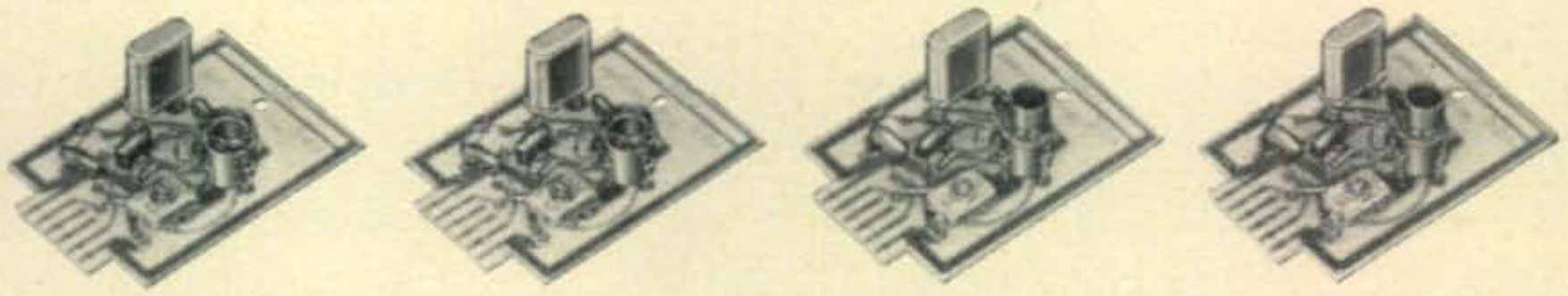
Five transistor oscillators covering 20 mc - 160 mc. Standard 77°F calibration tolerance ±.0025%. The frequency tolerance is ±.0035%. Oscillator output is .2 volts (min) across 51 ohms. Power requirement: 9 vdc @ 10 ma. max.

OSCILLATOR TYPE	OSCILLATOR RANGE	CRYSTAL TYPE	TEMPERATURE TOL. —40°F to 150°F	OSCILLATOR (LESS CRYSTAL) PRICE
OT-24	20-40 mc	CY-7T	±.0035%	$ 9.10
OT-46	40-60 mc	CY-7T	±.0035%	9.10
OT-61	60-100 mc	CY-7T	±.0035%	15.00
OT-140	100-140 mc	CY-7T	±.0035%	15.00
OT-160	125-160	CY-7T	±.0035%	15.00

CRYSTAL FREQUENCY	CRYSTAL PRICE
20-60 mc	$ 6.90
60-100 mc	12.00
101-140 mc	15.00
141-160 mc	18.00



Order direct from International Crystal Mfg. Co.

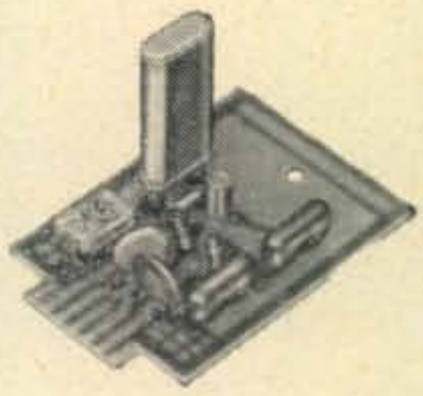


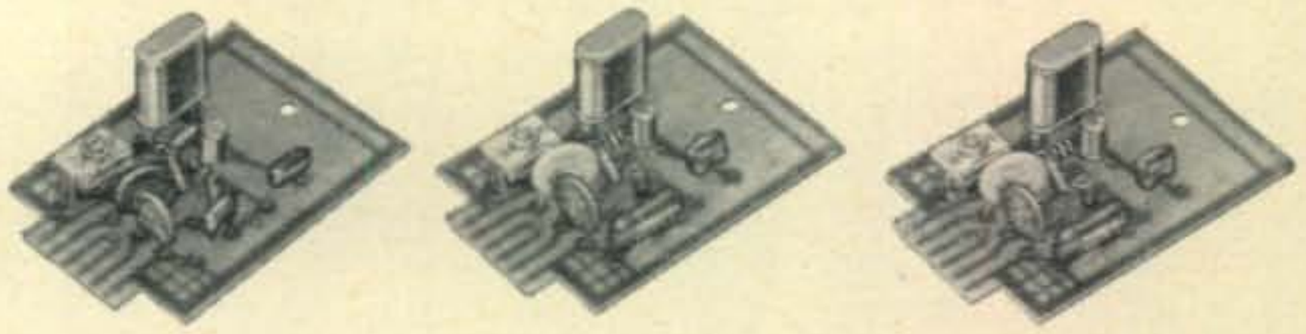
LOW FREQUENCY (70 kc – 20,000 kc)

Four transistor oscillators covering 70 kc - 20,000 kc. Trimmer capacitor for zeroing crystal. When oscillator is ordered with crystal the standard will be ±.0025%. Oscillator output is 1 volt (min) across 470 ohms. Power requirement: 9 vdc @ 10 ma. max.

OSCILLATOR TYPE	OSCILLATOR RANGE	CRYSTAL TYPE	TEMPERATURE TOL. —40°F TO + 150°F	OSCILLATOR (LESS CRYSTAL) PRICE
OT-1	70-200 kc	CY-13T	±.015%	$7.00
OT-2	200-5,000 kc	CY-6T	200-600kc ±.01% 600-5,000kc ±.0035%	7.00 7.00
OT-3	2,000-12,000 kc	CY-6T	±.0035%	7.00
OT-4	10,000-20,000 kc	CY-6T	±.0035%	7.00

CRYSTAL FREQUENCY	CRYSTAL PRICE
70-99 kc	$22.50
100-200 kc	15.00
200-499 kc	12.50
500-849 kc	22.50
850-999 kc	15.00
1,000-1,499 kc	9.80
1,500-2,999 kc	6.90
3,000-10,999 kc	4.90
11,000-20,000 kc	6.90





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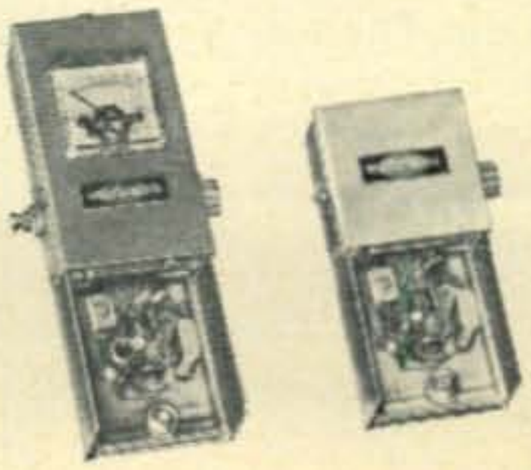
AOC OSCILLATOR CASES

Small portable cases for use with the OT series of plug-in oscillators. Prices do not include oscillators. (When oscillator and crystal are ordered with FOT-10 case a 77° F tolerance of ±.001% may be obtained at $2.00 extra per oscillator/crystal unit. When oscillator/crystal units are ordered with FOT-20 case, a single unit can be supplied with temperature calibration over a range of 40° F to 120° F. Correction to ±.0005%. Add $25.00 to the price of FOT-20 and oscillator/crystal unit.)

FOT-20

FOT-10



FOT-20 For high accuracy calibration requirements. Includes battery and output jack, output meter circuit and battery check, as well as thermistor temperature measuring circuit. **$87.50**

FOT-10 Basic case with battery and output jack for general wider tolerance applications. **$14.50**

MT-1 Oscillator board mounting kit. **$4.95**

For further information, check number 5, on page 110

Kilowatt Plate Tank Coil

BY LOU ADLER,* K8IKA

If you are thinking of building a linear here is how you can save money on an all-band kilowatt tank circuit. Some copper tubing, a surplus rotary switch and a little ingenuity can save you up to 25 dollars.

About two years ago I built my latest linear and had the problem of an inexpensive tank circuit confront me. Here's how I solved that problem.

If you have a single pole five position rotary switch of a heavy type of construction, preferably ceramic, you have the main component. If not you can acquire one through the many surplus outlets. This switch will provide your choice of bands. Acquire 18 feet of 3/16 inch copper tubing; this usually sells for 25 to 30 cents a foot. If you want to make this job real professional get your favorite mechanic in town to silver solder the entire length of this tubing. This is no big problem. Actually you can do this yourself with a gas type torch. When applying the silver solder, wipe it periodically, with a clean rag, before it cools. This will prevent blobs of silver solder from accumulating.

Construction

Clamp one end of the tubing in a vise and proceed to straighten out the kinks in the tubing. Apply the silver solder at this time if you are going to do so. When done with this step, lay the tubing on the floor. Mount the form on which you are going to wind the coil on, in a vise. The coil form should be 3 to 3¼ inches in diameter. One word of caution at this point; don't bend the copper tubing anymore than necessary. The more you bend it the more brittle it gets.

Begin to wind the copper tubing over the form you have chosen. Revolve the form rather than wrap the tubing; this way you're not as likely to cause kinks in the tubing. Wind this coil as tight and as close together as possible. After you have wound 17 complete turns on the form, leave at least four inches from the last turn and cut the excess tubing off. Now, slip the coil from the form, but don't stretch the coil out in doing so.

Forms

Take the ¼ inch plexiglass and cut four pieces, six inches long and ½ inch wide. These will be used to hold the coil in form. A nice tool to cut the plexiglass with is a fine tooth hack saw. Having cut the four pieces of plexiglass, mount two of them side by side in a vise, so the total width of the two pieces will be one inch. Cover them with a one inch piece of masking tape the full length. Starting ½ inch from one end, lay out 18 holes on the center line, ¼ inch apart as shown in fig. 1A. Proceed to drill the holes with a 3/16 inch drill. After drilling, don't remove the masking tape. You can use this as a jig to drill the second set. When drilling the plexiglass be careful not to force the drill. This will give you a nice clean hole. Keep these drilled plexiglass forms marked so that they are in identical sets.

After making two sets of forms we proceed to use one set. Slip ½ of the coil form inside of the coil. Spread the coil out carefully so that every turn of the coil will fall into the notches of the coil form. Using balsa wood glue, which I found works nicely, apply a light coat of glue to every notch and in between the notches of the form. Apply a coat of glue to the other identical form in like manner. Mesh the two forms over the coil and apply a small C clamp over the two at each end of the coil. Don't worry about the excess glue which oozes out over the coil. Proceed half way around the coil and apply the second set of forms. Set this coil aside to dry thoroughly. Two days will do the job nicely.

10 Meter Coil

Cut a piece of ¼ inch plexiglass three inches square. Drill a ⅛ inch hole in each corner ¼" from each side as shown in fig. 1B. Mount a

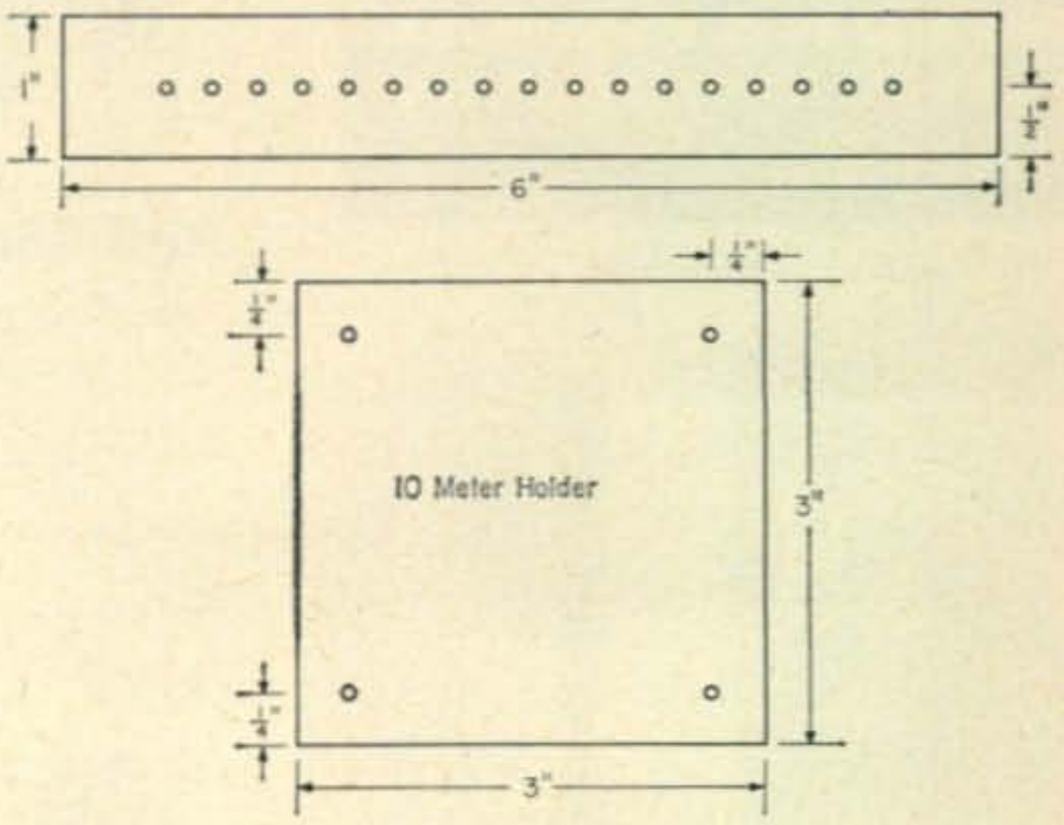


Fig. 1—(A) Dimensions of the coil spreaders. Two sets are needed to support the coil as shown in fig. 2. (B) Dimensions of the ten meter coil support.

*2822 11th Street, Cuyahoga Falls, Ohio.

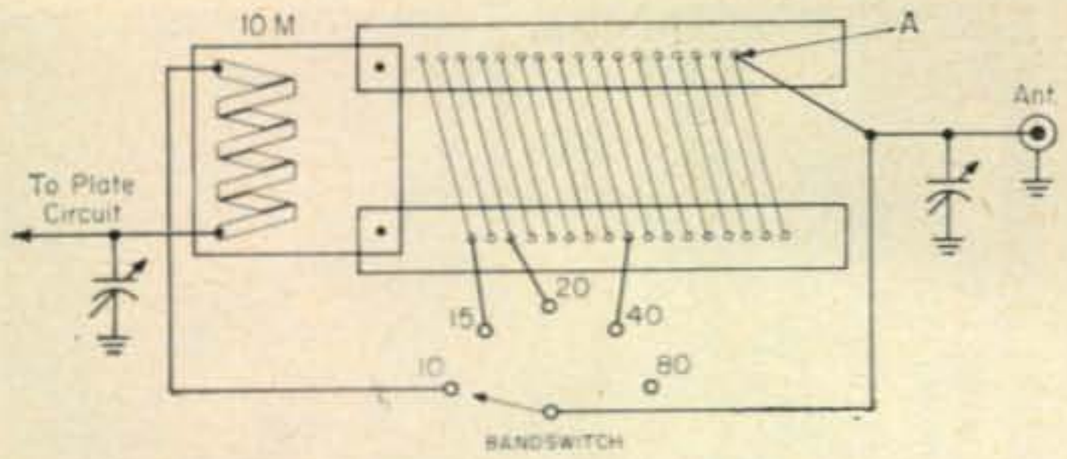


Fig. 2—Shown above is the combined coil supports and the basic circuit for the band switch. The tap points are discussed in the text. All the switch taps are connected with #12 tinned wire. The right end of the main coil should be secured to the form at point A. The left end of the coil should be attached to the 10 meter coil and be certain that both coils are wound in the same direction.

screw in one hole, with a ground lug under the head of the screw. Do likewise with a second hole. The other two holes will be used to mount this form to the main coil as shown in fig. 2. The ten meter coil is next. Using the ¼ inch strap copper, wind four complete turns over an old octal tube. (The metal type makes a good form.) Of course, wind this coil as tight and as close together as possible. When complete, remove the coil from the form and stretch it out carefully so the coil will just fit across the two lugs on the 3"×3" plexiglass holder. Solder the coil to the lugs.

When the coil form is completely dry, slip the 10 meter coil into the end of the main coil so the small coil is at right angles to the large one. Be sure the two coils don't touch. There should be about ½ inch of clearance between them. After the small coil is properly located, scribe and drill two holes in the main coil forms. Attach the 10 meter coil to the large coil with small screws and nuts. Work one end of the large coil over so as you can attach it to one end of the 10 meter coil. This completes the main construction.

All that remains is to mount this unit in your linear. I suggest you mount this coil just behind the front panel and parallel to it. The band switch should be located on the front panel and centered with the tank coil. Keep one inch of clearance between the rear of the switch and the coil. Attach a #12 tinned wire from the right side of the coil to the arm of the bandswitch. Leave the right connection free. This will be your 80 meter position. The rest comes with trial and error.

Setting the Taps

Be sure the linear is completely wired with all tubes in place. The procedure is to be followed with the *power off*. Set the bandswitch to the 80 meter position. Place both the plate and loading capacitors at the half capacity position. With a grid dip meter determine what portion of the 80 meter band you are at. With some luck you will be in the center of it.

With four 811A's, a 250 mmf plate capacitor and a 1000 mmf loading capacitor it took 17 turns on the main coil to hit 80 meters.

After 80 meters is established, switch to 40 and from that switch position connect a #12 wire to the coil, trying one turn at a time, until you hit the center of the band as indicated by the grid-dipper.

Follow the same procedure for the 20 and 15 meter bands. With the four 811A's there was one turn on the main coil for 15, three turns for 20 and nine turns for 40.

At best I would say you can build this coil for less than 8 dollars, but if you silver solder the coil, it would be more. The tank coil would be rated at least one kw d.c. input and I have never known of one to heat up and melt the plexiglass, even when off resonance for some time. Good luck on your venture. ■

The Simple-Gen Receiver

BY E. H. MARRINER,* W6BLZ

This simple one tube regenerative receiver covers 40 meters (but could cover any other band) and is companion unit for the Zipper Bag Transmitter. The two units make the ideal travelling rig.

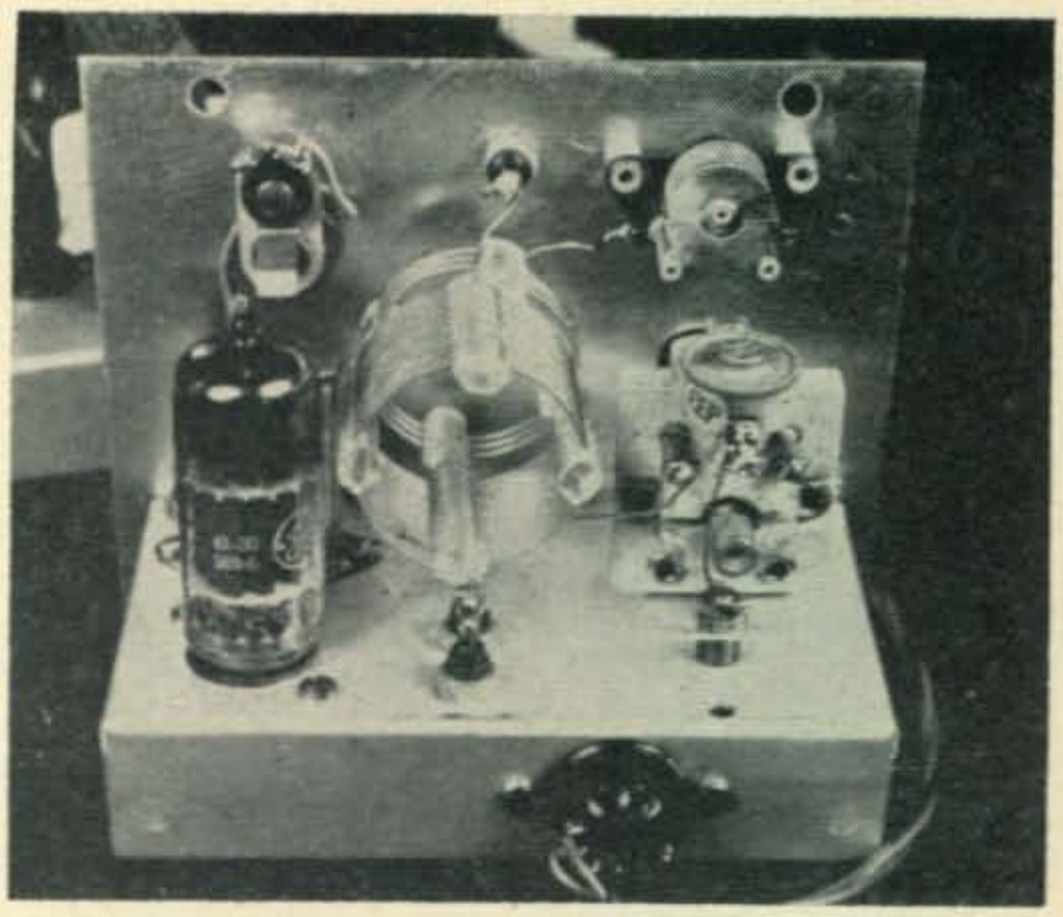
BUILDING a regenerative receiver may seem like going back in time thirty-five years, and I for one thought, many years ago, that I had built my last one.

Recently I had an occasion to make a quick trip by air and wanted to take a rig with me I only had two days to get ready and needed something in a hurry, something that did not require a lot of fussing around to make it work. It had to pack into my zipper bag luggage which could not exceed 40 lbs. I could see no substitute unless I wanted to leave my shoes and go barefoot. With this thought in mind the receiver described here was put together and is passed on for use by others who may find themselves in similar circumstances.

This is a two tube regenerative receiver band

*528 Colima Street, La Jolla, California.

spread for forty meters. I could go on any band but I was taking the little Zipper Bag[1] transmitter which was already on 7 mc and 40 was what I needed at the moment. It has enough volume to make your ears say ouch and the regeneration control works smoothly and holds in across the entire band without any adjustment. There is no body capacity when touching the panel. A 6EB8 pentode triode is used and with this cathode type tube the microphonics are at a minimum. It will work on any plate voltage from 45 to 150 volts without too much change in volume or setting of the regeneration control. It does a nice job for a quick trip or picnic outing, and you will be surprised by how well it works.



Rear view of the 40 meter regenerative receiver. The 45 mmf trimmer can be seen mounted on the main tuning capacitor.

Construction

The receiver is built on a 4½ × 2½ × 1 inch California Chassis and the power supply is built on a second identical chassis. The tuning capacitor is connected to a vernier dial by an insulated shaft. This prevents scratching noises when tuning, due to the dial mechanism.

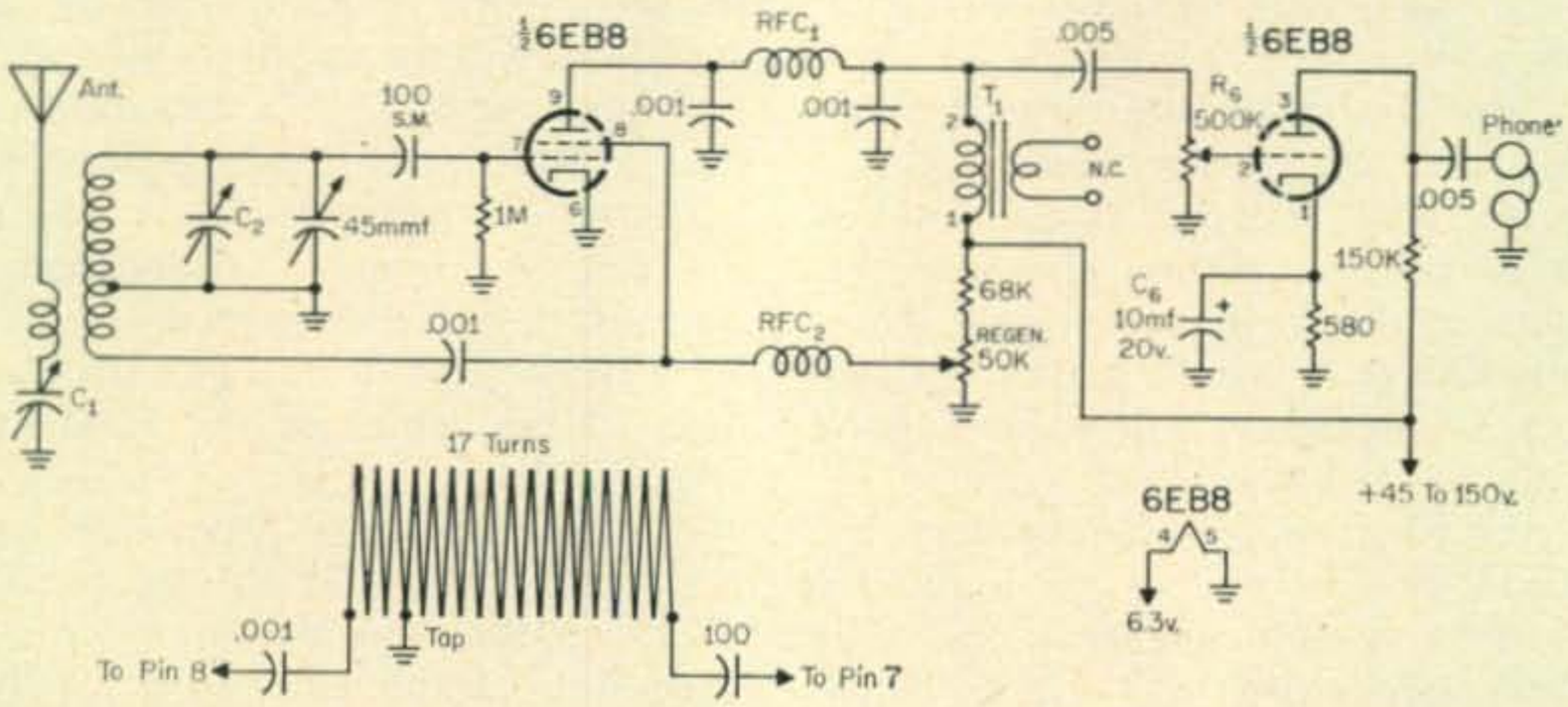


Fig. 1—Circuit of the 40 meter regenerative receiver. All resistors are ½ watt units. The two potentiometers are miniature types for space conservation. Capacitors greater than one in value are in mmf and less than one in value are in mf except where noted. Other than the one silver mica (SM) and one electrolytic the capacitors are all disc ceramics. The earphones are high impedance or crystal types.

C_1—25 mmf. Surplus from ARC-5 receiver.
C_2—35 mmf with all plates removed except for two rotor and two stator.
RFC_1, RFC_2—2.5 mhy, ferrite cores, J. W. Miller #6302 or equiv.
T_1—Any high impedance audio choke. A surplus transformer was used, 20K-600 ohms, available from J. J. Glass Co., 1624 S. Main St., Los Angeles, Calif. Marked Stancor 94138 GR-1CLA-FA-13. Cost, 35 Cents.

The coil, for simplicity, is mounted on feed-through insulators. The large bulk coil has higher *Q* than a small plug in type and gives better selectivity but plug in coils would work. The antenna winding is three turns of AirDux #1010 (or suitable hook-up wire) and it is placed at the end away from the ground tap. The antenna winding should run in the same direction as the main coil.

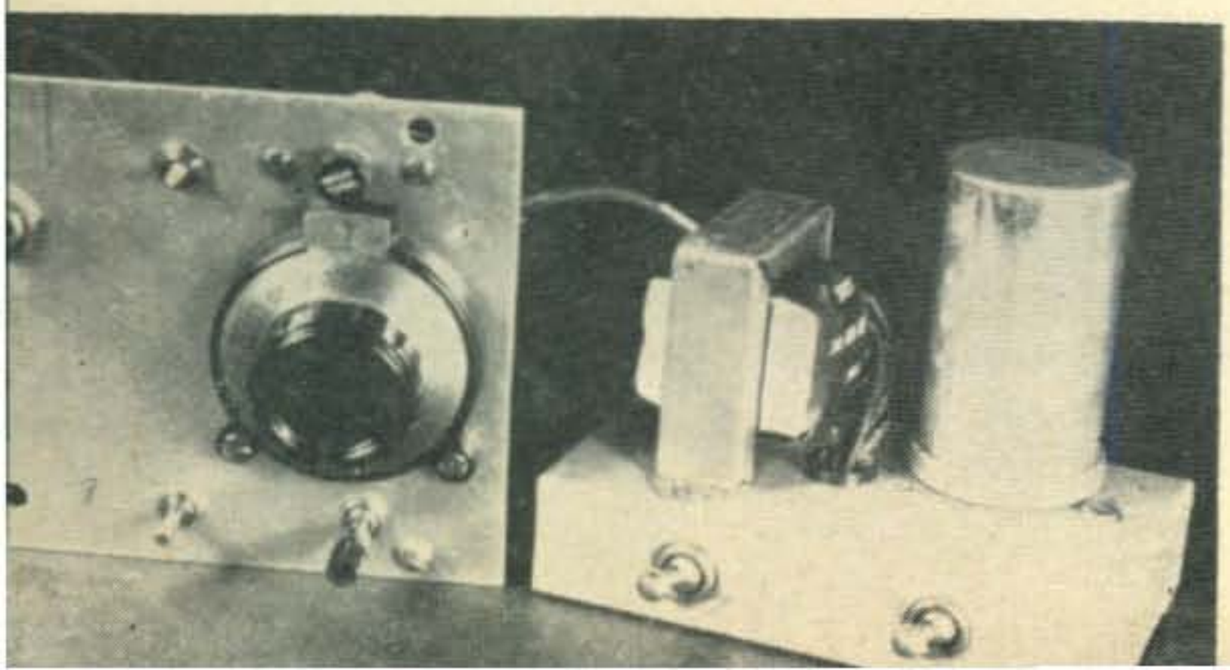
The regeneration tap is not critical and only needs be a few turns. Tapping of the coil to ground saves fussing around with polarity to make the set regenerate. Changing the tap only shifts the frequency which can be compensated by the trimmer across the tuning capacitor. Nothing is critical and the receiver should work the first try.

Testing

When you finish building the receiver set the

[*Continued on page 101*]

[1]Marriner, E. H., "Zipper Bag Transmitter," *CQ*, May, 1962, p .



Front view of the simple 40 meter regenerative receiver and power supply. The ANTENNA TRIMMER is above the TUNING dial, the REGENERATION control just below it and the VOLUME control just to the right. The ANTENNA TERMINAL is between the ANTENNA TRIMMER and the phone jack. The panel is 5 × 4 inches and the dial a 2" Philmore #S-50.

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FEATURES

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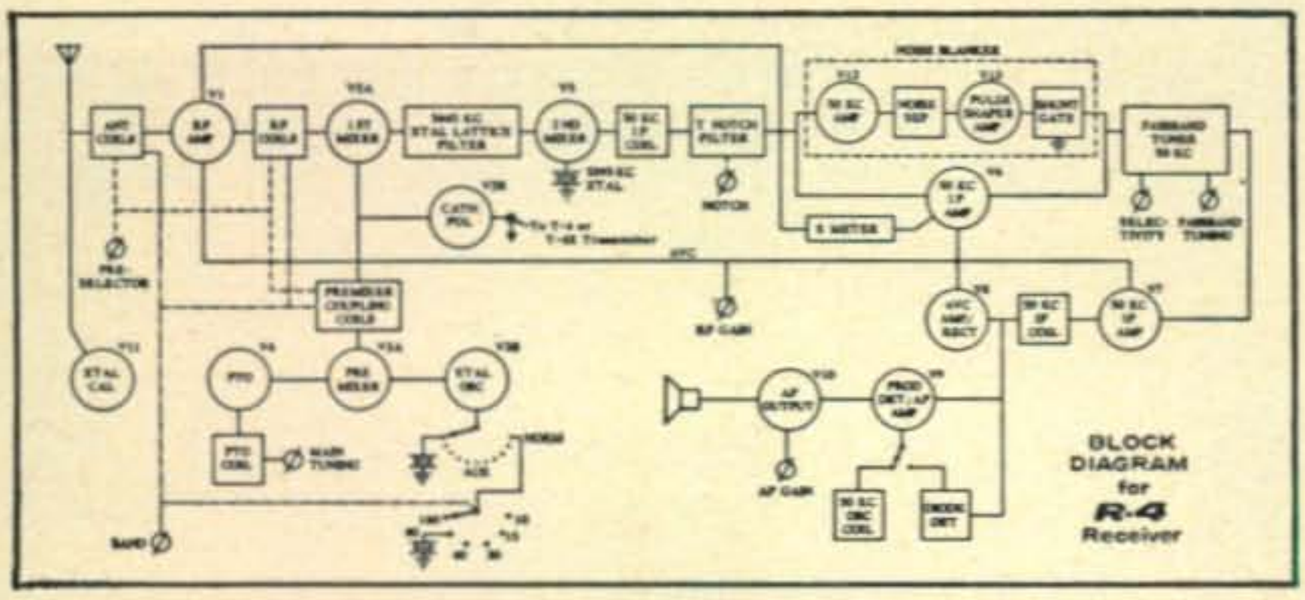
- **Compact size; rugged construction.**
- **Transceive capability;** May be used to transceive with the T-4 "Reciter" or T-4X Transmitter.
- **13 tubes and 7 diodes.**



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SPECIFICATIONS— Model R-4

FREQUENCY COVERAGE: 3.5-4.0 Mc, 7.0-7.5 Mc, 14.0-14.5, 21.0-21.5, and 28.5-29.0 Mc with crystals supplied. Ten accessory crystal sockets are provided for coverage of any 10 additional 500 KC ranges between 1.5 and 30 Mc with the exception of 5.0-6.0 Mc.

SELECTIVITY: Drake tunable passband filter provides:
.4 KC at 6 DB down and 2.6 KC at 60 DB down
1.2 KC at 6 DB down and 4.8 KC at 60 DB down
2.4 KC at 6 DB down and 8.2 KC at 60 DB down
4.8 KC at 6 DB down and 25 KC at 60 DB down
Selectivity switching is independent of detector and AVC switching.

I.F. FREQUENCIES: First I.F.—5645 KC crystal lattice filter; second I.F.—50 KC tunable L/C filter.

STABILITY: Less than 100 cycles after warm up. Less than 100 cycles for 10% line voltage change.

SENSITIVITY: Less than ½ uv for 10 DB signal plus noise to noise on all amateur bands.

MODES OF OPERATION: SSB, CW, AM, RTTY.

DIAL CALIBRATION: Main dial calibrated 0 to 500 KC and 500 to 1000 KC in 5 KC divisions. Vernier dial calibrated 0 to 25 KC in 1 KC divisions.

CALIBRATION ACCURACY: Better than 1 KC when calibrated at nearest 100 KC point.

AVC: Amplified delayed AVC having slow (.75 sec.) or fast (.025 sec.) discharge; less than 100 microsecond charge. AVC can also be switched off. 3 DB change in AF output with 60 DB change in RF input.

AUDIO OUTPUT: 1.4 watts max. and .5 watts at AVC threshold.

AUDIO OUTPUT IMPEDANCE: 4 Ohms and hi impedance for anti-vox.

ANTENNA INPUT: Nominal 52 Ohms.

SPURIOUS RESPONSES: Image rejection more than 60 DB. I.F. rejection more than 60 DB on ham ranges. Internal spurious responses in ham ranges less than the equivalent 1 uv signal on the antenna.

FRONT PANEL CONTROLS: Main tuning, AF gain, RF gain, AM-SSB/CW with slow AVC, fast AVC, or AVC off, function switch, band switch, xtal switch, passband tuning and selectivity, preselector, notch, and headphone jack.

REAR CHASSIS JACKS AND CONTROLS: S-meter zero, notch adjust, antenna jack, speaker jack, mute jack, anti-vox jack, accessory power socket, and fuse post.

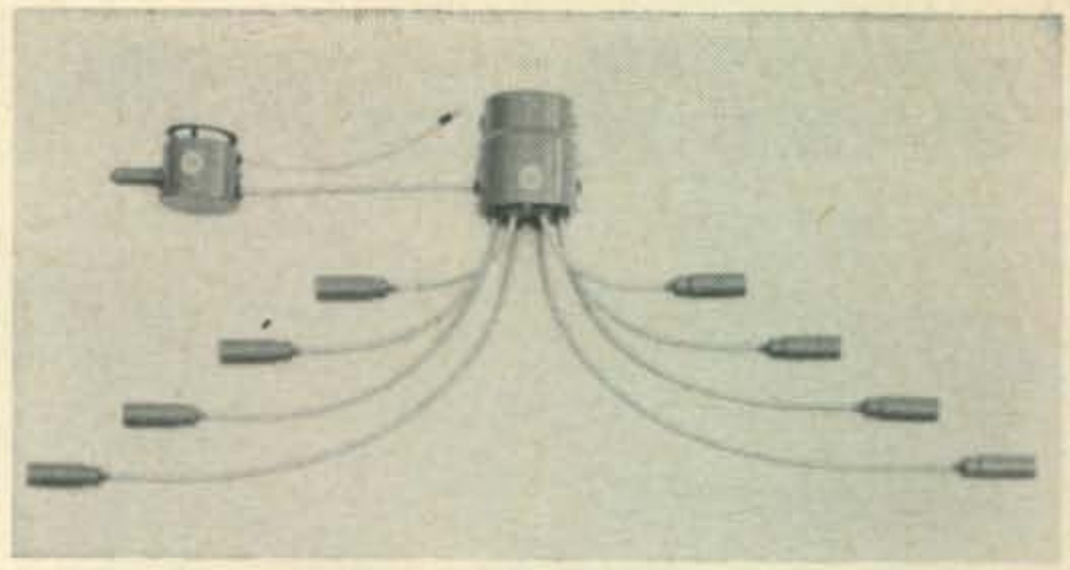
POWER CONSUMPTION: 50 watts, 120/240 VAC, 50/60 cycles.

DIMENSIONS: 5½" high, 10¾" wide, cabinet depth 11⅝", overall length 12¼", weight 16 lbs.

AVAILABLE ACCESSORY: Model MS-4 matching speaker cabinet with high efficiency 5 x 7 speaker. Cabinet also houses the power supply for the T-4 or T-4X matching transmitters.

For further information, check number 30, on page 110

Quieting Ignition Systems



A sample of a custom made shielded ignition kit ready to be installed. The 12 volt coil is fed through a coaxial feed through capacitor. Specially designed caps slip over the spark plugs.

BY KEN JUDGE GLANZER,* K7GCO

Here is the final word on how to beat the worst cases of ignition noise for good mobile operation.

Just about everyone who has operated mobile has been plagued with ignition noise (and other assorted noises). In one car I had, the ignition noise was so bad I had to park and shut the engine down to be able to operate. If the period of operation was too prolonged I would shut down, start the engine and recharge the battery with the 100 amp. alternator that was installed.

Another make of car was purchased and produced much less interference and the problem was forgotten until another new car was bought. This was a 1964 Ford and the noise was so bad that it even interfered with the f.m. radio.

The usual techniques were employed to reduce the ignition noise but nothing really helped too much. The biggest offender seemed to be the exhaust pipe. It was about a quarter wavelength on 10 or 11 meters and was mounted on insulated brackets all the way back. It acted as an antenna and reradiated the interference, but good. To break up the tuned length the exhaust pipe was bonded at the end and a few spots in the center. It had no effect, but other hams have had good results with bonding. All other tricks such as bonding the hood and wiper contacts up front were tried and did nothing. Bypass capacitors were installed all over the place; the noise prevailed.

Using a Heathkit Walkie Talkie as a probe the hot spots were located very quickly. The exhaust pipe was still hot but the main source of interference was still under the hood.

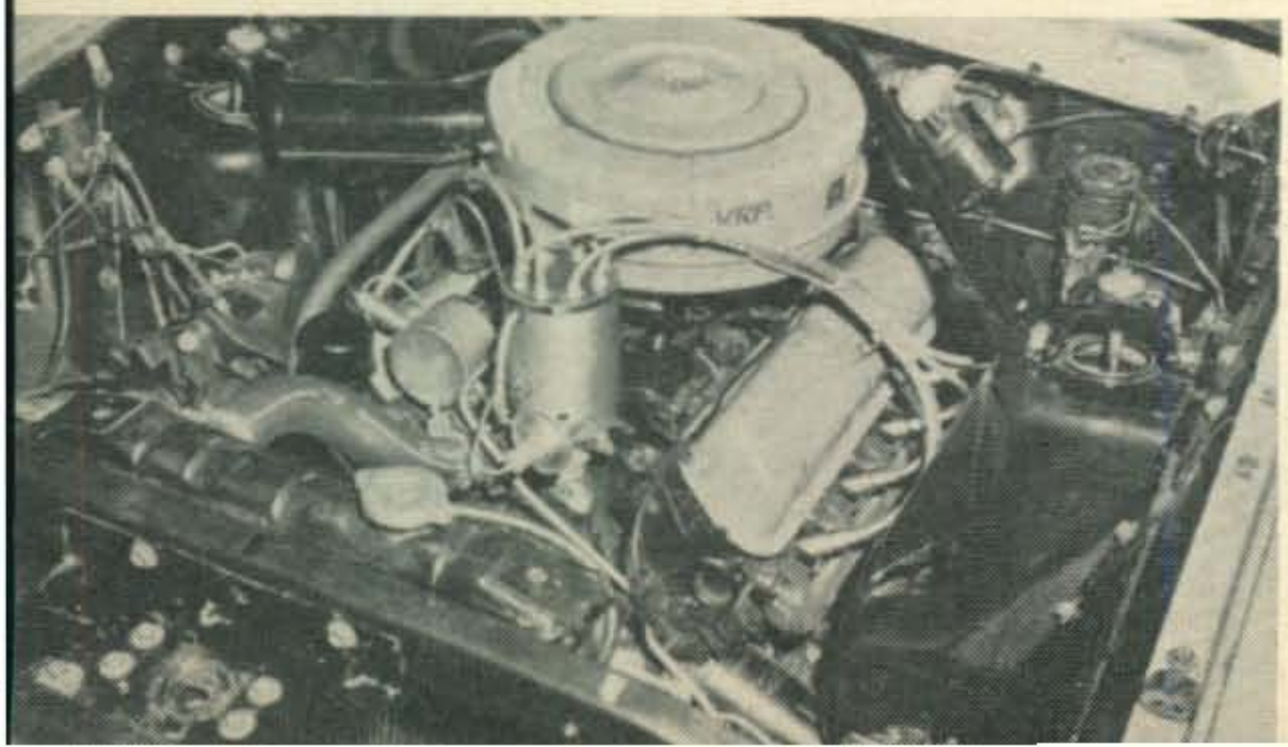
We stopped struggling and took stock of the situation. What were we doing? Trying to keep the noise out of the receiver. Why not attack it at the source? Preventing it from being radiated might just be simpler than cleaning it up. I was down at one of the local supply houses (buying some more capacitors) when a chap walked up and ordered a shielded ignition kit. What was this? I inquired and found out that shield kits were available for all the major cars or may even be purchased in a ready made custom kit. The unit for my car cost $49.50.

I ordered the kit and installed it in about 3 hours. It could have been done in less time but I was very careful about it. When complete, the car was started and the noise was down only about one half. Using the walkie talkie, it was observed that everything was considerably cooler but still not good enough.

A recently installed transistorized ignition system was now looked upon with suspicion as being a possible offender since it contained some unshielded l.v. wires. I had installed a switch under the dashboard to cut the transistorized ignition in or out to compare noise and engine power differences. Since the lines to the switch were all low voltage I felt there would be no noise radiation. While probing for noise sources, I came in contact with the terminals of the switch

[*Continued on page 99*]

*202 South 124th Street, Seattle 88, Washington.



Shielded ignition installed in a 1964 Ford. The resistance wires normally used for noise suppression are not used in the kit and thus some loss is eliminated. The distributor shield comes apart easily for servicing.

St. Helena Sojourn

BY GERRY SMILLIE*, G3PEU/ZD7BW

Here is an account of the DXpedition to St. Helena off the S.W. coast of Africa where Napolean was in exile. The author describes the problems in handling 7,200 QSO's.

"YES, that's right, St. Helena." "Where Napoleon was?" "That's right!" "Somewhere in the Mediterranean?" "No, that's Elba, he went there too!" I went through the motions of this conversation many times in the preceding months before my trip. So with memories of another conversation which went: ". . . just worked Gus as ZZ7A/Z,"—"Well done, where is that?"—"I don't know until I get the card from Ack," may I state, once and for all, that St. Helena is 16°S and 6°W, about 1000 miles off the coast of S.W. Africa.

By comparison to some less fortunate dx-peditioners, the 26,000 ton *Pretoria Castle* was a very luxurious method of reaching the chosen outpost. So it was that in the early hours of August 4th, 1963 I saw the dim, barren rock of St. Helena. The liner anchored about half a mile off the coast and passengers were taken to the little quay by small boats, ten minutes if the outboard motor started, half an hour if it didn't.

Waiting to greet me was Barry, ZD7SE, the only active (?—he hadn't been on the air for nineteen months) amateur on the island. Leaving the equipment in two large packing cases on the quay, we took my suitcases a few hundred yards to The hotel in Jamestown for a Council of War. I do not refer to the Consulate Hotel as The hotel through any sense of grandeur, it was simply the *only* hotel.

It was Sunday, and the next day was the time-honored institution of the British Bank Holiday. It would, therefore, be Tuesday before any licence could be arranged, so the day was spent making an initial exploration of the island, which is about ten miles by five. On Monday, having decided that the steep valley in which Jamestown was situated, was not the best location for a radio station, Barry arranged for the transportation of the equipment to a shack right at the top of the famous Ladder Hill. Here I was 600 feet above sea level, looking out over the South Atlantic to the north and west.

*Button End, Church Drive, Linby, Notts., England.

A view of the Ladder, all 699 steps, running up the hill.

The Collins KWM-2, with a 312B-5 PTO and 30L-1 linear were set up, and alongside went a KW Viceroy transmitter and KW77 receiver, which were to act as a reserve station. The latter combination was hardly ever used, but was of great psychological value, since only two scheduled ships, from South Africa, would call during my three month stay and spares would, to say the least, be difficult. As it happened, both ships were used to bring a few spare tubes, in response to emergency requests to Les, ZS6AKI and Anita, ZS1TZ, respectively.

The following day I visited the Government Secretary's office regarding a licence. I wrote out the requested details of equipment and these were returned to the office for incorporation into the licence. "You state here that this 30L-1 delivers 400 watts, p.e.p., whatever that means, while it says here," (reads from dusty file) "the power limit is 100 watts. . . ." "Well, you see . . ." I began in reply. (Any Collins owners, in possession of 30L-1 specifications, should firmly resist any temptation to re-read the above conversation.) I will simply point out that a 30L-1 can be run at 400 watts, p.e.p.

The next morning brought the license, duly signed by the Governor and with Barry's help I erected the KW trap dipole and the Hy-Gain 14AVS vertical antenna.

Power

This meant that I was ready to go; the only problem was power! So here we have the classic ham's nightmare: sitting beside not one, but two, complete stations, in possession of a licence, on as rare (from a sideband point of view) a spot as can be imagined, but without two volts to rub together! "Power supplies on the island," runs the London Colonial Office leaflet, "are 230 volts at 50 cycles for 24 hours a day." This was hardly true as the voltage fluctuated from second to second as the load changed. Anything between 185 and 210 was normal, while in the daily maintenance period, 0520 to 0600 GMT, it drops to 145 volts and even the receiver gives up! However, the total power cut which I was now experiencing was, truthfully, a rare occasion.

There was nothing to do but smoke and smoke, until, at 1700 GMT that evening, August 7th, everything came to life. I allowed fifteen minutes warm-up (after all, I did have 15 weeks) and tuned through 20 and found that the States were not coming in yet. I found a QSO between Bill, ZS6UR and Geoff, DL2OX, two good friends, and as good a place to start as any. A quick break, and ZD7BW was on the air, with the first two of over 7000 QSOs. Soon things were moving, and within half an hour the terrible twins George, G3AWZ and Tom, GW3AHN had appeared. George remarked that it was nice to find a dxpedition on the air bang on time! Little did he realize the power worries of the last few hours.

QSOs

The first Stateside station worked was K1OOJ but soon quite a few including Dorothy, K2MGE had their reports. In spite of Dorothy's extensive research to find legal sideband operation from ZD7 before my trip (she found no evidence) there still seems doubt as to whether or not a short expedition had been mounted before. However, it appears that any such activity was confined to 20, so, later in my stay, "Firsts" were accomplished on the other bands as below:

First 2×S.S.B. QSOs From ZD7

	to anywhere	*to the U.S.A.*
10 m	WA2SFP	WA2SFP
15 m	WA6UYI	WA6UYI
40 m	ZS6AOW	W3PHL
80 m	SM2BJI	WA2SFP

In addition to the above, during a short spell of good conditions, I got quite a thrill working Jack, K6ERV on 75, quite a long haul for that band. While on the subject of statistics, I made 7200 QSOs with over 5000 different stations, in 154 countries. One of the latter was accounted for by a few minutes pleasant chat with Gus at AC7, in one of his quieter moments. The band conditions, and especially the 15m path to the States, open some days for seven solid hours, were very much better than I had anticipated. The only major disappointment was the tremendous difficulty in reaching the VK/ZL area. After hours of trying, I finally made it with ZL1AIX and VK6RU plus a handful of others, with only days to spare before the end of my stay.

Since there were sixteen weeks to use, I was able to vary operating habits. On Sundays, I was often in the shack by 0300 GMT listening for Europe on 80 and would not pull the big switch until 20 closed to the States at about 2300. On the other hand, 1600 to 1830 on Mondays, Wednesdays and Fridays was almost sacred, tennis had priority. I managed to get Barry, ZD7SE on the air on a few occasions, although his job, studies and family occupied most of his time. On one occasion, he gave a CQ and had about ten stations on the frequency replying to him. Out of these, we picked the call 5A1TW, and, giving Gene a report, Barry passed it over to him. Gene handed it to Bill, 5A5TW, and on the next over I joined in to say hello to the boys in Tripoli. After a few minutes of the four-way QSO, we signed and found absolute silence on the frequency. We presumed the other stations had been so mystified by the calls 5A1TW and 5A5TW plus not one, but two ZD7's on sideband that they had gone for a stiff drink before continuing! !

The Island

I was often asked about the island itself, so a few remarks may be of interest. Of the 4800 people living on St. Helena, about 100 are Europeans who have either retired there or are working for the Government. The islanders themselves are a complex hybrid of European, African, Malay and Chinese descent. The only major

Gerry, G3PEU/ZD7BW, at the rig atop Ladder Hill in St. Helena. Note the card file system for quick and easy reference.

industry is the growing and processing of flax for fibre: however the game fishing is famed. While I was there a Marlin which weighed 1100 lbs. officially, but was probably nearer 1400 lbs., was landed.

The island has inland peaks of about 2600 feet, with deep valleys and ridges running down to the coast, like the spokes of a wheel. The roads going inland, which are narrow but of very high quality, rise from sea level to 2500 feet in six miles from either coast, which is fairly unusual anywhere in the world.

Summary

Some mention must be made of the standard aspects which are included in every expedition report. I must congratulate the vast majority of operators on their high standards. Oh sure, there were pile-ups and people got a bit carried away, but I think it is a great compliment to the amateur fraternity that I can say that only 5 stations out of over 5000 threw courtesy and consideration to the winds and knowingly caused interference and annoyance to the rest. The fact that, out of 2600 W/K stations worked, not one found their way on to that "banned list" of five, is high praise indeed. Yes, I know that the Stateside boys have been complimented before, but I am saying it again, because it wants to be said. The fact that the list did include a two-letter G3 call I prefer to forget!

The experience I had with aerials may be of interest. The kw trap dipole was strung from a mast, 18 feet high, at one end, to the 15 foot shack roof. The 14AVS was, contrary to instructions, simply stuck on top of a 6 foot pole without radials. On 20, there was no contest, the dipole suspended approximately E/W, performed very much better than the vertical, even in the directions of its ends. On 15, both worked well, and there was little to choose between them. Using only these two bands in the first few weeks, I began to wonder if the vertical's 9000 mile journey from Nebraska had been worthwhile. Then I tried working some 40 meter c.w. The difference between the two was even greater than on 20m, but was reversed. On 40, the 14AVS left the dipole at the starting gate! I have pages of log, on 40 c.w. to the States, that contain more 599 reports than other reports combined. In view of the unorthodox method of mounting the 14AVS, this may have been more luck than judgment, but it certainly made the careful transportation to St. Helena worth all the trouble. On 10 and 80 meters, little operation was made and the dipole was used.

Many stations were intrigued by being addressed with their correct name in the middle of a pile-up; the explanation will be seen in the photo of the rig. The cardex file system seen on both sides of the Collins gear, could be flicked through while replying to a call, and the operator's name found on his little card. The other photo shows the famous ladder joining Jamestown to the top of Ladder Hill. For the first few weeks I took a taxi up the road, and ran down the ladder, four times a day. I was later able to hire a car for the remainder of my stay.

The operation was closed by a pleasant chat with George, W8YBZ, on November 23rd, and I left the island twelve hours later.

I arrived home in the first few days of January to find 4600 QSL cards waiting for me—since then a further 600 have arrived, but have all, by now been replied to. I also found the Niagara Frontier DX Association's "DX Signal of the Month" award in the mail, the biggest thrill of all!

I should like to thank the authorities on St. Helena for their cooperation; Collins for their emergency spares kit, Hy-Gain for the 14AVS and everybody for the QSOs, without whom there would have been no St. Helena Sojourn. ■

U.S. Honors Amateur Radio With Special Postage Stamp

On December 15, the United States issued a 5¢ commemorative postage stamp honoring amateur radio.

The stamp, issued on the occasion of the 50th anniversary year of the American Radio Relay League, is light violet in color, and depicts a series of tone modulated waves and part of a large calibrated dial.

The stamp was first placed on sale at Anchorage, Alaska, in recognition of the outstanding performance of radio amateurs in providing emergency communications during the Alaskan earthquake of 1964. Post Office Dept. officials, League representatives and local Alaskan radio amateurs braved sub-zero weather to participate in special first-day of issue ceremonies.

The amateur radio stamp is now available at post offices throughout the United States.

W3ASK

F.S.K. for S.S.B. Transmitters

BY C. H. COMBS*

Here is a simple method to frequency shift key those complex s.s.b. transmitters without cutting into the v.f.o. The f.s.k. signal is fed into the audio section for perfectly legal and foolproof operation.

I WANT to go RTTY with my new $1,000 s.s.b. rig, but the oscillators are hard to get at and the v.f.o. is sealed up." Or: "I put f.s.k. diodes in my ultra stable v.f.o. unit and threw the calibration way off." Or: "My keying comes out upside down on most bands, so I have to use a relay." These are some of the complaints heard, and problems run into, when attempting to add f.s.k. capability to many of the new high priced s.s.b. units. Somehow the results don't always seem consistent with the good performance of the rest of the equipment. Cutting into these compact units is a job one can be reluctant to do.

The basic cause of this trouble of course, is the failure of the manufacturers to have f.s.k. built into the equipment. At present this is done by only a few. Until commercial practice catches up with this growing requirement of the purchaser, a simple way out has presented itself and can be easily used. This technique of f.s.k. is inherent in, and enabled by the high performance of this type of s.s.b. equipment, particularly with respect to carrier suppression. It is an audio type method and is a perfect complement to the audio TU method of receiving RTTY.

Quite simply, an audio oscillator is built up that can be shifted in frequency over a range of 850 c.p.s. or whatever shift is desired, by the teleprinter keying loop. The output of this is fed into the audio input of the transmitter. That's all there is to it. The v.f.o. oscillators are never touched and retain their full accuracy.

The output of the transmitter is two steady frequencies, one for *mark*, one for *space*, but this does not qualify as an audio signal in the technical sense. If carrier suppression is good, it is indistinguishable from a true f.s.k. signal at any distance from the shack. It is not a form of a.f.s.k., which is what would happen if the same thing were done to an a.m. or f.m. transmitter, where a carrier is also transmitted. This is perfectly legal. The government makes wide use of this method of f.s.k. on their s.s.b. transmitters, often having the unit built right in and included on the front panel function switch. The ARRL affirms its legality for amateur use, the only stipulation being that the carrier be adequately suppressed. By adequate suppression it means on the order of 40 db or more down from the tones, and this is a very typical performance for modern s.s.b. rigs.

You may wonder why I bear down so heavily on these political aspects, but I have been told point blank by several amateurs that this method would not actually produce an f.s.k. signal, or that it was illegal. I have found that it is not in wide use, despite the fact that one manufacturer, Collins, even recommends this procedure for their popular table top exciter, the 32S-3. I have seen two of these units cut into to make a conventional f.s.k. installation, and both times it has thrown the oscillator off frequency and both times the keying has been upside down on some of the bands.

Oscillator Unit

The circuit of a representative audio oscillator unit is shown in fig. 1. Many other designs will work as well, and if a unit has already been built for a.f.s.k. transmission on v.h.f., this can be adapted. In the circuit shown here, the shift-

[*Continued on page 96*]

*611 Walnut Avenue, Syracuse, New York.

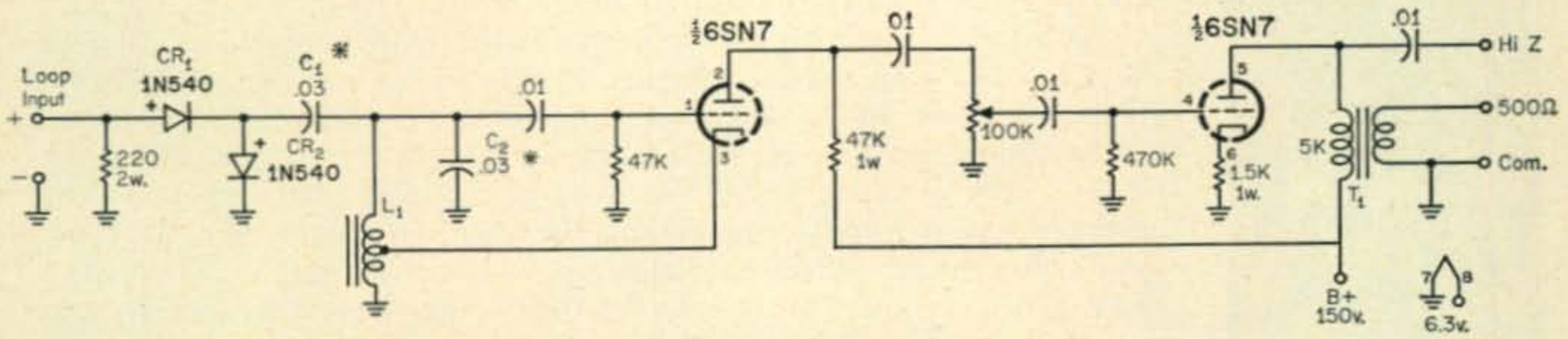


Fig. 1—The circuit for the audio oscillator needed to f.s.k. s.s.b. transmitters is shown above. All capacitors are in mf and all resistors are ½ watt unless otherwise noted. Transformer T_1 is a Stancor A-3250 and L_1 is a center tapped 88 mhy toroid.

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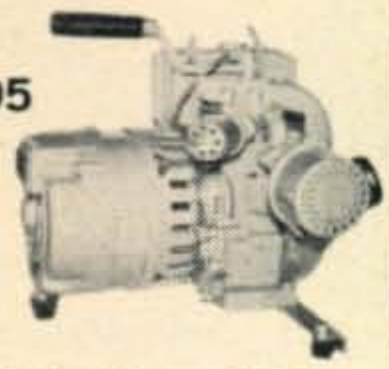

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OSCAR III

An Active Communication Satellite For Radio Amateurs

Part Two

BY GEORGE JACOBS,* W3ASK

OSCAR III, designed to be amateur radio's first active communication satellite, is expected to be launched sometime between the date that this article appears in print, and the end of the winter season. In anticipation of this impending launch, W3ASK, CQ's Space Communications Editor, discusses in Part 2 of this special two-part article, how the satellite can be used for 2 meter communications, how its signals can be used for interesting amateur scientific experiments, and how to obtain a QSL card for a space-listener report. Part 1 of this article, in which the design of the satellite was discussed, appeared in the October, 1964 issue of CQ.[1]

WHILE radio amateurs throughout the world are readying 2 meter equipment in an attempt to communicate through OSCAR III as soon as word is flashed that it is in orbit, the satellite presents a challenge to amateur space experimenters and space-listeners as well.

In addition to the translator, which will receive 2 meter signals from amateur radio stations transmitting from the ground, amplify these signals, and instantaneously retransmit them over great distances, the satellite will also contain a three-channel telemetry beacon and a second beacon transmitter which will emit a continuous unmodulated carrier. While radio amateurs may be interested mainly in using the satellite as a radio relay device, amateur space-experimenters may want to conduct experiments taking advantage of the assortment of signals which will be emitted from the satellite. The usefulness of such experiments have been demonstrated previously with the OSCAR I and II satellites, which contained only beacon transmitters. This article discusses how OSCAR III can be used for both communications and experimentation.

Communicating Through OSCAR III

OSCAR III will be a radio-frequency translator. It will accept any mode of transmission in a 50 kilocycle-wide channel in the 2 meter band (144.075 mc to 144.125 mc). The satellite has been designed to run continuously, and an operational life of about one month is expected before the batteries supplying power to the translator fail. Full details on the design of the satellite appear in Part I of this article, in the October, 1964 issue of *CQ*.

The operational range of OSCAR III will depend, among other factors, upon the height of the satellite's orbit above the earth's surface. As this article goes to press, the name of the satellite with which OSCAR III will ride piggy-back into space has not been announced. In all probability, OSCAR III's orbit will not be announced until after the satellite has been launched successfully.

The following table shows how maximum communication range varies with the height of the satellite.

Satellite Height *(Miles)*	Maximum Communication Distance *(Miles)*
100	1400
200	1900
300	2400
400	2750
500	3100
600	3400
700	3750
800	4100
900	4350
1000	4600

OSCAR III will have to attain an altitude of approximately 300 miles to permit its use for transcontinental communications, and 600 miles to make trans-Atlantic relay a possibility. Most of the satellites launched by the United States during 1964 were placed into orbits higher than 500 miles, so the chance appears good that OSCAR III may attain an altitude suitable for DX relay. It is also expected that the satellite will be placed in a north-south orbit similar to the OSCAR I and II orbits.

*SPACE COMMUNICATIONS Editor, *CQ*.

[1]This article has been compiled from material made available by the Project OSCAR Association, P.O. Box 183, Sunnyvale, California. The author wishes to express his appreciation to the Association for their assistance.

[1]From the standpoint of interference, however, experience indicates that probably no more than 10 pairs of s.s.b. stations will be able to use the satellite at the same time, and then only if self-disciplinary measures are taken to see that a separation of about 4 kc is maintained between each pair of stations. The number of stations operating simultaneously, using other modes of transmission, will depend on the bandwidth of each station.

Experiments conducted this past fall by radio amateurs living in the San Francisco area, with the satellite mounted atop a tower, proved that the satellite can be used satisfactory for two-way communication *provided the users know what they are doing and coordinate their efforts.* To communicate through OSCAR III will require different techniques, and considerably more operator discipline than is required for ground-based v.h.f. communications.

The output power of the satellite, approximately one watt, will be shared by all the signals passing through the repeater at the same time. As the satellite's receiver picks up more signals, a point will be reached where each signal commands such a small part of the available output power that none of the signals can be received by stations on the ground. In an effort to avoid chaos, confusion and unwanted interference that could result in such a condition, the OSCAR Association stresses operator discipline and suggests that the following procedures be used when attempting to communicate via the satellite.

A QSO via OSCAR III

One of the advantages of using a satellite for communications is that its orbit can be calculated and predicted with a high degree of accuracy. In other words, an amateur planning to relay signals through OSCAR III should be able to determine almost to the minute when and for how long the satellite will be in range. Unlike the chance openings upon which ground-based v.h.f. DX contacts depend, it should be possible to predict the times that the satellite can be used.

The OSCAR Association plans to supply up-to-the minute orbital data on a continuous basis through the world-wide OSCAR communication network. At the time that this article is being prepared, complete information about this network is not yet available. The headquarters station, W6EE, plans to transmit the satellite's altitude, period and inclination, as well as times for equatorial crossings during each orbit, on 80, 40 and 20 meter s.s.b., c.w. and RTTY. W6EE's transmissions will be picked-up and relayed by OSCAR communication stations throughout the world. In addition, latest OSCAR information will be carried on special transmissions over W1AW, the headquarters station of the ARRL. W1AW transmits c.w. on 3555, 7080 and 14,100 kc, and voice transmissions on 3945, 7255 and 14,280 kc. Official bulletins are given in c.w. Monday through Saturday at 0100 GMT and Tuesday through Sunday at 0500 GMT. Voice transmissions are scheduled Monday through Saturday at 0200 GMT and Tuesday through Sunday at 0430 GMT. While OSCAR is in orbit, W1AW plans to carry special bulletins throughout the day. With the basic orbital parameters known, it should be possible to calculate future passes without much difficulty.[3]

[3]Giro, "Planning OSCAR's Orbit with Ease," *CQ*, June, 1962. Hilton, "Making Your Own Orbital Predictions," *QST*, March, 1962. Walters, Wells, and Hillesland," Project OSCAR Measurements and Tracking," *QST*, July, 1961.

Based on the experience gained with OSCAR I and II, and the recent ground-based experiments with OSCAR III, the OSCAR Association has compiled the following hypothetical 2 meter QSO as an example of how to properly use the satellite.

The two stations in this example are a VE3 in southwestern Ontario, and a W2 in northwestern New York State, situated about 750 miles apart, on an east-west path. The operators at both stations made arrangements several days before OSCAR III was launched (during a QSO on 40 meters), to try to work each other on 2 meters through the satellite. Normally, both stations are well out of range for 2 meter communication. (The OSCAR Association strongly suggests that communication through the satellite be attempted on a pre-arranged basis between stations, rather than relying on calling CQ, or taking a random look across the satellite band).

The VE3 and W2 stations are both equipped with a stable, low-noise 2 meter receiver, accurately calibrated in kilocycles. To achieve as high a signal-to-noise ratio as possible, the receiver's bandwidth will be set to the *minimum* required for the mode of transmission being used. In addition, each station uses two crystal-controlled converters feeding into a stable low-frequency receiver. One converter is tuned to 145.85 mc, the telemetry beacon frequency, while the other is tuned to the c.w. beacon on 145.95 mc. (Actually, a single converter on either of these frequencies would be sufficient for tracking purposes). Each station will use this receiver as an "early-warning" system for heralding the satellite's approach. For transmitting, both stations are equipped with a 500-watt output (p.e.p.), crystal-controlled s.s.b. transmitter, the frequency of which is known to a kilocycle. In addition, each station has a medium-gain Yagi antenna (5 elements, approximately 10 db gain), rotatable in azimuth only. The antenna will be controlled by a *second operator,* whose job it will be to keep it aimed on the satellite, so that the beacon signals are received as strong as possible on the early-warning receivers. (The OSCAR Association suggests this "buddy-system" type of operation in order to track the satellite with antennas normally available to radio amateurs). While communication through the satellite may be possible using lower power transmitters, the stations used in this example are believed to be more-or-less typical of the type that will be required for s.s.b. communication.

From orbital information received via W1AW shortly after OSCAR III was launched, both stations were able to predict that the satellite would pass approximately between them, on a north-south path, on the following day between 1400-1407 GMT. In making the final arrangements for the satellite QSO, both stations agreed to transmit upper sideband on 144.110 mc, plus or minus a kilocycle. By using the following formula, they determined that the translated

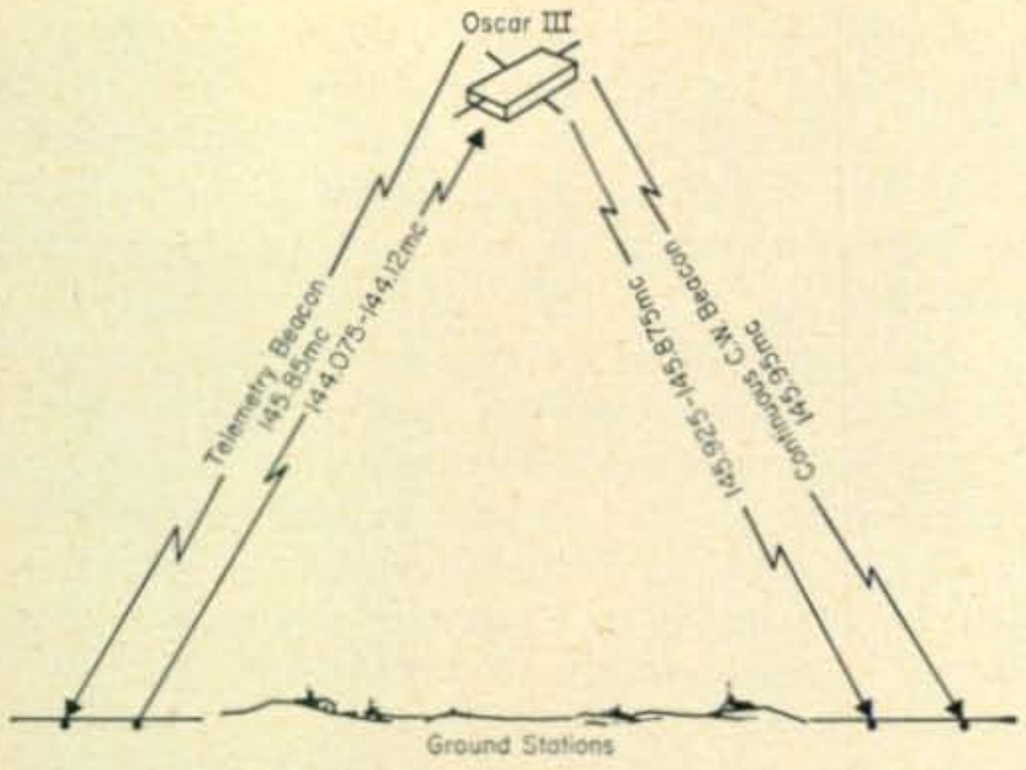


Fig. 1—Pictorial display of OSCAR III frequencies. Ground stations must transmit to the satellite on frequencies within the band 144.075-144.125 mc. The satellite inverts and translates this band, and retransmits it back to earth between 145.925-145.875 mc. Telemetry data will be transmitted from the satellite to ground on 145.85 mc, while a continuous c.w. beacon will operate on 145.95 mc.

satellite-to-ground frequency would be 145.890 mc.

$$S_f = 145.875 + (144.125 - G_f)$$

where: S_f is the satellite-to-ground frequency in mc. G_f is the ground-to-satellite frequency in mc.

OSCAR III's input will cover a range between 144.075 and 144.125 mc, and the frequency used on the ground-to-satellite log of the circuit must fall within this range. The satellite's translated output covers a frequency range between 145.925 and 145.875 mc. Reception on the ground of the satellite-to-ground leg of the circuit will be within this range. See fig. 1 for more details.

It should be noted that signals passing through the translator portion of OSCAR III and received on the ground will be subject to a Doppler shift. Doppler shift is the apparent difference between the transmitted and received frequencies resulting from the rapid velocity of the space-borne transmitter in relation to the fixed receiver on the ground. It is analogous to the apparent change in pitch of a train's whistle as it approaches an observer and then goes away. The whistle is higher in pitch, or frequency, as the train approaches and lower as the train goes away. At the exact instant that the train is opposite the observer, the true pitch of the whistle is heard. The same holds true for signals received from satellites.

OSCAR III has been designed to minimize the Doppler effect. The frequency inversion incorporated in the translator system causes the frequency shift on the "up" circuit to oppose the shift on the "down" circuit. Unfortunately, not all paths between ground stations and the satellite will encounter equal frequency shifts, so some Doppler shift will usually always be present. The shift observed at a ground station should be less than plus or minus four kilocycles from the carrier frequency, and may be higher or lower in frequency depending on whether the satellite is approaching or going away from the ground station. In most cases, the shift should be less than that commonly observed with many v.h.f. rigs using overworked surplus crystals, and it can be overcome by tuning the receiver slowly over a range of plus or minus four degrees from the carrier frequency.

Since the satellite's translator will invert signals when transmitting them back to earth, in this example, both the VE3 and W2 station must *receive* on *lower* sideband since they are *transmitting* on *upper* sideband.

It was decided prior to launch, that the VE3 station would start transmissions on 144.110 mc when he first hears the satellite's beacon transmitter on his early-warning receiver. The W2 will listen for the VE3's signal initially on 145.890 mc, but varying the tuning dial slowly plus or minus 4 kc to compensate for Doppler shift. At 1345 GMT, a few minutes before the satellite is expected to come into range, both stations take a final check of the following:

1. Clock properly set to GMT (Check with WWV for exact time).
2. Transmitter tuned to 144.110 mc, upper sideband.
3. Early-warning receiver tuned to 145.850 and/or 145.950 mc.
4. Two meter communication receiver tuned to 145.890 mc, lower sideband.
5. Antenna positioned in the proper direction according to the predicted orbit, with the second operator standing by to control the direction of the antenna in accordance with the beacon signal being received on the early-warning receiver.

As soon as the second operator at VE3 picks up the beacon signal, the first operator begins his initial transmission, which will last 30 seconds. Seven hundred and fifty miles to the east, the second operator at the W2 station has also heard the satellite's beacon transmitter and is tracking it. The first operator is tuning slowly across 145.890 mc. As the satellite comes into range he suddenly hears strong "white noise" in his receiver. This is the characteristic hiss of OSCAR III's translator, and its best identifier. Suddenly, just over the noise level he hears the transmissions of the VE3 station. When the VE3 ends his initial 30 second transmission, he signs over to the W2, and begins to listen for the W2's transmission on 145.890 mc. The second operator, meanwhile, continues to track the satellite beacon with the early-warning receiver, making any necessary adjustments to the beam antenna to hold the beacon signal at maximum strength. The W2 calls the VE3 on schedule for 30 seconds, and the VE3 hears the signal above the "white noise" level on 145.890 mc. He adjusts his tuning slightly to compensate for a slight amount of Doppler shift. Signal reports are exchanged, and the QSO begins to resemble a normal low-frequency contact. The QSO continues for about seven minutes, then as predicted, the satellite drops out of range, and contact is abruptly lost. A QSO via OSCAR III has been successfully completed! (For historical reasons, both operators recorded the QSO on tape as a permanent record of their unique accomplishment).

The above example is one way a contact via OSCAR III may take place. No doubt, sooner or later, some amateur will call CQ and receive an answer at random via the satellite. It is hoped, moreover, that trans-oceanic and trans-continental QSOs will be achieved by this unique repeater satellite. As this is the first time such an experiment has been undertaken, all prophesies and predictions are, of course, based upon intelligent guesswork and may prove to be invalid. At this time, however, the equipment and procedures used by the VE3 and W2 stations in the example, represent what is believed to be the best way to attempt communication through the satellite.

Interference Caution

To keep interference to the OSCAR III satellite to a minimum, especially near areas of intense v.h.f. activity, 2 meter stations *not* desiring to communicate through the satellite should make sure they *do not* conduct ground-based communications in the passbands 144.075-144.125 mc and 145.955-145.875 mc, or on the 145.85 and 145.95 mc beacon frequencies. Leave these frequencies clear so that they may be available for all those who may want to use the satellite.[2] Amateur radio can be very proud of the results of the OSCAR I and II experiments, during which time not a single incident of interference was reported on the beacon frequency used for both satellites. It is even more important that this splendid record be upheld during the period that OSCAR III will be in orbit.

Remote Area Beacons

The possibility exists that OSCAR III may be badly overloaded near areas of intense v.h.f. activity, yet remain silent but receptive over areas of the world where little v.h.f. activity is present. It is hoped that amateurs in areas of the world having little v.h.f. activity will supply signals from ground-based beacon transmitters that will activate the satellite and alert distant observers. A v.h.f. beacon in the Azores, for example, would be extremely useful for activating the satellite over the North Atlantic area, so that the beacon's signals could be heard on both sides of the Atlantic. Similar beacons located, for example, on a Pacific Island, or in India, could activate the satellite over the Pacific and Asian areas. While this would not be two-way communication, it would contribute useful data in determining the communication capability of the satellite, and would alert amateurs in other areas of the world as to the satellite's range. The OSCAR Association suggest that beacons located in isolated areas use 144.100 mc as a calling frequency. This will be translated by the satellite and relayed to ground stations on 145.900 mc.

OSCAR Experiments

In addition to communicating through the satellite, many challenging experiments are possible with OSCAR III which may be conducted

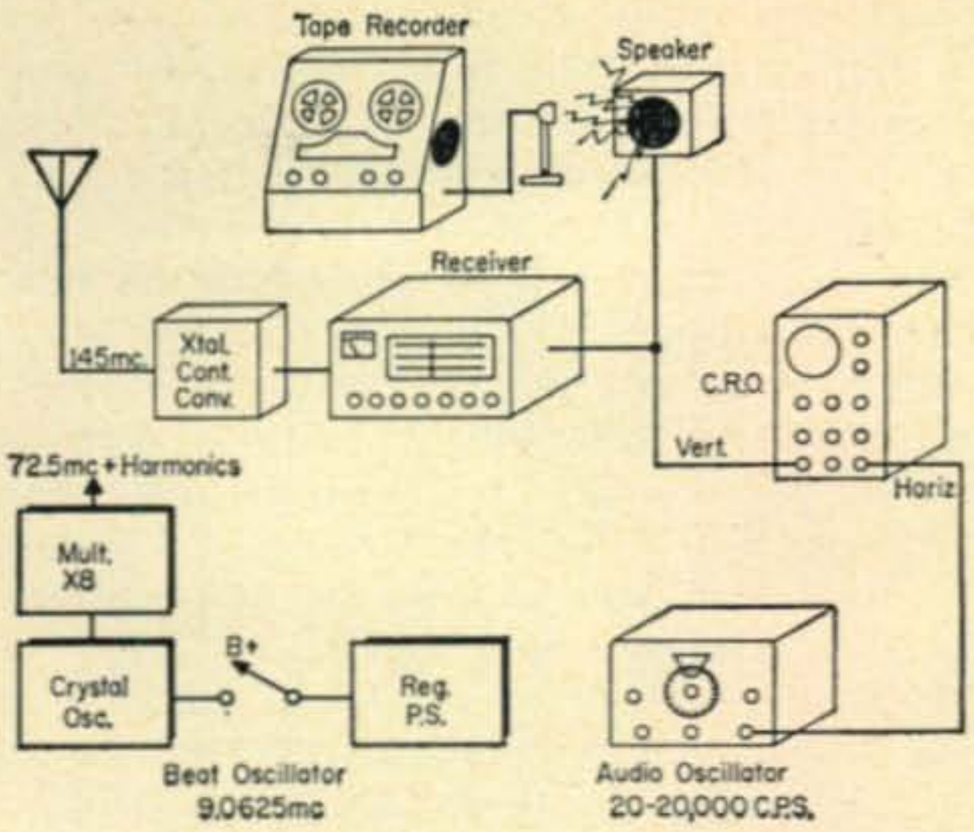


Fig. 2—Sample setup for measuring Doppler shift of OSCAR satellite. The coupling between the crystal controlled external beat oscillator and the converter input circuit must be as light as possible to prevent decreased receiver sensitivity as a result of overloading. Be sure to turn off external signal or b.f.o. when making signal strength measurements of OSCAR III's reception.

by non-radio amateurs. As examples of what may be achieved with OSCAR III, the following are some of the experimental results of the OSCAR I and II satellites:

1. The time that the satellite's signals were first heard, and the time that the signal faded out were recorded, and the data used for making orbital predictions. Further refinement of this data made it possible to determine the operational range of the satellite.
2. The time of closest approach (t.c.a.) and the slant range of the satellite at t.c.a. were determined with a very high degree of accuracy from Doppler shift measurements.
3. The envelope modulation of the received signal provided a clue to the roll rate of the package as it tumbled through space.
4. The internal temperature of OSCAR I was monitored by recording the number of HIs sent on the satellite's beacon transmitter in a minute. This data was used as a guide in establishing the external temperature-stabilizing surface treatment for OSCAR II. Similar observations of OSCAR II's HI rate indicated that the satellite's internal temperature was well within the design requirements.
5. The gain and power level requirements for the OSCAR III translator were established partly from data derived from the numerous signal strength measurements of the OSCAR I and II signals.

Similar experiments can be performed with the OSCAR III satellite.

Doppler Experiments

The 145.95 mc c.w. beacon aboard the OSCAR III satellite may be used for Doppler shift measurements. To measure the Doppler shift on this signal will require a stable signal source (drift of less than 500 c.p.s. in 30 minutes) to beat with the incoming signal on 145.95 mc. An audio oscillator and an oscilloscope will also be required to measure this beatnote. Fig. 2 shows how this equipment can be set up to give reasonable accurate Doppler shift measurements. OSCAR's beacon is tuned in on 145.95 mc, and the stable external signal source is set for a low audio note which will *rise* in frequency as OSCAR approaches. Thereafter, neither the receiver tuning nor the beat oscillator should be adjusted. Any change in beat note must be the result of

the Doppler shift or results will be inaccurate. By plotting the audio beat note against precise time (try for an accuracy of a second or two), the exact time of closest approach (t.c.a.) can be determined. This is the time during a pass when the satellite will be nearest to the ground observing station. The resulting curve will resemble the letter "S". The time at the center of the "S" curve corresponds to t.c.a. When the satellite passes nearly overhead, the total change in frequency will be approximately 8 kilocycles. The total shift will be less, the more distant is the point of closest approach.

If a tape recorder is available, the beat note may be recorded and played back after the pass, when it may be more convenient to determine the Doppler shift curve. Record the output of the receiver by placing the recorder microphone near the receiver speaker. Record a reference time mark on the tape (a "woof" at an exact minute) just before recording the satellite's signal. The Doppler data can be reduced after the pass is over and, if necessary, the tape can be run several times to improve the accuracy of the curve.

More complete data on Doppler shift, and how it can be measured, appear in the footnoted articles.[4]

Telemetry Measurements

A telemetry channel is incorporated in the OSCAR III satellite to enable ground observers to monitor operation of the equipment. If anything goes wrong with the satellite during orbit, the only clue to the malfunction will be contained in the information transmitted back to earth via this channel. It is urged that as many ground observers as possible monitor the telemetry channel of OSCAR III, and log the information received for transmittal to the OSCAR Association.

Plans call for OSCAR III to transmit telemetry data relative to temperature measurements made at various critical points in the satellite. This data will be transmitted on 144.85 mc, and the signal will resemble fig. 3A. One complete telemetry sequence will last from 6 to 12 seconds and will consist of two HIs sent in Morse Code (.... ..) as an identifier, followed by two bursts of pulses sent at a rate of 64 pulses per second. The duty cycle (ratio of pulse width to repetition rate) of the pulses in each burst conveys the desired temperature information, (see fig. 3B for details). An inexpensive oscilloscope may be used to measure the duty cycle. The pulse width conveys the information which is measured against the reference repetition rate. To facilitate use of the oscilloscope recordings, the telemetry bursts may be traced on the screen with a grease pencil and the duty cycle of the pulses in each burst determined after the pass is completed.

The repetition rate of the complete telemetry sequence (two HIs plus the two bursts) is a measure of the battery voltage. As the voltage drops, the HI and burst rate will decrease. Calibration curves for temperature and voltage readings will be available by early February from the OSCAR Association, P.O. Box 183, Sunnyvale, California.

Listener Reports

A total of over 950 radio amateurs and ground observers provided over 7000 individual tracking and signal strength reports of the OSCAR I and II satellites. These reports came from the United States and more than 30 foreign countries. Fed into a computer by the OSCAR Association, the reports provided valuable tracking and radio propagation data. Listener reports of the OSCAR III satellite will be just as valuable in providing scientific information of a very useful nature.

If OSCAR III is launched into its hoped-for north-south polar orbit, it will pass over or near almost every spot on the earth several times a day. This offers an excellent opportunity to observe the satellite's continuous unmodulated signal transmitted from a beacon on 145.95 mc. It should be possible to receive this signal on almost any 2 meter receiver, or converter-receiver, in good operating condition and using an outdoor antenna.

Useful signal level readings can be obtained with any receiver having an S-meter. Run the receiver "wide-open" and note the S-meter reading *before* OSCAR can be heard, and when there is no other signal on the beacon frequency. This reading is an indication of the residual noise level. Next, note the S-meter reading as OSCAR's signal is heard. *Subtract* the reading due to noise from the reading obtained with OSCAR's signal. To determine the signal in db above the noise level, multiply this difference by 6 db (on the assumption that one S-unit equals 6 db). For example, if the noise level with the receiver's r.f. gain at maximum is measured as S3, and the meter kicks up to S6 as OSCAR passes, the difference is 3 S-units, or 18 db of signal.

[*Continued on page 97*]

[4]Norgaard, "Eyeball and Eardrum Dappler Tracking," *QST*, April, 1962 and June, 1962.
Burhans and Rankins, "Keeping Track Of OSCAR," *QST*, May, 1962.
Hilton, "Making Your Own Orbital Predictions from Doppler Measurements," *QST*, March, 1962.

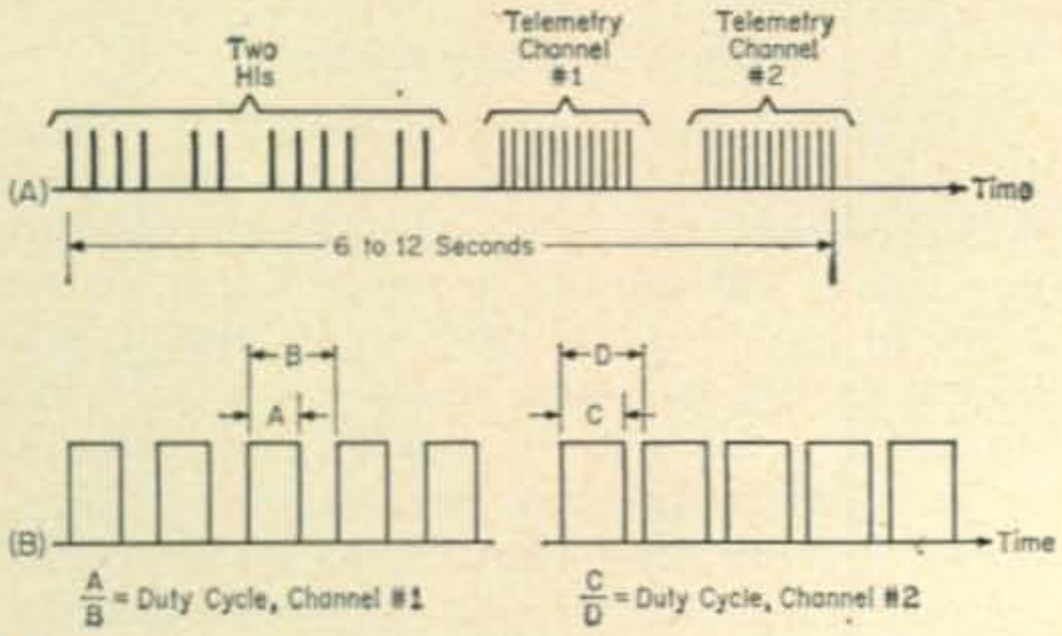
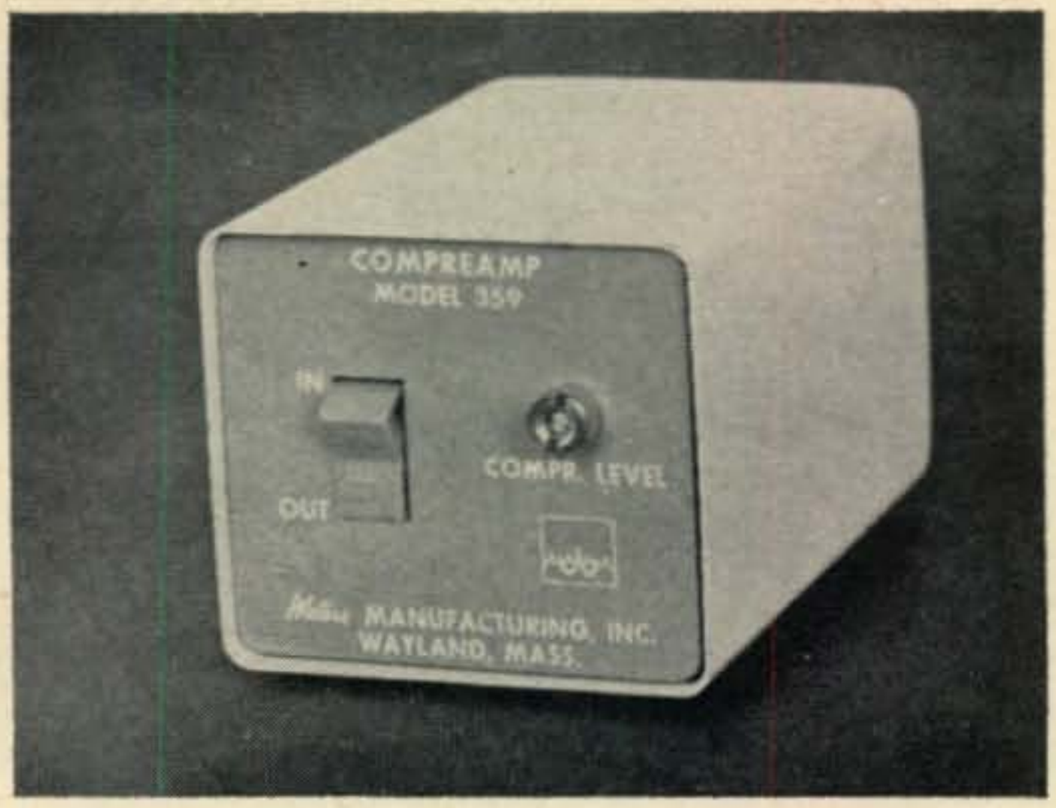


Fig. 3—(A) OSCAR's telemetry sequence will last from 6 to 12 seconds, and will consist of two HI's sent in Morse Code, followed by two bursts of pulses at a rate of 64 pulses per second. The repetition rate of the entire sequence will be a measure of battery voltage. (B) The duty cycle of the pulses in each burst will convey internal temperature information.



The Waters Model 359 Compreamp. The in-out rocker-type switch is at the left, the screw-driver-adjust level control is at the right. Connecting terminals are on the rear of the unit.

CQ Reviews:

The Waters Model 359 Compreamp

BY WILFRED M. SCHERER,* W2AEF

WANT to make that kilowatt a.m. or s.s.b. phone signal sound like two or more kw, or a few hundred watts sound like several hundred—and at the same time prevent overmodulation or flat topping? The Waters Model 359 Compreamp can do just that!

The Compreamp is a solid-state device which functions as a preamplifier and speech processor. As such it is designed for use with phone transmitters to increase the *average* voice level applied to a transmitter and to provide audio-peak limiting above a preset point. The unit is small in size and need only be connected between the microphone and the mic input of the transmitter. Power is supplied from a self-contained 9-volt battery.

Speech processing usually is obtained by means of compression or clipping. Space does not allow a detailed discussion of the operation or merits of each method, so only a few brief comments will be made at this time.

Compression is an automatic gain control (a.g.c.) arrangement which may be used at an a.f. or r.f. level. A high constant *overall* signal level may thereby be maintained without exceeding given peak levels, but only a moderate increase of *average* voice power can be realized. A.l.c. used in s.s.b. transmitters is r.f. compression, but in most cases some flat topping of the r.f. envelope takes place before the a.l.c. takes hold or it may even occur on recurrent voice syllables, causing both in-band and out-of-band distortion.

A.f. clipping cuts off the high-level input-amplitude peaks without affecting the lower-level components of speech. A high *average* voice level can thus be maintained. Unfortunately, clipping causes distortion by an amount depending on the degree of clipping, but this can be held to a tolerable point by employing a moderate degree of clipping, low-frequency roll-off ahead of the clipper and wave-shaping techniques after the clipper.

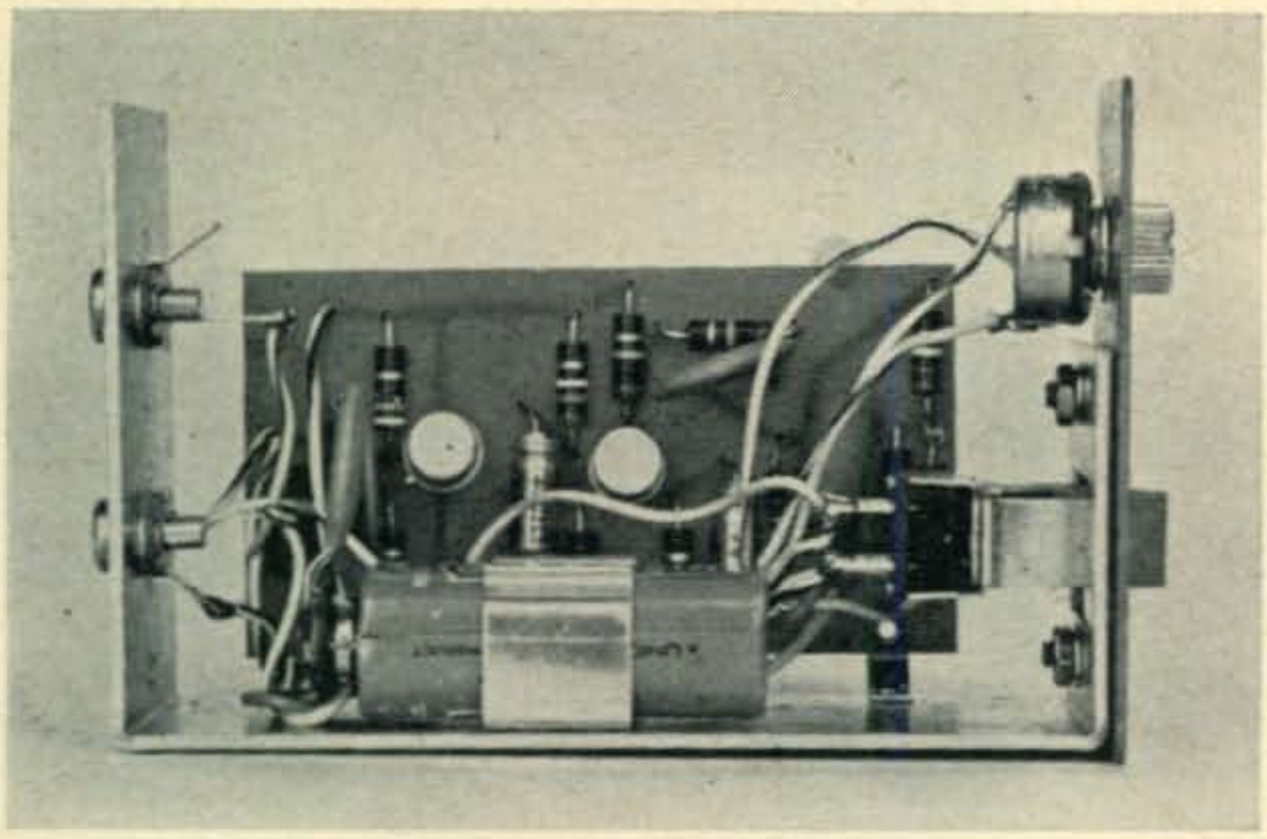
The average power in a clipped wave is higher than otherwise and thus can contribute to the overall increase in the average power in a voice-wave train. This is an additional dividend when a.f. clipping is used with a.m., but with s.s.b. a clipped or distorted a.f. input signal produces lower average r.f. envelope power than does an undistorted signal having the same peak power. It is largely for this reason that the impression is prevalent that speech clipping in the a.f. system cannot be of benefit with s.s.b., but we need not necessarily be concerned about the average power of a few clipped intermittent high-amplitude peaks[1] if at the same time we can increase the level of all the other dynamic components of speech which make up a complex voice-wave train (especially the weak h.f. sounds needed to produce speech intelligibility) and in this manner raise the *average voice power* in the r.f. envelope. This is what a properly designed and operated audio-clipping system can do.

Clipping can be more effective for s.s.b. when the s.s.b. r.f. envelope is clipped in a low-level r.f. stage of the exciter to obtain a high average r.f. level. In this case, the average power of a clipped peak can be maintained with the same result as experienced with a.m.

The method requires an additional sideband filter and can be more costly than a.f. clipping. When used as an accessory, it requires digging into the s.s.b. equipment for making the installation.

*Technical Director, *CQ*.

[1]These usually occur at the low voice-frequencies which convey little useful speech information.



Interior view of the Compreamp showing the components installed on a printed-circuit board. The battery is in the foreground held in by the clip.

The Compreamp

The Waters Model 359 Compreamp consists of a two-stage transistorized speech amplifier followed by a pair of back-to-back diodes which function as a full-wave a.f. clipper. A gain control, preceding the second stage, permits adjustment of the speech level for the desired degree of clipping. The frequency response of the amplifier rolls off at the lower voice-frequencies and a simple filter after the diodes shapes the clipped waveforms to an extent which minimizes high-frequency distortion products. The filter network also attenuates the output of the Compreamp to a level which is near the normal output level of the microphone itself and thus enables the Compreamp to be switched in or out without necessitating any major readjustment of the transmitter mic-gain control.

Power from a self-contained battery is applied to the Compreamp by means of a rocker-type panel switch which at the same time also connects the unit between the microphone and the transmitter mic input. When the switch is placed at OFF, the battery is disconnected and the microphone is fed directly to the transmitter, bypassing the Compreamp.

Operation

Proper operation of the Compreamp depends on the correct adjustment of the transmitter mic gain and the Compreamp level control. The basic procedure is one of setting the controls to the point where peak modulation can be obtained, without overmodulating or flat topping, along with a suitable degree of clipping or average voice-power increase. This is best done with the aid of an oscilloscope, but it can be conducted without special test equipment by following the instructions given in the manual.

When an oscilloscope is used, an r.f. envelope display will be filled up more in the valleys when the Compreamp LEVEL control is advanced into the clipping region. With a trapezoid display the pattern will be uniformly brighter with clipping. In no case should the mic gain be raised to the point where flat topping occurs with s.s.b. or where overmodulation and carrier breakup on the negative peaks takes place with a.m.

Performance

Since the "proof of the pudding is in the eating", let us take a look at the performance of the Waters Compreamp.

During bench tests with a.m., a noticeable increase in "upward" modulation was observed. Using s.s.b. with no a.l.c., the average power-meter readings with speech input to the transmitter (for a given peak power observed with an oscilloscope) were two to three times higher than obtained without the Compreamp in service. Similar tests without the Compreamp, but comparing a.l.c. alone as against no a.l.c., showed an average power rise of no more than 50%.

Extensive on-the-air tests proved the Compreamp to be highly effective with both a.m. and s.s.b. Instantaneously switched comparisons with and without the Compreamp were made while the r.f. output was monitored with an oscilloscope, using both r.f. envelope and trapezoid displays, in order to be sure that the peak power, without overmodulation or flat topping, was the same in all cases. Signal reports indicated a stronger and fuller sounding audio signal with better intelligibility with the Compreamp in operation on all modes of phone transmission. No reports of adverse distortion were forthcoming. Where s.s.b. alone was concerned, S-meter readings usually were higher also.

In some s.s.b. cases, little or no increase in effectiveness was reported. In these cases the signal saturated the receiver or was strong enough to begin with so that any power changes were levelled off by the receiver's a.g.c. and thus produced no significant change in audio output. Such reports can be received even when switching from an exciter to a high-power linear when the exciter signals are very strong at the onset and the receiver has a good a.g.c. system.

The increased talk power obtained using the Compreamp was particularly effective when the normal signal level was low or marginal, especially with DX contacts and during bad noise and QRM conditions. In these respects, its use with mobile gear should be most beneficial.

When a good amount of a.l.c. was already in use with s.s.b., any increased improvement afforded by the Compreamp was not as marked as when a.l.c. was not used; however, compared to

[*Continued on page 109*]

Inverted DSB On Two Meters With The SCR-522 Transmitter

BY E. L. WARDEN,* W4PGI

The inverted double sideband system previously described in CQ[1] is shown applied to an SCR-522 for 2 meter operation. Also given below are some helpful hints and answers to the many questions that followed the first article.

THE February, 1964 issue of *CQ*[1] described the basic principles of operation of inverted double sideband suppressed carrier and a simple transmitter of this type was shown as an example. This article will show the extreme ease of applying this technique by modification of an existing typical v.h.f. transmitter to gain the advantages of suppressed carrier with the resultant increased power gain. It will be assumed that the reader has read the previous article on inverted d.s.b., so a repetition of the basic theory of operation will not be given here.

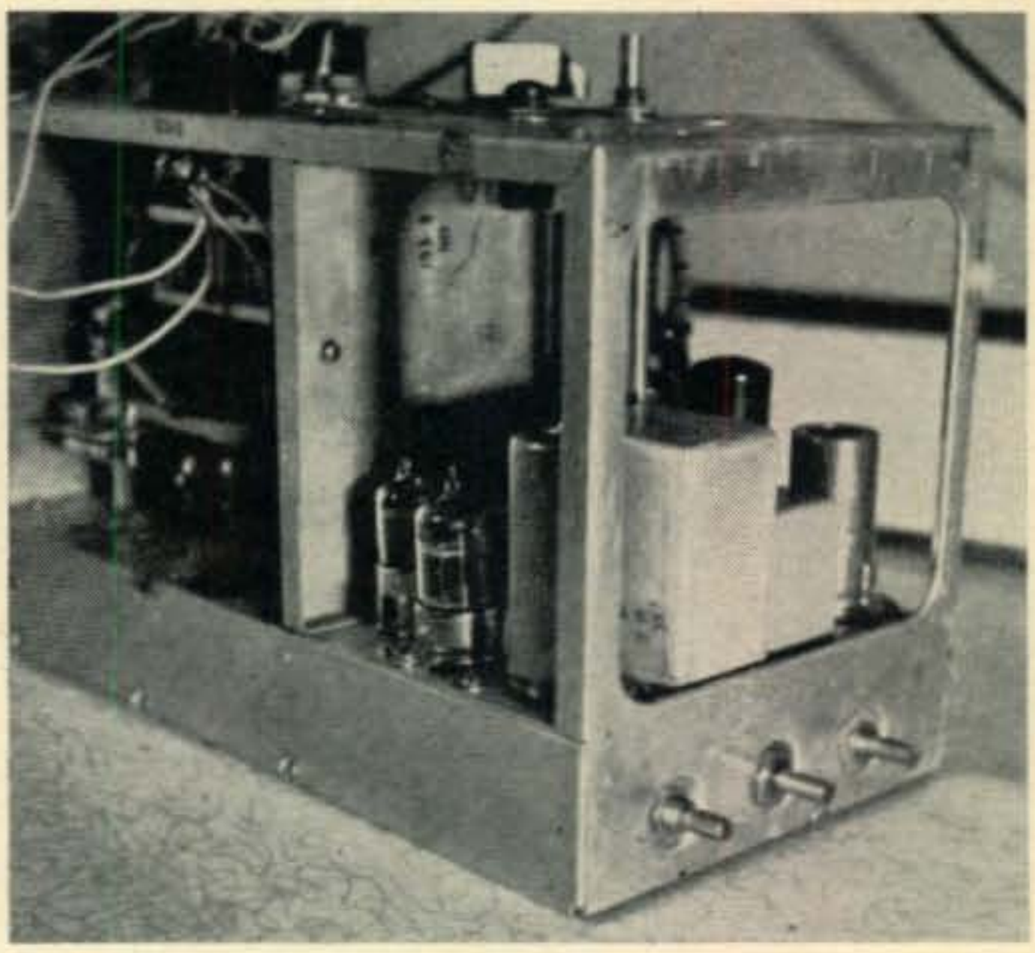
The use of single sideband on v.h.f. and u.h.f. has shown that it is possible to communicate over ranges that conventional a.m. transmitters cannot approach. Some outstanding work has been done on two meters using s.s.b.; ranges of several hundred miles have become routine with some v.h.f. s.s.b. operators. Most of the advantages of sideband techniques apply equally to v.h.f. and u.h.f. as well on the lower frequency bands. However, the complexity of a v.h.f. or u.h.f. single sideband transmitter is enough to make most amateurs hesitate. For this reason most amateurs continue to use a.m. on two meters and up.

The simplicity of inverted d.s.b. becomes particularly apparent on our higher frequency bands. It is not necessary to generate the signal at a low frequency and heterodyne to the operating frequency like s.s.b. transmitters do. All r.f. stages operate Class C and are no more complex or critical than those in a c.w. transmitter. The final stage is self-neutralizing (since the grids are in parallel and the plates in push-pull), which may be a relief to the amateur who is losing sleep trying to tame his 2 meter Class AB_1 final linear amplifier. The audio stages of the transmitter are no more complex than most "Hi-Fi" amplifiers. The use of inverted d.s.b. will avoid most of the disadvantages of conventional a.m. without resorting to the complexity of single sideband.

SCR-552

The transmitter which was modified for inverted d.s.b. was the old reliable SCR-522. These rigs can still be picked up on the surplus market for practically peanuts. I paid five dollars for mine.

The output stage of the transmitter was converted into a high level r.f. balanced modulator by removing the 832A and its socket and installing two 6146's. The circuit is shown in fig. 1. The plates are connected in push-pull to the balanced tank and the control grids are con-



The audio section is shown on the rear. On the left side we have the local oscillator, audio amp. and audio feed-through balance amp., and the 7360 (shielded). Along the rear edge, to the right of the 7360, is the audio inter-stage transformer, the low pass filter and the dual triode audio voltage amplifier are under the shield. One of the two 12A6 power amplifiers may be seen. The three controls across the back of the chassis are, from l. to r., AUDIO GAIN, FEED-THRU BALANCE, and LOCAL OSCILLATOR BALANCE.

*W-546 Arlington Towers, Arlington, Virginia.

[1]Warden, E. L., "Inverted Audio For D.S.B.," *CQ*, Feb. 1964, p. 26.

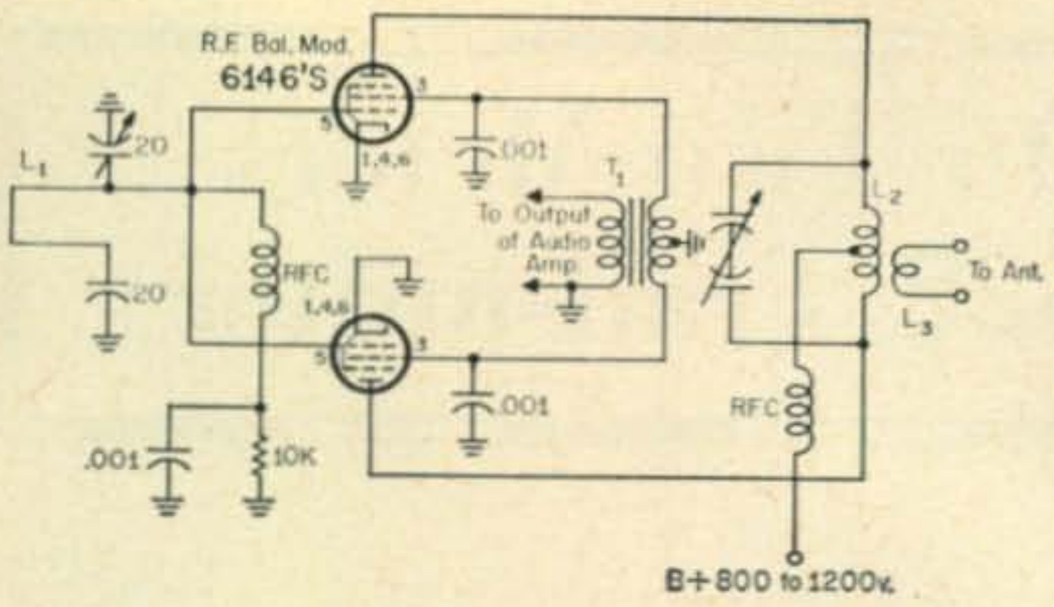
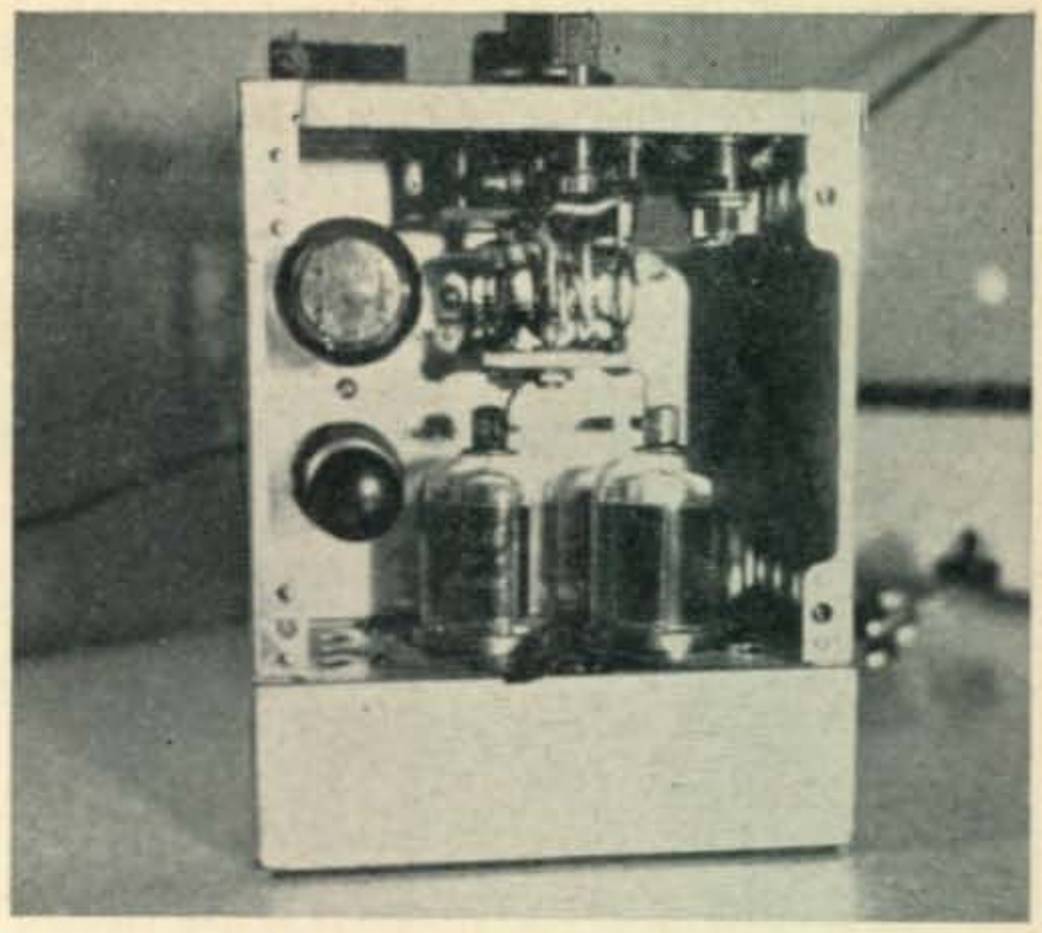


Fig. 1—Circuit of the r.f. balanced modulator output stage used to replace the 832A in the SCR-522. The driver stages remain unchanged. The tuning capacitor and r.f.c. connected to L_2 are those found in the SCR-552.

L_1—Hairpin loop wound around 832A driver plate line.
L_2—2t #14 wire, ¾" diam., 1" long.
L_3—2t #14 wire, ½" diam., ½" long, inside L_2.
T_1—Multimatch push-pull output transformer (p-p plates to voice coil).



View of the end of the chassis opposite to the audio shows the high level r.f. stages, two 6146's (where an 832A was formerly located). The r.f. driver stage remains unchanged.

nected in parallel. The inverted audio is fed into the screens in push-pull. It was originally planned to install an 829B into the original socket of the 832A, but it was discovered (after my soldering iron got hot) that the two screens of the 829B are connected together inside the tube.

The speech inverter and audio amplifier were built into the space that the original modulator occupied. These circuits are shown in figs. 2 and 3. The construction is conventional and there is plenty of space for all components and wiring.

Adjustment

The adjustment of the transmitter is as follows: By substitution of capacitors, vary C_1 until the local oscillator of the speech inverter is operating on approximately 3200 c.p.s. Put a scope across the input of the low pass filter. Adjust the local oscillator balance control to null out the local oscillator signal. Then put a pair of earphones across the low impedance winding of the output transformer of the 12A6's. Advance the audio gain controls slightly and speak into the microphone. Adjust the audio feed-thru balance control to null out the uninverted components of the speech. The speech will be inverted and totally unintelligible when the speech inverter is working properly.

After the inverter is checked out, tune up the r.f. stages of the transmitter and connect the rig to an antenna. Adjust the antenna loading and the audio gain controls so that the plate current in the final kicks up to about 150 ma on modulation peaks. The idling current will be about 10 ma (incidentally, if you use s.s.b., compare this with the idling current of your Class AB_1 linear amplifier). It is advisable to use a scope during the preliminary adjustments of the transmitter to make sure that you are not flat-topping in the audio stages or in the final (as you would do with any phone transmitter).

Helpful Hints

In response to the large number of letters received as a result of the previous article on inverted d.s.b., the following hints are given to help those who might have had some difficulty in getting their rig to work properly.

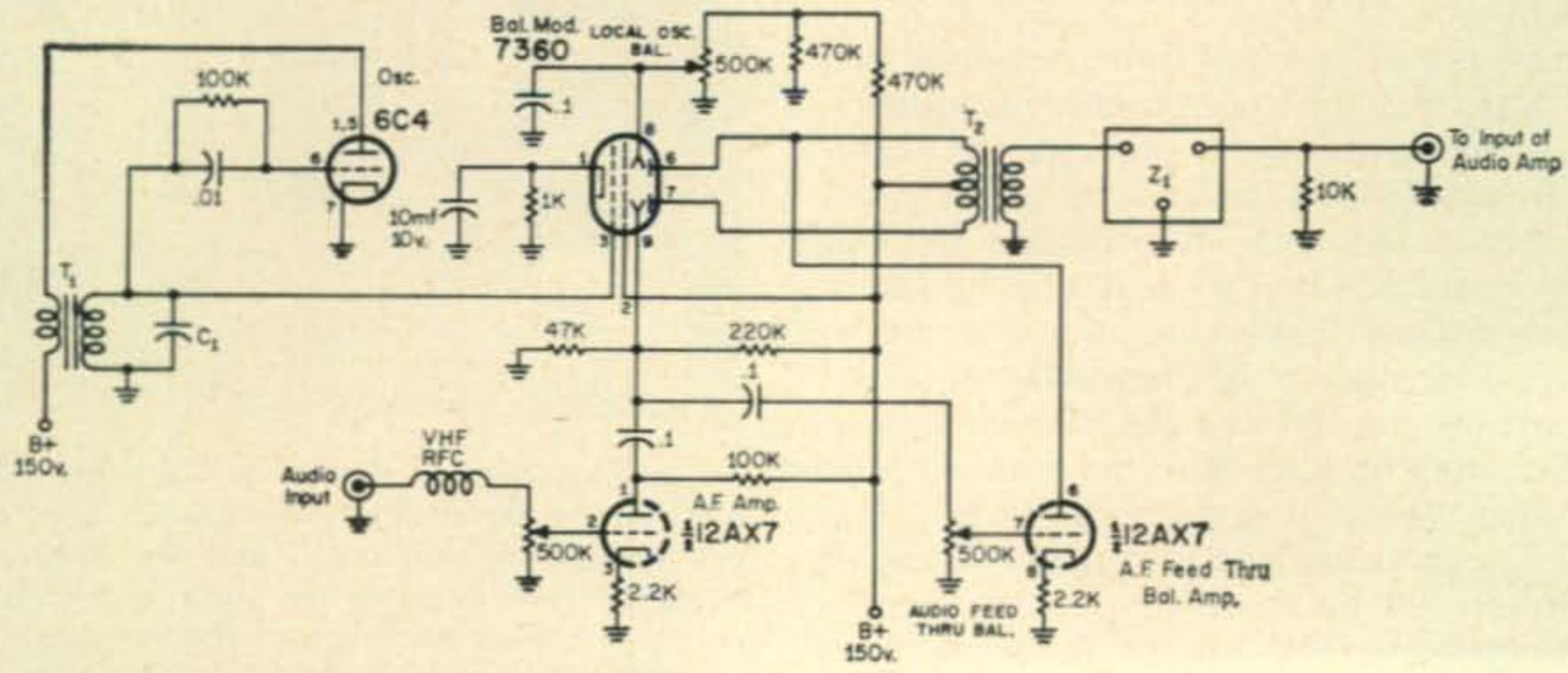


Fig. 2—Circuit of the speech inverter used to place the SCR-522 on 2 meter inverted d.s.b. Transformer T_1 is of the "50L6 output" variety and T_2 is an interstage type and is found in the SCR-522. Capacitor C_1 is selected in value to produce oscillation at 3,200 c.p.s. Filter Z_1 is a 3000 c.p.s. low pass, type UTC LMI-3000 or equivalent.

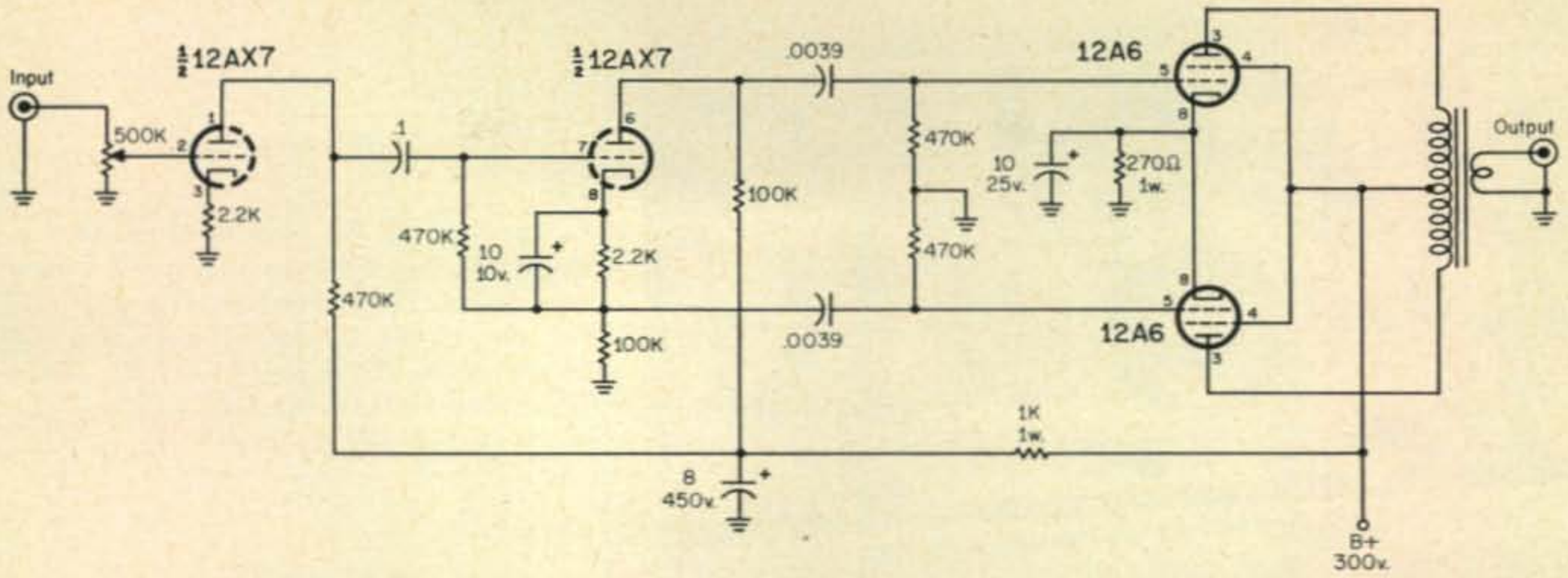


Fig. 3—Circuit of the audio amplifier used for inverted d.s.b. operation. The output of the speech inverter, shown in fig. 2, is fed to the input above. The output of this amplifier is then fed to T_1 in fig. 1. Transformer T_1 above is a push-pull plates to voice coil type.

The low pass filter must have a very sharp cut-off characteristic above 3000 c.p.s. Otherwise, you will transmit a broad signal with distortion components. For those who don't want to spend thirty or forty dollars for a commercial filter of this type, it is highly recommended that one be homebrewed using the information from the article by W2AEF.[2] By building your own, you can save at least twenty-five dollars, and at the same time have a filter that is for this purpose, superior to the commercial one originally used.

According to the RCA tube manual, the 7360 is rather sensitive to magnetic fields. If the tube is installed too close to an iron core transformer, some difficulties may be experienced.

The screen grid and deflection plates of the 7360 in the speech inverter described in the February issue were not operated according to the RCA recommended voltages. The 7360 in the speech inverter section of the rig described in this article, however, is operated fairly close to the manufacturer's recommended voltage.

The speech inverter in the previous article had a single 6AQ5 as an audio power amplifier. By using a push-pull amplifier like the rig in this article does, sufficient audio power will be available to modulate most rigs up to several hundred watts p.e.p.

Have the speech inverter well isolated from r.f. fields from the other section of the transmitter. Otherwise, you may be plagued with distortion problems and oscillation.

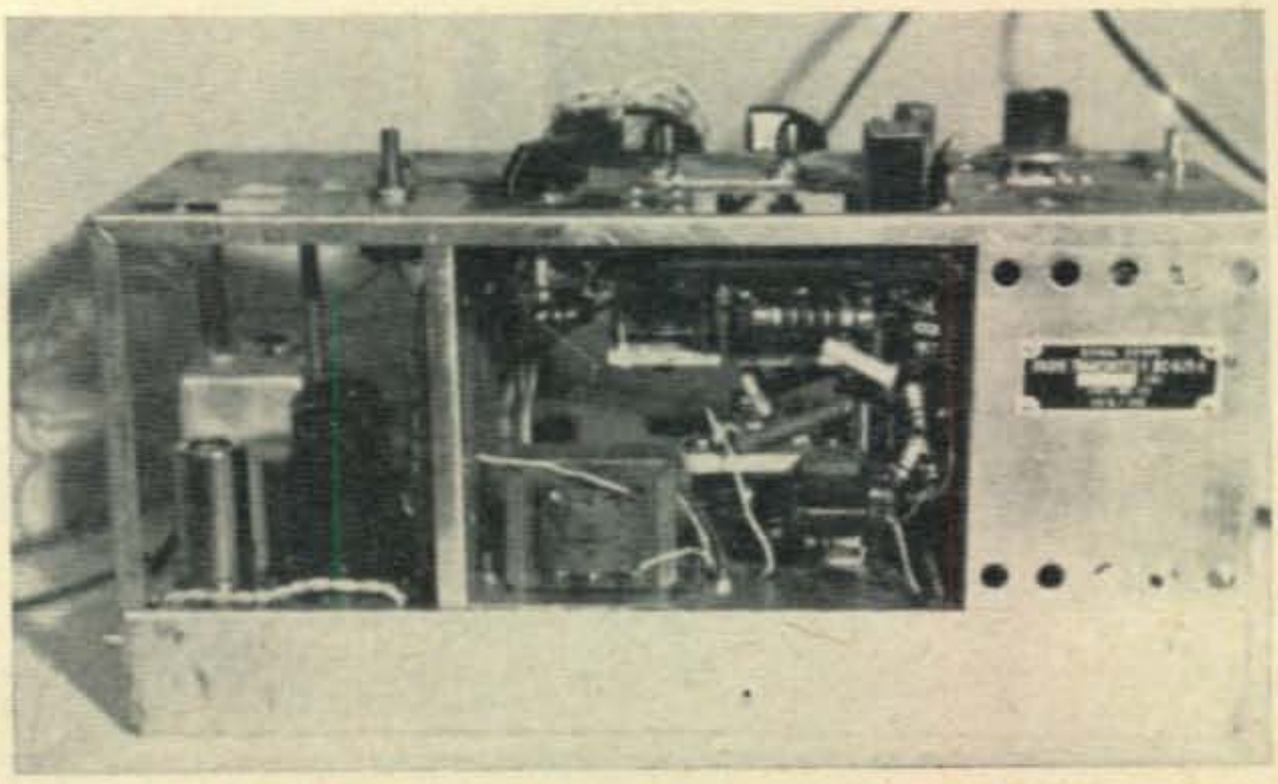
Other Possible Variations

There are, of course, many possible variations in the circuitry of an inverted d.s.b. rig. The 7360 beam deflection tube is not the only device suitable for use as an audio balanced modulator. A full-wave silicon diode ring modulator appears ideal for this application. This type of balanced modulator is balanced for both inputs, *i.e.* local oscillator *and* audio signal.

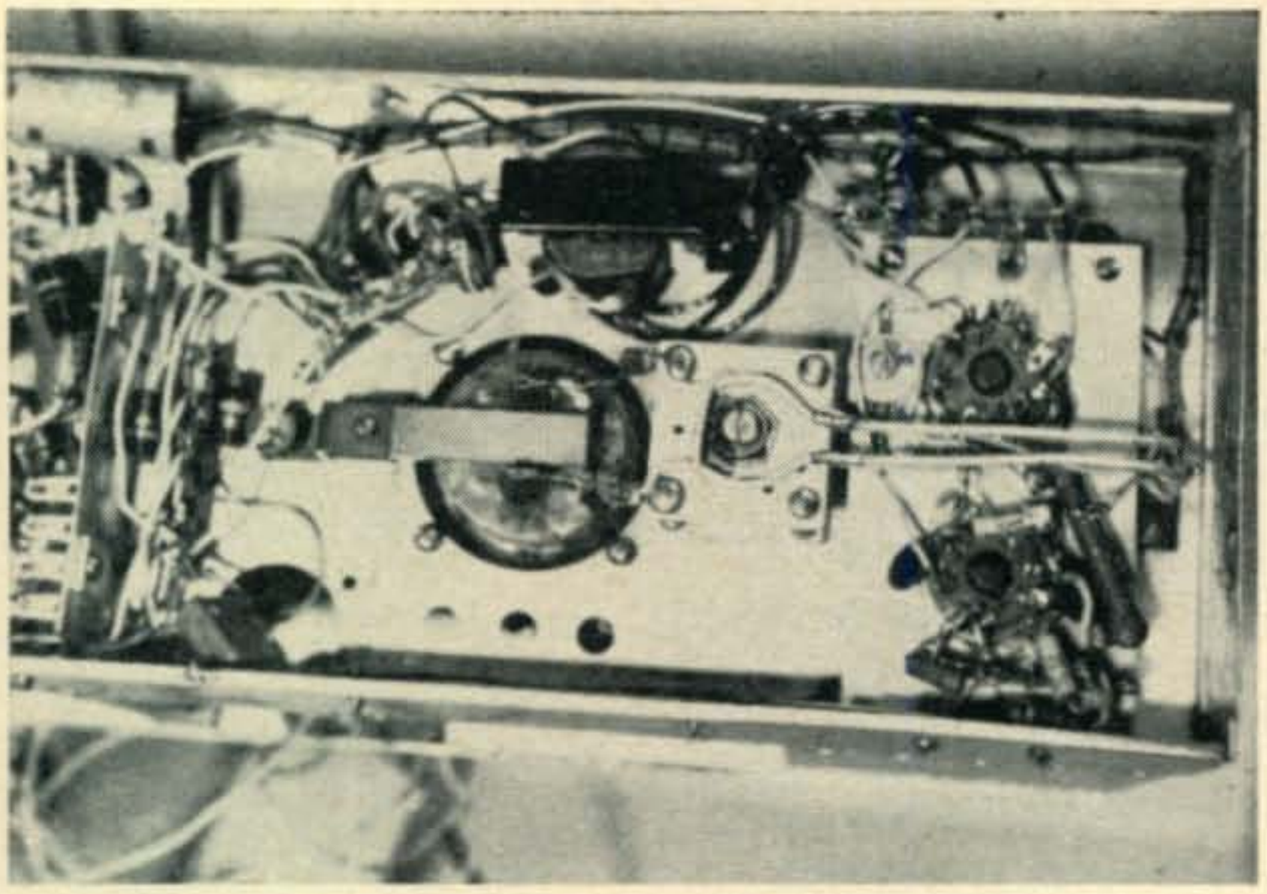
Another tube which may be used for audio frequency inversion is our old friend, the pentagrid mixer (6BE6, etc.). If a tube such as the 6BE6 is used, it will be necessary to use a separate double triode (12AX7, *etc.*, with a connection similar to the "Audio Feed-thru" balance amplifier like the rig in this article has) to null out the local oscillator signal *and* the audio signal.

Remember, whatever type of audio balanced modulator is used, it must be capable of nulling out both the local oscillator signal *and* the audio signal. Most so-called balanced modulators are balanced only for the local oscillator signal. In most balanced modulators used for single sideband service, for example, the local oscillator is operated at a much higher frequency than the audio signals, and of course, the audio signal does not appear in the output since it will be

[2]Scherer, W. M., "A Low Pass Filter For The Speech Inverter," *CQ*, April 1964, p. 29.



Side view of the transmitter shows the speech inverter and audio amplifier in the section on the left formerly occupied by the original modulator. The low level r.f. stages are in the center section with the audio transformer, used to drive the 6146 screens, mounted here. The right section, shielded, contains the modified high level r.f. section.



Bottom view of the high level r.f. section shows the two 6146 sockets on the right with the 832A to the left. The grid coil for the 6146s is wound over the full length of the 832A plate line. The audio transformer above the 832A is for the 12A6 output.

short circuited by the radio frequency transformer. However, when the local oscillator frequency is quite close to the intelligence frequency, it is necessary to use a type of balanced modulator which is capable of nulling out both input signals at the output, in order that only the sum and difference frequencies be present at the output. If the balanced modulator is not balanced for both inputs, it will be necessary to use an "audio feed-thru" balance amplifier to null out the undesired signal at the output.

In regard to the high level r.f. output balanced modulator, the control grids can be connected in push-pull with the plates in parallel. That way, you can use a single ended pi network at the output of the rig.

The purpose of this article is to illustrate the extreme ease of applying this technique by modification of a typical v.h.f. transmitter. There are, of course, several other v.h.f. and u.h.f. transmitters available which would be ideal for conversion to inverted d.s.b. Two of these are the Navy types AN/URT-7 (which will cover the 2 meter band) and the TED (which will cover the 220 or 420 mc bands with slight modification). Both of these transmitters have push-pull 4X150's in the final, which could be run at a kilowatt, with a suitable power supply. It would be very interesting to find out what kind of results could be had by running high power inverted d.s.b. on our v.h.f. and u.h.f. amateur bands. It would be a simple matter to reconnect the plates of the 4X150's in parallel (leaving the control grids in push-pull) and then feed the inverted audio into the screens in push-pull. If any one does convert these transmitters for inverted d.s.b., I would like to hear from them about the results. ■

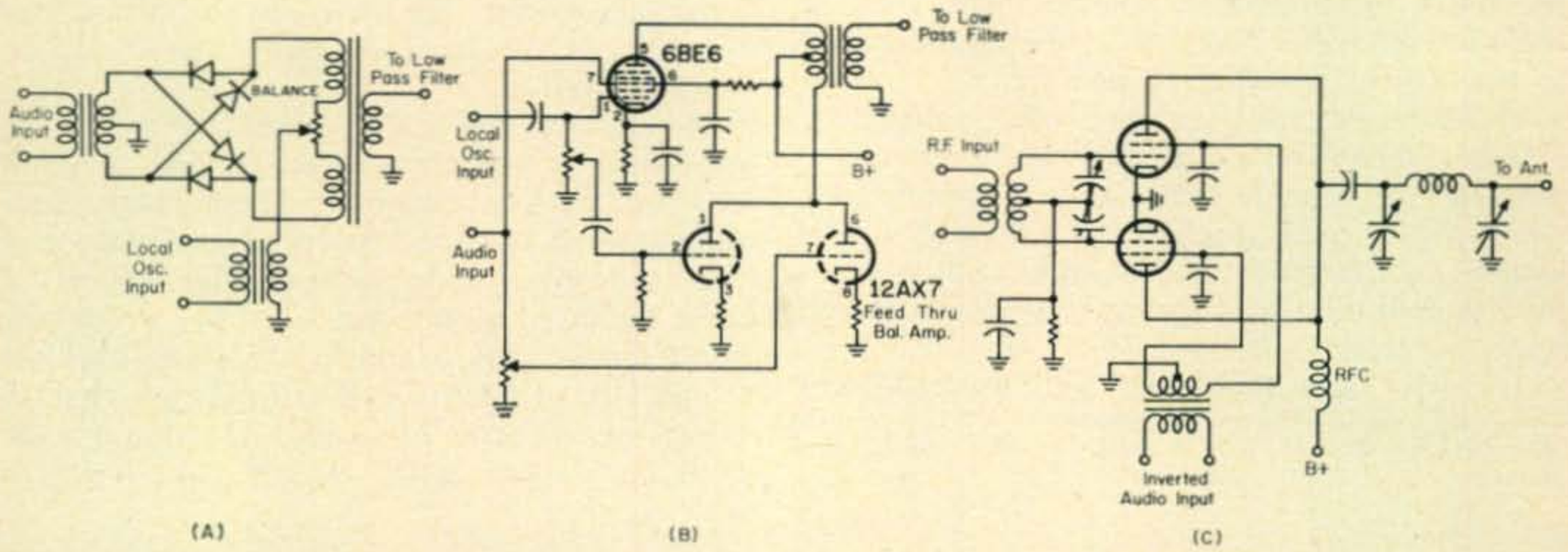


Fig. 4—Illustrated above are some possible variations discussed in the text. In (A) we have the diode ring modulator, (B) the pentagrid converter balanced modulator and (C) a high level r.f. balanced modulator with push-pull grids and parallel plates to feed a pi-network.

Designing High Power R.F. Attenuators

BY E. H. MARRINER,* W6BLZ

Presented below is a simple method that may be used to calculate the required resistance and wattage values for T pads.

MANY radio amateurs would like to use their s.s.b. exciter to drive a linear amplifier. Most of the s.s.b. exciters on the market today have more output power than necessary to drive a linear, especially if it is used in Class AB[1]. The Johnson Thunderbolt is a typical example of a low drive linear.

If a heavy duty potentiometer were used to reduce this power, neither the generator nor the load would look into a constant resistive load when the shaft setting is varied. It is necessary for optimum load impedance to be met if harmonic distortion and phase shift is to be kept to a minimum. Some linear amplifiers are very critical to this loading. The solution to this problem is to use an r.f. attenuator so that the transmitter will see a constant load at all times at the value of the transmitters output impedance.

The following is a description how an r.f. attenuator can be used to reduce power from the exciter/transmitter from 200 watts p.e.p. to a lower value of 20 watts p.e.p. for the example.

Loss in the attenuator is expressed as loss in db of power delivered by the source. The power ratio in db used in this example will be the symbol N. To find this value of N so that we may proceed with our calculation we divided the power into the attenuator by the power into the load.

$$N = \frac{\text{Power into attenuator}}{\text{Power into load}} = \frac{200}{20} = 10$$

Using this value of N in the formula we can find the values of the three resistors, R_1, R_2, R_3, necessary in the attenuator pad. (Fig. 1)

To find the value of R_1 when our exciter feeds a 50 ohm coax line to the linear amplifier:

$$R_1 = Z\,\frac{\sqrt{N}-1}{\sqrt{N}+1} = 50\,\frac{3.16-1}{3.16+1} = 26 \text{ ohms}$$

R_1 therefore is 26 ohms.

To determine the wattage necessary for R_1 we must consider that the output is 200 watts into 50 ohms. The current may then be calculated by:

$$I = \sqrt{\frac{W}{R}} = \sqrt{\frac{200}{50}} = 2 \text{ amperes.}$$

With the current known, the wattage may be determined as follows:

$$W = I^2 R = 2^2 \cdot 26 = 104 \text{ watts.}$$

To provide a safety factor, R_1 should be made at least 150 watts. This will allow for prolonged applications of power. Actually the short duty cycle of s.s.b. would not cause too much heat.

Resistor R_2 always equals R_1 and has to be 20 watts only to accommodate the output power.

Resistor R_3 is found by using the following formula:

$$R_3 = \frac{2Z\sqrt{N}}{N-1} = \frac{2 \cdot 50 \cdot 3.16}{10-1} = 36 \text{ ohms}$$

The wattage value of 150 watts is the same as R_1.

Construction

The attenuator resistors should be non-inductive types, mounted on insulators and placed inside a metal box. An aluminum chassis with a cover plate will be most satisfactory. Use perforated metal for the cover. Coax fittings for the input and output of the box will make convenient connections. ■

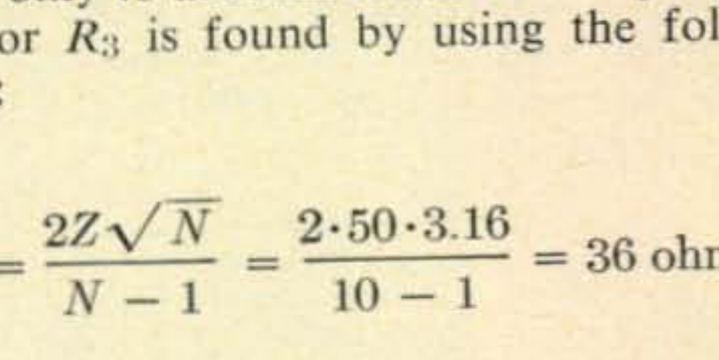


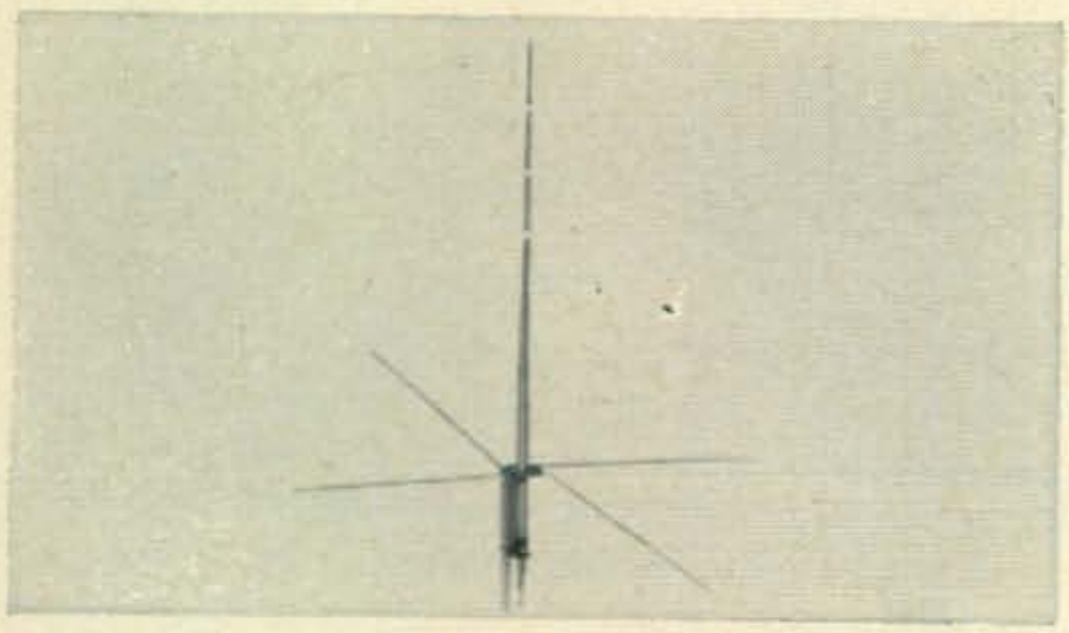
Fig. 1—The values in the r.f. T pad shown above are calculated to produce a 20 watt p.e.p. output for a 200 watt p.e.p. input. Any desired attenuation can be calculated as explained in the text.

*528 Colima Street, La Jolla, California.

CQ New Amateur Products

Webster 5600 Ignition System

THE Webster 5600 is a transistorized ignition system that can be added to any present 12 volt ignition system without removing it. It is mounted on the firewall of the car and switched into the line. The unit is completely shielded and rated to give up to 10 percent more gas mileage and nearly 5 percent more horsepower. The 5600 system is offered at $72.50. For complete information write to: Mr. James R. Adams, Webster Manufacturing, 317 Roebling Road, South San Francisco, Calif.

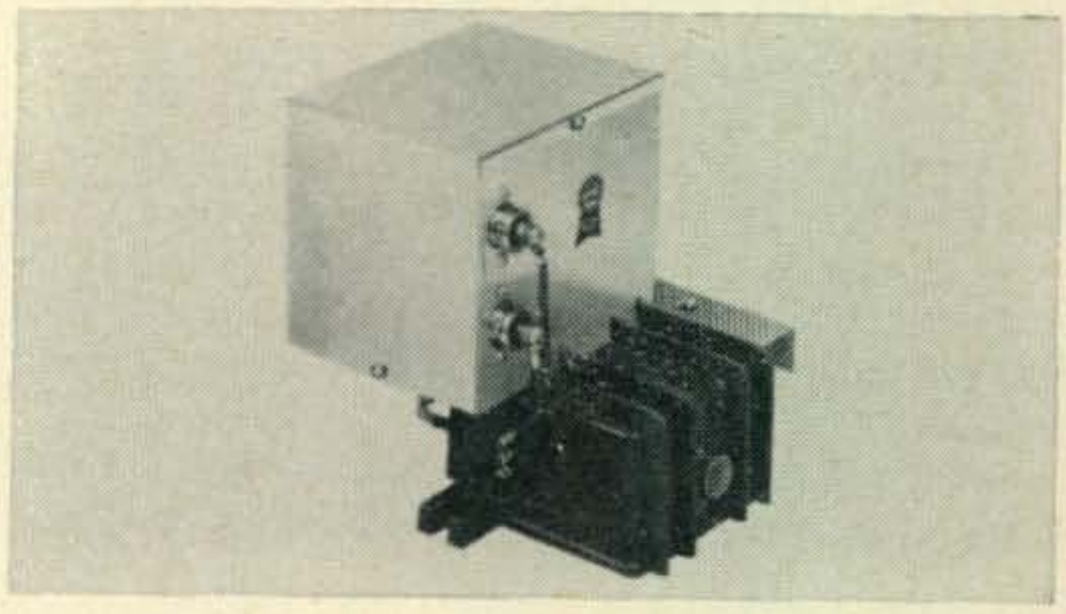


Triad Solid State Xfmrs

A NEW line of solid state transformers is being brought out by Triad. Designed primarily for use with solid state rectifiers, they still incorporate filament windings for vacuum tube applications or separate low voltage d.c. power sources. The transformers provide d.c. output voltages from 25 to 1000 volts in several models. Secondary windings are muted for full wave, full wave bridge, and voltage doubler circuits. Write to Triad at 305 N. Briant Street, Huntington, Indiana for complete spec sheets and prices.

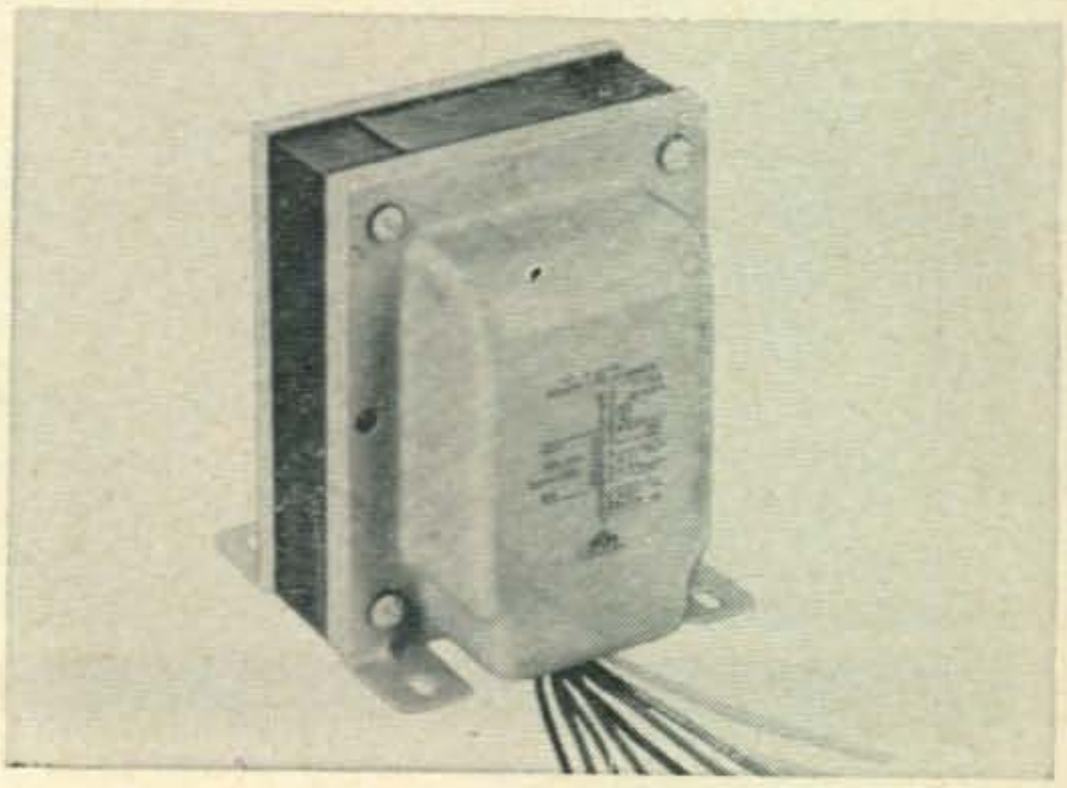
Alliance T-45 Tenna-Rotor

THE T-45 Tenna-Rotor by Alliance features a new five-wire circuit which allows precision operation unaffected by motor current, cable length or line voltage variations. The control unit is operated by a finger pressure control bar which rotates the antenna through 360° at a speed of one r.p.m. The motor itself is lifetime lubricated and enclosed in a weatherproof patented housing. The unit is priced at $39.95. Complete details of the rotor can be had by writing to Dept. MJ, The Alliance Manufacturing Co., Inc. Alliance, Ohio.



Master Mobile Dyna-Master Antennas

THE Master Mobile Dyna-Master antennas are a series of ruggedly built ground plane systems. They are designed for high performance and ability to withstand high wind loads of up to 100 p.m.h. Priced at $34.95 for either a 2 or 6 meter model. Write to Master Mobile, 4125 W. Jefferson Blvd., Los Angeles, Calif., for more specs.



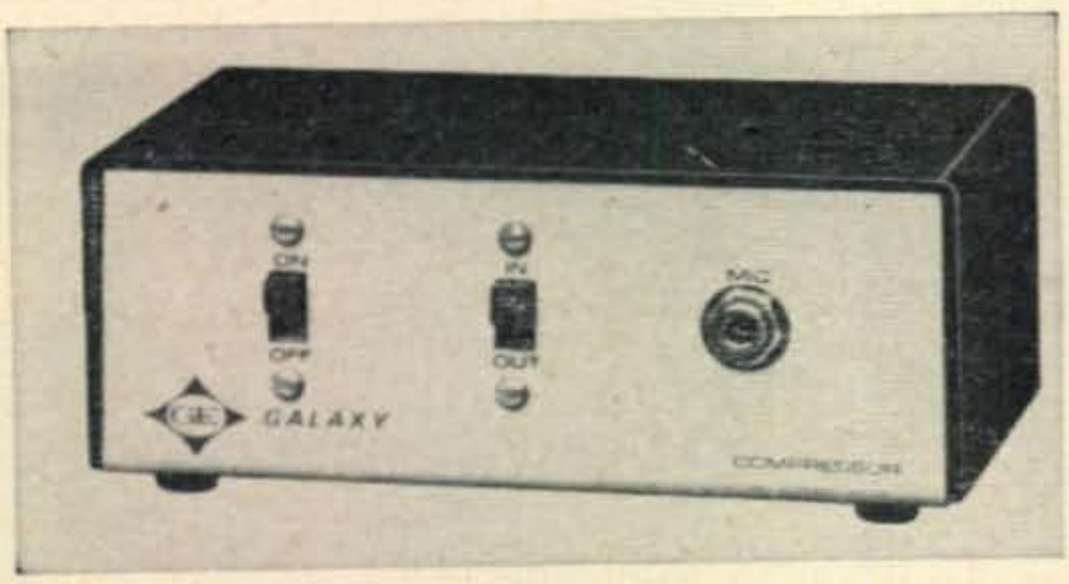
hth Electronics C.W. Monitor

A handy c.w. monitor is one put out by hth electronics. It also may be used as a code-practice oscillator. When used as a c.w. monitor, it is connected directly across the transmitter key and thus is automatically operated as the transmitter is keyed. No accessory relay, no pick-up antenna nor other connections or modifications to the transmitter are required. For code-practice work the unit may be operated while connected to the regular transmitter key with the transmitter turned off, or a separate key may be used.

The hth Electronics C.W. Monitor is an imported item which sells for $8.95 and may be obtained from hth Electronics, 1717 No. Vine Street, Hollywood, California 90028.

Ameco TX-62 Transmitter

THE Ameco TX-62 transmitter is a six and two meter transmitter with built in a.c. power supply. It is capable of 75 watts input on c.w. and 75 watts peak input on phone. The unit is crystal controlled or can take a v.f.o., it uses 8 crystals. The tube lineup is: 6GK6—osc.. tripler, 6GK6—doubler, 7868—tripler (on two meters) and 7984—final. The modulator is a 12AX7 and 6GK6. It is fully metered and can read r.f. output. The TX-62 costs $149.95 and is available from most dealers. For more information write to Ameco Equipment Corp., 178 Herricks Road, Mineola, L.I., N.Y.



Jensen Model 9 Miniature Drill

THE Model 9 drill accommodates drills up to ⅛" d. Designed primarily for light duty drilling of aluminum and plastics, it is capable of drilling through ¼" solid brass. The Model 9 operates from any d.c. source from 4 to 12 volts. The drill is priced at $16.00 and comes complete with chuck, 3 collets, brush, grinder accessory and two polishing wheels. It has an "on-off" switch. A brochure on the drill can be had by writing to Jensen Tools, 3630 E. Indian School Road, Phoenix, Arizona.

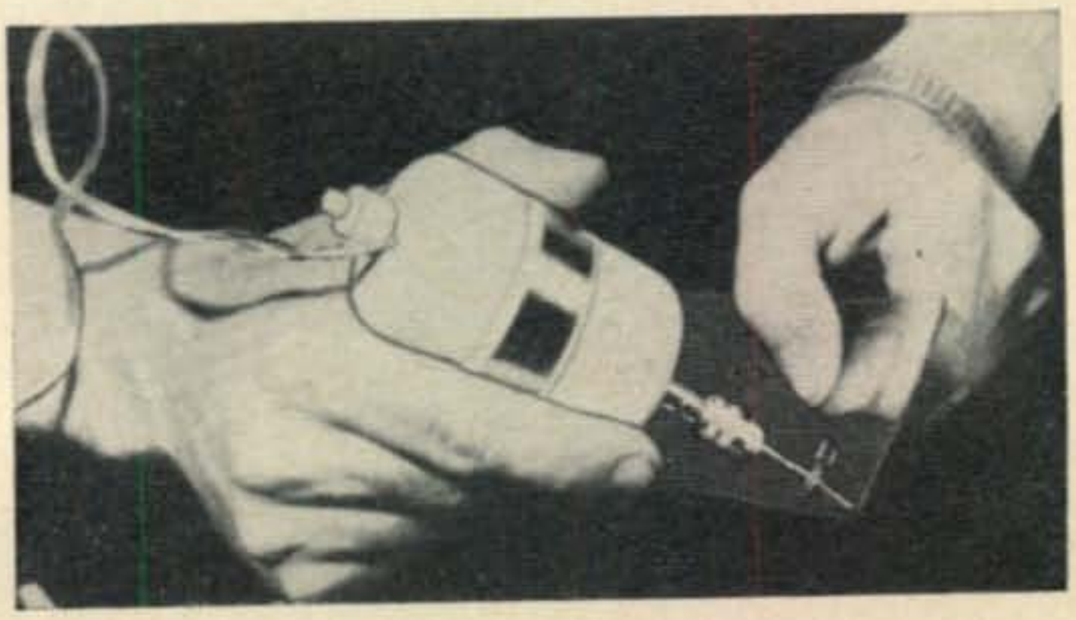
Lafayette HA-230 Receiver

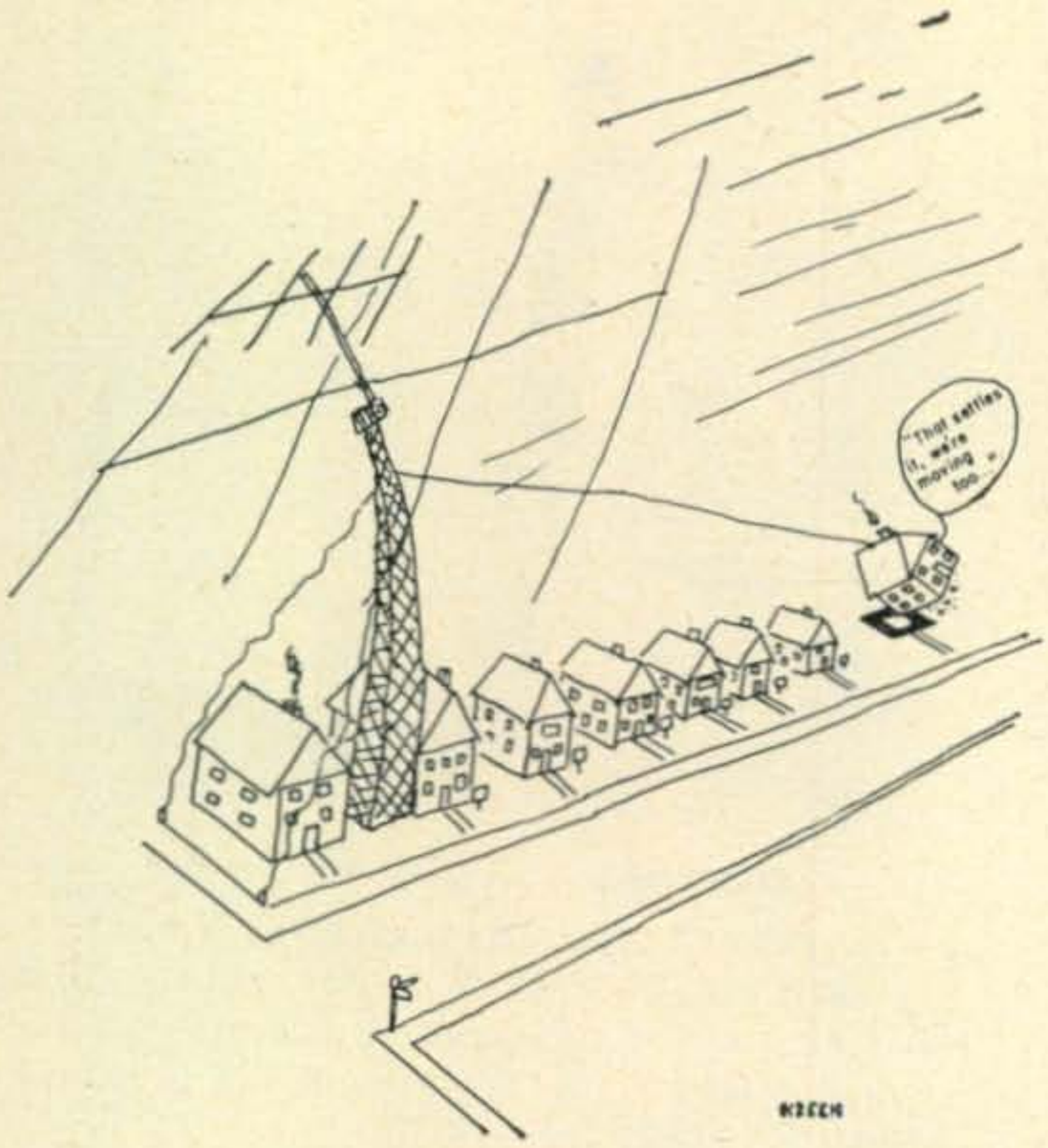
LAFAYETTE Radio, 111 Jericho Turnpike, Syosset, L.I., New York, announces the Model HA-230, a new 8 tube communications receiver. Available wired for $89.50 and as a semi-kit (Model KT-340) for $74.50.

It features separate "always on" transformer which supplies constant heater voltage to the mixer and osc. stages for freq. stability. Built in Q multiplier, and easy to read illuminated dial. It covers 550 kc to 30 mc in four bands, with 1 μv sensitivity for 10 db S/N ratio.

Galaxy Compressor

THE compressor is fully transistorized and adaptable to s.s.b. and a.m. transmitters. It is designed for equipment not having built in ALC circuitry. Microphone outputs up to 10 μv are amplified 10 db with strong peaks up to 1.8 v being compressed by 20 db, giving a total range of 30 db. Wired for push to talk, it uses a 9 volt battery, the unit costs $24.95. A product of Galaxy Electronics, 10 South 34th Street, Council Bluffs, Iowa.





Antenna Zoning; how it works.

BY CHARLES D. STOFFEL,* WA2JTT

FOR years zoning has been a "Bug-a-boo" to hams and the feeling that zoning curtails the liberty and activities of the amateur radio operator is an old story. But, recently there has been an increase in the number of law suits against hams and apparently many of these are unjustified. So, I would like to pass on what information I have learned about antenna zoning —for what it is worth.

Four years have gone by since I first started the research on zoning. During this time it was necessary to compile data, supply technical information and visit with various committees as well as carry on correspondence with state and local authorities on zoning and building codes. With a technical subject like antennae a definite height and wording was required and it was a difficult task to get everyone to agree on a final draft. There was many a hot moment, even among the hams. Two things an ordinance should do are grant certain height privileges or uses, and include all antennae (TV, CB, Commercial, etc.) and not just ham equipment.

Antenna problems are becoming more common with the mass movement into the suburbs and any piping job that bears the slightest tint of commercialism, will bring out the objectors in a highly residential neighborhood. Just as Cervante's story depicts the Spanish Knight, Don Quixote attacking windmills in his idealistic and impractical attempt for reform, suburbia is faced today with many quixotic situations in its construction and development including the antenna.

*Councilman, Irondequoit Town Board, Rochester, N.Y. 78 Havenwood Drive, Rochester, N.Y. 14622

Why Zoning?

The pamphlets and books in the library on zoning are sometimes confusing and details can get a little boring. All is not lost in this sea of literature, however. There are some interesting facts that seem to stand out above others. The word "zoning" is a broad term which actually comprises the efforts of a Planning Board, Zoning Board of Appeals, and the Building Inspectors, whose job is the inspection and enforcement of Zoning Ordinances and Building Codes.

Although not generally realized, all communities indulge in community planning to some degree, and zoning is the means of carrying out the planning programs with respect to property use. Just as any ham sets his eye on some new gear and plans to own it someday, so also do villages and towns plan to bring into focus the ideas and desires of its people and formulate a program that will encourage and maintain a satisfactory living environment. In short, zoning is the planned use of public *and* private property and it differs across the country in many ways. What applies in one section, may not in another; topography and climate are only two factors effecting planning.

Zoning further preserves the attractive surroundings of residential areas and helps protect property values. In unzoned communities, the instability of residential properties makes investment in a home a hazardous venture and accordingly discourages home ownership.

Antenna Committee

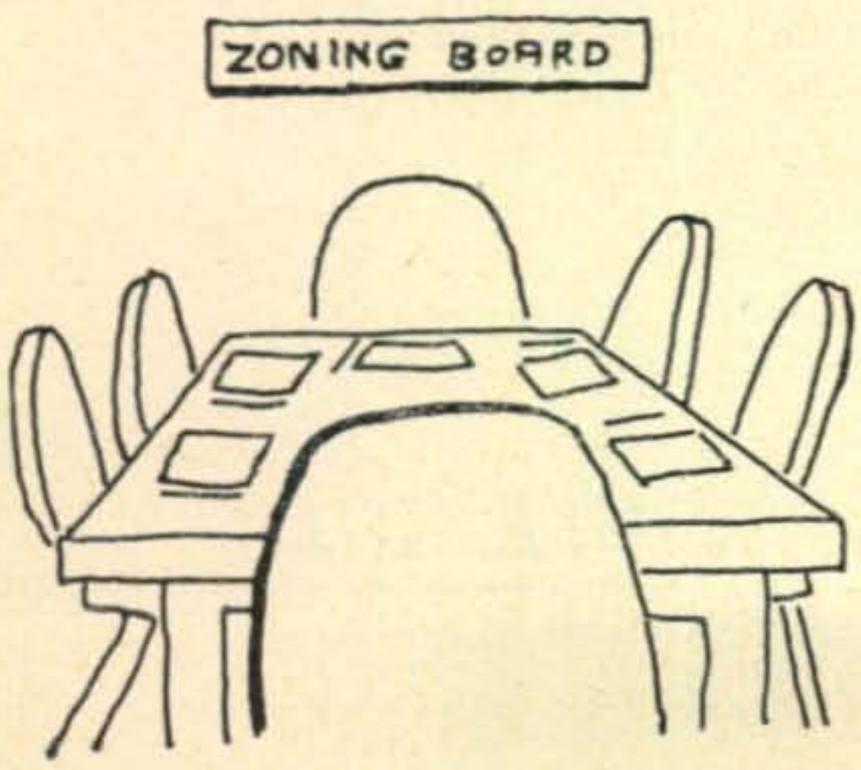
Amateur radio operators have often taken a lead in their community problems. Certainly the ham with perhaps some unearned scars can

solve some of the antenna technical details by encouraging proper zoning. Just as the TVI committees have performed a community service, so also can an antenna committee be a service both to Zoning Boards as a source of technical information and to the amateur who wants to put up a new tower.

A radio club antenna committee could begin by obtaining local regulations on antennae from the surrounding towns and adjacent cities, as well as building codes, if available. All factors which pertain to the local community should be abstracted from this material. It would be in order to arrange an informal meeting with the Zoning Board to seek its ideas and recommendations. Usually the Building Inspector is present at such a meeting and would provide the regulations for construction in the area. Zoning Boards frequently meet privately to give opinions to those seeking advice so as to conform with local planning. Some brief antenna literature should be left with the Board. This might cover briefly the description and purpose of antennae, length required by frequencies, necessity of height, and authority on TVI and BCI; including references in the literature, if needed. So often, Board members have little working knowledge of the necessity of an antenna and this is understandable because it is a specialized field.

After a lot of pen-scratching and leg-work the committee should be well fortified with enough information, and ready to recommend a proposed ordinance. Don't worry about the legal wording—all Boards have an attorney who will put the regulations into their proper phraseology. In areas where there already is antenna zoning, the committee can review the ordinance for the need of additions, corrections or updating.

In addition to the zoning project, the antenna committee will have become more familiar with the functions of local government. Another compensation is the opportunity of associating with the really splendid people that are attracted to local government today. It is hard to realize how many people still think that those who run our towns are fat, stupid and smoke cigars. Actually, they are sharp, considerate and extremely courageous. Dealing with the public is a tough job and many times these employees are poorly compensated for their civic work.



A Zoning Ordinance

The following Antenna Ordinance of the Town of Irondequoit is only submitted to illustrate what can be expected in the way of an ordinance and probably will not apply to every locality.

Irondequoit has a population of 60,000 people and is a highly residential suburb of the city of Rochester, N.Y. Basically, the above procedure was used to amend a previous ordinance and had the cooperation and help of the Antenna Committee of the Rochester Amateur Radio Association, a club of about 400 hams.

Antenna Zoning Ordinance
Radio-Television Antenna Structures

Definition: *Radio-Television antenna structure shall mean structural members used to support an antenna as well as the antenna itself, excluding non-rigid antenna wire.*

A) An antenna structure may be installed without necessity of a building permit on or at any building within the following limits:

(1) Maximum of 16 ft. height above the roof or ridge pole except that a single vertical pole may not exceed 21 ft. above the roof or ridge pole.

(2) A free standing antenna tower may not extend above the ground more than 21 ft.

B) Any antenna structure exceeding the above height restriction and up to 45 ft. maximum requires submission of evidence of structural stability to the Building Department and when acceptable, a Building Permit will be issued for the same. All structures shall be subject to a reasonable determination of structural stability by the Building Department. Specifications of manufacturer will be used by the Building Department as a guide to determine structural stability. Alterations which do not affect structural stability will not require another permit.

C) Any antenna structure over 45 ft. in height and exceeding the above restriction requires submission of structural stability as in (B) above and further requires favorable action by the Zoning Board of Appeals.

D) Pre-existing antenna structures including those on temporary permits shall be permitted without the necessity of obtaining a building permit hereunder.

This Ordinance approved and adopted by the Irondequoit Town Board on June 4, 1964.

Some of the terms above may sound strange to some hams but just as we have a vernacular all our own so do people working in zoning. Perhaps a brief and partial explanation is necessary to show how these terms and values were used in the above ordinance.

Radio-Television Antenna: Used to encompass all antenna types under a common ordinance.

Antenna Structure: Includes all types of towers and poles with the antenna attached. Originally only antenna Towers were controlled by zoning because they constituted an accessory structure

[*Continued on page 104*]

The United Nations Amateur Radio Club

BY GEORGE ELLIS*

The members of this club are taking advantage of a local educational TV program, "Electronics at Work," to build their knowledge of electronics and to secure amateur licenses for new members.

Two events highlighted recent activities of the United Nations Amateur Radio Club —a well attended Family Field Day on Long Island and club enrollment in a pioneering electronics course currently being telecast in the New York metropolitan area.

The Field Day, held at Old Westbury Gardens, Old Westbury, L. I., was arranged by United Nations Radio Club member Charles Krolewski (WA2ONI). Fifty members, their wives and guests, turned out for the event, the fourth to be held by the club, which extended cordial invitations to YL's, XYL's and Harmonics. While the ladies explored the park's 70 acres, the hams erected the club's four new 50-foot galvanized steel masts. The two antennas (N/S, E/W) provided excellent contacts on the 40-20-15 meter bands. Many South American, European, Mexican, Canadian, and United States stations were worked, all contacts being delighted to hear from the UN hams.

Harmon Schievink, WA2OBC, operated a Heathkit DX-100 transmitter and a Hammarlund HQ-145 receiver. Frank Moran, W21SC operated and tuned the rigs, while Jerry Doherty, W2UYK, who operated a Johnson Viking Valiant and a Collins 75-S1 receiver, checked equipment. Walter Strysko, W2ZUB, designer of the antennae system, was club photographer for the day. For their help in making the outing a success, Park Director Eaton and his staff received a vote of thanks from the club.

The pioneering television program, a 90-lesson course entitled "ELECTRONICS AT WORK," came to the UN Radio Club's attention through an article in *CQ* Magazine. Produced by John W. Wentworth, manager of the Current Concepts in Science and Engineering Program at RCA, and well known to the club's older hams, the course is designed to furnish an understanding of the basic principles of electronics and their major applications in communications systems.

Because of the convenience of taking the course at home, and its low cost, the UN Club's executive committee urged the membership to take advantage of this new opportunity to increase their knowledge of the electronics field. The committee also alerted the club's international members to a recent U. S. law allowing aliens, whose native lands have reciprocal agreements, to obtain an Amateur License to operate in the United States. With the help of the club's code classes, "Electronics at Work, and the assistance of advanced members, a student should be able to obtain his license after six months of study, the committee said.

Twenty six of the club's members initially enrolled in Electronics at Work, but the course generated such enthusiasm that the nine additional members also enrolled. The course winds up in May.

The UN Club, which presently shares quarters with other organizations, hopes to obtain permanent space in the UN Building during the next year for its growing membership and for a well equipped radio shack where members can welcome their many contacts. ■

*Rm. 915, 475 Fifth Ave., New York, N.Y.

A code class at a United Nations Amateur Radio Club meeting in their room on the 5th floor of the U.N. building.

RTTY From A to Z

BY DURWARD J. TUCKER,* W5VU

Part VII

The author has traced the RTTY subject all of the way from basic theory and practice, teletype machines, and the actual RTTY signal itself through the amateur's receiver. Now, with the RTTY signal at the output of the amateur's receiver the natural question is, "What's next?" The converter, that's what.

SOME RTTY old timer, with a sly grin, might be prone to answer the question, "What's next?" by stating, "You have just now really gotten to RTTY with converters or at least the part that is really something new for you." The next article of this series, including this article, will deal principally with the converter, as will a number of others later on.

The Converter

The terms Converter or Terminal Unit (TU), as used in RTTY, mean the same thing. The commercial services probably stick to the name Terminal Unit more so than amateurs do. However, the amateur uses the name interchangeably, so I will do likewise. This is the mysterious black box briefly touched upon earlier. The purpose of the unit is to take the two RTTY tones from the output of the receiver and not only convert them into d.c. pulses but do it in such a way that perfect copy or as near perfect copy as is possible is obtained.

One finds various frequency shifts being used on the air, some wide, some narrow and many of them, regardless of the shift being used, operating off the desired frequency or frequencies that they are supposed to be on. Some operators only use RTTY on the high frequency or v.h.f. bands for local or semi-local communications, while others only operate on the 14, 7 or 3.5 mc band or bands where selective fading, QRM and QRN is rampant. You may wonder why these seemingly irrelevant facts are mentioned at this time. Actually, facts such as these alter the requirements of a converter. For instance, a particular converter design may give an outstanding performance in the v.h.f. bands while on the twenty meter band its performance may leave much to be desired.

From the above, one wonders if there is any one converter that will serve all needs. Let us suppose, for instance, that one has been fortunate enough in obtaining a very good set of filters of the commercial variety for say 2125 cycles and 2975 cycles to use in building a converter. Some commercial filters of this type have extremely steep skirts and are very sharp indeed. The converter is built with great anticipation, using these filters. Finally the converter is finished and the operator breathlessly turns it on. Imagine his disappointment when he discovers that many of the signals are so far off from the 850 cycle shift that he can not get both the *mark* and *space* signal through his converter at the same time. He adjusts his receiver so that the *mark* signal is squarely in the middle of the passband of the 2125 cycles filter. Now he finds that the *space* signal misses the passband of the 2975 cycle filter altogether or else it is so far out on the edge of the passband that it is highly attenuated and hardly usable. If he adjusts his receiver so that the *space* signal is squarely in the middle of the passband of the 2975 cycle filter then he finds that the above is true for the *mark* frequency of 2125 cycles.

From this example, the beginner may be quick to assume that it is best to use broad filters and to avoid the use of sharp filters. That would not be a lasting solution to the problem at all but would only lead to other problems far more serious. This does not in any way close the subject of filters, as we will have much to say on this subject later.

Converter Types

Up to this point, all discussions related to the converter have been associated with the audio tone type of converter. There are actually two general types. The other one, which has not been mentioned up to now, is an r.f. type that takes the RTTY signals at the i.f. section of the receiver instead of at the audio output. The r.f. type is usually more complicated and difficult to build. Besides it requires that some modification of your receiver be made in order to get the signals from the receiver i.f. section to the terminal unit. As a general rule, limiting, amplifying and detection is done at some radio frequency such as 50 kc and the latter stages of both types of converters are similar, if not identical.[9]

*6906 Kingsbury Drive, Dallas 31, Texas.

[9]McCoy, J.L., "Radioteletype Conversion from Receiver I.F.," *QST*, Jan. 1960, p. 32.

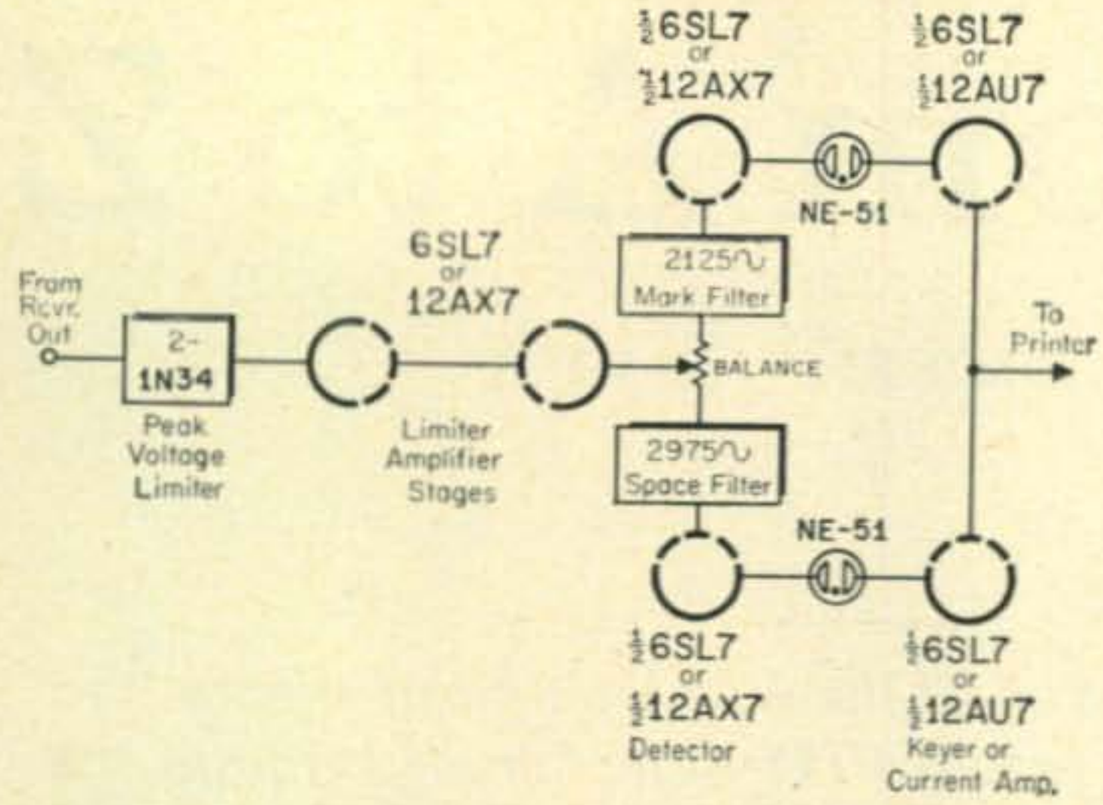


Fig. 41—Block diagram of the W2PAT Converter described in the text.

The r.f. type will not be discussed further here since perhaps not one RTTY'er in twenty-five uses this type of converter.

Converter Purposes

Actually, there is not a single reason for a converter as many beginners may think, but there are several reasons. The most important and basic reason for the converter is that it takes the two a.c. tone pulses and converts them into a pulsing d.c. current to operate the selector magnet of a teletype machine printer. Without this most fundamental function, all of the other reasons for the converter would be meaningless. A further purpose of the converter is to do those things that the receiver cannot do such as separate the two a.c. tones (*mark* and *space*). In addition, the converter, depending upon its design, may limit, amplify, or even supply a.g.c. to the two tone pulses. It detects the two signals and it may even change the time and/or amplitude relationship between the two a.c. tone signals, unintentionally or on purpose to improve copy.

Any amateur's experience with receivers should have certainly indicated to him that there is more than one way to build or design a receiver. There are numerous factors that control or dictate receiver design, the most important of which is cost. On the other hand there are certain fundamental design practices that become standard such as the heterodyne principle of operation.

The reference to receiver design was given because you have the same general considerations in the design of an RTTY converter. An RTTY converter may leave little or nothing more to be desired of it when used on the six meter band and be highly unsatisfactory when used on the twenty meter band, as pointed out earlier. From this it should be realized that this is not to be, nor can it be, one short treatise on converters.

W2PAT Converter

The W2PAT converter was about the first real popular basic design in converters and was by far the most popular unit of its day or any other day, for that matter.[10] Now, many years later, one still finds a number of these units around, or various versions of it. The circuit diagram has been reproduced in the *ARRL Handbook* for many years. A block diagram of this unit is shown in fig. 41. The unit begins with two 1N34 diodes hooked in opposite polarity across the first half of a dual triode 6SL7 (now shown as a 12AX7 in the current *ARRL Handbook*). This dual triode forms two limiter-amplifier stages. The *mark* and *space* signals are split at this point by the *mark* and *space* filters and each signal is fed to its respective detector (½ of a 6SL7 or 12AX7 dual triode tube). Each detected signal controls a keyer tube (½ of a dual triode 6SL7 or 12AU7 tube). These two keyer tubes operate the teletype printer either directly or indirectly through the use of a relay.

The details of the input circuit of the W2PAT converter in fig. 42, showing diodes CR_1 and CR_2. Diode CR_2 is back biased 0.3 volt. The action of these two diodes limits the audio voltage to the grid of the 12AX7 tube to about 0.6 volt even when the audio voltage applied to this circuit is as high as 30 volts. The limited voltage applied to the grid of the 12AX7 varies from about 0.15 volt to 0.6 volt, for an input voltage variation of about 1 volt to 30 volts from the receiver output. A simplified version of the diode portion of the circuit of fig. 42 is shown in fig. 43. The wave from the receiver to the input of the limiter-clipper is shown in (*A*) of fig. 43 and

[10]Bernstein, M., "An Inexpensive Radioteletype Converter," *QST*, Jan. 1953, p. 44.

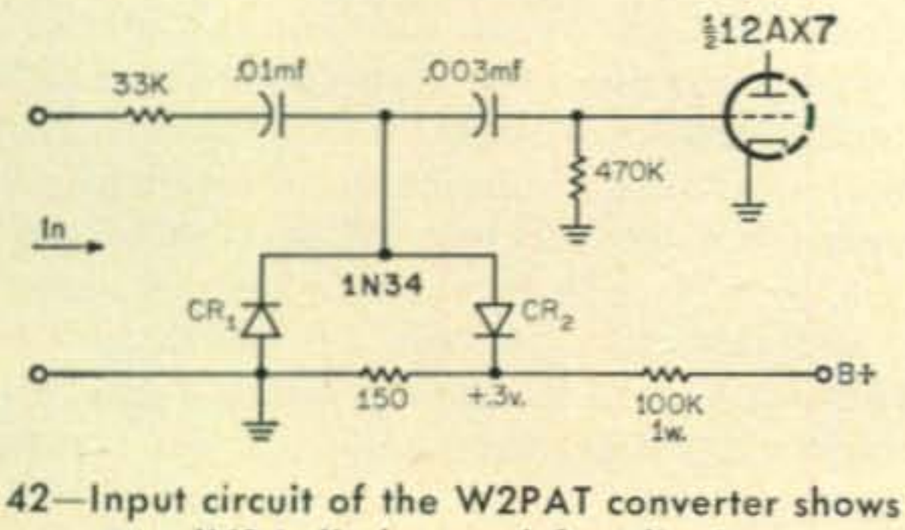


Fig. 42—Input circuit of the W2PAT converter shows the two IN34 diodes used for clipping.

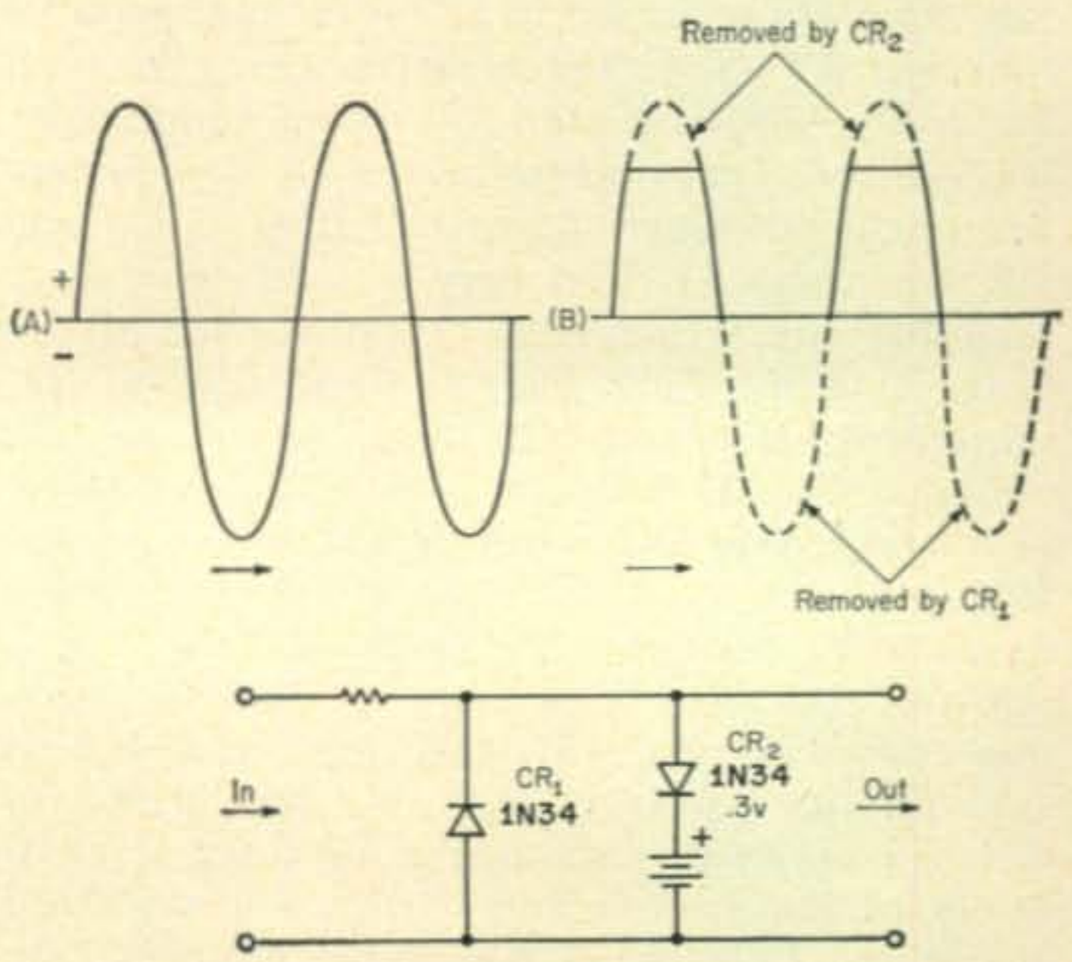
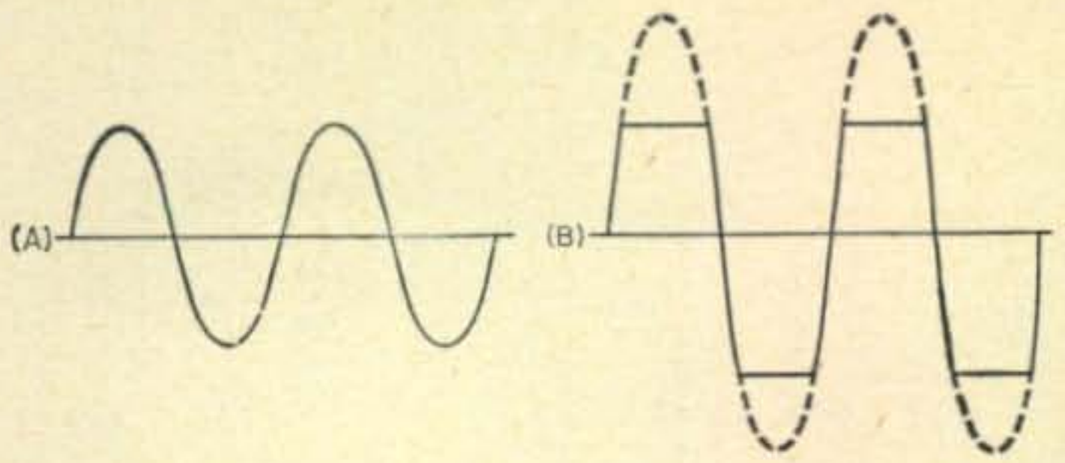


Fig. 43—Shown above is simplified version of the diode circuit shown in fig. 42.

the wave at the output of the limiter-clipper that is applied to the grid of the 12AX7 tube is shown in (*B*) of fig. 43. It will be noted that CR_1 removes the negative half cycles of the wave and that CR_2 clips off the top portion of the positive half cycles of the waves as shown in (*B*). Further inspection of (*B*) shows that the wave is now virtually a square wave and considerably reduced in amplitude. In practice the forward resistance of CR_1 is not zero, so not all of each negative half of the wave will be clipped. For the same reason all of that portion of the halves of the wave beyond the back bias of 0.3 volt will not be clipped, so in practice the output from this limiter-clipper circuit is almost 0.6 volt for an input voltage of 30 volts, as previously stated.

Further limiting and clipping as well as amplification and stabilization of the signals takes place in both halves of the 12AX7 limiter-amplifier stages. The output from the second half of the 12AX7 is a fairly constant 15 volts when the audio output signals from the receiver vary from less than 1 volt to 30 volts.

The limiter-clipper-amplifier functions of these two stages, especially the amplifier action, should be well known to most readers. However, it might be well to briefly cover the operation of triode tube clipper circuits. The basic triode clipper circuit is shown in its simplest form in fig. 44. When the positive peak of the input voltage wave exceeds the negative voltage of the bias battery *C* the net voltage on the grid is positive and grid clipping takes place. This action is similar to the diode clipping action on positive peaks just described and graphically illustrated in (B) of fig. 43. Negative peak clipping will occur when the input voltage is sufficiently large so that on negative peaks the negative signal voltage plus the negative bias voltage *C*, bias the tube to cutoff. That part of the negative half cycle, during which cut off condition exists does not appear in the output. Obviously, triode tube clipping has an advantage over diode clipping; you may accomplish clipping and obtain amplification of the signal at the same time. Although the output signal has been clipped, it is possible, with a triode tube clipper, for the output to exceed the amplitude of the input signal.



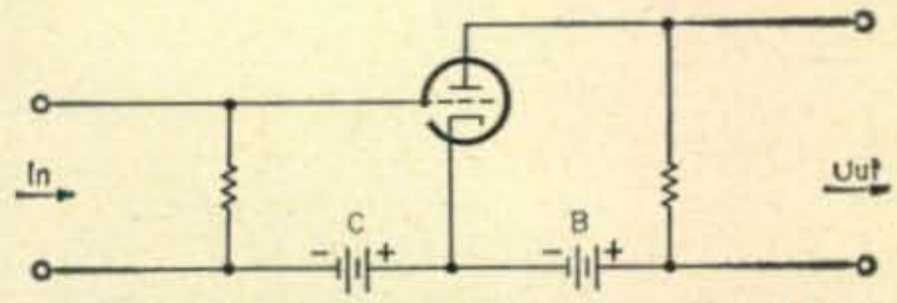


Fig. 44—Basic circuit of a triode clipper and its input and output waveforms. Note that the output while clipped is amplified.

Now, let's partially repeat but at the same time amplify some details of the W2PAT converter already touched upon. At this point, it becomes necessary to separate the two audio tones, *mark* (2125 cycles) and *space* (2975 cycles). The 12AX7 detector stage is a dual grid leak detector stage with the signals fed to the input of both detectors. The input to one detector is supplied with an audio filter resonant at 2125 cycles and the input to the other detector is supplied with an audio filter resonant at 2975 cycles. The two signal tones are separated by means of these two resonant filters. The *mark* and *space* signals control the keyer tube, 12AU7. More on the keyer tube later. Coupling from each detector plate to the grids of the 12AU7 keyer tube is by means of a neon NE-51 lamp. These neon lamps act as switches which give a more positive demarcation between the *mark* and *space* pulses. W2PAT stated that the converter will operate from signals that are only 6 db above the noise level.

The design of the W2PAT converter is relatively simple compared to some other converters. A general outline of the W2JAV converter is given next. The actual operation of these two converters will be covered in detail later.

W2JAV Converter

The next important radioteletype converter

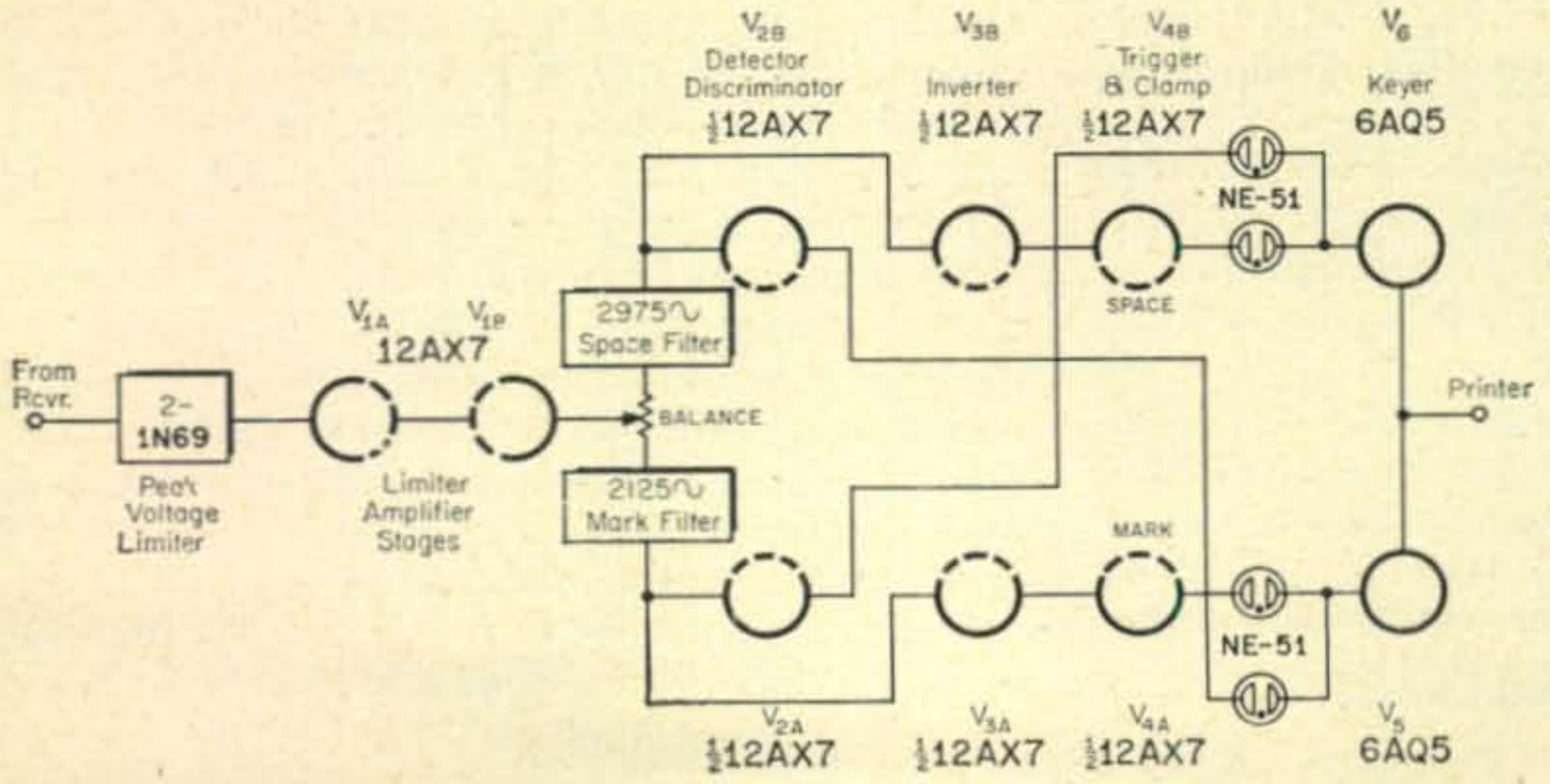


Fig. 45—Block diagram of the W2AJV converter described in the text.

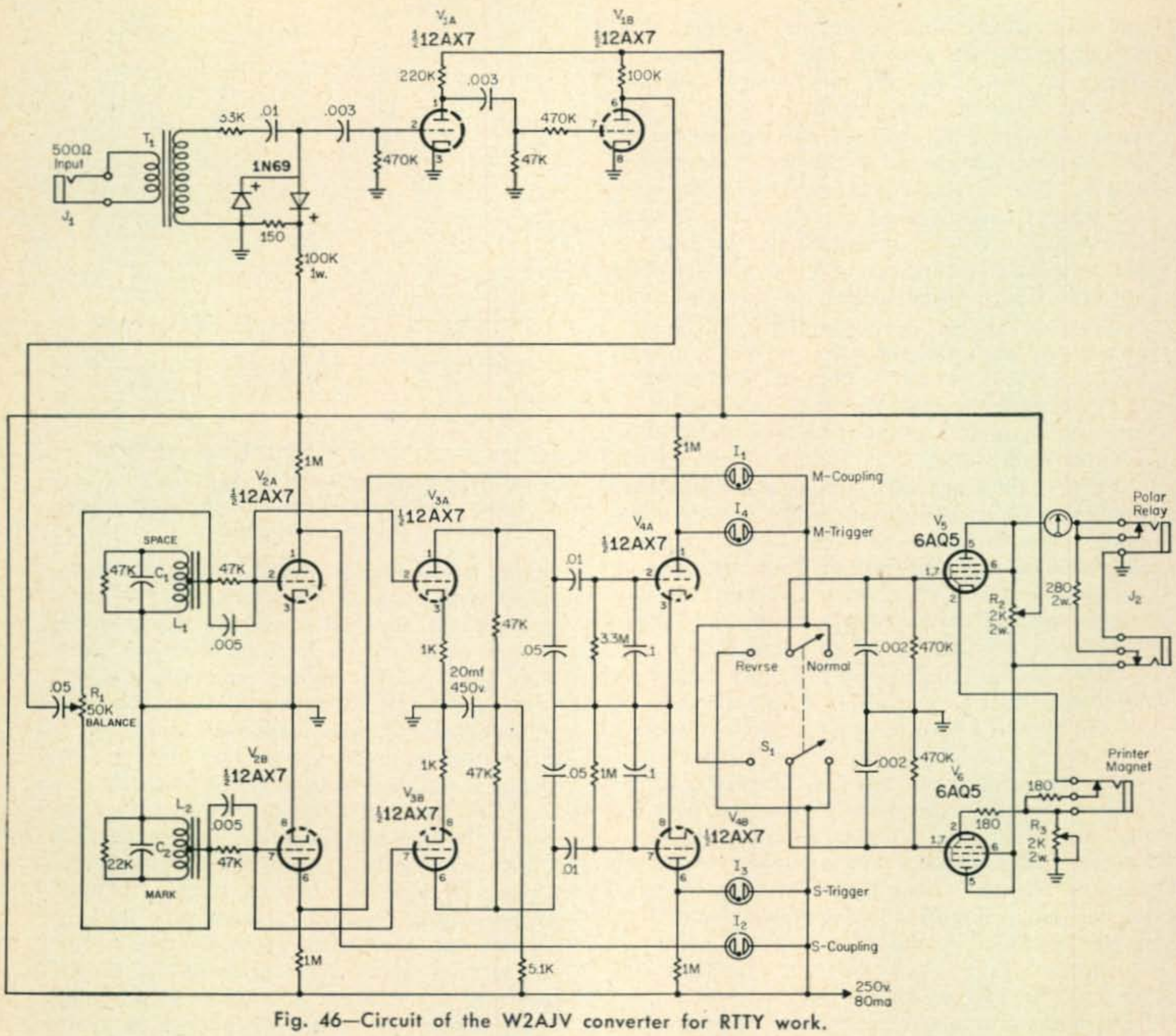


Fig. 46—Circuit of the W2AJV converter for RTTY work.

after the W2PAT converter, that received widespread attention, was the W2JAV Converter.[11] The W2JAV converter used the W2PAT basic circuit design but changed to 12AX7 tubes up to the keyer stage which was changed to two 6AQ5 pentodes. The basic difference between the W2JAV and W2PAT converters was that W2JAV added two dual stages between the dual detectors and the dual keying tubes. A block diagram of the W2JAV converter is given in fig. 45, which will give the reader a chance to compare it with the W2PAT converter shown in the block diagram of fig. 41. The complete circuit of the W2JAV converter is shown in fig. 46.

We have had much to say about upside down signals and turn-over switches, so it is doubtful if anyone had any difficulty in spotting S_1 as the TURN-OVER, or REVERSE switch in fig. 46, or have any doubts as to its purpose.

It will be noted that the circuit of fig. 46 indicates the use of a *polar relay*. This is a device not covered up to this point, although we did suggest the possible use of a relay in connection with frequency shift keying earlier when that subject was covered. The polar relay subject will be covered in detail later.

The W2JAV converter has improved selective filters as well as good limiting. The W2PAT converter used television width coils in the construction of the two tone filters (*mark*-2125 cycles and *space*-2759 cycles) whereas the W2JAV converter used toroidal wound coils which have a much higher value of Q than the conventional core type coils such as the television width coils. Naturally, the toroid-wound coils are much more selective and desirable. At one time toroid coils were not readily obtainable or well known in amateur circles. RTTY has changed this. These coils are now regularly advertised in many places and most any RTTY'er is acquainted with the superior merits of the toroid-wound coils. Another important feature of this converter, which is a carry-over from the W2PAT converter, is the BALANCE control (50K pot—R_1) which makes it possible to change the ratio of the *mark* and *space* signals being fed into the two tone separating filters.

A significant difference between the W2PAT converter and the W2JAV converter is that the latter added two stages (dual) that the reader

[*Continued on page 105*]

[11]Kretzman, B., "An Improved Radioteletype Converter," *CQ*, April 1958, p. 42.

Touch-Key Additions + + + +

BY ALBERT JACKSON,* VE3QQ

After some operating time it was decided that several additions to the Touch-Key[1] would be in order. These are a power supply to eliminate the batteries and provisions for a long dash.

AFTER a number of months operation of the original Touch-Key arrangement, it was decided to replace the batteries with a simple a.c. supply, and to extend the key's capabilities by the addition of a "long-dash" circuit. The latter gives certain advantages not normally found with electronic keys, and which are desirable to some operators, including the writer.

A.C. Power Supply

For those who can borrow 30 to 40 ma from an existing 6.3 volt heater winding, one end of which is, or can be, grounded, the circuit of fig. 1 makes an adequate a.c. supply. It gives approximate voltages of −8 and +1.2 to ground, containing sufficiently low ripple. Diodes CR_1 and CR_2 act as shunt regulators for the positive output.

This power supply can be substituted directly for the batteries and switch shown in the Touch-Key schematic. A separate filament transformer may, of course, be used as a voltage source, making a complete power supply for the key, if this proves to be more convenient.

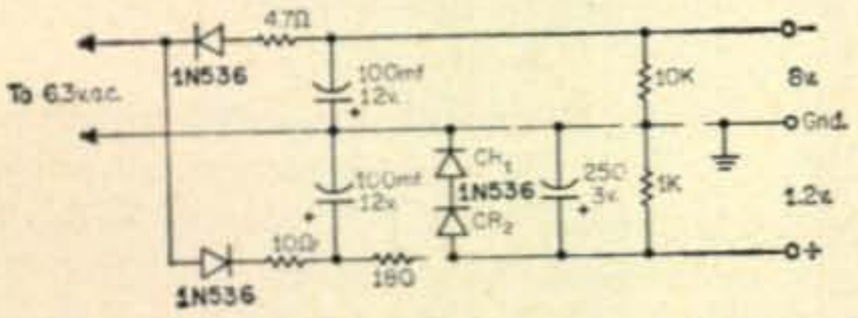


Fig. 1—The a.c. power supply shown above may be used to replace the batteries needed for the Touch-Key previously published. All the resistors are ¼ watt except as noted and all capacitors are in mf.

Long-Dash Circuit

In order to gain the great advantage of automatic dashes as a feature of most electronic keys, certain sacrifices have had to be made, namely the ability to send the long-dash or Morse zero, and to hold the key down for tuning purposes. For operators who would like to retain these capabilities, the circuit of fig. 2 can be added to the Touch-Key. Touching both paddles at the same time will then actuate the new relay in addition to the others, and give the effect of "holding the key down," if its contacts are properly connected into the external circuit.

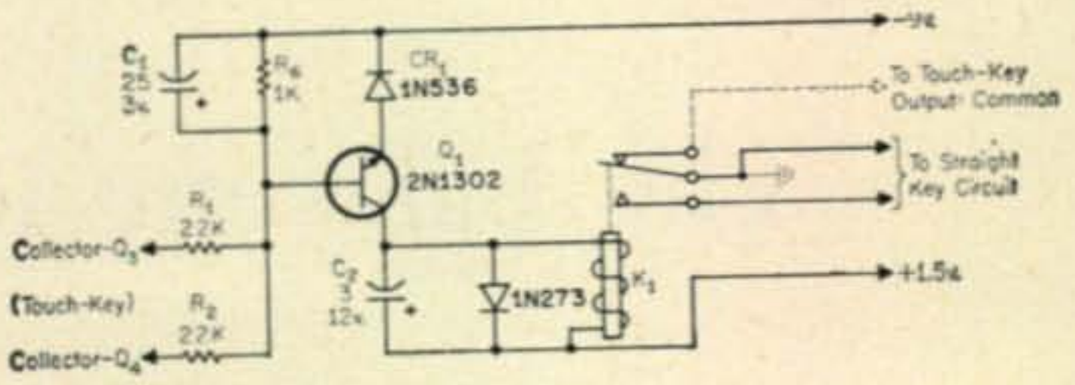


Fig. 2—Long-dash circuit that may be added to the Touch-Key. Relay K_1 has a 2,500 ohm coil and is a Potter Brumfield RS5D. It may be mounted, with Q_1, on the relay section of the original unit. All resistors are ½ watt and the capacitors are in mf. The dotted lines to the Touch-Key output are explained in the text.

The actual method of making this connection will depend on your particular electronic key, and involves these possibilities:

(a) You can connect the normally open contacts of the new relay across the straight or mechanical key input on your electronic key, if it has this provision. If not, it may be an easy matter to add such a feature. In any case, this is the preferred method.

(b) As a last resort, the new relay may be connected directly across the key terminals of your transmitter, subject to the usual current and voltage limitations for a small relay. This will, however, present monitoring problems unless your side-tone is controlled by the transmitter keying system itself.

Note that a self-completing electronic key, with either of the above arrangements, may continue a long-dash to the end of the next selected dot or dash character, after the key is "opened". This is, of course, of little or no consequence in tuning or for making the odd zero, and if such a set-up suits your requirements, use the solid line connections for the relay given in fig. 2.

Precise Control

More precise control of the long-dash can be obtained by a small change in the new

[*Continued on page 104*]

*12 Third Avenue, Box 453, Arnprior, Ontario, Canada.

[1]Jackson, A. H., "The Touch-Key," *CQ* November 1964, page 28.

The Lafayette HA-350 Amateur-Band receiver. A cast-aluminum escutcheon at the center dresses up the set and adds rigidity to the panel. The S-meter is at the left window, the calibrated dial is at the right window. The vernier-tuning dial in the center is marked off with 100 divisions. The preselector-tuning knob is at the left center and along the bottom row, left to right, are the following switches: calibrator on-off, band-selector, receive-standby, calibration-reset, function, and noise limiter with the phone jack at its right. The r.f. and a.f. gain are at upper right.

CQ Reviews:

The Lafayette HA-350 Receiver

BY WILFRED M. SCHERER,* W2AEF

JUDGING from inquiries received concerning the new Lafayette Model HA-350 receiver, a considerable amount of interest is evidenced therein. Whether this stems from its being a moderately priced receiver with features found in some more costly gear or if it is because it is a piece of amateur equipment imported from Japan, is not certain; but at any rate, having had the opportunity of looking over the HA-350 and having put it through its paces, we'd like to pass the low-down on it to our readers.

The HA-350 is an amateur-band-only receiver (plus WWV on 15 mc) for use on a.m., s.s.b. or c.w. with full coverage using the following ranges: 3.5-4.1 mc, 6.9-7.5 mc, 13.9-14.5 mc, 14.5-15.1 mc, 20.9-21.5 mc, 28.0-28.6 mc, 28.5-29.1 mc and 29.1-29.7 mc. Selectivity is obtained by means of a 2 kc mechanical filter and either upper or lower sideband may be selected for s.s.b. A dual-conversion system is used with tuning obtained by a single-range stable temperature-compensated v.f.o. which has a dial calibrated in 10 kc increments spread over 600 kc. It is operated by a smooth drive mechanism with a tuning knob that has a dial with 100 divisions marked on it for arbitrary reference readings.

Other features include: crystal-controlled h.f. heterodyne oscillator and b.f.o., preselector tuning, high sensitivity, low noise, good image rejection, S-meter, a.m. noise limiter, fast and slow a.g.c., envelope detector for a.m., product detector for s.s.b. and c.w., 100 kc crystal calibrator (crystal is optional), calibration reset, solid-state power supply and auxiliary power socket.

*Technical Director, *CQ*.

Circuitry

Circuitry of the HA-350 is quite conventional, but a number of short cuts are made which reduce some of the components otherwise required and thus help keep down costs, yet permitting excellent performance still to be obtained.

Straight-through single conversion is used for the 3.5 mc band and dual conversion is employed on the other bands using part of the 3.5 mc section for a tunable i.f., thus providing good image rejection, high stability and requiring only a single v.f.o. tuning range with the same incremental calibrations for all bands. Referring to the block diagram at fig. 1, operation is as follows:

V_1 is an r.f. stage for all bands and is inductively coupled through the preselector tuning circuits to V_{2A} which for 3.5 mc operation functions as a second r.f. amplifier. The 3.5 mc output of V_{2A} is connected to V_3 through a 3.5-4.1 mc bandpass coupler and is combined in V_3 with signals from the v.f.o., V_4, which tunes from 3955 to 4555 kc to produce an i.f. of 455 kc that is fed to a mechanical filter which has a 2 kc bandpass at 6 db down, and a 6 kc width at 60 db. The filter is followed by two 455 kc i.f. stages, V_5 and V_6. The product detector V_{8A}, the envelope detector CR_1 and the a.g.c. rectifier, V_{7B}, are fed from V_6.

The function switch, S_1, shifts the input of the a.f. stages to the output of the product detector for s.s.b. and c.w. or to the output of the series-type noise limiter, V_{7A}, connected to the a.m. envelope detector. B.f.o. potential for the product detector is simultaneously turned on when the function switch is set for s.s.b. or c.w. Two

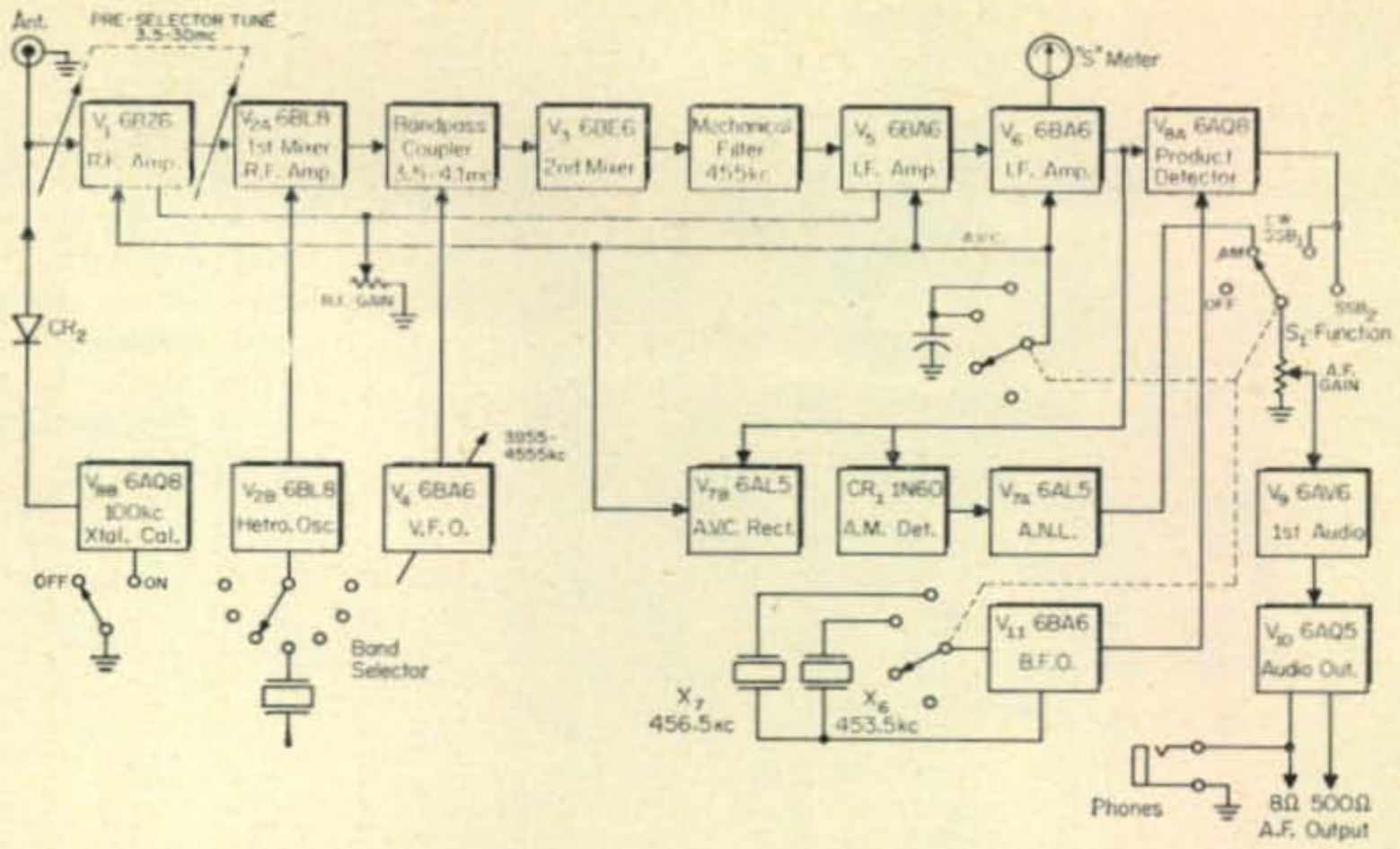


Fig. 1—Block diagram of the HA-350.

separate crystals are switched in as needed to provide sideband selection. When sidebands are switched, the v.f.o. frequency is not automatically shifted at the same time, so the receiver must be retuned 3 kc when sidebands are changed.

The function switch also changes the a.g.c. time constants, automatically providing fast a.g.c. for a.m., slow a.g.c. for s.s.b. and c.w. The S-meter is in a bridge arrangement between the cathode and screen of V_6. When the r.f. gain is reduced, the meter still is operative and its zero setting does not change (a zero-set control is provided on the rear of the set).

Dual conversion is used for all the other bands with V_{2A} then functioning as a h.f. mixer in conjunction with the appropriate crystal-controlled frequencies, from the heterodyne oscillator V_{2B}, needed to provide a 3.5-4.1 mc i.f. for the input of V_3. The number of crystals required is held to a minimum by utilizing two crystals for two different bands in some cases. A 11 mc crystal is used for both the 7 mc and WWV bands, an 18 mc one for the 14 mc band, 25 mc for the 21 and 28.5 mc bands, 24.5 mc and 25.6 mc for the 28 and 29.1 mc ranges respectively. When the same crystal is used for two ranges, the v.f.o. must be tuned in opposite directions for each band; that is, it must be tuned clockwise to increase the receiver frequency when the crystal frequency is lower than that of the band in use, and in a clockwise direction when the crystal frequency is higher than the band involved. "Reverse" tuning is not uncommon in present day gear.

Another saving is realized by the 600 kc tuning range of the v.f.o. which makes it possible to cover the entire 10-meter band with three crystals instead of four, customarily required when only a 500 kc range is available.

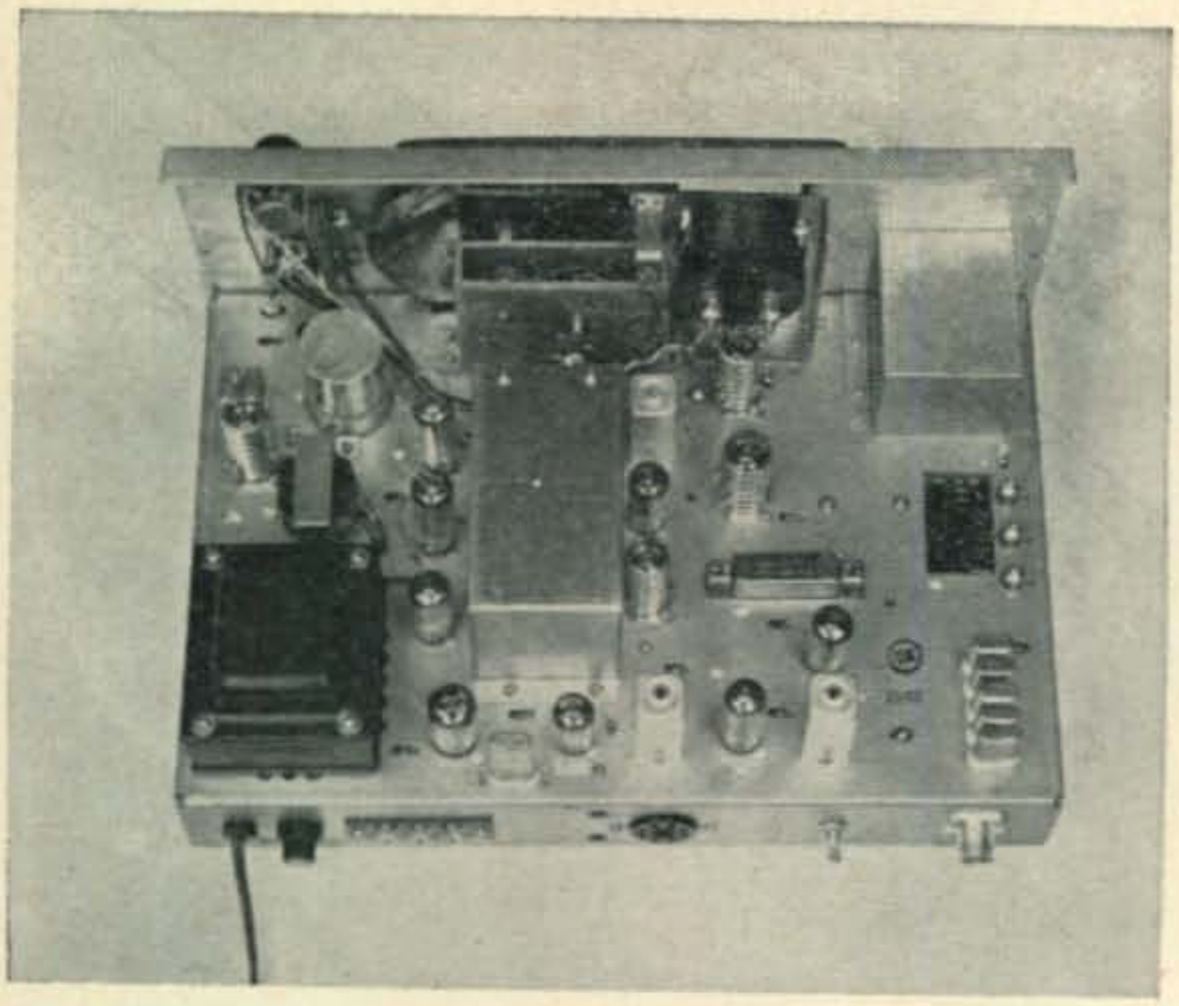
"Preselector tuning" is used at the input and output of the first r.f. stage. An economical feature here is that only two coil ranges are used. One covers 3.5 through 7.5 mc, the other 14 through 30 mc. Panel markings indicate the proper preselector setting for each band.

The output of the 100 kc crystal calibrator is fed to the antenna circuit through a crystal diode to increase the 100 kc harmonic levels on the higher ranges. The power supply uses silicon diodes in a full-wave center-tap circuit and a VR tube supplies regulated B-plus to all the oscillators and to the screen of V_6. The latter is used to stabilize the S-meter bridge circuit.

Construction

The HA-350 is well built using a copper-colored anodized-steel chassis and an aluminum panel with a heavy cast-aluminum escutcheon for the main dial and the meter windows and for the vernier-tuning arrangement. An extensive amount of shielding is used with the v.f.o. and the second mixer both completely contained in the same enclosure above and below the chassis. The preselector-tuning capacitor and the b.f.o. each are contained within separate cans. The "front-end" section is separated from the rest of the set with partition shields below the chassis and when the cabinet is in place, the front end is almost completely shielded. The dial-drive mechanism consists of a smoothly operating pinch drive in combination with a set of split gears installed in a heavy metal casting. The mechanical filter is mounted along with tiny input and output transformers on a small printed-circuit strip screwed to the chassis.

Besides the main tuning knob, other controls are: preselector tuning, r.f. gain, a.f. gain, bandswitch, function switch and calibration reset. Slide switches are used for turning on the crystal calibrator and the noise limiter, while a toggle switch takes care of the send-receive function for standby use. The rear apron has an SO-239-type coax connector for the antenna and a three-terminal screw-type connector strip for the speaker and 500-ohm a.f. outputs. A convenient feature here is that the terminal-screw heads, besides being slotted, are knurled so that they may be manipulated by hand. You don't have to scurry around for a screw driver when connections are to be made. An octal-type auxiliary



Top view of the HA-350. The v.f.o. and 2nd mixer enclosure is near the center with the metal casting containing the gear-drive mechanism toward the panel. The oblong-shaped component, horizontally positioned at right center, is the mechanical filter. The preselector tuning capacitor is covered with the shield at the upper right corner.

socket supplies heater and plate power, 500-ohm a.f. output, a.g.c. and receiver-standby control circuits. The antenna input also is bridged to the socket for converter use. Another nicety is that a socket plug is furnished which has a plastic cap that threads onto the plug, so removing the cap does not require prying it off with a screw driver as is so often otherwise needed.

Performance and Operation

Having had some disappointing experiences with imported gear in the past, we were somewhat apprehensive as to what sort of performance would be forthcoming with the HA-350, but happily our fears were dispelled, as may be evidenced from the following measurements and the results obtained with on-the-air operation.

The receiver sensitivity measured 1μv for 10 db signal-to-noise ratio for a.m. on all bands. With s.s.b. and c.w. it amounted to 0.5 μv with 12 db S/N on 7 and 3.5 mc and with 15 db S/N on the higher bands.

The selectivity measured up to the figures given earlier for the mechanical filter and no spurious responses outside of the filter passband could be found. Sideband suppression at 1 kc was —50 db for one sideband, —40 db for the other sideband. This difference was accounted for by a variation in the placement of the carrier-crystal frequencies in relation to the filter passband (due to crystal tolerances). In practice, sideband suppression was excellent and when the bands were crowded, we experienced fewer difficulties with QRM and monkey chatter than usual. Good low-frequency a.f. response was obtained using either sideband, in fact s.s.b. signals had more natural-sounding voice quality than customarily heard. On the other hand, due to the relatively narrow bandpass of the mechanical filter, a.m. signals sounded somewhat muddy and although some improvement could be realized by tuning the receiver to the edge of an a.m. sideband, good quality and better intelligibility could be obtained by using either one of the sideband positions and tuning to zero beat with the a.m. carrier. Also, if an annoying heterodyne from another a.m. station is present, you can then switch to the other sideband and get rid of the interference.

When the going gets rough, the c.w. operator may find somewhat better than 2 kc selectivity desirable, but a good dodge in this case is to use signal-signal-type reception to eliminate adjacent-channel QRM. This can be done simply by switching to the opposite sideband position. As pointed out earlier, this will require retuning the receiver 3 kc at the same time.

Image and Spurious Responses

Image rejection was —65 db on 3.5 and 7 mc, —60, —55 and —45 db on 14, 21 and 28 mc respectively. I.f. rejection (3.5-4.1 mc) was —55 db at 7 mc, —60 db on the higher bands. In this respect, very strong 80-meter signals could be weakly heard when the other bands were used, especially if a multi-band antenna covering the 80-meter band, such as a trap type, were employed. If any confusion should arise as to whether or not a weak signal is 80-meter feedthrough or an in-band signal, it is only necessary to detune the preselector and note if the signal diminishes or disappears. If it does, it will have been an in-band signal, if not, you're hearing 80-meter feedthrough. Any persistent annoyance in this connection could be eliminated with an 80-meter trap installed at the receiver input and which can be switched out when 80-meter reception is required.[1]

One or two oscillator birdies were found on some of the bands, but these were all less than an equivalent input signal of 1 μv, except one at 14,065 kc which was at the 3 μv level. (There is a trap, accessible from the rear of the set, for adjusting this one to the minimum level). Spurious responses of this nature are not uncommon in multiple conversion receivers, even in the high-price jobs.

[1]Miller slug-tuned coil #20A686RBI, adjustable 3.8-8.5 μh, shunted with 270 mmf. Connect trap between feedline and receiver antenna input. Adjust for maximum attenuation on 3.5 mc band. Then use trap when receiving on all bands, except 3.5 mc.

A.G.C.

A.g.c. characteristics were such that at signal-input levels between 10 and 100,000 μv the average increase in a.f. output for each 20 db increase in r.f. signal input was 5 db. Both the fast and slow a.g.c. time constants worked out satisfactorily with the modes for which they were intended. The slow release for s.s.b. eliminates pumping and dynamic a.f. amplitude distortion; however, the recovery at the end of your own s.s.b. transmission is slow unless the receiver is disabled during transmitting periods, which of course is the normal method of operation. This can easily be arranged with the HA-350 by wiring the send-receive standby terminals of the auxiliary plug to the vox control relay of the transmitter. During standby, the receiver-disabling circuit opens the B-plus line connected to several points in the r.f. and i.f. section, so any external relay contacts must be normally-closed ones *without* any ground connections. With some transmitters an auxiliary relay may then be required. On-the-air s.s.b. operation posed no other problems and no difficulties were found in obtaining sufficient a.f. level for good anti-trip operation.

Receiver Gain

The overall gain when switching from band to band was more uniform than normally encountered, being within ± 4 db. The S-meter readings on all bands for a 50 μv input signal averaged S-9 plus 15 db and the S-meter calibrations were somewhat less than the standard of 6 db per S-unit. There was plenty of a.f. gain and the maximum a.f. power output was 1 watt with 8% distortion at 1000 cycles. The resistive antenna-input impedance on all bands held closely to 50 ohms.

Stability and Calibration

Starting from an ambient temperature of 68° F., the warm-up drift during the first 15 minutes was 1.2 kc with 400 c.p.s. the following hour and 200 c.p.s. or less per hour thereafter. Banging the cabinet resulted in some evidence of frequency vibration, but was not serious enough to be detrimental during normal usage. A.c. line-voltage variations of $\pm 10\%$, centered at 115 v., produced a frequency shift of no more than 15 cycles on any band.

The number of revolutions of the tuning knob for each 100 kc of band coverage varies from one to three-quarters, since the v.f.o. frequency range is not quite linear; nevertheless, by noting the number of vernier-dial divisions required to cover each 100 kc segment indicated on the main calibrated dial, a close approximation of the number of kc per division may be had for the section of the band in use. The 10 kc calibrations on the main dial are spaced at an average of a little less than ⅛" apart, so the readout accuracy is limited to 2 or 3 kc. A yellow and a white scale on the frequency dial are calibrated in opposite directions. The dial window also has white and yellow numerals to indicate which band range corresponds to the white and yellow scales. The actual frequency is determined by adding the number of kilocycles indicated on the main scale to the band-range numerals. These numerals also have a dot or a triangle marked next to each one to indicate which sideband position is to be selected by the function switch where SSB1 is similarly marked with a dot, SSB2 with a triangle. These are the sidebands which are normally used for operation with the corresponding bands. Operation of the tuning mechanism was very smooth and backlash amounted to no more than 100 c.p.s.; however, for those not accustomed to tuning in s.s.b., the tuning ratio may be a bit on the fast side.

When the crystal calibrator was used, some confusion existed on the higher bands in selecting the correct beat, since multiple beats could be heard near each 100 kc point. The best way to determine the proper spot was to select the strongest beat and one which does not diminish when the preselector is detuned.

The WWV range tunes in the same direction as the 3.5 mc band and covers 14.5 to 15.1 mc, so that WWV will appear at 500 on the white scale.

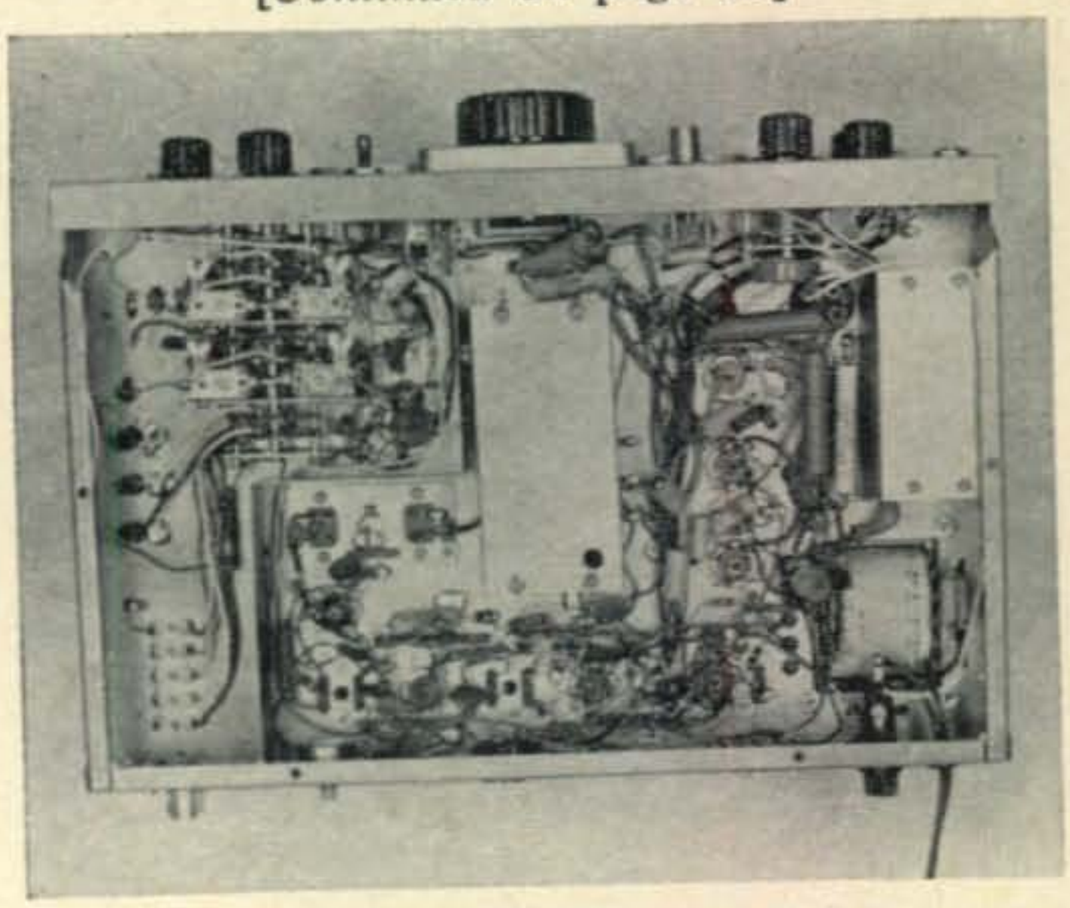
Difficulties and Modifications

The only difficulty that was discovered was that the 2nd i.f. stage clipped on very strong s.s.b. signals and caused distortion. The problem was brought to the attention of the manufacturer so corrective measures will probably be taken in later models.

A simple modification found useful was to reduce the gain on the 3.5 and 7 mc bands which was considerably higher than that of the other bands. The job was done by disconnecting and removing the red lead from between the bandswitch and coil LM_1 and then connecting a 3900-ohm resistor between the bandswitch terminal and the coil terminal that has another red lead which runs over to coil LM_2.

We're probably a bit finnicky, and as such we preferred a bit slower a.g.c. for s.s.b. with a

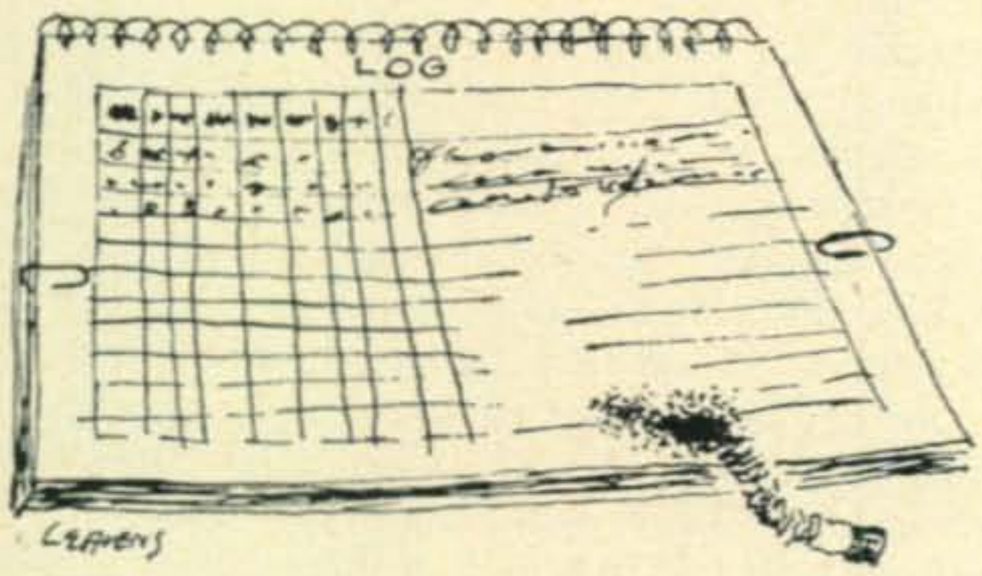
[*Continued on page 98*]



Bottom view of the HA-350. The center enclosure covers the underside section of the v.f.o. and 2nd mixer. A partition at the left shields the front-end. The b.f.o. is shielded in the can at the upper right.

A NEAR DISASTER

BY E. H. MARRINER,* W6BLZ



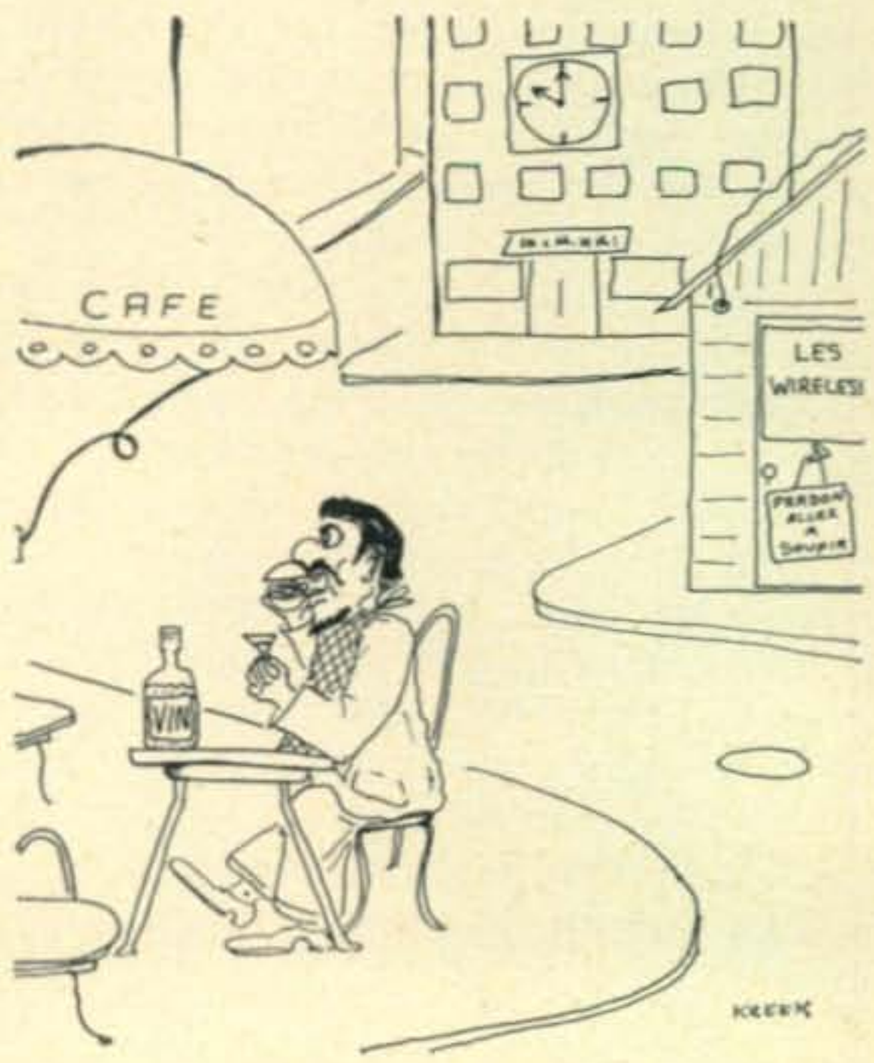
This short historical note might be more aptly titled "How Log Keeping Began."

In the early days of Wireless Telegraphy, Marconi, the father of communication, was trying hard to impress stockholders in his new company by establishing a communications link across the English Channel. Whether or not his company would get any backing depended upon his ability to maintain communication across the channel between Wembley, England and Wimereux, France twenty-four hours a day.

Capt. B. Baden-Powell, the founder of the Boy Scout movement went over to France to witness the demonstration. During the day-time the wireless equipment worked fine and messages were flying back and forth. About sundown the equipment went dead for no apparent reason. Inspecting the equipment, and the antenna, they could find nothing wrong. Here is a description of what happened in Baden-Powell's own words back in 1899 in a letter addressed to the London Times.

"Through Mr. Marconi's kind hospitality I have had the opportunity of watching message after message pass throughout the day, at all times and under all conditions, transmitted by different senders, even including myself. Scarcely a single letter has gone wrong, even though experiments were frequently tried to test new instruments or altered dispositions. A little anecdote of my experience may not be out of place as instancing the rarity and strangeness of breakdown. About ten o'clock one night, we at Boulogne attempted to ring up the South Foreland station. There was no reply. Doubtless, we thought, the attendant was having trouble with the equipment. After an interval we rang again, but no answer came. Could the instrument be out of order? A careful examination was made to our equipment, tests were applied, but no fault could be detected. Could anything be wrong at the other end of the line? Again and again we rang up, but all to the no good. A fresh receiving instrument was installed and all of the wires carefully overhauled. We went out into the black darkness of the night and tested and pulled at the vertical wire suspended from the great mast outside just to make sure that it was intact. An hour or more had passed, the greatest anxiety being displayed by the three officials. It had to be owned that the system had broken down! And there we sat in blank amazement, utterly at a loss to account for this apparent disaster to the great system in which we had all put such faith. Suddenly the bell rang! A short formal message followed, and then, in reply to our eager enquiries, came forth the prosaic message, "Have been away to supper." That is an incident that is not likely to occur again, for I expect that the epicurean telegraphist has since had almost as anxious a quart d'heure as did Mr. Marconi that night."

I would like to guess that Capt. Powell's description caused future wireless stations inevitable log keeping which has been a plague to all radio operators to this day. ■



*528 Colima Street, La Jolla, California.

Modifying The HT-32

BY ROSS F. FOX,* W8PZX

The performance of most transmitters can be improved by adding a.l.c. to increase talk power and replacing the rectifier tubes with silicons. How to do this and the benefits derived are described below.

MANY times I have heard hams asking others if they knew of a way to add a.l.c. or replace vacuum tube rectifiers with silicons in their transmitters. There have been many good articles on these subjects, but some readers tend to pass up theory articles, not wanting to modify their sets and then have them not work right. Most like to see an actual case history and then follow suit.

On contacts when they would ask me, "What is your rig and what kind of linear are you using?" and I answered, "HT-32 running barefoot," they would tell me that I seemed to have a little more punch than the usual barefoot rig. I attributed it to the a.l.c. and silicons, but maybe it was because conditions on the band were extra good. Seriously though, they do ask for the circuits.

These circuits have been in use for over a year, with many tests and good reports, domestic and DX, from 75 to 10 meters. This question is almost always asked, "Did any of the original set parts show any damage?" None have been changed because of failure since the installation. If for any reason you would want to change back to the original circuit, it would not take too long and no damage is done because existing holes are used.

The a.l.c. can be used in any set with class AB_1 in the p.a. and a low level amplifier stage to control. Before the a.l.c. was installed the setting couldn't be run above 4 on the AUDIO LEVEL control without reports of splatter. With a.l.c. the gain control can be run all the way up but this will vary with different mikes. The higher the gain control can be run without poor quality or splatter, the more the talkpower. With a.l.c. in the HT-32, the gain has been run all the way up with no adverse reports. There are no adjustments to make as it is fully automatic.

*319 Clark Road, Arlington Heights, Cincinnati, Ohio.

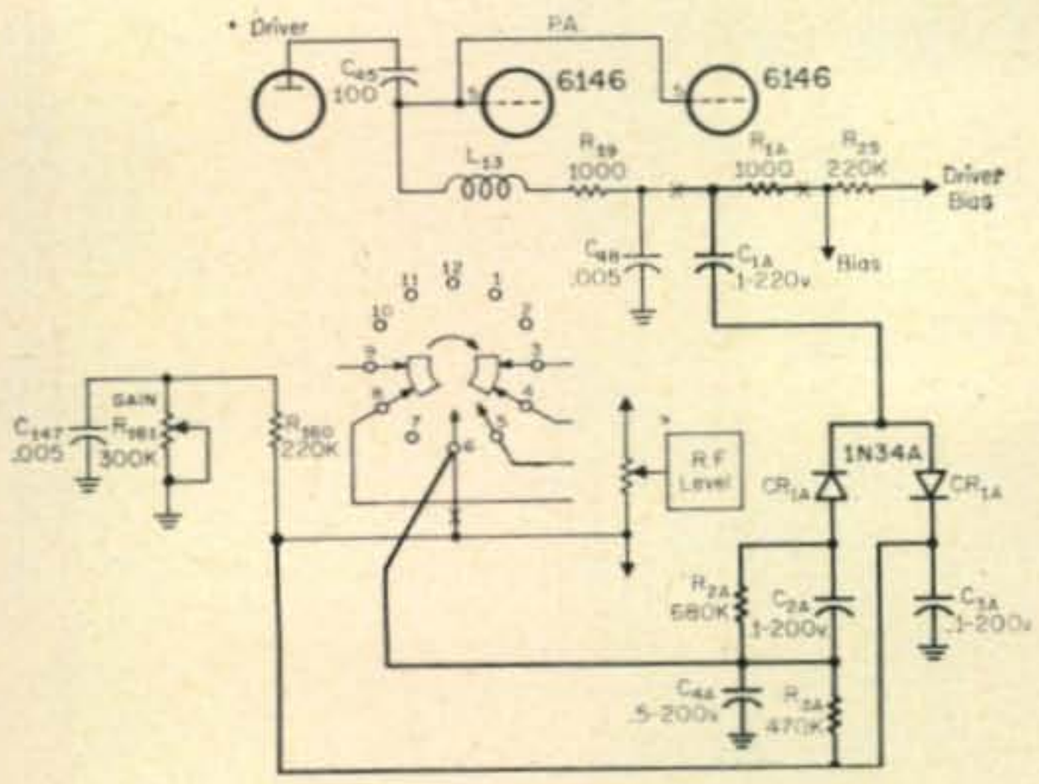


Fig. 1—Circuit showing the modifications necessary to add a.l.c. to the HT-32. Those components whose part numbers end in A are added parts. Points marked X are where lines are broken. Heavy lines indicate new wires to be added. The switch shown center is FS-1R.

A.L.C. Installation

The circuit showing how the a.l.c. is installed in the HT-32 is shown in fig. 1. The r.f. signal developed across R_{1A}, an added resistor, is fed to CR_{1A} and CR_{2A}. The rectified voltage is filtered and applied to the section of the FUNCTION switch labeled FS-1R.

Parts are mounted on a tie strip under the 6146 sockets. The interstage shield opposite the DRIVER TUNE tuning capacitor is a good place to mount it in the HT-32.

Rectifier Replacement

The replacement of the 5R4G rectifiers with silicons is a bit more of a mechanical problem.

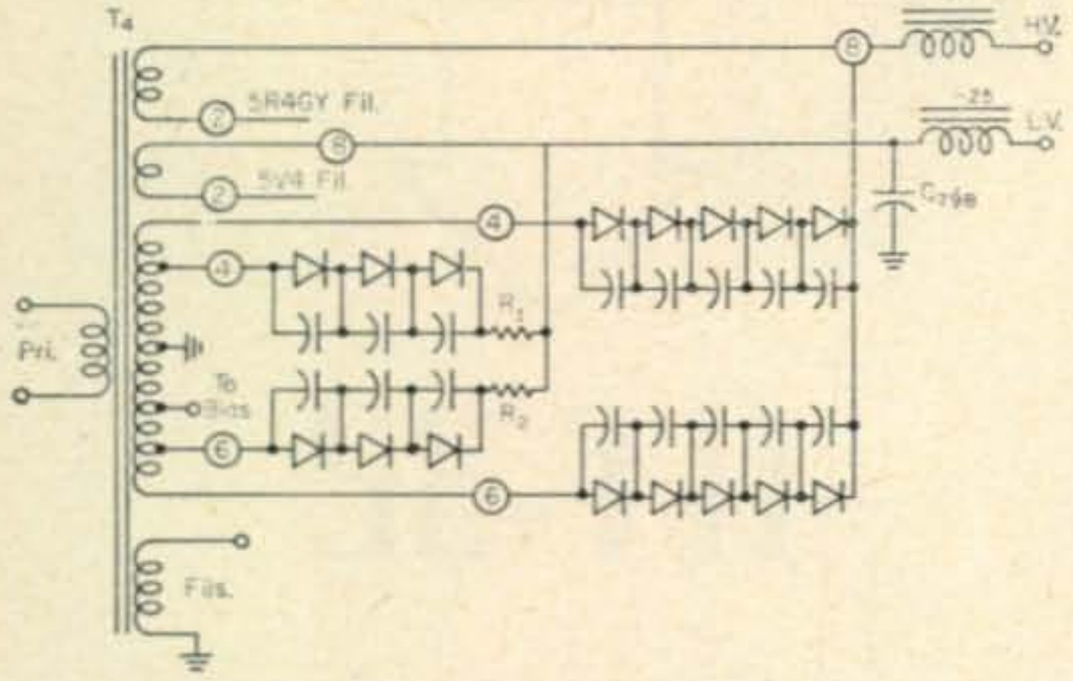


Fig. 2—Circuit of the HT-32 power transformer shows how the two rectifiers are replaced with silicons. The component valves are discussed in the text. The circled numbers are the rectifier socket pin numbers.

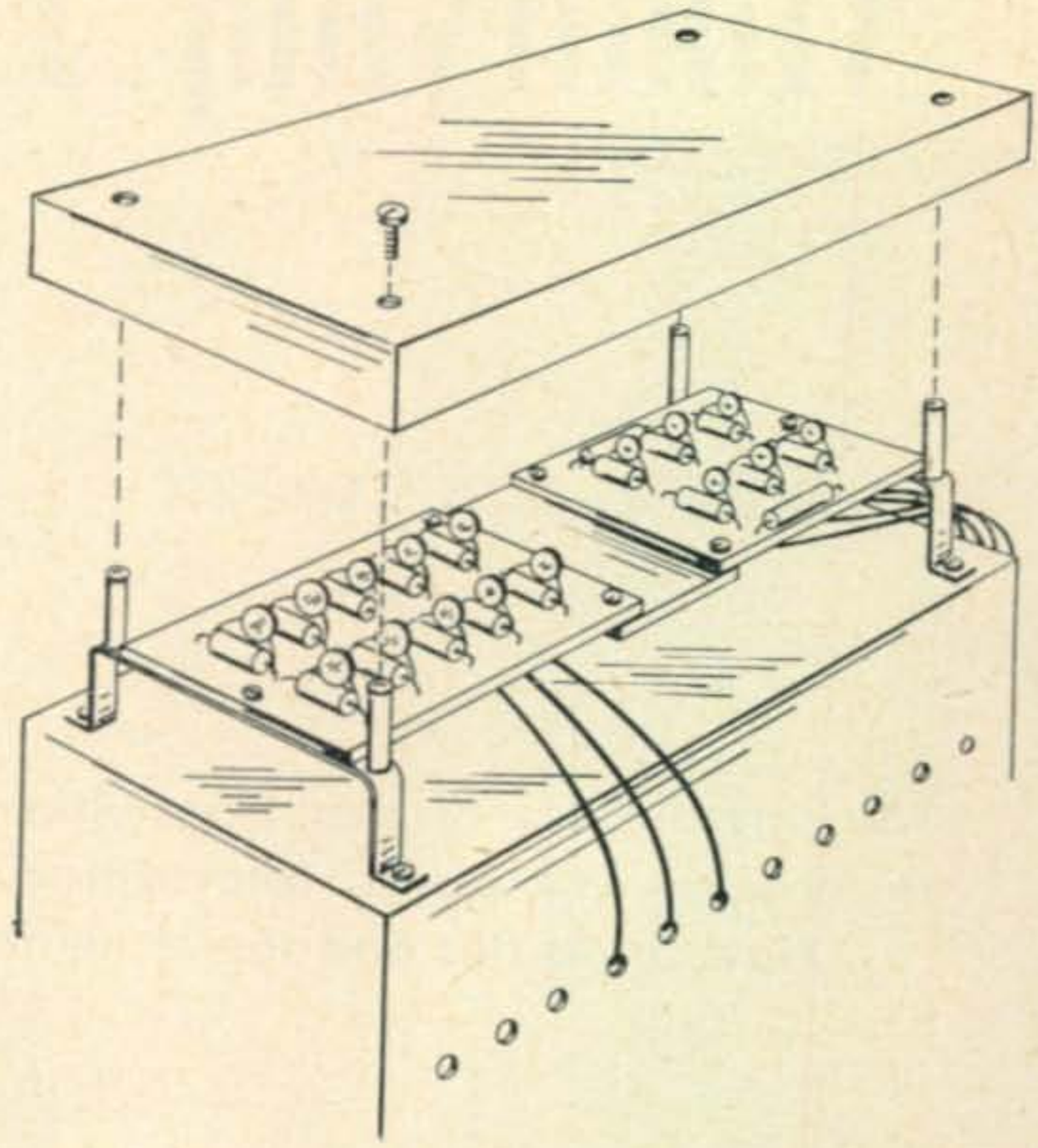


Fig. 3—Method of mounting the silicon rectifiers on top of the transformer (T-4) is illustrated above. The h.v. leads can reach through the vent holes as shown. The top cover is supported by four brass rods 1¼" long tapped at both ends. The two 100 ohm resistors are located on the rear board.

For the usual power supply handling 6146's, ten rectifiers with a p.i.v. rating of 600 volts and a current rating of 750 ma is adequate.

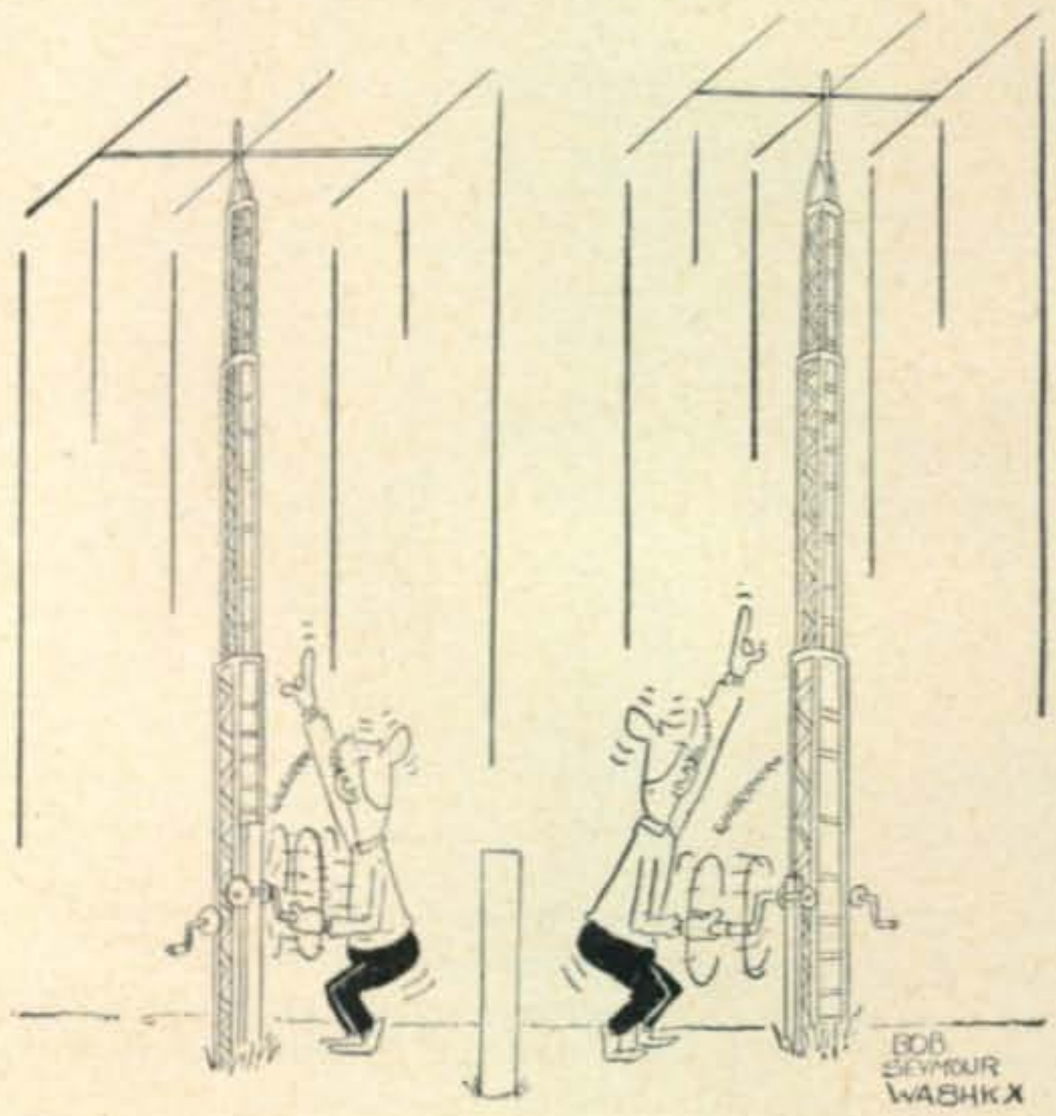
Tophat or epoxy silicons are suitable since these are most easily obtained and reasonably priced. A rating of 750 ma may seem a little high but they will run cooler and the life of a rectifier seems to have a direct relationship to temperature. It is best to use capacitors across the rectifiers. Disc ceramics of about 0.001 mf are cheap insurance against transients from the transformer and also the ones developed in the silicons themselves.

When changing a 5V4 to silicons use six with capacitors as with the 5R4 above. The output voltage in the low level stages will go too high, so install two 150 ohm 5 wass wire wound resistors, one in each leg, to get back to near normal voltage, other transmitters may need some experimenting. The 150 ohm resistors also make good surge limiters for high capacity input filters. If the higher voltage supply has a high inductance choke input, the choke and transformer secondary resistances will act as surge limiters.

Another common question is whether to use resistors across silicons. Ordinarily the answer is no; if they are put in without knowing the rate of leakage up to the avalanche point they can actually lower the p.i.v. of the stack. With high current silicons that have poorly defined avalanche points, resistors should be used to keep a few from taking all the voltage. To raise the p.i.v., sometimes it is more economical, instead of buying resistors, to just add more silicons since each one only drops the voltage from one half to one and a half volts. Adding more does little to lower supply output voltage.

Changing to silicons takes 20 watts of steady filament drain off the power transformer, so over 40 watts more input can be run with less heating. There is a slight rise in screen and about 100 volts rise in plate voltage which gives a little more input without hurting anything because most transmitters were designed on the conservative side. There is so much less heat the fan can be removed if you wish.

Mount the silicons under the top cover of the power transformer on insulated boards, this is a very convenient place. They are covered up and completely safe, yet there is easy access. Once in a while it is a good idea to check for shorted ones especially a short time after initial installation. Some fellows use tube bases and plug them in. One of these was made up and is in use in an HT-37 replacing the 5R4GY. ■



DX

BY URB LE JEUNE,* W2DEC

Here and There

AC5 Bhutan: Gus should be showing up as AC5A about the time you read this. He and his wife Peggy will be there for a year. A trip to AC3 land is planned for the very near future. *(Tnx W2EAF)*

CR4 Cape Verde Islands: After a real dry spell, this spot is finally back in business again in the person of CR4AJ and CR4BB. George, CR4AJ, has been very active of late both in the American band and below 14200, usually 14115. He speaks very good English and has a very strong signal. CR4BE also on c.w. normally on 17-1900 GMT 14020 and 21075, also 7012, 0200. *(Tnx NEDXA)*

FB8ZZ Amsterdam Island: FB8ZZ, operator Lionel, is now fairly active on s.s.b. He sometimes listens in the American Phone Band and then its anyone's guess just where he might listen.

FH8 Comoro Islands: FH8CD, Andre has been quite active lately low end 14 mc c.w. QSL via 5R8BC. *(Tnx WGDXC)*

FU New Hebrides: FU8AA, 14045 kc weekends, FU8AG, 14040-50 kc usually around 0800 GMT.

GC Guernsey: GC3MLR has been occasionally active on 21408 kc s.s.b. 1330 GMT seems to be his preferred time. *(Tnx WGDXC)*

KA4 Japan: Curt, KA2CM, has the license for KA4US. It was planned by Curt to visit Rokko Tropo (near Kobe) and operate for 72 hours with the following KA2's: LD, DF, and JH. Due to the failure of DF and LD to get excused from duty, the trip was postponed. This would have been the first KA4 activity in four years. It may have been rescheduled by the time you read this.

KG6I Marcus Island: KG6IF continues erratic operations between 2130 and 2230 GMT on 14258 kc s.s.b. *(Tnx NEDXC)*.

MP4 Middle East: MP4QBF has returned to the middle east and has been assigned calls MP4TBJ, MP4DAL, MP4MAU and MP4BFD. Due to very poor QSL returns, he will QSL only upon receipt of a card. His QTH is Don Aveling, Box 300, Abu Dhabi, Trucial Oman, Persian Gulf or via RSGB. *(Tnx Fla. DX Rpt.)*.

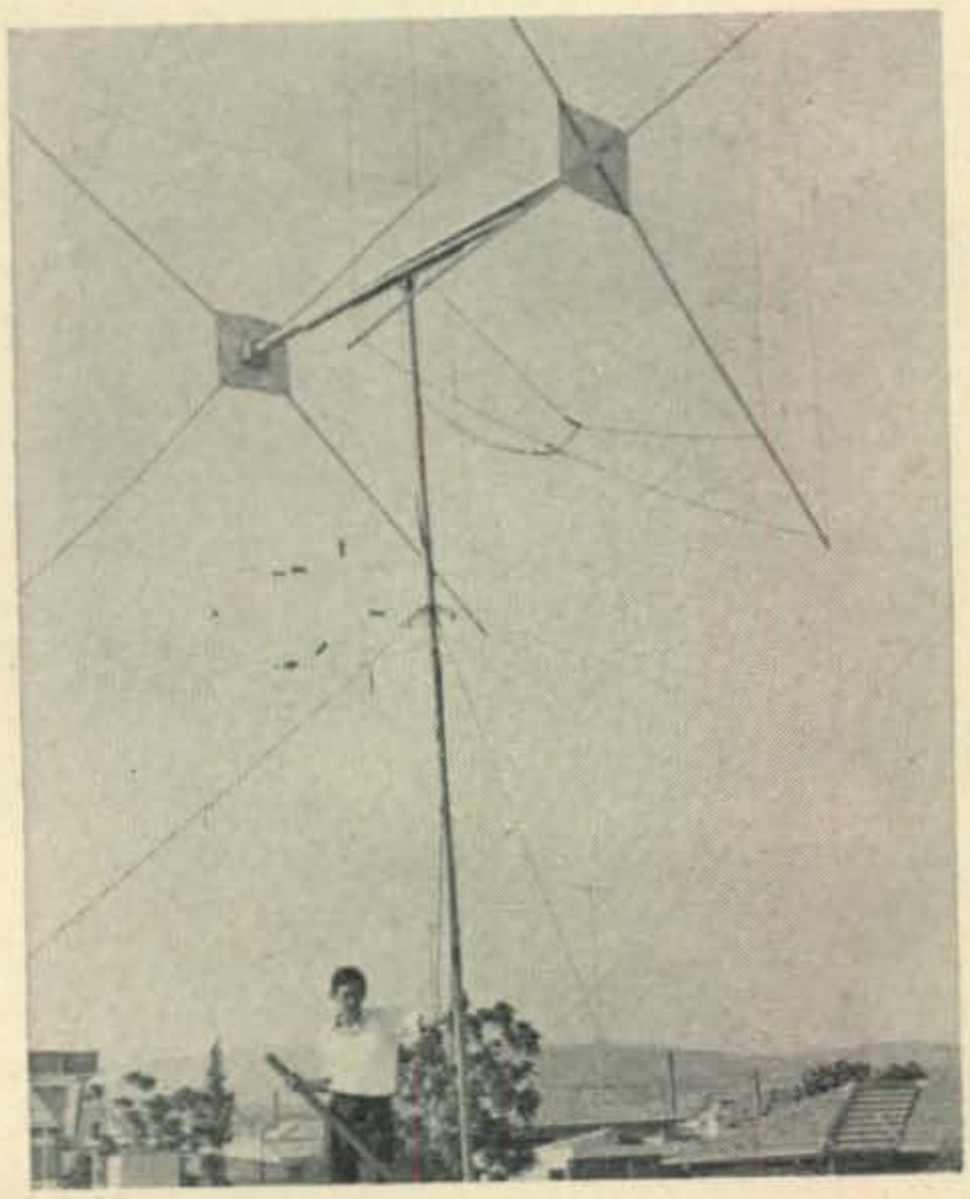
MP4T Trucial Oman: MP4TBJ has been active lately around 14040-50 kc from 1300 GMT. *(Tnx WGDXC)*.

TJ Cameroons: TJ1AC, Fred, 14270-80 kc 1530-1630 GMT lately s.s.b. QSL via DARC. *(Tnx WGDXC)*.

VK4 Willis Island: VK4TE has fundamental xtal 7058 kc and may be found there occasionally, however, 14116 kc will be his preferred frequency and he may be found there Saturdays from 0600 GMT and Sundays from 0530 according to work from VK-land where it is said he was only one xtal, but was heard on a Sunday on 14080 kc. Plans under way to send him a mess of crystals, so scan the bands. Late report puts him at 14063 kc. *(Tnx WGDXC)*.

VK9 Norfolk Island: VK9RB around 14080 kc weekends, VK9RH 14110 kc a.m. both usually active from about 0700 GMT *(Tnx WGDXC)*.

VQ1 Zanzibar: VQ1GDW, Willy, is back on the air (14120 kc s.s.b. 2130 GMT) after a long time off due to power transformer trouble, but says he will be active from 1800 GMT most days



This good looking chap is John, 5B4JF who is located in Limassol, Cyprus. John should be returning to G land about the time you read this.

*Box 35, Hazlet, New Jersey 07730.

The following certificates were issued between the period from November 6th to and including December 5th, 1964:

CW-PHONE WAZ

2073	DJ2BO	Karl Wentker
2074	W1GKJ	F. Norman Davis
2075	G5MD	Donald Powell
2076	OH5VF	Antero Vaananen
2077	UA4QA	Nikolaj Tjutin
2078	UT5AA	Anatoly Gortikov
2079	I1IF	Marcello Centamori

ALL-PHONE WAZ

275	W8ARH	Gary F. E. Vrooman
276	VK2AAK	Alex G. Swinton
277	W6QOG	Helen J. Leonard
278	EA1GH	Marcel Vandervorst

TWO-WAY SSB WAZ

275	W8ARH	Gary F. E. Vrooman
276	PY2QT	Rolf F. Simon
277	WA2HOK	Roger Bettin
278	VK3HL	Allan T. Hutchins
279	SM5BZ	Jan E. Bjork
280	OA4CV	Jesus Jay Fung Figueroa
281	OK3CDR	Juraj Sedlacek
282	W6LDA	E. E. St. John

CW WPX

595	W2EXH	Arthur Fenster
596	HB9YL	Anny Jenk
597	W2FVI	LeRoy Reeves

ALL-PHONE WPX

112	CN8AW	H. L. (Tommy) Hall

SSB WPX

201	DJ8RR	Dr. Karl Colling
202	VE6SF	Ray J. Nadeau

MIXED WPX

106	SP9RF	Andrzej Semkowicz
107	DJ8RR	Dr. Karl Colling

Javad, EP2DM, arrived in Atlanta to attend school and was met at the airport by Dr. Cook W4JOH on the left and Dr's. Carman and Meaders on the right. Javad is studying at the Southern Technical Institute on a Rotary Scholarship. He would like to hear from some of his ham friends and may be reached at the school, Box 8777, Marietta, Ga. *(Tnx WB2FMK).*

Thanks to K7SPH for the picture of FO8AA. This club station is very active of c.w. and s.s.b. and answers QSL's 100%. Since they work between 1200 and 1500 W's a month IRC's would be appreciated.

until the end of February when he goes QRT. *(Tnx WGDXC).*

VQ8 Rodrigues Island: VE8CO, Barry Bonser who will be remembered for his VS1BB/VS9/ZC5 operations, is reported likely to DXpedite to this spot after his tour of duty in VE8 land ends in December. VQ8AM & VQ8BS plans temporarily cancelled; maybe in March.

VR6 Pitcairn: VR6TC active 21 mc c.w. 20-2300 GMT, chirpy but strong signals into the USA. *(Tnx Fla. DX Rpt.).*

XT2 Upper Volta: XT2HV has been active on 14110 kc s.s.b. around 1800 GMT. *(Tnx WGDXC).*

ZC4-5B4 Cyprus: The Cyprus stations located in the British sovereign base area now using the ZC4 prefix are: ZC's 4CZ, GT, SS (Famagusta), GY (Bhekelia), KW, PC (Pergamos), HK, RA (Heraklis), CL, TJ, TX (Episcopi), AK (Akrotiri), MO (Troodos). Only CZ4s CZ and GT are now on s.s.b. *(Tnx VERON).*

ZD3 Gambia: ZD3A has QRTed and returned to G land. The proposed SSB operation was unsuccessful. *(Tnx NEDXA).*

ZD9 Tristan De Cunha & Gough Islands: ZD9AD, 14005 kc 2155 GMT saying QSL via PY2PE. *(Tnx WGDXC).*

ZS Queen Maudland: ZS6AP/KC4, the South African Antarctic Expedition is located in Queen Maudland near the Belgian Station OR4VN. He is mostly active on c.w. with a rather rough note. They will stay until February, 1965. He usually skeds ZS6 land around 1700-1730 GMT and is then QRV for other QSOs. QSL is requested via S.A.R.L. After his return in 1965 a special QSL will be printed. *(Tnx VERON).*

ZS2MI Marion Island: ZS2MI has been active on 14248 kc s.s.b. He is QRV between 1240 and 1300 GMT QRX 15 minutes for commercial sked and back until 1330 GMT. QSL via ZS1CZ.

9J2 Zambia: 9J2VB has been active on s.s.b. giving his QTH as Box 38, Mongu, Zambia. *(Tnx WGDXC).*

FB8XX, ZZ, WW: 24 members of the 5th mission to French Austral Lands leave Marseilles

Stu Meyer, W2GHK, and John Gayer, HB9AEQ at the November 20th meeting of the International Amateur Radio Club in Geneva, Switzerland. John is being congratulated on his election to "Fellow" in the IEEE.

aboard the S. S. *Galieni* en route to Crozet Island, Kerhuelen Island and New Amsterdam Island. At FR7 they will be joined by the rest of the party of 140 scientists and technicians. FB8ZZ's relief operator arrived about December 4th after which SS *Galieni* proceeded to FB8-WW, FB8XX to relieve those operators and to take HB9TL's rig to FB8XX for use during the next year. He is also taking a Hallicrafter's SR-150/c.w./s.s.b. all-band rig for use at FB8-WW. *(Tnx VERON).*

VS4RS: Ron Skelton, is now G3IHP until March 1965 then back to 9M6-8. Ron may be reached at 7 E. Mayplace Rd., East Bexleyheath, Kent and has his VS4RS logs with him. *(Tnx G2BVN).*

73, Urb, W2DEC

QTH's and QSL Managers

CEØAG	via VE3DGX, George Hrischenko, 3156 Bruce Ave., S. Windsor, Ont., Canada.
CP8AM	via K4GOX.
CR4AJ	Box 5, Paira, Cape Verde Islands.
CR4BB	Box 61, Praia, Cape Verde Islands.
CR7GF	via VE4OX.
CT3AQ	via K9ECE.
DJ6RN/M1	via DL1CF.
DJ9LH/M1	Via DL1CF.
ex-DL5CF	now K5HTE, Box 342, Ponca City, Oklahoma.
DLØMZ/LX	Horst Wiese, 6500 Mainz, Sommeringplatz 1, Germany.
DM7L	Siegfried Schlettig, Box 13, Glashvette/Sa Germany.
EL2AC	via K5SGJ.
FH8CD	Andre Lienard, Anjouan Isle Comoro Isle Mozambique Channel, Indian Ocean or via 5R8BC.
FL8AK	c/o Opms Co. 4th USASAFS, APO 843, Box 302, N.Y., N.Y.
FO8UL	via K2HWL.
FY7YL	Box 267, Cayenne, French Guiana.
HL9KH	via W6KTE.
HZ3TYQ/8Z4	W via W1RAN, DX to Box 1721, Aramco, Dharan, Saudi Arabia.
K7LMU/3W8	via K6EVR.
LX3MZ	via DLØMZ, Horst Wiese, 6500 Mainz, Sommeringplatz 1, Germany.
SVØWGG	via K1EAT.
TJ8AC	Roger Reymier, B. P. 26, Aeroport, Garoua, Cameroun.
UA2AO	Anly Moskalenko, Box 77, Kaliningrad, OBL, U.S.S.R.
VP2KA	via W2YTH.
VP2KI	via W2YTH.
VP2VI	via W2YTH.

The operating crew and position of the recent OH5TW/Ø and OH5VF/Ø DXpedition. The operators are, in the usual order OH5VF/Ø, OHØNI, and OH5TW/Ø. In 2200 QSO's the boys worked 105 countries. *(Tnx OH5VF).*

WAZ and WPX

THE WAZ and WPX certificates are awarded by the *CQ* DX department. WAZ is issued for proof of contact with the 40 Zones of the world as shown on the official WAZ Zone Map. WAZ is issued in three classes, *i.e.* Any mode, all phone and all s.s.b. For complete rules, see the January, 1962 *CQ*, page 50.

WPX is issued in four classes, *i.e.*, all c.w., all phone, all s.s.b. and Mixed. The number of prefixes required are: C.w.-300; Phone-300; s.s.b.-200; Mixed-400. For complete rules, see January, 1962 *CQ*, page 52. WAZ applications, Zone Maps and WPX applications may be obtained from the DX Editor at the address shown at the head of this column. Please send a self-addressed, stamped envelope or a self-addressed envelope and an IRC. All applications should be sent directly to the DX Editor.

For further information, check number 36, on page 110

ex-VK4JQ	John Copley, VK2AVU, Flat, NR3, Queenscliff, NSW, Australia.
VK4TE	via VK2AGH.
VK9RB	R. Hattersley, Box 24, Norfolk Island.
VK9TG	via W2CTN.
VK9TL	via VK3TL.
W8BZB/7G1	via K9BPO.
W9WNV/XU	via K6EVR.
XT2HV	Box 511, Ouagadagou, Upper Volta Republic.
YA3TNC	via KØRZJ.
YA4EK	via DL3RK.
ZD8BB	via W7ZMD.
ZD8WR	Western Electric Co., Ascension, P. O. Box 4187, Patrick AFB, Fla.
ZS2MI	via ZS1CZ.
4W1F	via W2CTN.
5R8AN	ex-TT8AG, via WB2PFI, ex-W3KVQ.
7Q7DS	Box 380, Blan Tyre, Malawi Republic.
7Q7GN	via WB6DDL.
9G1EO	via VE4OX.
9G1GN	via VE4OX.
9J2BB	via W4LIU.
9J2VB	Box 38, Mongu, Zambia.
9L1HX	via VE4OX.
9Q5HD	via VE4OX.
9M8EB	Ed Brogden c/o BLDC, Simanggang, Sarawak.

In November, Gus Browning, W4BPD, (center) visited the Jos. Schneider Optical Works in Germany. Gus, a photo enthusiast (noted by colored slides of his DX-peditions), is being shown the computer used in the design of lenses by Mr. Klempt, the lens designer. Mr. Klempt is DJ3HC, The man in the foreground is Mr. Esser a technician at the plant. Mr. Esser is DL1JW, and the winner of the CQ World Wide DX Contest for Single transmitter multi-operator class in 1963.

Looking For Something?

Looking for an old article? You can get reprints of past articles appearing in CQ by just sending in $1.00 for each reprint desired. If the issue itself is available from our files we will send that instead. Issues in the current year are still available at newsstand prices. Think back now, wasn't there something you were going to build or look up, but somehow misplaced the magazine? Well, you're not out of luck, just send us that letter. For those of you who are chronic "savers," we have a few 15 year indexes left (1945-1959) which lists every article appearing in CQ during those years. We are even contemplating a new up-to-date 20 year index, but so far no one has volunteered for the job.

—*K2EEK*

Propagation

BY GEORGE JACOBS,* W3ASK

BEGINNING about the middle of February, and continuing through March, a noticeable improvement usually takes place in high frequency propagation conditions between the northern and southern hemispheres. This improvement should be most noticeable on all h.f. bands between 160 and 15 meters, on circuits from the United States to South America, Africa, Australasia and the Antarctic. There is the possibility that some 10 meter openings may also take place between these areas.

Twenty meters is expected to continue to be the best band for world-wide DX during February. The band is forecast to open shortly after sunrise, and remain open to one area of the world or another until after sundown. Some fairly good DX openings are also forecast for 15 meters during the hours of daylight. Except for the possibility of an inter-hemisphere daytime opening of the type discussed at the beginning of this column, propagation conditions are not expected to be suitable for DX openings on 10 meters during February.

Forty meters is expected to continue to be the best band for DX propagation during the hours of darkness. The band is forecast to open for DX during the late afternoon hours, and remain open to one area or another until shortly after sunrise. Fairly good 80 meter DX openings are also predicted during the hours of darkness. Some DX openings are also forecast for 160 meters during the hours of darkness. The annual 160 meter DX Tests will be conducted on February 7 and 21 between 0500 and 0700 GMT. Check December 1964's PROPAGATION column for more details.

VHF Openings

No significant meteor showers are expected to take place during February, and very few short-skip sporadic-E openings are forecast for the month. On the other hand, there is generally an increase in auroral activity during February, and this is likely to result in some short-skip auroral type ionospheric openings on 10, 6 and possibly 2 meters.

Check the "Last Minute Forecast" appearing at the beginning of this column for those days that are expected to be either "disturbed" or "below normal", since there is a tendency for auroral activity to take place during these periods.

*11307 Clara Street, Silver Spring, Md. 20902.

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for February

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: **3, 7, 26**	A	A-B	B-C	C
Normal: **1-2, 4, 6, 8-9, 11, 15-16, 18-19, 21-23, 25, 27-28**	A-B	B-C	C-D	D-E
Below Normal: **5, 10, 12, 14, 17, 20, 24**	C	C-D	D	E
Disturbed: **13**	D	D-E	E	E

How To Use These Charts

The following is an explanation of the symbols shown above, and instructions for the use of the *CQ* propagation predictions:

1—Enter Propagation Charts on following pages under appropriate band and distance or geographical area columns. Read predicted times of band openings at intersection of both columns.

2—Following each predicted time of band opening is a forecast rating which indicates the relative number of days the band is expected to open during each month of the forecast period. The higher the rating, the more frequent the opening, as follows: (4) band open more than 22 days each month; (3) between 14 and 22 days; (2) between 8 and 13 days; (1) less than 7 days.

3—With the forecast rating noted above, start with the numbers in parentheses at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating higher than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following meanings: A-excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak and considerable fading and noise; E—poor opening, or none at all.

4—This month's DX Propagation Charts are based upon a transmitter power of 250 watts c.w.; 500 watts s.s.b., or 1000 watts d.s.b. into a dipole antenna a quarter-wave above ground on 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss, reception will become poorer by one level.

5—Local Standard Time for these predictions is based on the 24-hour system.

6—The Eastern USA chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9 and Ø areas, and the Western USA Chart in the 6 and 7 areas. The Charts are valid through February 28, 1965, and are prepared from basic propagation data published monthly by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

Sunspot Cycle

The Swiss Solar Observatory at Zurich reports a monthly mean sunspot number of 7 for November, 1964. This results in a 12-month running smoothed sunspot number of 10 centered on May, 1964. A smoothed sunspot number of 7 is predicted for February, 1965. This is approximately the same level of solar activity that was observed last during the spring of 1954.

Propagation Charts

This month's column contains DX Propagation Charts for use during February and March.

Short-skip Propagation Charts for February appeared in last month's column.

73, George, W3ASK

CQ DX Propagation Charts

FEBRUARY AND MARCH, 1965

Time Zone: EST (24-hour Time)

Eastern USA To:

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Western & Central Europe & North Africa	08-10 (1) 10-12 (2) 12-14 (1)	06-07 (1) 07-08 (2) 08-12 (3) 12-13 (4) 13-14 (3) 14-15 (2) 15-18 (1)	16-18 (1) 18-19 (2) 19-23 (3) 23-02 (2) 02-05 (1)	18-20 (1) 20-23 (3) 23-01 (2) 01-03 (1) 20-23 (1)† 23-01 (2)† 01-02 (1)†
Northern Europe & European USSR	09-12 (1)	06-07 (1) 07-10 (2) 10-14 (1)	18-02 (1)	20-00 (1) 21-23 (1)†
Eastern Mediterranean	09-11 (1)	06-11 (1) 11-13 (2) 13-15 (1)	18-20 (1) 20-21 (2) 21-23 (1)	19-23 (1) 20-22 (1)†
East & West Africa	08-10 (1) 10-12 (3) 12-13 (2) 13-16 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-19 (1)	18-19 (1) 19-22 (2) 22-01 (1)	19-21 (1) 21-22 (2) 22-00 (1) 20-22 (1)†
Central & South Africa	10-13 (1)* 07-10 (1) 10-12 (2) 12-14 (3) 14-15 (2) 15-18 (1)	07-14 (1) 14-15 (2) 15-17 (3) 17-18 (2) 18-21 (1)	18-20 (1) 20-22 (2) 22-00 (1)	19-22 (1) 19-21 (1)†
Central Asia	*Nil*	06-07 (1) 07-09 (2) 09-11 (1) 19-22 (1)	05-07 (1) 18-21 (1)	*Nil*
Southeast Asia	17-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-20 (1)	06-08 (1) 17-20 (1)	*Nil*
Far East	16-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-20 (1)	05-08 (1)	06-07 (1)
Pacific Islands & New Zealand	15-17 (1)* 12-16 (1) 16-18 (2) 18-20 (1)	07-09 (2) 09-20 (1) 20-22 (2) 22-07 (1)	00-02 (1) 02-06 (3) 06-07 (2) 07-08 (1)	02-03 (1) 03-05 (2) 05-07 (1) 02-06 (1)†
Australasia	12-16 (1) 16-18 (2) 18-20 (1)	06-07 (1) 07-09 (2) 09-15 (1) 20-23 (1)	03-05 (1) 05-07 (2) 07-09 (1)	04-05 (1) 05-07 (2) 07-08 (1) 05-07 (1)†
North & Central South America	12-16 (1)* 07-08 (1) 08-09 (2) 09-11 (4) 11-13 (2) 13-15 (4) 15-16 (3) 16-18 (2) 18-20 (1)	00-06 (1) 06-07 (2) 07-10 (3) 10-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-00 (2)	18-19 (1) 19-20 (2) 20-03 (3) 03-05 (2) 05-07 (1)	19-21 (1) 21-02 (2) 02-06 (1) 00-04 (1)†
Southern Brazil, Argentina, Chile & Uruguay	12-15 (1)* 07-09 (1) 09-11 (2) 11-13 (1) 13-15 (2) 15-17 (3) 17-19 (1)	06-07 (1) 07-10 (2) 10-14 (1) 14-16 (2) 16-18 (3) 18-20 (4) 20-22 (2) 22-03 (1)	19-21 (1) 21-03 (2) 03-07 (1)	21-06 (1) 01-04 (1)†
McMurdo Sound, Antarctica	15-17 (1)	16-18 (1) 18-20 (2) 20-23 (1) 06-07(1) 07-09 (2) 09-11 (1)	23-05 (1)	*Nil*

*Predicted 10 meter openings, all others in column are 15 meter openings.

†Predicted 160 meter openings, all others in column are 80 meter openings.

Time Zones: CST and MST (24-hour Time

Central USA To:

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Western & Central Europe & North Africa	08-08 (1) 08-09 (1) 09-12 (2) 12-14 (1)	06-08 (1) 08-12 (2) 12-14 (3) 14-15 (2) 15-17 (1)	16-19 (1) 19-22 (2) 22-02 (1)	18-20 (1) 20-22 (2) 22-00 (1) 20-00 (1)†
Northern Europe & European USSR	08-12 (1)	07-08 (1) 08-10 (2) 10-13 (1)	19-01 (1)	20-23 (1)
Eastern Mediterranean	09-12 (1)	07-11 (1) 11-13 (2) 13-15 (1)	19-23 (1)	20-22 (1)
East & West Africa	08-10 (1) 10-12 (2) 12-15 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-13 (2) 13-15 (3) 15-17 (2) 17-18 (1)	18-19 (1) 19-21 (2) 21-00 (1)	19-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)†
Central & South Africa	11-13 (1)* 08-10 (1) 10-12 (2) 12-14 (3) 14-15 (2) 15-18 (1)	07-14 (1) 14-15 (2) 15-16 (3) 16-17 (2) 17-20 (1)	18-20 (1) 20-22 (2) 22-00 (1)	19-22 (1) 19-21 (1)†
Central Asia	*Nil*	06-07 (1) 07-09 (2) 09-11 (1) 19-21 (1)	06-08 (1) 19-21 (1)	*Nil*
Southeast Asia	10-14 (1) 17-20 (1)	06-07 (1) 07-09 (2) 09-12 (1) 19-21 (1)	06-08 (1) 17-19 (1)	*Nil*
Far East	16-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-20 (2) 20-22 (1)	02-09 (1)	05-07 (1)
Pacific Islands & New Zealand	14-17 (1)* 12-16 (1) 16-18 (2) 18-21 (1)	18-19 (2) 19-21 (3) 21-00 (2) 00-06 (1) 06-09 (2) 09-18 (1)	22-01 (1) 01-06 (3) 06-07 (2) 07-09 (1)	00-03 (1) 03-06 (2) 06-07 (1) 03-07 (1)†
Australasia	12-16 (1) 16-18 (2) 18-20 (1)	06-07 (1) 07-09 (2) 09-14 (1) 17-19 (1) 19-21 (2) 21-23 (1)	02-04 (1) 04-07 (2) 07-09 (1)	04-05 (1) 05-07 (2) 07-08 (1) 05-07 (1)†
North & Central South America	11-15 (1)* 07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-15 (4) 15-17 (2) 17-19 (1)	00-06 (1) 06-07 (2) 07-09 (3) 09-14 (2) 14-16 (3) 16-18 (4) 18-20 (3) 20-00 (2)	18-19 (1) 19-20 (2) 20-02 (3) 02-04 (2) 04-06 (1)	20-21 (1) 21-02 (2) 02-06 (1) 00-03 (1)†
Southern Brazil, Argentina, Chile & Uruguay	12-14 (1)* 07-08 (1) 08-10 (2) 10-12 (1) 12-13 (2) 13-16 (3) 16-17 (2) 17-19 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-17 (3) 17-19 (4) 19-21 (2) 21-02 (1)	19-21 (1) 21-03 (2) 03-06 (1)	21-05 (1) 01-04 (1)†
McMurdo Sound, Antarctica	15-17 (1)	16-18 (1) 18-20 (2) 20-00 (1) 06-07 (1) 07-09 (2) 09-11 (1)	00-07 (1)	*Nil*

[*Continued on page 99*]

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

January	**30-31**	**CQ WW 160 DX**
January	30-31	REF C.W.
February	5-7	QCWA Party
February	13-14	ARRL DX Phone
February	20-22	Vermont QSO Party
February	20-21	RSGB BERU
February	21-22	Sask. QSO Party
February	20-22	YL/OM Phone
February	27-28	ARRL DX C.W.
February	27-28	REF Phone
March	6-8	YL/OM C.W.
March	13-14	ARRL DX Phone
March	20-21	YL Int. SSB
March	23	Pakistan DX
March	27-28	ARRL DX C.W.
April	**10-11**	**CQ WW DX SSB**
April	10-11	SP DX C.W.
April	24-25	PACC C.W./Phone

CQ WW 160

Starts: 9 P.M. EST Friday, January 29
Ends: 9 A.M. EST Sunday, January 31

A reminder, mailing deadline for your log is February 28th and they go to: *CQ*, Att: 160 Contest, 14 Vanderventer Ave., Port Washington, L.I. N.Y. 11050.

R. E. F.

C.W.—Jan. 30-31. **Phone**—Feb. 27-28.
Starts: 1400 GMT Saturday, Ends: 2100 GMT Sunday in each instance.

This year's contest is in celebration of the 40th anniversary of the REF, with a special award for the occasion.

Complete rules in last month's CALENDAR.

Contest logs go to: The R.E.F., BP 42-01, Paris R.P., France

QCWA Party

Starts: 2200 GMT Friday, February 5
5 P.M. EST Friday, February 5
Ends: 2200 GMT Sunday, February 7
5 P.M. EST Sunday, February 7

This year's party is sponsored by the Northwest Chapter of the QCWA. The activity will be found on these frequencies: ± 5 kc.

C.W.—3540, 3655, 3790, 7005, 7030, 7100, 14100, 21110, 28110.
A.M.—3810, 3950, 7230, 14240, 21340, 28900.
SSB/LSB—3804, 3999, 7204, 7299.
SSB/USB—14300, 21410, 21440, 28690.
RTTY—7105, 21140.

Other information will be found in last month's CALENDAR.

*14 Sherwood Road, Stamford, Conn. 06905.

Results of the 1964 PACC Contest

United States		Canada	
W1WY	270	VE2IL	3
WA1ANR	198	VE3BWY	90
W1CKA	150		
W3ADO	399	Netherlands Top Five	
K4IEX	36	PAØLV	46,648
W4HOS	3	PAØPN	42,120
W4RLS	3	PAØLOU	29,158
W7DJU	12	PAØVDV	26,988
K8NMG	12	PAØVB	19,932

Mail your logs as soon after the Party as possible to: Dr. F. Clifford J. Spike, W7OS, 1015 Medical Arts Bldg., Tacoma, Washington. 98402

ARRL DX

Phone—February 13-14 and March 13-14
C.W.—February 27-28 and March 27-28
Starts: 0000 GMT Saturday. Ends: 2400 GMT Sunday in each instance.

A brief summary of the rules appeared in last month's CALENDAR. If you require more detailed information you will find it in the January issue of *QST*.

Your entry must be postmarked no later than April 24th to be eligible, and they go to: ARRL DX Competition, 225 Main Street, Newington, Conn. 06111.

Vermont QSO Party

Starts: 2300 GMT Saturday, February 20
Ends: 0300 GMT Monday, February 22

All amateurs are invited to participate in the Vermont QSO Party sponsored by the Central Vermont Amateur Radio Club. Here's an op-

DL9EN receives the CQ Club Plaque for the Deutches DX Team from DL9VL.

Claimed Scores

1964 CQ World Wide DX C.W. Contest

Single Operator

All Band

9M4LX	494,910
WA4NGO	402,462
W8JIN	401,579
KR6BQ	384,385
6O6BW	323,188
9Q5AB	276,000
W9IOP	245,752
W4BVV	222,480
VE2NV	215,912
K1HVV	214,920

21 mc

G3HCT	35,773
W1BIH	32,088
W2WZ	24,258
I1WSG	23,161
W6BSY	21,828
W5KC	19,789

14 mc

W4KFC	266,631
W1BPW	186,333
W3AFM	125,498
VK2APK	116,982
W8VSK	110,814

7 mc

PY4AP	81,673
W6EPZ	50,224
YV5BTK	32,207
I1BAY	29,640
W9YYG	22,876

3.5 mc

VE3AU	13,908
ZC4TX	7,588

1.8 mc

VE2UQ	2,626
W2EQS	423

Multi-Operator

Single Transmitter

W8SH	279,624
OH3AH	165,236
W3/YE	127,834

Multi-Transmitter

W3MSK	1,508,654
W6VSS	1,363,980
W4KXV	1,040,348

portunity to compete for certificates and also earn credits in the USA-CA program and the difficult "Worked Vermont" certificate.

Rules: (1) There is no time limit or power restrictions. (2) The same station can be worked on different bands for contact credit.

Exchange: Vermont stations will send QSO number, RS/RST report and county. All others; QSO number, RS/RST report and ARRL section. (Foreign stations will be identified by their call.)

Scoring: Vermont stations, 1 point per contact, multiplied by the total number of ARRL sections and foreign countries worked. All others; 3 points for each Vermont station, multiplied by the number of Vermont counties worked. (14 available.)

Awards: (a) Certificates to the highest scoring station in each ARRL section and each foreign country. (b) A Trophy to the highest scoring station outside Vermont. (c) A smaller Trophy to the highest scoring Vermont station. (d) 2nd, 3rd & 4th place gold-trimmed certificates to Vermont stations. (e) Special certificates to multi-operator groups. (f) The "Worked Vermont" certificate may be gained by working 13 out of the 14 Vermont counties.

Frequencies: 3520, 3855, 7030, 7250, 14040, 14250, 21050, 21300, 28100, 28600, 50250, 50360, 144 thru 144.5, 145.8 and Novice bands.

Logs postmarked no later than March 31st go to: CVARC, c/o Ann L. Chandler, W1OAK, RFD 2, Barre, Vermont.

The W6YY Trophy is shown here being presented by DL9VL to DL1JW (left) and DL1KB, winners of the Multi-Operator, Single Transmitter section of the 1963 CQ W.W. DX Phone Contest.

RSGB BERU

Starts: 0001 GMT Saturday, February 20
Ends: 2359 GMT Sunday, February 21

This announcement is primarily for the benefit of our Canadian and Caribbean friends since the contest is only open to amateurs licensed to operate within the British Commonwealth and British Mandated Territories.

You will hear a lot of real juicy prefixes in this one but you are flirting with the "black list" if you attempt to work any of them and you are not eligible. *(Remember 1776?)*

I am sure those interested are familiar with the rules but we have a few copies available for distribution.

Mailing deadline for your entries is March 15th and should be sent to: The R.S.G.B. Contest Committee, 28 Little Russell Street, London, W.C.1, England.

Saskatchewan QSO Party

Starts: 0001 GMT Sunday, February 21
Ends: 0001 GMT Monday, February 22

The Regina Amateur Radio Association announces the first Saskatchewan QSO Party open to all amateurs.

Rules: There is no time limit or power restrictions. The same station can be worked once on each band. Phone (s.s.b. or a.m.) and c.w. will be considered separate contests

Exchange: VE5 stations will send QSO number, RS/RST and QTH. Outside stations, QSO number, RS/RST and ARRL Section.

Scoring: VE5 stations, 1 point per outside contact and multiply by the number of ARRL Sections worked. Outside stations 3 points per VE5 contact and multiply by number of VE5 QTHs.

Awards: Certificates will be awarded to the top scoring station from each ARRL Section and to the top five VE5 stations.

Frequencies: 3550, 3850, 7050, 7250, 14050, 14250, 21050, 21300, 28050 and 28550 kc.

Your logs go to: RARA Secretary, 2328 Grant Road, Regina, Sask., Canada. Closing date is March 15, 1965.

YL/OM Party

Phone—Feb. 20-22. C.W.—Mar. 6-8.
Starts: 1800 GMT Saturday. Ends: 0500 GMT Monday in each instance.

[*Continued on page 99*]

the USA-CA PROGRAM

BY ED HOPPER,* W2GT

As this column was being prepared, an application was received from that young man, Cliff Corne, K9EAB, for USA-CA 3000 mixed, with endorsements for USA-CA-1500 All 7 mc and USA-CA-2000 All s.s.b. As you probably remember, Cliff was also No. 1 for USA-CA-2500, No. 1 for USA-CA-2000, No. 1 for USA-CA-1500 and No. 6 for USA-CA-1000.

Statistics

USA-CA awards have been issued to 28 different countries in all continents except Asia. The 439 USA-CA-500 awards have been issued as follows: 65 to DX stations (including 3-KH6, 1-KL7, 1-KP4, 1-KZ5 and 12-VE stations); 7 have gone to SWLs; 32 to K1/W1; 35 to K2/W2; 19 to K3/W3; 49 to K4/W4; 38 to K5/W5; 36 to K6/W6; 18 to K7/W7; 52 to K8/W8; 49 to K9/W9 and 39 to KØ/WØ. Of the 56 USA-CA-1000 awards issued, all went to U. S. stations except for #12 going to VE3BKL and #41 going to VE2-9301. All 21 USA-CA-1500 awards went to U. S. stations as well as the 7 USA-CA-2000 and the 3 USA-CA-2500 awards. So if you want to earn any USA-CA award, don't move to Asia but go to the 8th district.

Letters

Charles Emary, G5GH/ex VS6AX-ZC4XA, wrote that although he has been fortunate in getting 250 awards with just two dipoles and all c.w., he was unlucky in that all his logs and cards up to 1952 were destroyed by accident. This meant that some 3000 W cards among others for the period 1933 to 1936 and 1949/50 as VS6AX were lost. He would like to qualify for USA-CA and it would help greatly if any U. S. station would send him a duplicate QSL for the above mentioned periods via the bureau to VS6AX via G5GH.

Short Wave Magazine (G6FO) is sorry for any inconvenience or misunderstanding regarding their certificates and awards. For details see *Short Wave Magazine*, as they are issued, to readers only, as explained in their January 1965 issue.

Tommy, G6QB, a regular reader of *CQ*, writes all about his wonderful trip to California where he enjoyed visits to W6EBG, W6AM, W6YY and others as well as several wonderful radio clubs. His only regret is that time did not permit meeting and seeing more.

Thanks to the many others who have written to extend their well wishes, including W1FPS, W1HHR, WA2MIT, WA2PVB, W3BQA, W3-IMN, K5SGJ, K5SGK, K8CIR, K8YGU, WA9-AJF, K9EAB, G2MI and so many others and thanks for the many suggestions. A very nice note from WB2LZF/W9OIJ in which he mentioned that he realized the terrific amount of work involved in handling USA-CA but it is richly repaid by the many new friends gained in the ham fraternity. Also thanks for the many invitations to join-in the many nets, unfortunately my operating time has been extremely limited these past few months.

Awards

Regarding the W-VT (Worked all Vermont) —This is a real challenge as only 145 have been issued since this award first became available in 1954. To aid those working for this award it is suggested they watch 3520 kc at 2400Z; 3855 kc daily at 2230Z, Sunday at 1400Z.

The All Alaska Counties Award (Judicial Divisions) sponsored by the Wildwood Amateur Radio Club (Formerly Wildwood STATION ARC) is now administered by A. L. Hershberger, KL7EAN, Box 280, Soldatna, Alaska. As the borough system of government is slowly shaping up in Alaska, it is assumed the award rules will undergoe some changes in the future.

The Worked All Connecticut Award sponsored by the "Willimantic Jaycees" of Willimantic, Connecticut, is being revised and will be shown here in the future, per letter from "Sully", W1HHR.

Here is the latest membership list of the B. & O. R.R. Amateur Radio Club which issues a nice award: K2BG, LMS, PEG, WA2KAP, W3ABU, ADK, AHQ, AYV, BVL, CJN, CKA, DBU, FFO, HWU, ILB, JC, JFR, KPS, KWJ, LBC, LQW, LQY, MAH, QOH, VMI, VQE,

USA-CA HONOR ROLL

2500

K9EAB 1
K8CIR 2
WØMCX 3

2000

K4VOF 6
K5SGJ 7

1500

K5SGK 13
K5SGJ 14
W9HAS/K4KWQ 15
W8UPH 16
K8KOM 17
W9CMC 18
WA8EZW 19
W8NAN 20
KØIDV 21

1000

K9AZX 48
W8WUT 49
W8WT 50
WA2PWI 51
K8IWI 52
W9HAS/K4KWQ 53
W5EHY 54
W1FPS 55
K8IQB 56

500

W1HTE/PJ2AE 395
W4SKI 396
WA6RXM 397
WA9AIB 398
TG9SC 399
WA6OET 400
K4GMR 401
W2EBW 402
KH6BIH 403
W6KG (TCR) ... 404
WA4FJF 405
K4BAI (TCR) ... 406
K7NHG (TCR) .. 407
W1VKZ 408
VE3CWE 409
K8BIT 410
K8MQB 411
XE1VT 412
WPE-9-ETT 413
W8SH 414
W1DPJ 415
K1VBR 416
K1LBH 417
WØGNX 418
VE6ABV 419
WA8AJZ 420
K5YWX/Ø 421
SP7HX 422
W4HKJ 423
K1BOM 424
WA2RMP 425
W1WHQ 426
LA6CF 427
K4MSS 428
K9VYL 429
WA2MIT 430
WA2RUB 431
W1DWA 432
W4KA 433
K1TNB 434
KØIOZ 435
VE6AGE 436
W5EMZ 437
WA8EUC 438
K4VGL 439

*103 Whittman St., Rochelle Park, New Jersey.

Michigan Counties Award—MCA

The Six Meter Club of Chicago

Worked All Aardvarks Award

The South Jersey Radio Association

The Baltimore and Ohio R.R. ARC

WN3AWC, WN3BSP, K3ANJ, BHJ, BPE, CHE, CKC, EVM, GZK, HPE, IAG, JDF, JOM, KHG, KJZ, KSS, LJB, LXU/4, MEX, MIU, NYJ, ONU, OXJ, PED, PVW, PZF, QOL, QCI, RPT, RZR, URP, WSQ, ZRZ, W4YYC, K4AVY, AYI, K7VGA, W8AKQ, DXZ, GWR, QLK, RBE, RIN, SCZ, ZCW, WA8BVB, DOY, K8BPK, EEJ, KRU, KZF, PTE, RHF, QYG, TVG, UAA, VAI, ZWM, W9PKQ, YVS, WA9BGE, GWC, IWV, K9FMM, GGO, HEZ, PRJ.

Information of awards from Arkansas, Delaware, Iowa, Maine, Maryland, North Dakota, Oklahoma, Rhode Island, Utah and Wyoming is requested as information on these states has been scarce or nonexistent.

Abbreviations

TCR: Top Class Rule means that for awards that are issued in several and higher classes, one may skip any lower classes and apply for any earned higher class without losing credits or endorsements for lower classes.

MER: Multiple Endorsement Rule means that under TCR rule, at the time any higher class of an award is being processed, the applicant may request all accrued endorsements without extra fees.

One small gremlin sneaked in last month, WA6UHV is active member of SFARC, not 6UHF.

Hope you have all been using the new commemorative U. S. stamps, please use some of them by dropping me a line, and how was your month?

73, Ed, W2GT

Rules

The Six Meter Club of Chicago, Inc. offers three VHF Certificates as follows: For TEN member contacts on 6; TEN member contacts on 2 and FIVE member contacts on 220 MC.

[*Continued on page 95*]

Tri-County ARC Worked Vermont Award W-VT

Worked All State Capitals (WASC) Certificate

The Old Old Timers 50 Year Award

The Old Old Timers Certificate

British Counties Award

SPACE COMMUNICATIONS

BY GEORGE JACOBS,* W3ASK

THE long-awaited launch of the OSCAR III amateur radio communication satellite is near at hand! The satellite has passed all its pre-launch tests with flying colors, and is now waiting for a piggy-back ride into space. While it may not be possible to announce the launch of OSCAR III until it is successfully in orbit, the chances are excellent that the satellite will rocket into space sometime between the date that this column appears in print, and the end of the winter season.

Part 1 of a special two-part article entitled "OSCAR III—An Active Communication Satellite for Radio Amateurs," appeared in the October, 1964 issue of *CQ*. It discussed in detail the design, circuitry and theory of operation of the OSCAR III satellite. Part 2 of this article, dealing with how the satellite can be used for 2 meter communications, and discussing several experiments that can be performed with the various signals emitted from OSCAR III, has been completed since last fall. Its publication has been delayed, however, so that it might appear in print a month or so before the expected launch of the satellite. It appears elsewhere in *this* month's issue of *CQ*.

If you intend to participate in the OSCAR III project as a radio amateur, as an amateur space experimenter, or as a space-listener, be sure to read Part 2 of "OSCAR III—An Active Communication Satellite for Radio Amateurs" . . . but read it soon, since time is of the essence. Lift-off is approaching rapidly, and it may require extensive preparation in order to communicate through the satellite, or conduct space experiments with its signals. Get that equipment ready NOW, and don't miss out on this new adventure for amateur radio.

Transmitting Satellites

As of December 31, 1964, no fewer than 40 satellites were in orbit transmitting radio signals back to earth on 80 different frequencies. Many of the signals in the h.f. band can be heard well on relatively inexpensive short-wave receivers, while v.h.f. signals can often be received with relatively simple frequency converters. Table II contains those frequencies on which space orbiting satellites were transmitting as of December 31, 1964. Many of these satellites are expected to continue to transmit radio signals during 1965.

[*Continued on page 100*]

*11307 Clara Street, Silver Spring, Md. 20902.

Table I—List Of Frequencies To Be Used On American Satellites Expected To Be Launched During 1965

Freq. (Mc)	*Satellite Name and Purpose*	*Remarks*
136.23	NIMBUS B—Advanced Weather Satellite	Telemetry on command
136.5	"	Continuous C.W. and command telemetry
136.95	"	Continuous telemetry
136.23	TIROS 9—Operational Weather Satellite	Continuous C.W. beacon and command telemetry
136.92	"	"
136.275	SERB B—Radiation Belt Research	Continuous telemetry
136.32	S-6A—Atmospheric Structure Research	Telemetry on command
136.56	"	Continuous C.W. beacon
136.71	OSO-B—Orbiting Solar Observatory	Continuous telemetry and beacon
136.26	OAO-A—Orbiting Astronomical Observatory	Telemetry on command
136.44	"	Continuous C.W. beacon
136.08	ALOUETTE-2 USA/CAN Ionospheric Propagation Research	Telemetry on command
136.59	"	"
136.98	"	C.W. beacon on command
136.125	IMP-C—Interplanetary Research	Continuous C.W. beacon and telemetry
136.916	"	Telemetry on command
136.105	IMP-D—Interplanetary Research	Continuous C.W. beacon and telemetry
136.918	"	Telemetry on command
136.53	SAN MARCO USA/ITALY Research Satellite	Telemetry on command
136.74	"	Continuous C.W. beacon and telemetry
136.35	FR-1—USA/FRANCE VLF Radio Propagation Research	Telemetry on command
136.8	"	Continuous C.W. beacon and telemetry
136.40	PEGASUS—Micrometeorite Research	Telemetry on command
136.89	"	C.W. beacon and command telemetry
145.90	OSCAR 3—Amateur Radio Active Communication Satellite	Repeater communication channel (145.875-145.925 mc)
145.85	"	Continuous telemetry
145.95	"	Continuous C.W. beacon

Table II—List Of Frequencies On Which Satellites Can Be Heard (As Of December 31, 1964)

Freq. (Mc)	*Satellite Name and Country*	*Date Launched*	*Inclination* (Degrees)	*Period* (Minutes)	*Remarks*
1.500	EXPLORER 20—USA	25 Aug. 1964	80	104	Ionospheric sounder
2.000	"	"	"	"	"
2.850	"	"	"	"	"
3.720	"	"	"	"	"
5.470	"	"	"	"	"
7.220	"	"	"	"	"
19.430	ELEKTRON 2—USSR	20 Jan. 1964	59	1356	Command telemetry and beacon
19.540	"	"	"	"	"
19.800	COSMOS 40—USSR	18 Aug. 1964	56	92	"
19.895	POLYOT 2—USSR	12 Apr. 1964	58	92	"
20.005	ELEKTRON 1—USSR	30 Jan. 1964	61	169	"
20.005	EXPLORER 22—USA	10 Oct. 1964	80	105	C.W. beacon on command
20.005	COSMOS 31—USSR	6 Jun. 1964	49	89	Command telemetry and beacon
20.034	COSMOS 38—USSR	18 Aug. 1964	56	91	"
20.084	COSMOS 39—USSR	18 Aug. 1964	56	92	"
30.007	COSMOS 31—USSR	6 Jun. 1964	48	89	"
30.008	ELEKTRON 1—USSR	30 Jan. 1964	61	169	"
40.010	EXPLORER 22—USA	10 Oct. 1964	80	105	C.W. beacon on command
41.010	"	"	"	"	"
54.000	1963-49C—USA	5 Dec. 1963	90	107	Command telemetry and beacon
89.102	COSMOS 40—USSR	18 Aug. 1964	56	92	"
90.022	COSMOS 25—USSR	27 Feb. 1964	49	90	"
90.022	COSMOS 31—USSR	6 Jun. 1964	49	89	"
90.023	COSMOS 44—USSR	29 Aug. 1964	65	100	"
90.225	ELEKTRON 2—USSR	30 Jan. 1964	59	1356	"
90.378	COSMOS 39—USSR	18 Aug. 1964	56	92	"
108.012	VANGUARD 1—USA	17 Mar. 1958	34	134	C.W. beacon only when in sunlight
136.020	ECHO 2—USA	21 Jan. 1964	82	109	C.W. beacon & continuous telemetry
136.050	TELSTAR 2—USA	7 May 1963	62	43	C.W. beacon & command telemetry
136.077	ALOUETTE—USA/CAN	29 Sep. 1962	80	106	Telemetry on command
136.080	EXPLORER 23—USA	6 Nov. 1964	52	99	"
136.111	EXPLORER 18—USA	27 Nov. 1963	36	5602	C.W. beacon & command telemetry
136.140	RELAY 1—USA	13 Dec. 1962	48	185	Telemetry on command
136.142	RELAY 2—USA	21 Jan. 1964	46	195	"
136.147	EXPLORER 21—USA	4 Oct. 1964	34	2097	C.W. beacon & command telemetry
136.170	EXPLORER 22—USA	10 Oct. 1964	80	105	C.W. beacon & command telemetry
136.170	ECHO 2—USA	21 Jan. 1964	82	109	"
136.200	OGO 1—USA	5 Sep. 1964	31	3837	C.W. beacon
136.233	TIROS 8—USA	21 Dec. 1963	59	99	C.W. beacon & command telemetry
136.234	TIROS 7—USA	19 Jun. 1963	58	97	"
136.292	EXPLORER 25—USA	21 Nov. 1964	81	116	C.W. beacon
136.326	EXPLORER 20—USA	25 Aug. 1964	80	104	Telemetry on command
136.350	EXPLORER 20—USA	25 Aug. 1964	80	104	Telemetry on command
136.406	ARIEL 1—USA/UK	25 Apr. 1962	54	101	C.W. beacon & command telemetry
136.468	SYNCOM 2—USA	26 Jul. 1963	33	1438	Command telemetry and beacon
136.470	SYNCOM 3—USA	19 Aug. 1964	1	1436	"
136.499	NIMBUS 1—USA	28 Aug. 1964	99	98	C.W. beacon
136.558	ARIEL 2—USA/UK	27 Mar. 1964	52	101	C.W. beacon & command telemetry
136.590	ALOUETTE—USA/CAN	29 Sep. 1962	80	106	Telemetry on command
136.620	RELAY 2—USA	21 Jan. 1964	46	195	Command telemetry and beacon
136.620	RELAY 1—USA	13 Dec. 1962	48	185	"
136.653	1963-38C—USA	28 Sep. 1963	90	107	C.W. beacon & continuous telemetry
136.680	EXPLORER 20—USA	25 Aug. 1964	80	104	C.W. beacon & command telemetry
136.710	EXPLORER 24—USA	21 Nov. 1964	81	116	C.W. beacon
136.771	1964-40C—USA	17 Jul. 1964	37	2366	C.W. beacon
136.803	EGRS—USA	11 Jan. 1964	70	104	C.W. beacon & continuous telemetry
136.857	EXPLORER 23—USA	6 Nov. 1964	52	99	C.W. beacon & command telemetry
136.860	EXPLORER 25—USA	21 Nov. 1964	81	116	Telemetry on command
136.886	SOLAR RADIATION—USA	11 Jan. 1964	70	104	C.W. beacon & continuous telemetry
136.922	TIROS 7—USA	19 Jun. 1963	58	97	C.W. beacon & command telemetry
136.924	TIROS 8—USA	21 Dec. 1963	59	99	"
136.980	SYNCOM 2—USA	26 Jul. 1963	33	1438	Telemetry on command and beacon
136.980	SYNCOM 3—USA	19 Aug. 1964	1	1436	"
150.000	1964-26A—USA	4 Jun. 1964	90	103	Tone modulated C.W.
150.000	1963-22A—USA	11 Jun. 1963	90	100	Command telemetry and beacon
150.000	TRANSIT 4A—USA	29 Jun. 1961	67	104	Tone modulated C.W.
150.000	1963-49B—USA	5 Dec. 1963	90	107	Tone modulated C.W. and telemetry
162.000	EXPLORER 22—USA	10 Oct. 1964	80	105	Command C.W. Doppler transmitter
162.000	ANNA 1B—USA	31 Oct. 1962	50	108	Command tone modulated C.W.
162.000	1963-49C—USA	5 Dec. 1963	90	107	Tone modulated C.W.
324.000	ANNA 1B—USA	31 Oct. 1962	50	108	Command tone modulated C.W.
324.000	1963-49C—USA	5 Dec. 1963	90	107	Tone modulated C.W.
324.000	EXPLORER 22—USA	10 Oct. 1964	80	105	Command C.W. Doppler transmitter
360.090	EXPLORER 22—USA	"	"	"	Command C.W.
400.000	TRANSIT 4A—USA	29 Jun. 1961	67	104	Tone modulated C.W.
400.000	1963-22A—USA	16 Jun. 1963	90	100	Command telemetry and beacon
400.000	1963-49B—USA	5 Dec. 1963	90	107	Tone modulated C.W. and telemetry
400.000	1964-26A—USA	4 Jun. 1964	90	103	Tone modulated C.W.
400.250	OGO 1—USA	5 Sep. 1964	31	3837	Telemetry and beacon on command
400.850	OGO 1—USA	"	"	"	"

RTTY

BYRON H. KRETZMAN,* W2JTP

RTTY Operating Frequencies

Nets centered on frequencies given; operation usually ± 10 kc on h.f.

80 meters	3620 kc
40 meters	7040 kc
40 meters ... (narrow shift) ..	7140 kc
20 meters	14,090 kc
15 meters	21,090 kc
6 meters	52.60 mc
2 meters	146.70 mc

AUTOSTART, one of the more useful forms of radioteletype, was discussed briefly in last month's RTTY Column. As we said, it doesn't *have* to be complicated. Simple autostart operation, practical when only a few stations are involved, can be achieved by continuously monitoring the channel (52.60 or 146.70) and by having any RTTY station start your machine motor by sending a steady *mark* tone (2125 cycles) for about 5 to 10 seconds.

The autostart unit, the device that senses the steady *mark*, usually is associated with the receiving converter or terminal unit (TU). Naturally, there can be as many different kinds of autostart units as there are TU's. And, many times there just isn't room enough in an already-operating TU to add the components required to have this feature. One solution is to build an autostart unit which is completely independent from the TU.

Autostart, Part II

An autostart unit, to be independent from the TU, should operate from the audio output of the receiver. To prevent false starting of the machine motor such an autostart unit should not respond to voice or any other tones that might appear on the channel. In other words, it should respond *only* to 2125 cycles. Other design considerations should be simplicity, compactness, and low power consumption while monitoring.

Figure-1 is the schematic of the autostart unit of W2JTP. This unit satisfies all of the design considerations mentioned above. A two-section filter tuned to 2125 cycles provides the selectivity necessary. No limiting is provided, purposely, to prevent response from sub-multiples, such as 1062.5, 708.3, etc. Only two *pnp* transistors are used. Q_1 is connected as an emitter-follower so that a high impedance is presented to the *RC* network that determines the time constant for a delay of about 4 to 5 seconds to prevent response from random signals. Q_2 is a transistor switch, to control the current through the relay *RY*, an inexpensive high resistance "sensitive" relay. Power for the autostart unit, just a few milliamperes, is taken from any convient 6.3 volt a.c. source. A simple voltage doubling rectifier provides about 15 volts d.c. for Q_2 and about 7 volts for Q_1.

Parts

Inductors L_1 and L_2 are the familiar 88 mhy telephone loading coils. A little over one foot of wire was removed to resonate each (separately) to 2125 with the 0.068 mf capacitors used. (See Chapter 7.3 in the *New RTTY Handbook*, page 163.) Less wire would have to be removed if two 0.033 mf capacitors were connected in parallel. The type of diodes used is not critical. 1N34A, 1N64, and even computer-surplus diodes were all found satisfactory. The miniature tantalum capacitors used in the *RC* and in the d.c. filter were also computer-surplus. While 1N537 silicon diodes were used in the power supply voltage doubler circuit almost any silicon diode rectifier with more than a 50 volt p.i.v. can be used.

The relay is an imported "Argonne" AR-21, a 5000-ohm item available from Lafayette Radio, Syosset, N.Y. (F-260) Careful adjustment was needed to get the relay to operate. It is recommended that a *Sigma* 4F or a *Potter and*

*431 Woodbury Road, Huntington, N. Y. 11743

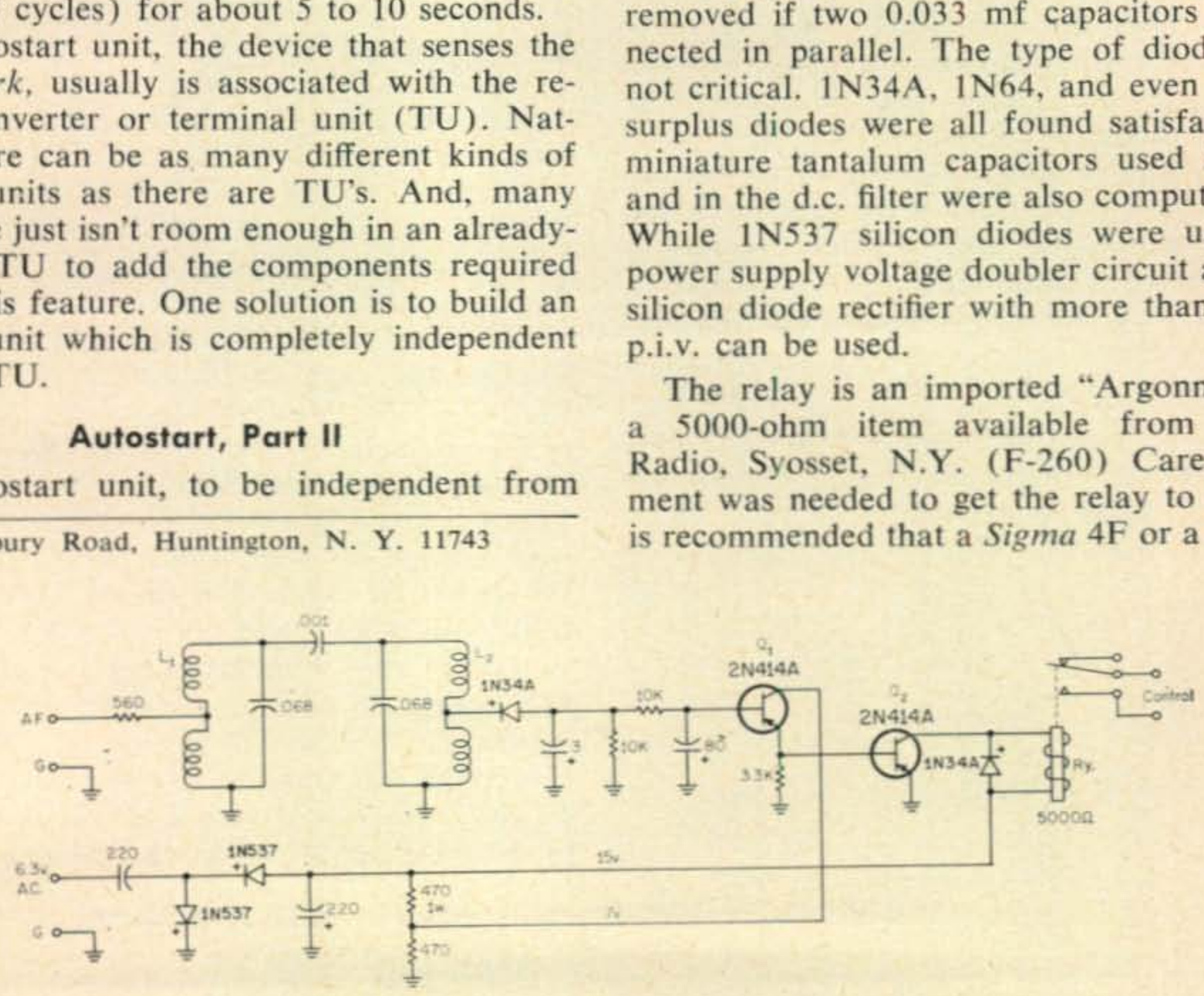


Fig. 1—Schematic Diagram of W2JTP Autostart Unit. The horizontal 10K resistor is R, and the 80 mfd capacitor is C. The voltages 15 and 7 are negative.

Brumfield RS5D of 2,500-ohms coil resistance be used instead.

Construction

The autostart unit is built on perforated unclad circuit board available from Lafayette (MS-916), using their flea clips (MS-263) as terminals. The board is mounted on two ½-inch pillars inside a *Bud* mini-box 5¼" long, 3" wide and 2½" high (CU-3006A). This box, with an identical box to house the Relay Unit, is mounted on a 3½" rack panel at W2JTP. Since the circuit board is vertical with the box thusly mounted, the relay was mounted on the board on a small angle bracket so that it would be right-side-up. Transistor sockets were used rather than wiring-in the transistors. We therefore were able to try several different types of transistors.

Connections

Audio connection may be made to either a voice-coil circuit or to a 500-ohm line. If a speaker is used on either of these circuits it is suggested that a dummy load resistor be switched in when *only* machine monitoring is desired. The minimum input level to the autostart unit is 0.6 volts r.m.s. Power is taken from the 6.3 volt a.c. heater circuit of the monitor receiver.

Naturally the little contacts on the sensitive relay in the autostart unit cannot be used to directly switch on and off the relatively heavy load of the machine motor. Therefore, for simple control of the machine motor from any RTTY signal on the channel, the contacts on the sensitive relay are used to operate a heavier 115-volt a.c. relay such as the *P & B* Type MR-5-115v. which has 5 ampere contacts. Figure 2 shows the simple hook-up. DO NOT LEAVE OUT THE FUSES! Note that the a.c. plug, and the receptacle for the motor, are polarized (the ground-side blade is wider) so that the ground side of the line is always connected to the unfused side of the a.c. circuit. Be sure, *too*, that the power supply for the monitor receiver is separately fused. Continuous monitoring is completely safe; *if* you fuse everything intelligently.

On the Bauds

W2CKX of Westville, N.J., now has a Model 26. W2BVE of Maywood, N.J., has for sale some I-193 polar relay test sets for $19.95. W2NRY of Briercliff Manor, N.Y., works 80

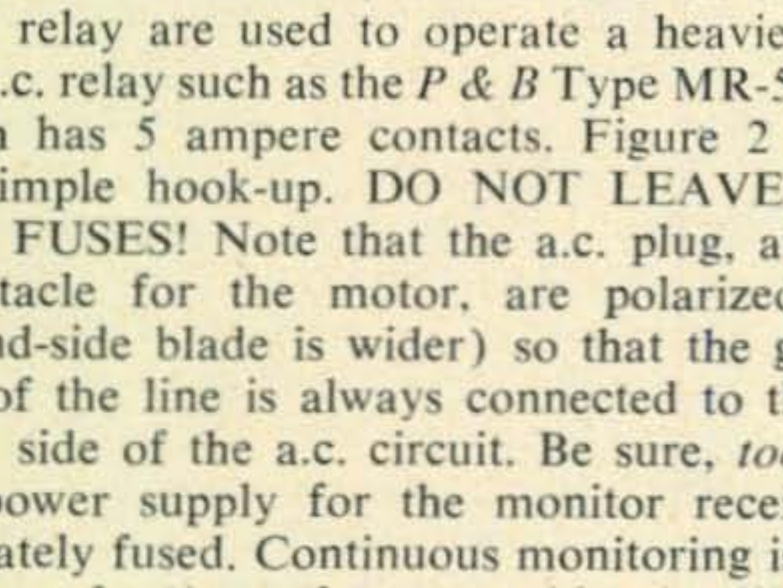
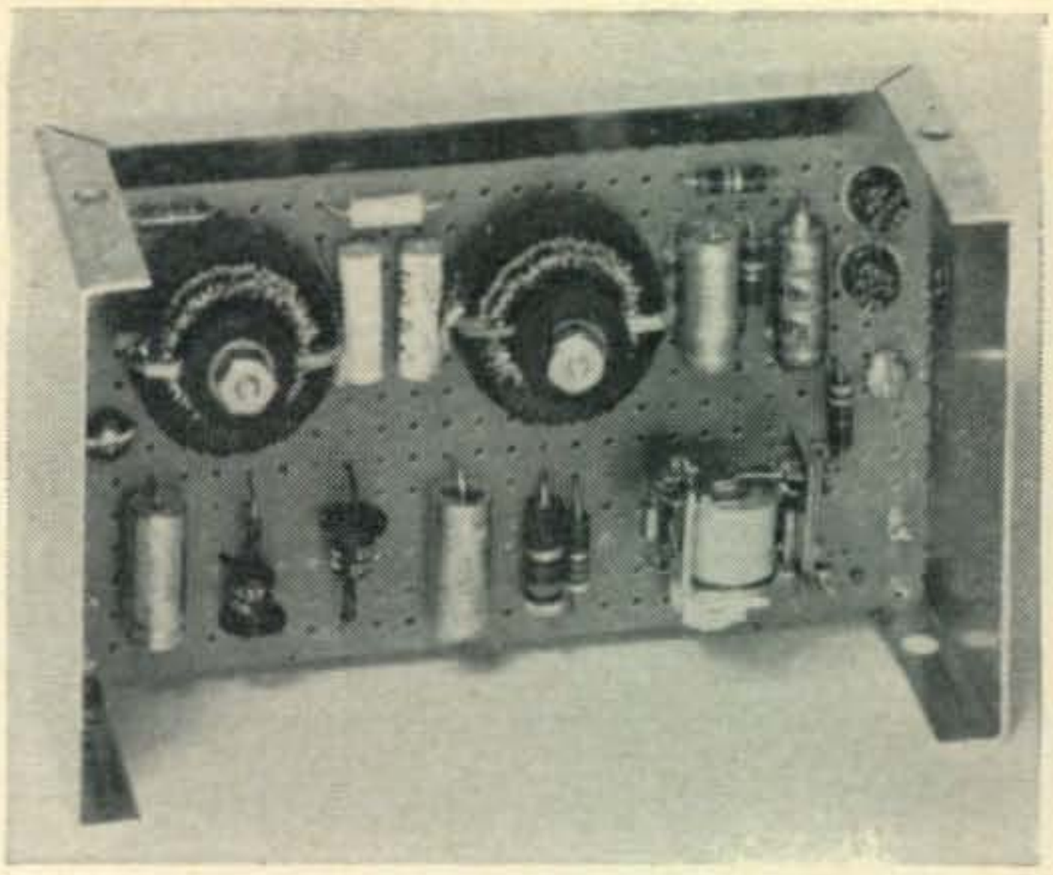


Fig. 2—Simple Hook-up for Continuous Monitoring.



Transistorized Autostart Unit of W2JTP

with tape. K2AMI of Lewiston, N.Y., is on 80 with W2FAN of Lockport, N.Y., and K2SQL of Niagara Falls, N.Y.

K3YAH, near Harrisburg, Pa., is on 80 as is W3VYY of Bryn Mawr, Pa., and W3UQS of Edgewater, Maryland. W4EAW of College Park, Ga., is going a.f.s.k. and magnetic tape for local loop purposes. W4AIS of Taylors, S.C., has a pair of CV-89's (AN/URA-8A) for sale or trade. K1VJC was heard /4 from the USS Raleigh in port at Norfolk, Va.

W5SYN of Silsbee, Texas, is looking for a "transistorized *(mark)* hold circuit." *(Look no further, Jess: try the W2JTP transistorized autostart unit, using the back contact of the control relay.)* WB6DBD (ex-W7LVR) is now an RTTY—OBS, sending bulletins on 14,098 kc at 2300Z on Tuesdays, Thursdays, and Saturdays. Al uses a 30S-1 linear with his 32S-1 for this. K6ROR works 20.

W8IXZ of Akron, Ohio, is building a W2JAV transistorized a.f.s.k. oscillator for his G-76 on 6 and his ARC-3 on 2 meters. (His W2JAV TU was built in 1958 and is still going strong.) W8MAC of Dearborn, Mich., uses a Viking II and a vertical antenna on 40. W8FWG of Laurium, Mich., works 20.

W9DPY, old timer RTTYer of Lombard, Illinois, uses tape on 20. K9ZDO of Zanesville, Ind., is on 80. New officers of the Illiana Teleprinter Society are: W9HXW President, W9CAV Vice President, Ozzie Smith Secretary-Treasurer, and WA9BBC Sergeant-at-Arms. Active stations on 146.70 are: W9CAV, K9HSL, W9HXW, WA9BBC, K9BHM, W9HYI, W9UFK, W9KRJ, K9FNP, K9CEK, K9TYH, W9QVQ, and W9YVP. KØAQO of Freeman, Mo., works 40 without polar relays. WØHFX is on 20.

VO1DZ of Gander, Newfoundland, uses a TT-4G with his Mohawk. ZS6BCT was heard loud and clear on 20 at W2JTP.

W1AW Bulletins

Apparently there are some amateurs who believe that the sending of official ARRL bul-

[*Continued on page 100*]

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THE VHF COLUMN

BY BOB BROWN, K2ZSQ
and ALLEN KATZ, K2UYH*

IT'S amazing how much time we devote each month just answering letters from v.h.f. men asking our opinion on what is the best rig to build or buy. One came in just yesterday, for example, from a new Technician in Texas who wanted to know, listed here in order of their importance to him: 1.) What v.h.f. band is the most active in his area? 2.) What part of that band is the most popular? 3.) What polarization should be used? 4.) Exactly what model commercially-built antenna should he buy (must be under $31)? 5.) What rotator should he buy and how much is a "good price" on it. 6.) What type of coax should he buy? 7.) What is the best rig for this frequency? 8.) How much should he expect to pay for it? . . . etc., etc., etc.

Well, in an attempt to shorten a rather lengthy story, the letter of queries was 3½ pages long, with the balance of questions in much the same vein as those above. Yes, we answered the letter, though grudgingly. The percentage of our correspondence that winds up in our "Best Rig" file is staggering. Perhaps appalling would be a better word.

Since the early 1950's when the Technician license was effected, operators on the bands above 50 mc have been under almost continual fire from other amateurs. Such terms as "mail-order hams," the "video rangers" and more recently the "CB crew" have become familiar to all inhabitants of six and two meters. Time and time again we have stressed in this column and in other endeavors that this labeling is unjust. And after investigation we find too that those who do the name-calling have seldom if ever even listened in on anything above 10 meters. But this is not the point.

Another item we have restrained ourselves from commenting on was incentive licensing, something that has been discussed, argued about and rehashed so much that a good deal of its meaning and purpose became lost in the shuffle. But we are ready to say something now. For what it is worth, we are beginning to understand why many feel that the U.S. amateur should be "up-graded" technically.

Another word about this column, also, while we're at it. We have tried to maintain on these pages every month a degree of reporting and education which we feel is necessary to keep this column on a par with the true amateur v.h.f. purpose and spirit. By not particularly catering to one group or another, but rather establishing our own point of view, we feel we have reason for existing as a section in *CQ*.

We are fully aware that if we downgraded the column to a "who's on what band"—"walkie-talkie" level that we would be perhaps more warmly received. But, at least in these writers' opinion, the apparently dwindling number of dyed-in-the-wool enthusiasts want more than that. We feel justified in holding the calibre where it is, regardless of side effects. True, these statements may seem dramatic and a bit one-sided, but I think that we are in a fairly good position to observe v.h.f. doings the world over. And what we see isn't always rosy. It would be foolish to deny the fact that the "video rangers" exist. They do. And their numbers are growing.

So why this sudden editorial furor over a situation that has existed for many years? Simply this: Although you seldom see much opinionated crusading in this column, your conductors certainly do have certain deep-rooted beliefs regarding the state of the art, or hobby, as it were. We prefer to stay out of such arguments, keeping these personal feelings out of our column and correspondence. But over the past year or so the percentage of "Best Rig" letters has grown to a point where it is becoming harder and harder to honestly answer them without offending. Last month we received a request to devote an entire column to commercial six meter low-power transceivers, rating them in performance and capability. We referred this boy to *Popular Electronics*.

If you feel we have the wrong slant altogether, drop the editor a line. If, on the other hand, you agree with the established purpose of this column, how about taking the time to tell us about yourself, and what you have been experimenting with? We are still extremely interested in publishing new circuits, information on novel v.h.f. techniques, and the latest news on behind-the-

Shot in the midst of the June contest, our VHF camera caught K2KJI/2 redhanded. Note conspirator WB2KPD in background stealthily cutting the coax while K2KJI calls CQ. Portable location is near Wurtzboro, New Jersey.

*c/o Allen Katz, Electrical Engineering Dept., Murray Hall, Rutgers University, New Brunswick, New Jersey.

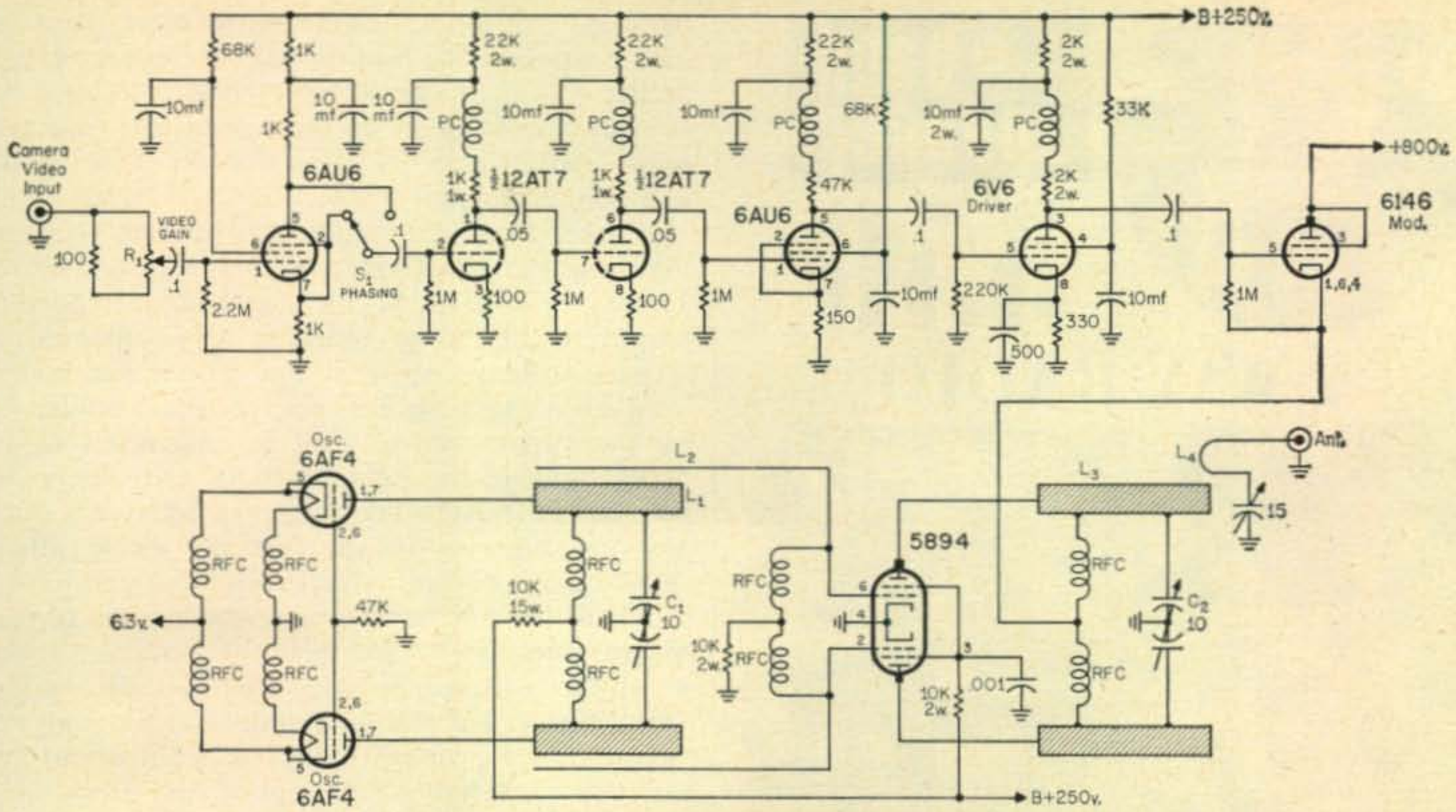

Fig. 1—Low cost, easy to build video transmitter for 440 mc band. Designed to put delinquent closed circuit systems on the air.

C_1, C_2—10 mmf Butterfly Variable Capacitor.
L_1—3½" of number 12 wire mounted on Butterfly Capacitor.
L_2—5" of number 12 wire.
L_3—3½" by ½" copper straps mounted on Butterfly Capacitor.
RFC's—16 turns of number 18 wire, 3/16" in diameter.
PC—peaking coil from old TV set.

scenes attempts at getting the ultimate out of what the frequencies above 50 mc have to offer. We are not trying to divide v.h.f. men into groups; we are merely trying to uphold a reason for being. As a closing line to this confession, let us not forget the line that the F.C.C. wrote years ago to explain the amateur radio operator: "*Amateur radio exists because of the service it renders.*" The same goes for this column.

TV Transmitters

Closed-circuit amateur television systems have been sprouting up all over. However, the jump from closed-circuit experiments to on-the-air operation has been slow and in some cases imperceivable. One of the reasons for this poor progress is the lack of information on transmitting gear applicable to TV operation. The transmitter shown in fig. 1 was designed for the express purpose of getting the closed-circuit TV fugitive on the air. It can be reproduced for less than the price of the surplus ART-26 TV transmitter, yet compares favorably in operation. For simplicity the circuit employs a self-excited oscillator on the 440 mc band. This type of excitation is not a bad compromise when it is realized that a TV signal is over 6 mc wide! No problems of stability have been found during on-the-air operation. However, care should be taken in determining the frequency of operation. If no other means are available, lecher wire or a slotted line may be used to determine transmitter frequency. Special notice should also be paid to the coupling between the oscillator and the 5894 amplifier. Place a 10 ma. meter in series with 10K grid resistor and adjust the spacing between the grid wires and oscillator plate lines for maximum grid current. At least 3 ma. of grid current is needed to drive the amplifier; if this value is not obtained, try pruning the grid wires. The rest of the circuit is straight-forward.

Plate modulation is achieved by varing the drop across a 6146. A plate voltage somewhat higher than normal is desired to compensate for the drop in the 6146. We use 800 volts, although the amplifier will work quite well with only 400 of plate voltage. The video amplifier has a phase inverter stage which enables the transmitter to be used with any camera and still produce a proper composition video signal. The transmitter is designed for coaxial output, but may be easily modified for balance output as shown in schematic.

Moving Forward

Do you realize that the present era will probably be the most exciting in all the history of radio? Radio amateurs have always enjoyed recalling the past: the first transcontinental contact, the bridging of the Atlantic, etc. Yet the events of today rate equally with these historic moments. Twenty years ago who would have dreamed of transoceanic QSO's on 144 mc or even 1296 mc? Now they are realities. However, we have still only scratched the surface.

No one has really put under-the-noise-detection principles into practice. There has been talk, even hints of such techniques being used on W6DNG—OH1NL QSO. Though from the little we have heard (and we do mean *little*)

these efforts amounted to little more than a modification of the Squires-Sanders variety noise limiter to cut out noise bursts and thereby provide a kind of "edge" on the cosmic and receiver noise upon which to listen for the very weak moonbounce signals.

Neither has the amateur (or anyone else for that matter) used the optimum in antennas. Thanks to W1FZJ, K2TKN and others, the potential of the large reflector type antenna is starting to be recognized. Yet no one has really tried to increase the efficiency of these reflectors by the various novel feed arrangements as is being done in the field of radio astronomy. It sure would make a big difference to have a dish working close to 100 percent efficiency rather than the 55 percent as generally accepted.

As for propagation, here is where some of the biggest questions lie unanswered: Sporadic-E on six meters, ionospheric scatter on all bands (How far can a station bulldoze his signals?), Moonbounce propagation (The California-Finland contact has just supplied questions—no answers), Aurora (Hams have been hypothesizing about a North Atlantic path to Europe for years, but no one has really given the path a try. And how about aurora on the u.h.f. frequencies? It does exist there!).

It has been said by the learned that the total evolution of radio will take less than a hundred years. Amateur radio is now well into the second half of that century. Now is the time to act. It takes no more effort or imagination to undertake a worthwhile project today than it did our fellow hams of fifty years ago.

From the Mailbag

Al, K7VQI, on Amateur Television: "Amateur TV activity is still increasing here in Tucson area, and we now have what we believe to be a first in ATV. John Molly, WA7BBM, assisted by Fred, K7KHN, today was able to send Ham-TV pictures from both a portable position using emergency power and from his car *in motion* to both Bob, K7KYQ and to myself. Equipment was all home brew using a live vidicon camera. Pictures were of call signs and of K7KHN who manned the mike. While the car was in motion, pictures were taken of landscape, trees and cars. They were not quite as good as the portable ones, but this is understandable. About half an hour of portable operation and 15 minutes in motion were spent for this experiment. Three-way voice communication was used on 2 meters during the entire test. John deserves credit for his work and persistency." *Quite a feat, though we do believe several groups have already tried it. What really would be a first would be a mobile-to-mobile TV QSO. Besides the fun projects, Al and John have been spreading the gospel of amateur TV by giving demonstrations for local radio clubs—most recently at the Old Pueblo Radio Club of Tucson, Arizona.*

Marv Moss, W4UXJ on "Linear Varactor Multipliers": "The name 'linear frequency multipliers' as suggested in the correspondence section of the November 1964 column for the varactor tripler is incorrect. Actually multiplying does not take place! A better name would be linear frequency mixer. The F_1 input is generally used to create harmonics $2F_1$ and $3F_1$, however note that a $2F_1$ tuned circuit is necessary for proper operation of the tripler. The output is tuned to $3F_1$ but it is a mixing of F_1 and $2F_1$ which yields the $3F_1$ output. Please remember that when mixing takes place, all sideband frequencies retain their original relationship to the input

carrier. I sure hope this helps you a little." *We sure hope so too! Incidentally for the sake of our ego, I would like to point out that the description given in the November column was not how we interpreted a varactor to operate, but only meant to point out the paradox of linear multiplication. We had previously assumed that a whole string of sidebands would be present. Actually if you do go through the mathematics you will find that there is a string of sidebands above and below the carrier but of much smaller amplitude, than the first sidebands.*

George Waldron, K6AJL, on varactors and such: "I'm a late comer to the latest in u.h.f. in a sense, because, in spite of being a ham for several years, I have mostly experimented with various circuits, rather than operated on the air. It is rather amusing that with my close association with communication equipment (I am a State-of-California Technician), I have had to wait for some time to see in a ham publication a discussion of varactors (Or should we call them diode multipliers?)" *Call them diode mixers!* "In line with this, though, is there available a flyer or copy of an article on these devices that one might get a hold of?" *Try writing to Texas Instruments; they have some excellent information on the subject. As for construction articles, we have planned one for the column . . . just be patient.*

Bill Woddington, WN7BCD on Novice problems: "As a lowly novice I have had no experience but am fascinated by v.h.f. operation. I hope to get my General soon so I can start tinkering. I have been gather 2 meter gear for a long time in order to get into the Spokane MARS net, but now I find out that one has to be 16 (I'm only 15)." *A year may seem like a long time to you now, but just wait.*

"I have a BC-522 transmitter and a Centimeg converter working into an RME-84 receiver. It is very haywire, but works fine. My big problem is that everyone around here either works MARS or FM. So here I am with a usable rig and no one to talk to. Doesn't anyone around here use ancient modulation? What say fellows?" *There must be someone around Spokane who is willing to work AM in the two meter band!*

Ed Hopper, W2GT: "Although the following item will probably appear in the Announcements section, the boys at the East Coast VHF Society will be happy for any mention you might make in the V.H.F. column of their 7th annual Dinner and Hamfest. The time is 7 P.M. on Saturday night, February 27th at the Swiss Chalet, Route 17, Ramsey, N.J. They usually have 200 to 500 in attendance. Tickets are $6.00 per person. Write to the club at P.O. Box 1263, Paterson, N.J." *The East Coasters have quite a shindig each year. This is one affair you don't want to miss.*

George Elliott, VE2LI, with more on the valve: "With reference to the VHF column, page 76 in October, The M.O. Valve Company of London, England, designed and built a beacon transmitter for operation on 431.5 mc and beamed on the receiving station in The Hague, Holland, to study mixed-path propagation. The beacon was described in *Wireless World*, December, 1962. Information is also available in Application Bulletin No. 6 from the M.O. Valve Company.

"There are two versions, both using cavity resonators of fixed dimensions in the form of square boxes. One uses a single 4X250B. The other uses two 4X250B's. I built the single tube version about 18 months ago and it worked quite satisfactorily.

"Ran successful schedules from September 1963 until March 1964 with W1BU in Boston, over an approximate distance of 250 miles. Also maintained contact with W1QWJ in Springfield.

"This summer I built the two tube version with two 4X250B's in parallel, but ran into trouble in the grid circuit. In this connection I saw in your column that W5YKQ had built this amplifier and I was wondering whether he had constructed the single or double tube affair. Also I would like to know what modifications he made. As I cannot find the address of W5YKQ in the *Calibook*, could you drop a line and give me his address?" *Better than that, George, we'll print yours, just in case anyone else out there could lend you a hand: VE2LI, 4665 Connaught Avenue, Montreal 28, Quebec, Canada.*

Bill Waddington, WN7BCD, (15), would like to hear from two meter a.m. men in the state of Washington. See his letter in this month's From the Mailbag section.

"Worked W2MDE several times on 432 mc in Hicksville, L.I., this summer." *Congratulations! Wish more u.h.f. operators would take the time to let us know what they're doing!*

Sign Off

Let us hasten to remind v.h.f. club officers to contact us now regarding logs and data sheets for our May 1-2 Spring V.H.F. Contest, which, incidentally, promises to be the biggest bash yet. Individuals are also requested to send us self-addressed stamped envelopes for full advance information on this affair.

And let's not forget to keep ye lowly v.h.f. editors informed on your doings! Correspondence is an important part of any monthly column, offering its writers an easy way to get news. Seriously, however, we love to answer letters whenever we can be of help. Note the new address on the first page of the column this month.

By the way, On October 19th, K2ZSQ's XYL put her first signal on the air. A "peanut-whistle" we must admit, but there's nothing wrong with the modulation. His name: Douglas Scott; weight at birth: 1 lb. 13 oz.

73, Bob, K2ZSQ and Allen, K2UYH

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HAM CLINIC

CHARLES J. SCHAUERS,* W6QLV

WE COULD literally fill a bushel basket with letters from hams asking us how to obtain more r.f. output power from transmitters such as the DX-40, DX-60, Ranger, 32V, HT-40, KWM-1, Eico 720, AF-67, Chief 90, Comm II, TBS-50, DX-20, Navigator, MB-560 and others. Because some of the sets are screen-modulated, we have also been asked how to add plate or high level modulation.

Increasing the power of any of these sets by 50% only results in a 3 db signal increase—providing overall output circuit efficiency is high enough.

It is only natural for any ham to want more power capability in the equipment he owns, but there is a limit to what one can *practically* do to achieve higher output power.

I feel that the effort to convert or modify a 50 watt transmitter for 100 watt output is generally not worth the trouble—a 500 watt transmitter, yes.

If you insist that you must increase the power output of your little transmitter, and you are willing to spend the money and the time, then here are some hints and advice that may prove useful to you. We hope that we will find fewer letters in our mail bag on the subject in the future.

Power and Modulation Conversion Hints

All of the sets mentioned in the first paragraph of this column do *not* contain power supplies heavy enough to handle the current and voltage requirements for *doubled* power output. Furthermore, those sets that are plate modulated require more power to handle the extra af requirements for 100% modulation at doubled r.f. power.

First of all, one thing should be crystal clear—merely replacing the power transformer with one having double the current rating of the old one; changing other power supply components and adding another final r.f. stage tube in parallel with the existing one is *not* the *whole* answer to the power conversion problem.

When you parallel tubes to handle the 50% plus increase in power, you *halve* the total effective tube impedances. The values of the tuned circuit components involved must be changed if you are to maintain the *Q* required. When tubes are paralleled, the input *Q* will of course be altered and generally result in the need for doubling grid tank capacitance. Final tank capacitances must also be doubled if the original *Q* is to be maintained.

Then remember that the impedance as presented to the final modulation transformer secondary by the final plate (s) will change too (if the rig you are working with is a high-level plate modulated one).

Before the change, say that the rig's final had 500 volts on the plate and was loaded to 100 mils—this is 50 watts input. At 50 watts input, the secondary of the modulation transformer should have an impedance of about 5000 ohms. Now with 500 volts at *200* mils, (100 watts input), the af impedance would *drop* to 2500 ohms. You more than likely will need a new plate modulation transformer of the correct wattage rating. Further, your audio power would have to be doubled. This would mean conversion of your modulator from the old 25 watt unit to one of about 50 watts, for the latter is the power you would need to modulate your 100 watt final 100%.

In the screen modulated jobs you would have to provide *twice* the af driving power. This power for 100% screen modulation is generally ¼ the d.c. power input to the screens of the final r.f. tubes. Here again you must compensate for the impedance changes encountered when paralleling tube screens.

When power is boosted, r.f. driving requirements must also increase. Most of the rigs mentioned above contain driver tubes that are not usually capable of 50% more r.f. output except possibly on 80 or 160 meters.

Usually if a ham is determined to keep his small transmitter and requests that we tell him what he should do to increase power output, we recommend using the small rig as a driver. The final stage of the small rig would be used for the necessary r.f. drive of a succeeding higher powered r.f. stage and the set's modulator used as the driver for a larger modulator (if a.m. is used). On the other hand, we also recommend using Heath's SB-10 with a small rig and tacking a good higher powered linear on the end of the latter. Besides enjoying the benefits of s.s.b. this approach is not expensive.

Questions

Printed Circuit Boards–"I, like many other hams, enjoy making a lot of my own equipment. I also enjoy trying out various circuits I find in technical journals. I feel that it is foolish to use anything but a printed circuit board, but gosh the work to prepare them! Tell me, can you recommend a company who offers printed circuit boards in kit form with everything needed to come up with a usable product?"

Sure can. I recommend the kits produced by Ami-tron Associates, 12033 Otsego Street, North Hollywood, California. W6SFM is certainly producing a wonderful product. The kit he sells is called E-Z Etch. All you have to do is to place

*c/o *CQ*, 14 Vanderventer Ave., Port Washington, L. I., N. Y.

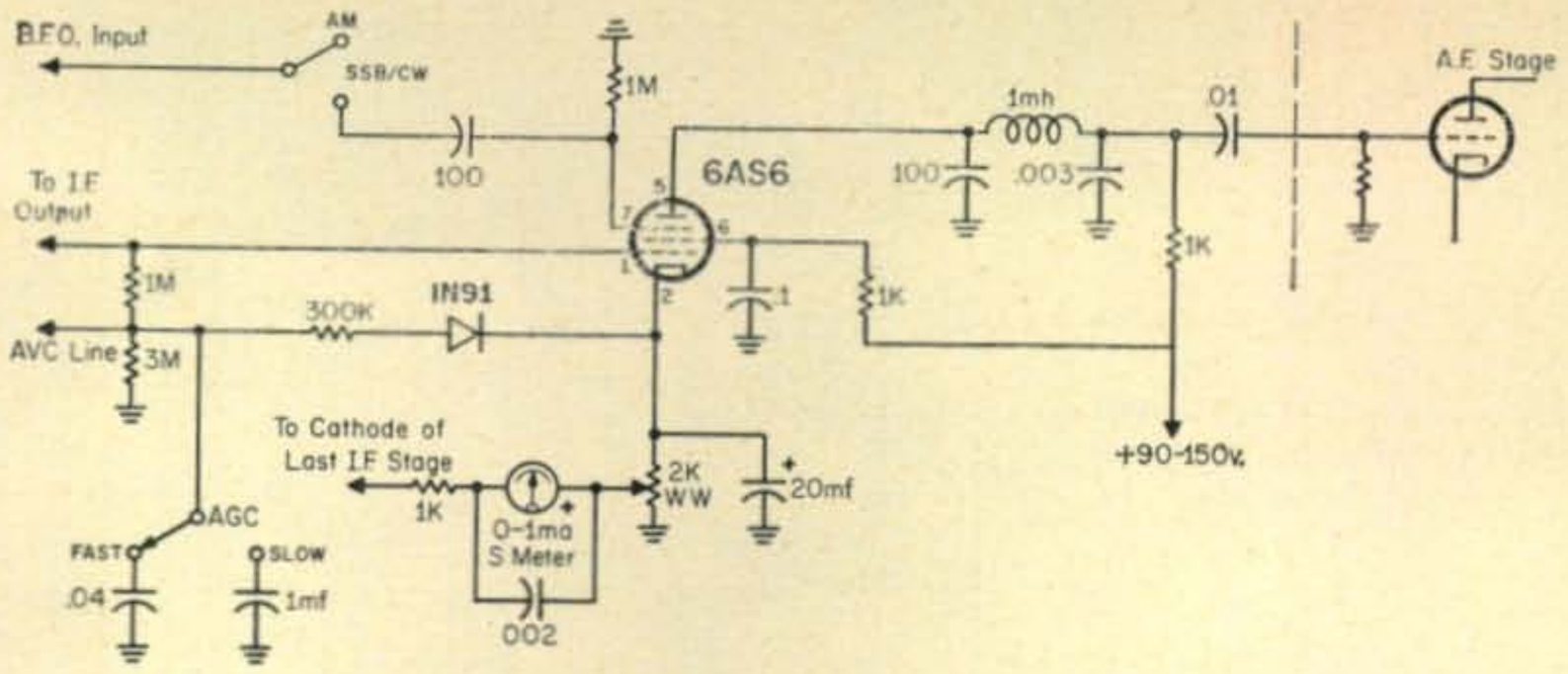


Fig. 1—Philco's product detector which provides detection of am, cw, and s.s.b. without altering agc action.

a transfer sheet (containing hundreds of lines, circles etc.) over the board, transfer your desired "wiring" to the board by rubbing the desired image on the transfer sheet. Peel the sheet back leaving the etch resistant material on the copper surface and then etch in a plastic vessel (bag) provided with its own etchant. It is terrific! Ami-tron also produces the lowest priced rub on transfers in the U.S. Drop them a line.

Product Detector with a.g.c.—"Has any product detector been described in the literature which provides for a.m., c.w. and s.s.b. operation, and at the same time provides a.g.c. action, as well as signal strength ("S" meter) connections?"

Yes. Recently in Philco's TechRep Bulletin and in November 1962 in *Radio-Electronics*, a circuit on which a patent is pending for Philco is shown. This circuit is similar to the one contained in the 1959 edition of Collins' *Fundamentals of SSB* (Chapt. 3. Fig. 3-8), but provides a number of features not found in Collins'.

I tried out the circuit with the KE-93 receiver and it worked beautifully. Philco has something. Fig. 1 shows the circuit.

Because the b.f.o. input is isolated from the detector circuit, it does not influence a.g.c. level. The diode (1N91) controls the delay time of the a.g.c.

I also tried out the detector on the TMC GPR-90 with excellent results. In any event it is not difficult to install and can even be switched in or out of an existing diode or power detector circuit.

HAM CLINIC Bargain Counter—Beginning this month we start a service to our readers not offered by any other ham publication. Each month, we will choose two or more *bargains* for ham gear (surplus or new) which have not been advertised before, nor is there any intention on the part of the dealers concerned to advertise them unless subsequent demand is heavy and the equipment or gadgets are still available.

Dealers or distributors having *real* bargains to offer HAM CLINIC readers in limited (but adequate) quantities are invited to send full descriptions of their offers (with prices) to HAM CLINIC before the 25th of any month. HAM CLINIC reserves the right to refuse any offering without stating the reason therefor. Dealers etc., should advise us how many units are available and state that they have *not* advertised the items at the prices offered.

This month we start with two items. First from Lafayette Radio is a miniature code practice oscillator (Nr. F-429), fully transistorized, with key, earphone and oscillator. It can be used as a monitor too. The price is $2.29.

Next, a midget motor and fan from Allied Radio Corp. for 115v a.c. for cooling tubes, transformers etc. (Nr. 39A457D) for only $1.98.

DX Transceiver Operation—"Why doesn't some manufacturer come out with a transceiver with dual v.f.o.'s? This would be a fine thing for those of us who often operate overseas as well as in the U.S."

Be patient. One manufacturer is doing this. I hope that while he is at it, that he will not forget the need for 220v a.c. operation; preferably, his power transformer should have taps for operation for a wide range of voltages from 110v a.c. to 240v a.c. While he is at it, I hope he also gives *full* band coverage for both c.w. and phone operation (as allowed for North American operation). One other point: a.m. operation will be with us for sometime to come (dern it), so provisions for it should be made too.

Vertical Antenna Matching—"I only have space for a vertical antenna, and as you know most verticals come with a bottom coil whose taps must be changed for each band. Can you suggest a way to do this from the shack?"

There are two possibilities. First you can replace the coil with a Master Matcher, obtainable from Master Mobile Mounts (4125 Jefferson Blvd., Los Angeles, California). This unit is a motor driven coil, allowing very fine adjustments. Although designed for mobile operation it can be used with such antennas as the Gotham, WRL, Hy-Gain etc.

DX-40 to 6 Meters—It is always a refreshing experience for me to receive information from one of my readers who has improved on something that I have done or suggested. Vincent J. Shroad (K3ZQN) of Levittown, Pa. tried out my modification for the DX-40 to 6 meters as described in the June 1962 issue of *CQ* and ran into one little trouble after another. But this didn't faze Vince. He came up with his own modification and I can see that it is easier and better than the one I did.

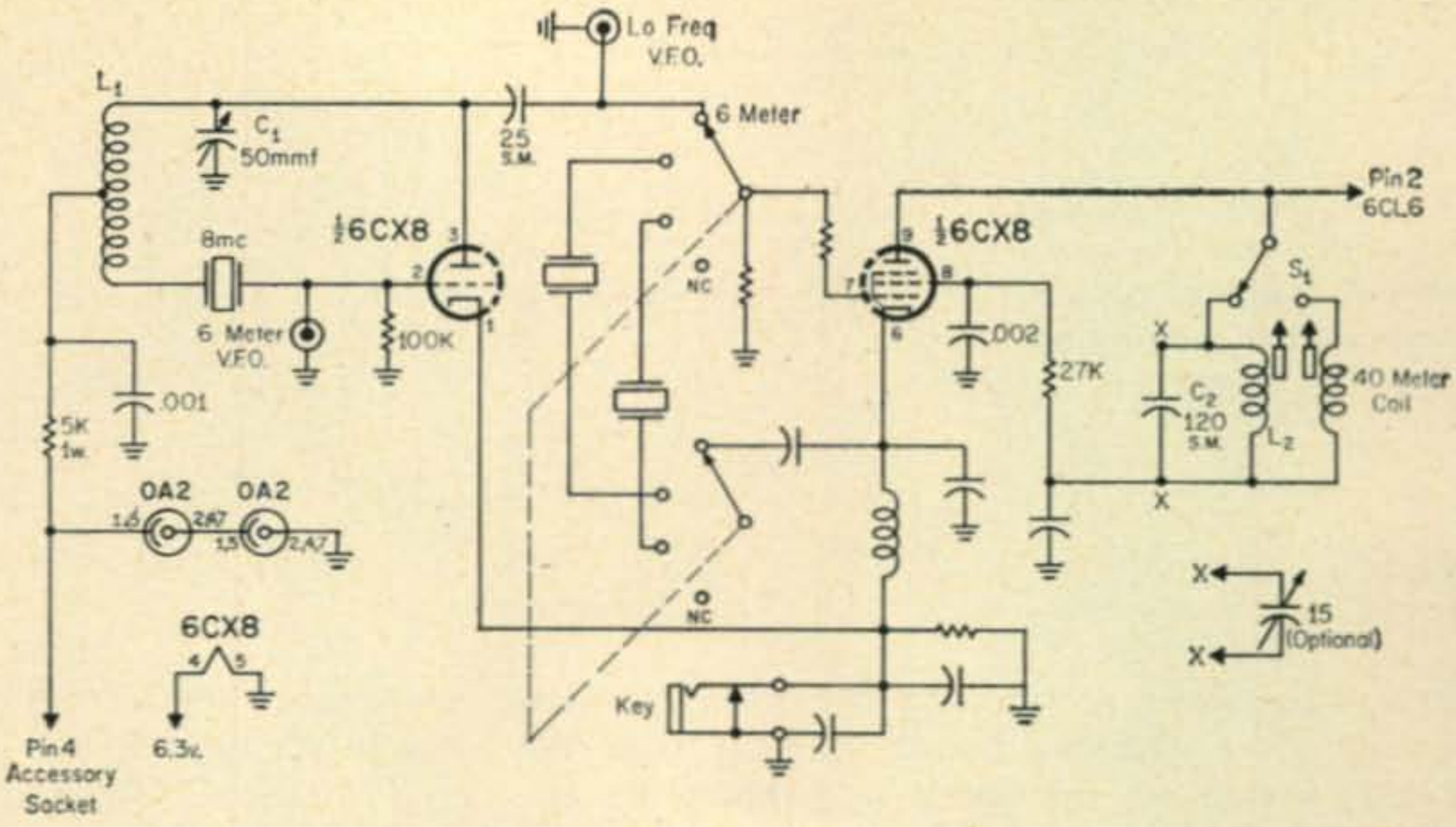


Fig. 2 — The oscillator driver section of the DX-40. Capacitors not marked, are the original ones in the set.

Figures 2 and 3 show how the modification was done.

First he changed the 6U8 I suggested to a 6CX8. To make the LSM-30 coil prescribed in the article resonate at 25 mcs, a 120 mmf silver mica capacitor was placed in parallel with it. Two 0A2 v.r. tubes were added to stabilize the oscillator voltage. In the 6CL6 circuit the pi-wound choke was removed and a Z-50 substituted, this stopped a resonant condition encountered.

One turn was removed from the new final plate coil, the new coil now has 2 instead of 3 turns. The .425 mh choke in the plate circuit of the 6146 final was shorted out.

He found that the LSM-30 coil would not provide sufficient drive over the entire 50 to 54 mc spectrum so he installed a midget 15 mmf variable capacitor across the coil and 120 mmf capacitor combination.

It is recommended that at least #20 solid copper hookup wire be used for making connections. Vince also recommends that the small mica capacitor from the junction of the 47K and the 47 ohm resistors to the cathode of the 6CX8 be removed. If this is done the drive will be improved.

We suggest that you refer to the original article in the June 1962 issue of *CQ* before you modify your DX-40 for 6 meter operation.

Thirty

Here in Switzerland it seems that we are always having visitors. Among those who have visited with us during the last year were: John Gayer, President of the International Amateur Radio Club; Gus Browning and his charming wife—Gus was on his way to Bhutan and more DX; George Jacobs, W3ASK our *CQ* SPACE and PROPAGATION man; hams from all over the world and non-ham friends.

During 1964 we were honored with a Doctor of Science Degree, a trip home and we did a lot of traveling.

We hope 1965 will be the year when Public Law 88-313 is implemented to its fullest. (PL-88-313 is the reciprocal ham operations law).

For this month then, 73 and 75. Chuck

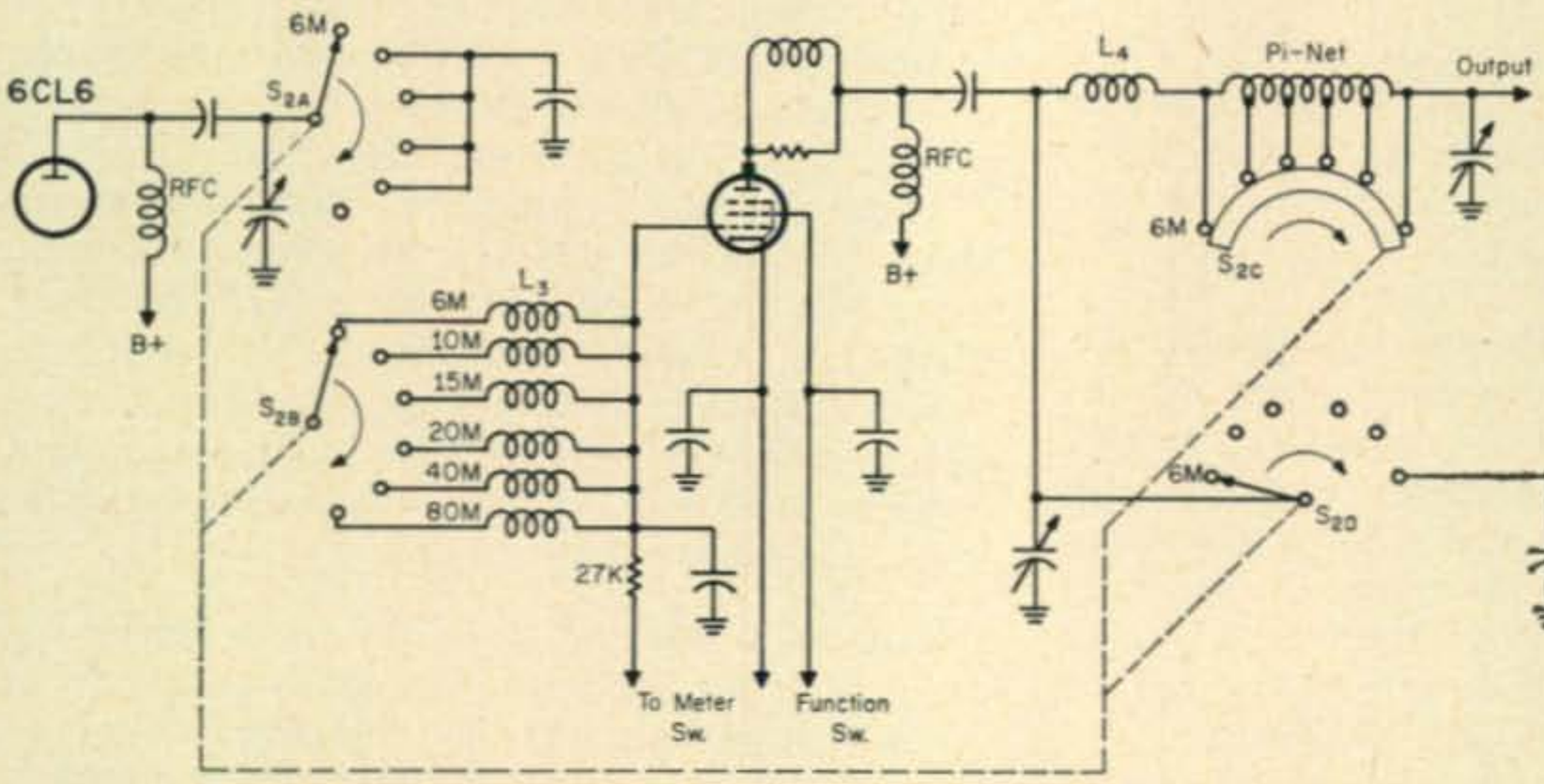


Fig. 3—The driver-final section of the DX-40. Capacitors not marked are the original ones in the set.

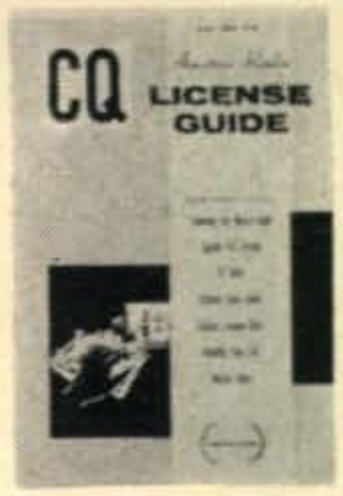
L_1—14t B&W #3003 tapped 4½t from xtal end.
L_2—Cambion LSM 30.
C_1—50 mmf ceramic trimmer.
C_2—120 mmf Silver Mica.
S_1—s.p.d.t. ceramic switch. Mount L_1 on terminal strip for rigidity. Use xtal socket on extreme left of chassis (viewed from below) for 8 mc xtal. Rewire other socket to right side of chassis.

L_3—9t #18e, ½" long, ¼" dia.
L_4—2t #18e, ⅜" long, 1" dia. (Airdux 808T).
$RFC_{1,2}$—Ohmite Z-50.
S_1—4 standard Centralab ceramic switches, (3) type XD and (1) type FFD sections mounted on switch detent assy. type PA, approx. 6" long. This can be matched with a little ingenuity to existing switch assy.

CQ TECHNICAL BOOKS

CQ ANTHOLOGY I

We've looked back through the years 1945-1952 and assembled all in one place the articles that have made a lasting stir. The issues containing most of these articles have long ago been sold out and are unavailable.



CQ LICENSE GUIDE

212 pages of everything the Amateur must have to get his license and progress toward the general class ticket. Plus many additional pages of vital information for the ham operator.

ANTENNA ROUNDUP

A common denominator for all ham stations is the antenna. Here at last is the cream of antenna information packed into a 160 page book. Forty-seven information-packed articles that will dispel much of the mystery surrounding antennas.

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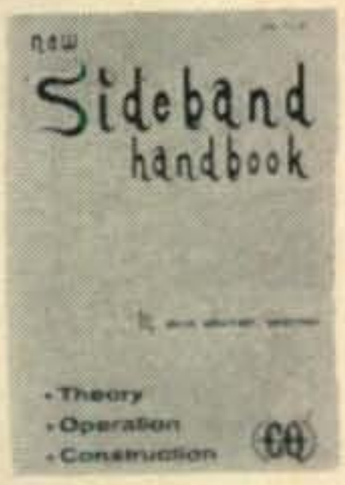
MOBILE HANDBOOK

This new Mobile Handbook by Bill Orr, W6SAI, has been getting raves from top experienced mobile operators. Written for advanced, as well as beginning mobile operators, much of this information cannot be found anywhere else. This is NOT a collection of reprints.



SIDEBAND HANDBOOK

Written by Don Stoner, W6TNS, who was almost one full year in the preparation of this terrific volume. This is **not a technical** book. It explains sideband, showing you how to get along with it . . . how to keep your rig working right . . . how to know when it isn't . . . and lots of how to build-it stuff gadgets, receiving adaptors, exciters, amplifiers.

VHF FOR THE RADIO AMATEUR

If you are, or are planning to be a VHF operator, you can't afford to be without this dynamic new handbook written especially for you. Filled from cover to cover with all new and original construction material presented so you can understand it. Written by Frank C. Jones, W6AJF, nationally acclaimed for his VHF pioneering.

SURPLUS SCHEMATICS

This is a book literally loaded with schematics for all the currently popular pieces of surplus gear. Most amateurs are well aware of the problems encountered in purchasing seemingly inexpensive surplus units, only to find that no schematic diagram is available. Trying to figure out the circuitry cold turkey can be many-times more difficult than the most involved puzzle, and purchasing a single instruction book can run as high as $3.50.

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NOVICE

WALTER G. BURDINE,* W8ZCV

LAST month I was asked to talk to members of the Clinton County Amateur Radio Association, where I met many amateurs from within a fifty mile radius. I was surprised to find so many school teachers in the area. They seemed very anxious to find methods of teaching radio in the schools. Boy, this sort of thing puts a fellow on the spot; these fellows are doing a lot for the country and for the young folk of their schools. It has been proven that a young fellow with an amateur radio license doesn't have time to be a juvenile delinquent, as he is too busy with his own problems of setting up his station. The teacher that goes out of his way to help youngsters get their license is to be commended for his efforts. I just wonder if anyone ever thinks of the extra time that he devotes to this effort, and says "thanks for the favor." If not, let me say, "THANK YOU ONE AND ALL" for your time and effort.

By the way, the nice publicity given the speaker in the local papers did not in any way hurt the amateur, I even received two letters from their readers saying they wished they could have heard the talk and that they would like to meet me. In addition, the police of Wilmington were very nice to escort me to the home of the Secretary of the club, WA8KSW. They even saw to it that I was parked in the right place. My hat is off to the Wilmington Police Department.

I expect a lot of new activity from the Clinton County amateurs in the near future. It was a nice meeting.

I want to say thanks to all of you who took the time and effort to write me about the old *QST*'s, *CQ*'s, *Radio News*, and *Radio* that you had lying around. Many of them wanted me to put a price on them, but I didn't think that I should do that. I have answered all letters. I want to especially thank W5DAZ and W3AYS for their offer of free magazines, if I would pay the postage. I have accepted and should have a bigger store of information to work from. I also find many others are doing the same. I really think too many do not use their reading material as much as they could. I have received many letters asking for information that was included in the article if the reader had have read the article more carefully. The handbook has the answer to many questions if you look for them.

*R.F.D. 3, Waynesville, Ohio 45068.

Novice Information

Irv Strauber, K2HEA, sent along the following information about the Hallicrafters HT-44. The Hallicrafters Company has a field service bulletin entitled *Crystal Control of the Model HT-44 for Novice Band Operation*. Irv says: "Since sideband seems to be the "thing" today, this simple modification might save some young man some future expensive growing pains!" I think you could get a copy from Hallicrafters.

Thanks Irv, I'm sure that a good many of the fellows will now take a second look at the HT-44 before buying their rig. Then they can use the same rig for the general class bands using s.s.b. A good idea.

How Does It Work: Frequency Multipliers

The natural resonant frequency of a crystal is proportional to the size and thickness of the crystal plate. In other words the higher the frequency the thinner the crystal. Therefore, the frequency to which a crystal can be ground finally reaches a physical limit of thickness. To get to a higher frequency we must multiply the frequency either mechanically or electronically. Overtone crystal frequencies are obtained by mechanical means, the frequency of an overtone crystal is always an ODD multiple of the resonant frequency of the crystal blank.[1] The usable overtone frequency to which an overtone crystal can be used economically is about the ninth overtone, although Bell Laboratories has obtained one up to the 21st overtone. Third and fifth overtone crystals are commonly found in transmitters and receivers above 50 mc.

Special crystal oscillators will have controlled output on *any* multiple of a fundamental crystal blank up to about the fifth harmonic.[2] A harmonic is an integral multiple of the fundamental frequency of the crystal blank, while the overtone frequency can be either above or below the ODD multiple of the fundamental frequency, rarely an exact multiple. Circuits for harmonic type crystal oscillators can be found in your handbook.

Electronic multiplication of a crystal controlled frequency is done very simply by using a frequency multiplier circuit. As it is often desired to operate at frequencies much higher than those obtained by direct crystal control it will be necessary to use electronic means to multiply the frequency of a lower frequency crystal to the desired operating frequency. Ordinarily harmonic distortion is to be avoided in an amplifier circuit, because the distortion alters the wave shape of the original signal. However, when frequency multiplication is required, the signal is deliberately distorted to form strong harmonics. The desired harmonic is selected by a sharply tuned circuit in the plate circuit of the multiplier stage.[3]

[1]Tilton E. P., "Overtone Crystals—How and Where To Use Them," *QST*, March 1955, p.16.
[2]Ellis, R., "Frequency Stability of Third-Overtone Crystal Oscillators," *QST*, January 1963, p.58.
[3]Nagle, J. J., "Series and Parallel Mode Crystal Operation for V.H.F.," *CQ*, April 1964, p.44.

This nice little DX corner belongs to Dick Jones, WN9LLS, 1135 Bohland, Bellwood, Illinois. He likes CQ and the NOVICE column, read his letter.

The output of a class C amplifier is greatly distorted, therefore frequency multipliers are generally operated as class C. In fact, the grid circuit of most frequency multipliers is biased more negatively than most class C amplifiers to cause the greatest possible distortion. Rule One: The higher the grid bias, the greater the grid excitation or grid drive required. The grid circuit is always tuned to the frequency of the *preceding plate circuit* while the plate circuit is tuned to the desired harmonic. The fly wheel effect of the plate tank circuit will make up the remaining portion of the sine wave of the harmonic-peaks furnished by the vacuum tube. Fly wheel effect was described in past issues. A frequency multiplier stage may be operated straight through as a buffer-amplifier (usually requires neutralization) or as a doubler, tripler or Quadrupler. If the stage is operated at all times as a multiplier it will not need neutralization as the grid and plate tanks are tuned to different frequencies, therefore they will not oscillate.

The plate circuit of single tube multipliers can be tuned to any frequency up to the fifth harmonic, Odd or even multiple. Push-pull multipliers will produce ONLY ODD multiples of the input frequency. Push-Push Multipliers (grid circuit in push-pull configuration with plate circuit in parallel configuration) will produce ONLY EVEN multiples of the input frequency.

I believe that the pushpush circuit could be used more often if we would only use our noodles for electronics. The plate circuits of almost all presently used amateur transmitters will tune to 12 meters (10 meter position) and two times 12 meters is 6 meters. *(Aw heck figger hit out urself)* This would be the simplest method of getting on six meters for many. A pushpull tripler would go from two meters to 432 mc with very few parts. An SCR-522 will drive a pair of 2C43s to 7½ watts output on 432 mc using 8 mc crystal. I know that isn't much power but you can always amplify it. I will work out the details if you want. We should make more use of these frequencies. The output of the push-push doubler is not distorted, it is capable of good output and has good efficiency. The plate efficiency of a multiplier stage decreases as the frequency multiple is increased.

Circuits of frequency multiplier stages may be found in any handbook.

Letters

Part of a letter from Everett C. Bollins WA3/WN3AOS, Naval Communications Unit, Navy #3080, Box 19, c/o F.P.O. San Francisco, California. "I would like to sked any novice that would like to work Midway Island. I will meet them on any band that they choose. I hope I will be hearing from some of you soon. Tell the low-power novice that they would be surprised at the signals that the 3, 1, 2, 4, and 6's come in out here on Midway Island. I hope to be able to work some of them but they will have to listen for me. I, myself am a radioman in the U. S. Navy."

"Dear Walt: Although I am no longer a novice I thought I'd drop you a few lines. I received my novice license last November (WNØHWH) and being stationed in Okinawa I soon got my Ryukyu Island permit (KR6NAM). I operated from January til July when I got my conditional license (WAØHWH) and my new Ryukyu Island permit KR6CA. As a novice I worked 190 stations in 11 countries including England and the United States.

My equipment consists of a homebrew 75 watt transmitter, a 15 meter dipole and two receivers, an SX-28 and an SP-600.

I owe much of my success as a ham to the local KR6s such as KR6DP (WA6IGL), who gave me the tests and helped me with my equipment.

At the present I am not on the air because I'm leaving very soon for the States and my equipment has already been shipped. I plan to be on the air from my home in Nebraska in about two weeks. It will be the first time I have used the home call. Best DX and 73 Norm." Norm's home address is: Norman A. Kramba, WAØHWH, Wilber, Nebraska.

Well, at least you know there are still some chances to work Okinawa because Norm said so, and Norm will find it harder to work out as a WAØ.

Dick Jones, WN9LLS, Bellwood, Illinois sends this interesting note: "Dear Walt: I'm 12 years old and licensed as WN9LLS since May 5, 1964. My very first rig was constructed from your June 1964 article on 80 and 40 meter c.w. transmitters. My Dad and I built the oscillator breadboard fashion using a 6V6 and a B & W coil for L_1 and L_2. We were pleasantly surprised when it worked on the first try, lighting a 15 watt bulb to about ⅓ brilliancy.

I'm now using a T-60 and an HRO-60. The antenna is an all-band dipole fed with an open wire line. Enclosed is a picture of my station.

Please keep the articles on home-brew and "How does it work" coming all the time. 73. Yours Dick."

Thank you Dick, I'm glad that the rig did ok. I will keep the home brew articles coming and I hope to have a nice home brew article for the March *CQ*. Get the soldering iron out and let's build more in '65.

Some very good information comes to us in a letter with a whole load of exotic calls printed on it, read it and heed it. The letter is from Larry Jack, ON5YE/G. 9A1KAV/M1Q, Apple Tree Cottage, Burfield Road, Chorleywood, Herts., England.

"Dear Walt: For two years now, I have been a faithful reader of your column and at last I thought it time to sit down and write you. I can remember the first time I ever saw *CQ*, your column was the first that I read.

However, being an alien in the British Isles, I cannot unfortunately operate any of my equipment save the receiver. By the time this letter reaches you I will be on my way back to the states where I will operate as WB6KAV.

If I may, and this has been said many times, give a word of advice to your novices. *Listen*. I can't overstress the fact that listening and not CQing is what accounts for the many DX contacts. To back it up, during my stay here in England, I have heard on my Hallicrafters S-20R receiver (with an antenna only 40 feet

long, 7 feet high), stations such as OA8s, YU's 9G1 calling CQ less than a kilocycle away from some unexpecting *(unexperienced, ed)* W-K amateur (usually novice) also calling CQ, yet neither will hear the other. Many of them have missed working some good DX by not listening and then calling the DX station.

Oh well, I wish to wish every success in your column, now and in the future! 73, gud Dx &bcnu sn. Larry."

Thanks for the letter, Larry, and I'm sure a few will heed your advice. I have often found that many of the pile-ups were caused by people calling a DX station in the hope that they might be heard when *they* were not hearing him themselves. You are just cluttering up the band when you use this practice of trying to work DX. My mother used to say, "It just shows their bad bringing up."

That good friend of amateur radio and of the Novices, F. Allan Herridge, G3IDG, 96 George Street, Bainstoke, Hampshire, England sent a couple of cards with the following information. "Dear Walt: 25 Oct. The following novices heard to-day on 21 Mc/s between 1220 and 1715 GMT. WN1CPB, WN2MPQ, WN2MZJ/3 (QSO'd), WN3BCN, WN3BFR, WN4RXZ and WN9-LDK. My receiver is a fully miniaturized HRO-MX with a 150 foot antenna bent into a W.

I'm a fellow magazine collector, with *QST* back to August 1923, *RSGB Bulletin* complete from the first issue (1925), but three Copies of *CQ* missing, (March, April, June 1945). Am still hoping tho! Some day will get the set of *73* to see t'other side of the controversial hoo-haa! NEXT CARD. More novices heard on 21 Mc/s. Sunday 1 Nov., WN2MZJ/3, WN4ROJ, WN4UTN, WN9LDK and WP4CLB. On Sunday 8 Nov., WN2MSC, WN2MYN, WN2RNI and WN3AQX. Those on November 8, were heard using an indoor Joystick with its associated Joymatch into my miniaturized HRO-MX. I am hoping for many novice QSOs when I get my Joystick fixed outside. 73. Allan."

Thank you very much for the letter, Allan, I'm sure that the news in it will be received with joy by those mentioned and maybe they will take the time to listen a little better hereafter. Of course, we have many novices crowded into a small slice of our frequency spectrum but maybe this is one method of getting a "well cured ham" from their efforts. Surely this shows the good operator how to handle the situation and the results will show up in the logbook. Keep the reports coming and I will use them to bolster the spirits of the local gang. Good Luck on your Joystick, you might even hear W8ZCV soon.

Help Wanted

Let this speak for itself. "Dear Sir: I take the liberty of writing you to ask if you would be so kind as to give me please the name and address of an amateur station to use as a penpal. My name is Tony Berger. I am 21. I can understand English quite well, but I cannot speak it very well. I am a shortwave listener, I like to read. I also go to the theater and the cinema. My address is: Berger, Tony 505/198 Leninova. Praha 4, Czechoslovakia." There you are fellows, a possible new ham friend in a new country for many of you.

In response to my letter to Bayard, W3AYS, Baltimore, Maryland, I find that he had worked all of the counties in Ohio, but unfortunately his cards were lost when he sent them to The Dayton Worked all counties committee. He now needs Shelby and Carroll counties to finish his second batch of cards. He has been so nice to me that I wish some one would try to help him get cards from those two counties. His address is Bayard Smack, Jr., 5500 Groveland Ave., Baltimore, Maryland. Call W3AYS.

Clarence E. Conn, K7DUE, 12440 S.E. Lincoln Street, Portland, Oregon 97233 is a Technician who needs someone nearby to send code practice at 10 to 16 w.p.m. between 0300 and 0600 GCT in the 80 meter band. If you live in the vicinity of Portland's 80 meter coverage would you please contact Clarence.

Tom Richards, 901 Sixteenth Street, N.E. Auburn, Washington needs help with the code and someone to give him the test. Phone 833-6108.

Dean Rogers, 527 North Wild Olive, Daytona Beach, Florida 32018 needs help with the code and theory.

W. Edgar Johnson D.D.S. 53 High Street, Berlin, New Hampshire would like for a local ham to contact him so that he might see how a station operates and have the operator tell him some of the facts of life concerning ham operating.

Another DX corner that is DX, is WL7ESA, James J. Chepey, 1800 Toklat Street, Anchorage, Alaska. Jim is an air traffic control specialist at Elmendorf Air Force Base for the FAA. Jim should be sporting a General Class license by now.

Jerry Van Vactor, 811 10th Street, Spearfish, South Dakota 57783 phone 642-2371 needs help with code and some one to give him the test.

Come on fellows maybe we can get another South Dakota station on six meters, it will make that state more easy to work.

Paul Ssroggie, Sprague, Washington 99032 phone 237-4284 area code 508 needs help with the code and some one to give him the test. He would also like to correspond with any other hams living in a canyon, he says "Will it affect my transmitter and receiver?"

Add to the Help Wanted;

This list came from KØCCA, Skip, Bismarck, North Dakota who taught a class in amateur radio at Camp Miniwance American Youth Foundation camp, Stony Lake, Michigan. The class lasted for a week with 45 minute periods daily in operating theory and code practice. Those taking the class were: Robert Bush, 1023 Colonial Blvd, Canton, Ohio. Danny Wheeler, 404 Bolivar Hwy, Jackson, Tennessee, John Toney, R.R.#1, Lancaster, Kansas, George Portice, 2610 Black Road, Twining, Michigan, Clark W. Cleveland, Box 302, Hinsdale, Montana, Tom A. Hansen, 2nd Ave Road, Clinton, Iowa, Jack Snyder, 1765 Norton Avenue, Dayton, Ohio.

OK fellows I'm going to keep this list separate and see from your letters how many make the grade and send me a letter and a picture of yourself and station.

If you can help any of these fellows get their tickets it will make you enjoy your ham radio much more. It seems like the more I help the more I enjoy my radio. My "bread casteth upon the waters" has returned many fold, maybe not from those helped but from many unexpected places that I never expected to get help. If you read this column very carefully this month you will see what I mean. A local ham told me this week that he had decided to let his license expire, as he wasn't impressed by the type of operators on the bands anymore. I plainly asked him if *he* impressed anyone or tried to help those that never impressed him. He will renew. I guess he had never thought of it that way. If you are helping someone, you are learning something new all of the time and that makes for better ham radio. A man's stature never grows when he draws up within himself and lets George do it all. Any way thanks for all of the help that you have offered me and don't think that it's not sincerely appreciated.

That's just about all for this month. 73, Walt.

YL

LOUISA B. SANDO,* W5RZJ

CONGRATULATIONS to the winners of YLRL's 25th Anniversary Party! The c.w. section (Oct. 21-22) was won by Jeanine, VE3-BII, while Irma, K6KCI, earned the highest score on phone (Nov. 4-5). The Corcoran plaque for highest *combined* score was won by Ellen, WA4FJF. Available for the first time in this contest, to DX YLs for combined c.w.-phone scores, were the W4HLF cups. The one for North/Central America DX YLs was won by Jeanine, VE3BII, with 4441 points.

Here are the top scores:

1st c.w.—VE3BII, Jeanine Burgess 1595
2nd c.w.—WA6OET, Jessie Billon 1540
3rd c.w.—WA4FJF, Ellen Ackerman 1375
1st phone—K6KCI, Irma Weber 7860
2nd phone—K5YIB, Barbara Houston ... 7500
3rd phone—WA4FJF, Ellen Ackerman ... 7200

Corcoran Award

WA4FJF, Ellen Ackerman 8575

District High Scores

Phone		C.W.	
K1EKO	3990	K1NST	660
K2JYZ	3850	K2JYZ	712
K3HZY	1993	K3HZY	20
WA4FJF	7200	WA4FJF	1375
K5YIB	7500	K5YIB	1045
K6KCI	7860	WA6OET	1540
K7RAM	6325	K7OFX	1170
W8HWX	4987	W8HWX	617
K9TRP	4663	W9MLE	1050
WØJUV	2379	VE3BII	1595
PY2SO	60	G2YL	162
KZ5TT	3075	OH5RZ	36
VE7ADR	3330	VK3KS	1
VK3KS	1		

*4417 Eleventh St., N.W., Albuquerque, New Mexico 87107.

With the Clubs

Officers for WRONE for 1965 are: Pres., K1IIF, Ruth; V.P., K1ICW, Mary; S-T, K1TOP, Alice; net & membership chm., W1CML, Meg; hospitality, K1WXF, Norma.

New officers of WAYLARC include, pres., W3UXU, Betty; V.P., W3CDQ, Liz; secy, K4-EAM, Vi; treas., W3UTR, Meg; K4LMB, Ethel, is representative to the Foundation for Amateur Radio (21 local clubs). For WAYLARC certificate apply to Brooke Brown, WN4VLI, Rt. 4, Box 205, Vienna, Va.

International YL CHC Chap. 4 officers for 1965: Pres., K8MZT, Shirley; V.P., W4ZDK, Mike; secy & P/C, W6YZV, Mable; treas., WØ-ESD, Estelle; council member, K6UTO, Betty; Royal Huntress, W1YPH, Leona, and Royal Wolf, K7UGA, Barry Goldwater.

YL Net Revisions

On the YL Net listing in November *CQ*, p. 117, please make these changes: Mon. 3890 Oregon YLs—the net name is the "Honeybee Net" (the name suggested by K7NZO since *Bea*, W7HHH, has been NCS for years and the YLs who check in are all supposed to be honeys!).

Tues., Blue Ridge—NCS is K4YAK, Ginny. Add to Tues. 0900 (PST), 3885, Ironing Board Net. . . . The YL International SSB'ers meet *daily* at 1300 (EST) on 14,331.

Warning

A note of *warning* from one of our YLs: Be cautious in requesting phone patches to your OM when he is out of town. This gal tried to get a phone patch to her OM in a distant part of the country. Overheard on the air, she was kept awake all one night by phone calls from a guy who deluged her with obscenities. A ham, unfortunately, in this case, but others could eavesdrop. She adds, "I think it is important for the gals to know that such a thing can, and does, happen. I don't think the guy who called me meant any physical harm, but one never knows. Believe me, from now on when my OM travels I will keep very quiet about it. A phone call if you want to talk to the OM is a much smaller price to pay!"

Ginny, K1LCI, and "Doc" Powell, W1BWM. Ginny, who has held her General since '59, is YLRL's International Membership Chairman. Her OM is a general practitioner and they have four jr. ops, one in prep school, two in high school and one in grade school. Ginny is a member of WRONE (president in '64), works all bands, loves c.w. and ragchewing. Other interests are painting (children's portraiture), philately, Scouting and sports.

YL-OM Contest

Don't forget the dates of this annual contest: Phone—Feb. 20-21; C.W.—Mar. 6-7. See full rules in January *CQ*.

YLRL Membership

Don't forget to renew your membership in the Young Ladies Radio League! Dues are $2.50 per year ($3 for DX, $1.25 for a family member) and should be in the hands of the receiving treasurer by March 1. The office of receiving treasurer is a newly created one, filled by special election in November. The receiving treasurer is Joyce Garlick, K1OLM. Her address is Box 243, Harvard, Mass. (K5YIB, Barbie, who has been serving as YLRL treasurer, is now disbursing treasurer.)

German-English Dictionary

Correction: In Jan. *CQ* we publicized the 4000-word German-English Dictionary, newly prepared by OE9CZI, as available for $1. Chris now informs us that since postage rates are so high he is requesting $1.10 for the book ($1 bill & 10¢ in stamps); or 9 IRCs, or Money Order for 28.00 Austrian shillings.

DX Item

From W4TVT, Claire, we hear that HC1BX, Betty, whose OM is U.S. Ambassador to Ecuador, was interviewed on WRC/TV while she was in Washington during November. Betty has been doing an FB job of getting help for needy schools in the Quito area and she also boosts the morale of U.S. employees by handling phone patches to families back home. 33—W5RZJ

Ruth Barber, K1IIF, president of WRONE for 1965, after being V.P. in '64. Ruth was licensed in '57. OM Jack is W1PRT, and they have two jr. YLs. Ruth also is pres. of Bloomfield ARC and College Club of Hartford; past pres. Womans Republican Club of Bloomfield; member of Int'l Ham Hop Club and garden club. Ruth holds YLCC(250) and also enjoys photography, sewing, traveling and camping. An article by Jack & Ruth on Virgin Island camping is in "Camping Guide" for Jan. '65.

USA-CA [*from page 76*]

Endorsed for Phone or CW—No charge, mail log data to Club Secretary, Eleanor M. Lukas, W9AFA, 3400 W. Columbus Ave., Chicago, Ill., 60652.

The South Jersey Radio Association Achievement Certificate is issued for two way contacts with members of SJCR which has a membership of about 300 spread over several New Jersey counties. SJRC has been serving amateur radio since 1916 but for purposes of this award, only contacts after October 1, 1957 will count. There is no charge for the award, send alphabetical list of station call letters claimed with log data to Amor Klotzbach, W2FYS, Awards Chairman, SJRA, 412 Princeton Road, Haddonfield, New Jersey. Requirements: 25 contacts for stations outside the continental U. S. and 35 contacts for stations within the continental U. S. as well as Alaska and Hawaii. SJRA members are required to make 50 contacts. Endorsement stickers are available for 35, 50, 75, 100, 125, 150 and etc. . . contacts.

The Old Old Timers certificate is issued by The Old Old Timers Club for working the required number of their, over 500 members. There several classes of awards starting with 10 members, then 25, 50 and 100. Send $1 or 10 IRCs and GCR list to W6WPF, P. B. Dunn, 18123 Marilla St., Northridge, California 91324.

The Old Old Timers Club 50 Year Award is issued to members only. At the present time, 214 of the 518 members have qualified for their 50 year seal and two others for their 60 year seal.

The Muskegon Area Amateur Radio Council offers the Michigan Counties Award (MCA), for confirmed contacts with 23 of Michigan's 83 counties. There are endorsements for 53 and 83 counties, with special endorsements: A. Work 23 counties with Mobile Stations. B. Work 23 counties while operating Mobile. There is no limitations as to date, band, mode. Mobile and Portable contacts must show county and/or city on QSL's. USA-CA rules apply, GCR, application certified by two other amateurs. The Award manager reserves right to request QSL's. Submit ALPHABETICAL LIST BY COUNTY showing station, band, mode and date. USA Amateurs $1.00 or 10 IRC's. DX Stations (other than W/K) 50¢ or 5 IRC's. Endorsement seals, SASE or IRC. Awards Manager: "OTTS" Beyer, K8CIR. 15426 Comstock, Grand Haven, Mich. 49417.

A VHF-Worked All Aardvarks Award is offered by the Peninsula Amateur Radio Klub, P. O. Box 531, Bayonne, N.J. 07002. Those in 2nd call area work 7 club members and the club station WA2VLR, all others work 3 members and the club station. There is no charge, send log data, no QSLs. Members are K2DWL, WA2GBW, KRI, LCK, MGA, NQE, QOA, QYX, RIR, RZG, SZY, TAY, UOX, UPT, UZI, UZJ, VKW, WAS, WZF, YZY, WB2DLM, DOW, FUJ, HUX, HVO, HVP, HVQ, IYI, KIY, K3VPV.

The new **British Counties Award** sponsored by the English CHC Chapter No. 8, is issued in 3 classes for 50, 75 and 98 counties for Post WW2 contacts. United Kingdom amateurs use 160 meters only, others any or all bands. Award endorsed for single band or mode. QSOs with members of CHC Chapter 8 may be used for the members own county OR as a substitute for a missing county up to a maximum of 5 substitutions. Send $1, 5/- or 8 IRCs and GCR (no QSLs) to: Awards Manager, 133 Fairlands Ave., Thornton Heath, Surrey, England. CHC Chapter 8 includes G2BUL, BVN, FFO, MI, GM, G3FTQ, MCA, OCA, PEU, LPS, JXE, MCN, NFV, NOZ, NMQ, IFB, HZL, NUG, NUY, OXC, G5GH, G6LX, VQ, G8PL, KS, TS, GD3ENK, ST2AR, 5N2JKO, ZB1RM. *Available to SWLs.*

The Tri-County Amateur Radio Club W-VT (Worked Vermont) Certificate of Achievement is issued for working 13 or 14 Vermont counties. Mobile and portable stations worked in Vermont are valid, but QSLs should show the name of the town within the county for which credit is claimed. There is no charge for the W-VT award but return postage would be appreciated. Send QSLs and return postage to: Tri-County Amateur Radio Club, C/O Ray N. Flood, W1FPS, W-VT Custodian, 2 Marlboro Ave., Brattleboro, Vermont 05301.

The Worked All State Capitals (WASC) certificate will be issued upon receipt of proof of confirmed contacts with amateurs in the Capital City of each state after January 1, 1955. Mobile confirmations will be accepted if the mobile station was within the limits of the Capital City and it so states on the QSL. Send an alphabetical list by states, showing Capital City and other log data. Applications showing contact dates on, or after, January 3, 1959 must include a confirmation from the State of Alaska and if on or after August 21, 1959 must include a confirmation from the State of Hawaii. U. S. Applicants send $1. and others may send 12 IRCs. Apply to Award Manager: H. L. German, W3IMN, 129 N. 30th St., Camp Hill, Penna. (If you worked the ole 48 and do not have Alaska and Hawaii—rush before the rules get changed—Hi).

The Baltimore and Ohio Railroad ARC award is issued in three classes for working members: Class "A" U.S. Stations work 50, all others work 15, Class "B" U.S. Stations work 25, all others work 7, Class "C" for U.S. Stations to work 10 and all other need to work 3. No charge, send postage only and GCR list of QSLs you have in your possession to The B. & O. R.R. ARC, W. T. Heller, W3BVL, Awards Manager, 7388 B. & O. Building, Baltimore, Md., 21201.

73, Ed, W2GT

FSKing SSB Transmitters [*from page 36*]

ing diodes operate the same way as they do on a v.f.o. Only the parts values here are much larger to allow for the low audio frequencies in the circuit. Both high and low impedance outputs are provided to match the audio input or microphone connection on various transmitters.

Frequencies

The big difference here from the a.f.s.k. oscillator, is that in practically all cases, it will not be possible to use the old standard frequencies of 2975 c.p.s. and 2125 c.p.s. for the audio. It is not necessary to adhere to any particular audio frequencies as long as the spacing between them is 850 c.p.s., the standard shift. This is because in s.s.b. the receiver can be tuned to make the received signal come out at any audio frequency that will pass through the receivers bandwidth. In this case, it is necessary to use lower audio frequencies because the crystal filters in the typical s.s.b. transmitter will not pass frequencies as high as 2975 c.p.s. without considerable attenuation and this is not wanted. Both tones must come out of the transmitter at the same level. It is well to use audio frequencies more conveniently situated in the middle of the passband, say 1500 and 2350 c.p.s. But the numbers don't matter, only the spacing between them. Do not go below about 500 c.p.s. though; the transmitter is apt to attenuate that also.

One of the features of this circuit is the extreme ease with which the amount of shift may be controlled or changed, by adjusting C_1. Basic frequency is controlled by C_2. Notice also that the loop input requires loop current; it is not a dry keying circuit. Either 20 ma or 60 ma will work. In RTTY it is well to avoid dry or no current keying circuits, because the sending contacts in the machines were designed to have current pass through them, and without it are apt to become just corroded enough not to contact solidly. This leads to inaccurate sending and continual fussing with the contacts in a vain attempt to keep them clean. With current they should almost never need any attention.

When the oscillator is working correctly by itself, connect it to the audio input of the transmitter for testing. Adjust the 100K pot to keep the output level down around that of the microphone or whatever other audio source is ordinarily used, to avoid overloading the amplifier stages in the transmitter. Do not count on the transmitters audio gain control to do the whole job.

With the transmitter on the air, measure the power output into the antenna with the oscillator held first in the *mark* position and then in the *space* condition with the teleprinter loop. The power outputs should be equal. The signal should sound like an RTTY signal on nearby receivers when they are arranged so as not to be overloaded. The signal can be "turned over" for the various bands by changing from upper to lower sideband on the transmitter. That's all there is to it. ■

OSCAR III [*from page 42*]

The most important signal measurement is the one taken when the satellite's signal is at *maximum* intensity. This will indicate the satellite's point of closest approach to the observer. Other important observations can be made at the time the signal is first heard on each pass, and when it fades out completely.

The OSCAR Association urges that time shown for OSCAR III observations be reported to the nearest second, and be given in GMT. Since computers will be used to evaluate this information, reports given in time other than GMT will lead to erroneous results. Times reported should be as exact as possible. A few seconds error in time can also lead to inaccurate results. Timing devices used for OSCAR III observations should be checked against a standard time station such as WWV, JJY, CHU, etc. Accurate time can also be obtained in many areas as a telephone service.

Propagation Observations

Another important result of the OSCAR I and II experiments was in the field of v.h.f. propagation. Most reports confirmed that the satellite's signal appeared and disappeared abruptly, and that the radio range was horizon-limited as propagation theory would indicate. However, there were several reports of the satellite's signal being received initially for several seconds, followed by a quick fadeout, then reappearance of the signal again. Similar reception was sometimes observed also as the satellite disappeared over the horizon at the end of a pass. This unusual reception was apparently due to some diffraction process in the atmosphere.

Several reports received from Alaska and South Africa confirmed that OSCAR I and II's signals could not be heard when aurora was present. Apparently the v.h.f. signals were prevented from reaching the earth by the dense ionization associated with auroral displays. The signals also appeared to be affected by ionospheric disturbances while passing over tropical regions, where some observers reported fluctuations in signal strength and gradual, rolling fades.

Some observers reported receiving signals from OSCAR I and II at distances considerably beyond the theoretical range of approximately 1400 miles. One observer reported hearing a signal when the satellite was 7000 miles away.

It is hoped that continuous observations can be made throughout the world of OSCAR III's beacon transmission in an effort to detect unusual propagation conditions. This might be the sort of activity that could best be handled by a radio club. Although it may be impractical to maintain round-the-clock monitoring for the entire period of satellite life (hopefully, estimated to be at least a month), it should be possible for a club to set up a 48-hour watch over a week-end. Not only is it important to record observations of unusual fading, or reception over unusual distances, but it is also important to record instances where the beacon signals *were not* heard when they should have been. Such reports could provide a clue to ionospheric disturbances and auroral activity.

A single-operator station may conduct propagation observations by using a continuous running receiver, tuned to the satellite's c.w. beacon on 145.95 mc, and coupled to a slow-speed tape recorder. The recording would serve as a permanent record of reception, and could turn up instances of unusual propagation conditions.

Clearing House for OSCAR Reports

This article has mentioned only a few of the experiments that can be performed by observing the signals that will be transmitted from the OSCAR III satellite. Additional experiments, some of a more advanced nature, appeared recently in a *QST* article on this subject.[5]

The OSCAR Association, Box 183, Sunnyvale, California, USA will serve as a clearing house for *all* reports dealing with the satellite. Reports of communications through the satellite, tracking reports, reports of signal reception, and the results of experiments should all be sent to the Association, where they will be evaluated. Reports can be sent directly to the Association by airmail, or through local OSCAR Coordinators,[6] or via amateur radio to W6EE. Reports sent via radio should be followed by written confirmation as soon as possible.

The Association points out that all reports should contain the latitude and longitude of the reporting station. If possible, the reports should also contain the following information; transmitter power, type of receiver, antenna used, including gain, polarization and radiation pattern, and altitude of station above sea level.

How To QSL OSCAR

All reports of OSCAR III reception, from the simple "I heard it!", to the most advanced experimental reports, will be verified 100% by the OSCAR Association with a distinctive QSL card. Nearly a thousand radio amateurs, observers and space-listeners throughout the world are the proud owners of OSCAR I and II QSL cards, and a large supply of the OSCAR III cards is expected to be on hand for distribution by the time the satellite is launched and reception reports begin pouring in at the OSCAR Association headquarters.

Radio amateurs communicating through the OSCAR III satellite will, of course, QSL each other directly. Space-listener's "reading the mail" on satellite QSOs should request QSL cards directly from the stations that they hear.

Philosophical Reflection

Two-way radio amateur communication via OSCAR III may open new fields of experimentation and answer scientific questions yet unposed. Radio amateurs are capable of fulfilling an im-

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[5]Gabrielson, "Experiments with Oscar III", *QST*, July, 1964.
[6]Jacobs, "Space Communications", *CQ*, May, 1964, page 60.

OSCAR III [*from page 97*]

portant role in this great adventure. Numbering over 350,000 scientific-minded, naturally curious individuals, radio amateurs have left their mark on the history of communications to date.

OSCAR III has been designed as a "free access" satellite.[2] All licensed radio amateurs world-wide will have access to the satellite on an equal basis, and to the information derived from the project. OSCAR III will enable radio amateurs and amateur space scientists in all countries to cooperate in a joint communication and experimentation program. It is hoped that the satellite will serve as a tool and a catalyst that will encourage participation in space communications by the younger generation in particular, who will be the engineering and scientific leaders of tomorrow. Self-education and advancement in this, the newest of sciences, is the philosophy of OSCAR III.

Time is of the essence. Lift-off is approaching rapidly! It may be just a few short days away by the time this article is read by overseas subscribers. To communicate through the satellite, or to conduct the experiments discussed in this article will require extensive preparation if they are to be successful. Get that equipment ready *NOW*. Don't miss out on this new adventure for amateur radio. Thrills and surprises will be in store for those who participate. *The* OSCAR III *satellite belongs to the world.* Devoted to the peaceful use of space, it may benefit not only the radio amateur and his country, but all of mankind as well. ■

Lafayette HA-350 [*from page 62*]

softer attack on recurrent words. This was accomplished by adding .2 mf across the s.s.b. time-constant capacitor, C_{65}, in the a.g.c. line.

No further difficulties were encountered with s.s.b. or c.w. The performance comments were based on the results made following the foregoing modifications.

Conclusion

If you're the type who likes to tinker, you may wish to add an s.s.b. i.f. noise limiter,[2] an accessory *Q*-multiplier for c.w. peaking or heterodyne-notching and a switching diode with appropriate capacitor for simultaneously shifting the v.f.o. 3 kc when sidebands are changed.

At any rate, you'll find the HA-350 surprisingly good and well worth the money. Considering today's advanced types of operation, this receiver might be hard to beat for the selling price of $189.50. It is marketed by Lafayette Radio Electronics, 111 Jericho Turnpike, Syosset, L.I., N.Y. Optional 100 kc calibrator crystal is $3.95. The mechanical filter used in the HA-350 is available as a separate item for $19.95. We'll give you a rundown on it next month. ■

[2] "IFNL, an S.S.B. I.F. Noise Limiter," *CQ*, June 1960, page 42.

Propagation [*from page 72*]

Time Zone: PST (24-hour Time)

WESTERN USA To:

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Western & Central Europe & North Africa	08-11 (1)	23-01 (1) 06-08 (1) 08-11 (2) 11-15 (1)	18-00 (1)	19-22 (1) 19-21 (1)†
Northern Europe & European USSR	07-10 (1)	23-01 (1) 06-07 (1) 07-09 (2) 09-12 (1)	18-23 (1)	20-23 (1)
Eastern Mediterranean & East Africa	*Nil*	07-12 (1) 19-21 (1)	18-21 (1)	*Nil*
West & Central Africa	07-08 (1) 08-10 (2) 10-13 (1)	06-10 (1) 10-13 (2) 13-15 (3) 15-16 (2) 16-18 (1)	18-22 (1)	19-21 (1) 19-21 (1)†
South Africa	09-11 (1)* 07-10 (1) 10-13 (2) 13-15 (1)	05-14 (1) 14-17 (2) 17-18 (1) 23-01 (1)	19-22 (1)	20-21 (1)
Central Asia	17-19 (1)	07-09 (1) 16-18 (1) 18-20 (2) 20-21 (1)	05-08 (1)	*Nil*
Southeast Asia	11-15 (1) 15-17 (2) 17-19 (1)	07-09 (1) 09-11 (2) 11-13 (1) 19-22 (1)	02-05 (1) 05-07 (2) 07-09 (1)	05-07 (1)
Far East	12-14 (1) 14-18 (2) 18-20 (1)	07-12 (1) 12-14 (2) 14-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-22 (1)	22-00 (1) 00-02 (2) 02-06 (3) 06-08 (2) 08-09 (1)	00-02 (1) 02-05 (2) 05-07 (1) 03-06 (1)†
Pacific Islands & New Zealand	15-17 (1)* 10-13 (1) 13-15 (2) 15-17 (4) 17-18 (2) 18-20 (1)	07-08 (1) 08-10 (2) 10-16 (1) 16-17 (2) 17-19 (4) 19-21 (2)	21-22 (1) 22-05 (3) 05-07 (2) 07-09 (1)	22-00 (1) 00-05 (2) 05-07 (1) 02-06 (1)†
Australasia	15-17 (1)* 13-17 (1) 17-19 (3) 19-20 (1)	07-08 (1) 08-10 (2) 10-17 (1) 17-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	00-03 (1) 03-05 (3) 05-07 (2) 07-08 (1)	02-03 (1) 03-05 (2) 05-07 (1) 04-06 (1)†
North & Central South America	10-14 (1)* 06-08 (1) 08-13 (2) 13-15 (3) 15-16 (2) 16-18 (1)	00-05 (1) 05-06 (2) 06-08 (3) 08-14 (2) 14-16 (3) 16-18 (4) 18-20 (3) 20-00 (2)	18-20 (1) 20-00 (3) 00-03 (2) 03-05 (1)	20-21 (1) 21-01 (2) 01-04 (1) 23-02 (1)†
Southern Brazil, Argentina, Chile & Uruguay	10-14 (1)* 06-08 (1) 08-10 (2) 10-12 (1) 12-13 (2) 13-15 (3) 15-16 (2) 16-18 (1)	05 07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-17 (3) 17-19 (2) 19-00 (1)	19-21 (1) 21-02 (2) 02-05 (1)	21-94 (1) 00-03 (1)†
McMurdo Sound, Antarctica	08-10 (1) 14-16 (1)	15-17 (1) 17-19 (3) 19-00 (1) 05-06 (1) 06 08 (2) 08-11 (1)	00-06 (1)	*Nil*

Contest Calendar [*from page 74*]

Detailed information about this one will be found in Louisa Sando, W5RZJ's YL column in the January issue.

CQ WW DX SSB

Starts: 1200 GMT Saturday, April 10
Ends: 2400 GMT Sunday, April 11

Full rules will appear in next month's issue. No rule changes anticipated but a clarification of the rest period might be in order.

It is not the intent of the rest period to handicap the operation of a station but rather to limit the operating time to 24 out of the 36 hour contest period. The 12 hours of non-operation can be taken in one or two periods, at the beginning, end or during the contest. The two period option need not be in two equal periods but any combination that will equal a minimum of 12 hours.

A few of the "hot shot" all banders did not want to be limited to 24 hours of operation but the majority of contestants were in favor of this rule.

Basically the rules in the SSB contest are the same as the WW DX contest, except that prefixes are used as a multiplier instead of Zones and Countries. Credit for a given prefix however may only be taken once during the contest, and *not* once on each band.

It is recommended that a separate check list of prefixes (as they are worked) be kept in addition to your log.

Incidentally, official log forms are available from *CQ* and a s.a.s.e. will fill your request. (In a pinch you can use your leftover WW DX sheets.)

Ed Note

We didn't do so good for the C.W. week-end, conditions were rather erratic, especially on 21 mc, and impossible on 28 mc. However I hesitate to predict that scores will be lower this year, a good contest station somehow always manages to come up with a good score. It was gratifying to hear the activity on 160 but the pickings were slim. (Except for W1BB)

It's too early at this writing to have much of a Claimed Scores list but the following few will give you an idea of the trend.

73 for now, Frank, W1WY

Shielded Ignitions [*from page 32*]

and got quite a jolt. A jolt from a 12 volt line? There must have been something else running on the line too. I happened to have the walkie talkie in my right hand and was gripping the cable with my left hand. The tighter I held the cables, the louder the noise. (Normally the tip of the walkie talkie antenna is used as a probe.) Obviously the low voltage lines were radiating. I shielded these lines and for the first time in years, I had no ignition noise!

During a recent trip to Los Angeles, I visited the Estes Engineering Co. in Gardena, California, to meet the designer of the shielded ignition kit. They make kits for anything that radiates: cars, boats, tractors, airplanes or scooters. The distributor is Webster Manufacturing, 317 Roebling Road, South San Francisco, California. ■

Space [*from page 77*]

The satellites which should be heard with the least difficulty are those which transmit C.W. beacon signals. These signals can usually be identified by their steady tone when the receiver's beat frequency oscillator (b.f.o.) is in the ON position. Telemetry signals may be somewhat more difficult to receive, since telemetry data, in most cases, is transmitted for brief periods upon command from the ground. Telemetry signals usually consist of two or more musical tones being transmitted at the same time, or in the case of the Russian COSMOS satellites, of a series of dots and dashes of different length.

Inclination and period data are included in the listing as a further aid in identifying satellites from which signals can be received. The inclination is the angle that the satellite's orbit makes with the equator. If a directional antenna is being used to receive satellite signals, the inclination data can be used for determining the direction from which the satellite's signal should be heard first. The satellite's period is the time it takes, in minutes, for the satellite to complete an orbit. By timing reception on successive orbits, it is often possible to identify the satellite.

Table I contains frequencies that are expected to be used on satellites that the United States plans to launch during 1965. The list is by no means complete, and some changes in frequency may be made before actual launch time. The list, however, can be used as a guide as new launches are announced.

73, George, W3ASK

RTTY [*from page 80*]

letins on RTTY by W1AW would serve only the RTTYers, few in number when compared to the single sidebanders, for example. This is true, if you only consider the number of amateurs who might *directly* use this particular service. If you stop to consider the numbers who could use this service *indirectly*, you will see our point. We are speaking now of the OBS system.

It has been suggested that the RTTY-OBS station send bulletins that have been mailed to all OBS stations. This is inconceivable to the RTTYer for two reasons: The important news would be stale, and the time-consuming punching of tapes by each and every RTTY-OBS station would be inefficient use of time available for amateur radio.

Look at it this way: If each OBS station could tape RTTY bulletins from W1AW, these tapes, and the corresponding page copy, would be *immediately* available for re-transmission on other frequencies and by other modes, such as by 'phone. This would be efficient use of time. The news would be "hot," and the overall effectiveness of the OBS system would be increased many times. We would surely have many more OBS stations as the result. W1AW would thusly serve a much greater number of amateurs than it does at present. 73, Bryon, W2JTP

Simple-Gen [*from page 30*]

band edge at zero on the dial by adjusting the trimmer across the tuning capacitor. Push the power supply at least one foot away from the receiver or you will pick up hum from the field of the transformer. Don't try to build the power supply on the same chassis. If you use batteries, use a Lantern type battery #941, Ray-O-Vac, and it will operate the filament a long time. Any small 45 volt battery will take care of the plate supply. Just don't get one of the tiny ones if you want it to last. Both of these batteries can be slipped into your hip pocket if you are crushed for weight boarding a plane. Have fun; I did! ■

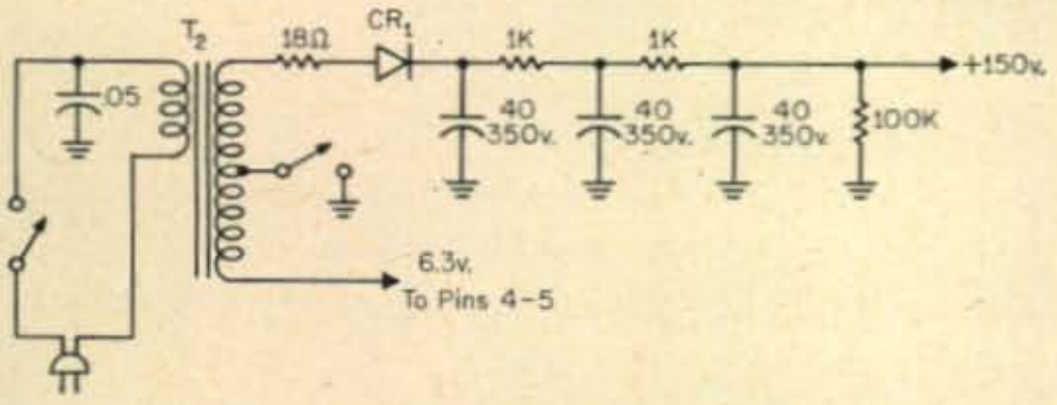

Fig. 2—Simple power supply used to power the 40 meter regenerative receiver. The power transformer provides 125 v.a.c. at 15 ma and 6.3 v.a.c. A Stancor PS-8415 or equivalent may be used. All capacitors are in mf and all resistors are one watt. The diode, CR_1, may be any unit with a 600 p.i.v. rating.

Homebrew Slot Antenna [*from page 26*]

If a third director is desired, cut it to 35¼" and space it 16" out from the second director. Of course, a longer boom is necessary here.

Fasten all elements, including the slot, to the booms with long screws through the boom and element, then a lock washer and wing nut. Tighten down enough to slightly compress the ⅜" tubing used for the elements. The spacing on assembly is determined by the slot element, and the entire structure becomes rigid when fastened to the mast with U clamps.

Feeding

Fed with RG-11 coax as specified, the s.w.r. is better than 1.2 to 1 even down on 143.46 mc, which is our MARS net frequency. The design frequency of this slot element is 145 mc, according to article, so it's quite frequency tolerant.

On comparison test with a three element beam I was formerly using, the average report was at least plus 3 db from the local crowd. The biggest surprise, however, came on reception. With the same equipment, fellows I could never copy before on our net came in loud and clear.

Considering the cost, which in my case was zero, since the aluminum was scrounged and I had the coax, I'd say that the British have done it again, by Jove. If you work two meters, and share my respect for British ingenuity, put up a slot and hear the difference. ■

Need A V.F.O. [*from page 25*]

Normally, a broad tuning range is not compatible with optimum performance.

After proper feedback is chosen, temperature compensation is accomplished by standard methods illustrated in amateur handbooks. With the unit shown, the author has achieved opera-

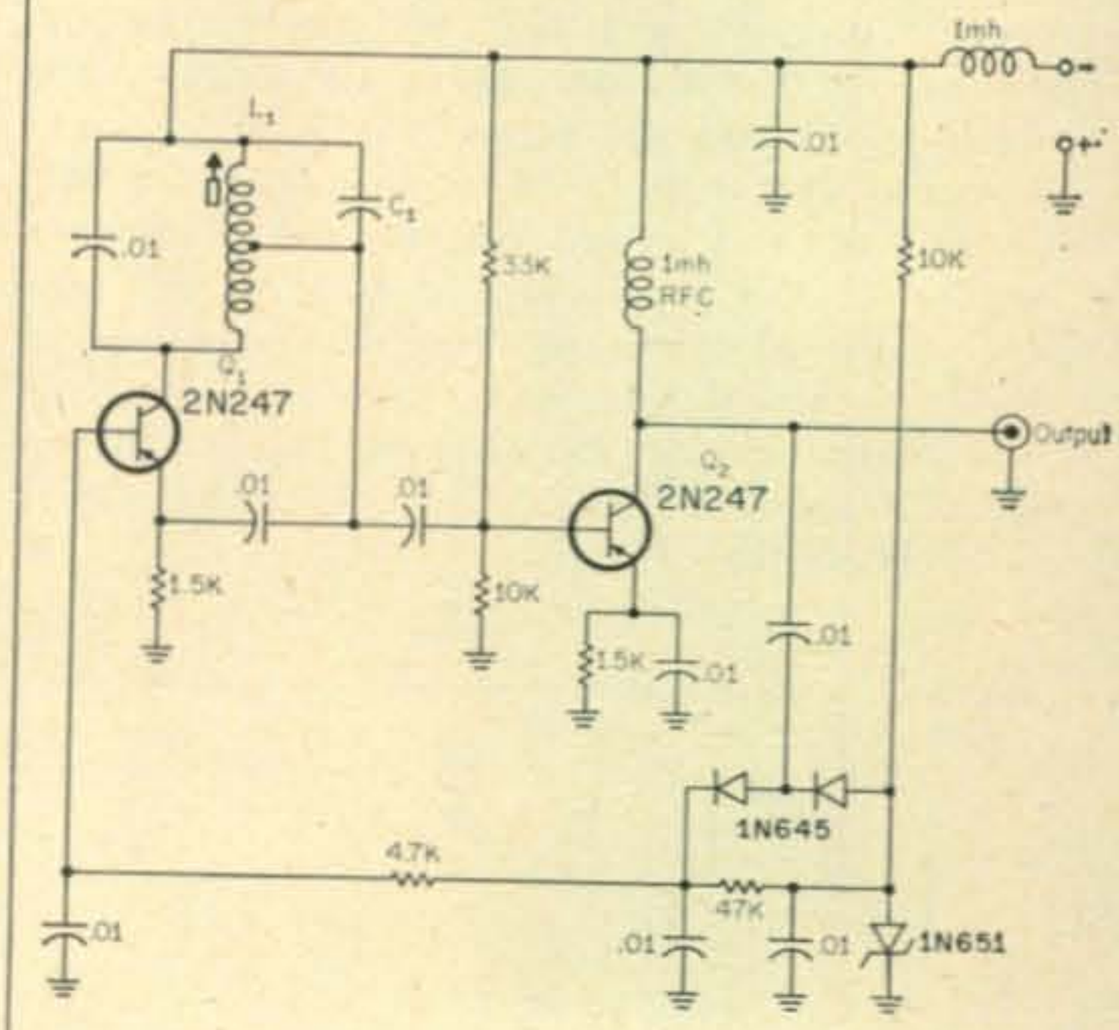

Fig. 2—Circuit of a stable transistorized v.f.o. As explained in the text and shown in fig. 1, the stability is controlled by the location of the tap on the oscillator coil, the value of C_1 and the value of the supply voltage. The mechanical construction methods, as always, are also important. More details are given in the text.

For further information, check number 44, on page 110

For further information, check number 45, on page 110

For further information, check number 46, on page 110

tion in a mobile transceiver that satisfies even the most critical operator.

The circuit shown in fig. 2 uses type 2N247 transistors. Although these work quite well, more expensive types in the oscillator, Q_1, that would produce higher gain, would require less drive signal from the feedback loop and would thus have less distortion.

The oscillator coil form used was made from a paper base phenolic material ½" in diameter and 3" long. The coil has 24 turns and is wound over 1" length, with the same length of the ¼" brass slug. The tap was located 6 turns from the cold end. Naturally, the size and material of the slug affects the tuning range and should be chosen by experiment. ■

Antenna Zoning [*from page 53*]

upon property. Since some towers are used as antennae this wording was accepted.

Free standing: Antenna not attached to a building.

Pre-existing: About 20% of the 156 hams in town had towers and some on temporary permits under the old ordinance. All were inspected and OK'd.

Heights:

16 ft. The maximum building codes would allow for safe roof structures including beam antennae.

21 ft. (A1) The average height for an 80 meter vertical antenna (No Beams) for roof structure. (A2) A safety measure for adjacent property for ground structures (towers) near lot lines.

45 ft. The average height for tower permits in the past was 40 ft. and 5 ft. was added for the antenna.

Obviously, the subject of zoning is too comprehensive to set-up one basic formula which would encompass all the conditions of every community. The above material represents no legal advice but merely is an attempt to clarify some of the mystery surrounding zoning and provides a basis for solving one of amateurs big problems at the local level. ■

Touch-Key Extension [*from page 59*]

circuit and Touch-Key relay connections, if your electronic key satisfies the following conditions:

(a) The common paddle connection is grounded.

(b) One of its straight key terminals is grounded.

(c) Touching the dot and dash connections together, *without* grounding, produces no action. This can be determined by trial.

If your key checks out on all points, return the Touch-Key output common line through the rear contact of the long-dash relay and ground the relay's movable arm, as indicated by the dotted lines in the schematic. This will disable the self-completing circuits during long-dash op-

eration, thus providing more exact control of dash length.

Circuit Connections and Operation

Note that the collectors of Q_3 and Q_4 in the Touch-Key are connected to the relay coils in the Relay Unit. The long-dash circuit can therefore be added to the relay section, without disturbing the Touch-Key itself in any way.

Referring to fig. 2, the bias developed across CR_1 improves the temperature stability of the transistor, Q_1. Resistors R_1 and R_2 may require slight adjustment to obtain best operation of the relay, but the two should be kept equal in value. Capacitor C_1 introduces a short time lag on relay closure, to prevent operation during possible "overlap" in dot-dash keying, which sometimes occurs. A small delay on relay opening, provided by C_2, was also found desirable.

The new relay may be set up similarly to those of the Touch-Key, except that contact spacing and spring tension can be greater, as really high speed operation is not a requirement. Further attention should be given to the rear contacts, if you plan to use them as suggested above.

For amateurs who are landline telegraph operators as well, here is an opportunity to try your electronic keys on the wire circuits, using the "other" code with its long-dash characters. ■

RTTY From A to Z [*from page 58*]

has probably already noticed from a comparison of their respective block diagrams. The first added dual stage (V_{3A} and V_{3B}) is an inverter stage. The second added dual stage (V_{4A} and V_{4B}) is a trigger and clamp stage. Original credit for this circuitry goes back to T. W. Groger, W7HJC.[12] This added circuitry in the W2JAV converter is perhaps the most important feature, which gives it the ability to copy on *mark only* or *space only*. This is a very desirable feature, almost a must in any modern terminal unit. The probability of losing both the *mark* and *space* signal at the same time in a crowded band is certainly not as great as losing one or the other at a time. With the ability to copy on one alone, you can lose first one and then the other and keep right on copying. The W2JAV converter has been, and still is, a popular converter. It is simple, inexpensive, and easy to build. It will copy shifts that are less than 850 cycles but with diminishing success as the shift is reduced.

Next month the author will cover in detail how these converters work, tracing the action all of the way through the respective converters. It is suggested that you read the original articles between now and next month, if they are available, since it will be discovered next month that we use a somewhat different approach from that of either of the original authors in covering this material.

[*To be continued*]

[12] *RTTY*, June, 1956, W6AEE.

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 25¢ per word. **Minimum Charge $1.00.** No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day of the second month preceding date of publication.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein.

FOR SALE—Clegg Zeus transmitter $475.; Clegg Interceptor Receiver $300; both for $750, or what do you have to trade. W1ZZF, 18 Fairview Ave., Trumbull, Conn.

ATTENTION HAMS! We buy, sell ham gear. Repair and alignment facilities available. Hold Advanced and First phone. Used gear always reconditioned. Money back guarantee. KitKraft Company, P.O. Box 406—Canal St. Station, New York N.Y. 10013.

FOR SALE Complete instructions including 28 page booklet and 22" × 36" schematic for converting the ART-13 transmitter to a.m. and s.s.b. Satisfaction guaranteed. $2.50. Sam Appleton, 501 No. Maxwell St., Tulia, Texas.

12 DB GAIN forward. 100 db front to back ratio. Our rhombic antenna is superior to any other antenna on the market. We challenge you to find an antenna on the market with as much forward gain. We do not guarantee good performace, just the best. Specifications: 2000 watts p.e.p. 600 ohms impedance, swr 1.3 to 1, low Q, easy to match. Complete with high tensil strength copper wire, insulators, and termination resistor. This is the same antenna used by telephone companies for overseas communication. Sold on a fifteen day money back guarantee. Exact frequency must be specified. Order now! 20 Meters $44.95, 15 Meters $37.95, 10 Meters $39.95. The Hilliard Laboratories, Box 2614, Macon, Georgia.

WANTED—AN APR-14, 13 receivers. SG-13, H-p4, SG-1, SG-2, MD-83, 479 Collins, in any condition. T-368-C xmtrs. R-390, 390A, R-388, 389, 391. Receivers. RT-66 thru 70 Rt units RT/77-GRC-9, GRC-10, GRC-19. RCA, Bendix, Collins Aircraft Radio and Radar Equip. Hewlett Packard, General Radio, Tektronix, etc., Test Equipment. GRC, PRC, GRR, TCC, ARC, sets. ARM, PRM, URM, UPM, URM, SG Test sets any and all types. You name it. Call E. Charol, Tech Systems Corp., 42 W. 15th Street, N. Y. 11, N. Y. CH 2-1949 Collect.

CENTRAL ELECTRONICS 10A W/QT-1 Harvey Wells TB5-50 W/v.f.o. Knight TV-FM Sweep Generator Heathkit impedance Bridge @ 1 kc ferris noise & field intensity meter 32A Wheatstone Bridge 1-49. Best offer Takes. Gordon Ostlund, 212 Market Street, Pocomoke City, Md.

BUY OF A LIFETIME for VHF homebrewers 100 Watts output up to 250mc. Type 5894 Tubes made by Amperex including Johnson recessed ceramic sockets $14.95 each. Ruggedized for mobile use. Brand new in original cartons. 1 yr. REPLACEMENT GUARANTEE shipped postpaid. Cash or M.O. WØFUV, Box 463, Troy, Ohio.

AR-22 OWNERS—know where your beam is pointing. Compass rose for your indicator calibrated 6° increments, $1.00 postpaid. WAØDGM, 2411-57th, Des Moines, Iowa.

CAPACITORS Clerinel 40 HFD 330 AC $5.95. Filament transformers Stancor 117/107 volts 60 cycles Secondary 6.3 volts CT @ 6.0 amps $3.95 all new postpaid. Goodman 5826 South Western, Chicago, Illinois 60636.

REMOTE CONTROL UNIT, brand new $5.00. Postpaid. (cost Navy $125.00) MDC, 923 W. Schiller, Phila. 40.

SURPLUS electronics technical manuals. Stamp for list. W3IHD, 4905 Roanne Drive, Washington WC, 20021.

WANTED: Commercial or Military, Airborne or Ground, Equipment and Testsets Collins, Bendix, others. We pay freight . . . RITCO Box 156, Annadale, Virginia.

FREE! BLUE BOOK LIST. WØGFQ offers you discounts on hundreds of reconditioned equipment bargains. 30S-1 (6 weeks old—like new) $1199.00; SX-140 $71.96; AF-67 $49.96; SR-160 $260.00; Warrior $196.00; NC-109 $89.10; HT-32 $254.40; RME-6900 $180.20; Cheyenne $49.18; HRO-50 $125.48; HT-41 $254.20; HQ-140X $125.00, and many more. Ask for our new, 1965 catalog. Write Leo Box 919, Council Bluffs, Iowa.

HELP WANTED—A young alert Radio Amateur who desires to combine his vocation with his avocation. Sales experience required. Advancement for the right man guaranteed. Apply—HARVEY RADIO CO., INC., 103 West 43rd Street, New York, N.Y.

TRADE, electronic, radio, television, high voltage experimental items, tubes, publications. Want good tape recorder, BC-458, transmitting equipment. Exchange lists. William C. Reichard, Netcong, New Jersey.

ELECTRONIC TUBES—TOP BRANDS SOLD at substantial savings! (Minimum Order $15.00). Authorized GE distributor. Send for FREE Buyers' Guide for all your Tube Requirements. Top Cash paid for your excess inventory (New Only—Commercial Quantities). Metropolitan Supply Corp., 443 Park Avenue South, New York, N.Y. 10016, 212-MU 6-2834.

FOR SALE: Back issues of QST and CQ. Large S.A.E. for list. Will swap. W2TAM, 140 Summit Ave., West Trenton, N.J. 08628.

ANTENNA tuning unit, brand new $3.00 postpaid (cost Navy $85.00). MDC, 923 W. Schiller, Phila., 40, Pa.

COLLINS 32S-1 xmtr $300; J. F. Young W5HXW, 1234 Glen Cove Richardson, Texas. Tel: 214-235-6927.

MIDLAND (TEXAS) Amateur Radio Club Annual St. Patrick's Day swapfest, March 21. This one will be the biggest ever. Swan 350 Grand Price—Contests—Examinations—Annual outstanding Amateur Aeard—Social Activities on Eve of March 20—Complete Dealer-Manufacturer Displays. Inquire 510 Midland Savings Building, Midland, Texas 79704.

RTTY Gear for sale. Write for list, 88 or 44 mhy torroids five for $1.75 postpaid. Elliott Buchanan W-6-VPC, 1067 Mandana Blvd., Oakland, Cal. 94610.

FOR SALE: Swan 240 and 110 volt power supply, $350. K3MHK, 338 Grandview Ave., Chambersburg, Pa., Phone 264-4547.

WANTED: May 1945 issue of CQ for CQ collection. Issue must be complete and in good condition. Contact the CQ editorial office with price and condition.

WANTED early issues of **QST.** 1922—Jan., Feb., Mar., 1921—all but May and July, 1920—all but April, May and June. K2EEK, **CQ,** 14 Vanderventer Ave., Port Washington, L.I., N.Y., 11050.

BOUND VOLUME 1964 **CQ** for sale. Order now and be sure to receive your copy. Limited quantity. First come first served. Send $15.00 to Dept. H.W. **CQ** Magazine, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

Lets Swap Club. Used Electronics, Mechanical, Misc. Items. Send list, stamp. CB equipment needed. Cabon 1510 S. Dunsmuir, Los Angeles, Cal.

WANTED: HEATHKIT SB-10. W3JAK, USNS Norwalk, FPO, New York.

COMPLETE KNIGHT AMATEUR Station for $180. Individual prices: T-60 xmtr $40; VFO $25; R100A rcvr w/spkr, xtal cal, S-meter $100; SWR meter $12; Grid Dip Meter $20. R. E. Davis, 10 Phelps Rd, Warehouse Pt., Conn 06088.

MECHANICAL FILTER WANTED, 800 cycles for 75A-4. W2DPP.

SELL: 75S-3B w/500 cycle mech. filter, 32S-3, 516F2, all as new condx, less than six months old, works $1200. Will deliver within 500 miles, or I pay shipping in continental U.S. G. Schoofs, WØIVY, P.O. Box 32, Silver Bay, Minn. Phone (218)226-4133.

RTTY or automation. Model 14KSR typing reperforator w/keyboard. No waiver. Fresh overhauled. Holding magnet selector, synchronous motor, 60 WMP $70. RO $60. Spare parts, 19 table. Need keytops. QTH Los Angeles area. John Alter, 5502 Elmbank Road, Palos Verdes Pens., Cal.

SALE NEW HG-303 xmtr. 75 watts 80-10 mtrs., and matching model V-10 DeLuxe vfo. Both for only $99.95. K2ZSY 3013 Valentine Ave. Bronx, NYC 212-SE-3-6152.

MODEL 26 RTTY printer and keyboard for sale complete with stand. Write for further details to Mark E. Ballard, 721 West Seventh St., Marion, Indiana. All inquiries answered.

FOR SALE: New Viking "Courier" linear amplifier, 500 watts, factory wired, $175. Bill Sasnett, Waxhaw, N.C.

ELMAC AF68 & FW ac-dc M1070 supply—$135. SX99—$85. All three $200. WRL 755A vfo—$23. AMECO 6 mtr nuvistor converter (BC output)—$30. All FB conds. Prefer pick up or you pay freight. W8FWB, Box 242, Dover, Ohio.

SALE: Apache, Mohawk, Warrior KW A-1 condx, firm at $475 you ship. WA2YQP, Robt. B. Cummings, R.D. #1 Rock Stream, N.Y.

RTTY GEAR for sale. Write for list 88 or 44 Mh Torolds. Five for $1.75, postpaid. Elliott Buchanan, W6VPC, 1067 Mandana Blvd. Oakland, California, 94610.

FOR SALE—Clegg Zeus transmitter $475.; Clegg Interceptor Receiver $300; both for $750. or what do you have to trade. W1ZZF, 18 Fairview Ave., Trumbull, Conn.

SELL: Heath HR-10 receiver, $50; Health HX-11 transmitter with three crystals $30; Both excellent. f.o.b. WA5FRL/6, 998 Benito Ct., Pacific Grove, Cal.

SAVE MONEY on new equipment. Still a few of our 1964 demonstrators left. Write for special low cash, no trade prices. Ed Judge Electronics, 1514 Pennsylvania, Fort Worth, Texas.

INTERESTING OFFERS! Ham's trading paper. 12 issues $1. Sample free. "Equipment Exchange Bulletin", Sycamore, Illinois.

SELL Comm. III, Mint Condx. 3 rocks, JT-30 mic, Beam, a.c., d.c. cords. $160, or HW-12, W5BLZ.

Waters Compreamp [*from page 44*]

conventional a.l.c., the effectiveness of the Compreamp alone was superior in all respects and even when excessive clipping was employed, the effects were not as detrimental as those resulting with a.l.c. carried to a similar excess. In addition, there is no pumping with the Compreamp.

In cases where the exciter used to drive a linear does not have provision for connecting external a.l.c. bias control from the linear, utilization of the Compreamp will allow maximum peak power to be consistently realized with absolutely no inherent flat topping of the r.f. amplifier, no matter how loudly one shouts into the mic.

A limitation imposed with the Compreamp is that if you're already kicking the final amplifier up to the maximum legal kilowatt limit as indicated by the plate-meter swing times the plate voltage, you'll have to back down on the gain a bit when the Compreamp is used, since its use does raise the average plate-meter swing. The effectiveness of the Compreamp may thus be slightly diminished, nevertheless a useful degree of improved talk power will still be obtained along with the prevention of flat topping. On the other hand, for the fellow with a 1 kw p.e.p. rig, the plate meter can be allowed to kick higher than normal (without exceeding peak power capabilities) and the overall result in average talk power can be equivalent to that obtained by the boys' running a normal legal 1 kw metered input (2 kw p.e.p.), but a needed precaution will be that the power supply and the amplifier tubes must be capable of handling the increased average power requirements.

Another useful feature of the device was that with the Compreamp level full on, one could wander around at a short distance away from the microphone and maintain a full speech level, yet prevent over-modulation when near the mic. This does away with the need for working at a fixed position close to the mic and thus makes it possible to minimize hissy and breathy sounds.

The Compreamp can be used very effectively with phone-patch operation to provide amplification of weak telephone voices and to make possible or to improve v.o.x. operation. Limiting of excessively strong speech, such as that of the station operator, will occur too. The Compreamp may be employed to advantage with other a.f. devices such as tape recorders and p.a. systems.

The Model 359 is packaged in a metal case 2¾" H., 3" W., 4½" D. A four-terminal screw-type connector strip is provided on the rear of the unit for input, output and push-to-talk circuits. A separate terminal lug is included for a chassis-ground connection which is recommended to minimize r.f. pickup. Two ⅜-inch diameter holes are provided on the rear panel to allow the user to conveniently add jacks or plugs if desired instead of making terminal connections. The self-contained battery is held by a large clip with a snap-on connector used for the battery leads, making battery replacement easy. Estimated battery life is 250 hours with normal operation. Nominal specifications are: Input impedance, 100K; Output impedance 50K; Voltage gain, 10 db; Operating input level, .005 to .02 v.; Output level, .06 v.

The Model 359 Compreamp is priced at $27.95 and is produced by Waters Manufacturing, Inc., Wayland, Mass. ■

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THE BEST HAM BUYS ARE AT HARVEY

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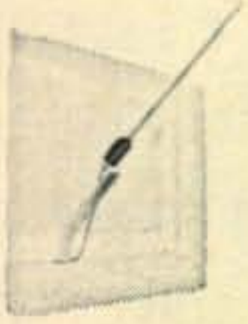
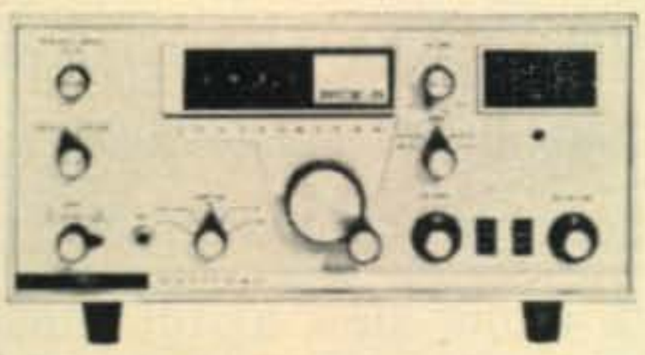
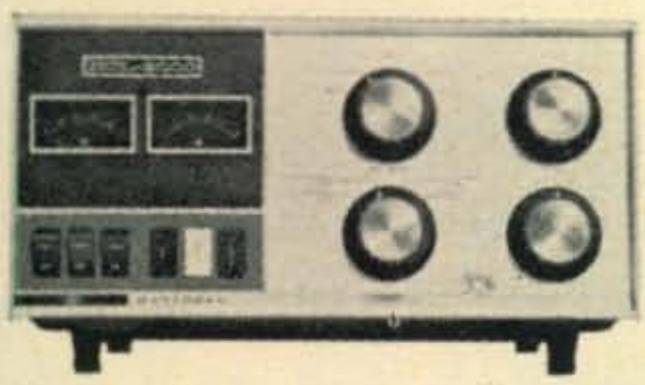
W 2AU SUPER 2 ELEMENT QUAD $44.95



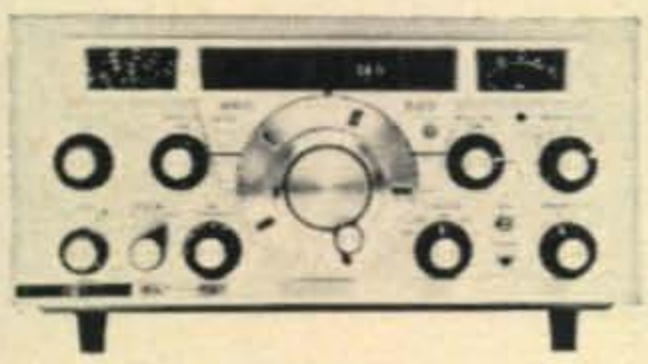
VERSATILE B & W "VACATIONER" PORTABLE ANTENNA
Designed as a highly efficient transmitting and receiving antenna for the travelling amateur. Can be installed and disassembled in minutes. Power rating — SSB, 300 watts input PEP; CW, 180 watts input: Frequency — 20, 15, 10, 6 and 2 meter amateur bands. Maximum extension, 57 inches; minimum, 18½ inches. Weight, 2 lbs. complete with coils and counter-poise.
"VACATIONER" PORTABLE ANTENNA, COMPLETE $19.95



NEW NCX-5 ALL-BAND TRANSCEIVER FROM NATIONAL
The new NCX-5 transceiver represents the finest money can buy at half the cost of closest comparable equipment. Designed as a total amateur station for the 80, 40, 20, 15 and 10 meter bands without compromise for either mobile or fixed station operation. Incorporates a linear solid state VFO with essentially no warmup drift. Dial calibration by means of a digital counter read-out accurate to one kilocycle on each band with additional calibration to 100 cycles. Mobile mount included. One-year warranty. Dimensions: 6¾″ x 13⅝″ x 11⅝″. Weight: 26 lbs.
NATIONAL NCX-5 ALL-BAND TRANSCEIVER $585.00



NEW NCL-2000 LINEAR AMPLIFIER FROM NATIONAL
National's new 2000 watt linear amplifier is desk-top dynamite. Every component in the NCL-2000 is rated for operation at a "DC" Kilowatt. Adding the NCL-2000 to your desk-top station permits you to run at the maximum power allowed by law. The two 8122 ceramic tetrode output tubes were designed specifically for SSB, and provide 800 watts of plate dissipation to assure conservative operation. Not only does the NCL-2000 deliver the power but it does it cleanly. One-year warranty. Dimensions: 7⅝″ x 16½″ x 12¾″. Weight: 62 lbs.
NATIONAL NCL-2000 LINEAR AMPLIFIER $585.00



NEW HRO-500 SOLID STATE RECEIVER FROM NATIONAL
The new HRO-500 receiver by National is the result of 30 years of "improvement of the breed." By all criteria the HRO-500 is extraordinary. In design, it is totally solid state with frequency determined by a phase-locked crystal synthesizer feeding a VFO-controlled tunable IF. Transistors make it extra reliable and compact. The HRO-500 may be operated anywhere — even from flashlight cells. Its frequency coverage encompasses the entire VLF through HF spectrum. It employs a turntable 6-pole filter to meet any selectivity requirement. If your specifications demand the finest amateur receiver obtainable, the National HRO-500 solid state should be your one choice. Dimensions: 7⅝″ x 16½″ x 12¾″. Weight: 32 lbs.
NATIONAL HRO-500 SOLID STATE RECEIVER $1295.00

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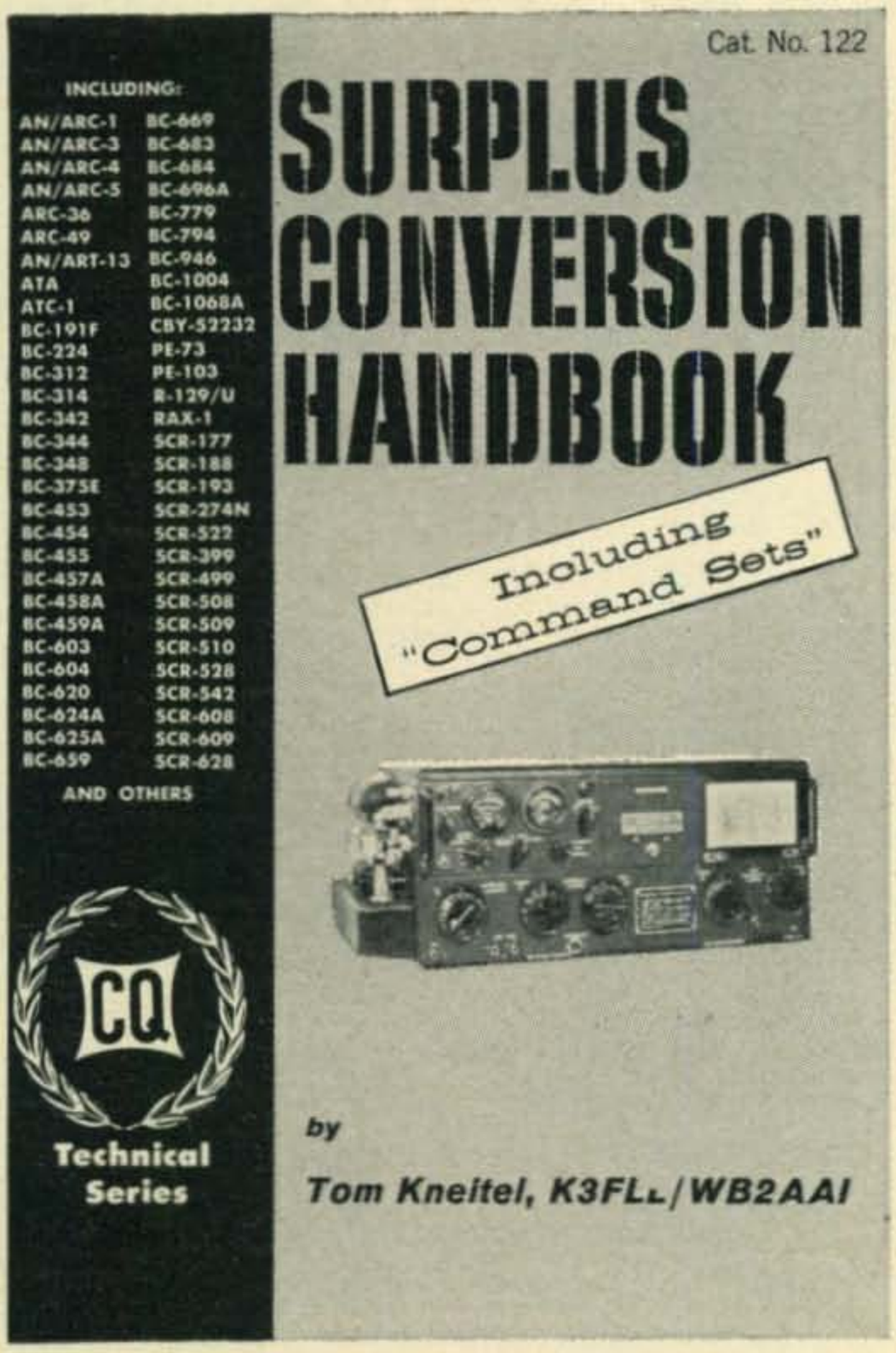
For further information, check number 33, on page 110

Our Most Popular Handbook



The most popular handbook ever to be presented in the CQ Technical Series was the venerable old "Command Sets." Countless signals on the air today are there because of the information contained in "Command Sets," which went on to become the standard reference guide and definitive work on the topic. It went through 5 sellout printings, and when the last book of the final printing was stripped from our stock room we decided that the next printing would be an even bigger, newer, expanded, revitalized version of "Command Sets."

Our new book is called "Surplus Conversion Handbook," it's 192 pages BIG (that's 58 pages more than its predecessor). We kicked out all of the space-taking ads which cluttered up the old book and replaced them with more conversions—conversions of surplus gear other than just "command sets" alone. So the new book contains all of the best command set conversions of the original edition, plus complete conversion details on a whole slew of the most popular military surplus gear available today, including such winners as: SCR-522, ART-13, BC-603, BC-620, BC-624, BC-659, BC779, ARC-1, ARC-3, ARC-4, and many more. Actually, it covers just about every piece of surplus gear which is worth the time and effort to convert for ham use.

"Surplus Conversion Handbook," Edited by Tom Kneitel, K3FLL/WB2AAI, is a book which every ham will find to be a valuable and interesting addition to the shack. It's available for immediate delivery.

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

NATIONAL RADIO COMPANY, INC. 37 WASHINGTON STREET, MELROSE, MASS. 02176

World Wide Export Sales: Auriema International Group, 85 Broad St., N. Y. C.; Canada: Tri-Tel Assoc., 81 Sheppard Ave. W., Willowdale, Ont.

For further information, check number 3, on page 110

RCA VoltOhmyst® Kit WV-77E (K) The high-quality VoltOhmyst® at a low price. In addition to the popular VoltOhmyst features it includes: Separate 1.5-volt rms and 4-volt peak-to-peak scales for accurate measurements at low AC voltages. Measures AC and DC voltages to 1500 volts, resistances from 0.2 ohm to 1,000 megohms. Complete with ultra-slim probes, long flexible leads. Only $29.95* (Factory-wired, calibrated, $46.95*).

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