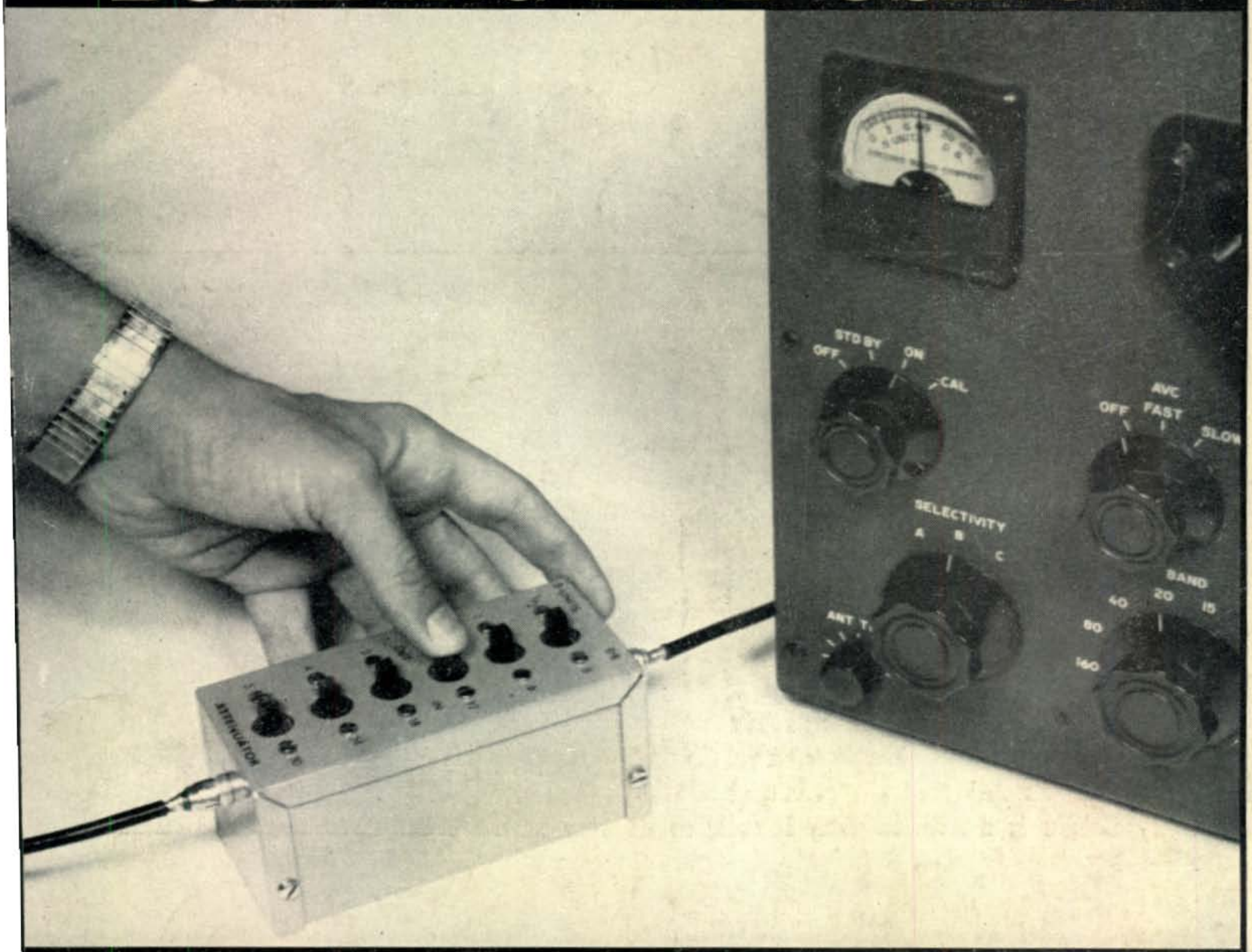
October 1964
50¢

CQ

In This Issue:

- The OSCAR III Story
- A Two-Band SSB Transceiver
- RTTY A to Z, part III
- The Ups and Downs of Pole Tracking

BUILDING AND USING

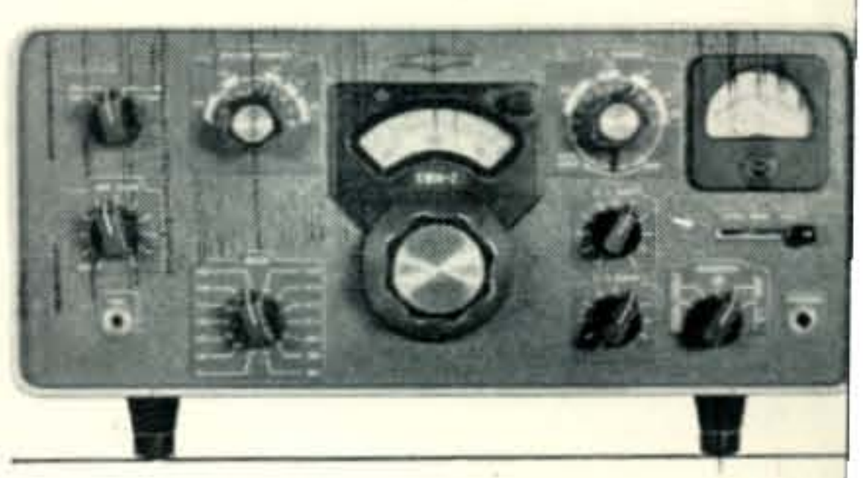


THE STEP ATTENUATOR

The Radio Amateur's Journal

COST
C!OST
COST
C!O!S!T!
COST
COST!!!!!!!!!!!!!!!!!!

Why is it the most expensive is often the most economical? A paradox? □ No! □ First, with any purchase, and especially with ham equipment, you want self-satisfaction. Next, you want a good investment. □ *What better satisfaction* than to know you have the finest. When you purchase Collins you get such features as complete station compatibility; frequency stability; frequency calibration; more QSO's per kilocycle; mechanical filters; dual or single PTO control; automatic load control; negative RF feedback; light weight; simplicity and styling. And Collins is still the only equipment which has all ten of these features — and is still unexcelled in any of them. □ *What better investment* can you have than in Collins equipment — proven over the years by such famous units as the 32V series, the 75A series, the S/Line — and in the end costing less than the lower-priced units. Collins is interested in protecting your investment by not introducing new models and styles every year or so just to stimulate sales. □ As one of our customers told us, "You can't afford to buy less than Collins." See your Collins dealer. Ask for a demonstration. Then you'll know why Collins is the finest. Why it costs so little to own.



COLLINS

For further information, check number 3, on page 110

Many Thousands of Famous PR Crystals In Popular Frequencies Are Always In Stock, Ready for Immediate Shipment

AMATEUR TYPES

FUNDAMENTAL, PR TYPE Z-2—Frequency Ranges in Kcs.: 3,500 to 4,000 (80-M); 7,000 to 7,425 (40M); 8,000 to 8,-222 (2M); 8,334 to 9,000 (6M) ± 500 Cycles . . . $2.95 Net

(All Z-2 Crystals calibrated with a load capacity of 32 mmfd.)

Third Overtone, PR Type Z-9A, 24,000 to 24,666 and 25,000 to 27,000 Kc., ± 3 Kc. . .$3.95 Net

6 Meters, Fifth Overtone, PR Type Z-9A, 50 to 54 Mc., ± 15 Kc..... $4.95 Net

Citizens Band, PR Type Z-9R .005% .....$2.95 Net

ORDER FROM YOUR JOBBER

Here is one section of the Stock Room where finished PR Crystals are kept. There are hundreds of crystals in each drawer, and hundreds of drawers in the room. PRs in popular frequencies can usually be supplied immediately out of this stock. Your jobber has a supply of PR Crystals. If he cannot furnish the exact frequency you want, he can get it in a hurry from the factory.

Since 1934, amateurs everywhere have applauded the fine dependability, activity, high output, economical operation and hair-line accuracy of PR Crystals. Get PRs now for your rig, and you'll have the finest precision frequency control that money can buy!

PR Crystals

Since PR 1934

USE PR AND KNOW WHERE YOU ARE

PETERSEN RADIO COMPANY, INC.
COUNCIL BLUFFS, U.S.A.

For further information, check number 1, on page 110

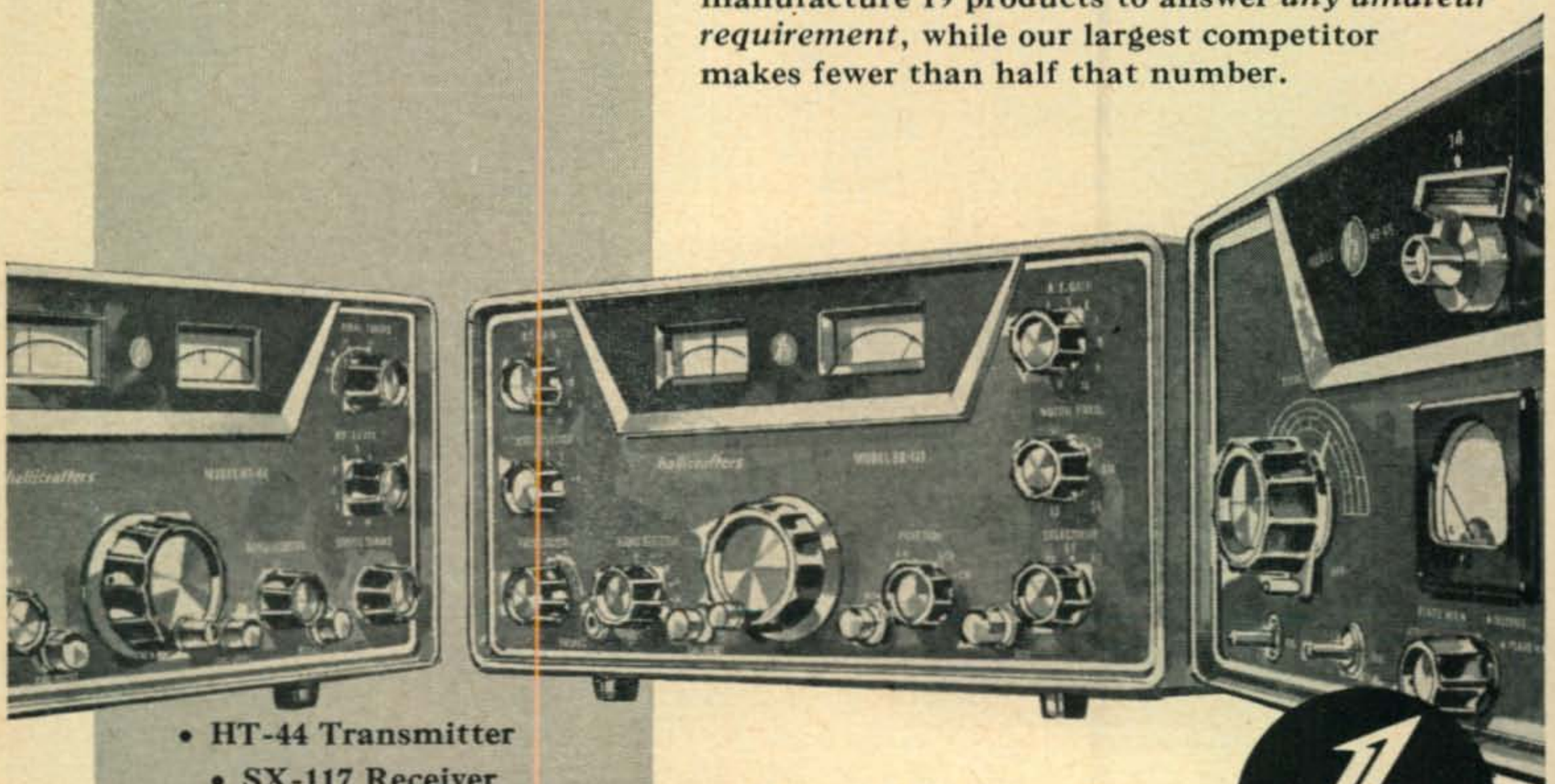
When you're No. 1, you have to try *twice* as hard

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.

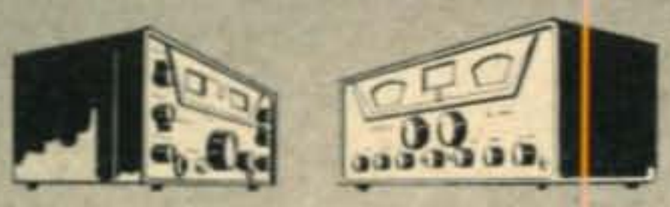
In 1933, we had less than a dozen competitors. In 1964 we have over two dozen (at last count). Naturally, they all want to be the leader.

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**

"Quality through Craftsmanship"

hallicrafters

5th & Kostner Aves., Chicago, Ill. 60624

P.S. We'll send you complete specifications twice as fast, too!

For further information, check number 2, on page 110

CQ

The Radio Amateur's Journal

Vol. 20, No. 10 Oct., 1964

OFFICES

14 Vanderventer Avenue
Port Washington, L.I., N.Y. 11050
Telephone: 516 PO 7-9080

CQ—(Title registered U. S. Post Office) is published monthly by Cowan Publishing Corp. Second class postage paid at Port Washington and Garden City, New York. Subscription Prices: U.S.A., Canada and Mexico, one year, $5.00; two years, $9.00; three years, $13.00. Pan-American and foreign add one dollar per year. CQ does not assume responsibility for unsolicited manuscripts. Please allow six weeks for change of address. Printed in the United States of America.

Table of Contents

Departments

Thinking about going to SSB?

. . . if you own a Viking "Valiant", "Valiant II" or "Five Hundred" . . . here's a deal for you!

LOW PRICE OFFER EXTENDED . . . DUE TO POPULAR DEMAND!

If you own a Viking "Valiant", "Valiant II" or "Five Hundred" – then here's your chance to go to Single Sideband at a tremendous saving! All authorized Johnson Amateur Equipment Distributors have $100 certificates, which when validated by him, may be applied against the purchase price of a new Viking "SSB Adapter".

Save $100 by going to SSB now!

SAVE $100.00 NOW!

Certificates are available only through your authorized Johnson Amateur Equipment Distributor. See him soon and save $100.00 by going to SSB now!

SSB ADAPTER – Popular, filter-type SSB generator – bandswitching 80 through 10 meters – more than 50 db sideband suppression. Features built-in multiplier requiring VFO input only – design and front panel controls make operating practically foolproof! Superb audio fidelity and balanced audio response. Other features: positive VOX and anti-trip circuits with built-in anti-trip matching transformer and adjustable VOX time delay. With remote power supply, tubes and crystal filter, less microphone.

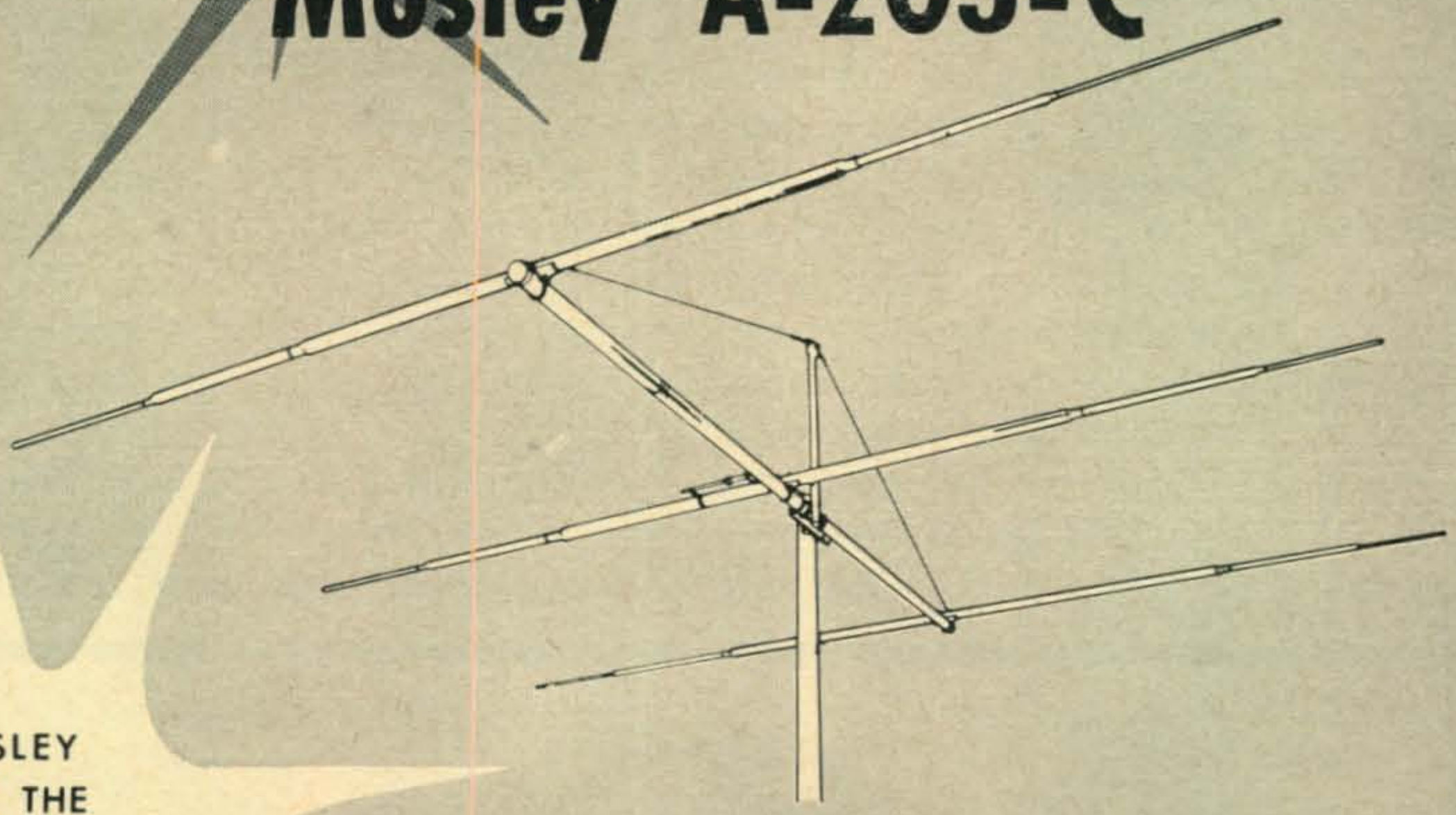
Cat. No. 240-305-2 . . . Wired, tested . . . . . **Net $369.50**

(WITH CERTIFICATE: $269.50)

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

For further information, check number 4, on page 110

NEW ..... for 20 meter operation
Mosley A-203-C

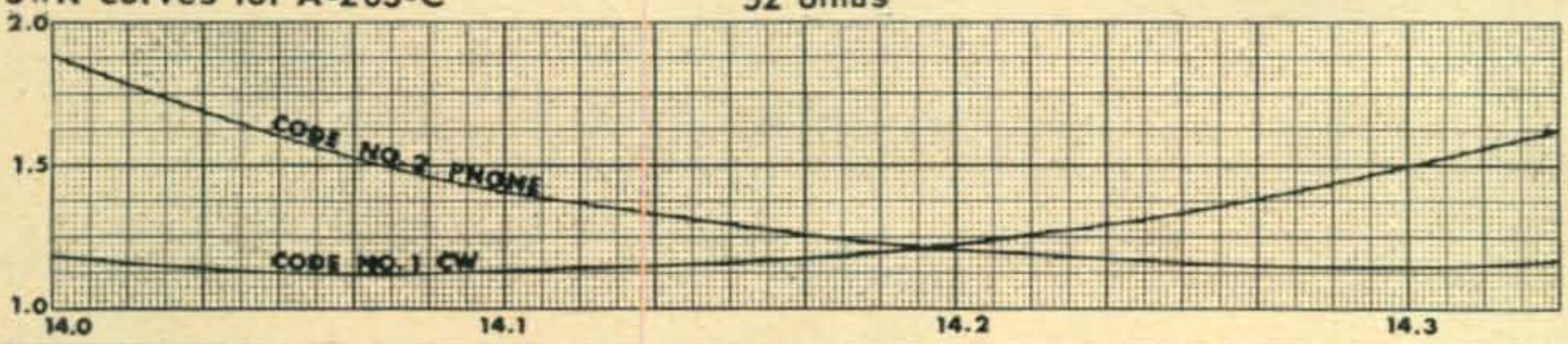


MOSLEY HAS THE OUTSTANDING THREE ELEMENT ARRAY FOR TWENTY METER DX OPERATION.

The new clean-line A-203-C will give you that DX punch that will over-ride QRM. The A-203-C is a three element twenty meter beam using swaged tubing elements to give this antenna rugged durability. The antenna has a special new type element design that virtually eliminates element flutter and boom vibration. A-203-C is a wide spaced, gamma matched, full size beam that every ham needs for the tough competition enforced by the present conditions on the DX bands. This antenna will equal the performance of many four to six element beams without the headaches of large size and heavy weight necessary for these big beams.

- *GAIN (8 db. or better) (F/B 24 db.)*
- *HANDLES MAXIMUM LEGAL POWER*
- *BOOM LENGTH 24 ft.*
- *MAXIMUM ELEMENT LENGTH 37 ft.*
- *TURNING RADIUS 22 ft.*
- *WIND LOAD (80 mph wind) – 140 lbs.*
- *ASSEMBLED WEIGHT 40 lbs.*
- *SHIPPING WEIGHT 49½ lbs.*

SWR curves for A-203-C 52 ohms



MOSLEY ELECTRONICS INC. 4610 N. LINDBERGH BLVD. – BRIDGETON MO. 63044

For further information, check number 6, on page 110

ZERO BIAS

ONE of the most important results (from the ham's point of view) of the nomination of Senator Barry Goldwater for President is the enormous publicity being received by amateur radio. Hardly a day goes by when at least one mention is not made in the local newspaper or on radio/TV newscasts of the Senator's ham activities. Publicity of this level and in such depth is priceless and will probably do more to improve the stature of amateur radio in the eyes of the general public than nearly any other single event. Regardless of the political beliefs of an individual, the fact that a major contender for the Presidency of the United States makes hamming a major part of his personal life cannot help but enhance the image of every amateur.

But as pleasant a benefit as it may be, the great publicity also throws a bit more responsibility on each of our shoulders, to try to live up to the flattering image that has been created. Many years may pass before we once again fall into such a brilliant spotlight, so let us use it well while we may.

Try to remember, now, more than ever before, to put forward your best personality and charm when dealing with the local populace on interference or antenna problems. You have been given an edge on your public relations problem by a simple political turn of events. Make good use of it.

National Convention

The ARRL National Convention held August 21-23 here in rotten old New York proved to be a huge success both for the sponsoring Hudson Amateur Radio Council (HARC) and for all of us here at *CQ*. Attendance at the exhibits was encouraging to say the least, with hams by the hundreds stopping by the *CQ* booth just to shake hands and say hello.

On the whole, the convention ran in a very reserved and dignified way, befitting the lavish surroundings of the New York Hilton hotel and the distinguished guest speaker at the convention banquet, Senator Barry Goldwater. But the surroundings and celebrities present couldn't dull the enthusiasm of the thousands of conventioneers. All in all, it was as pleasant a convention weekend as we've had in a long time.

Unclaimed Awards

Our appeal in the August issue for information concerning the whereabouts of several award-winning amateurs has brought them unexpectedly large response. Through the kind efforts of readers, we have been able to locate nearly half the amateurs mentioned on page 68 of the August issue. Certificates are now on their way to their deserving owners, a bit delayed, to be sure, but on their way. Thanks.

Lasers

Speaking of reader response, we'd just like to pat ourselves on the back and say that the response to Stan Leinwoll's "LASERS" article in August and September has been just short of fantastic. Honestly, though, we had no idea that amateurs were so hungry for information on this fascinating new field. In response to reader requests, we will have, in the future, articles dealing with the construction of an operating gas LASER from readily available components. Watch for it.

November Issue

Just in case you're not already a subscriber to *CQ*—if you've been content to take your chances on finding *CQ* on the newsstand each month—a word to the wise: Next month's issue is likely to be hard to come by. Why? Because it will be about the fullest issue of *CQ* in many a year, with more solid feature articles and more good ham-type reading than you've ever gotten before in one magazine. It's sure to be an early sell-out. If it sounds like we're blowing our own horn, we are . . . we *know* it's going to be good!

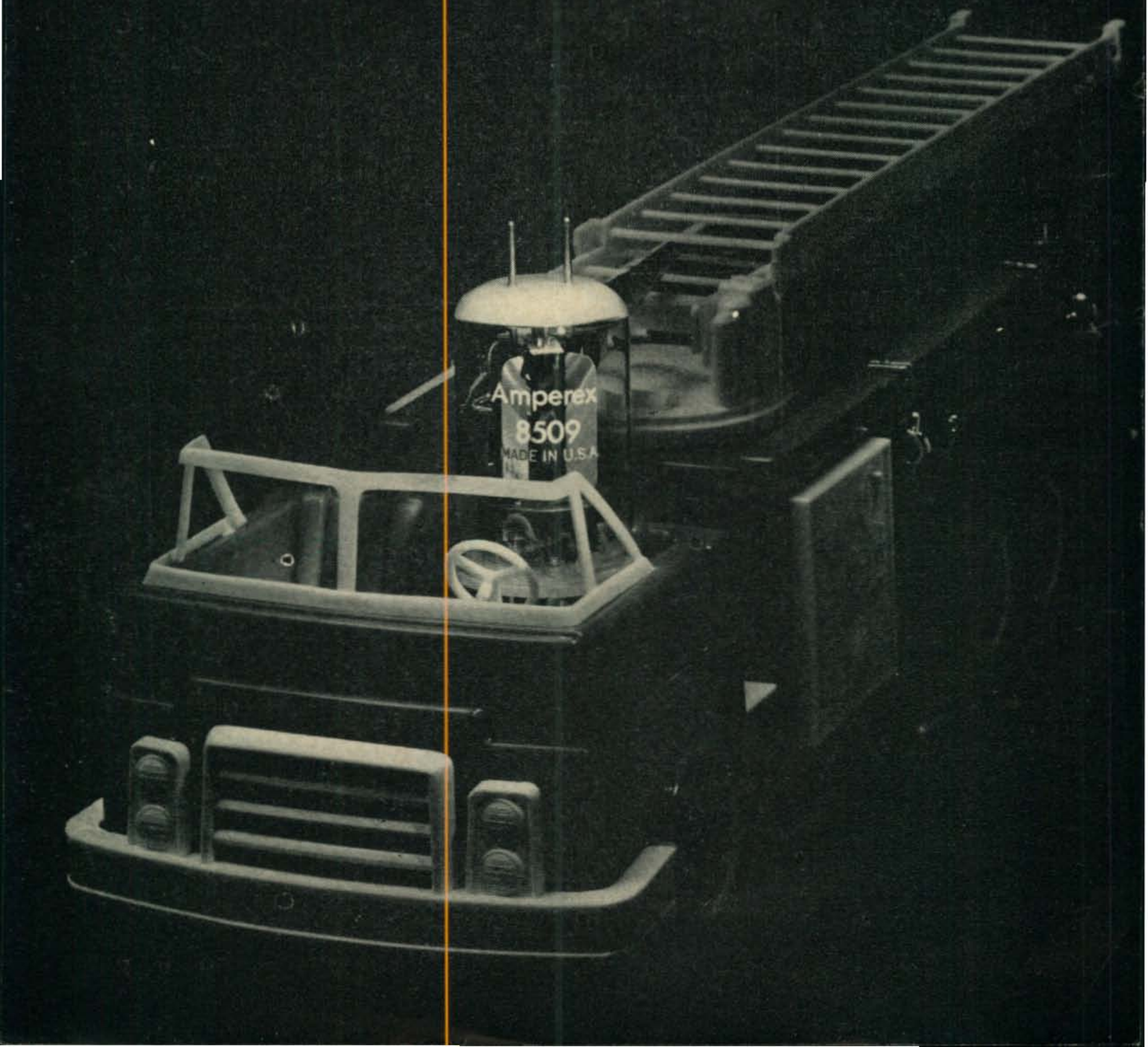
Miscellaneous

Another tragedy struck the popular Harvey Radio Co. in New York recently. Close on the heels of founder Harvey Sampson's death in July, ham department manager George Zarin, W2DIO, died at the age of 52 on August 12. George will be remembered for his courteous service and helpful guidance during his 20-year tenure at Harvey. Licensed in 1920, George was an active amateur. He is survived by his wife and two children.

Don't forget the *CQ* World Wide DX Contest coming up on the weekends of Oct. 24-25 (phone) and Nov. 28-29 (c.w.) Rule sheets, logs, and summary sheets are available from *CQ* for an s.a.s.e. Complete rules appeared in *CQ* for September.

73, Dick, K2MGA

...and for Mobile Communications Equipment with greater power in a smaller package, there's the new Amperex 8509, instant-heating version of the renowned 5894



Take the Amperex 5894, a twin tetrode widely recognized by communications equipment designers and end-product users alike for its overall superiority. Take the Amperex instant-heating Harp Cathode, the same Harp Cathode that is now proving its exceptional qualities in the rapidly growing Amperex family of instant heating communication tubes. Put the two together and the advantages to designers of transistorized communications equipment—whether its back-pack or land safety—are unbeatable.

Like the famous 5894, the new 8509 is designed for use as an RF power amplifier, oscillator, modulator and frequency multiplier. It features high-gain, unfailing uniformity and extreme reliability.

Unlike the 5894, however, and thanks to its Harp Cathode, the 8509 has an operational warm-up time of only 0.5 second thus insuring an ideal marriage with transistorized circuitry, and the reduction of battery power supply-size without sacrificing either power output or equipment efficiency.

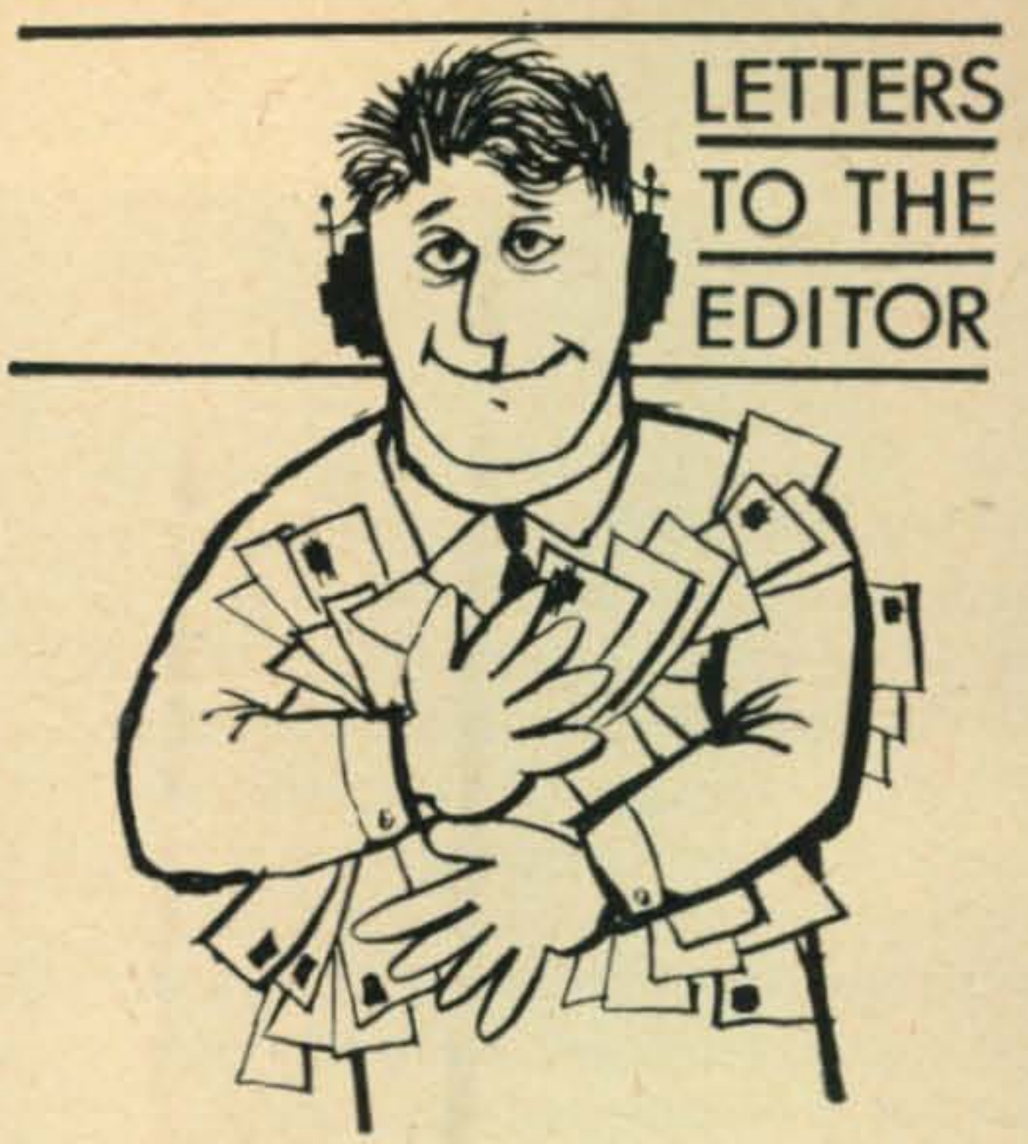
Under Typical Class C Telegraphy ICAS operation as a Push-Pull RF Power Amplifier, the 8509 will deliver a Power Output of 96 watts at 250 mc. At reduced ratings the tube may be operated up to 500 mc.

For complete data on the new 8509 and other Amperex instant-heating communication tubes for mobile applications, write: Amperex Electronic Corporation, Tube Division, Hicksville, Long Island, New York 11802.

Amperex®

IN CANADA: PHILIPS ELECTRON DEVICES LTD., TORONTO 17, ONT.

For further information, check number 9, on page 110



We're In The Middle

Editor, *CQ:*

At long last I am giving in and now include a check for a year's subscription to *CQ*. Please start it with the August issue. I have been buying it at Radio Supplies so I may as well have it sent direct.

I have been receiving *73* and of course *QST*, one extreme to the other. I hope that *CQ* will sort of take a stand in the middle and not be influenced by either unless it's for the good of amateur radio.

Alfred G. Smith, WA2TAQ
504 Beach 43d Street
Far Rockaway, N. Y.

Al, we feel that all too much damage is being done to amateur radio by the extremists in our ranks. It is our intention to lend a moderate and impartial voice to amateur politics, criticizing when criticism is necessary and supporting when support is warranted. Thus, we hope to help mend some of the painful wounds afflicting our hobby.—K2MGA

Just An Old Timer

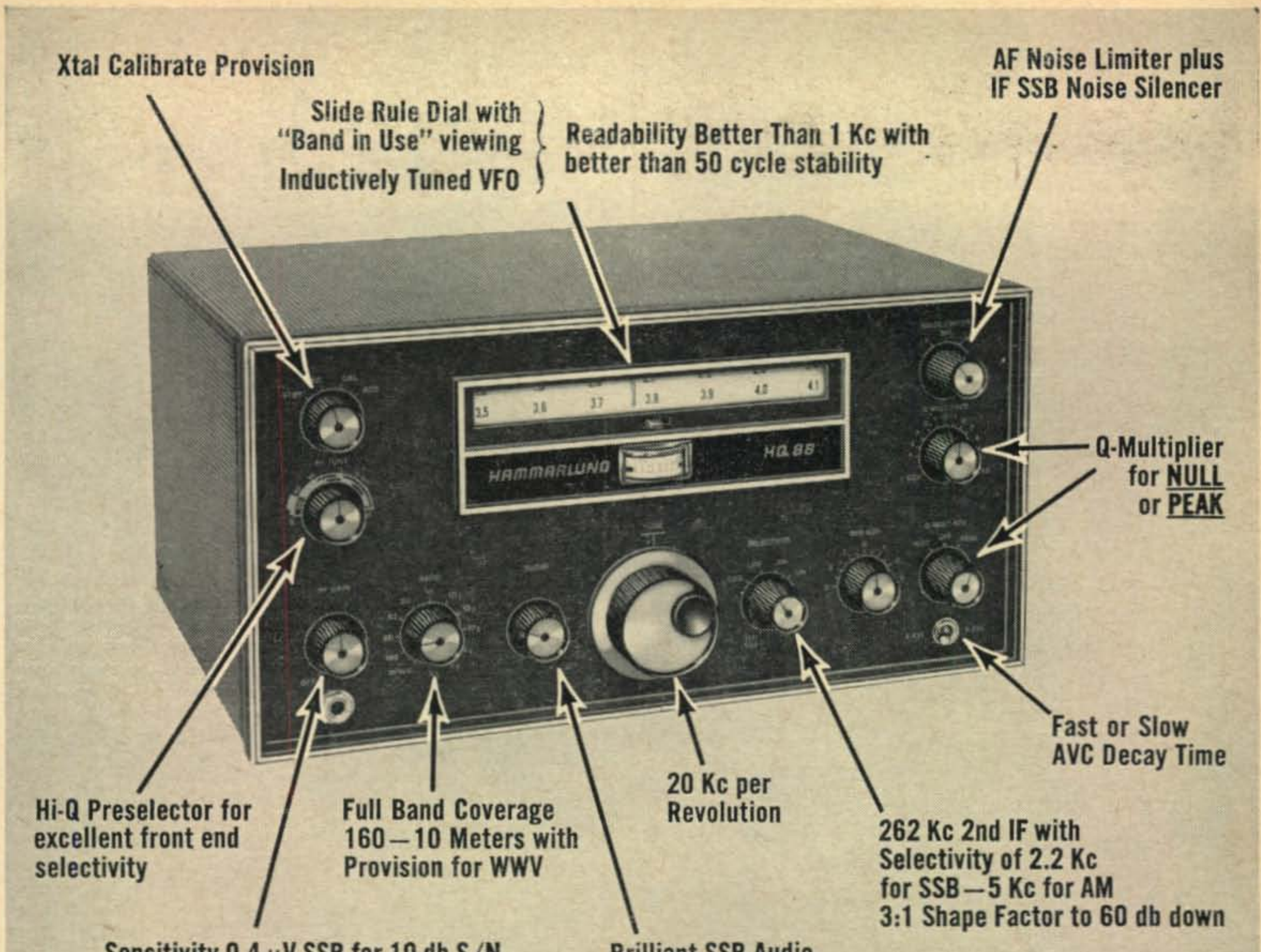
Editor, *CQ:*

I suppose WA2GMG's letter to the editor [LETTERS, Aug. '64] ought to be answered before *CQ* starts publishing just crystal set circuits.

The '6BLZ Special was built with only a grid-dip meter and a calibrated 400 mmf condenser all of which were built from picture drawings in *Popular Electronics*. You would be surprised at what you can build with just simple test equipment if you make one part of the circuit work before going on to the next. First, you must be interested enough to just try! W6BLZ doesn't have any EE degree, he is just an Old Timer that likes to build more than yakking on the air. This comes about after listening to operators who have bought all of their gear and don't see the need for key click filters. It is also too hard to find an operating frequency that doesn't have ten stations on it or one that isn't "owned" by somebody telling you to get off, it's occupied.

The young fellows today don't know what it is like to get down on the kitchen floor and file out tube socket holes in steel chassis with a rat-tail file. Those of us who started in the depression days must have had a real interest to pound out old Packard hoods to get an aluminum panel. Then there was double spacing a BC condenser to make a transmitting one, or rewinding a "B eliminator" transformer to get a filament voltage. Instead of surplus filter condensers we had to take the condensers from eliminators, series them, put them in a coffee can and pour wax on them for a filter. I could go on, but, oh well, who would listen.

➤ For further information, check number 10, on page 110



Here's why!

the **ALL NEW** HAMMARLUND HQ-88

has created a new set of performance standards for Hi-Stability receivers

FEATURES: ■ Separate diode AM detector and SSB Product Detector ■ Accessory Socket ■ Coax Input ■ 3.2 and 500 ohm audio output ■ Dimensions: 15" W x 7¾" H x 10½" D.

$299.00

Thermal drift on the "88" is rated at no more than 50 cycles after warmup. See and test this high stability receiver at your nearest Hammarlund Distributor *Today!*

HAMMARLUND MANUFACTURING COMPANY
A GIANNINI SCIENTIFIC COMPANY
53 West 23rd Street, New York 10, New York

For further information, check number 11, on page 110

All I can tell Pete is to cheer-up, perhaps in the brave new world that's coming, you can go into a ham store and buy your IBM QSO card and plug it in the rig so you won't have to ta]k. Nuff sed!

E. H. Marriner, W6BLZ
528 Colima Street
La Jolla, California

More Info for SWL's

Editor, *CQ:*

I have noted with much interest the letter from Miss Judy Hunnicutt, Secretary to the Director of Engineering of KOA TV/Radio, Denver concerning QSL requests.

Our experience here at Radio Canada is very similar to that described by Miss Hunnicutt. This year, we shall probably process about 10,000 requests for our QSL card. Of these, about 35 per cent will be refused due to one or more errors or omissions in the reception report.

So far as Radio Canada is concerned, reception reports must contain the following before they will win our QSL card. First—time of reception, second—date of reception and third—frequency (or wave length). Programming details must also be included in the report for checking against our station logs. Incidently, it is surprising the number of reception reports which do not identify the time zone used. If GMT is used, it should be stated in the report. If local time is used, then it too should be so indicated.

For most radio stations, standard band or shortwave, the QSL operation represents a large investment in man-hours and finance. We at Radio Canada are happy to assume this operational burden as we believe that an accurate reception report should be answered with some token of the station's appreciation. However, we do not appreciate incomplete or inaccurate reports and neither do we appreciate reports which are six or seven weeks old.

One source of discontent so far as the s.w.l. is concerned is the time taken for some stations to send their QSL card in answer to a reception report. The audience relations or engineering department, either of which normally handles QSL's in a radio station has a certain number of people working on this part of the station's activity. It is not always possible for the department concerned to send out a QSL within seven or fourteen days after receiving the request. This depends upon vacation periods, sickness, or priority work and so on. However, I am sure that the majority of radio stations do their best to send out QSL's as quickly as possible—and this, of course, includes Radio Canada.

Incidently, the "Radio Canada Shortwave Club" which is on the air every Saturday at 6 P.M. EST on 9625 kc for listeners in the United States, very often advises members and listeners how to properly apply for a QSL and what radio stations look for in a properly prepared reception report.

S.B. Duke, Supervisor
of Engineering Services
International Service
Canadian Broadcasting Corp.
P. O. Box 6000
Montreal, Canada

DXing From G-Land

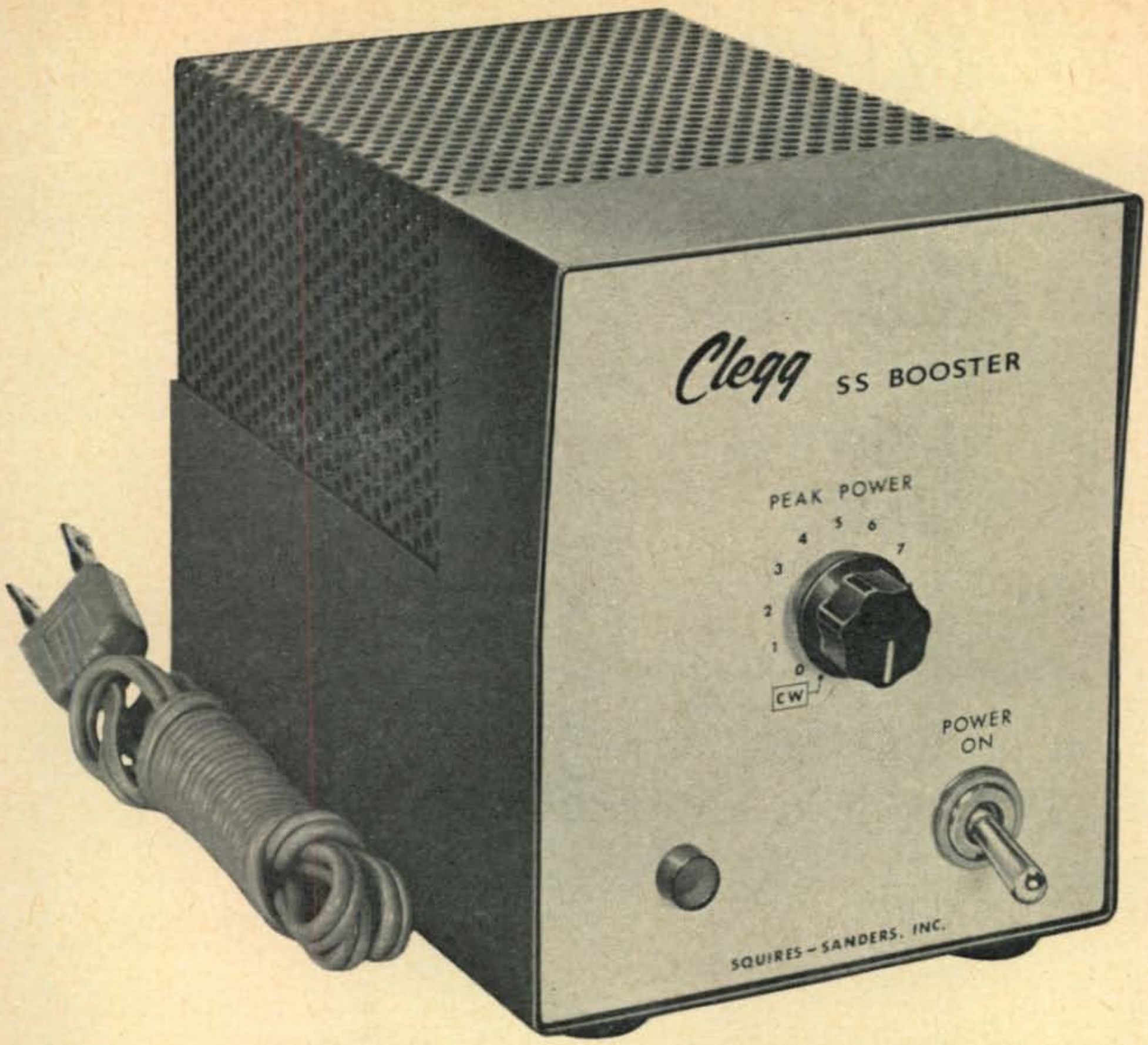
Editor, *CQ:*

Re: Article by G6QB (DXing From G-Land, *CQ*, Aug, '64.)

This is a most illuminating article, It is especially interesting to note that many, if not most, operating evils do *not* originate in W-K land! All Americans are entirely too self-conscious and self-critical, not just in the field of radio but in every way.

The truth is, and I can quote many DXpeditioners including Gus Browning, and many DX fixed station operators (5A4TH, e.g.) to the effect that W-K's *in general* are among the most courteous and best operators in the world. Certainly, we ought to clean up such evils as exist, but let's not damn American operators wholesale, as has been so fashionable (always by way of vague generality, I might add).

G6QB makes a constructive suggestion which I think bears study and *calm* consideration. The world-wide 150-watt limit (British interpretation converts this to 600 watts p.e.p. input on s.s.b.).



the Big BOOST for Sideband Signals.....
barefoot or with a linear!

The Clegg SS BOOSTER makes a barefoot VENUS sound like a "kilowatt" . . . and with an APOLLO 700 linear amplifier added . . . WOW . . . ! Up to 20 db increase in average power results from this latest Squires-Sanders development (see Sideband Speech Clipping, QST, July 1964, page 11). The SS BOOSTER has other advantages, too . . . it provides power level control . . . it protects against "flat topping". Single panel control provides adjustment from no boost to approximately 26 db.

On-the-air test with the Clegg VENUS six meter transceiver produced the following results: 1) Until properly informed, many stations regularly worked previously (without the SS BOOSTER) were convinced a "linear" had been added. 2) Stations that previously could not be worked consistently reported solid and consistent copy when the SS BOOSTER was used. 3) Average reported signal improvement in weak-signal-path "A-B" tests indicated a gain with the SS BOOSTER equivalent to 6 to 12 db. 4) Over any weak-signal path, intelligibility was always better with the SS BOOSTER than without.

Several models of the SS BOOSTER will ultimately be available, the first of which is for use with the VENUS (as the Clegg SS BOOSTER illustrated above). Tests are currently being conducted on the application of this unit to other equipment such as the S/LINE. Other versions include an SS BOOSTER built into the SS-1T (matching transmitter for the SS-1R receiver) and a model for use with sideband transmitters utilizing mechanical filters. The potential for application to existing equipment is broad on two conditions: 1) The SS BOOSTER must contain a filter matching that in the sideband exciter, and 2) The transmitter final amplifier (and a linear as well) must be capable of the increased average power input. With the SS BOOSTER in full BOOST, average power will approach peak power, thus tubes and power supply must be capable of operating continuously at (the equivalent of) full CW input.

Installation of the SS BOOSTER requires minor internal modifications. In the case of the Clegg SS BOOSTER for use with existing Clegg VENUS transceivers, complete instructions and an installation kit are included with the Clegg SS BOOSTER. Owners desiring factory installation will be accommodated at a nominal charge.

AMATEUR NET:

Clegg SS BOOSTER TYPE A $97.50. Type B for Collins 32-S3. Price to be announced.
Other models priced according to specific filter required.

Squires-Sanders, Inc.

475 WATCHUNG AVENUE, WATCHUNG, N.J. • 755-0222

For further information, check number 13, on page 110

Isn't it true that we run 2 kw p.e.p. just to keep up with the others who run this power, just to keep our own signals from being QRMed? I think so. I know I would be delighted to throttle down to 600 watts p.e.p. if everyone else did so. But I won't do it and give up almost 6 db to the competition! Neither will very many others.

I cannot imagine my failure at 600 watts p.e.p to make any contact I ever made while running more, so long as there are no stronger stations filling the band with QRM.

Would it be observed? No, not by all, any more than today's limit is observed by all. But the 6 kw boys would have to cut down some or they'd be easily recognized as cheats! And I do believe (perhaps naively, but I think not) that most of us obey today's rules and will obey any such new rule. Let's think about it.

J. Foy Guin, W4RLS
Box 26
Russelville, Alabama

Just Plain Bad Manners

Editor, *CQ:*

The following incident took place on August 13, 1964: A new ham who received his license on that day invited me to be present when he made his first call. He called *CQ* at about eight to ten words per minute and a K1 station answered at about fifteen words per minute. This fellow went back to him with the following message: "I just got my license today and you are my first contact. Please send more slowly." Then he gave RST, QTH, and name. The K1 station came back as fast or faster than before and made no comment other than giving RST, QTH, and name. Again this fellow went back; "QRS to about ten words" and carried on with the transmission and asked if the K1 would please QSL as he would like a card from his first contact. The K1 station returned a fifteen words per minute with the following message: "I don't QSL to everyone, if you want a card send me one."

This was his first experience on the air and I am sure you will agree it is not very encouraging to meet a fellow like this for a first contact. I wonder if this K1 was ever a Novice or if he was treated like this on his first call.

I must say I have never met a ham like this and on my first few calls they were very cooperative.

Malcolm "Mac" Smullen, VE1ACE
P. O. Box 119
Weymouth, Nova Scotia

On Zero Bias

Editor, *CQ:*

I originally dropped my subscription to *CQ* a few months ago because I felt that its editorial policy was one of "anti ARRL for its own sake" to the extent that amateurs were being misled just for the sake of controversy. This was being done; there is no denying it."

This morning I happened to see a copy of *CQ* on a newsstand. I have not read the May or June Zero Bias columns, but if they are attacking the gross misrepresentions being perpetrated by Wayne Green, they present something which has been needed for some time. In short, I like your new editorial policy; i.e., acting in the best interests of ham radio. . . . Since ARRL takes the position of choosing not to answer *73* in its own fashion (and rightfully so, since if they did they would only be fighting fire with fuel), I feel you are doing the right thing by bringing the truth out into the open. Even your Novice and Letters columns take the words right out of my mouth.

Martin M. Peritsky, K3PBU
505 Susquehanna Street
Forest City, Pa. 18421

Martin, I'm afraid that a denial is in order to your charge that CQ *has opposed the ARRL simply for the sake of controversy. Careful inspection of* CQ *editorial policy for at least the past four years will clearly show our attitude towards ARRL; one that has offered criticism only when we sincerely felt it necessary. More often than not,* CQ *has supported ARRL and, in fact, this support of amateur radio's own organization has on occasion brought criticism to us for "me-too-ism."*—K2MGA

SBE

powerful, peak performance pair

SB-33/SB1-LA . . . diminutive duo . . . four-band (80-40-20-15) SSB transceiver/exciter and high power linear amplifier. Bright, state-of-the-art version of a full thumping kilowatt . . . entirely self contained, **including all power supplies** . . . in two tiny cabinets! The only "extras" needed are microphone . . . antenna . . . two lineal feet of mounting space . . . and a strong desire for a clean-cut big signal. And when you look at the photograph above, (the 664 dynamic **does** look big in comparison to the linear amplifier behind it) consider that the SB-33 transceiver on the right also includes **an outstanding receiver** capable of solid-copy reception of the DX that is bound to be stirred up by the KW signal from your powerful pair.

SB-33 TRANSCEIVER

389.50

SB1-LA LINEAR AMPLIFIER

279.50

Aside from the use of advanced solid-state circuitry and techniques, there are at least 37 other good reasons why SB-33 can be so small and still deliver in such a convincing manner—18 transistors, 18 diodes and 1 zener diode! (The heavy-duty work is done by two rugged PL-500 beam tetrodes and a 12DQ7 driver). The SB1-LA linear uses 6—6JE6's for 1000 watts P.E.P. on 80-40-20 and 750 watts P.E.P. on 15, achieves its small size in part by careful design and by the use of an all-solid-state voltage-multiplying power supply.

See these best buys at your SBE distributor—**compare** them fully with anything else available, feature-wise, price-wise. (Remembering that SB-33 has **4-bands—panel selectable sidebands—Collins Mechanical Filter—built-in 117V AC power supply** and **loudspeaker,** is 5½"H, 11¾"W, 10¼"D, weighs 15 pounds.

Please send full information on SB1-LA Linear and SB-33 Transceiver.

NAME

NUMBER STREET

CITY ZONE STATE

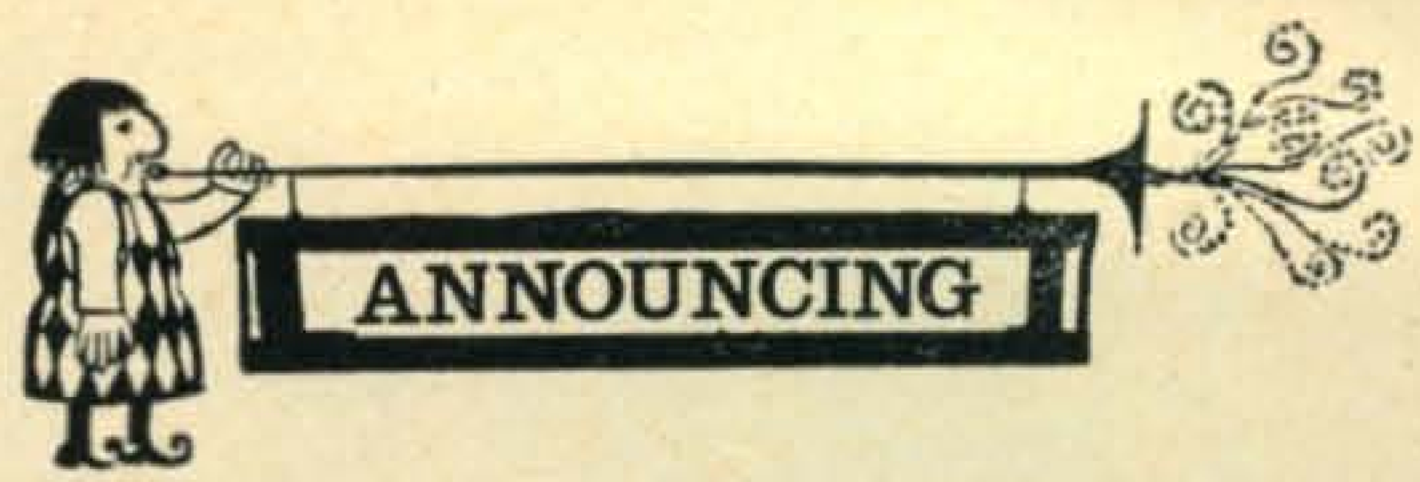
SBE **SIDEBAND ENGINEERS**
317 Roebling Rd. So. San Francisco, Calif.

An operation of Webster Manufacturing

Model SB2-DCP
DC to AC INVERTER
for SB-33 (only)
Quiet . . . entirely solid-state.

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

For further information, check number 15, on page 110



Dedham, Massachusetts

The New England DXCC will hold its 14th annual dinner meeting October 17, at the Motel 128, Dedham, Mass. It is at the intersection of Routes 1 and 128. A roast top sirloin dinner will be served. The meeting starts at 6:00 P.M. with dinner at 8:00. Members and guests are invited. Tickets are $5.00 each. For reservations, make checks payable: Leo Wilber, W1MV, 74 Bedford Street, Bridgewater, Mass. Also contact him for any further information.

Irvington, New Jersey

The Irvington Radio Amateur Club will have its annual Club Dinner on October 17, 1964, at the Community Building, 1143 Clinton Ave., Irvington, New Jersey. Door prizes and other activities are planned. Write to Dave Rettig, K2VOB, 240 W. Kinney Street, Newark, New Jersey for more details.

Rockaway Park, New York

The Rockaway Amateur Radio Club will hold their Fall auction Friday evening October 23, 1964. The auction will start at 8 P.M. (the doors will be open at 6 P.M. to accept gear) and will take place at the Daniel M. O'Connell Post 272, American Legion Hall, at 301 Beach 92d Street, Rockaway Beach, New York. Admission of one dollar will include door prizes and refreshments. Drop a line to Al Smith, WA2TAQ/WB2FNW, care of the Rockaway Amateur Radio Club, P.O. Box 205, Rockaway Park, N.Y. for more info.

Fishing Around for Minow's?

Due to complaints that they are too hard to find, the MINOW (Montana, Idaho, Nevada, Oregon, and Wash.) YL's will plan to be especially active on all bands during their first annual QSO Party which begins October 12th at 1700 GMT and ends October 17th at 0500 GMT. The girls will monitor and use 3880, 7260, 14285, 21410 and 28700 if the 15m. and 10m. bands are open. C.w. stations will hand out on or close to regular CHC frequencies, 3575, 7030, 14075, 21090 and 28.90. For MINOW certificates, U.S. stations must work six MINOW members in at least 3 states, DX stations must contact any 3 members. Send full log data and 50¢ to Mary Ruckman, K7RBC, 1002 14th Street, La Grande, Oregon. No charge to DX stations. MINOW members send their logs to Phyllis Shanks, K7KSF, 74 McMurray, Richland, Washington for cross checking.

Milbrae, California

The Greater Bay Area Hamfest will be held at the Thunderbird Hotel, Millbrae, California on October 17th and 18th, 1964. The Hamfest sponsored by six local radio clubs offers prizes, banquet, XYL activities, dancing, swap tables, outstanding speakers and displays. Tickets are $6.50 each. For registration and more information write to: The Greater Bay Area Hamfest, P. O. Box 113, Hayward, California.

Tampa, Florida

The Hillsborough Amateur Radio Society, Inc. (HARS) will hold an old-fashioned hamfest on Sunday, October 11, 1964, at Sulphur Springs Pool and Recreation Area. There will be prizes, free lunch with each registration ticket, as well as non-commercial exhibits, sheltered uncrowded swap tables and acres of free parking. For further information write to HARS, P.O. Box 8373, Tampa 4, Florida.

[continued on page 86]

GONSET SIDEWINDER
TRANSCEIVER **Model 900A**

SOLID STATE "SCOOP" FROM GONSET!

FIRST AND ONLY TRANSISTORIZED 2 METER SSB-AM-CW TRANSCEIVER FOR MOBILE, PORTABLE AND FIXED COMMUNICATIONS

The totally new Gonset Model 900A *Sidewinder* is the first and only transistorized SSB-AM-CW transceiver (except mixer, driver, final stages in transmitter) to provide complete coverage of the 2 meter amateur band in 4 segments 1 MC wide. Yet it's so compact it fits quickly under the dash of the newest cars! Transistor design makes possible a primary power requirement in the receiver of less than ½ amp! Separate power supply accessories snap-fasten to back of transceiver, or may be used for remote installation. Here's the trouble free, solid state transceiver with power to spare for any fixed, portable or mobile application!

For complete information, visit your Gonset Distributor, or write Dept. CQ-10.

CHECK THESE HIGH-PERFORMANCE SPECIFICATIONS:

TRANSMITTER: Transistorized (except for mixer, driver, final states) • **Frequency Range:** 144-148 MC • **Power Input:** 20 watts PEP SSB, 6 watts AM, 20 watts CW • **Spurious Suppression:** —50 db • **Carrier Suppression:** —50 db on SSB • **Unwanted Sideband Suppression:** —40 db • Features include VFO low frequency 1st conversion, with crystal controlled high frequency 2nd conversion for stability, filter type side-band generation and broadband circuits for easy operation.

RECEIVER: All-transistorized • **Frequency Stability:** Highly stable; utilizes same VFO as transmitter • **Sensitivity:** ½ microvolts or better for 10 db $\frac{S}{N}$ • **Selectivity:** 3.5 kc filter for both receiver and transmitter • **Audio Output:** 3.0 watts • **Spurious Suppression:** —50 db or better • **Image Rejection:** —50db (receiver and transmitter utilize double conversion) • Full RF amplifier with three tuned circuits for low noise figure, good selectivity. Separate RF and AF gain controls.

TRANSCEIVER: Both the receiver and transmitter are dual conversion, using 15 MC and 9 MC frequencies with a **hermetically sealed** crystal lattice filter. **Dimensions:** 8⅞" W., 4⅞" H., 7 3/16" D. • **Wt.:** 10 lbs.-8 oz. POWER SUPPLY: **Dimensions:** (AC or DC) 8⅞" W., 4⅞" H., 5 13/16" D. • **Wt.:** 13 lbs.-8 oz.

PRICE: TRANSCEIVER: $399.50 Amateur Net; POWER SUPPLY: AC—$67.75 Amateur Net • DC—$79.50 Amateur Net

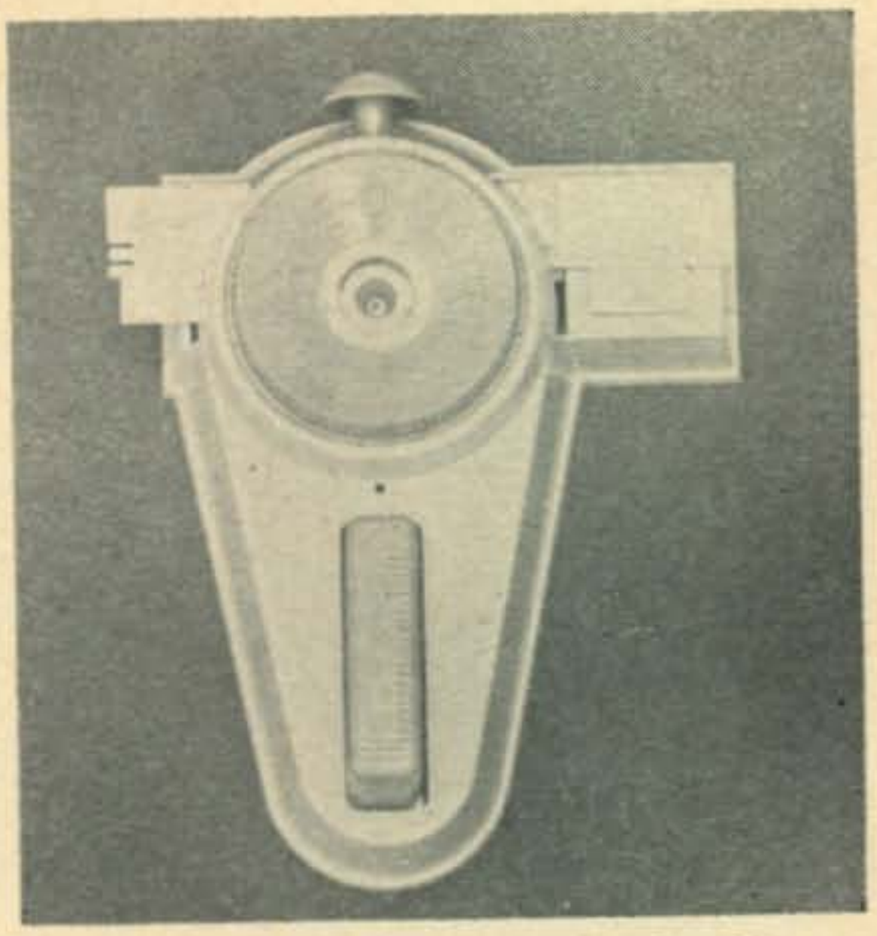
ALTEC LANSING CORPORATION

GONSET, INC.

ALTEC LANSING CORPORATION
LTV *A Subsidiary of Ling-Temco-Vought, Inc.*
1515 S. MANCHESTER AVENUE, ANAHEIM, CALIFORNIA

For further information, check number 17, on page 110

New Amateur Products



Name-O-Matic Label Machine

THE Name-O-Matic Labeler is one of the latest self adhesive tape raised letter embossing machines on the market. It is the first to permit you to make two lines on a single tape, and can also make the conventional one line labels. The machine comes supplied with twenty-three feet of tape. The Name-O-Matic labler is available from Grace Spitz, Box 4095, Arlington, Virginia, at a cost of 5.95 each postpaid. Additional tapes can also be obtained for one dellar each.

Lafayette HA-350 10-80 Meter Receiver

LAFAYETTE Radio Electronics Corporation, 111 Jericho Turnpike, Syosset, L.I., N.Y., announces a new ham radio receiver, Model HA-350. One of the most important features of this unit is the use of a mechanical filter in the 455kc IF section offering high selectivity of 2kc bandwidth at 6db down and 6kc at 60 db down. A tuneable preselector circuit gives a sensitivity rating of less than 1 microvolt for 10 db signal to noise ratio. The 100kc crystal calibrator and 15mc WWV band provision assures accurate calibration. s.s.b. reception is improved by the use of a product detector which provides selectable upper or lower sideband. It measures 15" × 7½" × 10" and its Lafayette stock nummer is 99-2524WX. The net price is $189.50. Its matching speaker model HE-48 (stock no. 99-2537) sells for $7.95.

12 NEW AMATEUR BEAMS

from

FINCO®

ALL GOLD CORODIZED

ALL GAMMA MATCHED

3 New combination 6 & 2 meter beams
5 New 6 meter beams
3 New 2 meter beams
1 New 1¼ meter beam

SEND FOR NEW TECHNICAL INFORMATION CATALOG #20-226

THE FINNEY COMPANY

34 West Interstate • Bedford, Ohio

For further information, check number 19, on page 110

NEWS

B & W OFFERS AMAZING Model 6100 TRANSMITTER FACTORY DIRECT!

OR THRU YOUR LOCAL DISTRIBUTOR

NOW ONLY $495.00 NO TRADES

FOB FACTORY

Here's why B & W's Model 6100 has been called the "Most Amazing Transmitter of Our Time"!

- The Barker & Williamson Model 6100 Transmitter has been engineered and built to give the discriminating operator the ultimate in SSB, CW and AM communications.
- The 6100 uses the B & W crystal controlled frequency synthesizer, producing an order of stability which up to this time has been available only in costly military and commercial communication systems.
- The crystal lattice filter method of sideband generation is employed. Superior sideband suppression results.
- Solid state rectifiers are used.
- Dual automatic level control (ALC) with adjustable threshold prevents overdrive of output stages.
- Digital Dial System offers a high degree of dial accuracy.

WIRE, WRITE OR PHONE - FACTORY DIRECT - DEPT. T

BARKER & WILLIAMSON, Inc.

A SUBSIDIARY OF RENWELL INDUSTRIES, INC.

Complete Radio Communication Systems and Equipment

Beaver Dam Road, Bristol, Pa., • 215 768-5581

For further information, check number 20, on page 110

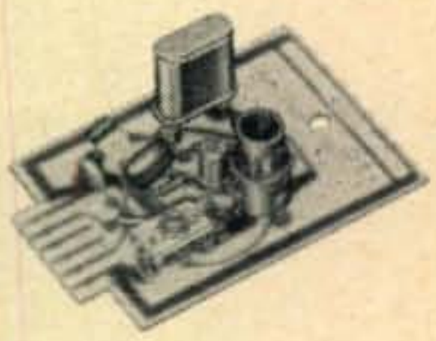
NOW DIRECT CRYSTAL CONTROL TO 160 mc With AOC Plug-In Transistor Oscillators

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

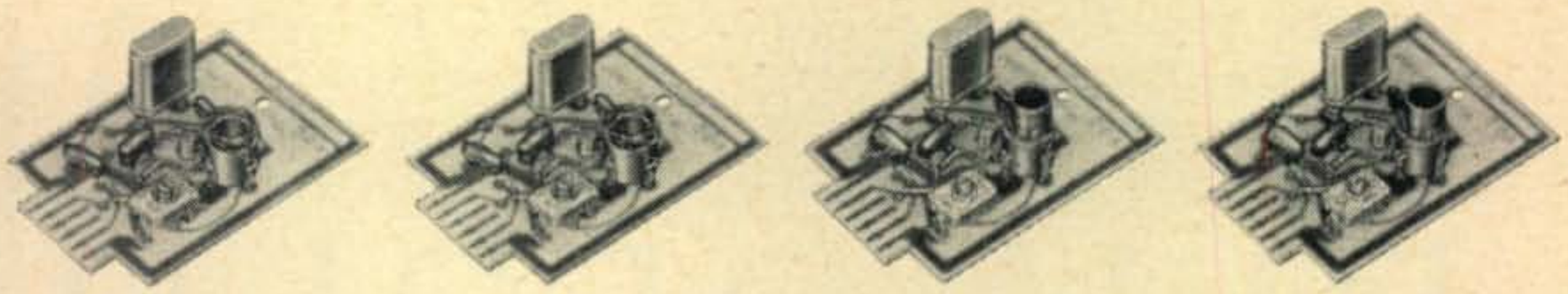
HIGH FREQUENCY (20 mc – 160 mc)

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	CRYSTAL FREQUENCY	CRYSTAL PRICE
OT-24	20-40 mc	CY-7T	±.0035%	$ 9.10	11,000-20,000 kc	$ 6.90
OT-46	40-60 mc	CY-7T	±.0035%	9.10	20-60 mc	6.90
OT-61	60-100 mc	CY-7T	±.0035%	15.00	60-100 mc	12.00
OT-140	100-140 mc	CY-7T	±.0035%	15.00	101-140 mc	15.00
OT-160	110-160 mc	CY-7T	±.0035%	15.00	141-160 mc	18.00



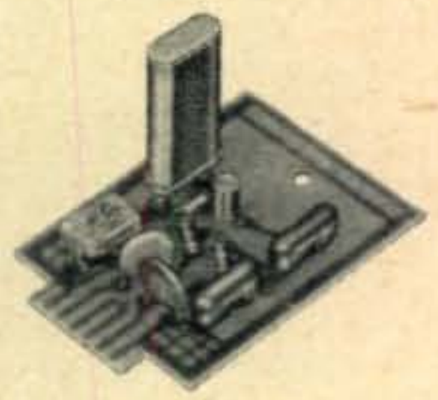
Order direct from International Crystal Mfg. Co.

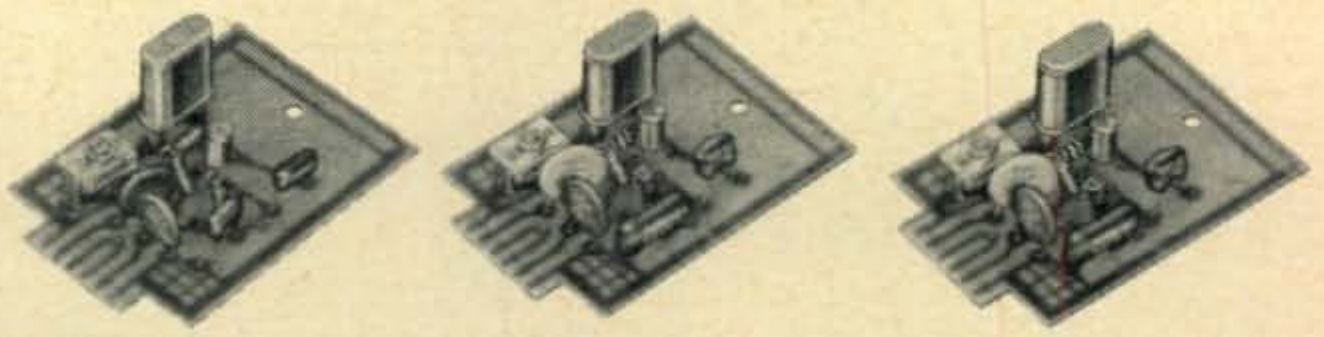


LOW FREQUENCY (70 kc – 20,000 kc)

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	CRYSTAL FREQUENCY	CRYSTAL PRICE
OT-1	70-200 kc	CY-13T	±.015%	$7.00	70-99 kc 100-200 kc	$22.50 15.00
OT-2	200-5,000 kc	CY-6T	200-600kc ±.01% 600-5,000kc ±.0035%	7.00 7.00	200-499 kc 500-849 kc	12.50 22.50
OT-3	2,000-12,000 kc	CY-6T	±.0035%	7.00	850-999 kc 1,000-1,499 kc	15.00 9.80
OT-4	10,000-20,000 kc	CY-6T	±.0035%	7.00	1,500-2,999 kc 3,000-10,999 kc	6.90 4.90





INTERNATIONAL CRYSTAL MFG. CO., INC.

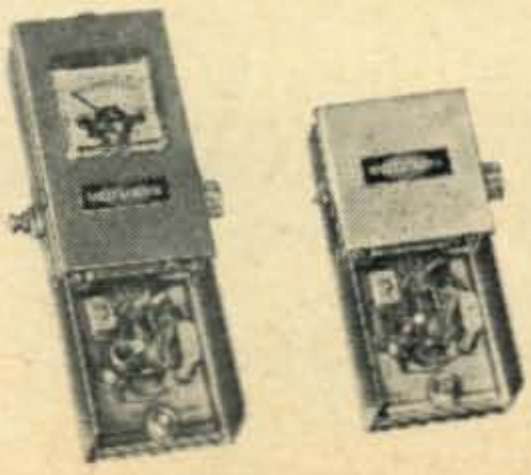
8 NORTH LEE OKLAHOMA CITY, OKLA.

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 21, on page 110

QUICK AS A WINK AND BLINDFOLDED!

Yes, you can select an exact frequency on your KWM2/2A transceiver quick as a wink, and blindfolded — with the Waters Channelator Model 349! Just a flick of the switch finds the frequency you want among six pre-selected channels. You're never in the dark in your ham shack. With your eyes on the road in mobile operation, you'll still hit the precise crystal-controlled frequency you want — and stay there for stable operation! No more "getting a word in edgewise" on a busy channel — just switch over to another frequency, check it out, and move your conversation there without interruption — quick as a wink! The Waters Channelator Model 349 installs on top of, or alongside, the Collins KWM2/2A in minutes — with only one cable to solder. □ For Schedule operations, for MARS, for CD nets, for sure DX operation close to the edge of the band, select the Channelator Model 349 by Waters to do your quick as a wink, blindfolded frequency selecting for you. The built-in heterodyne frequency meter and "pullable" crystals permit exact frequency adjustment. The four-position mode switch chooses transmit or receive, crystal controlled or PTO tunable operation. The Waters Channelator Model 349 operates from either a fixed or mobile KWM2/2A power supply. You can *buy* it quick as a wink, and blindfolded! Price: $79.95. Crystals, any frequency, USB or LSB, are $6.00 each. ■■■

WATERS CHANNELATOR
CRYSTAL FREQUENCY CONTROL

WATERS MANUFACTURING, INC., WAYLAND, MASSACHUSETTS

Other Waters Products: Coaxial Switches – Dummy Load/Wattmeter – "Little Dipper™" (Transistorized Dip Oscillator)

For further information, check number 22, on page 110

VERSATILE, CONVENIENT NEW SSB MICROPHONE FROM TURNER

The Turner Model 454X crystal is designed especially for convenience in the hamshack. Choice of PTT on standard model or VOX. Lever-lock holds mike live with PTT wiring. Response: 300-3000 cps. Level: —48db. Price . . . just $15.90, amateur net. For more information, write:

MODEL 454X

THE TURNER MICROPHONE COMPANY
925 17th Street N.E.
Cedar Rapids, Iowa

In Canada: Tri-Tel Associates, Ltd., 81 Sheppard Avenue West, Willowdale, Ontario
Export: Ad Auriema, Inc., 85 Broad Street, New York 4, N.Y.

For further information, check number 23, on page 110

One Control tunes this rig . . . from VFO thru final

Special gang-tuned circuits in Li'l Lulu let you QSY instantly — there's no buffer tuning and final dipping needed when the frequency is changed. And the rig is really TVI proof! By keeping the VFO grid circuit in the 25 mc range, TVI is eliminated. Price: $225 thru your dealer.

Check these features:

- 117 vac, 12 vdc integral power supply
- Class A high level modulation
- Carbon, dynamic, or crystal mic input
- Push-to-talk, or use panel switch
- Built-in cw keying filter
- VFO spotting switch
- VFO control
- 12DQ7 final.

WHIPPANY LABORATORIES, INC.
1275 Bloomfield Ave., West Caldwell, N. J.

Li'l Lulu

COMPLETE

50 MC

TRANSMITTER

For further information, check number 24, on page 110

CALLING ALL HAM DEALERS

Get Aboard The CQ Election Special

We're campaigning on a platform of more business for *you!*

Yes, the *CQ* Election Special is all set to roll on the advertising campaign trail. *CQ's* November Election Special is ready to carry your sales message to your customers as no other sales promotion can. And that's not just a "campaign promise" either—because *CQ* reaches *more active hams* than any other publication and sells more copies on the newsstands than *all others combined!*

What's our Election Special deal? We're offering ham dealers a special one inch "business card" ad at the very special rate of $25 . . . a saving of *25%* over regular rates. And if you sell to the CB market, you'll want to get your ad into *S-9*, The Citizens Band Journal, too, at the combination rate of $40 for both.

What lower cost way is there to tell your customers that *you're* interested in *their* business and that *you* are eager to serve *them?* There is none!

And it couldn't be easier—just fill out the coupon below and mail with your check. Don't try to write a book in 1" but be sure to put in your store hours, call letters, etc. We'll take care of all the rest.

Don't wait . . . do it *NOW!*

Staple Your Check Here

Yes, I want to get on the CQ Election Special. Please insert the following ad in ☐ CQ ☐ S-9 ☐ Both

Just give us a sketch of what you want.

Please note our low price prohibits cuts or logos.

My check for $..... ..... is attached. (See rates above).

NAME.....

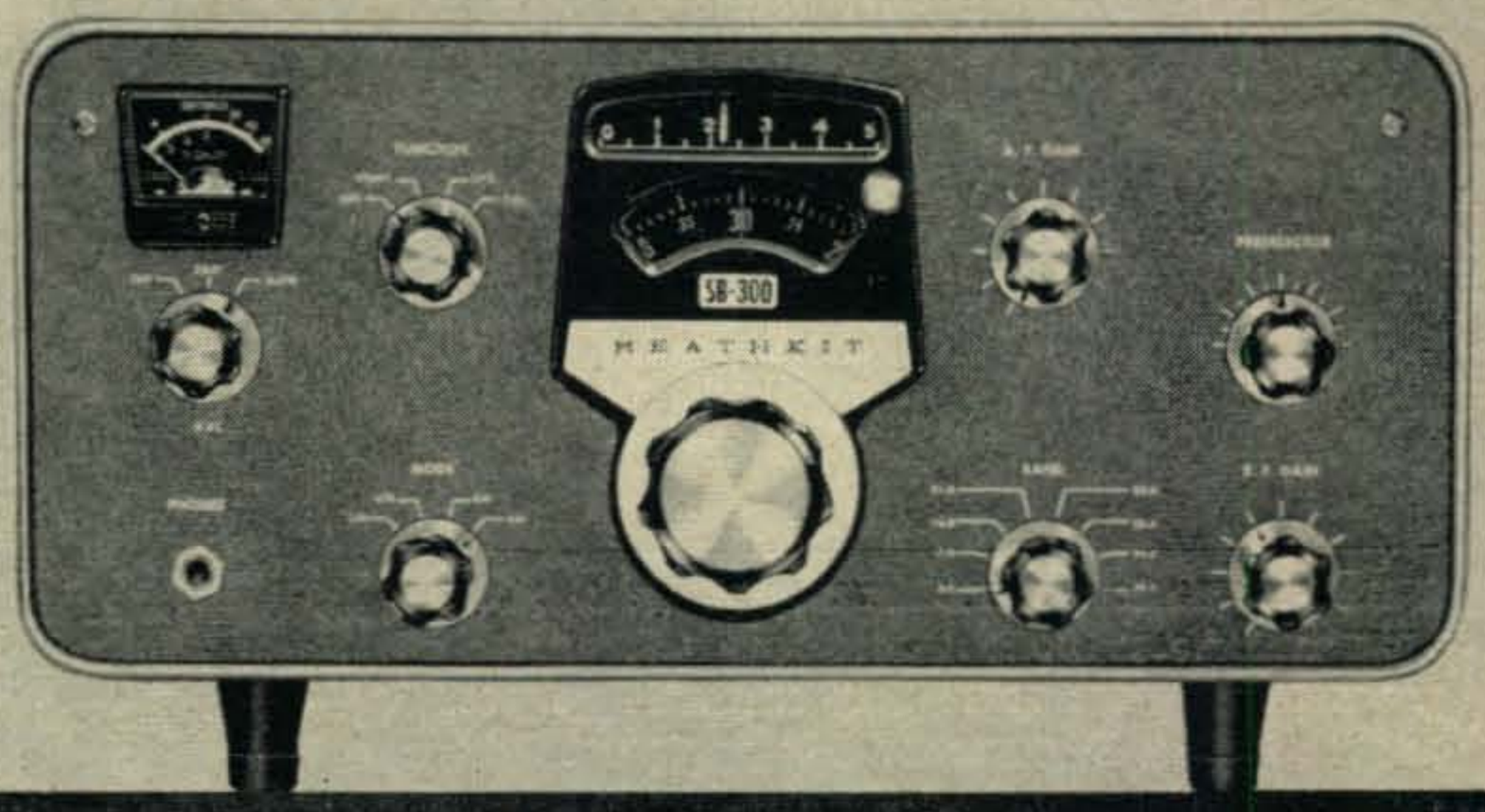
COMPANY.....

ADDRESS.....

CITY..... STATE..... ZIP.....

THIS IS #1 IN THE SERIES

HEATHKIT®
SB-300
SSB-RECEIVER
$265.00



• Everything you could ask for in a deluxe receiver and more! • Complete coverage of 80 through 10 meter amateur bands with all crystals furnished, plus provision for VHF converters • Crystal-controlled front-end for maximum stability on all bands • 1 kc dial calibrations—100 kc per dial revolution provides bandspread equal to 10 feet per megacycle—tuning knob to dial ratio approximately 4 to 1 • Provision for transceive operation with matching SB-400 Transmitter • Pre-built Linear Master Oscillator (LMO), wiring harness and two heavy-duty circuit boards for fast, easy assembly • Professional styling and features at 60% savings

Good news travels fast! . . . especially on the amateur airwaves! Since its introduction, the Heathkit SB-300 has set the amateur world on its ear as one of the finest values in the industry! Deluxe styling and features now bring you a new dimension in quality, performance and dependability never before thought possible in kit form! . . . and by doing the easy assembly yourself you'll save 60% the cost of comparable units!

Experienced amateurs will quickly recognize the high standards to which this receiver was designed. Its many superb features include a crystal-controlled front-end for optimum stability on all bands, a pre-built Linear Master Oscillator (LMO) for linear tuning with 1 kc dial calibrations, a built-in crystal calibrator, hermetically-sealed 2.1 kc crystal band-pass filter, smooth non-backlash vernier dial mechanism . . . and many, many more! Order yours today!

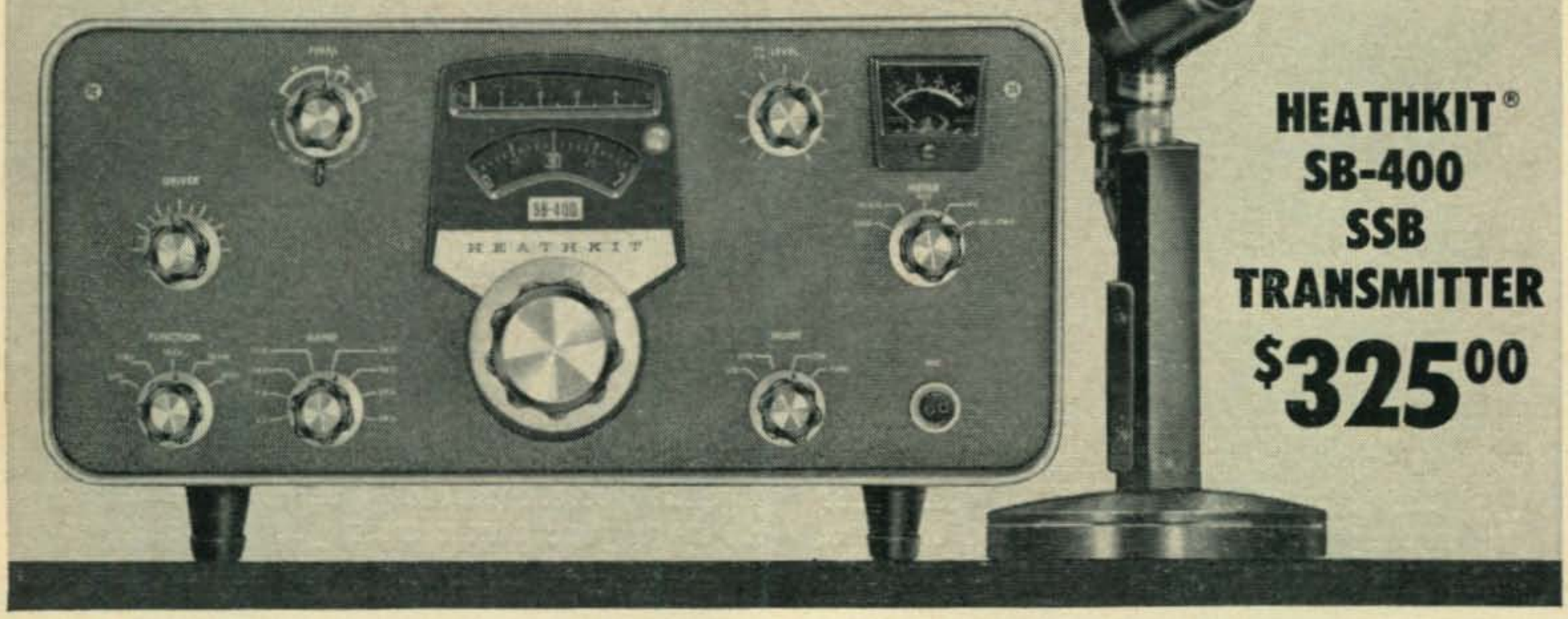
Kit SB-300, less speaker
22 lbs., $27 dn., $22 mo.....$265.00
SBA-300-1 Optional AM crystal filter
(3.75 kc) 1 lb.....$19.95
SBA-300-2 Optional CW crystal filter
(400 cps) 1 lb.....$19.95
Export model available for 115/230 volts AC, 50-60 cps; write for prices.

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:** Less than 100 cps per hour after 20 min. warmup under normal ambient conditions. Less than 100 cps for ±10% line voltage variation. **Visual dial accuracy:** Within 200 cps on all bands. **Electrical dial accuracy:** Within 400 cps on all bands after calibration at nearest 100 kc point. **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. **Audio response:** SSB: 350 to 2450 cps nominal at 6 db. AM: 200 to 3500 cps nominal at 6 db. CW: 800 to 1200 cps nominal at 6 db. **Audio output impedance:** Unbalanced nominal 8 ohm speaker and high impedance headphone. **Audio output power:** 1 watt with less than 8% distortion. **Antenna input impedance:** 50 ohms nominal. **Muting:** Open external ground at Mute socket. **Crystal calibrator:** 100 kc crystal. **Front panel controls:** Main tuning dial; function switch; mode switch; AGC switch; band switch; AF gain control; RF gain control; preselector; phone jack. **Rear apron connections:** Accessory power plug; HF antenna; VHF #1 antenna; VHF #2 antenna; mute; spare; anti-trip; 500 ohm; 8 ohm speaker; line cord socket; heterodyne oscillator output; LMO output; BFO output; VHF converter switch. **Tube complement:** (1) 6BZ6 RF amplifier; (1) 6AU6 Heterodyne mixer; (1) 6AB4 Heterodyne oscillator; (1) 6AU6 LM osc.; (1) 6AU6 LMO mixer; (2) 6BA6 IF amplifier; (1) 6AU6 Crystal calibrator; (1) 6HF8 1st audio, audio output; (1) 6AS11 Product Detector, BFO, BFO Amplifier. **Power supply:** Transformer operated with silicon diode rectifiers. **Power requirements:** 120 volts AC, 50/60 cps, 50 watts. **Dimensions:** 14⅞" W x 6⅝" H x 13⅞" D. **Net weight:** 17 lbs.

FREE CATALOG
See the wide array of Heathkit Amateur Radio Equipment available at tremendous do-it-yourself savings! Everything you need in "mobile" or "fixed" station gear with full descriptions and specifications . . . Send for Free copy!

For further information, check number 25, on page 110

THIS IS #2 IN THE SERIES



HEATHKIT®
SB-400
SSB
TRANSMITTER
$325.00

• 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 PEP 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 using CW sidetone • CW "shift" transceive operation to eliminate transceiver chasing • 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 amplifier antenna relay • Sturdy, lightweight, heavy-gauge aluminum construction throughout • Neat, modern "low-boy" styling

Here it is . . . the new Heathkit SB-400 Transmitter . . . second in the exciting new Heathkit series of Deluxe SSB Amateur gear! Following the same high standards set by the Heathkit SB-300 Receiver, the new SB-400 Transmitter now offers a matching counterpart that permits complete transceive operation with a host of advanced engineering design features for unmatched performance, versatility and operating convenience!

Unique mechanical design . . . prebuilt Linear Master Oscillator (LMO) . . . built-in heavy-duty power supply . . . sturdy chassis construction . . . beautiful modern styling . . . and power-packed performance are just a few of the many features that make the SB-400 your best buy in an SSB Transmitter! Order yours today for "Deluxe" communications at tremendous do-it-yourself savings!

Kit SB-400. . .33 lbs. . . Write for credit details. $325.00
Export model available for 115/230 volts AC, 50-60 cps; write for prices.

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 ohm—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 under normal ambient conditions. Less than 100 cps for ± 10% line voltage variation. **Carrier suppression:** 55 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). **CW sidetone:** 1000 cps. **ALC characteristics:** 10 db or greater @ 0.2 ma final grid current. **Noise level:** 40 db below rated carrier. **Visual dial accuracy:** Within 200 cps (all bands). **Electrical dial accuracy:** Within 400 cps on all bands after calibration at nearest 100 kc point. **Backlash:** Less than 50 cps. **Oscillator feed-through/mixer products:** 55 db below rated output (except 3910 kc crossover which is 45 db). **Harmonic radiation:** 35 db below rated output. **Audio input:** High impedance microphone or phone patch. **Audio frequency response:** 350 to 2450 cps ±3 db. **Power requirements:** 80 watts STBY, 260 watts key down @ 120 V AC line. **Dimensions:** 14⅞" W x 6⅝" H x 13⅞" D.

WATCH FOR THE NEW SB-100 ALL-BAND SSB TRANSCEIVER SOON TO BE RELEASED!

HEATHKIT®

☐ Enclosed is $265.00 plus postage. Please send SB-300 Receiver.

☐ Enclosed is $325.00 plus postage. Please send SB-400 Transmitter.

☐ Enclosed is $200.00 plus postage. Please send SB-200 Linear Amplifier.

Heath Company, Dept. 9-9-1
Benton Harbor, Michigan 49023

☐ Please send Free Heathkit catalog.

Name _____
(Please Print)

Address _____

City _____ State _____ Zip _____

Prices and specifications subject to change without notice. AM-147R

For further information, check number 26, on page 110

#3 IN THE HEATHKIT® SSB SERIES

SB-200 LINEAR AMPLIFIER AT ONLY $200.00

• 1200 watts PEP SSB—1000 watts CW • 80 through 10 meter band coverage • Built-in SWR meter—antenna relay solid-state power supply • Automatic Load Control (ALC) • Shielded, fan-cooled amplifier compartment • Pre-tuned cathode input circuit • Circuit breaker protection—no fuses • 120 /240 volt operation

Handsomely styled to match the Heathkit SB-300 Receiver and SB-400 Transmitter, the new SB-200 is a completely self-contained desk-top KW Linear that provides globe-circling SSB power at tremendous savings!

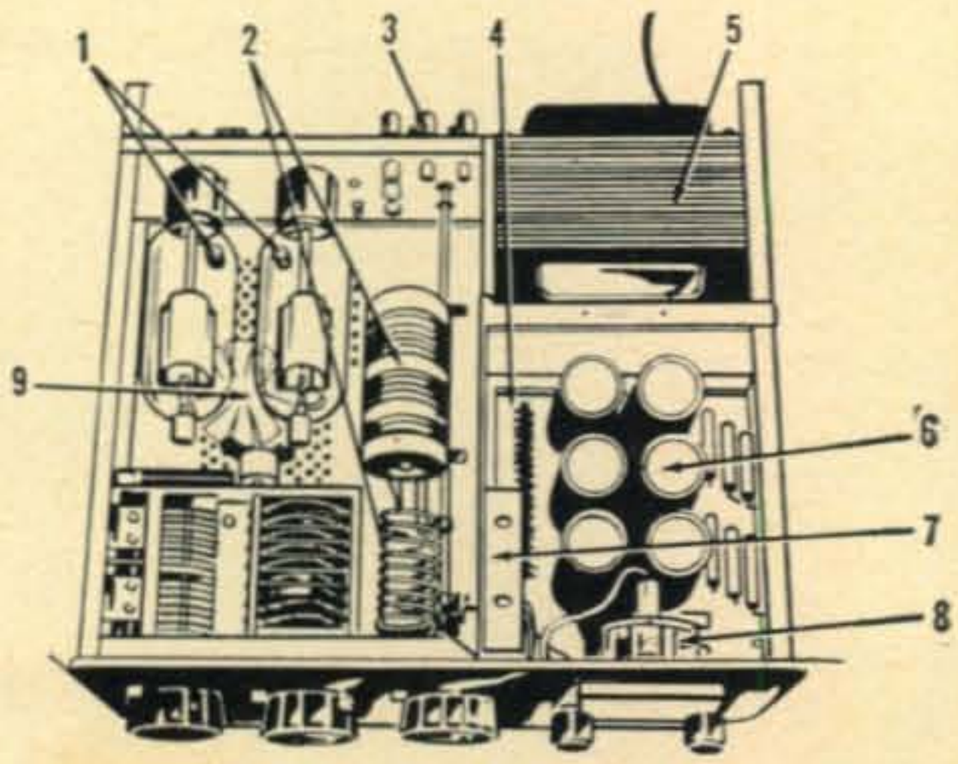
Many Advanced-Design Features! Incorporated in the SB-200 is a pre-tuned cathode input circuit for maximum efficiency and low distortion . . . ALC output for automatic exciter control . . . a rugged, well-rated solid-state power supply, protected by circuit-breakers (No fuses to replace or worry about) . . . two heavy duty 572B /T-160-L final amplifiers, fan-cooled for maximum life . . . complete shielding for maximum TVI protection and stability . . . plus a built-in SWR meter and antenna relay for full operating convenience. Antenna is automatically transferred to the exciter when the Linear is switched "off".

Quality Built Throughout! A heavy-gauge one-piece aluminum chassis, partitioned for extra strength and isolation of circuits . . . use of high quality well-rated components . . . and clean circuit layout all contribute to assure extra years of dependable, trouble-free performance.

Complete Operating Versatility! Compact and lightweight the SB-200 is an ideal companion for the SB-400 Transmitter, the soon to be released SB-100 Transceiver and nearly all other popular SSB & CW exciters in use today! Power supply operates on either 120 or 240 volt power sources for use anywhere. When you go "high power" choose the SB-200 for extra value, performance and dependability!

Kit SB-200, 38 lbs., $20 dn., $17 mo.....$200.00

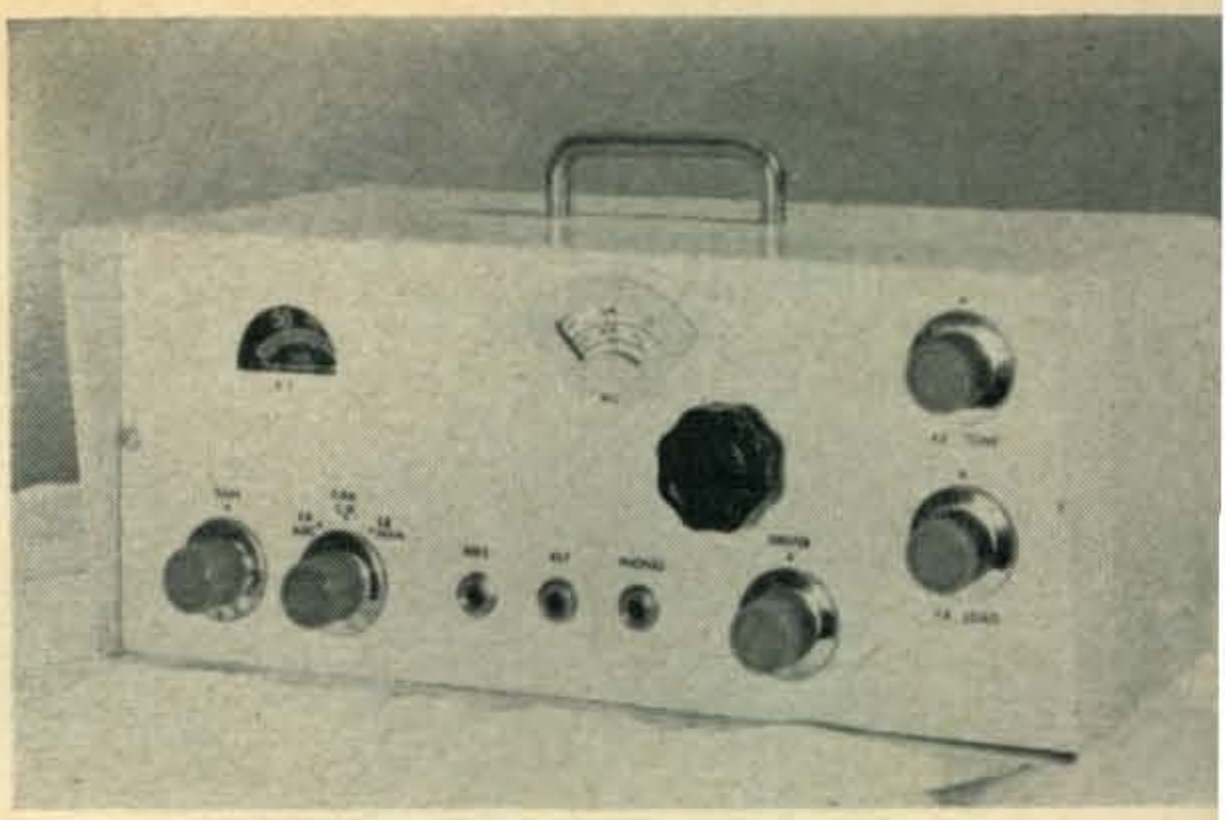
SB-200 SPECIFICATIONS—Band coverage: 80, 40, 20, 15 & 10 meters. **Maximum power input:** 1200 watts P.E.P. SSB, 1000 watts CW. **Driving power required:** 70 to 100 watts, depending upon frequency. **Duty cycle:** SSB, continous voice modulation; CW, 50% (key down time not to exceed 5 min.). **Third 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 pretuned 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 572-B/T-160L (in parallel). **Power requirements:** 120 volts AC @ 16 amperes (max.), 240 volts AC @ 8 amperes (max.) **Cabinet size:** 14⅜" W x 6⅝" H x 13¾" D. **Net weight:** 35 lbs.



1. Two heavy-duty 572B/T-160-L tubes in parallel **2.** Separate pi-network output coils for 80-20 meters & 15-10 meters. **3.** Pretuned cathode input circuits **4.** Long-life silicon high-voltage rectifiers **5.** Conservatively rated 120/240 volt power transformer **6.** High capacity (125 mfd ea.) voltage-doubler filter capacitors **7.** Two manual-reset circuit breakers for power supply protection **8.** Switched panel meter measures SWR, Rel. Pwr., plate current, grid current, & hi-voltage **9.** Fan-cooled final amplifier compartment for long tube life.

For further information, check number 27. on page 110

A TWO-BAND SSB TRANSCEIVER



Front view of the 80 and 20 meter s.s.b. transceiver. Controls are, from l to r, RECEIVER GAIN, FUNCTION SWITCH, MIKE, KEY and PHONE jacks, DRIVER TUNE. On the right top is the P.A TUNE and below is the P.A. LOADING. The bandswitch is on the left of the cabinet and not visible in this photo.

BY E. KIRCHNER*, VE3CTP

This compact s.s.b. transceiver was built for fixed or mobile use on 20 or 80 meters and is in the 100 watt class. It incorporates such circuits as amplified voltage doubled a.v.c. in the receiver and a.l.c. in the transmitter section.

It should be pointed out that the following is not intended to be a step by step construction article as exact duplication of this unit will be difficult because certain surplus parts were used which may not be readily available elsewhere. It is hoped however that the description of the circuitry and the general physical layout will be helpful to those who are contemplating the homebrewing of a transceiver without going through experimental breadboarding first.

Basic Circuit

A block diagram of the unit is shown in fig. 1. In receive position a 14 mc or 3.5 mc signal is fed to V_{14}, amplified, and fed to the mixer V_5. Here it is mixed with the signal from the v.f.o., V_7, which covers the range from 5 to 5.5 mc. This results in an i.f. of 9 mc. (14 mc − 5 mc = 9 mc, 14.5 mc − 5.5 mc = 9 mc, 3.5 mc + 5.5 mc = 9 mc. and 4 mc + 5 mc = 9 mc.) The i.f. is fed through the 9 mc filter which has a bandwidth of 2.5 kc at the −6db points. The output from the filter is amplified by V_{10} and V_{11} and then applied to the product detector V_{13}. Here the received signal is mixed with the carrier derived from V_1. The resulting audio is amplified by V_{12A} and V_{15}. The output from V_{15} is fed to either headphones or a speaker.

The i.f. signal is also fed to V_{12B} where it is amplified and rectified in a germanium diode voltage doubler circuit. The resulting negative d.c. is used as a bias to control the gain of the first i.f. amplifier V_{10}. This a.g.c. system is very useful in roundtable QSOs and mobile opera-

*2 Andirondack Avenue, Agincourt, Ontario, Canada.

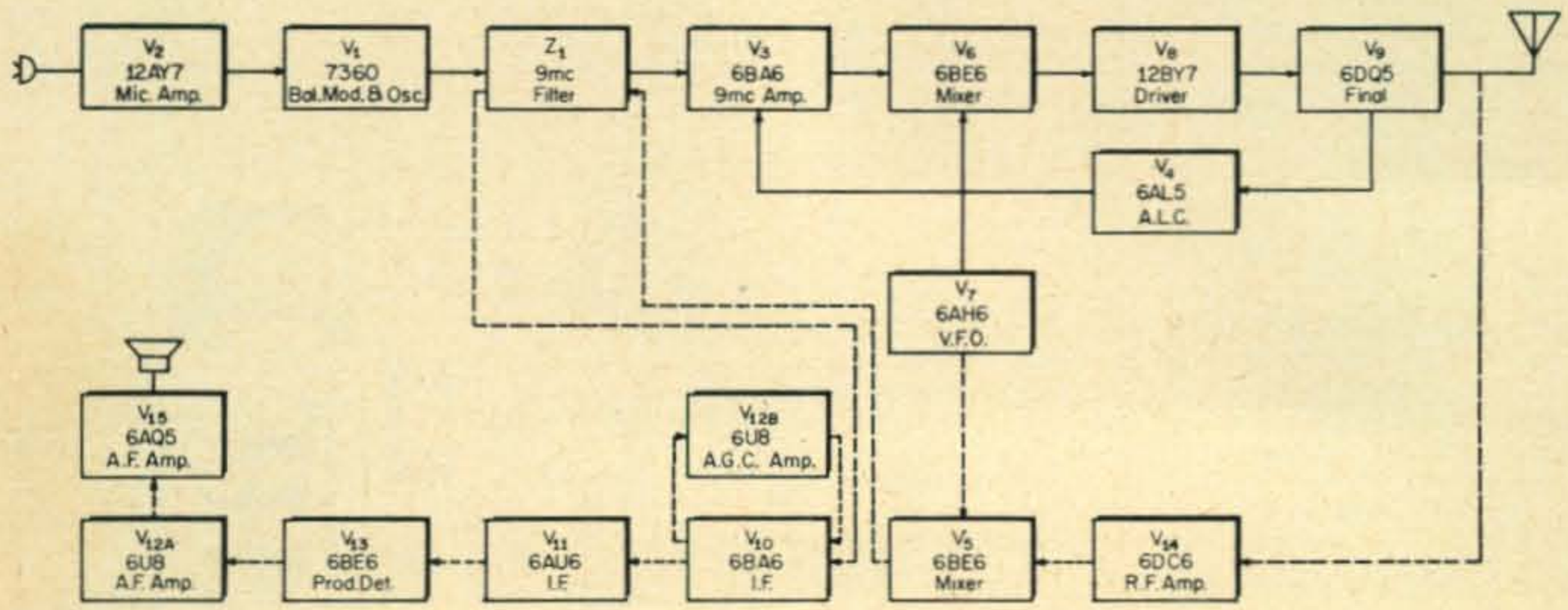
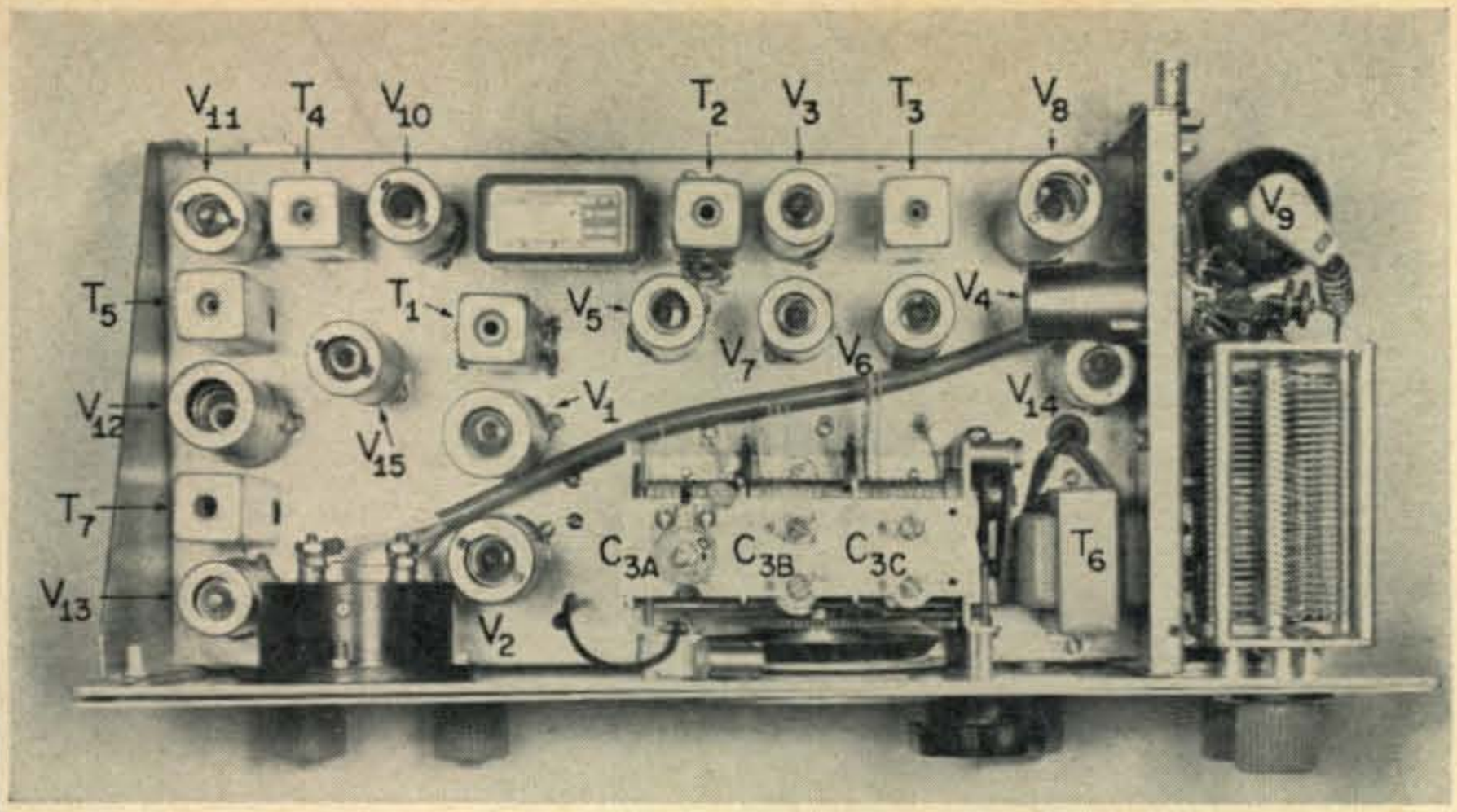


Fig. 1—Block diagram of the 20 and 80 meter s.s.b. transceiver. The transmit paths are shown in solid lines while the receive paths are shown with dotted lines.



Top view showing location of major components.

tion where the strength of the incoming signal varies widely.

In the transmitting position V_2 amplifies the audio signal derived from the microphone. The output from V_2 is fed to the balanced modulator V_1 which also generates the carrier. The carrier is balanced out and a double sideband signal remains. This d.s.b. is applied to the 9 mc filter where one of the sidebands is rejected. The remaining single sideband signal is amplified in V_3 and fed to the mixer V_6 where it is mixed with the v.f.o. signal. As the v.f.o. covers the range from 5 to 5.5 mc the resultant frequency bands, after mixing in V_6 are: 9 mc + 5 mc = 14 mc, 9 mc + 5.5 mc 14.5 mc (20 meter band); 9 mc − 5 mc = 4 mc, 9 mc − 5.5 mc = 3.5 mc (80 meter band). The output for either of the two bands is selected by the tuned circuits around the driver V_8, amplified, and fed to the final amplifier, V_9.

A portion of the r.f. voltage developed at the hot end of the pi-network is rectified by V_{4B} and the resulting negative d.c. is passed through a fast attack-slow release *R-C* network in the circuit of diode V_{4A}. This d.c. is applied as a control bias to the 9 mc s.s.b. amplifier, V_3. A delay bias at the cathode of V_{4B} is so adjusted that it starts conducting only when a certain r.f. voltage level in the plate circuit of the final amplifier is reached. A compression effect results which automatically compensates for too high a signal from the microphone which would otherwise overmodulate the final. Overall talk power is thereby increased which is a desirable feature for a low power unit. This system is also known as a.l.c. (for automatic load/level control).

Transceiver Problems

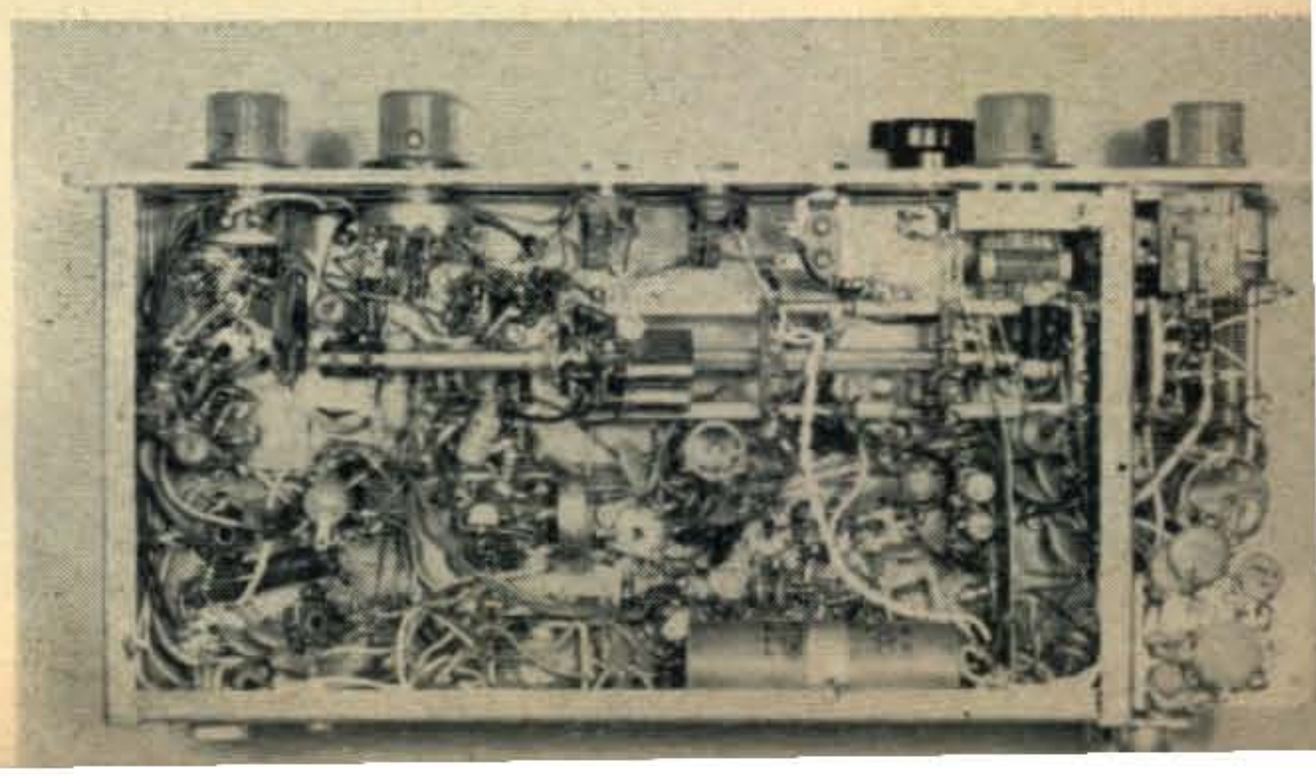
As can be seen from the circuit diagram $C_{3A,B,C}$ is a ganged tuning capacitor and is taken from an ARC-5 receiver (3-6 mc version). The center section is used to tune the v.f.o. over its range. All plates except three were removed and the remaining plates were cut down to give a fairly linear dial. The other two sections are used to tune the plate circuits of mixer V_6 and the receiver r.f. amplifier V_{14}. From the section which tunes the plate circuit of mixer V_6 all but two plates are removed. From the section which tunes the plate circuit of V_{14} all but one plate are removed. The remaining plate of this section is cut to yield good tracking.

The sense of direction of $C_{3A,B}$ and C for tuning the 20 meter band is the same while in 80 meter band operation the sense of direction of C_{3B} is reversed in respect to C_{3A} and C_{3C}. Therefore, these sections are disconnected from their circuits on 80 meters by switch S_{2B} and S_{2F}. However, due to the relatively low Q of the pi-network, the receiver is sufficiently sensitive, even at the band edges, when L_1 and L_7 are peaked at 3.75 mc.

The transmitter covers the whole band with more than enough drive available. The drive actually had to be reduced by inserting an additional cathode resistor in V_8 when operating in the 80 meter band.

Extensive experimenting was done with the input circuit of V_{14}. The writer feels that optimum performance here can only be accomplished by using a separate tuned grid circuit. As mentioned before, the Q of the pi-network is too low for proper matching to the grid of V_{14}. However the elimination of this extra tuned circuit is too tempting and it is felt that the present solution is a good compromise.

Another problem in this stage was the coupling



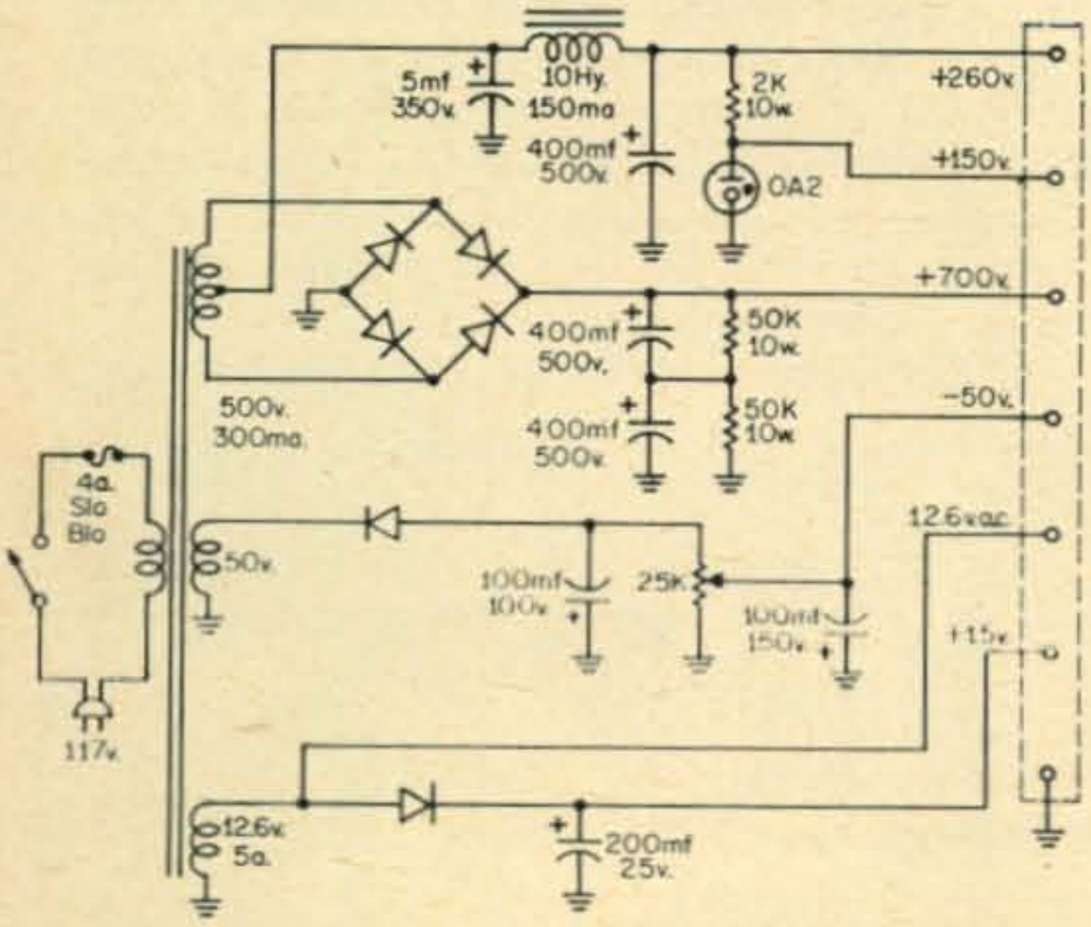
Bottom view of the chassis shows the compact wiring. The BANDSWITCH extends across the chassis and an extension shaft brings it out on the left side. Note the two crystals on the first switch wafer. Changing bands automatically selects the correct sideband.

Fig. 2—Circuit of the 20 and 80 meter transceiver. Relays K_1 and K_2 are shown in the receive position. All resistors are ½ watt ± 10% except where noted. All capacitors less than one are in mf and greater than one in mmf except where noted.

of V_{14} to the pi-network. When in transmit position a high r.f. voltage was present at the grid of V_{14} and many tricks were tried to prevent grid current from flowing. (high negative cut-off bias, ungrounded cathode, extremely small coupling capacitor etc.). But the only safe solution appeared to be a small relay (K_2) to ground the grid of V_{14} when transmitting.

The switching from receive to transmit is performed by relay K_1 which is a three pole double throw type. It is energized by applying 12 volts to its coil through a push-to-talk switch in the microphone. One set of contacts of K_1 removes the B plus from stages not used when transmitting and applies it to stages in use. The second set of contacts connects the cathodes of the driver V_8 and final amplifier V_9 to ground.

The balanced modulator, V_1, is unbalanced in the c.w. position of switch S_1 when transmitting. Thus, the carrier is not balanced out and is partly passed by the filter to the following stages. If the balanced modulator were left in this condition when receiving, the carrier would also be amplified by the i.f. stages V_{10} and V_{11} and the



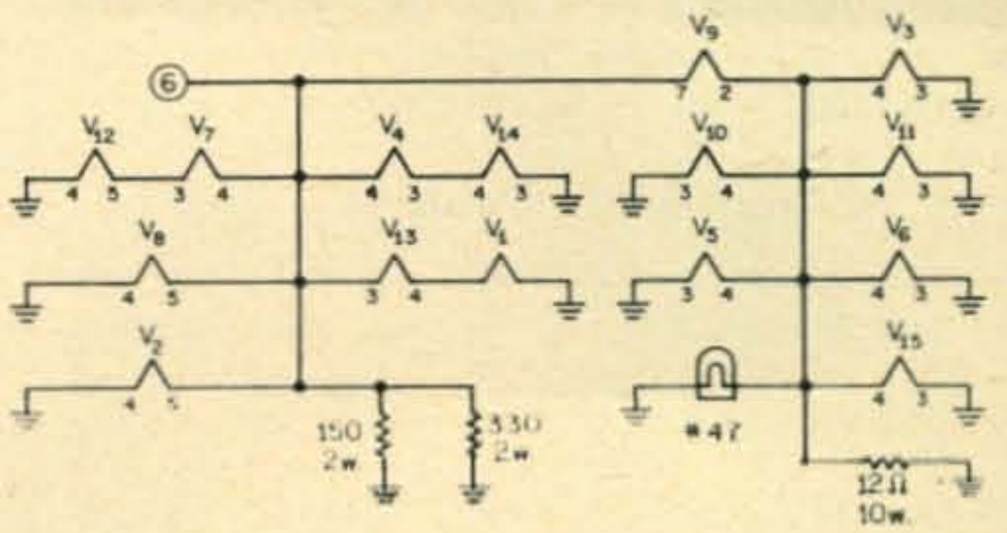
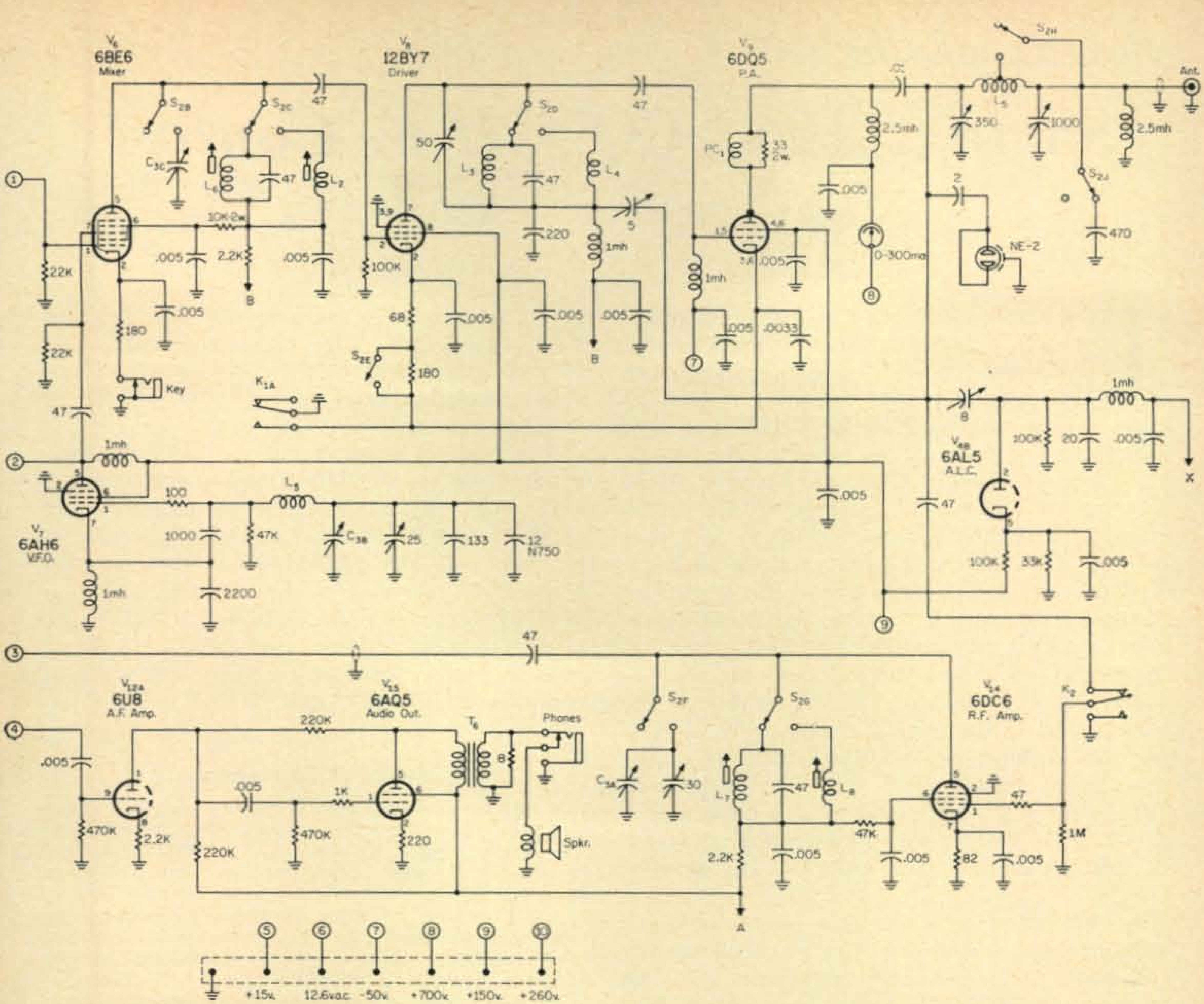


Fig. 3—Circuit of the fixed operation power supply and filament wiring for the transceiver. The diodes are rated for ½ ampere at 800 p.i.v.



C_1, C_2—See text under Adjustments.
$C_{3\,ABC}$—ARC-5 tuning capacitor modified as explained in text.
L_1—45t #38 on ⅜" dia. slug tuned form.
L_2—12t #30 on ⅜" dia. slug tuned form.
L_3—60t #36 on ⅜" dia. slug tuned form.
L_4—22t #24 on ⅜" dia. slug tuned form.
L_5—Air dux—820D10, 1" dia. 20 and 10 t.p.i. See text.
L_6—28t #26 on ¾" dia. ceramic form.
L_7—12t #30 on ⅜" dia. slug tuned form.
L_8—45t #38 on ⅜" dia. slug tuned form.
PC_1—5t #16 on 33 ohm 2 watt resistor.
Z_1—9 mc filter Model F-9000 complete with 2 crystals. C. R. Snelgrove Co., Ltd., Don Mills, Ontario, Canada.

a.g.c. stage, V_{12B} would constantly supply a negative control bias to V_{10} reducing its gain considerably. Therefore the balanced modulator has to cancel the carrier when receiving c.w. The third set of contacts of relay K_1 performs this switching action (in the c.w. position).

Construction

As can be seen from the photo (top view of chassis) all parts are so arranged as to create the shortest possible signal paths for all r.f. leads. The only exception is the lead from the plate circuit from V_{14} to the mixer V_5. To eliminate instability of the r.f. stage, V_{14}, this lead consists of miniature coax. The capacity of this lead is part of the tuned circuit in the plate of V_{14}.

Six controls are brought out through the front panel. The band switch, S_2, is brought out at the left side of the cabinet. The speech amplifier (V_2) and receiver audio (V_{12A}, V_{15}) have fixed gain. The two balancing controls for the balanced modulator are internal screwdriver adjustments.

All ground connections are soldered directly to the chassis which was fabricated from #20 gauge sheet steel and then copper plated. The copper plating, while inexpensive, has many obvious advantages.

A double front panel of aluminum is used. The inner one consists of ⅛" thick hard aluminum for stability. A 1/16" thick panel covers the counter sunk screws and gives the unit a professional appearance. The painting (two shades of light grey) was done with spray cans available in hardware stores.

Parts Modification

Other than the ARC-5 tuning capacitor the only other parts requiring modification are the i.f. transformers T_1, T_2, T_3, T_4, T_5, and T_7. These are all 10.7 mc transformers. For T_1 proceed as follows: Remove both coils and disconnect the molded-in capacitors at the bottom plate. Wind a new coil with 20 turns of #26 enameled wire

[*Continued on page 96*]

Results of the

Spring, 1964 CQ *V.H.F. Contest*

BY BOB BROWN,* K2ZSQ

THIS spring's contest was full of surprises for all concerned. After computing the scores and reading over the logs and comments we appreciate the astonishing turn of events which took place on the weekend of May 2-3. I suppose most of us expected the Peninsula Amateur Radio Club of Bayonne, New Jersey, (WA2VLR), to hang on to the prized High Honors Trophy awarded them last year for top score in the Club Aggregate division. And they certainly fought for it. But a surprise contender, the Mt. Airy VHF Society of Philadelphia edged them out by 205,136 points and the final tally wound up like this: Mt. Airy—1,316,528; Peninsula—1,111,392. Although the gang manning the PARK's station, WA2VLR, will still capture the All Band, Multi-Operator award, they must tearfully pack up their beloved Trophy for a 365-day stay in Philadelphia, where it will be up to Mt. Airy to defend it next year or suffer a similar fate. Our hats off to both groups.

In spite of some severe rain storms in many sections of our country that weekend, scores reflected a much larger contest activity this year than last and generally higher point totals. Perhaps the most encouraging sign is a marked interest by v.h.f.-oriented clubs in our Club Aggregate division, begun last year for the first time. This year's clubs almost double last year's in number and in the percentage of individual club members participating. On the whole, it was a healthy contest.

Scanning the results, you'll note WA4GJU/4 capturing the Tennessee state award (through the proverbial "rain, sleet and snow"), W8TTU/8 walking away with West Virginia, K7OQP/7 taking Washington state, K1PLX/1 snagging the New Hampshire certificate with 140,220 points on both six and two meters, K9DZK/9 running away with the Indiana honors (on s.s.b. no less!), and K4ZMQ/4 who deservedly took the Georgia certificate after a rough battle with Mother Nature for rights to operate. We were pleased to learn that '4ZMQ won out, through sheer endurance more than anything else.

For the second year in a row now, the Zephyr V.H.F. Society came out on top in New Jersey competition. This group, operating under the call W2LST, not only again won the certificate, but topped last year's score with 708,180 points! It's going to take some real operating to beat them next year.

A surprise to no one was K2SWI's 585,600 points on six meters alone, winning the New York state award. They had a good lead early in the contest and held to it throughout and didn't neglect a brief opening that almost no one else reported!

The highest score of all in statewide competition was by W3MFY (conveniently enough a Mt. Airy member.) His accumulation of 110 counties and 375 contacts (single-handed) on six, two and 220, yielded 990,000 points—the highest yet recorded in this contest. Last year W8HBI/8 in Ohio accumulated 936,240 and at that time we ventured that their score would hold as "tops" for many a year. Not so! Our compliments to Pres Funk, W3MFY, for a terrific job!

Notes & Comments

W3MFY—Very excellent conditions. Did not notice any poor operators, but did notice many lower scores. Thoroughly enjoyed the contest! . . . *WA5AUA*—Had to share time with baby-sitting duties. Maybe more operating time can be scheduled next contest—HI! . . . *W1QXX*—Could have made many more contacts if the weak a.m. stations in the noise level would learn that there is still such a thing as c.w. . . . *K4JWZ*—Conditions generally the worst I have ever seen in a v.h.f. contest. . . *W3ETB*—A "fun" contest. I like the exchange of county idea. Would like to see all hams have name of county printed as part of QSL card . . .

K8MDU/8—How about a new award such as the "You Lose Because of Geographic Location Award?" Maybe now that someone knows there is life in the frozen wastelands, we might get some QSO's. After all, we're only 500 miles north of Detroit! . . . *WA9EPD*—No hours multipliers should be allowed . . . *K3AKR*—

Rob Little, W3ETB, hasn't missed a v.h.f. contest for as long as at least this writer can remember. Here he is caught in the act by junior op Dave using the temporary contest layout. Rob's one of those lazy fellows who calls "CQ" on a pre-recorded tape. Apparently, however, it produces!

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

Here's the Indiana state winner WA9FAF who helped operate station K9DZK/9 on six meters from Elephant Hill, right outside of Connersville, Indiana. And how's this for groundwave: Contact between K9DZK/9 and K1PQY, Worcester County, Mass? That's just a smattering of what these boys are doing nowadays with sideband.

HIGH SCORES

Club	Mt. Airy VHF Radio Club	
General	W3MFY	990,000
Novice	WN2KDD	50,400
A.B.M.O.	WA2VLR	1,111,392

Like your scoring best of all. But let's use GMT next time . . . *K8ZES*—Time span is excellent—Don't change it! I must comment on the excellent cooperation of those not in the contest but were giving out points . . . *WA4MTP*—Next year I hope to be on top of the mountains that surrounded me this time . . . *K1WHS/1*—Disappointed in activity in this neck of the woods. First time operating from Durham, N.H. I did hear Fred, WA2FSQ, in Fort Lee, N.J., early Sunday morning on two meters. His sigs were 5x3 on a.m.

WA9FJW—A leaky tent helps keep you awake . . . *K3IWK*—This was the best *CQ* contest that I've operated yet . . . in more ways than one. I heard VE3 on c.w. and WA9??? that just came in and out. Couldn't turn my beam fast enough . . . *W6YIO*—A much more fair scoring system than the other v.h.f. contests. . .

K1RQE—Power multiplier should be changed, splitting power up between bands. . . *WA6RTM*—Where was everybody? Weather was lousy. Our QTH was on my 1200 acre cattle ranch in back of my house on 1400' mountain. But no activity. . . *WB6CGM*—Overall, a very good contest. . . *K1YLU/1*—Much better activity than last year. Counties are better for v.h.f. than ARRL sections. . .

W3CCH/3—Located portable on top of Mt. Penn., Reading, Pa., 1100' above sea level. It was *very* cold. . . *WA8FRL/Ø*—We were here; openings weren't. Wait till next year. . . *W1QQ/1*—Note relative lack of activity on part of VE2's and VE3's upon whom I depend greatly from my QTH . . . *W8CCI*—Most active v.h.f. contest in the area in years. The work in putting up the stacked 11 over 11 six meter beams paid off in groundwave and DX . . . *K1NAY/1*—Competition in Maine is greater; more stations on the air. . .

K8BHH—First time I've worked a contest on six. Much more activity than on two! . . . *KB6BUT*—Ignition noise from passing cars made me ask WN6JDK to repeat his call 5 times. Hope to work the full 24 hours next year. . . *K3USC*—Heard many stations I never knew existed. Will look forward to next contest. . . *W8RPA*—Why not have a s.s.b. v.h.f. contest some weekend? . . . *K4CSH*—Don't have the contest on the Kentucky Derby weekend! It's tough here in Louisville. . . *WAØHVF*—Very little six meter activity here. . . *WB2ECR*—Contest was tiring, but a lot of fun. Had opportunity to work K1YLU, who I worked two years ago as a Novice, but the highlight was being the *first* two meter station to work K2US at the New York World's Fair. . .

Club Scores

Totals are computed by adding all individual member totals, which are also entered separately in the other categories. An engraved trophy is awarded by *CQ* on a rotating basis to the overall high scoring club.

Mt. Airy VHF R.C., Inc. (Pa.)	1,316,528
Peninsula A.H. Klub (N.J)	1,111,392
Reading R.C. (Pa.)	903,057
Montachuset A.R.C. (Mass.)	856,800
Zephyr VHF Society, Inc. (N.J.)	719,559
Mountain Top VHF R.C. (N.J.)	678,210
Butler County VHF A. (O.)	658,752
Cleveland 50 McDX C. (O.)	371,280
Crawford Hill VHF C. (N.J.)	292,320
Dallas 6 Meter C. (Tex.)	275,474
Licking County VHF C. (O.)	268,536
Tri-State College A.R.C. (Ind.)	260,190
Marion VHF Hi-Banders, Inc. (O.)	213,260
The ALA VHF Society (Conn.)	204,750
Six and Two Ham C. (Ill.)	196,202
Rockaway A.R.C. (N.Y.)	178,500
Dayton A.R.A. (O)	155,175
Hampden County R.C. (Mass.)	140,220
Burlington A.R. Society (N.J.)	127,872
Morris R.C. (N.J.)	127,776
Cleveland A.R.C. (Tenn.)	117,260
Centerville H.S. A.R.C. (O.)	108,995
Michigan State U. A.R.C.	100,224
Mt. Buck VHF Society (W.Va.)	99,600
Six Meter Club of Chicago	88,165
Hilltop A.R.C. (O.)	62,624
Lanier-Land A.R.C. (Ga.)	52,124
Oxford Furnance VHF C (Va.)	49,300
Case A.R.C. (O.)	47,550
Indiana School for the Blind	41,580
Kentuckiana R.C.	37,250
Thumb and Elbow C. (Conn.)	36,960
Windsor A.R.C. (Ont.)	24,926
Central N.J. VHF Society	24,750
Triangle A.R.C. (N.C.)	17,899
Suncoast VHF C. (Fla.)	14,720
Seneca Drums A.R.C. (N.Y.)	13,300
Greensboro R.C. (N.C.)	13,177
Corona Gang A.R.C. (Calif.)	12,319
Five Towns R.C. (N.Y.)	7308
Denver Hamsters VHF C. (Colo.)	4800
Lawndale Boys Club (Ill.)	4760
Niagra Peninsula A.R.C. (Ont.)	4374
VHF Hill-Toppers (Calif.)	1482
University of N.H. A.R.C.	313
Riverside County A.R.A. (Calif.)	192

General Competition

This group includes multi-operator stations using only one band and all single operator stations regardless of band or bands used. Number groups after call letters denote the following: number of contacts; number of counties; hour multiplier; band(s) operated and final score.

Alabama					
K4HPR	98	14	19	6,2	32,585
Alaska					
W8KNC/KL7	8	1	3	6	30
California					
W6YI0	68	16	17	2	23,120
WB6KAP	57	16	11	6	10,032
WB6CKT	43	13	14	2	9777
WB6AGM	45	7	19	2	7481
K6STI/6	57	6	8	2	3420
WN6JLO	14	1	11	2	192
W6TJ	12	4	4	2	192
Canada					
VE3CXK	69	17	17	2	24,926
VE3VM/VE3	68	13	22	2	24,310
VE3CCS	33	10	11	2	4374
VE3BTO/VE3	17	8	10	2	1700
VE7BNO	9	4	8	2	360
Colorado					
KØFHQ/Ø	95	17	24	6,2	48,450
WAØHVF	48	5	16	6	4800
Connecticut					
K1WVE	100	31	15	6	58,125
K1RTS	70	21	18	2	33,075
WN1ANB	55	16	14	2	15,400

Florida

WA4FVD	72	18	24	6,2	38,880
WA4EEZ	64	8	23	6,2	14,720
W4JTA	36	12	19	6,2	10,260

Georgia

K4ZMQ/4	73	32	21	6	49,056
K4UQM	21	12	9	6	2835
WA4QON	9	8	6	6	540

Idaho

K7MFA	2	1	2	6	5

Illinois

K9DWR	110	28	24	6,2,1¼	92,400
WA9FJW	128	19	24	6,2	58,368
K9ZWU	79	16	24	6,2,1¼	37,930
K9HMB	52	41	17	6	36,244
K9ZWV	64	17	24	6,2,1¼	32,640
WA9JCO	66	16	16	6	21,120
K9IOG	78	13	14	6	17,745
WA9FIH	92	9	17	6	17,595
W9CEK	61	11	19	6,2	15,936
K9ZPY	36	16	12	6,2	6912
WA9IRU	37	8	16	2	5920
K9YHB	68	7	10	6	4760
K9USW	28	7	28	6	1960
WA9FSN	27	3	10	6	1013
K9YHH	27	6	5	6	810
W9CTR	14	6	6	6	630
WA9BSF	24	2	6	6	360
WA9AXJ	6	3	3	6	68
K9DNW	7	2	3	6	56

Indiana

K9DZK/9	154	65	22	6	275,275
W9BF	147	59	24	6	260,190
WA9DRO/9	76	18	24	6	41,580
WA9AKU	75	15	24	6	37,750
WA9GNC	103	16	18	6	29,664

Kentucky

K4CSH	83	15	24	6,2	37,250
WA4LDP	42	27	18	6	25,515

Kansas

WØZXO/Ø	7	1	6	6	53

Massachusetts

W1QXX	190	47	24	6	214,320
K1ZGH	41	16	21	6	17,220
K1TCU	31	12	15	6	6825
K1ULZ	24	11	15	6,2	4938
WN1BHX	12	5	12	2	900

Maryland

W3JZY	134	59	12	6	94,872
K3NXH/3	21	16	11	6	4610

Michigan

WA8CDF	90	39	22	6	77,220
WA8IZV/8	118	20	22	6,2	64,900
W8RPA	81	37	20	6	59,940
W8BDV	83	22	24	6	43,824
K8VEX	61	23	21	6	36,850
W8VRH	68	22	19	2	28,424
W8CLH	31	15	11	2	6394
WA8JEI	29	8	12	2	3480
K8MDU/8	4	1	3	6	15

Minnesota

WØTRD	64	12	22	6,2	21,120

Nebraska

WAØDJK	8	2	6	6	120

New Hampshire

K1PLX/1	123	38	24	6,2	140,220
K1WHS/1	10	5	5	2	313

New Jersey

W2LST	319	74	24	6	708,180
K2MWA/2	290	42	24	2	292,320
W2NNL	171	32	19	2	129,968
K2SQS	144	37	24	6	127,872
WA2KZF	121	44	24	6	127,776
WN2KDD	80	21	24	2	50,400
WA2HNI	91	23	16	2	41,860
WA2OOD	55	20	18	2	24,750
WA2UPK	51	24	14	6	21,420
WA2WIL	61	18	13	2	17,483
WB2AJK	57	17	7	2	8479
WA2CMG	31	20	5	6,2	3100
WA2EKM	22	10	8	2	2200
W2KAI	14	10	4	2	700
WA2VTE	9	6	6	2	405

New York

K2SWI	305	80	24	6	585,600
WA2TGC/2	150	69	24	6	248,400
K2CBA	156	59	24	6	220,896
WB2ECR	170	35	24	2	178,500
K2ODL/2	98	44	22	6	94,864
WA2LRO	138	40	12	6	66,240
WA2FUZ	55	16	24	6	26,400
WA2IGF	101	19	10	6,2	19,190
WB2DKF	35	17	24	6	17,850
WA2SQC/2	40	19	14	6	13,300
WN2INR	53	21	7	2	9739
WA2DRK	29	18	14	2	7308
WB2HHS	37	11	8	2	7326
Wb2FXB	32	12	9	2	4220
WN2MYU	29	8	11	2	3190
W2IP	13	10	5	2	812
K2CHS	12	6	4	2	360

North Carolina

K4QIF	75	35	24	6,2,1¼,¾	78,750
K4MHS	42	23	19	6,2,¾	22,980
WA4REX	56	13	23	2	20,930
WA4ALB	56	11	15	2	11,550
WA4FJM	31	16	14	6,2	8680
K4BE	43	8	13	2	8090
W4BUZ	37	10	11	2	5087
W4LEN	24	16	10	6,2	4800
W4FDO/4	29	5	12	2	2175
W4PEN	18	10	9	6	2025
W4VON	7	5	5	2	219

North Dakota

W8FRL/Ø	1	1	1	6	1

Ohio

W8CCI	292	94	24	6	658,752
WA8BCA	238	52	24	6	371,280
WA8AHU	171	49	24	6	201,096
K8ZES	132	65	22	6,2	188,760
W8KKF	123	38	24	6,2	140,220
W8TKP/8	103	38	16	6	62,624
W8EDU	85	19	24	6	47,550
K8NLT	72	17	24	6,2,¾	36,720
WN8KGS	50	28	14	2	24,500
K8ALO	52	23	18	2	21,528
K8HVA	36	20	19	2	17,100
WA8DZU	46	15	17	6,2,¾	14,663
WA8IKN	36	18	17	2	11,016
WA8FHP	39	16	17	6	10,608
WA8DKC	47	16	11	6,2,¾	10,340
WA8GQQ	39	13	13	6,2	6592
WA8CLD	28	10	18	2	6300
W8FBP	53	7	12	6	5565
WA8KAK	31	10	13	6,2,¾	5038
W8JRN	30	10	16	6,2	4800
WA8IFU	38	5	15	6	3563
WA8DKA	18	4	11	6,2,¾	1080
WA8JBK	16	2	8	6	320
WA8BBV	6	3	2	6	45

Oregon

K7ZIR/7	68	12	22	2	17,752

Pennsylvania

W3MFY	375	110	24	6,2,1¼	990,000
K3ACR	220	56	21	6,2,1¼	323,400
K3LNU	153	51	24	6	234,090
W3ETB	124	51	16	6,2	126,480
K3IWK	64	35	18	6,2	50,400
K3LIJ	59	19	24	6,2	33,627
K3ZTJ/3	39	22	21	6	22,523
W3SNM	53	23	13	6,2	15,903
K3AKR	29	19	22	6,2	12,122
K3BUB	45	17	12	6	11,475
K3PQB	23	12	14	2	4830
K3PSX	39	7	14	6,2	4777
K3IPM	34	23	4	6,1¼	3128
K3CBE	26	7	13	6	2957
K3YIZ	26	7	12	2	2730
K3OEA	33	15	5	6	2475
K3USC	24	6	11	6	1980
W3DYX	22	7	12	6	2310
K3KBG	19	7	7	6	1164
K3MGO	25	9	5	6,2	1125
W3MCX	21	6	5	6,2	787
W3WOL	21	2	9	6,2	472
W3EYN	17	2	7	6,2	297
K3WQR	18	2	6	6,2	270
K3ALQ/3	14	5	3	6	262
W3LDA	7	5	5	6	219
W3UQC	16	4	2	2	160
W3CDS	16	1	6	2	120
K3VWT	14	1	6	2	105
K3VWS	13	1	6	2	97
K3TSQ	7	1	3	2	26
KN3ZGI	3	2	3	2	23
W3SLA	4	1	2	6	10

Tennessee

WA4GJU/4	130	41	22	6	117,260
K4JWZ	108	29	22	6,2	86,130
K4EJQ	71	30	24	6,2	63,900
WA4OOG	24	13	8	6	3120
WN4PZB	14	7	9	2	882

Texas

WA5EYD	119	26	22	6,2	85,085
K5MLD	112	21	24	6	70,560
K5TIQ	87	21	24	6	54,810
K5CMC	102	20	18	6	45,900
K5IVB	81	19	19	6	29,241
K5DRF	60	16	22	6	24,400
K5ARU	68	12	16	6	13,056
WA5AUA	44	15	15	6,2	12,375
WA5HIQ	63	7	11	6	6063

Vermont

W1QQ/1	1	1	1	2	1

Virginia

K4DTP	116	67	18	6	174,870
WA4JNL	65	32	19	6	49,300
WA4JWC	31	18	9	6,2	10,811
WA4MTP	4	1	4	2	20

Washington

K7OQP/7	82	12	20	6	24,600
W7ANI	31	5	9	6	1743

West Virginia

W8TTU/8	91	34	23	6	88,953
WA8KJX/8	71	41	24	6	87,330

Wisconsin

K9YGR	85	25	20	6	53,125
WA9EMI	50	11	21	6	14,438

Great Britain

G2DHV/p	32	9	8	2	2880

Novice Results

WN2KDD	80	21	24	50,400
WN8KGS	50	28	14	24,500
WN1ANB	55	16	14	15,400
WN2INR	53	21	7	9739
WN2MYU	29	8	11	3190
WN1BHX	12	5	12	900
WN4PZB	14	7	9	882
WN6JLO	14	1	11	192
KN3ZGI	3	2	3	23

All Band, Multi-Operator

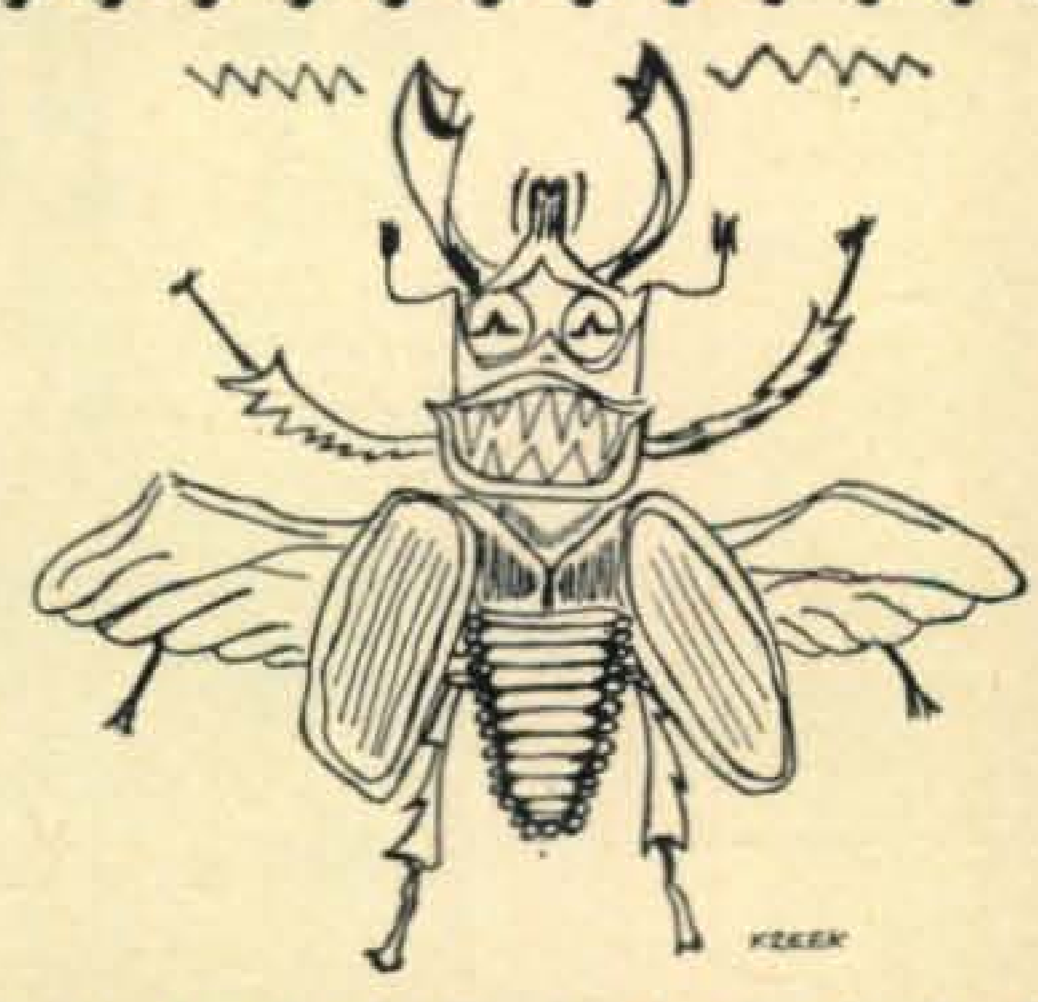
WA2VLR	457	102	24	6,2,¼	1,111,392
K1YLU/1	350	102	24	6,2	856,800
W3CCH/3	319	109	24	6,2	834,504
WB2GSK	193	68	24	6,2	393,720
W3JEZ/3	155	68	24	6,2	315,100
K1NAY/1	182	52	24	6,2	283,920
WA8DYD/8	167	67	24	6,2	268,536
WA1AKF	175	39	24	6,2	204,750
K6IXA	166	35	24	6,2	174,200
WA2SLY	174	60	15	6,2	164,600
K4LZO/4	138	50	18	6,2,¾	155,250
K1UVP/1	116	56	23	6,2	149,408
K1NCA	95	53	24	6,2	120,840
K8BHH	97	37	24	6,2	107,670
WA2GCH/2	87	39	24	6,2	101,789
WA2HFL/2	103	41	24	6,2	101,352
W8SH	87	48	24	6,2	100,224
K8ZPO/8	83	40	32	6,2	99,600
K1PVT	81	30	24	6,2	72,900
W1HPM	88	34	19	6,2,1¼	71,060
K1RQE/1	74	30	24	6,2	66,600
WA8CYX	74	29	24	6,2	64,380
WB2AYV	70	25	23	6,2	40,365
K1SQN	56	22	24	6,2	36,960
W4DGF	65	31	10	6,2	26,446
WA6PJD	115	5	24	6,2	17,250
WB6CGM	73	9	15	6,2	12,319
WA6RTM	19	6	13	6,2	1482
K7VTM	12	7	6	6,2	730

ONCE upon a time there was a little boy who lived in a far off country. His father was very rich (good thing—you'll see why later).

One day the little boy was playing in the woods near the castle (he lived there) when he saw a very odd little creature with eyes that glowed like filaments (4-1000A's). The little boy approached the beetle (that's what he looked like) very cautiously, for he didn't know whether he was dangerous or not (he'd left his i.f.f. toy at home). The boy noticed that the bug was blinking his eyes in a very odd manner. The bug (or beetle if you insist there is a difference) was using two of his many appendages (anything stickng out of his cotton pickin' body) to open and close his eyelids. Furthermore, he was not closing both eyelids together, but first one and then, as he pushed that open, he'd pull the other closed. The boy watched for quite awhile (nothing else to do) before he asked the beetle:

"Tell me, strange sir, what is that you're doing?" (It's a fairy tale, remember).

A Parenthetical Fairy Tale



BY C. F. TURNER*, W1JBQ

"Well, young man," the beetle replied, "My optical amplifier grids (eyelids to you) are not self-excited like yours, so I must drive them from another source."

"Oh, I see," exclaimed the boy (he didn't really—but you know how it is), "but why first one eyelid and then the other?"

"Ain't you never heard of push-pull, sonny?" the beetle snapped.

"No, I haven't" admitted the kid, "what would you call the way I work my eyelids—both at the same time?"

"Well, if the way I'm doing it is push-pull, then I'd say your way is push-push. And with two eyelids, I guess you could say you were doubling," answered the beetle.

"Har-de-har-har," sneered the boy. (He had picked up the phrase from a wandering, overweight jester.) "I think I'll step on you and do my good deed for today."

Now the beetle, with the built-in instinct Mother Nature provides all her creatures, began to feel that maybe this was a mean widdle kid who might, just *might*, do him harm, and so he sought to protect himself. An arc snapped between his two antennae (4000 gc). It seemed that the increased adrenalin, or whatever beetles have, caused an overload. With that he flew at the mean widdle kid with eyeballs (the beetle's) glowing red (the arc had caused a high standing wave ratio).

The boy reacted, turning to run for home. But, alas, the beetle bit him (where?—use your imagination), and flew off blinking his blinkin' eyelids (push-pull, of course) Class B (B for Beetle).

The little boy ran for home screaming (400 cycles—200% modulation), but when he got there and tried to explain what happened, he could no longer talk. Every time he opened his mouth, all that came out was—"Dah-dit-dah-dit/dah-dah-dit-dah."

Although his crying soon subsided, his dah-ditting continued. His parents, not being the type who call the doctor every time their son hiccupped, began to wonder (after a week) if perhaps there wasn't something wrong with the kid.

The best medical minds of the realm were summoned, but to no avail, until one day an obscure physician (he wore a mask) arrived at the palace. He spoke not a word, however, and because he wrote all questions and answers, was obviously deaf and dumb. When asked what his name was, he wrote: "Maximus, or Maxim for short."

When ushered into the boy's room, Maximus (or Maxim for short) wrote "Speak to me" on a card. (No, it wasn't a QSL card.)

The boy opened his mouth to try, but all that came out was: "Dah/dit/dit-dit-dit/dah."

The physician's eye lit up and he spoke (if you could call it that) for the first time, "Dah-dah-dit-dah/dit-dah-dit/dah-dah-dit-dit" (with a questioning tone, of course).

"Dit-dit-dah-dah-dit-dit" is all the boy could answer (he hadn't learned his Q signals yet).

Turning to the anxious parents, the obscure physician (he still wore his mask) scribbled on a

[*Continued on page 102*]

*36 Lawrence Rd., Hamden, Conn.

HAVING somehow survived to an age of slightly more than two-score years, of which three quarters of that time has been spent climbing trees, ladders, poles, and running about assorted roofs, this experimenter decided that hanging on with one hand and adjusting elements with the other was no longer attractive. The problem was particularly acute because of a desire to make changes and adjustments to experimental v.h.f. arrays, sometimes on a daily basis. Since the family budget could not provide the solution by way of one of the telescoping, lean-over, commercial wonders, it became necessary to engage the gray matter in the painful effort to overcome this problem. What follows is only one of the ways in which this might have been accomplished. It was the easiest, least expensive, and perhaps most important, required no special tools, talents or know-how to construct. Some very qualified assistance was used in digging the hole and erecting the pole, but I'm getting ahead of the story.

THE UPS AND DOWNS OF POLE TRACKING

BY LEE AURICK*, K3QAX

The use of a telephone pole, 50 feet long, and angle iron track, permits the raising and lowering of an antenna carriage quickly and easily with a winch. This is the ideal arrangement for the antenna experimenter.

First Things First

Just as the famous recipe for rabbit stew starts by advising the cook to "First catch a rabbit," the most essential ingredient for this project was the pole. Yours might come from any source, even new, but this one was purchased from the local telephone company who was replacing it for some reason. It was fifty-five feet long, acceptably straight, and weighed about two tons where it lay, about five miles from the spot where I planned to erect it. After a little discussion with an official of the telephone company, a delicate hint that somehow this pole could play an important part in public service to the community in time of emergency, it was agreed that the pole would be delivered to my house. Total cost so far: $25.00. Telephone people have an enviable record of public service, and are usually more than anxious to assist in any worthwhile project, providing you don't pour it on too thick.

Tracks and More Tracks

While these negotiations were in progress, many types of track were investigated and discarded. Garage-door track, unless you can find someone who is demolishing a three-bay service station, is either too expensive or not available.

*Mt. Pleasant Road, R.D. #1, Columbia, Pa.

Most supply houses, including the national catalog stores, sell the track and accessories for specific size doors in kits, and didn't even want to listen to our pleas for just one hundred feet of track. Also ruled out was channel-iron, and the very elaborate, albeit serviceable, track of the type used in this part of the country for large, sliding, barn doors. Too expensive.

In the final analysis, plain, old-fashioned, angle-iron won out for simplicity, and cost. After all, the purpose of the track was only to act as a guide for whatever type of carriage or vehicle we were eventually going to ride up and down the rails, and to hold this carriage in position at a fixed distance from the pole at all times. It was felt that 1½" × 1½" angle-iron, one-eighth inch thick, would be more than adequate to stabilize the largest v.h.f. beams we could handle. One hundred feet, in ten foot sections, to fit inside the station wagon, cost about $20.00 at the local, steel supply house. Had another method been available for transporting the angle-iron, it would have been preferable to have left it in the original twenty-foot lengths. This would have eliminated some of the alignment adjustments that necessarily followed.

Riding The Rails

The decision as to the type of carriage was of course arrived at simultaneously with the decision to use angle-iron as the track. One complemented the other, and the die was cast as to the way to proceed to design the carriage once the angle-iron had been purchased. Early in the planning we envisioned a rectangular, angle-iron framework, perhaps two-feet high and one-foot square, that would perhaps have two "arms" at the top and two at the bottom. These "arms" would keep the carriage a fixed distance from the rails, and would ride the rails from top to bottom of the pole. A steel plate was to be bolted to the bottom of the carriage to serve as a mounting plate for the rotator. This is shown in fig. 1A.

There was only one annoying fact gnawing at our complacency at this point. Telephone poles have a way of tapering, and this one tapered from 15" at the bottom to 8½" at the top. Obviously, it would be necessary to "step" the rails out as they ran up the pole. Since the pole, all two-tons of it, was lying on uneven ground, it was difficult to imagine an orderly way to figure out the exact way to first measure, and then construct, the blocks which would serve to "step" the rails out from the pole, and keep them vertical as they proceeded up the pole. The idea of blocks appeared to be a weak point in the construction, too. Stumbling mentally, we arrived at the conclusion that the easiest way was the strongest way; bolt the angle-iron directly to the pole. How then to keep the "arms" from leaving the rails as the carriage rode the rails up the tapering pole?

Confidence began to return when the alternative (allowing the "arms" to move with the taper of the pole) occurred to us. It wasn't immediately apparent how this was to be accomplished, but the task of bolting the angle-iron firmly to the pole was begun with renewed vigor.

Angles Have Angles

The pole was first rolled back-and-forth on the ground to select the best two opposite surfaces. Indentations and bumps were to be avoided. The entire family got into the act at this point, and the cry, "Watch the toes" became the byword for the afternoon. Once the surfaces had been tentatively identified, nails were driven part way into the pole at the top and bottom on one side. This permanently established the upper and lower limits for one track.

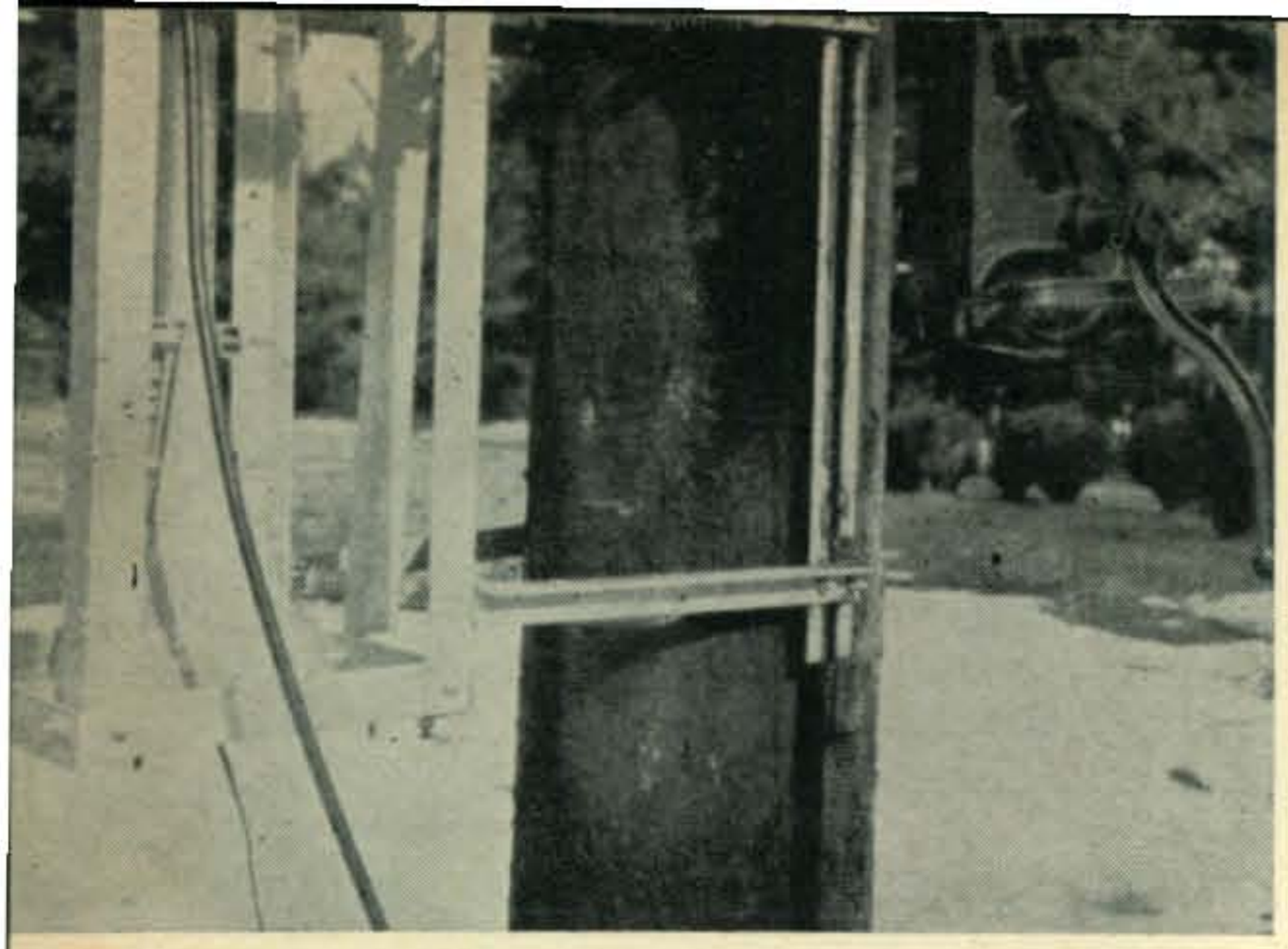
A string was then passed around the pole at the top and bottom to determine the exact circumference at each point. Taking half the length of the string at each end of the pole gave the exact point on the opposite side of the pole for the upper and lower limits on that side. These points were also marked with nails. The pole was then rolled slightly so that one surface was facing up.

It was quickly discovered that it would not do to place the angles on the pole and bolt them down. They had all sorts of cute little wiggles and variations in them. Sighting along the first one was a revelation, and a disappointment. It was necessary to stretch heavy string between the top and bottom nails, and bolt one end of the angle-iron to the pole, just touching the string. It was then possible to move a few feet down the pole and insert another bolt, pulling the angle-iron into alignment as we went. Generally, one bolt every five feet, or three per ten foot section, was sufficient. The first section bolted was the top ten feet.

The two pieces of angle selected for the opposite sides at the top of the pole had already been drilled near one end to accept a ½" steel rod, one foot long, with holes for ¼" bolts in each end. This rod would serve as the axle for a ten-inch steel pulley purchased from a local automotive supply house, and would function as the pulley carrying the entire load. Each top section was bolted to the pole with the end with the ½" hole protruding seven inches above the top of the pole. From the top of the pole down to about five feet from the top, bolts were installed every foot. It is while the carriage and antenna are at this point that the system will encounter the greatest torque when riding out high winds. It is unlikely that you will want to do much work on antennas during a storm, and therefore the only point where great rigidity is required is at the top. Lag bolts, ¼" × 2½", were used throughout. About 75 are required at a cost of $3.00.

Carriage Construction

As previously mentioned, it was decided that the carriage would be made of angle-iron to provide a rugged support that would resist the torque forces of large arrays. When this project was first considered, about the only material that was on hand was about 20 feet of 1½" angle-iron. This was more than sufficient to construct the carriage, which ultimately measured



Side view of the carriage shows how the arms ride the tracks. Note the winch on the rear of the pole.

two feet high by one-foot square. Each corner was bolted three ways with ¼" × 1" steel bolts. This arrangement produced a very satisfactory carriage, but it would have been almost as rugged, and still as serviceable, if it had been made of the same 1¼" angle-iron as the rails.

The one-foot square dimension was selected as a compromise between the top and bottom dimensions of our particular pole. It was finally decided that an effort would be made to adjust between these limits by the use of hinges. In this way, the "arms" would be independently articulated, and would be free to adjust as the carriage rode the rails. Accordingly, steel hinges were bolted to the carriage with ¼" × 1" bolts, and the "arms", of 1½" × 1½" angle-iron, 15-inches long, were in turn bolted to the hinges. Four such arrangements were made; one on each corner facing the pole. Two-foot lengths of ¾" angle-iron were then bolted vertically between the top and bottom "arms" on each side. These pieces were bolted "back-to-back" about ¼" apart, as shown in fig. 1B, to form a channel that would fit over the 1¼" angle-iron mounted on the side of the pole. At this point it was not certain that the dimensions were correct, but we kept telling ourselves that we had no way of knowing for sure until the entire system was completed and tested.

Trial And Error

At last the final hole was drilled (or so we thought), and we were ready to try a test haul of the carriage up the pole. Since the winch had not yet been obtained, this required some perserverance on the part of my father, and the Jr. Op., K3QAF. It quickly became apparent that our tentative arrangement to keep the "arms" against the track was inadequate. This first effort used short, sturdy springs connecting the "arms" at the top of the carriage, and connecting the "arms" at the bottom of the carriage.

They did indeed keep the "arms" against the pole, but they did not keep the carriage riding directly in line with the pole as it was raised and lowered. The carriage would slew first one way, and then the other. It was obvious that even without a beam mounted on the carriage, this situation was extremely unsatisfactory. The carriage was lowered and a full reappraisal of the problem made. It was still necessary to provide some method of maintaining the "arms" tightly against the track. It was also desirable that the "arms" move more independently of each other than was now possible. The tension was the same on the "arms" in each set, since they were linked together by common springs, one at the top, and one at the bottom.

The next approach was to purchase two gate springs. These were filed in half (much easier than cutting tempered-steel with a hacksaw), and sufficient heat applied to the new ends with a soldering iron to permit turning a new hook into each end. The middle bolt fastening each hinge to the carriage was removed, and an end of one of the shortened springs inserted. Each spring was then stretched across to the opposite "arm" where a hole had been experimentally drilled to take the other end of the spring. A few experimental holes had to be drilled to adjust the tension on each arm before the entire arrangement was declared satisfactory. Now, any tendency to slew around the pole was counteracted by an increase in tension on the opposite spring which quickly dampened this deviation (fig. 1C).

Final Adjustment

Several winches had been investigated, and it was finally decided that one of the larger types used for hauling small boats out of water and

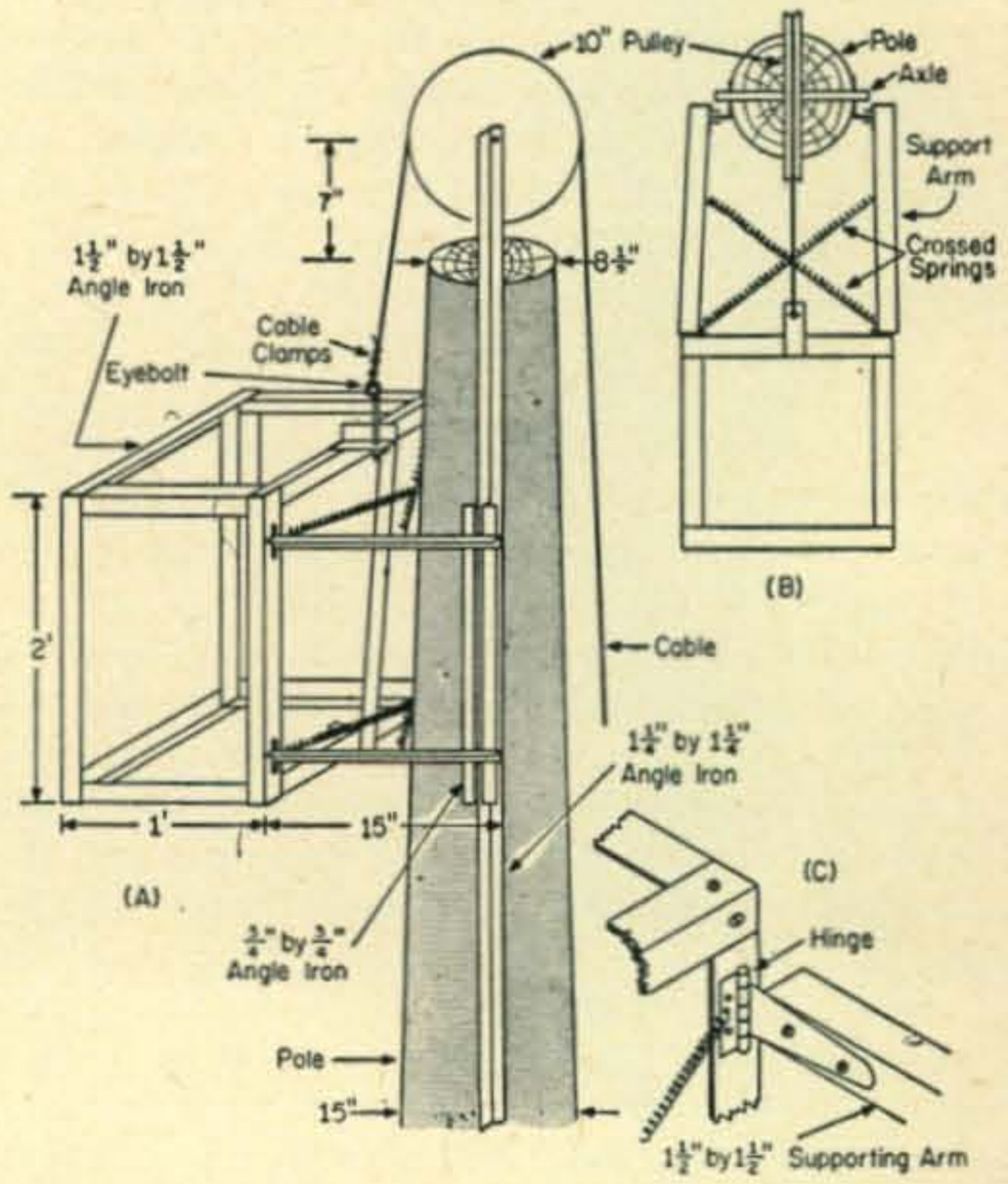


Fig. 1—(A) The antenna carriage is shown attached to the pole. It is made of 1½" × 1½" angle iron with a ⅛" steel bottom plate for mounting the rotator. (B) shows the arrangement of the clamp used to ride the rails and the interconnection of the four springs. (C) the hinges, supporting arms and tension springs are installed as shown (see photograph).

onto trailers would be satisfactory. The larger types have sufficient strength to do the job, and adequate reel capacity to hold more than 50 feet of ¼" steel cable. This is the maximum amount of cable that would be wound on the winch at any time, if your pole is no more than 50 feet above ground. It developed that we did not have to buy a winch, and the one that was made available was several times larger than was required. However, since it is on "indefinite loan", we are not about to resent the reserve capability.

With the installation of the winch, suitably mounted with ⅜" × 3" lag bolts, we were ready for the final adjustments.

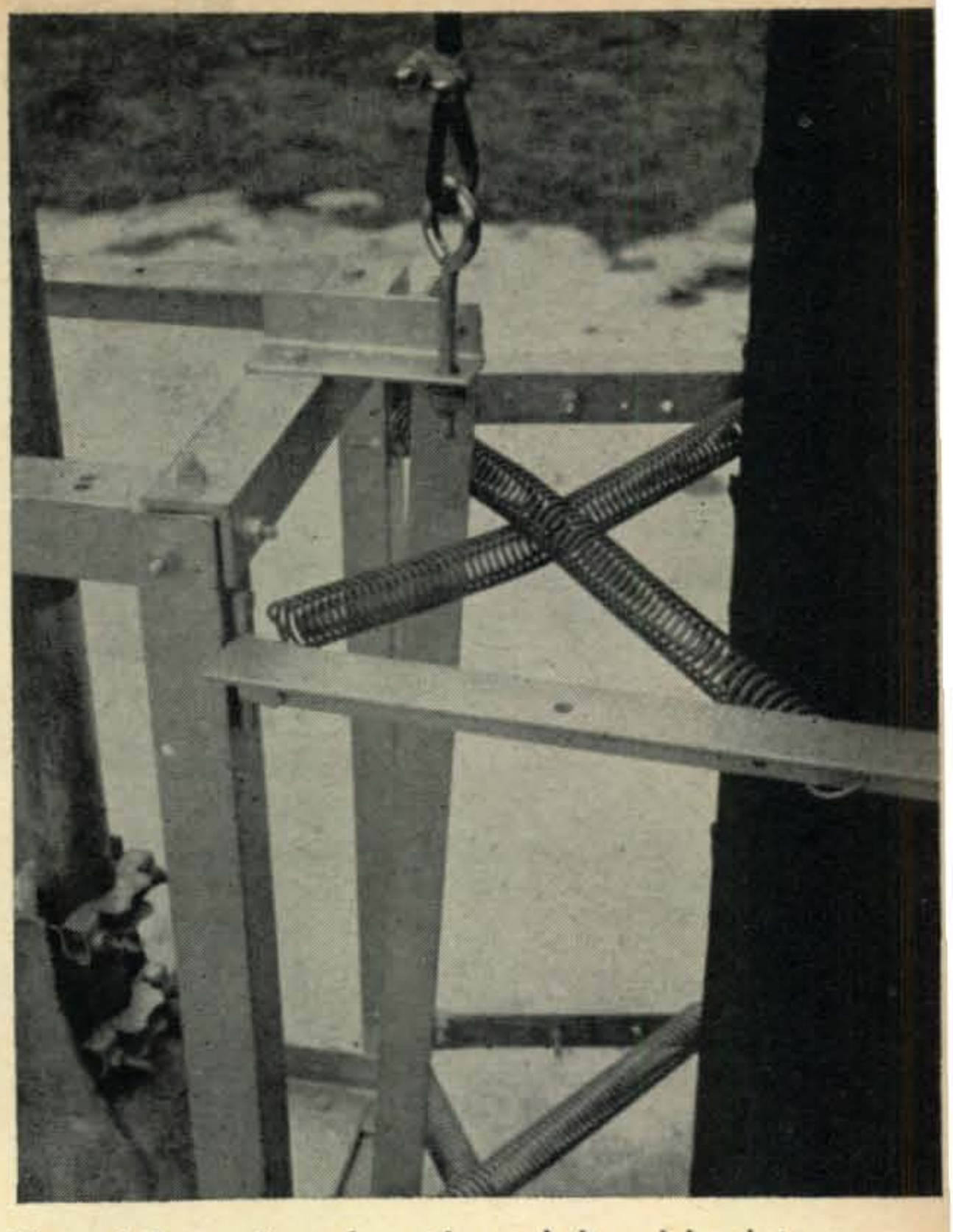
Previously, while the pole was still on the ground, and after all the angle-iron rails had been bolted into position on the pole, all rails were marked to indicate which ends butted together. This was done with a few daubs and stripes of paint. Then, the bottom 20 feet of rails on each side were removed from the pole. This was done as it was anticipated that in raising, the pole would flex, and with it, the angle-iron track. The pole would straighten itself when placed in the hole, but we weren't so sure about the track. We believe the extra work was a wise precaution.

The bottom and mid-point bolts of the middle 10-foot sections were also removed and these sections secured to the pole by a piece of wire which was passed around the pole and through the holes in each end. Once the pole was erected, it was only necessary to climb the extension ladder to a height of 25 feet, install the bolts in the holes on each side, then proceed down to the 20 foot level and install these bolts, after the wire had been removed. The remaining two 10 foot sections on each side were then raised and bolted into place. A certain amount of shimming was required to align the butt-ends of the track so that the carriage would pass easily from section to section. Again, had the track been maintained in its original 20-foot lengths, this problem would have been minimized. Even here, the job was a simple one, and was accomplished by inserting small pieces of hanger strap iron, suitably folded, between the pole and the track.

It is well to liberally grease the top sections, prior to erection, with a good grade of axle lubricant. These sections will not be readily available again; not without defeating the purpose for which the pole was installed. The remaining sections can be greased as they are installed for the last time. Also, don't forget to apply plenty of grease to the axle at the top of the pole. This is one job you *won't* want to do again, ever.

Other Suggestions

Omitted from this story so far have been the details of how the hole was dug, and the manner in which the pole was actually erected. They were purposely left until now, for these details were purely mechanical ones and would be no different regardless of the manner in which the pole was to be used.

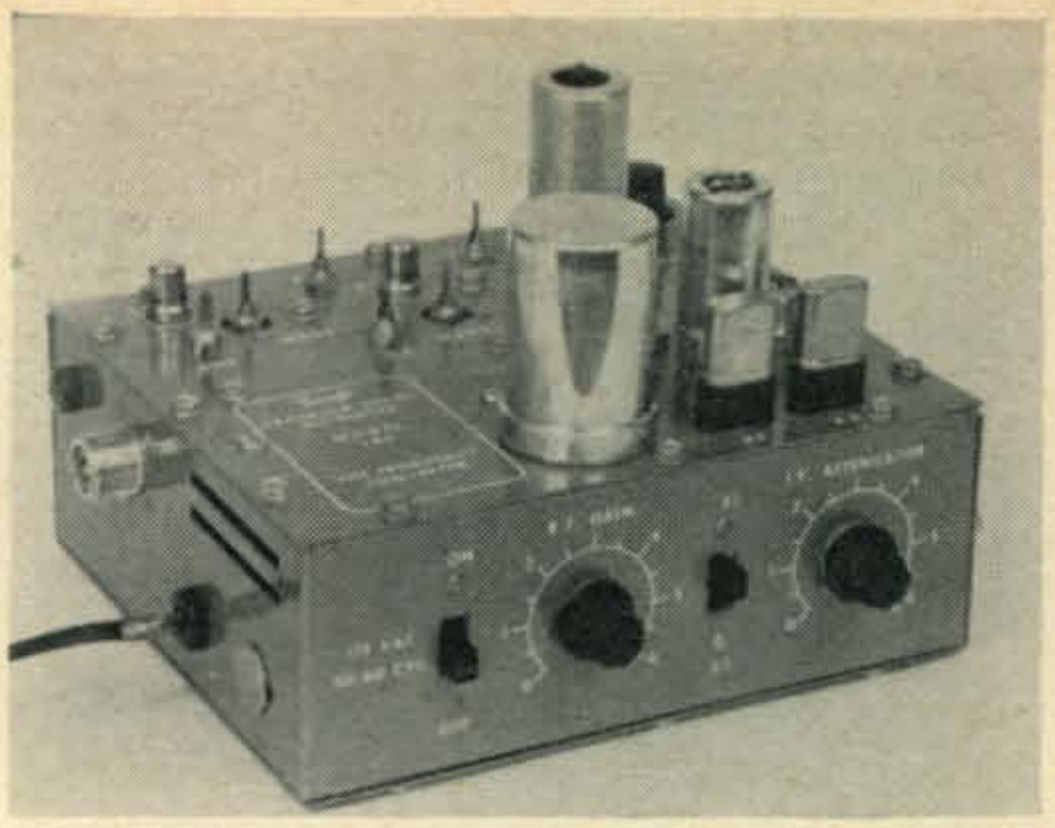


View of the carriage shows the eyebolt and bracket arrangement as it is tied to the cable. Note, also, the hinge and spring arrangement.

A chance encounter with a local pole-line construction crew, while the planning was in progress, led to their showing up one day in my yard with the large rig used for boring holes for poles. In twenty minutes they were in and out, and we had a beautiful hole, 8 feet deep, and 2 feet in diameter. Upon rewarding them modestly for this noble service, they volunteered to come back and set the pole when it was ready. A few weeks later, we used the telephone number which had been so graciously offered, and announced that the pole was ready for installation. Two days later it was in the ground 8 feet, and above ground 47 feet. It looked like a hundred, and the largest single project we had ever tackled in Ham Radio was very near completion.

Doubtless, you have considered such a project from time to time. The details of this particular installation have not been presented with the idea that you may want to duplicate it, but only to demonstrate that such a venture is completely within the capability of everyone.

The carriage has been up and down the pole a few hundred times in the last six months, often, several times a day, and this experimenter is convinced that this was the most worthwhile project ever undertaken here. Total cost, including pole, hole, erection, angle-iron, pulley, 100 feet of ¼" cable, hinges, bolts, hardware and springs was just over one hundred dollars. The purchase of a boat winch would add to this figure, but you should be able to approximate this amount, for a similar system, with very little shopping. ■



Tecraft Criterion series v.h.f. converter. At the left side are the a.c. power cord, SO-239 antenna connector and pin jack for external a.g.c. The front-end Nuvistors and alignment controls are at top rear with the mixer-output stage. Crystals are shown in the two crystal sockets at the right foreground. These are selected by the slide switch between the r.f. gain (left) and the i.f. attenuator (right) on the front apron. The a.c. power slide-switch is at the left of these. The i.f. output selector is at top right rear corner, barely visible. An SO-239 connector for i.f. output is at right behind the crystals.

CQ Reviews:

The Tecraft Criterion V.H.F. Converters

BY WILFRED M. SCHERER*, W2AEF

THE name Tecraft has long been familiar to v.h.f. enthusiasts as the trade name of The Equipment Crafters, one of the pioneer manufacturers of high-quality v.h.f. amateur gear. As new techniques and components are developed, it is natural to expect such improvements to be incorporated in new equipment from time to time. Tecraft has done just that with their Criterion Series of converters for 50, 144 and 220 mc.

These units are of advanced design featuring very low noise figure, high sensitivity and signal-to-noise ratio, high gain, excellent cross-modulation characteristics enhanced with a variable r.f. gain control, full 4 mc bandpass, high-frequency crystals for lessening spurious responses, .005% crystal accuracy, i.f. output-frequency selector, i.f. output attenuator, use of a.g.c., 52-72 ohm input (300 ohm with balun), 2 crystal sockets with selector switch for use with restricted-band receivers, self-contained power supply, complete filtering of power wiring and extensive shielding; all at a reasonably low price.

Circuitry

The heart of the Tecraft Criterion converters is the front end where two Nuvistors are employed in a "neutrode" circuit. Referring to fig. 1, two inductively-coupled bandpass r.f. stages are used. The coupled circuits are tuned with variable capacitors, resulting in a higher-C arrangement than usually is encountered. This stiffens the system and, together with the carefully worked-out mutual coupling, provides a relatively flat bandpass with high rejection of out-of-band signals such as images and those in the i.f. range.

Another departure from the familiar type of circuitry is the use of individual grid neutralization for each stage which completely stabilizes the system. The overall arrangement ensures low noise, high sensitivity, gain and image rejection with better cross-modulation characteristics than can be realized with Nuvistors in the popular cascode-type circuit. The possibility of cross modulation from local high-powered stations may be further minimized, if needed, by means of the r.f. gain control located in the second stage where its use does not seriously deteriorate the signal-to-noise ratio. A.g.c. from the i.f. receiver may be applied to the front end through a pin jack on the converter.

The mixer is one section of a 6JK8 low-noise dual triode, the second section of which is connected as a cathode follower to provide a low-impedance i.f. output. A tapped coil with a selector switch at the cathode follower input provides a choice of i.f. output frequencies to permit use of the most convenient tuning range on the associated receiver. For the 144 and 220 mc models the selection covers frequencies between 6 and 54 mc. For the 50 mc model the range is from 6 to 35 mc. An i.f. output attenuator enables the signal level from the converter to be adjusted for best operation with the i.f. receiver; that is, above the receiver's inherent noise level and below the overload point of the receiver.

One half of a 6J6 is used as an overtone-crystal oscillator, while the second half is used as a frequency tripler, except in the 50 mc model where it is not needed. High-frequency crystals are used to limit the required frequency multiplication, thereby providing greater freedom from spurious responses.

Either of two crystals may be selected for

*Technical Director, *CQ*.

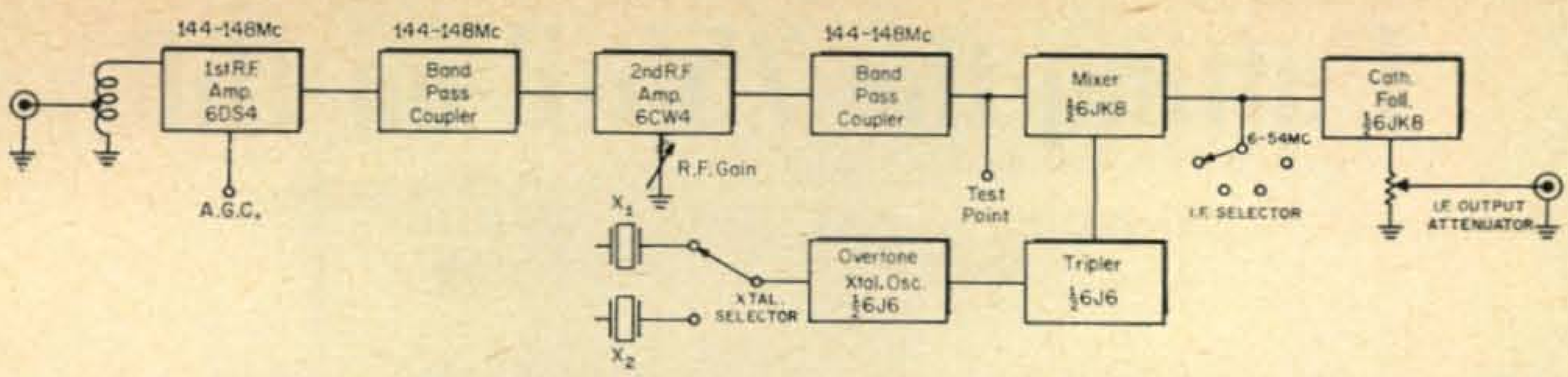


Fig. 1—Block diagram of the Tecraft Criterion converter. See text for description.

use in cases where the accessory-receiver band coverage is restricted. For instance: where coverage is over only a 500 kc band segment, the crystals may instantaneously be selected for any two 500 kc portions in the converter range, or two crystals will take care of the full 4 mc converter range in cases where a ham-band-only receiver covers the 2 mc range from 28 to 30 mc. Crystals, of course, must be chosen according to the desired i.f. band. Only one crystal is needed when the receiver covers a continuous range of 4 mc. In this respect, the converters usually are supplied with one crystal for 14-18 mc i.f. output.

The gain over a 4 mc spread on a general-coverage communications receiver may vary considerably. Ordinarily this should not affect the sensitivity or the signal-to-noise ratio when converters are used therewith; however, if converter realignment were made for uniform response from the receiver output in such cases, the converter performance could deteriorate. To avoid this, a test-point pin jack is provided on the unit in order that proper alignment of the converter *itself* may be made according to voltage readings obtainable with a v.t.v.m. connected at the test jack.

Optimum front-end performance is realized only within a limited range of B-plus potentials for the Nuvistors. Therefore, to ensure peak operation, a power supply is built into the Criterion converters. Not only does this avoid improper voltages, but it also is a convenience whereby the user is not required to rob power from another piece of gear or to employ a separate power source.

Construction

Special attention has been paid to the construction and the components of the Criterion converters, all of which largely contributes to their excellent performance.

NPO bypasses are used in critical r.f. circuits, while silver-micas are employed where neutralization capacitance is involved. The *variable* neutralizing capacitors and those used in the tuned r.f. circuits are the piston type having Corning-Glass quartz dialectric and a spring-loaded slug, thereby ensuring low loss and high stability of adjustment. Selected low-noise resistors are utilized where needed. Extensive shielding is included, as may be seen in the photograph, and the shield partitions are well tied together with soldered joints. They and the chassis are made of copper-plated steel, providing high r.f. conductivity with good electrostatic and magnetic shielding. All power leads are well filtered to ensure freedom from unwanted r.f. pickup.

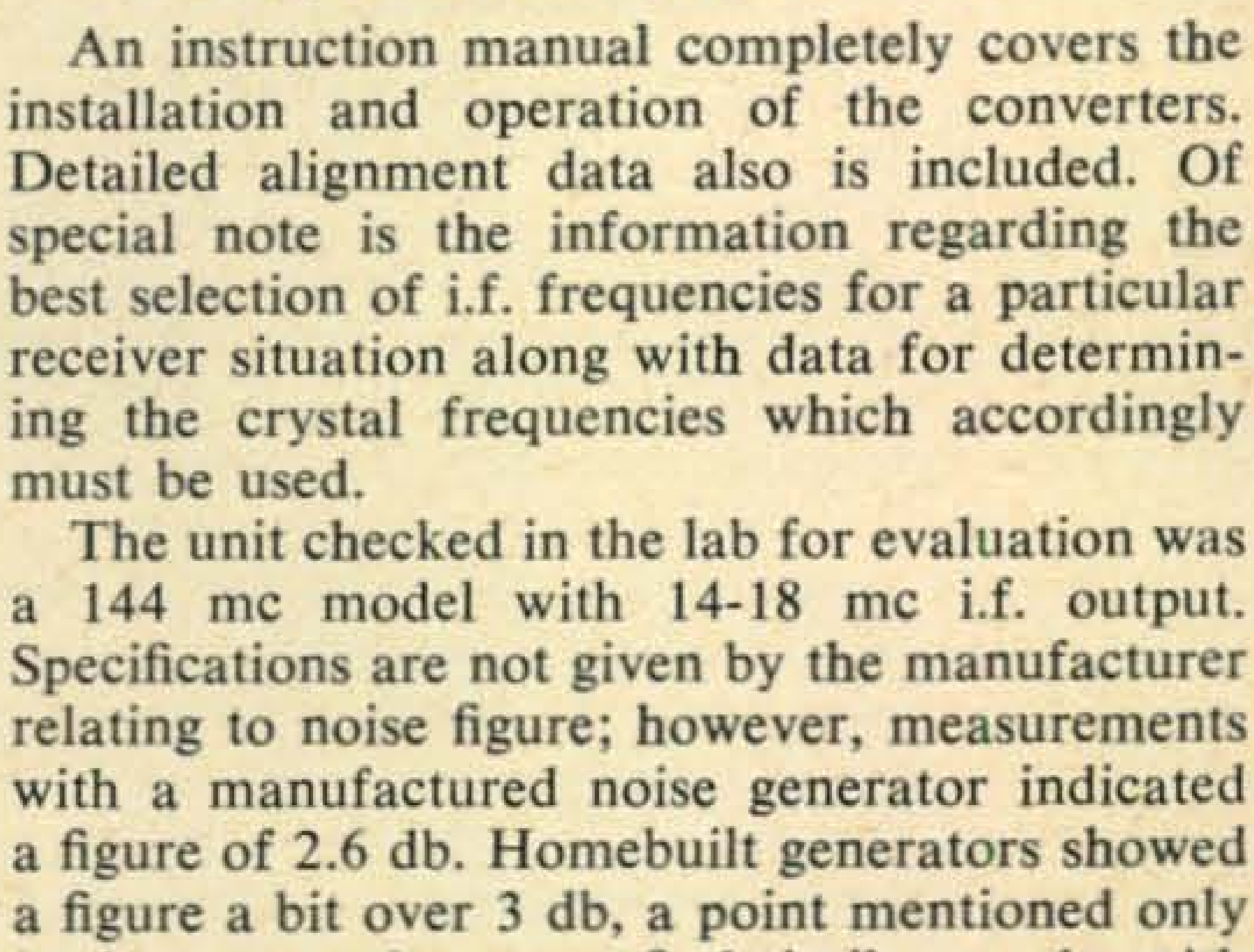
The Criterion units are finished in Hammertone gray with white lettering and black knobs. The chassis size is 2½" H. × 7" W. × 6" D., maximum overall height, including tubes, is 4¾".

Operation and Performance

An instruction manual completely covers the installation and operation of the converters. Detailed alignment data also is included. Of special note is the information regarding the best selection of i.f. frequencies for a particular receiver situation along with data for determining the crystal frequencies which accordingly must be used.

The unit checked in the lab for evaluation was a 144 mc model with 14-18 mc i.f. output. Specifications are not given by the manufacturer relating to noise figure; however, measurements with a manufactured noise generator indicated a figure of 2.6 db. Homebuilt generators showed a figure a bit over 3 db, a point mentioned only in the event others may find similar results with such gear. It is also worthy to note that the care taken in the selection of high-quality components and stabilized circuitry showed up significantly in that noise-figure readings remained essen-

[*Continued on page 88*]



Interior view of the Criterion converter. Note the extensive shielding. Compartments along the front, left to right, are: 1st r.f., 2nd r.f. and mixer-output. Power supply and crystal oscillators sections are at rear. The vertical cylindrical components, in the front sections, are the piston-type quartz-glass variable capacitors.

Putting the 75S-2 on 160

BY E. E. BALDWIN*, WØRUG

This simple modification can be accomplished with no change in external appearance and no major surgery. It requires only a handful of inexpensive capacitors and one crystal.

ACTUALLY I admire the S-line as is but I have felt that the lack of 160 meters was a weak point worth doing something about. Due to the existence of an extra crystal board and sockets in 75S-2 this modification is simple.

Modification

After pulling the chassis and turning it up on its side, the first step is to rotate the bandswitch to make the screws on the fiber switch shaft coupling accessible. Loosen the rear screw, allowing the shaft to be removed from the rear through a hole provided in the chassis. Then remove the nuts and lockwashers from the top side of the chassis allowing removal of the three coil shield cans covering the coils and switch sections. Next, I clipped the jumpers between 3.4 and 3.6 mc positions on the switch wafers (which I call terminal #1 and terminal #2 on each wafer) and the small capacitors from #1 were resoldered to #2, thus leaving terminal #1 floating. The schematic of fig. 1 shows this clearly.

Now, starting at S_2, the high frequency oscillator switch deck, a 480 mmf compression type mica trimmer was mounted on heavy buss wire as supports from terminal #1 to chassis and mounted in such a position as to be easily adjustable through a hole in the bottom of the shield can after replacement of this can

At S_3, the r.f. stage switch deck, another 480 mmf trimmer in shunt with an 1800 mmf silver mica capacitor was added from terminal #1 to chassis, again using heavy buss wire and allowing for adjustment after replacement of the coil can.

This process was repeated on S_4, the antenna switch deck, but this time I used a 330 mmf and a 390 mmf, both in shunt with a 480 mmf trimmer. The three of these are connected from terminal #1 to the chassis the same as the other stages. About an 810 mmf capacitor would have probably worked fine but at this point the junk box let me down.

Operation

After replacement of the coil shields and the fiber bandswitch shaft, a 4.955 mc crystal was plugged into the #1A crystal socket, and all trimmers peaked at 2 mc with the preselector knob at about #2 on the logging scale.

With the proper crystal, the dial is still direct

[*Continued on page 102*]

*R3, Box 153A, Longmont, Colorado 80501.

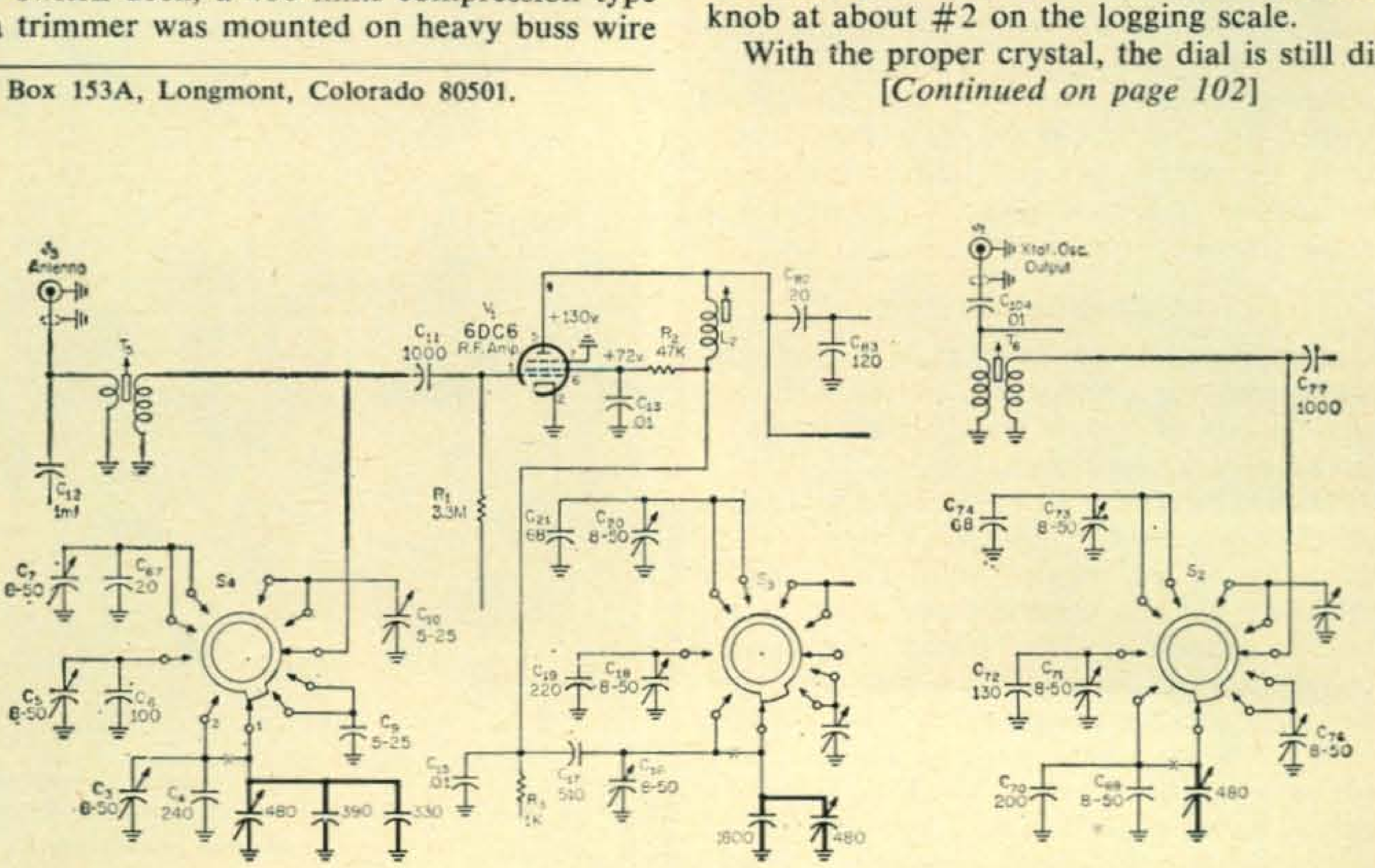
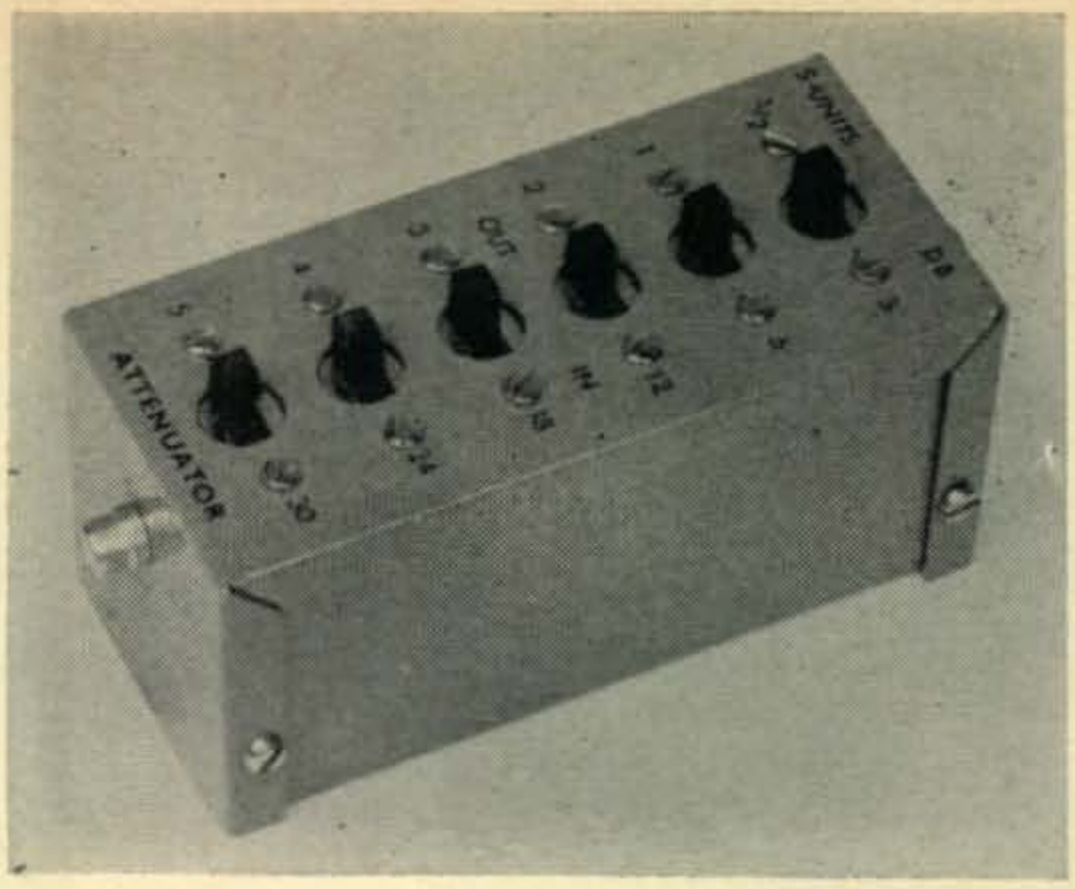


Fig. 1—Circuits of the bandswitch portions of the 75S-2 showing the wiring modifications for the addition of 160 meters.



Step attenuator. Round hole openings for the slide-switch levers are simply made and still make a neat appearance. Steps of attenuation are calibrated in db and S-units.

A Step Attenuator

for Receiver and Test Applications

BY WILFRED M. SCHERER*, W2AEF

A HANDY device to have around the ham shack is a variable step attenuator calibrated in known increments. It may be employed with a receiver to check S-meter calibrations, to accurately check relative signal levels, relative antenna gain and front-to-back ratio, receiver sideband suppression, image and i.f. signal rejection, cross talk in coax switches; to make comparative receiver-sensitivity measurements; to provide known r.f. voltages from an r.f. signal generator; to minimize receiver cross modulation, a.g.c. pumping with s.s.b. signals, background noise and QRM; or to improve the accuracy of noise figure readings.

Commercially manufactured step attenuators are available, and are quite costly, and a suitable inexpensive unit may be made from readily available components. The model shown here consists of six cascaded sections, each having a different degree of attenuation, which may be switched in or out as needed. The steps are: 3, 6, 12, 18, 24 and 30 db, equivalent to ½, 1, 2, 3, 4 and 5 S-units per step respectively. The accumulative attenuation is 93 db. Any single step or combination of steps may be selected by means of switches. Input and output impedances are 50 ohms, making it possible to use the device in either direction. The maximum permissible applied power is ½ watt.

The particular steps used were chosen to coincide with S-unit values for correlating receiver measurements with the standard rating of a 6 db relative signal change per S-unit. For some applications other step combinations may be more desirable, such as might be needed with a signal generator for obtaining known r.f. voltages in voltage steps by factors of ten down into the microvolt region. Such an arrangement would be steps 4, 6, 10, 20, 20, 20 db, or 10, 10, 20, 20, 20, 20 db.

*Technical Director, *CQ*.

Circuitry

The circuit for the step attenuator is shown at fig. 1. Pi-type attenuator sections are used instead of the more common T-type since their required resistor sizes are more easily obtainable and the configuration lends itself nicely for the application both from an electrical and mechanical standpoint.

One-half-watt composition-type resistors are used (BWH resistors made by IRC look like composition resistors, but they are wire-wound and should not be used). Table I lists the resistor sizes needed for several different steps of attenuation. The target values are given along with the nearest available standard sizes of 5% tolerance, the use of which should result in an average error of no more than about ½ db. On the other hand, for closer accuracy, sizes nearer the target values may be selected from a group of resistors by measurement made with a bridge or a reliable ohmmeter.

Construction

The step attenuator is built into a 5" × 2⅛"

Attenuator	*Target Values (ohms)*		*Nearest Standard 5% Size (ohms)*	
Db	R_1	R_2	R_1	R_2
1	870.0	5.8	820-910	5.6
2	436.2	11.6	430	12
3	292.4	17.6	300	18
4	221.0	23.8	220	24
5	178.0	30.4	180	30
6	150.5	37.3	150	36
10	96.2	71.1	91-100	68-75
12	83.5	93.2	82	91
18	64.4	195.0	62-68	200
20	61.1	247.5	62	240
24	56.7	394.0	56	390
30	53.2	790.0	51	750-820

Table I—Resistors sizes required for various steps of attenuation. See Text.

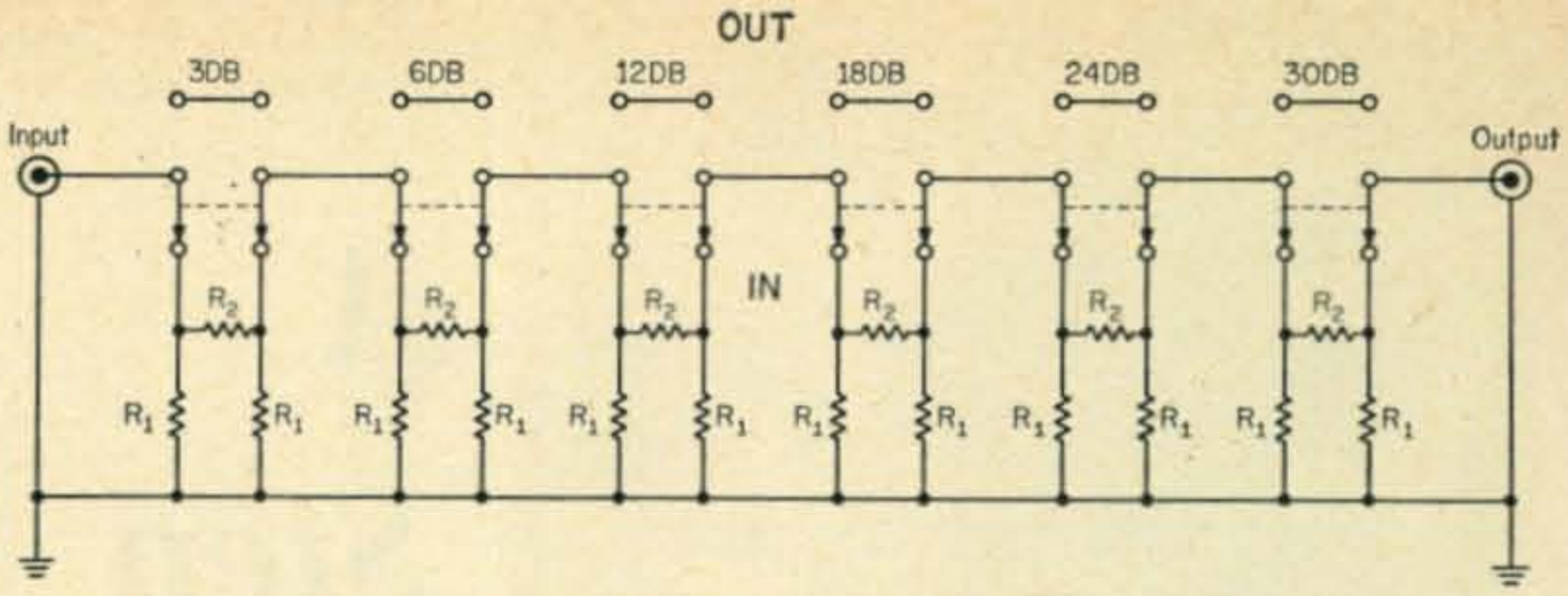


Fig. 1—Circuitry for step attenuator. Values for R_1 and R_2 may be found from Table I.

× 2⅛" Minibox with a physical layout as shown in the photos. Drilling dimensions are given in fig. 2.

Slide-type switches are used to keep costs down and because they are more suitable electrically, compared to some type toggle switches. The switches should be of high quality having dependable low-resistance contact and low inter-terminal capacitance. Those made by Stackpole have been found excellent. Wirt also should do. Imported switches should be avoided by all means!

A drawback often encountered by the builder with construction involving slide switches is the difficulty of making the small rectangular hole for the switch lever. As may be seen, this has been solved simply by the use of a ½" hole instead. Such holes may be cleanly and uniformily made with a chassis knockout punch, but in the event the holes must be drilled, a neat result can be obtained by first making a small hole and then using progressively larger drills up to the final ½" size.[1]

When a switch is installed, it must be exactly centered in the large hole so that the full swing of the switch lever can be made in either direction. Drilling the small mounting-screw holes a bit oversize will allow flexibility in positioning the switch.

Input and output connectors are the one-hole-mount type of phono jack (Switchcraft 350FB), but any other type coaxial connector may be used. The resistors are connected and positioned as shown in fig. 3, with the ground ends of the shunt arms soldered to lugs held by the switch mounting screws.

After the attenuator has been constructed, the accuracy of each step may be checked with an a.f. oscillator and an a.c. voltmeter which has incremental db calibrations. To do this, connect the attenuator between the output of the oscillator and the voltmeter. Terminate the generator and the meter each with a 50-ohm resistor. Obtain a reading near full scale on the meter with all the attenuator steps out. Then switch the various steps in and out and compare the db reading changes with the expected attenuation. Be sure the db calibrations of the meter coincide with the a.c. range used, since separate low and high a.c. scales are often used. This can be checked by noting on which range-scale the voltage calibrations tally with a 6 db change when the voltage readings are halved or doubled.

The accuracy of the attenuator should hold well up to 50 mc. At higher frequencies some deterioration may be expected due to stray capacitance leakage and lead inductance. The degree of error usually increases with the larger steps of attenuation.

Operation

The step attenuator is designed to work from a 50-ohm source into a 50-ohm load, so to ensure maximum accuracy during relative measurements, the proper terminations should be em-

[1] "Drilling and Cutting Holes," *CQ*, Nov. 1963.

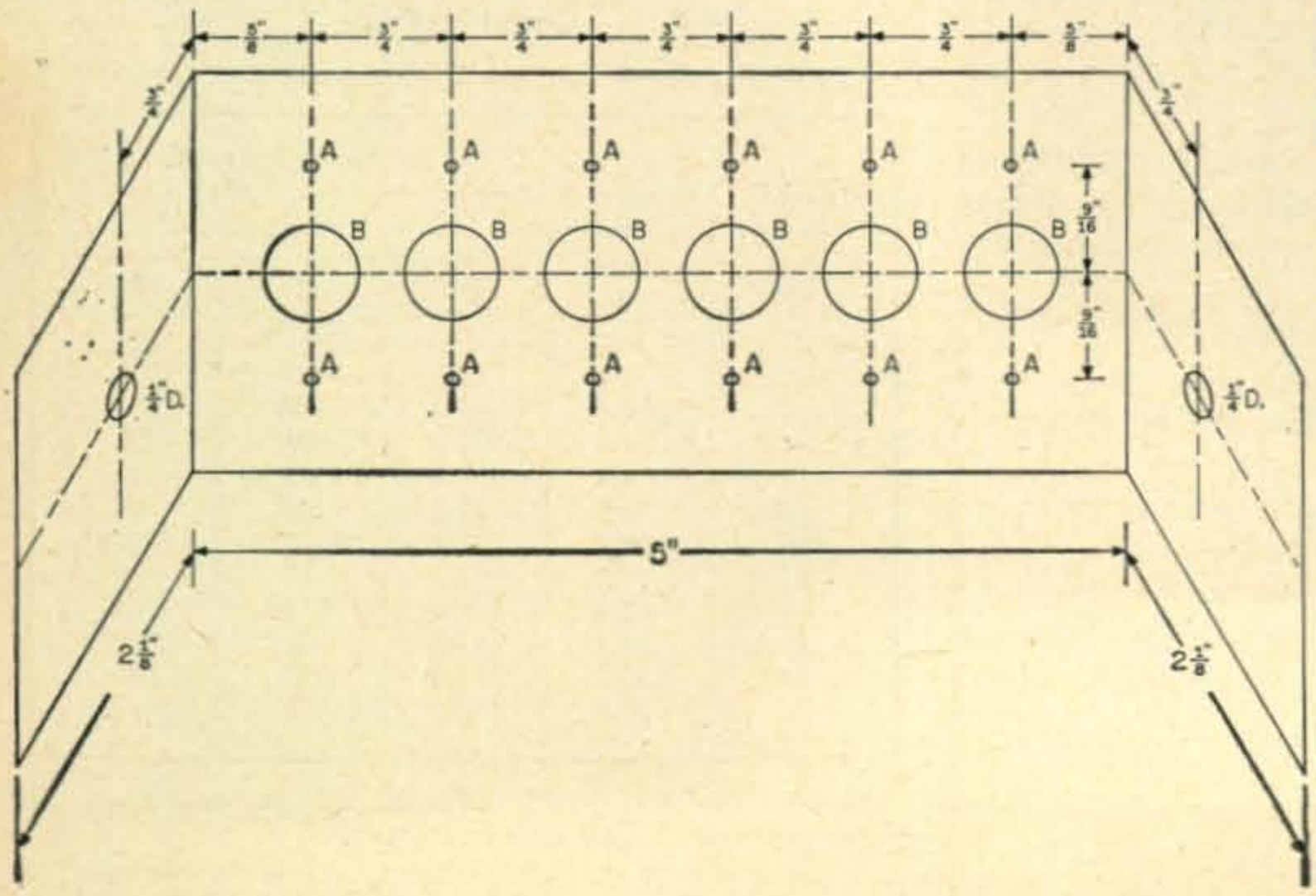


Fig. 2—Drilling dimensions for the step attenuator. A is a number 31 drill (about ⅛"), B is ½". The purist can still file rectangular holes.

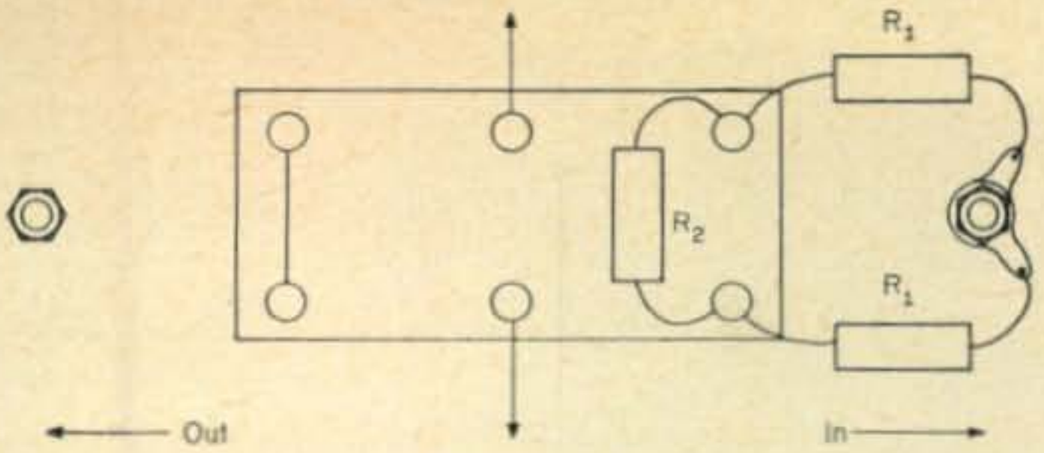


Fig. 3—Wiring details for step attenuator.

ployed. Use with a low-impedance-output signal generator or with a matched 50-ohm feedline from an antenna usually will satisfy the source-impedance requirement. Most of the modern receivers will present a load near 50 ohms; however, in other cases better accuracy may be realized by connecting the load to the 3 db end and then leaving this stop engaged during measurements. Where an absolute known voltage is required, as described later, it must be kept in mind that the voltage at the load will drop to 70 per cent of the applied voltage when the 3 db step is in use.

The signal source may be an r.f. signal generator, a received signal or a crystal calibrator *outside* of the one used in the receiver itself. The calibrator from another receiver may be used by connecting this receiver's antenna input to the attenuator input. Some experimentation may be needed with the position of this receiver's bandswitch for the best signal level from the calibrator.

Measurement Applications

S-meter Calibrations: The relative S-meter calibrations of many receivers do not coincide with a level change of 6 db per S-unit. To check this, connect the attenuator between a *steady* signal source and the receiver. Adjust the level at the source or with the attenuator for an S-9 meter reading. Then note the change of attenuation required to lower the meter reading for each S-unit indicated on the meter, or by noting what part of or how many S-units the meter drops for each 6 db of attenuation. Calibrations above S-9 may be similarly checked by using the various step combinations which fall nearest 10, 20, 30 and 40 db.

Relative Signal Levels: The step attenuator employed in this application will be found useful for accurately comparing the relative strength of on-the-air signals and for checking relative gain between antennas or the front-to-back ratio thereof.

The basic technique is one of switching the attenuator steps in or out to produce a given fixed meter reading at the receiver for each signal. The relative levels are then determined from the difference in attenuation required for each signal.

To do this, the attenuator is connected between the signal source and the receiver. The output meter at the receiver may be the S-meter (a.g.c. on), a d.c. voltmeter across a diode detector load resistor (a.g.c. off) or an a.c. voltmeter at the receiver a.f. output, preferably at the phone jack (a.g.c. off). For some measurements an advantage gained by using an external voltmeter is that more accurate readings can be obtained, and where the signal level cannot be varied, the r.f. gain control may be adjusted for a suitable reading without making the meter inoperative as might be the case if an S-meter were used. On the other hand, if the receiver is equipped with an antenna trimmer or a preselector tuning control, signal levels for S-meter readings may be adjusted, to some extent, by manipulating these controls rather than by using the r.f. gain and upsetting the S-meter.

When external meter readings are made with the a.g.c. off, care must be taken to be sure the signal level is low enough to prevent receiver overload in the r.f. and a.f. stages. In view of this, the general rule is to use as much attenuation or as low a signal level as possible consistent with obtaining a suitable meter reading.

Receiver Sideband Suppression: This is another relative signal measurement for which the corresponding technique is used. Tune in a steady signal for a 1 kc beat note with the receiver in either sideband position and with the attenuator set for as much attenuation as can be tolerated to produce a meter indication. Note the meter reading and then switch the receiver to the opposite sideband. The meter reading should drop. Switch out attenuator steps as needed to obtain the original meter reading. The sideband rejection at 1 kc then is indicated by the total attenuation which was removed.

If the receiver does not provide sideband switching, the above procedure may be conducted first using the available sideband for the reference reading, then tuning the receiver to a point 1 kc toward the opposite sideband for the second operation.

Receiver Image and I.F. Signal Rejection: This is a relative signal measurement requiring the use of a signal generator. Adjust the generator and the receiver to the same frequency with the attenuator set for as much attenuation as can be used while obtaining a reference meter reading. Leaving the receiver set, switch out all the attenuator steps and tune the generator in the vicinity of the expected image or the i.f. band of interest until the signal is heard and peaked at the receiver.

The signal generator level applied to the attenuator should be the same as that during the previous step. Next, switch the attenuator back to the original high attenuation setting used and then *decrease* the attenuation until the reference meter reading is obtained. Read the degree of rejection according to the total attenuation removed.

Cross Talk in Coax Switches: The technique is similar to that described above. Assuming a two-position coax switch; connect the switch arm to the receiver, the signal source through the attenuator to the closed switch-position and a 50-ohm resistor across the open switch-position. Tune in the signal for a reference reading using

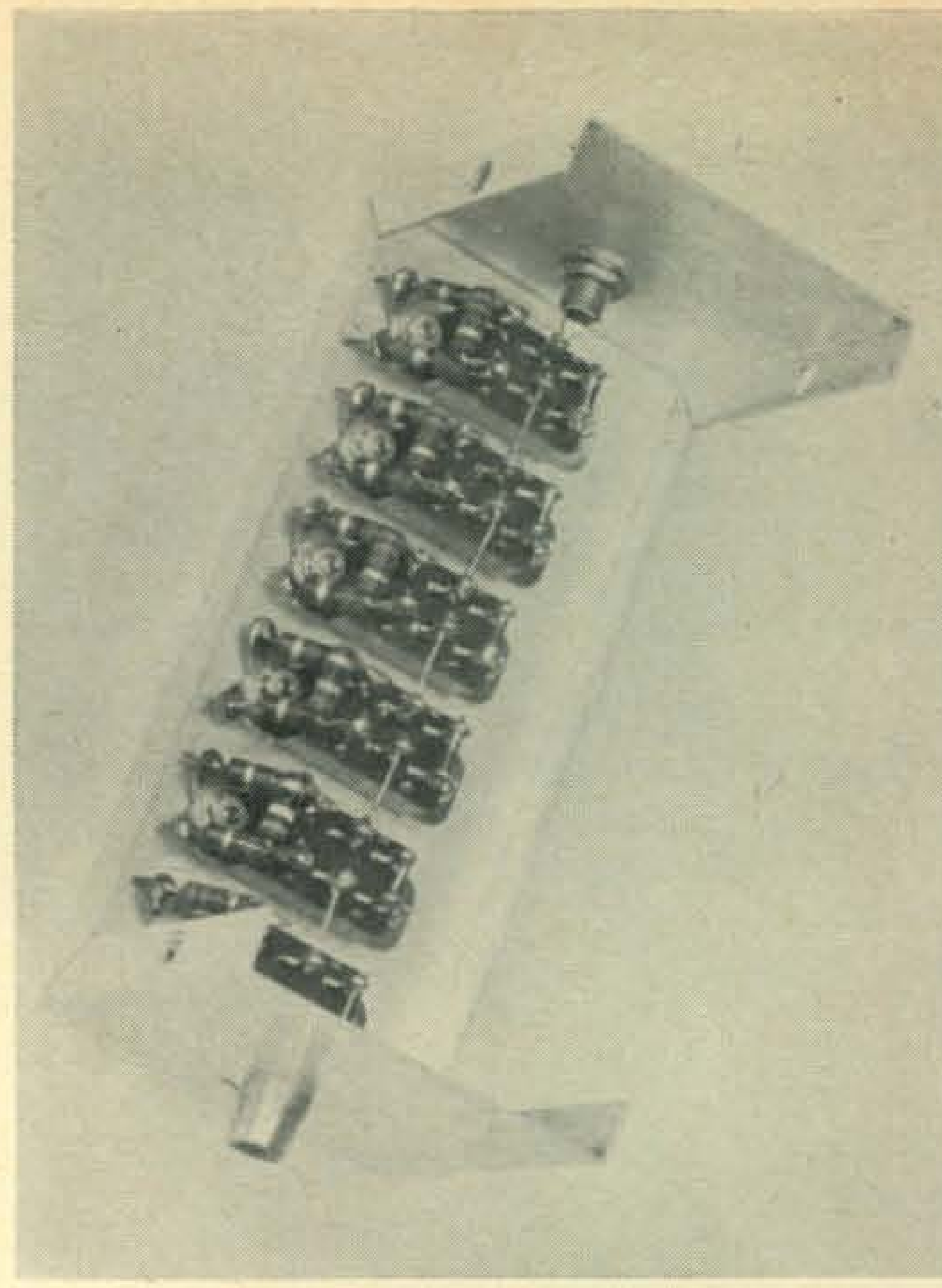
as much attenuation as possible. Then turn the switch to the opposite position (the 50-ohm resistor) and *decrease* the attenuation until the initial reference reading is obtained. The cross-talk level (—db) at the frequency used will be that indicated by the total attenuation removed.

Comparative Receiver Sensitivity: The sensitivity of receivers may be compared by using the attenuator along with a signal source for determining the lowest descernible signal for a given signal-to-noise ratio. For a.m. evaluation the signal source is modulated (usually 30% at 400 c.p.s.). The technique is to drop the signal level with the attenuator, to a point where switching the modulation on and off results in a receiver output increase (usually 10 db) for the modulated signal over the output from the unmodulated signal. Similarly, the evaluation is made for s.s.b. and c.w. by dropping the signal level to a point where the beat note produces an output which is a given amount higher than the inherent receiver noise when the signal is removed (a.g.c. should be off and metering must be done at the a.f. output for all modes). For s.s.b. and c.w. tests any other fixed r.f. source besides a conventional signal generator may be used.

By using the same signal source and level applied to the attenuator in each case, performance comparisons between receivers can be determined from the different signal levels for a given signal-to-noise ratio according to the settings of the attenuator. Similarly it can be determined if modification made to a receiver actually improve its performance. It should be noted that absolute sensitivity will not be found unless the voltage output from the generator is known.

Known Voltages from Signal Generator: If a signal generator is not calibrated for output or does not have provisions for obtaining known output voltages, which often is the case with the inexpensive equipment used by the amateur, such voltages may be determined using the step attenuator if the applied voltage is known. Fortunately, many signal generators will produce an output voltage of 100,000 μv (.1 v.) which can be measured with an r.f. probe in conjunction with a v.t.v.m. Thus the step attenuator can be used to reduce this voltage in intermediate steps down to 10 μv when 80 db attenuation is used or to 1 μv with 100 db attenuation. Also, if the known voltages from the generator are in the order of a few microvolts, voltages below 1 μv can be obtained using the attenuator.

In this application the alternate attenuator step combinations, described earlier, may be more suitable, but in any case, the point to keep in mind is that for each 20 db change of attenuation the voltage drops to one-tenth or rises by a factor of ten. Also, for each 10 db change the voltage drops to 32% of the original value or rises to 320%, for each 6 db it halves or doubles and for each 3 db it drops to 71% or rises to 141%. The increments for intermediate steps may be found by reference to a db/voltage-ratio chart.



Interior view of step attenuator showing switch connections and method of installing the resistors.

Good accuracy can be realized if the voltage measured at the attenuator input is accurately determined and providing stray r.f. leakage through the signal generator case is not induced into the receiver. Short 50-ohm coax cables should be used for connections in all cases.

Noise Figure Measurements: When noise-figure measurements are made using a noise generator, the accuracy of such readings is dependent on the linearity of the detector used in the receiver.[2] The use of a product detector usually will provide the needed linearity, but when this is not available, the use of a 3 db attenuator may assure better accuracy. Measurements of this nature mostly concern the use of a v.h.f. converter with a communications receiver. Thus, the 3 db attenuator may be inserted as needed between the converter and the receiver. Since the impedances of both the converter output and the receiver input may deviate from 50 ohms and since high accuracy is desired, the attenuator is best terminated at each end with another 3 db section to more easily present the proper termination. If such work is contemplated, the attenuator steps may be changed to 3, 3, 12, 18, 24, and 3db, so that the first and last 3 db steps may be used to match impedances while the second 3 db step is switched as required. Sufficient output from a converter usually is available to overcome the 9 db loss thereby incurred.

The technique is to insert only the two *outside* 3 db steps, and with the noise generator turned off, read the noise output from the receiver with

[*Continued on page 92*]

[2] J. A. Huie, "A V.H.F. Noise Generator," *QST* Feb. 1964.. H. Olson, "The Diode Noise Caper," *QST* Feb. 1964.

Some Thoughts on a Forthcoming Frequency Conference

BY WILLIAM I. ORR*, W6SAI

THE first article of this series[1] discussed some aspects of the 1959 International Telecommunications Union Administrative Radio Conference of importance to amateur radio, and various problems which confronted the amateur radio service at that epic meeting. These serious problems were, by and large, not of great interest to most radio amateurs as the amateur radio service came out well at the conference, retaining the popular h.f. bands almost intact. Amateurs in touch with frequency allocation matters, and also the ARRL (acting as spokesman to the U.S. government for American amateurs) were well aware that the allocation problems had not been solved, but merely postponed. A general feeling of well-being was prevalent among radio amateurs, luxuriating in unprecedently high sunspot numbers and ultra-DX and the long-term dangers besetting amateur radio were largely forgotten.

The second article[2] covered the relationship between the amateur radio service and the ITU over the past fifty years, and emphasized that frequency allocation for all radio services is a continuing and pressing problem as the use of the h.f. spectrum continues to grow. As amateur radio allocations have remained relatively static, allocation problems are of little concern to most amateurs, who view their bands as a "natural right" except, perhaps, during Frequency Conference[3] and, hopefully, presents some opinions directly upon amateur allocations.

This article discusses problems the amateur radio service presently faces with regard to a possible forthcoming Administrative Radio Conference[3] and, hopefully, presents some opinions and suggestions that may help place amateur radio in a position of strength before the forthcoming conference arrives. It must be emphasized that, although the conference may be almost a decade away, the preparation for this event cannot wait until the day before the conference. Preparations must start *now* so that they will be in full flower by the time the conference starts.

Why "Frequency Conferences"?

Historically, the radio spectrum has been occupied by communication services, usually in advance of the scientific knowledge of the behavior of the frequencies selected for use! Early frequency assignments were determined largely by equipment limitations and the antenna systems then available. Subsequent expansion of existing services and incorporation of new services into the radio spectrum encountered problems and limitations by reason of having to avoid frequency bands already occupied and in use.

By and large, the orderly administration of the radio spectrum as a valuable natural resource has come about through a continuing series of international conferences which established rules, regulations and techniques governing those stations and services capable of creating international interference by the practical solution of providing exclusive frequency bands for each service[4]. Existing international regulations, therefore, are a result of many years of operating experience and mutual compromise, representing a mixture of technical, economic and political solutions. This continual refining and modifying process has produced the table of frequency allocations we have today which has proved to be generally successful. The scope of the allocation problem may be judged when it is realized that the 1932 summary of radio propagation given at the Madrid Conference was seven pages long. The 1937 report on this subject given at the Bucharest CCIR meeting was 42 pages long. A 1943 report on propagation was 238 pages long, with lengthy supplements, and the CCIR paper on this subject given at the 1963 Geneva Plenary meeting was a weighty stack of thousands of pages, over three feet high!

Thus as knowledge advances, the demands placed on the radio spectrum increase while science of communication and need for rapid transmittal of intelligence grows.

Present at the continual sequence of communication conferences through the years have been the ARRL and the IARU, backed by other overseas radio societies, all representing the amateur radio service. Amateurs have seen the "top" of the radio spectrum expand from 200 meters to 300 kilo-megacycles, and have contributed mightily to this expansion. Today's amateur, although cramped by his growing numbers, enjoys substantially the same frequency bands as he possessed after the precedent-setting Washington Radio Conference of 1927. The same cannot be said of other radio services (with the exception of international broadcasting) which have lost frequencies over the years.

A 1951 "Ideal" Allocation Proposal

In passing, it should be noted that an "ideal" frequency allocation table was proposed in 1951

---

[1]"Amateur Radio Tomorrow?", Orr. *CQ*, July, 1964.
[2]"Amateur Radio Regulations" and "Frequency Conferences", Orr. *CQ*, August, 1964.
[3]"Geneva Conference", editorial. *QST*. April, 1964.

*48 Campbell Lane, Menlo Park, Calif.
[4]At one time the I.T.U. considered making allocations on the basis of nationality. That is, each country would be allocated a segment of the h.f. spectrum for its exclusive use. The scheme was rejected at an early stage.

by the *Joint Technical Advisory Committee* (JTAC) of the Institute of Radio Engineers and the then Radio-Television Manufacturer's Association[5]. JTAC has no connection with the ITU and conducted this hypothetical study as an independent action. Other studies, of course, have been made by other groups at various times.

The "ideal" allocation table for the h.f. and v.h.f. spectrum was based upon a peaceful world, and on the assumption that all peoples would cooperate to make the best and most efficient use of available facilities. The proposal considered latest technical factors and did not take into account political or military requirements. This "ideal" allocation table of 1951 proposed the following radio amateur allocations:

3500-3750 kc	(I.S.M. shares 3622.5-3627.5 kc)
7000-7500 kc	(I.S.M. shares 7245-7255 kc)
14,000-14,990 kc	(I.S.M. shares 14,490-14,510 kc)
28,000-30,000 kc	(I.S.M. shares 28,980-29,920 kc)
43.47-43.53 mc	(I.S.M., shared with amateur)
50.00 54.00 mc	
720-770 mc	

NOTE: I.S.M. = Industrial, Scientific and Medical.

The 100-720 mc portion of the spectrum (in which now reside several of the radio amateur v.h.f. bands) was to be allocated to television.

Needless to say, many advances in techniques and changes in spectrum usage, have occurred since 1951, and this attempt at deriving an "ideal" allocation of the h.f.-v.h.f.-u.h.f. spectrum is probably obsolete today. Nevertheless, it is of historic interest as one proposed solution to divide the radio spectrum as it should be, not as it is. It will be interesting to see the forthcoming JTAC allocation proposal, due later in 1964.

The ITU—What it is not!

Many attempts have been made to describe the ITU, its meetings and its actions. A popular false concept of the ITU among many radio amateurs should be noted. The ITU (and the Administrative Radio Conferences) do not comprise a form of tribunal, before which the frequency requirements may be pleaded, and by whom allocations are doled out to those with the most moving tale of woe. On the contrary, the ITU is a common meeting ground of *governments* on an equal basis which attemps to reconcile the various *national interests* of all concerned so that the radio spectrum may be put to the most practical use, consistent with political and engineering considerations. As with most similar situations, the deliberations of the ITU usually reflect a compromise position wherein no one is vitally damaged, and whereby no one seems to be particularly pleased, with disaffection divided among all participants.

In this imperfect world of continuing tensions, the radio amateur has occupied a position of minor importance in most countries, particularly those in which civil communications is a government monopoly, and private communication facilities are looked upon with doubt or suspicion. By a selective process, the various administrations in the communications world have established a "priority ladder" based upon national needs and in the majority of countries (including the United States) the position of the amateur radio service is understandably low on this ladder. Reasonable support for amateur radio, however, exists in many countries and, in the past, the United States has been one of the strongest supporters of this service, consistent with its own national needs. *It is our task to make certain the support for amateur radio exhibited in the past by our government does not fail us in the future.*

Because amateur radio occupies a position near the bottom of the communications priority ladder, it would seem that the dangers to radio amateur frequency allocations that existed in 1959 still exist today in aggravated form, and will once again present a peril at the next Frequency Conference. It is necessary, therefore, during the coming months for the spokesmen of amateur radio to explore the problem in detail and to examine possible moves that may be taken in advance of the next conference to insure that amateur radio is as well protected, and its cause as effectively presented as possible. As the amateur service is not without power and friends, a reasonable defense of this service may thus be prepared.

The "Service" Definition

A clear distinction must be drawn between the *Amateur Radio Service* and *"Public Service,"* two terms that are often confused as being the same. They are not. The former term is defined by the ITU in Section 78, Part 1 of the 1959 Geneva Radio Regulations, as follows:

AMATEUR SERVICE: A service of self-training, intercommunication and technical investigations carried on by amateurs, that is, by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest.

Public Service, as applied to amateur radio, is any action undertaken in "the public interest, convenience and necessity," and these terms are not further defined by the FCC. As a result, the public service image is largely the image created in the minds of radio amateurs and the public *by radio amateurs themselves*. The public service connotation, no matter how worthy, thus bears little significance at any international conference where amateur radio is judged solely by the ITU—defined service aspect covering self-training, intercommunication, and technical investigations, by persons interested in radio techniques.

Interestingly enough, in the Soviet Union, the amateur radio service closely adheres to the ITU service concept, with the added connotation of a sport. The Soviet equivalent of the ARRL (a member of the IARU) is called "The Radio Sports Federation of the U.S.S.R." Great emphasis is placed on various operating contests and technical achievements in the Soviet Union, and the radio amateur advances through various classes depending upon his activities in such achievements and "sports." The public service aspect, as generally understood in the United States, is entirely absent in Soviet amateur radio. This is not to say that one philosophy of amateur radio is better than another, but merely to point out that there are other ways of satisfying the ITU definition of the amateur radio service than the current practice in the United States, and we must not assume ours is the more nearly correct merely because it fits the radio amateur's own definition of "public interest."

A Defense of Amateur Radio

While the various conferences of the ITU are meetings of governments, the amateur radio service may participate in these deliberations in two ways: first, in an observer status having no vote. The IARU (of which the ARRL is one of 60 members) is a recognized observer body of the ITU and has been a spokesman (by invitation) for the amateur radio service at all major communications conferences for the past 40 years. It is the *only* group that represents amateur radio at these conferences. Second, individual radio amateurs, expert in allocation problems, may attend the various conferences as members of the delegations of their respective countries. It must be emphasized, however, that radio amateurs on such delegations are *under the control of their government*, and must reflect and adhere to the predetermined government position vis-a-vis the amateur radio service. While the position of the radio amateur on a delegation may often be one of strength, he also carries the inherent risk that the position of his government may not be in complete harmony with the needs and aspirations of amateur radio. The amateur delegate may thus be "trapped" by the position of his government.

[*Continued on page 86*]

---

[5] "Radio Spectrum Conservation", a Report of the J.T.A.C., McGraw-Hill Co., 1952.

RTTY From A to Z

BY DURWARD J. TUCKER*, W5VU

Part III

Part II covered general information on Teletypewriter machines. This article covers the most important mechanisms of the various machines.

As stated before, the teletype code is binary which simply means that it is formed from two conditions, On or Off. A teletype machine works on that principal. The receiving mechanism (mechanical and electrical) responds to an On and Off d.c. signal. One's thoughts, at this point, may wander to how the r.f. or a.f. signals operate the machine. The answer is simple—they don't—that is, not directly since the machine *is* a d.c. operated device. That part will be easier to understand after a more basic knowledge of the machine itself is gained, so let us pursue further some of the basics of the Teletype machine.

Machine Mechanics

A machine is chock full of mechanisms, but the most important basic functional ones are: (1) keyboard; (2) synchronous a.c. motor; and (3) receiving mechanism (selector magnet and associated typing unit). As a matter of fact, the Model 15 machine is mechanically assembled on that basis. First, there is the machine base shown in fig. 13. The motor mounts on the base at the rear and to one side and is also shown in fig. 13.

The keyboard and its associated transmitter (mechanical parts with electrical contacts) fits into the front of the base and is held in place with knurled screws. Figure 14 shows a close-up of the top of the keyboard alone and fig. 15 shows a close-up of the bottom of the keyboard.

The receiving mechanism containing the selector magnet, selecting parts and the printing mechanism (the remaining part of the machine) is built as one unit and fits over the keyboard where it, in turn, is fastened down with knurled thumb screws. An inspection of figs. 8, 13, and 14 will show how the receiving mechanism fits into place over the keyboard. Figures 16, 17, 18 give top, bottom and left side views of these, the most complicated portion of the Model 15 machine. The selector magnet may be seen in the lower left foreground of fig. 18. Its associated selector mechanism is adjacent and to the right. The range finder (to be discussed later) is in the center bottom foreground. It is the flat plate with a half-moon cut-out and adjustable arm. The three basic units as described above may be separated from each other in a matter of seconds. The motor unit provides the power to operate the various parts of the other two units. Each unit is supplied with a drive shaft and gear so that they mesh properly as each unit is put in its proper place. See figs. 13, 14 and 17. Care should be exercised when meshing the gears to avoid damage to the fiberglass gears.

Keyboard Operation

As previously stated, the teletypewriter key-

*6906 Kingsbury Drive, Dallas 31, Texas

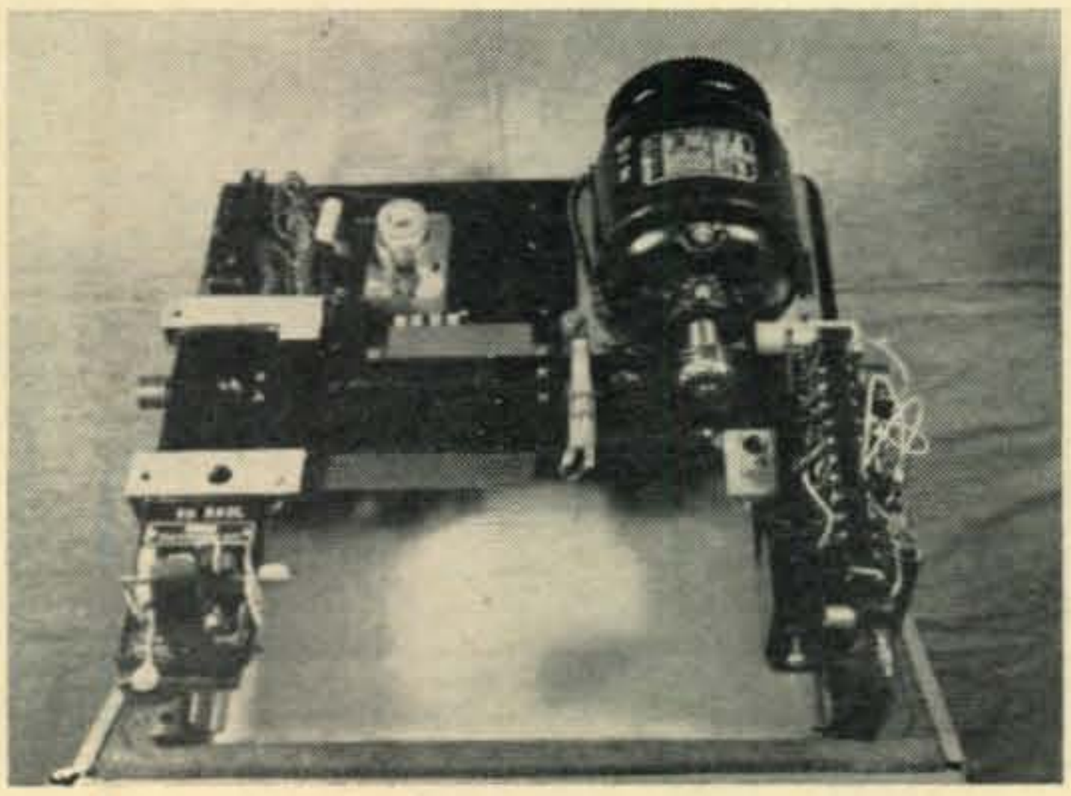


Fig. 13—Model 15 base showing the synchronous motor.

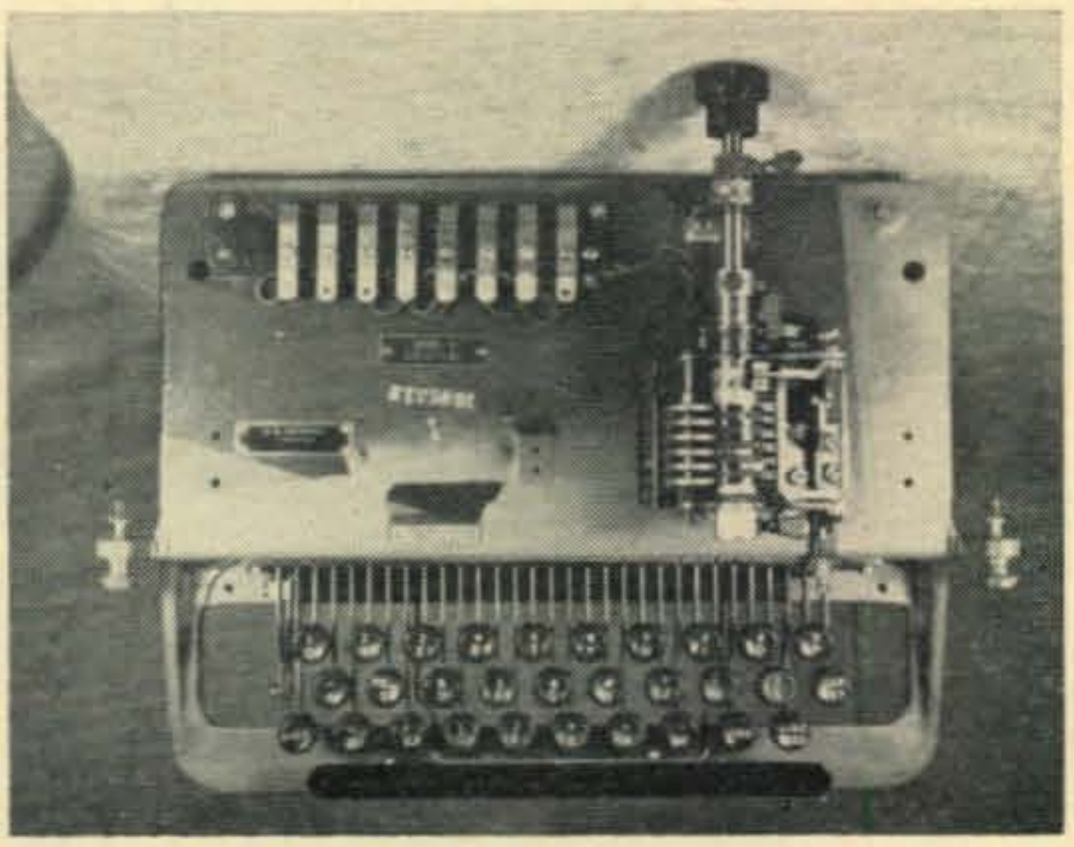


Fig. 14—Model 15 keyboard. The transmitter mechanism may be seen on top, to the right.

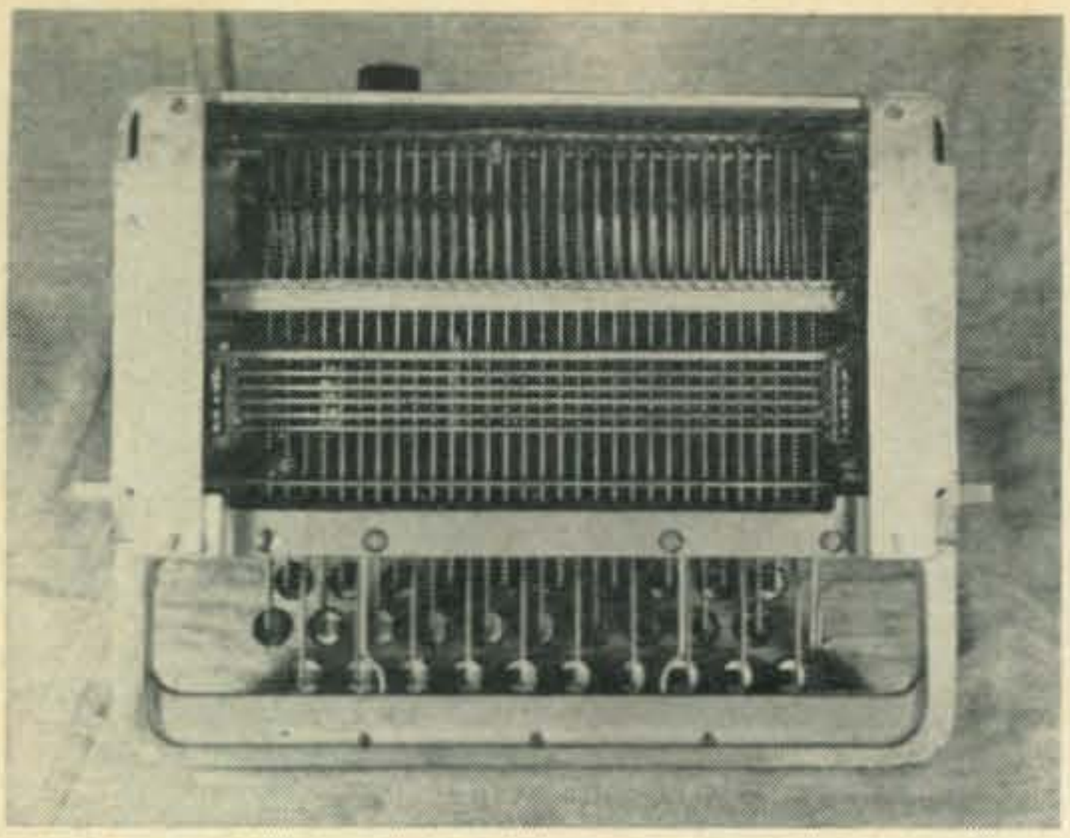


Fig. 15—Bottom view of the Model 15 keyboard showing the five crossbars.

board is similar to that of a standard typewriter except it has only three rows of keys instead of four, and the keyboard function and printer function are mechanically separated.

The type basket of a Teletypewriter machine uses type bars not too different from those of an ordinary typewriter. However, the type bars are not mechanically connected to the keyboard keys as in an ordinary typewriter.

An idea of how the keyboard works can be gained by looking at its bottom side and its associated mechanisms in fig. 15. The first thing to note is that there are five crossbars extending crosswise (at right angles) to the key bars and from side to side thereby extending under all the key bars. The crossbars have odd shaped sawtooth type notches along their top edges under the key bars. The crossbars are each free to move (lengthwise). When a key is depressed, the key bar presses downward into the slots of all five of the crossbars. If the slot under the key bar is open, then the crossbar is not forced to move. If the slot has a slanting side under the key bar, then that crossbar is forced to move longitudinally. This is shown in fig. 19. The crossbars move or do not move, depending on the character of the slot of each crossbar under the key bar that is depressed.

Transmitter Mechanism

The next thing to note is the transmitter

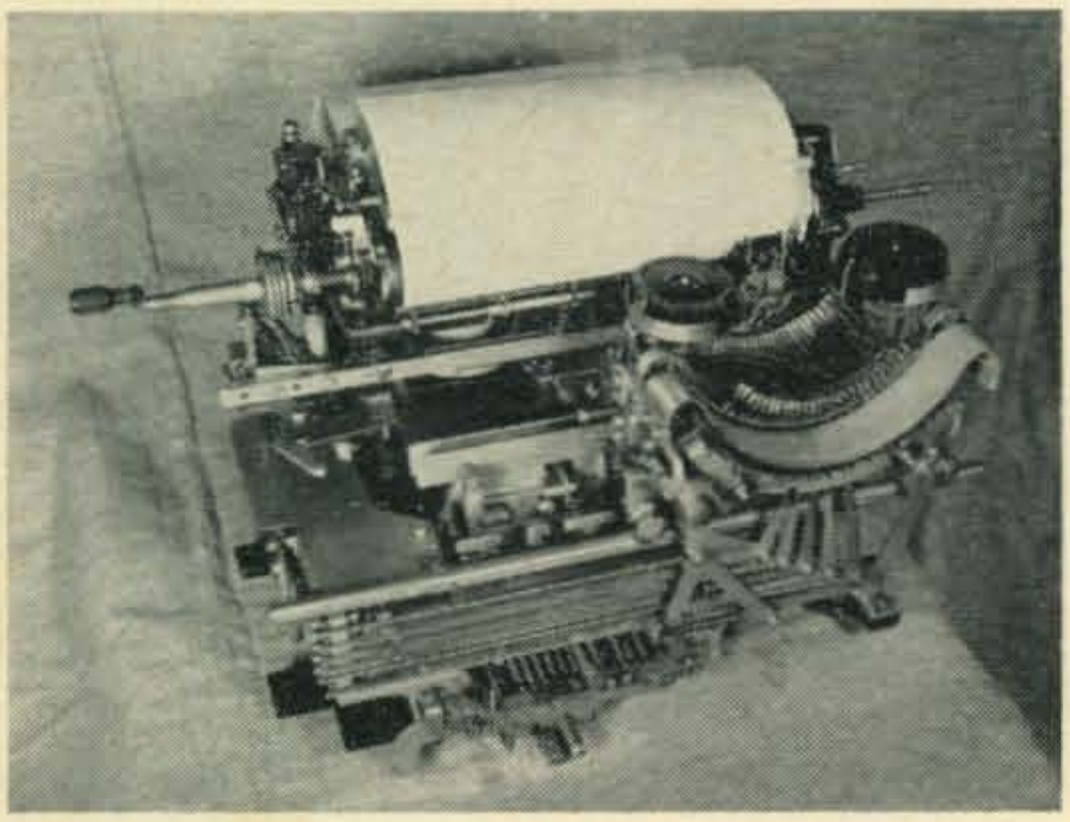


Fig. 16—Top view of the Model 15 receiving mechanism.

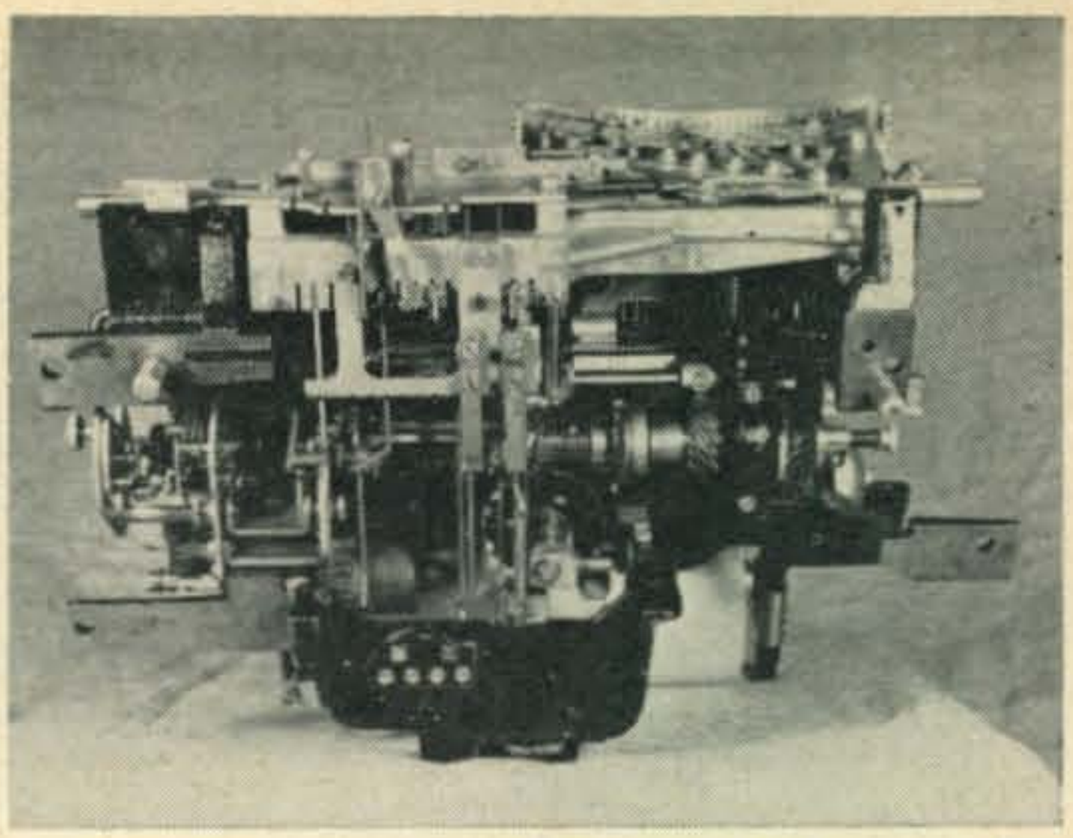


Fig. 17—Bottom view of the Model 15 receiving mechanism.

mechanism on top of the keyboard unit shown in fig. 14; it is on the right side. This unit has a drive shaft with a clutch and a distributor with six cams. A metal finger with an associated make-break switch rides on each cam. Five of the switches are normally open. These are the ones that form the five teletype characters. The sixth switch is normally closed and provides for the 31 ms stop pulse. The cams are circular discs about ⅛" thick and about ¾" in diameter. The five code cams have slots of equal length that allow their associated switch fingers to fall in permitting the associated switch to stay closed for 22 ms. The cam slots are placed around the circumference of the distributor so that the next one starts where the previous one ended with the exception of the 31 ms cam slot and the first 22 ms cam slot. There is a 22 ms space between these two. This accounts for the complete circumference of the circle for one rotation. This is illustrated in fig. 20.

The next thing to note is that each crossbar is connected to a lever extending to the transmitter distributor on top of the keyboard frame. This is also shown in fig. 19. The code signal notches on the crossbars allow the levers to operate and lock the metal fingers into place on the transmitter distributor to operate the electrical switches. Obviously, these levers position themselves simultaneously, in accordance with the

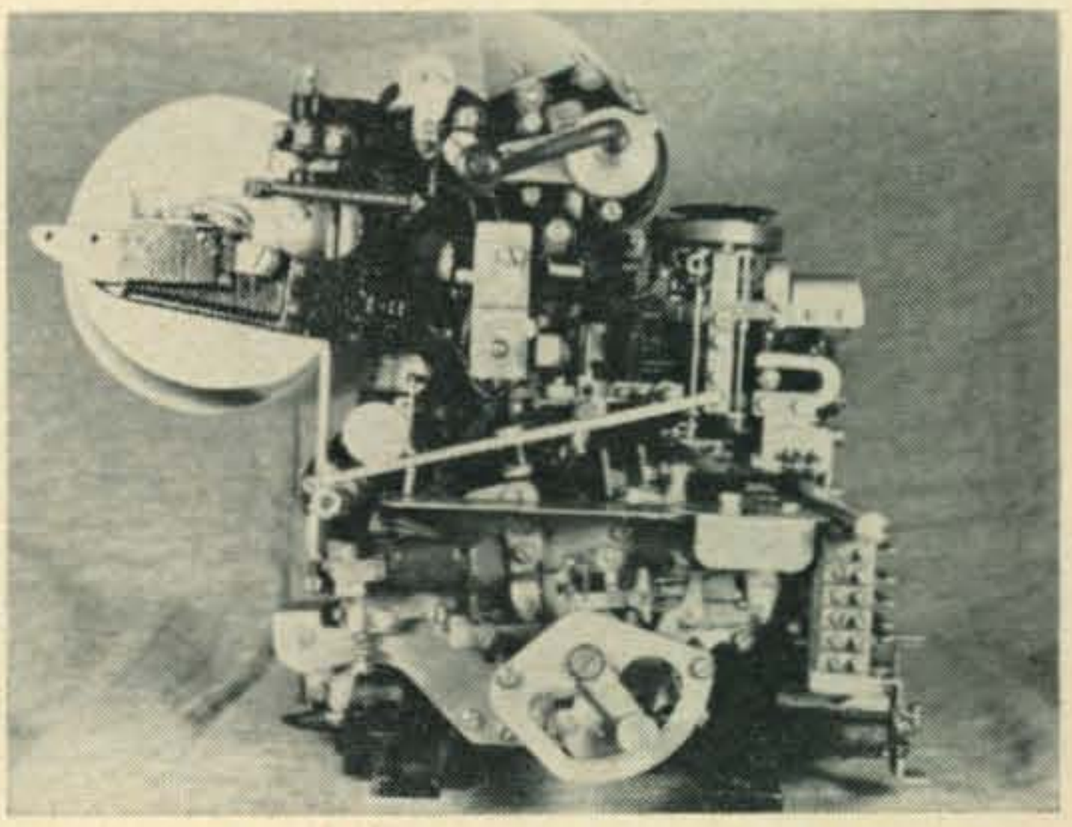


Fig. 18—Left side view of the Model 15 receiving mechanism.

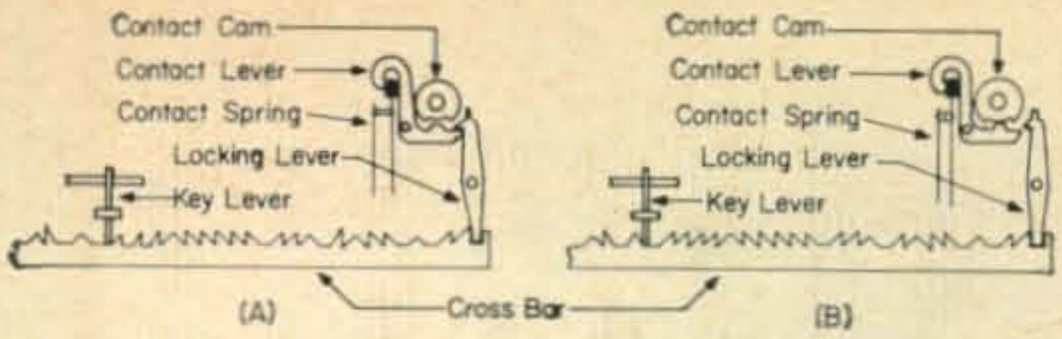


Fig. 19—Cross-section view showing how the key lever actuates the cross bar which, in turn, actuates the locking lever to open or close the associated switch which rides on the cam.

crossbar notches, the instant that a key is pressed. In popular present day scientific language we would say that the information was stored.

At this point, the transmitting distributor (the cam cylinder) is released to make one revolution being actuated by the pressed key. With the turning of the distributor, the d.c. pulses are accurately formed or transmitted in correct time relationship to each other. Likewise, they are received by the selector magnet of the receiver, stored in its mechanism, then released in proper sequence and time relationship to the printer mechanism. The transmitter distributor turns one revolution for each and every character transmitted and at the same time it also sends the 31 ms stop pulse as well as providing for the start space of 22 ms. The time for one revolution is 163 ms or 0.163 seconds. Thus, $1 \div 0.163$ equals 6.133 revolutions or characters per second or 6.133×60 seconds equals 368 r.p.m. which is the speed of the distributor at 60 w.p.m.

Model 14 Transmitter Mechanism

The Model 15 machine just described and the Model 14 typing reperforator are only basically similar. Figure 21 shows the base and keyboard of the Model 14 typing reperforator. The transmitter mechanism is on top and in the right foreground. Figure 22 shows the right side of the receiving mechanism. It will be noted that the motor is associated with this unit whereas it is mounted on the base of the Model 15 machine. Figure 23 show sa close up view of the selector magnet and associated mechanism as well as the range finder.

Model 14 Transmitter-Distributor

The Model 14 transmitter-distributor is equipped with five small sensing pins arranged

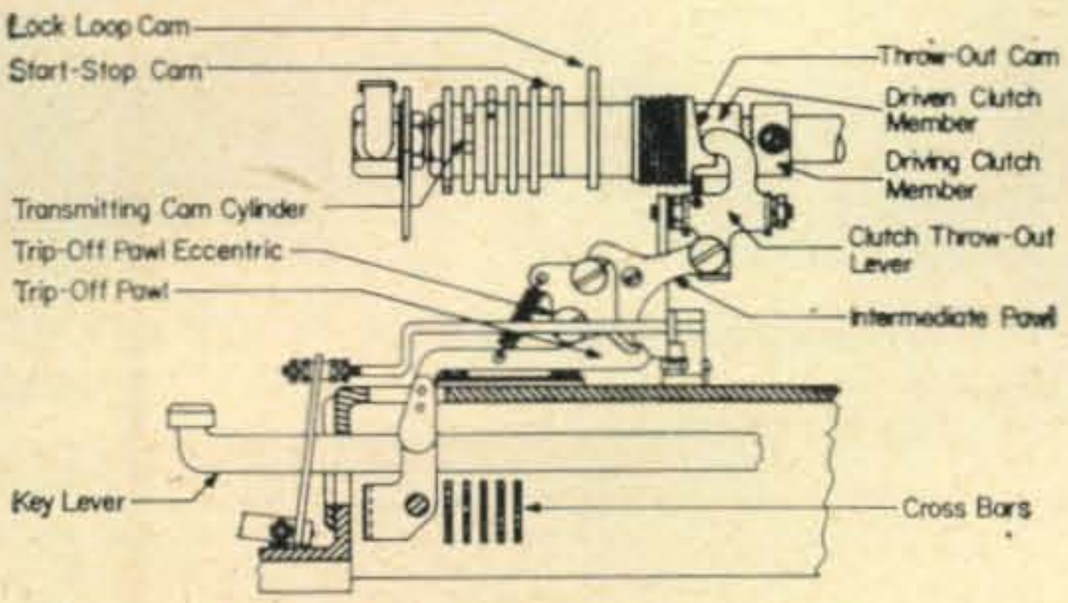


Fig. 20—Cross section view of the keyboard showing the relative positions of the key levers, crossbars and the transmitter mechanism atop the keyboard.

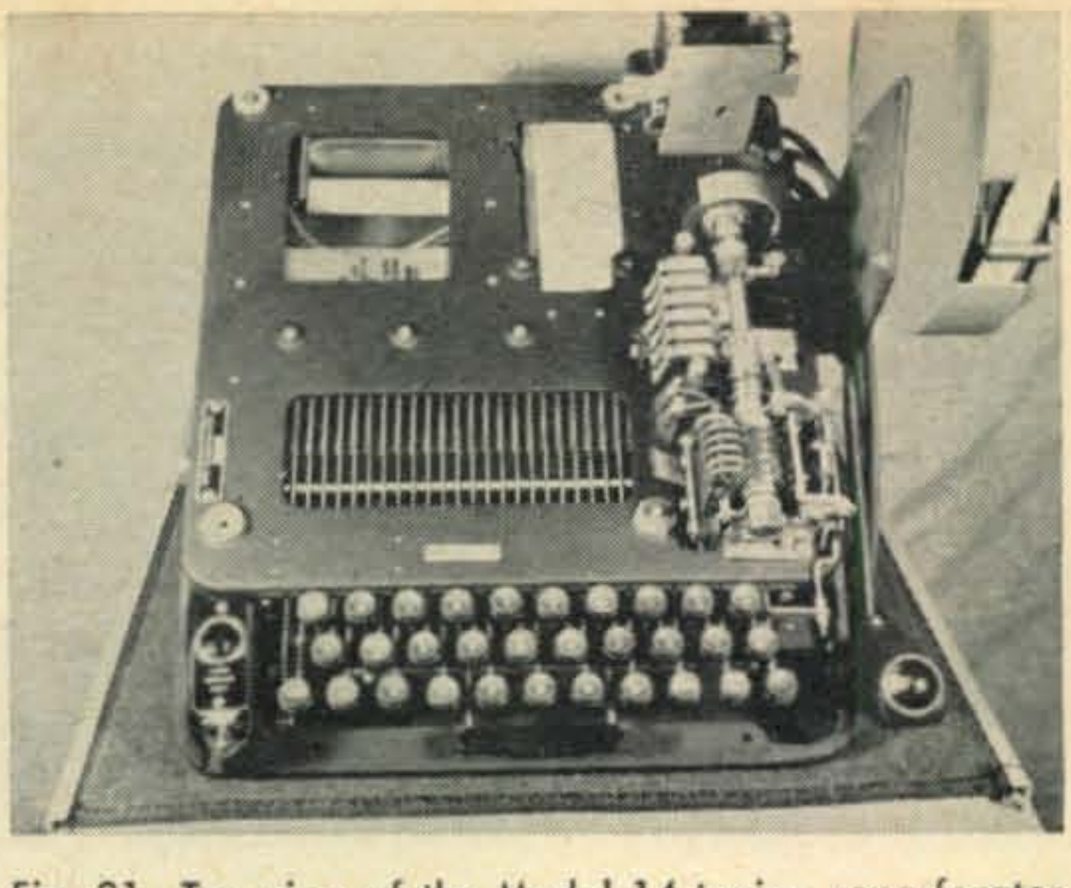


Fig. 21—Top view of the Model 14 typing reperforator base and keyboard.

in a row at right angles to the length of the tape. Perforated holes indicate "On" and the absence of a hole indicates "Off". The perforated tape does not pass over the row of pins at a uniform speed. To the contrary, the tape moves in jumps or spurts. A perforated character is positioned over the pins. Where there is a perforated hole the corresponding pin moves up through the hole closing an electrical contact. Naturally, any pin that has no perforation above it is unable to move up so that contact remains open. A closed or On contact means *mark* and an open or Off contact means *space*. The tape remains stopped long enough for the closed and open contacts associated with the five tape sensing pins to be transmitted in proper time sequence by the distributor plate which can be seen in fig. 9. The distributor plate makes one complete revolution for each character and stops. The time for the complete transmission of each character is 0.163 sec. or 163 ms for a speed of 60 w.p.m. as previously noted. The tape then jumps forward almost instantaneously to the position of the next perforated character on the tape and the process is repeated.

Receiver Printing Mechanisms

At this point it has become obvious that the

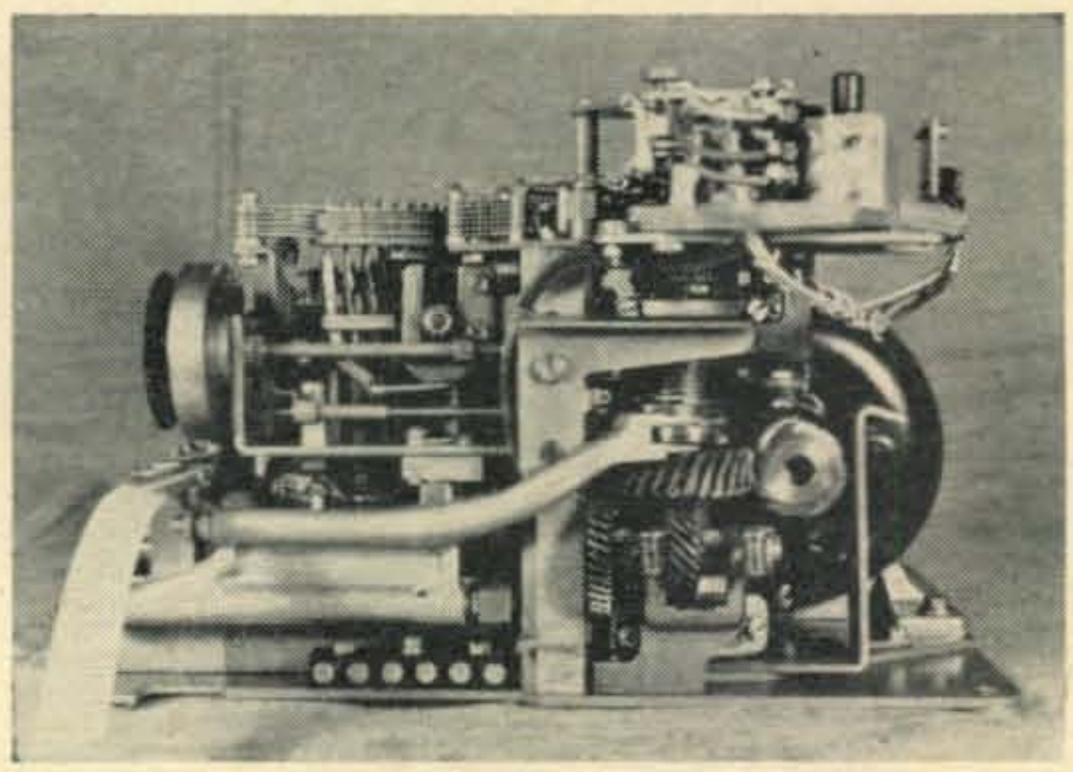


Fig. 22—Right side view of the receiving and reperforating unit of the Model 14.

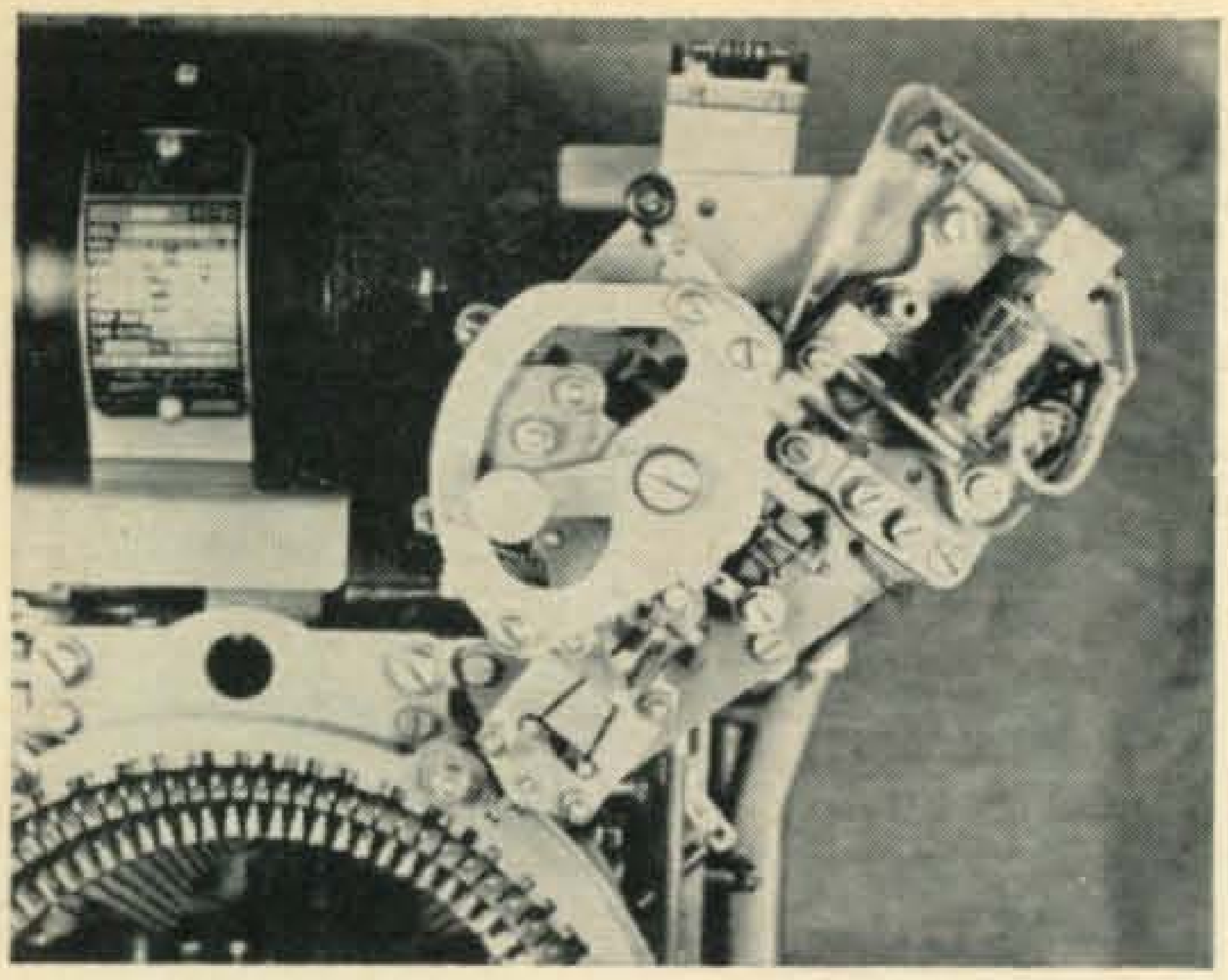


Fig. 23—Close-up view of the selector magnet and associated mechanisms as well as the rangefinder of the Model 14 typing reperforator.

actual teletype code sending mechanism is nothing more than five simple make-break switches that either close or stay open when the 22 ms time interval for each to function, comes by. They make and break a supply voltage of 120 to 200 v.d.c. at either 15 to 20 ma or 50 to 60 ma of current. From this it is safe to surmise that the main part of the receiver unit is nothing more than a fast and positive acting electromagnet. This is exactly the case and it is called a selector magnet. The selector magnet of the more common machines, such as Model 14 and 15, have two coils. The selector magnet of the Model 15 machine is shown in fig. 18 and the selector magnet of the Model 14 is shown in fig. 23.

The selector magnet in the receiver mechanism is actuated by the d.c. signal pulses received from a transmitting mechanism (of the same machine or any other machine). The armature of the selector magnet controls the selector mechanism which consists of a complex combination of various shaped levers, posts and springs. The On-Off pulses fed to the selector magnet are translated into mechanical pulses and fed to the lever system. In turn, there are five selector levers which determine the letter to be printed and these are positioned according to the coded pulse series.

This mechanism is driven through a clutch by the constantly running synchronous a.c. motor. The basic design of this unit is not the same as that of the transmitting unit. However, it is not considered sufficiently different to warrant a detailed description here as was given for the transmitting unit.

Next month's installment will discuss machine circuitry and how the machines are operated by r.f. signals.

[*To be continued*]

OPERATION TALLWIRE TWO

OPERATION Tallwire Two was conducted at Fort Chaffee, Arkansas, July 11, 1964, under the sponsorship of Fort Chaffee MARS in conjunction with Fort Smith Area Amateur Radio Club. The operation constituted antenna experimentation utilizing a vertical long wire (500 feet) which was lifted by a large helium filled balloon. Antenna height, length, vertical angle, and grounding systems were varied to determine performance data. Participating in the operation were: Bud Tyson, WA9FFV/5, Dick Widman, K5BWA (chief operator), Jack Williams, W4VQX/5, Fort Chaffee MARS Director, Lyle Shaw, W5GZP, Major Gordon Cunningham, Fort Chaffee Signal Officer, and SP4 J. B. Shaw.

Two Balloons are in the sky at this time supporting the 500 foot vertical long wire. W5GZP is operating the rig with Major Cunningham on the right.

L. to r. Major Cunningham, Lyle Shaw, W5GZP, Jack Williams, W4VQX/5, SP4 J. B. Shaw (half hidden), Dick Widman, K5WBA, and Bud Tyson, WA9FFV/5.

HAM-LETS

The Craven

BY AMOS ANON

(*With apologies to Edgar Allen Poe*)

Once upon a midnight dreary
While I pondered weak and weary
Over a pile of QSL's
piled from the bedroom floor
There came a sudden burst of static
From the station in my attic
Then a call sign strange and distant
Then a silence—nothing more

Ran I to the attic station
Tuned the band in wild frustration
For that call sign unfamiliar
For that call sign heard before
Up and down the band I listened
Sweat upon my brow it glistened
Hoping for another murmur
Like the one I'd heard before

Then another burst of static
Then a CQ most emphatic
But the call was still a weird one
Never heard by me before
Then I grabbed a call book near me.
Lest the strange one heard so clearly
Might elude my handy log book
Always set for one more score

But no call like that was listed
Through the pages still I twisted
Frantic searched I for the strange one
Now I heard it with a roar
Then the moment of decision
Then a blurring of my vision
As I loosed the power forward
For an answer did implore

Then a silence, strange and haunting
Then another try undaunting
Oh to nab that strange new call sign
Excitement shook me to the core
Suddenly I heard a whisper
Stronger now a noise eclipser
Calling me with steady patience
Nearly fell I to the floor

Come in please the signal begged me
Answer please, please can you hear me?
Came the signal, came the signal
Stronger than it was before
Yes I hear you, Yes I answered
But the call is not familiar
What is your exact location
Now the beads of sweat did pour.

Tuning now my ears were straining
Perspiration from me raining
Hoping just for one more answer
From the station heard before
Then the answer not expected
From that call to me directed
Then a silence, eerie silence
Only that and nothing more

And as I sat in silent wonder
No more did I need to ponder
Whence the call sign strange and eerie
Had been aimed at my own door
Turned the knob and closed the station
Filled with some extreme elation
Turned and left the attic slowly
Locking fast the wooden door.

Turned my back upon the attic
Knowing that the station static
Never would again attract me
Back beyond that wooden door
No more signals to attract me
No more strange ones to distract me
I had heard that strange of strange ones
After that one—nothing more.

OSCAR

An Active Communication Satellite For Radio Amateurs

Part One

BY GEORGE JACOBS,* W3ASK

OSCAR III, the third in a family of satellites designed and built entirely by radio amateurs is now undergoing final ground tests in preparation for a winter launch. If all goes according to plan, radio amateurs may soon be able to communicate through the satellite over distances of several hundred, and perhaps thousands of miles, on the 2 meter band. In this special two-part article, W3ASK, CQ's Space Communications Editor, describes the satellite in detail (Part One), and explains how the satellite will be used for communications and other experiments (Part Two).[1]

OSCAR stands for *O*rbiting *S*atellite *C*arrying *A*mateur *R*adio. OSCAR III will be the third satellite in the OSCAR family, but the first that will function as an *active communication* satellite for radio amateurs. OSCARS I and II, launched successfully in December 1961 and June 1962, respectively, carried simple beacon transmitters. While it was not possible to use these satellites for communication, the beacon transmitters were received by thousands of radio amateurs and other observers in all corners of the world. The results obtained from the first two OSCAR satellites paved the way for the development of OSCAR III. Dubbed the "radio amateur's TELSTAR," OSCAR III will operate in much the same manner as the more complex TELSTAR or RELAY. The OSCAR satellite will receive 2 meter amateur signals from the earth, amplify them, and then retransmit them over distances many times greater than the line-of-sight range of stations on the ground. Depending on the actual height of OSCAR III's orbit, the maximum distance that may be achieved by communicating through the satellite will range between 2000 and 4000 miles.

OSCAR III Package

The OSCAR III package will look somewhat different than its predecessors (see photograph). It will measure approximately 17.5 × 12 × 6.5 inches, and will weigh approximately 30 pounds. Four antennas, one for receiving and three for transmitting, project from its sides. This newest of amateur radio satellites will be a transistorized *radio frequency translator*.

OSCAR III will receive 2 meter signals from amateur radio stations transmitting from the ground, amplify the signals, and instantaneously retransmit them over distances up to several

*SPACE COMMUNICATIONS Editor, CQ.

[1]This article is based on 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.

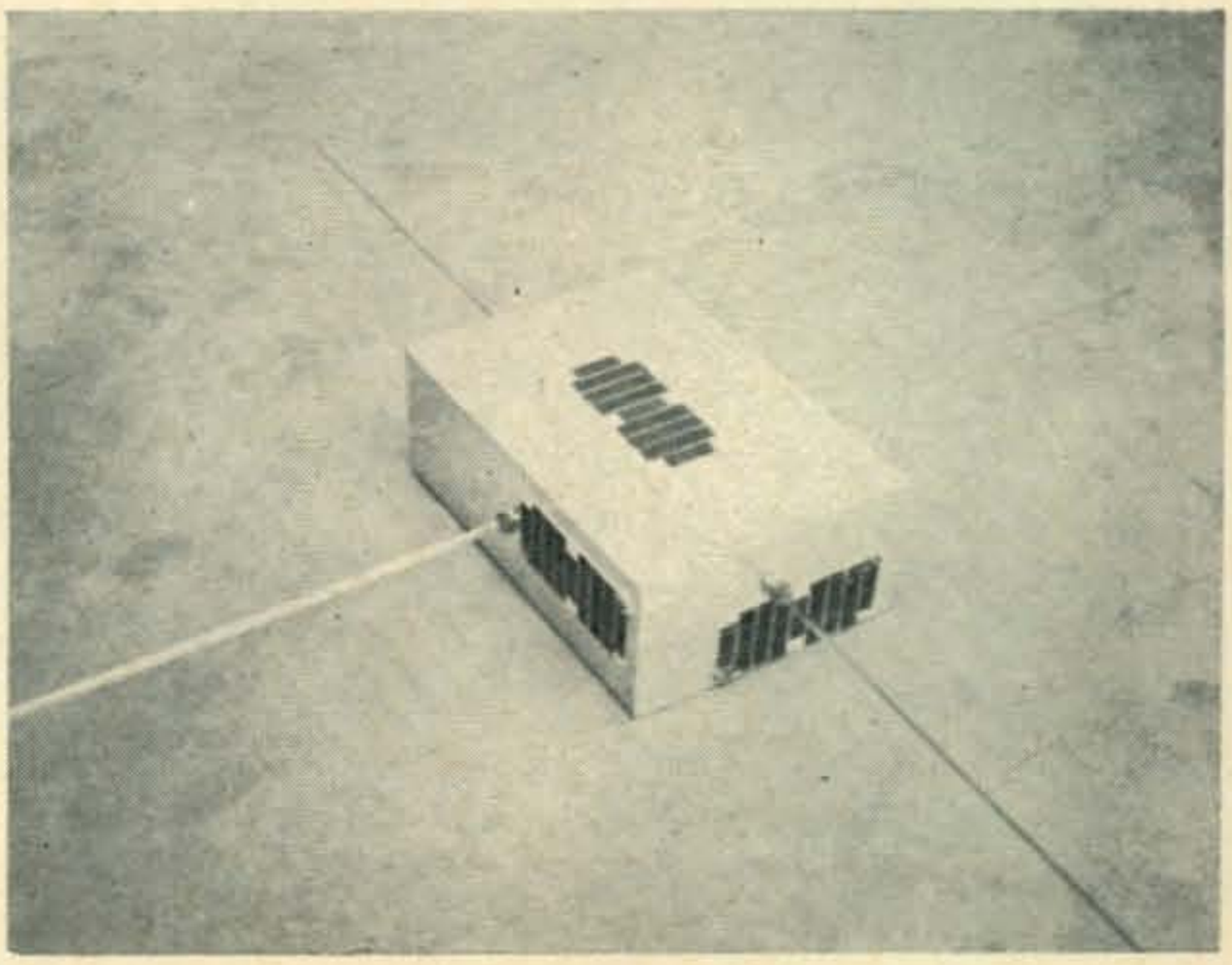


Fig. 1—Recent photo of OSCAR III mock-up taken while undergoing ground tests. Receiving, translator, beacon and telemetry antennas can be seen projecting from the sides of the satellite's casing. The solar cells mounted on the surfaces will be used to power one of the satellite's beacon transmitters. OSCAR III will weigh about 30 pounds and measure approximately 17.5 × 12 × 6.5 inches. Latest plans call for a launching sometime late this coming winter for amateur radio's first active communication satellite. *(Photo courtesy W6DKH).*

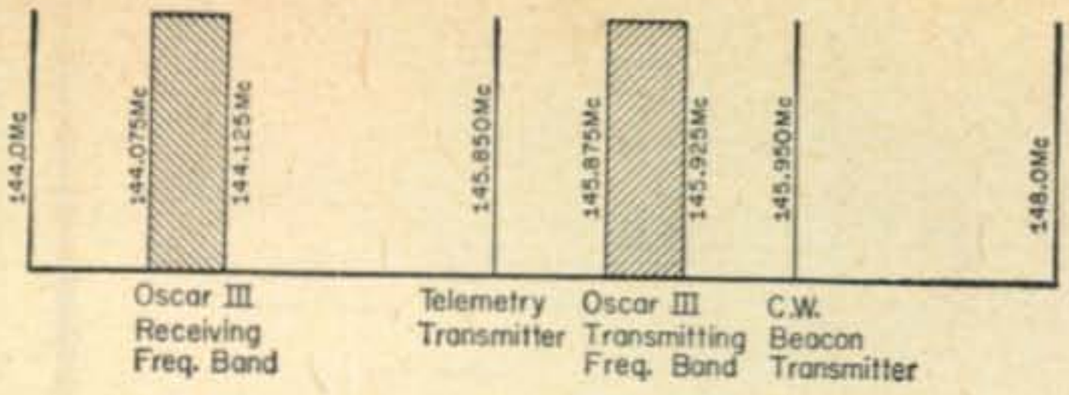


Fig. 2—OSCAR III receiving and transmitting frequencies in relationship to the 144-148 mc band allocated to amateur radio space communication activity on a world-wide exclusive basis.

thousand miles. The satellite will listen, and accept any signals it hears in a 50 kilocycle wide channel in the 2 meter band, centered on 144.1 mc. It will instantly amplify and translate this portion of the spectrum to a 50 kilocycle segment centered on 145.9 mc, retransmitting the latter band segment back to ground stations. The satellite will be designed to operate continuously, with a life expectancy of about three weeks. It will be a "free-access" satellite, and will require *no* special codes or procedure for working through it. The satellite's orbit is expected to carry it over almost every corner of the globe, and it will be available for radio amateurs throughout the world to use.

In addition to the "wide-band" frequency translator-repeater, OSCAR III will also carry on board two beacon transmitters. The first beacon will transmit on 145.85 mc, sending the well known OSCAR HI identification in Morse Code (. . . . .). It will also be used to telemeter data on internal temperatures and voltages, probably using the HI rate as in OSCARS I and II, plus two groups of variable-width pulses interspersed between the HIs. The second beacon, operating on 145.950 mc, will transmit a continuous carrier for tracking purposes, and for signal strength, Doppler shift, and other propagation measurements. Both beacon transmitters, bracketing the 50 kilocycle segment which contains the output of the translator, can be used as frequency markers for the main output channel at ground receiving stations. The key frequencies and bands that will be involved in the OSCAR III satellite are shown in chart form in fig. 2.

Frequency Translation

Figure 3 is a block diagram of the transistorized frequency translation system used in OSCAR III. Note that the system employs heterodyning from one frequency to another, and that there is *no* detection of the incoming signals, and no demodulated audio appears in the circuitry. R.f. signals entering the 50 kilocycle receiving passband will simply be amplified, translated in frequency and reradiated.

Starting at the low end of the portion of the 2 meter band allocated to amateur radio on a world-wide basis for space communication, the satellite receives the 50 kilocycle segment from 144.075 to 144.125 mc. All energy present in this segment, including noise, will be processed. It will take approximately a 2 microvolt signal at the satellite's input to produce a 1:1 s/n ratio with 50 kc satellite bandwidth. This will be equivalent to approximately a 20 to 1 s/n ratio at ground receiver using a bandwidth of 3 kc. The satellite will be capable of handling all modes of transmission, including s.s.b., c.w., a.m., f.m., slow-scan TV, etc.

The input signals to the satellite are received on a separate receiving antenna which feeds directly into a band-rejection filter. This filter keeps the satellite's output from feeding back into the input circuits. The filter has at least 70 db rejection at 145.900 ± .025 mc, the translated signal output band. The transmitting and receiving antennas are cross-polarized to achieve an additional 10 db separation between input and output circuits. The successful isolation of the receiver input from the translator output was one of the major technical achievements in the design of the satellite. A few years ago, experts claimed that it would be impossible to achieve the required isolation over such a small frequency difference in input and output ranges!

The rejection filter has an insertion loss of 10 db at the center of the receiving passband. Passing through the filter, the input signals are amplified and fed into the first mixer. A 114.1 mc crystal controlled oscillator also feeds into the first mixer, producing a 50 kilocycle wide intermediate-frequency band centered on 30 mc.

The i.f. signal is next fed through a 30 mc bandpass crystal filter which provides a very sharp 50 kilocycle passband having high skirt selectivity. This bandpass filter sets the limits of the translator response band. The signals in the passband are then amplified in six i.f. stages and fed to a high-level balanced mixer. A 175.9 mc mixing signal is also fed into the balanced mixer, thus producing an output frequency band between 145.925 and 145.875 mc. Since the second mixer-oscillator operates on the *high* frequency side of the output band, signals at the high end of the input passband become signals at the low end of the output band. For example, a signal transmitted from the ground on 144.080 mc. will appear at the translator output on a frequency of 145.920 mc. A signal going into the satellite at exactly band center, 144.1 mc., will come out on 145.9 mc., which is the center of the transmitting band. Signals near the high end of the input band come out near the low end of the output band, and vice versa. A ground station transmitting to the satellite on upper sideband s.s.b. will be transmitted through the satellite and received on the ground as lower sideband s.s.b. This frequency reversal was incorporated to minimize the total Doppler shift at the ground receiving station.

From the balanced-mixer, the band of signals centered about 145.9 mc is next fed into the linear r.f. amplifier. Here, the entire bandpass is amplified to a maximum of 1 watt peak-envelope power, and coupled into a transmitting antenna for retransmission to ground observers. The linear amplifier, as well as all the other stages in the system, is completely transistorized.

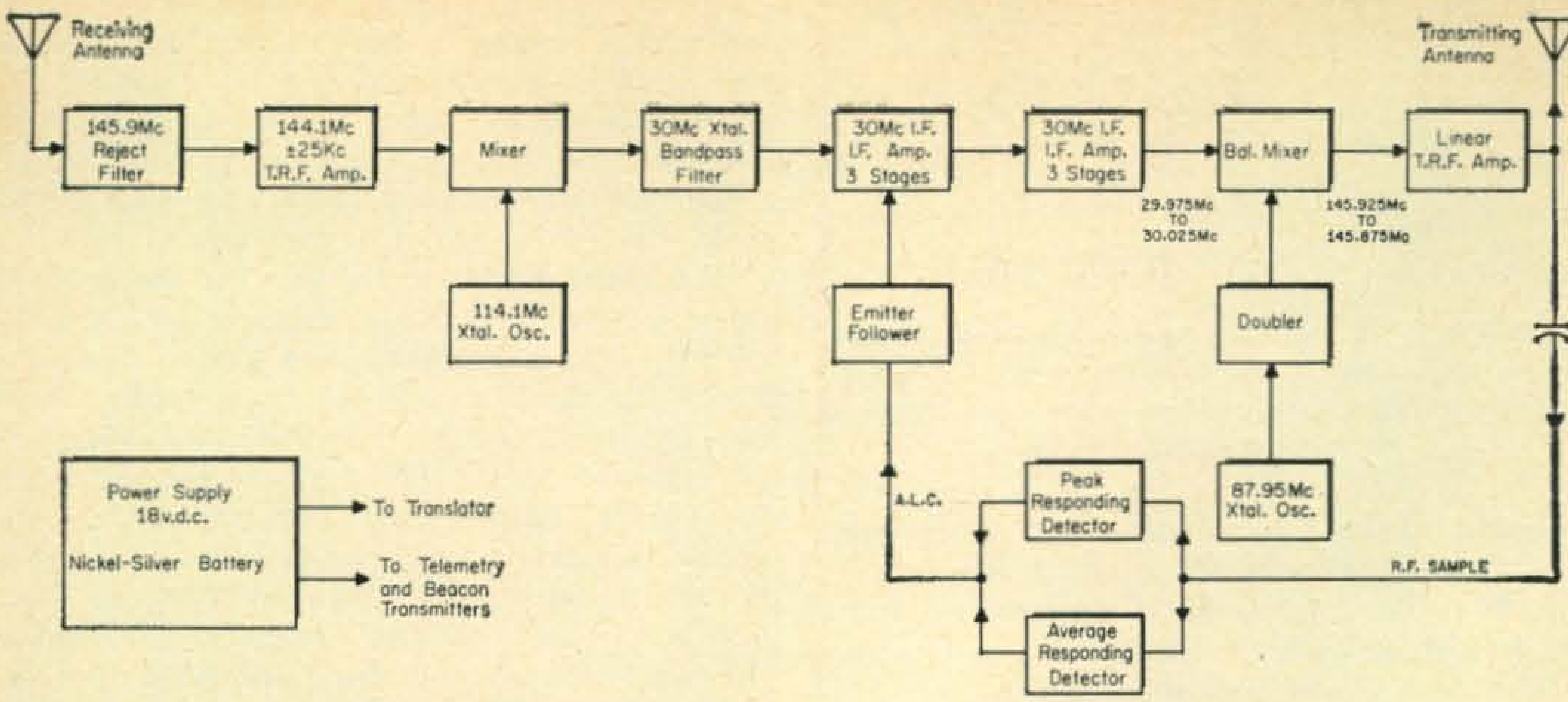


Fig. 3—Block diagram of the OSCAR III 2-meter frequency-translator system which will make it possible for radio amateurs to communicate over distances up to several thousand miles on the 2 meter band, via the satellite.

Automatic Level Control

OSCAR III's output power of one watt must be shared by all signals passing through the repeater at the same time. If this power level were to be exceeded, it would cause non-linearity and distortion in the linear amplifier, as well as excessive drain on the power supply and possibly damage to electronic components. To prevent strong signals from overloading the translator system and to maintain a constant power output of one watt, OSCAR III is equipped with Automatic Level Control (a.l.c.) circuitry.

The a.l.c. system consists of two separate detector circuits; one samples *peak* r.f. voltage output and the other samples *average* output. When the levels of either peak or average signal output exceed safe values, a bias voltage is immediately applied to the 30 mc i.f. amplifier stages. This control voltage reduces the gain of the translator system and restores signal levels to safe values, while maintaining the output at one watt. While the a.l.c. action may cause a noticeable drop in the strength of all signals being relayed when a strong signal enters the translator, it prevents the satellite from being overloaded and possibly damaged, and permits maximum battery life to be realized.

Telemetry

OSCAR III is the third of what is hoped to be a long series of amateur radio satellites. Just as information gained from OSCAR's I and II helped in the design of OSCAR III, it is expected that information gained from OSCAR III will assist in the design of future, improved OSCAR satellites.

In order to learn as much as possible about OSCAR III while it orbits in space, signals representing measurements of key internal satellite parameters will be telemetered back to earth from the telemetry transmitter operating on 145.850 mc.

The satellite's telemetry system will consist of three channels over which measured data will be transmitted to earth. One channel will be used for transmitting temperature measurements of the transistors in the linear amplifier. These measurements will be made because the transistors are believed to be the most heat sensitive components in the satellite, and they are expected to be the first to fail if the internal temperature rises beyond design limits. Measurements made with OSCAR III will provide inflight data concerning the performance of these transistors at various temperature levels.

A second telemetry channel will monitor the temperature of the primary silver-zinc battery. Since the battery is the largest thermal mass device in the satellite, a check on its temperature will indicate whether or not OSCAR III's heat dissipation system is working properly. A third telemetry channel will transmit information concerning the level of primary battery voltage. This will give an indication of the expectant life of the satellite. All three channels of information will be transmitted continuously by varying the repetition rate and the pulse width of the coded information transmitted from the 25 milliwatt telemetry transmitter on 145.850 mc.

The heart of OSCAR III's telemetry system is an advanced design patterned after the system used in the OSCAR I and II satellites. Thermistors will be used to sense the temperatures and voltages being monitored. Thermistors are resistive components which change their values as temperature levels change. As the resistance values of the thermistors change, so will the repetition rate and duty cycle of the coded information being transmitted. The repetition rate will be used as a measure of battery voltage. The duty cycle will be used for transmission of temperature.

Calibration curves for the thermistors are being drawn up during the present period of ground testing the OSCAR III satellite. From these curves it will be possible to transform the observed repetition rates and pulse widths of the coded signals into accurate temperature and

[*Continued on page 90*]

More Watts Per Dollar

BY CHARLES GUDER*, W1TFH

The amateur is known as one who can frequently get the last fraction of a watt out of his final and still not destroy the tube. Here, W1TFH tells how to get a power increase of 75% from a 6146 without affecting tube life adversely. Also discussed is the advantage of the 572-B when used as a replacement for the 811A.

OVER the years it has been the amateur who has found out how to get the most performance from the least amount of equipment. Since in large part the power output of a transmitter is determined by the tubes used in the final stage, the tube itself gets the first look.

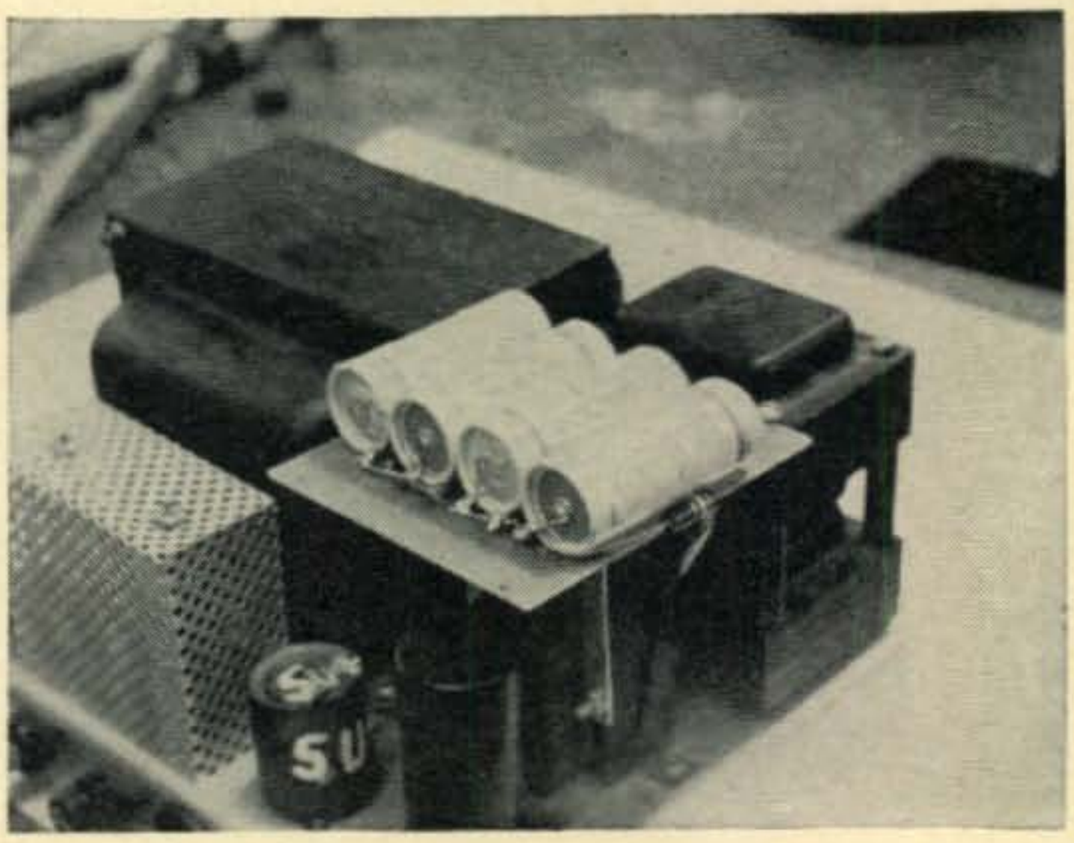
The 6146 is a very popular tube, especially since single sideband equipment came on the market using a pair in class AB1 to produce 100 watts of r.f. output. In all of the manufactured equipments, the 6146 has been operated with 800 volts on the plates drawing 200 mils, and with screen voltage of 260 volts. During tune-up procedure with full carrier the tubes get *hot*, but on careful examination, it turns out that it is the screen grid that really becomes incandescent *first*. When this happens, the tube wants to "run away" and destroy itself. This suggested to the writer that perhaps the basic difficulty is secondary emission of the screen itself. Looking at the tube tables, you see that the tube is rated for a.m. service at 750 volts which suggests the possibility of increasing the plate voltage in single sideband service to increase output power and, at the same time, to reduce screen emission by increasing the ratio of plate to screen voltage from the usual 3:1 to 4.5:1.

Modifications

I was operating a Collins KWM-2 from an a.c. power supply (Collins 516F-1). It was convenient to obtain these higher voltages from this supply by using silicon rectifiers for both plate and screen sections and by changing to capacitor input in the high voltage section. This provided 1250 volts for the plates and 275 volts measured at the screen terminals of the 6146s. Surprisingly, at 1250 volts and 250 ma on the plates and 275 volts measured at the screens, the 6146's ran cool black, and the r.f. output, as measured by the Waters Model 334 Dummy Load-Wattmeter, was 175 watts instead of the normal 100 watts. Resting current was set at 0.040 to 0.050 amperes (as at the original lower voltages). This higher power operation was continued for several months to determine whether the life of the 6146 would be shortened. To date no difficulty has been encountered either with the original set of tubes or with the KWM-2 itself.

Recently a new tube, the 6146B, appeared on the market and a pair of these were tried and found to operate slightly better, producing just a few more watts output at the higher voltages. The next obvious move was, of course, to set up these same operating conditions for mobile use. This was accomplished by a specially made Adcom power supply that would provide *both* the normal 800 volts and 1250 volts, switch selected, and a full 275 volts for the screens. Results were just as satisfactory in the mobile as in the fixed station. As a further check, the same changes were made in several other stations and the same results obtained with no damage at all.

Since most KWM-2's used on a.c. lines are operated with the Collins 516F-2 power supply, a simple modification of this power supply has been worked out (fig. 1) to provide the higher



Exposed view of the Collins 516F-2 power supply shows the plug-in silicon units and the h.v. input filter mounted on a board atop the filter choke.

*26 Pennymeadow Rd., Sudbury, Mass.

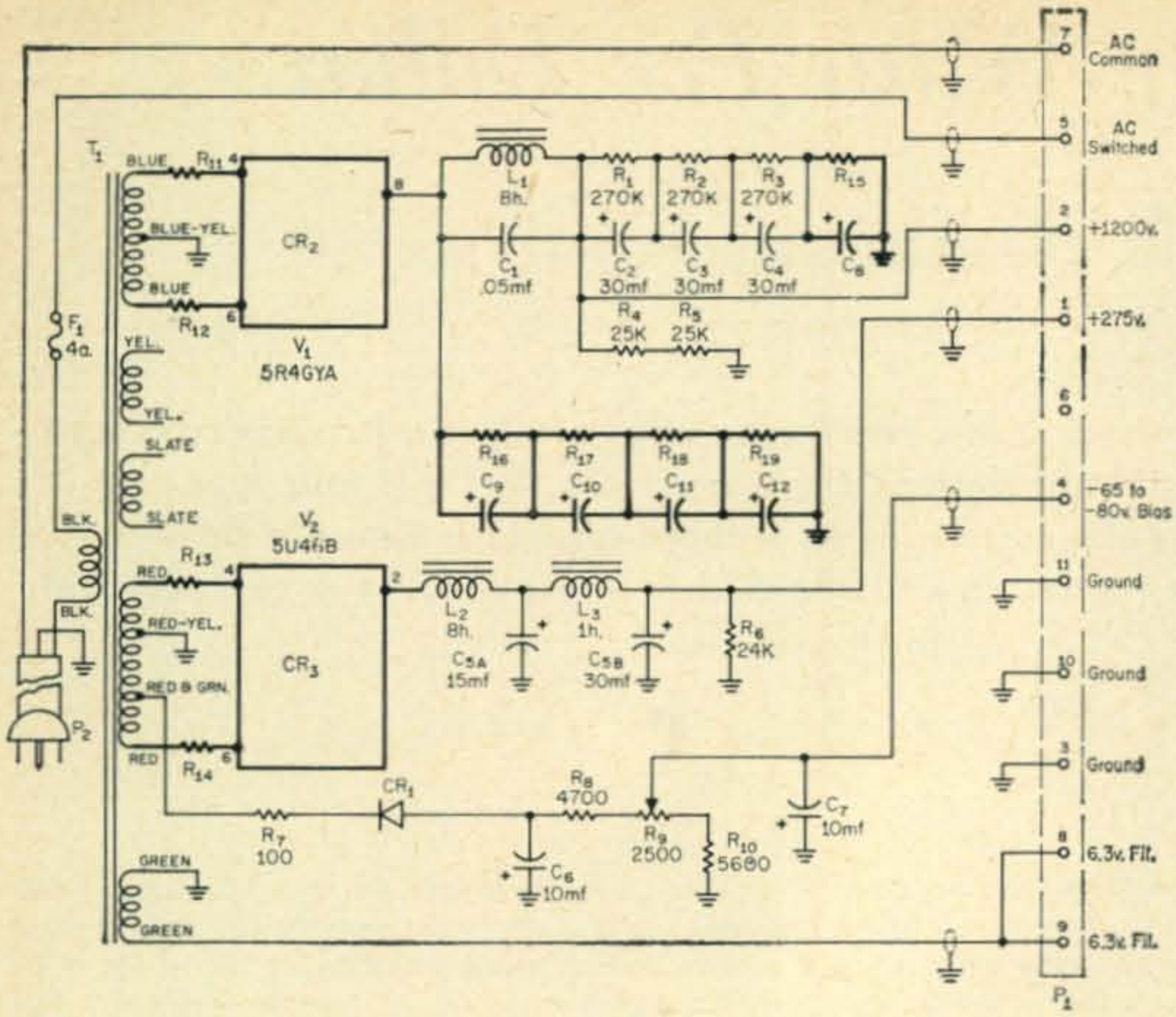


Fig. 1—Circuit of the Collins 516F-2 a.c. power supply modified as explained in the text.

C_8 to C_{12}—30 mf, 450 volts.
CR_2 — International Rectifier ST-2A.
CR_3 — International Rectifier ST-14.
R_{11} to R_{14}—10 ohms, 2 watts.
R_{15} to R_{19}—270K, 1 watt.

voltage. All parts listed on the diagram are commercially available.

The same operating results have been obtained with the Collins 32S-1 and 32S-3 exciters as with the KWM-2. No wiring changes are required in either the KWM-2 or the 32S- exciter; only the power supply is modified. As far as these changes in equipment other than Collins KWM-2 or 32S are concerned, the word is be careful that the final amplifier components are rated for use at the higher voltage *before* you go high voltage.

The UEW 572-B

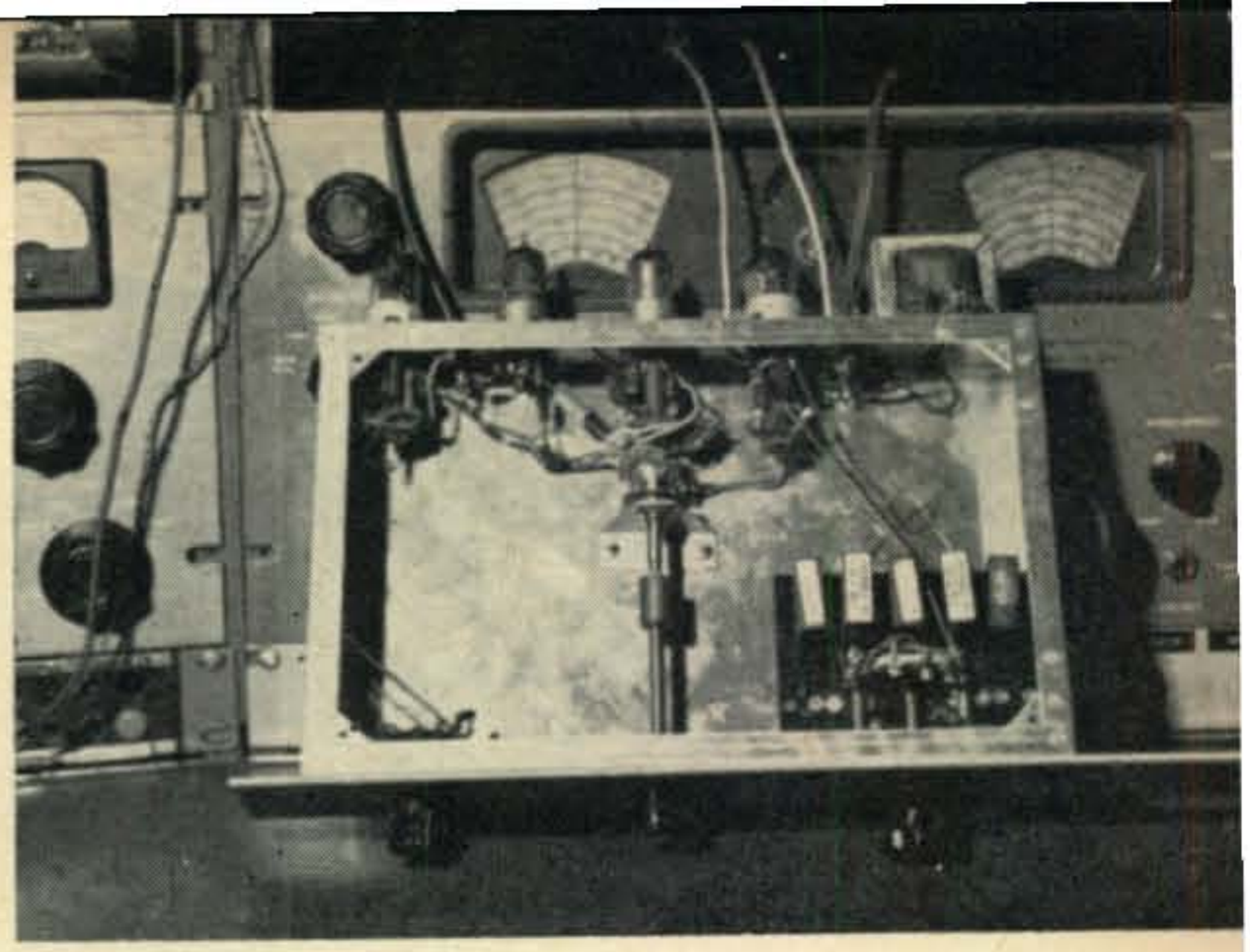
Since we started out to get more power from existing equipments, it was only natural to look at the several linear amplifiers now on the market using 811A's in parallel, 2 or 4. The United Electronics-Waters UEW 572-B became available some months ago and seemed to be a "natural" replacement for the 811A. Both tubes are mechanically interchangeable, have the same filament requirement, but differ in that the UEW 572-B has a 160 watt graphite plate and "hard glass" bulb. The 811A has a 65 watt metal plate and a soft glass bulb. Electrically, one UEW 572-B equals two 811A's.

Again we chose the Collins unit on which to experiment, the 30L-1 Linear Amplifier. This unit uses four 811A's in parallel with 1500-1600 volts at 600 mils and produces output under carrier-inserted tune-up condition of 550-600 watts. (Not too long, please, the 811A's get very red!) We then replaced the 811A's with UEW 572-B's, being careful that the pins on the tubes went into the proper holes in the sockets . . . it is possible to force them in wrong and not get the filaments to light! Now, with *no* changes in the 30L-1 and driven by a standard KWM-2, we got 800 watts of r.f. output and the tubes ran cool black. When driven with the KWM-2½, the r.f. output went up to 1050 watts into the dummy load-wattmeter. The tubes still ran cool black but we found that a ½ watt grid resistor (R_{28}) in the 30L-1 couldn't take the increased grid current. We changed the resistor that is located just inside the chassis next to the output coax connector to a 2 watt size, same resistance value as originally used, 39 or 47 ohms. No other changes are required in the 30L-1 to get a husky talking kilowatt in a small box. The first set of UEW 572-B's are still working after several months, including some 10 hour demonstration days at ham fests! We do recommend a "stiff" 120 volt a.c. line, however, to run the beefed-up 30L-1.

The same output power increase has been obtained in the Gonset Linear using 811A's, and we are thus led to the conclusion that the UEW 572-B is a worthy replacement for the 811A in any single sideband Linear Amplifier now in service using 811A's. The UEW 572-B is available from most amateur distributors, and while it costs more than an 811A, it gives out with more r.f. for a longer time and never shows color. ■

	811A	572B
D.C. Plate Volt.	1,500 v.	2,750 v.
Max Sig D.C. I_p	175 ma	225 ma
Max Sig Plate input	235 w.	600 w.
Plate Dissipation	65 w.	160 w.

Table I—Comparison between the maximum ratings of the 811 and UEW 572B for a.f. or r.f. service, Class B.



Exposed view of the adaptor shows how the chassis was positioned flat with the tubes on the rear flange.

S.S.B. Receiver Adaptor

BY HARRY LOWENSTEIN*, W2HWH

Many of the older, better quality receivers can be made "useful" for s.s.b. service with this outboard adaptor. It requires no receiver modifications and the adaptor contains an i.f. amp, an a.v.c. system, a product detector and a 5-frequency crystal controlled b.f.o.

THERE is a lot to be said for the better quality older receivers in use at many ham stations. They usually have a crystal filter that will effectively reduce heterodynes and, if aligned properly, will have adequate selectivity for their "used" going price today.

Their main disadvantage in present day ham operation is lack of a product detector and a variable a.v.c. time constant. Also, the tuning rate could be a lot slower than originally designed.

The main problem with the older receivers, and some of the new ones, is getting the s.s.b. signal in the proper part of the i.f. passband. This can be done by fussing with the tuning dial, using the S meter and then setting the b.f.o. pitch to the proper point. Unfortunately, by the time you do this, the signal you are tuning is in QSO with someone else.

To overcome these disadvantages several previously published circuits have been grouped together in one outboard adaptor. This is shown in fig. 1. The original receiver is enclosed in the dotted portion of the circuit.

The three circuits are an untuned i.f. amplifier with an adjustable a.v.c. time constant, a product detector and a crystal controlled b.f.o. The i.f. signal is picked off the diode detector plate and coupled out to the 6BA6, V_1, an untuned i.f. amplifier, which can, therefore, operate at any i.f. frequency.

This stage is controlled by a separate a.v.c. amplifier, V_2. The circuit (both V_1 and V_2) is taken from the *Sideband Handbook* where it is credited to T.M.C. This now provides two a.v.c. loops, the fast one in the receiver i.f.s. and this second adjustable speed in the untuned i.f.

The output of the 6BA6 can be fed to the r.f. or oscillator grid of V_4, a 6BE6, wired as a product detector. For a.m. operation it is fed to the oscillator grid. For s.s.b. the i.f. signal is fed to the r.f. grid and the b.f.o. is fed to the oscillator grid. All switching for a.m. or s.s.b. is accomplished in the adaptor. This circuit was also published by T.M.C.

For c.w. and s.s.b. reception the b.f.o. signal is generated in V_{3B}, a Pierce crystal oscillator. The frequencies used will be discussed later. The other half of V_3 is a cathode follower the output of which couples to the 6BE6 product detector. This circuit was developed by Eldico.

The audio output of V_4 is connected back to the receiver audio gain control as shown in fig. 1. As may be seen, very little work has to be done at the receiver.

Crystal Frequencies

While the i.f. frequency of most of the older receivers is 455 kc they have crystal filters which frequently *are not exactly* 455 kc. Before determining the crystal frequencies to be used in the circuit of V_3 we must know the exact frequency of the crystal filter and align the receiver i.f. to that frequency.

*12 Maplewood Ave., Maplewood, New Jersey.

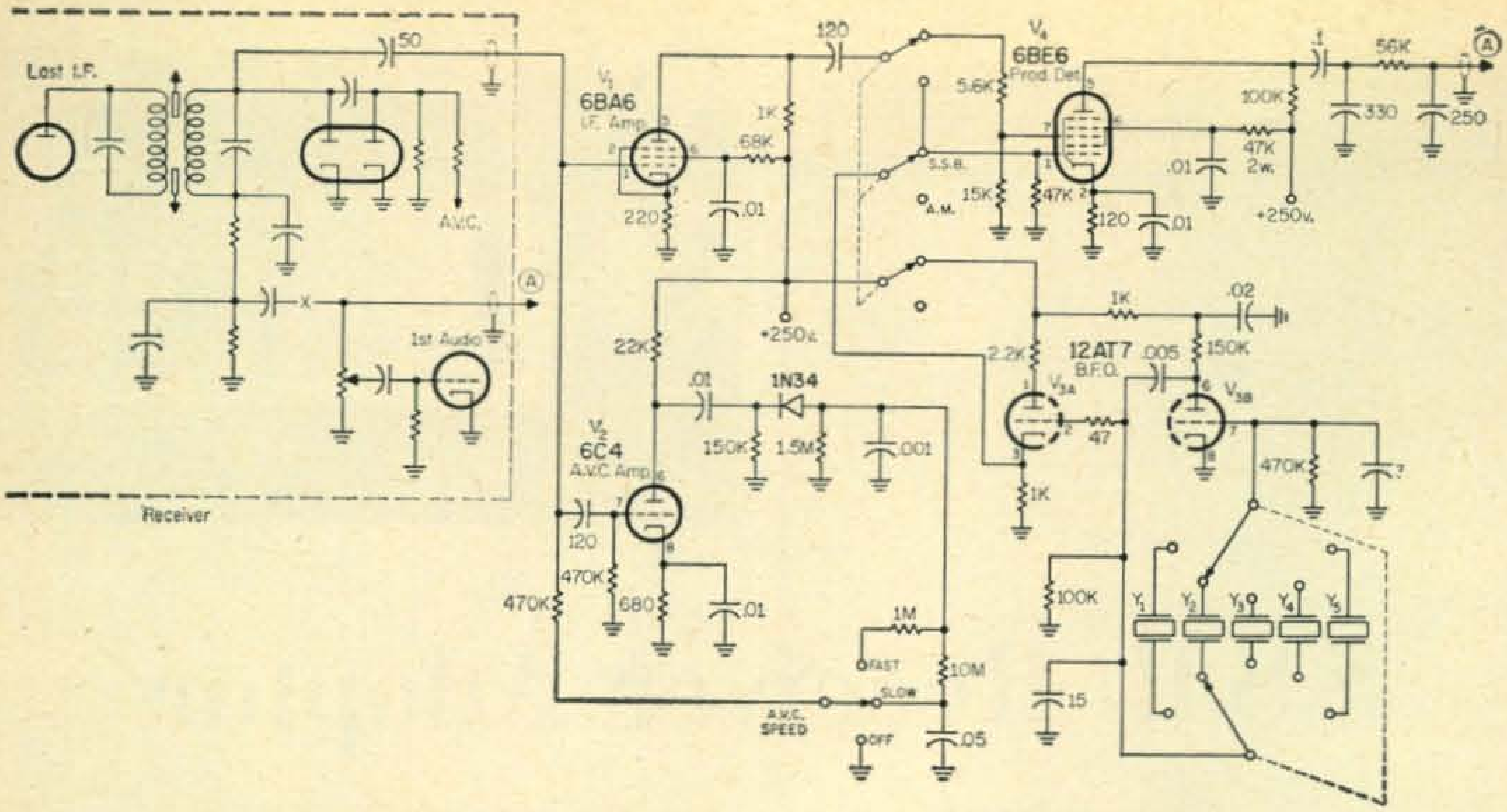


Fig. 1—Circuit of the outboard adaptor for s.s.b. reception. The area enclosed in the dotted lines is the receiver and only two connections are made, the i.f. signal takeoff and the audio input to the volume control. All resistors are ½ watt, all capacitors greater than one are in mmf and capacitors less than one are in mfd.

To determine this frequency switch the crystal filter in at the sharpest position and swing an LM frequency meter (or a good quality signal generator) across the i.f. bandpass. The peak will be at the crystal frequency. Align the i.f. amplifiers at this frequency.

Assume that the crystal filter is accurate, 455 kc. A crystal of 455 kc is chosen for zero beating and Y_1 is cut for 455 kc.

C.W. Reception

For c.w. reception two crystals are used. Each is 1.2 kc away from the 455 kc i.f. or 453.8 and 456.2. When a c.w. signal is tuned in and is at exactly 455 kc, either crystal Y_2 or Y_3 will produce a 1200 cycle audio tone in the output. Why two? A look at fig. 2A shows the received signal centered on the i.f. bandpass, 455 kc. When crystal Y_2 is employed, a 1200 cycle difference frequency results and is fine until some interference opens up further down but still in the i.f. bandpass. The beat frequency difference caused by the interference is also heard in the output of the receiver. By shifting to crystal Y_3 at 456.2 we will still produce a 1200 cycle audio output for the received signal but the interfering signal produces an audio tone that is too high to be reproduced by the audio system.

S.S.B. Reception

There is nothing unusual about using two crystals for s.s.b. reception, one for upper and one for lower sidebands. The same two crystals, Y_2 and Y_3 are used for s.s.b. as well as c.w.

RTTY

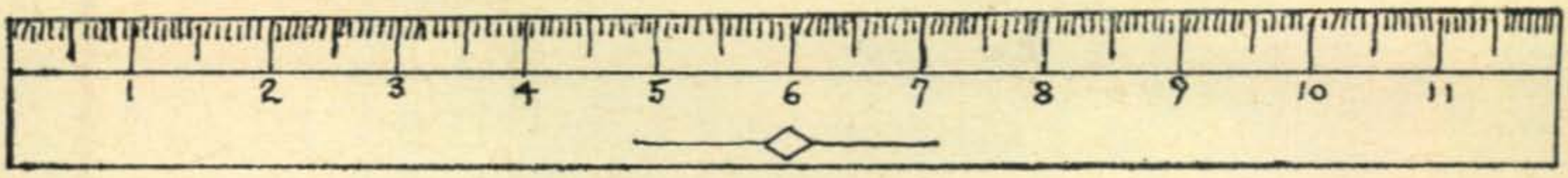
The two crystals for RTTY reception are Y_4 and Y_5 and are 2.55 kc above and below the i. f. (457.5 and 452.45 kc). These crystals serve the same purpose for RTTY that crystals Y_2 and Y_3 serve for c.w. reception; they will sometimes allow interfering signals to be eliminated.

Figure 2B shows how Y_4 and Y_5 may be used to produce the two audio tones associated with an 805 cycle shift, 2125 cycles and 2975 cycles. By switching between crystals Y_4 and Y_5 and resetting the reversing switch on the terminal unit, clear copy may be achieved. This ability to shift the crystal frequency permits greater flexibility in using the notch of the crystal filter to eliminate the interfering signal.

[*Continued on page 86*]

Chassis and panel fit neatly above the receiver. The controls are, from left to right, A.V.C. Speed Control, S.S.B.-A.M. and B.F.O. Freq. The space on the right is for a scope tube to be used with a panadaptor in a future project.

The Antenna Measuring Contest



BY FREDERICK W. BROWN*, W6HPH

There is probably more controversy about antennas than any other technical subject. The Antenna Measuring Contest, besides being one of the best argument settlers ever devised, combines all the outdoor fun of a Hamfest, Field Day, and V.H.F. contest.

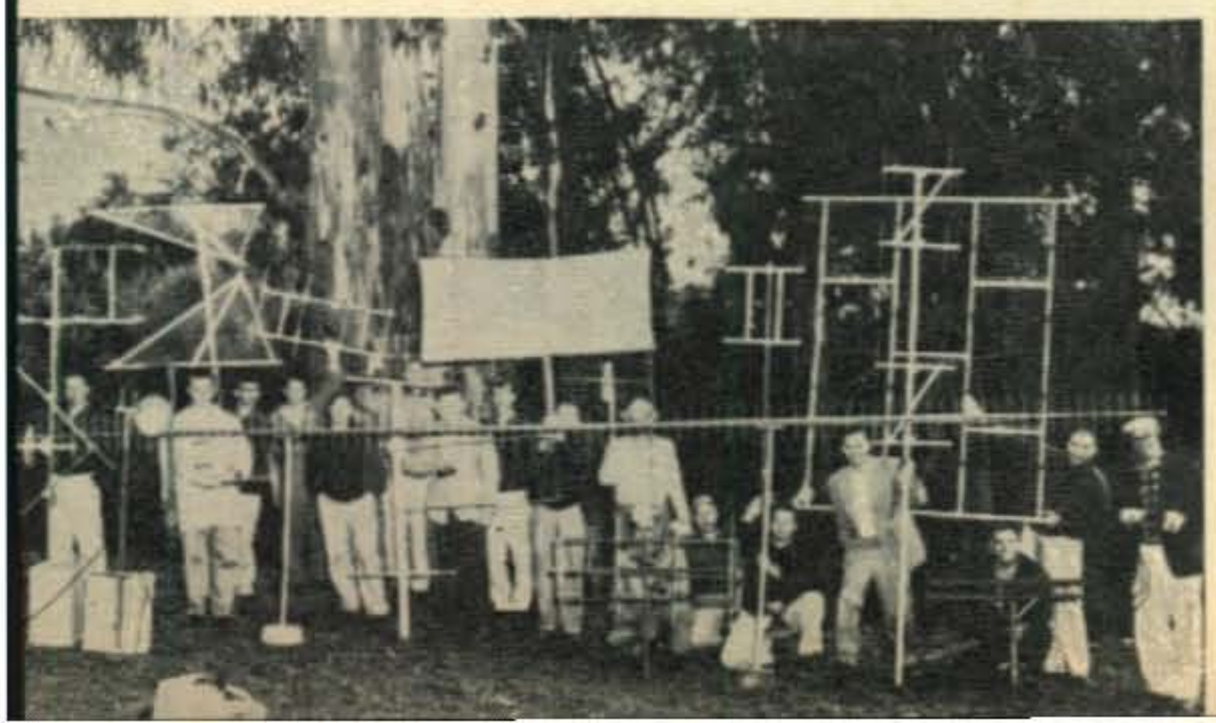
For the u.h.f. man interested in antennas, (and what u.h.f. man isn't?) the most interest-arousing and enjoyable of all sociable activities is the Antenna Measuring Contest. Each participant learns by direct measurement what his antenna is *really* doing in terms of gain over a dipole and in relation to the other entries. Results are not only educational, but very often are quite startling. Gains almost always measure lower than textbooks or certainly advertisements would lead us to believe. In one recent contest, a certain much advertised commercial Yagi showed up with a gain 8 db *below* a dipole. Another manufactured Yagi did better, it actually was 2.7 db above the dipole. Both of these antennas are advertised at more than 10 db gain. *Caveat emptor!!*

As far as we are able to determine, the Antenna Contest was first invented in the San Francisco Bay Area by Everett Emerson, W6PBC and Bob Melvin, W6VSV. The first one was held in 1957, and they have recurred more or less annually since then. Bay Area contests have been so successful that the local 432 mc gang has formed the UHF Radio Society, Inc., a non-profit organization devoted to advancement of u.h.f. work. As a memorial to the late Oliver Wright (a pioneer antenna experimenter and inventor of the famous GD beam), the group was assigned Oliver's old call, W6GD.

Essentially, the contest amounts to a gain-measuring experiment. Prizes are awarded on the basis of most gain, or gain *versus* size. The refinements of making accurate gain measurements have been published in detail[1] and will not be repeated here. Usually the best band for antenna contests is 432 mc—lower frequency antennas are too clumsy and very few are usually available for higher bands. All but one Bay Area contest was held on 432 mc.

*Pine Cove, Idyllwild, California.

The 1958 Antenna Contest was held at Tilden Park in Berkeley. The extremely long V driven Yagi running the length of the picture was entered by W6EDC and placed second. First prize went to W6MJV who entered the large "bed spring" array at the right.

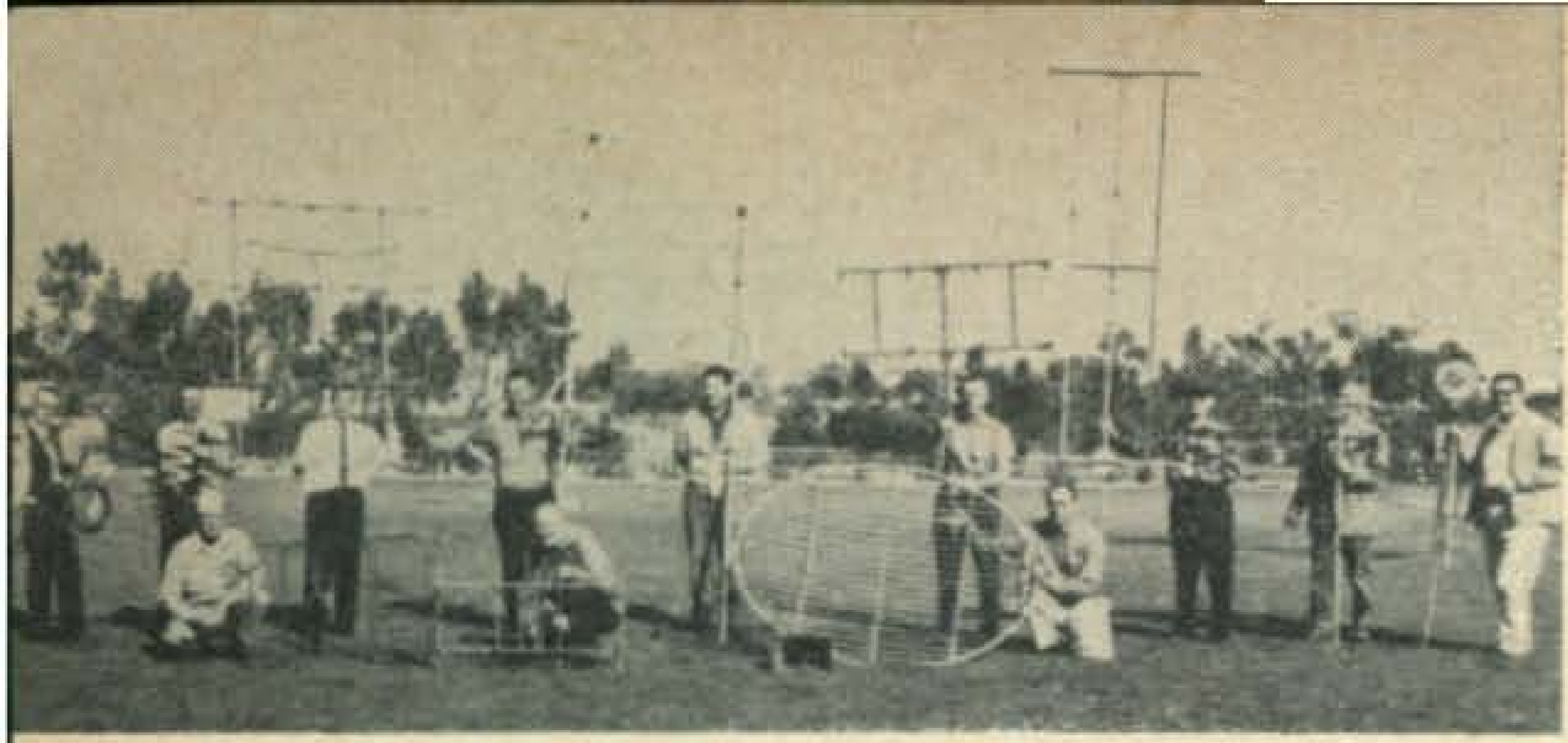


Participants

Probably the best way to get contest entries is by personal invitation. This prevents too many nonparticipating onlookers from showing up and getting in the way, etc. If there is not enough 432 mc activity in your area, operators on lower bands can be invited to make 432 mc scale models of their antennas. Of course, any local "expert" who has been bragging about the tremendous gain of his antenna should be challenged to either "put up or shut up."

Invitations should be issued far enough in advance so that everybody has plenty of time to construct or take down their antennas and do any final pruning or tuning. Obviously, a time should be chosen when most people are free—a Sunday afternoon is usually best. The prizes offered should be attractive enough to encourage as many entries as possible. If no one is willing

[1]Brown, F. W., "How to Measure Antenna Gain," *CQ* November, 1962, page 40.



The 1963 contest was held in San Mateo. Winner was W6DFU (14.5 db) with a 32 element Oliver Wright design. Vertical polarization is used on 432 mc in California.

to donate a pair of 4X250B's, you can at least get some fancy certificates printed.

The Site

The contest site should be reasonably free of reflecting objects such as buildings, cars, trees, *etc*. It should also be fairly well secluded from the public; a group of people holding strange looking antennas is likely to attract an unfavorable amount of curiosity. An open field is about as reflection free a spot as you are likely to find in most parts of the country.

A shady place with picnic tables should be nearby, and a refreshment committee appointed. Adequate parking space far enough from the test site to avoid car reflections should also be arranged.

Sixty cycle power must be available unless all equipment is battery powered. The availability of a fairly well regulated putt-putt will grant you independence from the power lines, of course.

Equipment

The test equipment required has been discussed in the Antenna Measurement article.[2] An a.c. v.t.v.m. connected directly to a receiver i.f. stage will overcome the second detector non-linearity problem. Be sure to check the accuracy of your receiving set-up against a signal generator having a good piston attenuator—some a.c. v.t.v.m.s have good linearity at audio frequencies but become very nonlinear above a few hundred kc.

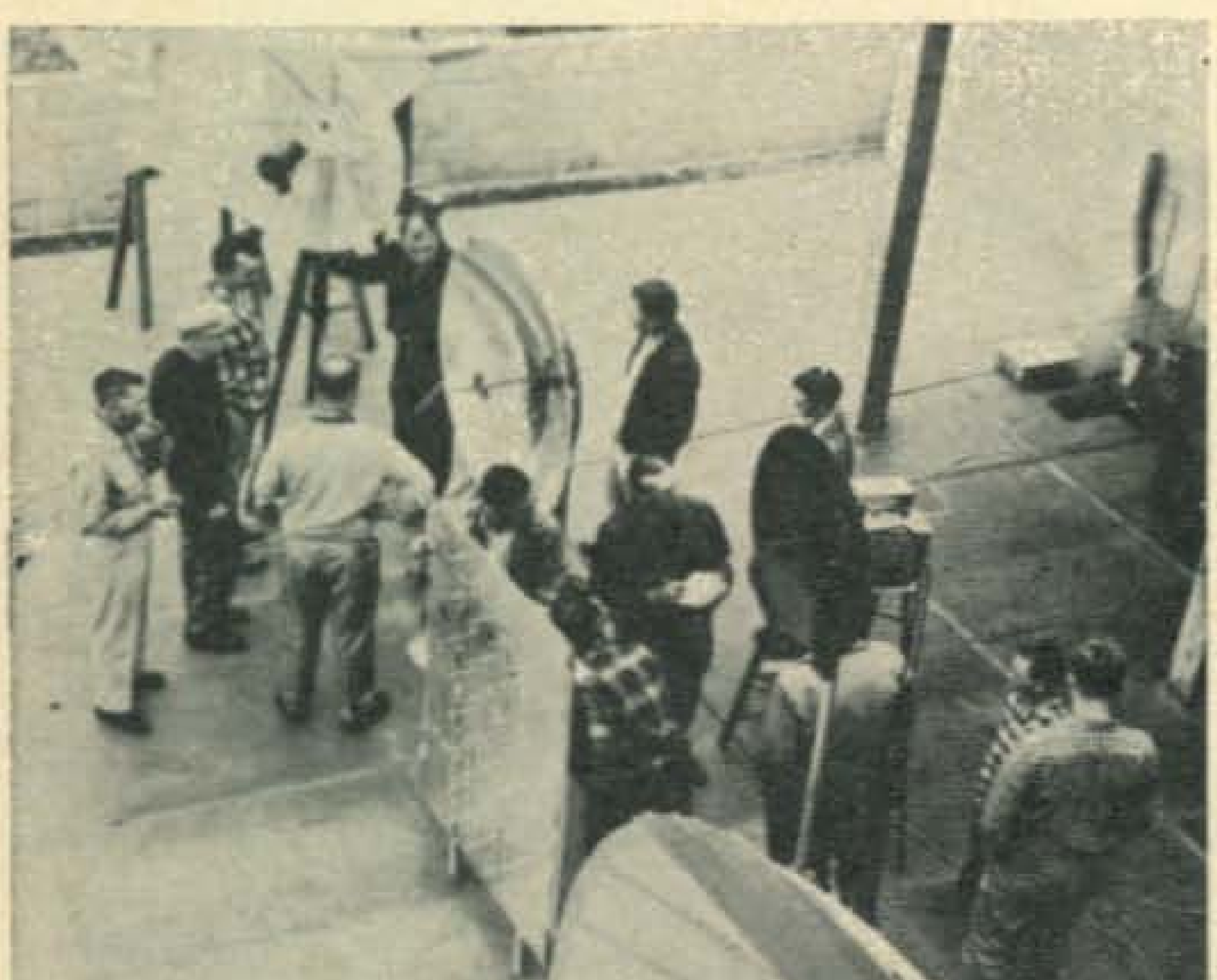
For best results a line voltage regulator or at least a regulated plate supply is desirable; small variations in line voltage are essentially magnified by the number of receiver stages.

Bay Area contests have always used a 1000 cycle square wave modulated signal generator for transmitting, with a HP 415B standing wave indicator and crystal detector for receiving. This arrangement is very stable and accurate.

In addition to the signal source and receiving equipment, a half wave dipole for zero db reference is needed. It should be on the end of a wooden stick so the holder's body will not disturb the field near the dipole. Your antenna range can be tested by moving the dipole a few feet up and down, back and forth, and sideways. If there is much variation in received signal strength, an average reading will have to be taken for the reference level.

Most 432 mc antennas are fed with either twin lead or coax. The receiver input should be fed through a 50 ohm pad so to insure a proper termination for the transmission line. (The mismatch loss to 75 ohm coax will be negligible.) A 4 to 1 balun will take care of the twin lead users. Have on hand a supply of coax adapters (BNC to type N, etc.) to accommodate the various types in use. Each antenna should be equipped with a few feet of transmission line for connection to the receiver, but forewarn contestants that they will not be permitted to add any assumed transmission line loss to the gain reading.

[2]Brown, F. W., "Design of Yagi Antennas" *CQ*, May 1963, page 38.



The 1961 Bay Area contest was held on 1296 mc. It was won by the large semicircular dish partly visible in the foreground.

Rules

Antenna Measuring Contest rules are fairly simple: the participant stands inside a small circle marked on the ground and, holding his antenna in the air, tries to get the most signal from the distant signal source. A meter is placed where he can observe the relative receiver output. The contestant is permitted to do anything he wants: change polarization, slide aluminum foil on the twinlead, point the antenna at the moon, *etc.*—anything that will bring up the signal short of placing an amplifier in the transmission line!! When he has maximum signal, the recorder reads the meter and writes down the gain in db. The next participant then takes his turn.

There are two schools of thought on how antenna contests should be judged: gain, or gain vs. size. The largest antenna will usually (but not always) win the gain contest. There is something to be said for both viewpoints. The gain-alone proponents argue this way:

"There is no substitute for gain in communications work. Size is limited anyway by what one man can hold off the ground. The man who goes to the trouble of building the biggest antenna and lugging it to the contest should have his labors rewarded with first prize."

[*Continued on page 86*]

DX

BY URB LE JEUNE,* W2DEC

•DXpeditions

G5KW, who is now in Saudi Arabia, has s.s.b. gear and a beam and will visit some of the nearby DXotic spots during his several year stay in HZ land. *(Tnx G2BVN & WGDXC).*

Indian Ocean Islands-Les, G8KS, has arranged via Leny, 5Z4GT, for the Hallicrafters SR-150, SX-117 to go aboard the *S.S. Galieni* for a trip to Madagascar, Mauritius, Comorros, Reunion, Tromelin, etc. through the Indian Ocean. The S.S. *Galieni* returns to France to pick up the new crew for Crozet Island. On the way South the boat will call in at Mombasa where Leny, 5Z4GT, will speak to the radio operators aboard and check to see if they are amateurs. If they will operate the equipment amateurwise, Leny will loan them the Hallicrafters equipment for a period of twelve months until the end of January 1966. *(Tnx G8KS/5Z4GT/VERON).*

160 Meters

Record for first ever JA 160 meter DX QSO since recent opening of JA band on spot frequency of 1880 kc goes to JA3AA, who on June 27th at 1505 GMT QSO'd (359) none other than our ardent and also successful 160 meter DX globe-trotter VS1LP (459) in Singapore. Wonderful to have JAs with us on 160. Congratulations to both on another first.

VE2UQ again went close to the North Pole to Cornwallis Island, Resolute Bay 74.43N—95.00W, only 900 miles from the North Pole where it is daylight all night. July 14th to 20th receiving tests were conducted with W1BB/1 to see if 160 meter signals would penetrate daylight conditions near "The Shadow Edge." No 160 meter signals were heard, not even 2 kw WCC on 2036 kc. Lowest frequency heard was 3.5 mc with only S2 to 3 signals coming through. VE2UQ then visited Thule Greenland to check on 160 and then on to Prince Edward Island as VE2UQ/1 working quite a few W/VEs.

Congratulations to ZS6BCT for first summer DX worked when he QSO'd W1BB/1 at 0435-0455 GMT July 15th on a frequency of 1809 kc using 10 watts to a doublet antenna peaking 349. W1BB's signals were 449/569 using 100 watts to his 260 foot high inverted Vee. Chris set up the schedules by first observing WCC's peaking times, then airmailing W1BB for schedules. Contact was made on the second try. WCC's signals have been consistent, varying 229 to 559 several different nights. ZS6BCT's s.s.b. signals also peaked 239. Apparently, the North-South path is in good condition.

Pete, 9L1HX, scored a resounding first ever . . . Sierre Leone to the USA when he QSO'd W1BB/1, 579 at 0447-0515 July 26th. Stew and Gary, K1KSH (visiting BB to discuss his forthcoming trip to Pakistan and 160 DX from there) got on 160 at 0330 to try for Gordy, VE2UQ, on Prince Edward Island and DL1FF, who had a schedule. Neither were heard. So, DX CQs were sent alternate five minute periods for an hour. Suddenly, after K1KSH's trick at the key, 9L1HX appeared calling W1BB/1. An almost solid QSO 469/379 was had for about 25 minutes. Credit for this contact goes to G3PLQ/mm, commercial operator on M.V. *Perang* who, unable to get a transmitting license for 160/mm faithfully monitors 160. He makes port at Freetown occasionally and interested 9L1BX in getting on 160.

The QSO with 9L1BX was halted to answer another station 349 heard calling near the frequency. This turned out to be ZS4PB, who quickly faded out since peak conditions had already passed. He was receiving W1BB/1 459. Additionally ZS6BCT listening in, reported VQ2AS and ZS9G also were on.

Another first . . . to VQ2AS, John, who, alerted by ZS9G to band conditions and hearing ZS6BCT QSO W1BB/1, got on 160 himself and with signals 229/339 made it a QSO on July 29th at 0410. John used a 250 foot sloping dipole to copy W1BB/1 459. British s.w.l. Smith monitored this QSO.

DX has suddenly erupted in grand style to ZS land. No doubt about it. The band was in excellent condition to the south and the African hams are making themselves known on 160. This is a good omen for the coming 1964/1965 DX season of the IQSY and low sunspot numbers.

Thanks to W1BB for the above 160 meter information.

*Box 35, Hazlet, New Jersey 07730.

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.

The following certificates were issued between the period from July 4th, 1964 to and including August 3rd, 1964:

CW-PHONE WAZ

2010	K6TSY	Ted A. Cullian
2011	G5DV	H. Andrews
2012	W6FET	A. H. Stovall, Jr.
2013	W9LJU	Raymond T. Peschek
2014	WA2TAG	Paul R. Jorgensen
2015	OH5UQ	Paavo Miettinen
2016	VQ2W	P. R. Golledge
2017	W9UXS	William C. Price
2018	SM3BHT	Sven V. Jonsson
2019	W6EOZ	Harold E. Olson
2020	K8VDV	Roy C. Kronauge
2021	W7LBP	John Houk
2022	W7UZA	Porter A. Skinner
2023	KØEZH	Dr. Bennett W. Muir
2024	K6KII	Clifford G. Moore
2025	DL1HH	Hermann Groh
2026	F8IH	Docteur Maurice Artigue
2027	UB5ZV	Vladimir Drozdowski
2028	W8ARH	Gary F. E. Vrooman

ALL-PHONE WAZ

254	WA2TAG	Paul R. Jorgensen
255	W6TXL	Harold E. Bennett
256	W7LBP	John Houk
257	W7UZA	Porter A. Skinner

TWO-WAY SSB WAZ

248	WA2TAG	Paul R. Jorgensen
249	ZS6LW	A. D. van der Watt
250	W3CGS	Harry Stark
251	W7LBP	John Houk
252	W7UZA	Porter A. Skinner
253	W4SSU	Curtis George

CW WPX

563	WØGNX	W.O."Woody"Bennett,Jr.
564	K4SCT	Hal Sillman
565	WB2FMK	Robert J. Rasche
566	KP4RK	Jose Toro
567	UA9JH	Nizamov Arkadij Chasjlovic
568	UA3BK	Felix Pokrovsky

PHONE WPX

111	YV5BBU	Juan Jorge Gugig

SSB WPX

188	DL3RK	Walter Geyrhalter
189	W8EVZ	James Resier
190	W4ZYS	Meryl C. Burns
191	SM5BPJ	Sune "Doc" Ericsson
192	W4BFR	Bruce E. Montgomery

100 TWO-WAY SSB

458	K9WJU	J. F. Swartzendruber
459	KØUKN	Bill Dennis
460	W7BTH	Elwood R. Johns

200 TWO-WAY SSB

123	SM5UF	Harry Engstrom

WPX ENDORSEMENTS

	Mode	*Continents*	*Band*
WA2WOQ	SSB		14
K2OUS	CW	E	
K4HPR	CW		14, 1.8
W5LGG	CW	O F	
	Mixed	O F	
W6CHY	Phone		28
K8ONV	Mixed	E	
W8TTN	CW		21
WØVBQ	CW	E A	
DL7CS	CW	E F	14, 21
G3DO	Phone		3.5
G8JR	CW		1.8, 3.5
IT1AGA	CW	F	
OK1AFC	CW	E	
OK1SV	CW	E A F	14
OK3EA	CW		21
OK3EE	CW		1.8
ON4UN	SSB	E	3.5
SP2HL	CW	E	
ST2AR	CW		14, 21
UB5FY	CW	E	
UC2AF	CW	E	14
VK3XB	CW	E	
VK3AHQ	CW	E	
VK3JF	CW		14

A-Asia; *E*-Europe; *F*-Africa *N*-North America; *O*-Oceania; *S*-South America.

During a recent visit to K2US, the World's Fair Amateur Radio Station, Gus Browning, W4BPD (left), introduces his wife, Peggy to the delights of being a rare station as Trav Marshall, K9EBE, looks on. *(Tnx K2MGE)*

Here and There

BVI FORMOSA: BV1USA is crystal controlled on 14307 kc s.s.b. by regulation of the Chinese Government.

EP Iran: Phyllis, EP2AB, and John, EP2DJ, have permanently QRTd from Iran. QSLs have been mailed to all first contacts. Anyone who has not received a QSO confirmation may obtain a duplicate at the address shown in the QTH section.

EP2DM: EP2DM will start study at Southern Technical Institute in Marietta, Ga., thanks to the efforts of W4JOH. Maybe Javad will be on as EP2DM/W4 now that the reciprocal licensing bill is signed. *(Tnx WB2FMK).*

FH8 Comoro Islands: Andre has been QRV on 14290 s.s.b. daily around 1700 GMT. *(Tnx LIDXA).*

FL8 French Somaliland: The letter from K1QHP needs no explanation. "I plan to make a DXpedition to French Somaliland during the period 31 Oct. to 29 Nov. this year. Only the rare possibility of circumstance, due to military, would result in any change in plans or dates selected.

Travel distance, one way, from Asmara to Djibouti, is approximately 1,155 miles. With luck I hope to be in Djibouti, and on the air by 5 Nov. and remain operational until approximately 24 or 25 Nov. '64. If I am fortunate in locating another operator to make the trip with me, I look forward to 24 hour operation.

Equipment will be a Collins KWM-2 with antennas improvised as the situation permits. C.w. and s.s.b. is hoped to be worked on all bands, 3.5 to 21 mc and regulations permitting, favoring the following frequencies: 3505, 7005, 14005 and 21005 kc on c.w.; 3805, 7205, 14105 and 21405 s.s.b. Call sign will be assigned on arrival and may be either FL5 or FL8 prefix. For confirmations, I desire QSL and US airmail postage from those stations who desire QSL direct and QSL plus IRC from those foreign stations who desire confirmation direct. QSLs will be forwarded to all other stations worked via the Bureau. Cards will be ordered printed immediately on retutrn to Asmara.

WPX HONOR ROLL

CW WPX

W2HMJ	694	W8UMR	506	OE1FF	457	UA4IF	417	W3DJZ	447	G3DO	466	VE3BKL	300	W6YY	570
W8KPL	664	W8RQ	505	F9MS	457	W8GMK	417	G8KS	430	MP4BBW	462	K2POA	300	W5LGG	565
W5KC	656	W9UZS	505	OK3EA	456	SP8HR	416	VK6RU	421	HB9TL	452	W6USG	300	YU1AG	559
W2EQS	641	PA0LOU	505	UC2AR	456	K2PFC	415	W3AYD	420	W3NKM	451	SM5UF	295	W4BYU	557
W2AIW	617	G3EYN	503	W8KSR	456	VK3XB	415	F8PI	418	G8KS	450	W0CVU	291	K2ZKU	555
ON4QX	603	ON4FU	503	W7ABO	452	W1DGT	415	PZ1AX	413	K9EAB	439	GI6TK	278	W3AYD	552
W4OPM	600	YU1AG	503	SM5BPJ	452	W5AWT	412	K2CJN	409	G3AWZ	428	K5OGP	277	HB9EU	551
W6KG	596	W6YY	502	WA2CBB	451	W5DA	412	DL3TJ	404	W3MAC	425	K8ONV	275	W0MCX	529
W9UXO	582	DL7CS	502	K4TEA	451	WA2DIG	411	OE1FF	404	G3NUG	423	VE3ES	274	W2GT	528
DL1QT	573	K2CPR	501	SP6FZ	450	W2PTD	411	W1ORV	404	W4NJF	403	K2JFV	266	DJ2KS	524
W2NUT	571	W9SFR	501	W3PGB	450	K5LZO	411	W1UOP	402	I1AMU	403	KG6AJB	265	G8KS	520
W8LY	570	W2EMW	500	DL1YA	450	W4DKP	410	W6USG	400	PJ2AA	379	K2MGE	263	OE1FF	519
K6CQM	565	W2FXA	500	DL9KP	450	W1CKU	408	XE1AE	398	W6YMV	372	W3AYD	262	K9AGB	510
W5OLG	564	W2MUM	495	DL9KP	450	K4IEX	408	VE3BQP	386	W1ORV	370	W4EEU	262	PA0LOU	510
W2HO	563	W1WLW	494	W8JIN	449	K4JVE	407	SP7HX	385	W6RKP	360	DL1PM	257	G3HDA	509
K2UKQ	559	LA3DB	491	VK3AHQ	448	W5AFX	407	DL3RK	383	W2HXG	359	G3WW	257	HK3LX	508
W5LGG	558	PY4OD	491	W3AYD	443	SM5AJR	406	TG3AD	381	TI2HP	356	W3DJZ	257	W4BQY	505
W9DWQ	556	OK3DG	488	W6UNP	442	DJ5GG	404	DL6VM	376	W4RLS	355	XE1CV	256	W3KPD	501
IT1AGA	555	SM5CCE	488	W3BQA	437	SP7HX	404	G3FKM	366	LA5HE	354	G3FKM	255	LA5HE	500
W2KIR	555	W4BYU	487	LA5HE	437	W6ISQ	401	W8UMR	363	K1SHN	350	UR2AR	255	KP4AOO	500
OK1SV	553	W8PQQ	481	WA6SBO	435	K6VVA	400	SM3AZI	362	PZ1AX	345	DJ2QZ	254	SM5BPJ	490
K2ZKU	552	W4HYW	478	VE3ES	433	PY4AYO	400	DL2UZ	361	K1IXG	344	ZB1A	254	ST2AR	489
K2CPR	550	W8IBX	476	G3HIW	433			SM3EP	361	VE3BQP	334	W1EQ	253	JA2JW	480
W1EQ	549	W5BUK	475	W4CKD	431	**Phone WPX**		CX2CN	359	W4RBZ	332	K2ZKU	251	W4BFR	478
W1IJB	546	W0MCX	472	W0AUB	429	W9WHM	629	W1DGJ	358	XE1AE	324	K3BNS	250	W4RBZ	477
W9YSX	544	G8JR	472	W2RA	428	CT1PK	610	W5ERY	358	W2VCZ	320			W3CGS	475
KP4CC	542	K4HPR	470	K5LIA	428	W8WT	600	W6CHY	358	W1UOP	318	**Mixed WPX**		W9FVU	474
G2GM	538	W3OCU	466	OK1MB	428	G3DO	598	W8JIN	356	W2YBO	318	W40PM	658	DL9OH	474
W9GFF	538	K6SXA	464	W5EJT	428	CT1HF	586	W4RLS	356	W8PQQ	315	G3DO	638	K1SHN	463
SM7MS	534	SM3TW	463	W3CGS	426	MP4BBW	506	G3GHE	356	WA2EOQ	315	W8WT	631	G3FKM	463
W3GJY	526	W4BFR	463	W1EIO	425	DJ3CP	473	PY2CK	354	G6LX	310	W9YSX	622	DL1YA	456
K9AGB	515	VK3XB	462	OE3WB	425	W9YSQ	471	5A5TO	353	K4PUS	305	DL3RK	609	W1ORV	455
W6WO	511	JA2JW	461	KL7MF	424	PA0SNG	468	DL9OH	351	DJ3CP	304	K9EAB	606	VK2DI	454
DJ2KS	511	VE4OX	461	SM5WI	424	W9UZC	462	LA5HE	351	TG9AD	303	W8JIN	605	DJ5VQ	452
W2GT	510	W9WIO	460	W4HVQ	422	PA0HBO	453	ZS6IW	350	WA2SFP	300	W3NKM	605	W0ZBQ	452
K9EAB	510	W9WCE	458	W0PGI	420	G3NUG	451			K2TDI	300	W8UMR	599	G3NUG	452
DL3RK	509	W3BCY	457	HB9TT	419	K9EAB	450	**SSB WPX**		W3VSU	300	W3OCU	588	GI6TK	450
		W7HDL	457	KH6BLX	418	W6YY	448	W4OPM	530	K0RDP	300	W9DWQ	571		

A few additional items: As I will be listening on my own frequency, please accord me the normal requested courtesies. Do not call until the previous QSO is completed. A request for QSY from c.w. to s.s.b., or vice versa, will not be honored. Speed c.w. men are asked to play it cool; every station heard will be answered.

HK0 Malpelo Island: HK3LX reports that it will probably be 1968 before another try is made at activity on Malpelo.

HVI Vatican City: HV1CN, with I1AMU at the mike, has permission to operate one day per week on 14107 kc between 2000 to 2130 GMT. *(Tnx WGDXC).*

JT1 Mongolia: JT1KAA is now active on s.s.b. Crystal frequencies used are 14255, 14296 and 14324. Still QRV on 14045 c.w. *(Tnx WGDXC).*

KH6 Hawaii: WA6MWG has the final logs for KH6DKA for the period from Oct. 15, 1962 to July 15, 1963. Bill died in an airplane crash on July 16, 1963. The last entry in the log was to F8TH on July 15, 1963 at 0816. He had just finished with SM5CCE at 0805.

His wife, Mimi, has given Pete, WA6MWG, the logs, a large number of unsent QSLs that are made out but not mailed and a large number of unanswered QSLs, both W/K and DX. These will all be taken care of as soon as possible. Mimi said that unfortunately there were a large number that were inadvertently discarded before she realized what they were . . . so there are some folks who will not get QSLs for the period above and these are the ones trying to be reached.

Bill was very active mostly with European DX stations, and several of the unanswered QSLs state that his was the last contact for their WAC, WAZ, etc. Bill was also a member of CHC and had a number of awards that his QSL was good for.

At the same time, please note that WA6MWG, is the QSL manager for KH6BIH, Dave Fraser, a nearby neighbor of Bill's who is totally blind and totally paralyzed. Pete and Dave had daily schedules for over three years and any QSLs needed for QSOs with Dave can be obtained through WA6MWG, no time limit. Dave is also a member of CHC, FHC, QRP, and Int'l SSB's radio clubs. *(Tnx to Pete, WA6MWG, for the above).*

KH6 Kure Island: KH6EDY with KH6OR as MC is active on weekends on 14250 kc between 0700 and 0800 GMT. *(Tnx Fla. DX Rpt.).*

KP4 Puerto Rico: Sand, KP4BLH, has now QRTed and will soon be operating from Culver Military Academy.

KS6 American Samoa: KS6BL is the new call assigned to K7VAX/KS6. Bill is usually active nightly around 0300 GMT. *(Tnx LIDXC).*

MP4Q Qatar: Dick, ex-VQ9HJB, will soon start a two-year study in this DXotic stop. *(Tnx Fla. DX Rpt.).*

PY0 Trinidad: I am trying to make another DXpedition to Trinidad this year. If everything is OK, I plan to be there during *CQ* WW Phone contest next October with an s.s.b. station. Chances for St. Peter & St. Paul Rocks are almost zero. However, I am still checking the matter. *(Tnx to Flavio, PY1CK, for the above information).*

OX Greenland: OX3JV is sorry to report that his log between April 14th and April 23rd was lost in a plane crash.

SV0 Greece: Duane Fuqua, SV0WPP, of HND9A (Iran) fame is now active on 14025 and 14070. *(Tnx W5EGR).*

TU2 Ivory Coast: Smitty, TU2AU, will leave TU2 land in November and QSY to 6O1 land. He will try for trips to XT2 and SU7 before he QRTs from TU2. *(Tnx WGDXC).*

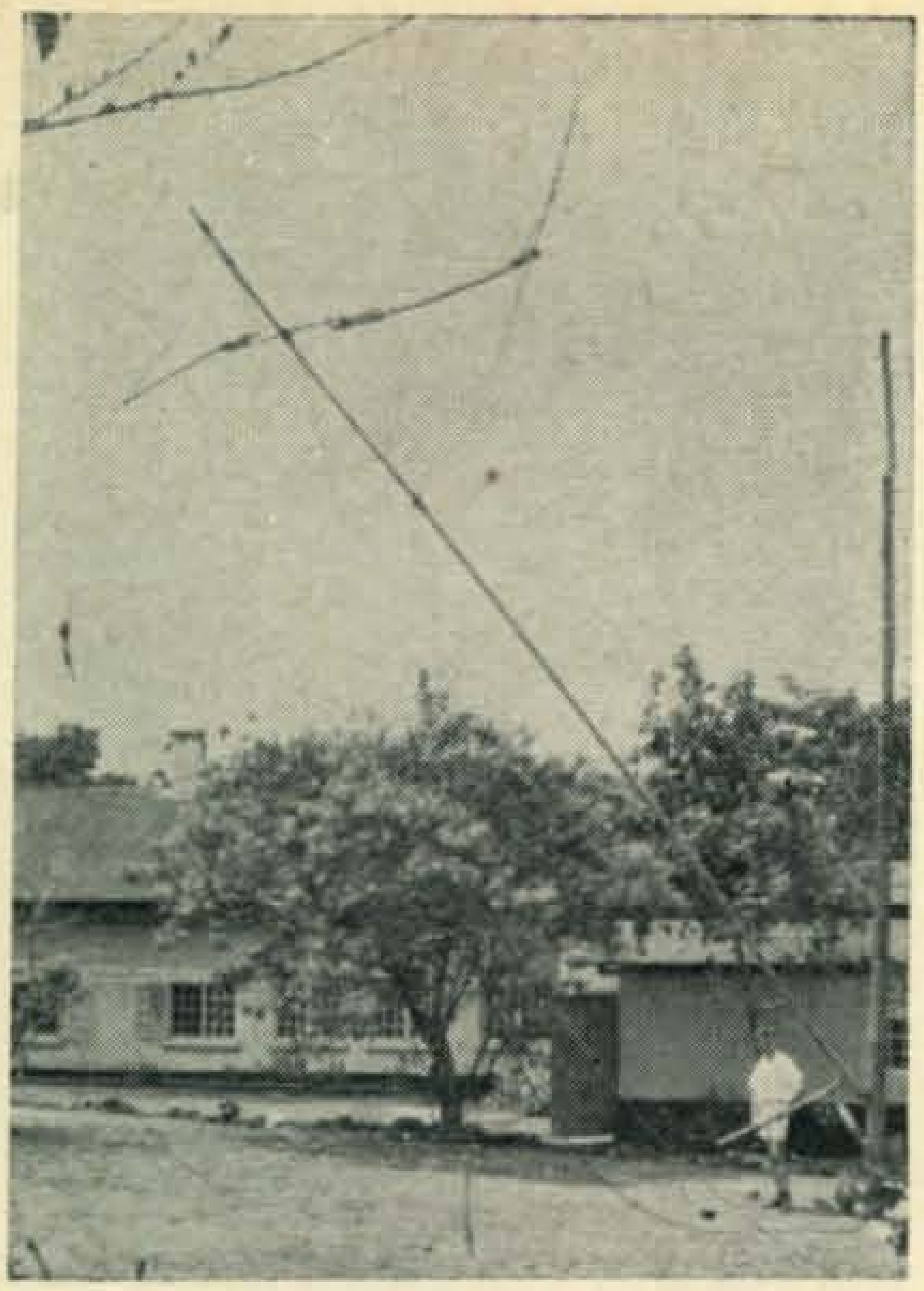
TZ2 Mali: 7G1IX plans a DXpedition to this rare spot with his 14050 kc rig. *(Tnx WGDXC).*

UA1 Franz Josef Land: Zemjla Franz Josef 50°E-80°N lying in the northern Polar Ice Sea, and perhaps the most northern and coldest place in Europe, is being kept warm with activity from UA1KED, sometimes with Walja and sometimes with Vic on a very fast key. Hats

SSB DX HONOR ROLL

The following amateurs have met the requirements for listing on the Honor Roll in accordance with the rules as stated in the January 1964 *CQ*.

T12HP	297	K9EAB	273	K6LGF	250
W2ZX	293	W2LV	271	W1AOL	250
W2BXA	293	K2MGE	270	K8ONV	244
W8PQQ	292	W3MAC	270	XE1AE	241
K4TJL	289	W3KT	270	YV5AFF	239
W0QVZ	288	WA2IZS	269	W7DLR	238
W2VCZ	284	G3NUG	269	W4RLS	236
W2TP	283	W4SSU	263	W6YMV	235
W2FXN	281	G2BVN	263	OZ7FG	233
W1LLF	281	W2RGV	261	W2PTM	230
G8KS	279	G3DO	260	W3VSU	228
W4OPM	278	W6RKP	258	K2JFV	223
W6UOU	277	PJ2AA	258	W3FWD	216
HB9TL	275	G2PL	257	WA2EOQ	210
I1AMU	275	W6WNE	254	W6ZJY	204
DL1IN	275			SM5UF	203
K8RTW	274			SM5UF	203



Peter, 9L1HX, shown at the operating position and in the process of raising his antenna which he calls a "Flintstone Special." It is made out of bamboo, rope, and wire. It is rotatable and folds over and anyone that has heard Peter's signal can attest to its effectiveness. The rig is all home brew. A 14 mc transceiver and a h.b linear. Peter is ex-VQ4HX, VQ1HX, VQ3HX, and G3LDO.

off to those men who make a lot of DXers happy with a new country. You can look for them every day about 14050, morning, noon and night. *(Tnx VERON).*

VK4 Willis Island: VK4TE is the new operator on Willis Island replacing VK4JQ who did a great job during his one-year stay on the Island. *(Tnx Fla. DX Rpt.).*

VK9 Nauru Island: VK9WP should now be starting activity. He is a Coastal Radio Operator and will be on the Island for two years. *(Tnx WGDXC).*

VK9 Norfolk Island: VK9RB presently active on 14060 c.w. around 2300 and 0600 GMT *(Tnx LIDXA).*

VKØ Heard: Activity may materialize from this spot some time in November. Details are vague at this writing. *(Tnx Fla. Dx Rpt.).*

VP2K St. Kitts: VP2KT is again active. Usually lower part of 14 mc c.w. VP2KJ, Ken, also active around 14105 kc s.s.b. usually around 2200-2300 GMT. *(Tnx WGDXC).*

VQ8 Rodriguez: VQ8AM may take Harvey's gear to Rodriguez in October. *(Tnx LIDXA).*

W6 San Francisco: K7UGA/6 reported active from GOP convention with beam installed atop his hotel. Will be QRV from White House in January if license approved by electorate. *(Tnx Fla. DX Rpt.).*

YA Afghanistan: Thought I would drop a line and give you the latest on Dick, K4UTE, now in YA land. He has been on rather regularly on Thursday evening about 0100 GMT until 0300. Quite a number of the guys are working him c.w. to sideband. (He is still on c.w.). His 32S-1 has been shipped so I imagine he will be showing up on s.s.b. soon. He has only been running 10 watts input on c.w. so maybe he will make a little more noise now. (Thanks to Glen, K4KMX, for the above letter. Glen, who is the QSL Manager for YA4A, will be remembered as 9N1GW).

YA/AP Neutral Zone: Dick, YA4A, will go to this spot if separate status is approved. *(Tnx LIDXA).*

YK Syria: YK1AA is now active daily on s.s.b. Try 14100 kc around 1600 GMT and between 0300 to 1100 GMT on Fridays *(Tnx Fla. DX Rpt).*

ZK1 Cook Islands: ZK1AR writes that he would like to express his appreciation to Jerry, K4LRA, for acting as his QSL Manager for three years. School work forces K4LRA to give up the position but K4SHB will carry on the fine work.

ZL3V Chatham Island: ZL3VB occasionally active on 14055 kc around 0400 GMT. *(Tnx LIDXC).*

4S7 Ceylon: 4S7IW has not heard W's for months but has been active on 40 working VKs. He was in the hospital with injuries which resulted from a motor cycle accident. *(Tnx LIDXA).*

9M2 Malaysia: The following is from Jim, 9M2DQ, via the LIDXA: "I have been transferred from Langkawi causing my correspondence to get all mixed up. I am now without a tower or beam and its going to be a long time before I get them up again as too much work over here.

"I am on the air after a fashion since my only aerial consists of an all-band horizontal which is 10 feet high at one end and only 7 feet high at the other end. Not very good, although I work Africa and the Middle East OK. Surprising . . . another big snag here is the local KWAC operator which makes a devil of a lot of interference and so far I have not been at all successful in suppressing this. I am in North Malaya, on the mainland, and about 15 miles South of the Thailand border. Not such a good QTH and surrounded by tall rubber trees."

5T5 Mauritania: The recent 5T5AB was, unfortunately, a bootleg operation. So reports WB2FXB who was given as 5T5AB's QSL Manager.

6O Somali Republic: The following letter is from Norm Duxbury, now in Vienna, Austria. "6O1ND is now no more. It was lots of fun, but it's good to be back in a big country.

"I am available in case anybody is lacking a QSL [*see QTH section*] but before they apply, they should double check with their QSL Bureau as I am now in the process of sending the last batch of cards for W/K's to ARRL. Still have about 300 European cards to answer (they just never stop coming) and am ordering 500 more from 9SKR . . . not as jazzy as the ones printed in Somalia but they'll have to do.

"There are 10 possible prefixes for Somali hams. The country is divided into 10 districts and each has its own prefix. I found this out just before leaving 6O1 or I would have done a little 6O1ND/6O4 work. This, by the way, accounts for 6O6BW's odd prefix . . . he's in Chisimaio working for Paul Smith Construction Co. building a port there. So, anything from 6O1 to 6OØ is possible . . . some of these areas are, of course, way out in the 'boondocks' and it is extremely unlikely we'll hear any of them in the foreseeable future.

"6O1MT, Mauro Tessieri, is now also QRT and in Italy; doubt if he'll return. 6O1KH recently went on leave to Germany but should be getting back to Mogadiscio and back on the air quite soon."

QTH's and QSL Managers

Bob Griffin, WA9IUL, would like to volunteer his services as a QSL Manager. His QTH is 1207 South Second St., Effingham, Ill.

AP2MI	A. K. M. Mamul Islam, Regional Tele. TNG, School Tejgaon Dacca 8, East Pakistan.
CR6JL	Box 71, Ganda, Angola.
CR7GJ	via VE4OX.
DL4CQ	via K8NTE.

[*Continued on page 88*]

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

October	3-4	VK/ZL/Oceania Phone
October	10-11	VK/ZL/Oceania C.W.
October	10-11	VU2/4S7 DX Phone
October	17-18	VU2/4S7 DX C.W.
October	10-11	ARRL CD C.W.
October	17-18	ARRL CD Phone
October	21-22	YLRL C.W. Party
October	**24-25**	**CQ WW DX Phone**
Oct. 31-Nov. 1		RSGB 7 mc DX Phone
Oct. 31-Nov. 1		New Hampshire Party
November	4-5	YLRL Phone Party
November	14-15	ARRL SS Phone
November	21-22	ARRL SS C.W.
November	21-22	RSGB 7 mc DX C.W.
November	**28-29**	**CQ WW DX C.W.**
December	5-6	OK DX C.W.
December	5-6	RSGB 21/28 Phone
December	12-13	Virginia QSO Party

VK/ZL/Oceania DX

Phone—Oct. 3-4. **C.W.**—Oct. 10-11
Starts: 1000 GMT Saturday. Ends: 1000 GMT Sunday in both instances.

This is the old VK/ZL contest. A modification of the rules now permits the working of other Oceania stations as well as VK/ZLs.

Complete rules in last month's CALENDAR.

Logs must be in the hands of the Contest Committee before January 16, 1965 and go to: The N.Z.A.R.T. Contest Committee, P.O. Box 489, Wellington, New Zealand.

VU2/4S7 DX

Phone—Oct. 10-11. **C.W.**—Oct. 17-18
Starts: 0600 GMT Saturday. Ends: 0600 GMT Sunday in both instances.

A new one which should put some of the rare Asian countries on the air.

Rules were covered in last month's CALENDAR.

Mailing deadline is November 15th and logs go to: ARSI Contest Committee, Post Box 534, New Delhi 1, India.

YLRL Party

C.W.—Oct. 21-22. **Phone**—Nov. 4-5
Starts: 1700 GMT Wednesday. Ends: 2300 GMT Thursday in each instance.

The party is open to all YLs and XYLs throughout the world. There will be certificates for all winners and Gold Cups for top scoring members of the Young Ladies' Radio League.

See Louisa Sando, W5RZJ's YL column on page 83 for details.

*14 Sherwood Road, Stamford, Conn. 06905.

1964 CQ World Wide DX Contest

Phone

Starts: 0000 GMT Saturday, October 24.
7:00 P.M. EST Friday, October 23.
4:00 P.M. PST Friday, October 23.
Ends: 2400 GMT Sunday, October 25.
7:00 P.M. EST Sunday, October 25.
4:00 P.M. PST Sunday, October 25.

C.W.

Starts: 0000 GMT Saturday, November 28.
7:00 P.M. EST Friday, November 27.
4:00 P.M. PST Friday, November 27.
Ends: 2400 GMT Sunday, November 29.
7:00 P.M. EST Sunday, November 29.
4:00 P.M. PST Sunday, November 29.

Mailing deadline is November 21st and reports should be sent to: Martha A. Edwards W6QYL, 44303 North Date Avenue, Lancaster, Calif.

CQ WW DX

Check the box in this column for dates and times, and page 36 of last month's issue for complete rules.

You are expected to score your log and also check it for duplicate contacts. These should be retained in your log but crossed out and no point credit taken. It is not *necessary* to recopy your original. A good clean carbon or reproduction is acceptable. And don't forget a summary sheet and signed declaration. There is still time to get official forms from *CQ*. A large addressed envelope with sufficient postage to cover your request will do the trick.

Mailing deadline for the Phone section is December 1, 1964, and January 15, 1965 for the c.w. section. Indicate on your envelope if the enclosure is a phone or c.w. entry.

And don't forget our new address: *CQ* WW DX Contest, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

RSGB 7 mc DX

Phone—Oct. 31-Nov. 1. **C.W.**—Nov. 21-22
Starts: 1200 GMT Saturday. Ends: 1800 GMT Sunday in each instance.

It's the world working the British Isles in this one, but the W/Ks and VEs are going to find it tough trying to dig the Gs out of the ARRL SS "madhouse."

Trophies won in the 1963 CQ World Wide DX Contest. The CQ Club Plaque won by the Deutsches DX team is at the rear. The trophies were on display at the ARRL National Convention in New York City, August 21-23 and are now well on their way to the eight proud winners.

1. Contacts must be made in that portion of the 7 mc band for which the entrant is licensed. Only one contact with the same station is permitted of course, and duplicate contacts must be shown but no credit taken.

2. Entries may be as Single Operator or Multi-operator.

3. The usual five and six figure serial number, RS/RST report plus a progressive three figure contact number starting with 001.

4. Contact point value varies according to the continental location of the station working a British Isle station.

Europe 5 points, North America 15 points, South America, Africa and Asia 25 points, and Oceania 50 points for each contact.

An additional bonus of 50 points may be claimed for the first contact with each British Isles country-numeral prefix. i.e. G2, G3, GB, GC2, GI2 and etc., a possible 37 in all.

5. Your final score therefore will be the sum of QSO points and bonus points; no multiplier.

6. Log sheets should be columned and show in this order: Date/Time (GMT), station worked, serial number sent, received, bonus points, points claimed.

7. Each entry should also include a summary sheet with your call, name and address in BLOCK letters, claimed score and other pertinent information. And don't forget the usual signed declaration that all rules and regulations have been observed.

8. Certificates will be awarded to the leading station in each country and each call area in the following countries: UA, VE, VK, W/K, ZL and ZS.

9. There is also a listeners' section with rules, scoring and logging the same as indicated for the transmitting section. Overseas stations should log British Isles stations only.

Log should show in this order: Date/Time (GMT), station heard, number sent by station, call of station being worked, bonus points, points claimed.

Entries must be postmarked not later than December 14th and go to: R.S.G.B. Contest Committee, 28 Little Russell Street, London, W.C.1, England.

New Hampshire Party

Contest period is divided into three periods.
From 0000 to 0400 GMT Sunday, Nov. 1
From 1200 to 1600 GMT Sunday, Nov. 1
From 0000 to 0400 GMT Monday, Nov. 2

The fifteenth New Hampshire QSO Party is sponsored by the Nashua Mike and Key Club. Besides certificates awards for contest activity this also offers an opportunity to gain credits for the WNH (Worked New Hampshire) and the GSA (Granite State Award).

Log Data: Date/Time in GMT, QSO number, station worked, RS/RST report and county for N.H. stations. If operation is on both c.w. and phone, separate logs must be submitted for each category, and each scored separately.

Scoring: N.H. stations, 1 point for each N.H. contact, 2 points for contacts outside the state. All other stations, 2 points for each N.H. contact. Multiplier for both is determined by the number of N.H. counties worked (Maximum of 10).

Frequencies: Suggested spots to watch are: 1805, 1815, 3530, 3842, 7030, 7220, 14,100, 14,250, 21,100, 21,350, 28,100 & 28,800. The same station may be worked on each band and on phone or c.w. for additional credit.

Awards: Engraved certificates will be issued to all participants reporting, with special endorsements for the highest scoring stations, both in N.H. and outside, in the phone and c.w. categories. Single operator stations only are eligible for the special endorsement.

Logs must be postmarked not later than November 25th and go to: Nashua Mike and Key Club, P.O. Box 94, Nashua, New Hampshire.

Detailed information about the WNH award can be obtained from the Concord Brasspounders, P.O. Box 339, Concord, N.H. The GSA is issued by the Nashua Mike and Key Club.

Editors Note

A final reminder regarding our World Wide DX Contest.

Unscored logs are no longer acceptable and

[*Continued on page 94*]

Propagation

BY GEORGE JACOBS,* W3ASK

THE 1964 *CQ* World Wide DX Contest will be held on the following dates: Phone Section: October 24-25; C.w. Section: November 28-29.

Continuing the practice of the past thirteen years, this month's PROPAGATION column contains DX Propagation Charts prepared for use during the 1964 contest periods. For those readers interested in statistics, last year's bulls-eye forecast brought the score of previous contest period predictions to: highly accurate 20 times, fairly accurate 4 times, missed the mark completely 2 times.

Sunspot Cycle

The sunspot cycle continues to decline, and sunspot activity during the 1964 contest periods is expected to be considerably lower than last year.

The Swiss Federal Solar Observatory at Zurich reports a monthly mean sunspot number of 3.4 for July, 1964. This is the lowest level of mean solar activity reported since 1954. The sun was completely bare of spots on nineteen days during the month!

With July's low reading, the latest 12-month running smoothed sunspot number, centered on January, 1964, has dropped to 19. A smoothed sunspot number of 11 is forecast for this year's contest periods. A level of 25 was reported during last year's contest.

General Forecast

10 Meters: With the bottom of the sunspot cycle nearly at hand, few DX openings are predicted for this band. During normal propagation conditions, some daytime openings may be possible to Latin America, with marginal openings also possible to Central and South Africa and the Pacific Islands area. If conditions are below normal during the contest periods, chances are that 10 meters may not open at all.

15 Meters: Although DX openings are expected to be somewhat less frequent than last year, 15 meters should be a good DX band during most of the daylight hours. During normal conditions, the band is forecast to open to many areas of the world sometime during the period from shortly after sunrise through the early evening hours. Signals from Europe and the north and east should peak shortly before noon, while signals from the Far East and the south and west should peak during the late afternoon hours. If conditions during the contest periods are above normal, 15 meters may turn out to be the best DX band during the daylight hours, with signals exceptionally strong. If conditions should be below normal or disturbed, openings may be spotty and of short duration.

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for October

Days	*Forecast Rating & Quality* (4)	(3)	(2)	(1)
Above Normal: **10, 14, 16, 22**	A	A-B	B-C	C
Normal: **1-2, 4-6, 8-9, 11-13, 15, 17-18, 20-21, 24, 28-31**	A-B	B-C	C-D	D-E
Below Normal: **3, 7, 19, 23, 25, 27**	C	C-D	D	E
Disturbed: **26**	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 Nov. 30, 1964, and are prepared from basic propagation data published monthly by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

20 Meters: Twenty meters is again expected to be the "backbone" band during the contest periods. Good DX openings are forecast to almost every corner of the world from sunrise through the early evening hours. Conditions should peak shortly after sunrise and again during the late afternoon and early evening hours. During these peak periods, 20 meters will very likely be the best band for DX, with openings characterized by strong signal levels. During periods of below normal or disturbed propagation conditions, 20 meter openings may become spotty and of shorter duration, but in general, the band is expected to hold up in fairly good shape during all but "blackout" conditions.

40 Meters: The band is expected to open for DX during the late afternoon hours, and remain open to one area of the world or another until shortly after sunrise. During the hours of darkness, 40 meters is expected to be the optimum band for DX openings. Signal levels

often are expected to be exceptionally strong on DX openings during periods of normal propagation conditions, while the band is likely to be spotty during periods of below normal conditions.

80 Meters: DX conditions on this band are generally at their best during periods of low solar activity. Some fairly good 80 meter DX openings are, therefore, forecast to several areas of the world during the hours of darkness. During these openings, signal levels are likely to be strong when propagation conditions are normal. Even during below normal or disturbed periods, there is a good chance that some fairly good DX openings will take place on this band during the hours of darkness.

160 Meters: Conditions on this band also improve considerably as sunspot numbers decrease, and DX openings are expected to be somewhat more numerous than last year. Openings to some areas of the world should be possible during the nighttime hours and the pre-dawn period. Because of low power limitations imposed on this band in many areas of the world, signals will usually be weak and noisy, especially on phone. Openings on 160 meters, while better than last year, will not be as good as the openings on 40 and 80 meters which also occur during the hours of darkness.

Contest Guide

The propagation information contained in the Charts can be transformed to serve as a useful guide for piling up points during the contest periods. For example, from data appearing in the Charts, the following 20 meter operational schedule can be devised which shows the optimum times for working various areas of the world. An eastern USA QTH has been selected for the example.

Sample 20 Meter Work-Plan for Eastern USA QTH

Time (EST)	*Areas to which openings are optimum*
00-03	Only Latin America, a good time to sleep.
03-06	" " " " "
06-09	Europe, Central & Southeast Asia, Far East, Pacific Islands, New Zealand, Australia, Latin America, Antarctica, North Africa.
09-12	Europe, Eastern Mediterranean, North Africa.
12-15	Europe, North & East Africa, Eastern Mediterranean.
15-18	West, Central & South Africa, Latin America.
18-21	Central & South Africa, Central & Southeast Asia, Far East, Pacific Islands, New Zealand, Australia, Latin America.
21-00	Pacific Islands, New Zealand, Australia, Antarctica, Latin America.

The following is a typical *multi-band* operational schedule based on a Western USA QTH. The schedule shows the times and bands when propagation conditions are expected to be optimum to various parts of the world.

Sample Multi-Band Work-Plan for Western USA QTH

Time (PST)	*Optimum Band*	*Areas Open*
00-03	80 Meters	Far East, Pacific Islands, New Zealand, Australia, Latin America.
03-06	40 Meters	Far East, Pacific Islands, New Zealand, Australia, Latin America, Central & Southeast Asia.
06-09	20 Meters	Latin America, Antarctica (a good time to sleep).
09-12	20 Meters	Europe, North & East Africa, Southeast Asia, Pacific Islands, New Zealand, Australia.
12-15	20 Meters	Africa, Far East, Latin America.
15-18	15 Meters	Pacific Islands, New Zealand, Australia, Far East, Central & Southeast Asia, Latin America.
18-21	20 Meters	Pacific Islands, New Zealand, Australia, Southeast Asia, Far East, Latin America.
21-00	40 Meters	Europe, Africa, Pacific Islands, New Zealand, Australia, Antarctica, Latin America.

Similar type operating schedules can be devised for other operating conditions and other QTHs.

WWV Transmissions

Check WWV and WWVH propagation transmissions for latest information on propagation conditions during the contest periods. WWV broadcasts propagation information on 2.5, 5, 10, 15, 20 and 25 mc every five minutes. The data is transmitted at 4½ minutes past the hour, and repeated every five minutes thereafter. Given in Morse Code, the transmissions consist of the letter N, W, or U followed by a number. The letter designations apply to propagation conditions as of the time of broadcast, and have the following meaning:

W—Ionospheric disturbance in progress or expected.
U—Unstable conditions, but communication possible with high power.
N—Conditions normal, no warning necessary.

The number designations apply to propagation conditions forecast for the subsequent 12 hours, and have the following meaning:

1—Impossible; 2—very poor; 3—poor; 4—fair-to-poor; 5—fair; 6—fair-to-good; 7—good; 8—very good; 9—excellent.

WWV propagation transmissions are intended primarily for trans-Atlantic high frequency circuits. WWVH, located at Puunene, Hawaii transmits similar information for trans-Pacific circuits. WWVH transmissions are given at 9 and 39 minutes past each hour on 5, 10 and 15 mc. (There is a possibility that WWVH transmissions will be retimed soon to coincide with the five minute transmissions of WWV. If propagation transmissions are not heard at 9 and 39 minutes after the hour, check every five minutes).

Post Mortem

The *CQ* World-Wide DX Contest, because of the large amount of amateur radio activity it generates throughout the world, offers an excellent opportunity to check the accuracy of the forecasts contained in this column. As a result of such information compiled during previous contest periods it has often been possible to improve the accuracy of these forecasts. Any comments or observations concerning the accuracy of this month's special Contest forecast will be appreciated.

C.W. Section Forecast

The Propagation Charts in this month's column are valid for *both* the phone and c.w. periods of the contest. Be sure to retain the Charts for use during the c.w. period. Next month's column will contain Short-Skip Propagation Charts for November and December.

Good luck in the Contest!

73, George, W3ASK

CQ DX Propagation Charts

OCTOBER & NOVEMBER, 1964

Time Zone: EST (24-hour Time)

Eastern USA To:

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Western & Central Europe & North Africa	07-09 (1) 09-12 (2) 12-14 (1)	06-07 (1) 07-10 (2) 10-12 (3) 12-14 (4) 14-16 (2) 16-18 (1)	15-17 (1) 17-18 (2) 18-23 (3) 23-02 (2) 02-04 (1)	18-20 (1) 20-23 (3) 23-01 (2) 01-03 (1) 20-00 (1)† 00-02 (2)† 02-03 (1)†
Northern Europe & Eastern USSR	08-11 (1)	06-07 (1) 07-10 (2) 10-14 (1)	17-03 (1)	19-01 (1) 21-01 (1)†
West & Central Africa	11-14 (1)* 06-07 (1) 07-10 (2) 10-12 (3) 12-13 (2) 13-16 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-17 (4) 17-18 (2) 18-20 (1)	17-19 (1) 19-23 (2) 23-03 (1)	18-20 (1) 20-23 (2) 23-01 (1) 20-00 (1)†
South Africa	09-14 (1)* 06-10 (1) 10-12 (2) 12-15 (3) 15-16 (2) 16-18 (1)	07-15 (1) 15-17 (2) 17-21 (1) 00-02 (1)	17-19 (1) 19-21 (2) 21-00 (1)	18-21 (1) 19-23 (1)†
Eastern Mediterranean & East Africa	07-09 (1) 09-11 (2) 11-13 (1)	06-12 (1) 12-15 (2) 15-18 (1)	19-00 (1)	20-23 (1)
Central Asia	*Nil*	06-07 (1) 07-09 (2) 09-11 (1) 19-22 (1)	17-20 (1) 05-07 (1)	*Nil*
Southeast Asia	*Nil*	06-07 (1) 07-09 (2) 09-11 (1) 17-21 (1)	17-20 (1) 05-07 (1)	*Nil*
Far East	17-19 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-21 (1)	05-09 (1)	*Nil*
Pacific Islands & New Zealand	12-16 (1) 16-19 (2) 19-21 (1)	17-20 (1) 20-22 (2) 22-00 (1) 05-07 (1) 07-10 (2) 10-13 (1)	00-03 (1) 03-07 (3) 07-09 (1)	03-04 (1) 04-07 (2) 07-08 (1) 05-07 (1)†
Australasia	15-17 (1) 17-19 (2) 19-21 (1)	06-07 (1) 07-09 (2) 09-11 (1) 15-20 (1) 20-22 (2) 22-00 (1)	02-04 (1) 04-07 (2) 07-09 (1)	04-05 (1) 05-07 (2) 07-08 (1) 05-07 (1)†
Northern & Central South America	07-09 (1)* 09-14 (2)* 14-17 (1)* 06-08 (1) 08-10 (3) 10-14 (2) 14-16 (4) 16-18 (2) 18-20 (1)	14-16 (2) 16-17 (3) 17-20 (4) 20-22 (3) 22-00 (2) 00-06 (1) 06-08 (2) 08-14 (1)	18-19 (1) 19-20 (2) 20-03 (3) 03-06 (1)	19-20 (1) 20-03 (2) 03-06 (1) 01-04 (1)†
Southern Brazil, Argentina, Chile & Uruguay	08-12 (1)* 12-17 (2)* 17-19 (1)* 07-09 (1) 09-11 (2) 11-13 (1) 13-15 (2) 15-17 (4) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-14 (1) 14-16 (2) 16-18 (3) 18-20 (4) 20-22 (2) 22-04 (1)	19-21 (1) 21-03 (2) 03-07 (1)	21-06 (1) 02-05 (1)†
McMurdo Sound, Antarctica	07-09 (1) 17-19 (1)	16-18 (1) 18-20 (2) 20-23 (1) 06-07 (1) 07-09 (2) 09-11 (1)	00-06 (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 & MST (24-hour Time)

Central USA To:

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

[*Continued on page 94*]

SPACE COMMUNICATIONS

BY GEORGE JACOBS,* W3ASK

On July 31, at 6:25 A.M. PDT, RANGER 7 successfully impacted on the Moon. During the last thirteen minutes of the spacecraft's 68-hour trip from Cape Kennedy, six television cameras on board took nearly 4000 photographs of the Moon, which were transmitted back to earth by RANGER's communication system.

The success of the RANGER 7 mission has been heralded as a giant step forward by the United States towards the day when a manned spacecraft will land on the Moon. It also represents a major achievement in the field of space communications. Three transmitters aboard the spacecraft operated flawlessly during the entire 243,665-mile trip. The lunar pictures transmitted to earth were of higher quality and definition than any that have been taken previously with ground-based high power telescopes, or by the LUNIK satellite which photographed the "dark-side" of the Moon five years ago.

Communication System

The spacecraft's communication system consisted of a radio receiver, a single 3-watt transmitter and two 60-watt transmitters. The 3-watt transmitter, operating in the band 959-961 mc, was used to transmit all the telemetry data from RANGER 7 from the time of launch until fifteen minutes before impact.

At impact minus fifteen minutes, both 60-watt transmitters and the cameras and television system aboard the spacecraft were turned on by ground control. At this time RANGER 7 was about 1200 miles from the Moon. A minute later, the cameras started taking pictures and transmitted them to earth via the two 60-watt transmitters.

RANGER 7's television system consisted of two wide-angle and four narrow-angle television cameras, all equipped with high quality, fixed-focus lenses. Behind each of the camera shutters was a vidicon television tube, one-inch in diameter and 4.5 inches long. A vidicon converts images seen by a camera into scanned electrical impulses. The electrical impulses generated by the vidicons on board RANGER 7 were used to frequency modulate the two 60-watt transmitters. One transmitter, operating on 959.52 mc sent pictures to earth from both wide-angle cameras; while the other transmitter, operating on 960.58 mc sent pictures from the four narrow-angle cameras.

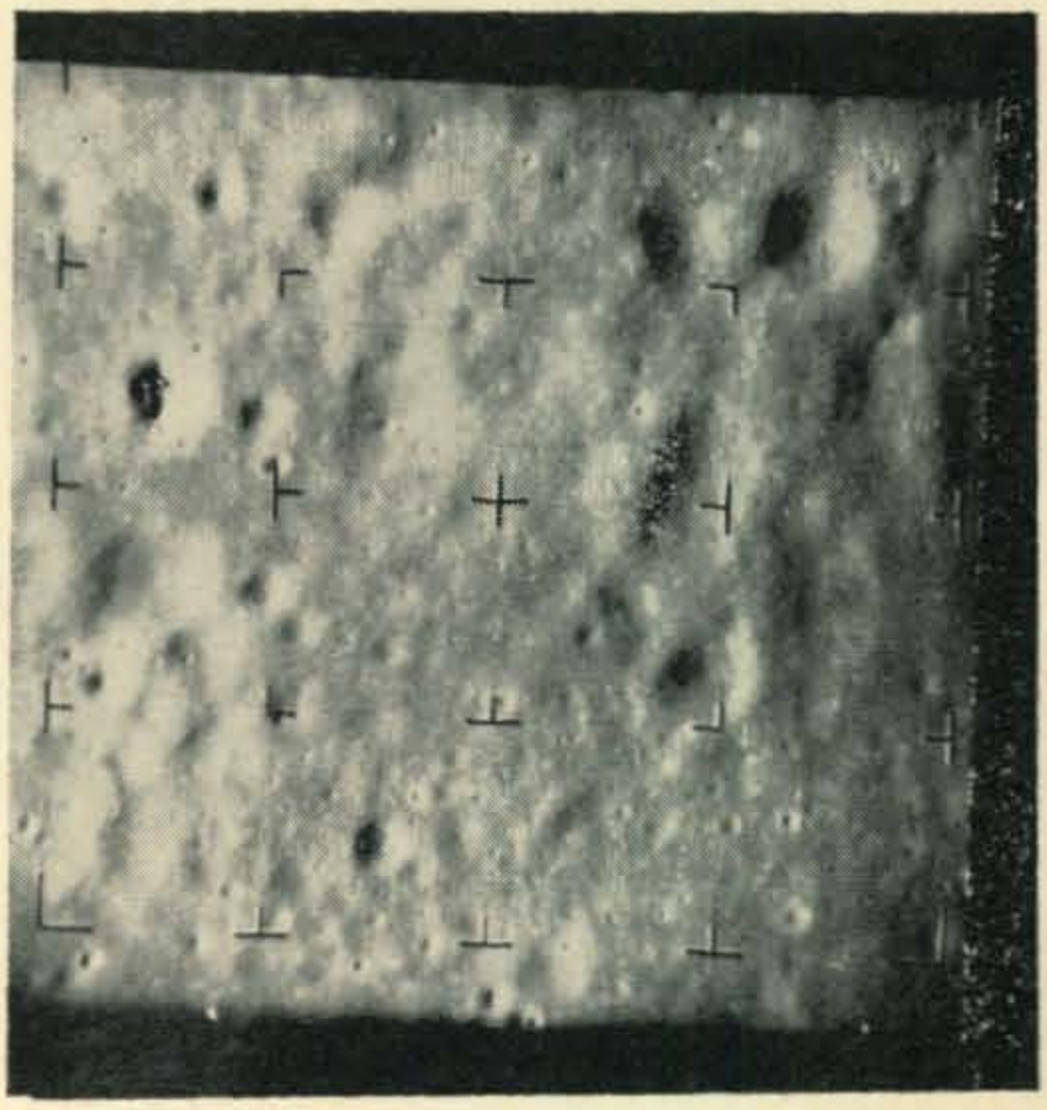
The pictures, transmitted to earth as electrical impulses, were received by two 85-foot-diameter parabolic antennas at the Goldstone Tracking Station, California. Here, the impulses were recorded on magnetic tape and converted back to photographs on 35 mm film.

RANGER 7's six cameras and the radio links operated flawlessly, remaining in operation from fifteen minutes prior to impact to about four-tenths of a second before impact. During this time the cameras took a picture of the Moon's surface every five seconds, for a total of nearly 4000 photographs. The first, taken nearly 1200 miles above the Moon's surface, covered a lunar area of 300-400 square miles; while the final picture was taken at a half-mile above the Moon's surface, showing an area less than 3600 square feet in size. In the final picture transmitted from the spacecraft, craters as small as 3-feet in diameter could easily be identified.

Antennas and Power

The main antenna aboard RANGER 7 was a small parabolic-dish type, equipped with an earth sensor which kept the antenna beamed on Goldstone at all times. A low-gain omnidirection top-hat antenna was used for receiving commands from ground control and part-time telemetry transmission.

Two panels containing nearly 10,000 solar cells supplied 200 watts of power to the spacecraft at all times. A special 33-volt battery powered the television system during the last fifteen minutes of flight. Two silver-zinc batteries provided additional power during the launch



Wide-angle photograph taken by RANGER 7 two seconds before impact on the Moon's surface. The picture shows an area less than two miles on a side. The small craters that can be seen clearly are approximately 30-feet in diameter and 10-feet deep. The photo was transmitted from the spacecraft to ground via a 60-watt transmitter operating on 959.52 mc. *(Official NASA Photo).*

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

period and when the space craft was required to carry out maneuvers.

Through the cameras and communication system of RANGER 7, earthbound man has been able to take a much closer look at the Moon's surface than has ever been possible before. But surely this is only the beginning. The success of RANGER 7 is certain to lead, in the not too distant future, to similar photo-explorations of Venus, Mars, other planets and the solar system as man edges closer and closer to unlocking the age-old secrets of the Universe.

New Book

During the past few years several excellent, but highly technical books have been published on the subject of space communications. Recently, however, a simple-to-read primer on the subject has been published by the John F. Rider Publishing Co., Inc., of New York City. The book, a 166-page soft-cover edition entitled *Space Communications*, is written by Stanley Leinwoll, a noted authority on radio wave propagation. It should be available now at book-dealers and amateur radio supply houses for $3.95.

Mr. Leinwoll has done an excellent job in handling a complex subject in simple-to-read, easy to understand language. The book describes, rather thoroughly, what has already been accomplished in the field of space communications and what can be expected in the near future. It has been written especially for the radio amateur, the space-listener and the informed non-technical layman who has a desire to know more about space communications. The book emphasizes how communication satellites work, and how one can participate actively, either as a radio amateur, a space-listener, or an amateur scientific observer, in some of the many exciting space projects now being conducted.

Space Communications contains 14 chapters, each loaded with interesting and useful information. Two chapters are devoted to a discussion of long-distance communications in general and the principles of space communication. Included in this discussion is an excellent explanation of radio propagation. Four chapters are devoted to a detailed, but easy to follow, description of each passive and active communication satellite system launched by the United States, including ECHO, WEST FORD, TELSTAR, RELAY, SYNCOM, etc. Also included are brief descriptions of such scientific satellites as RANGER, TIROS, MARINER, etc., as well as a chapter on such international space projects as ARIEL, ALOUETTE and SAN MARCOS.

Space Communications devotes four chapters to the role of the radio amateur in space. The history of the OSCAR project is discussed in detail, and the results of the successful OSCAR I and II launches are summarized. A chapter also contains information on OSCAR III, the satellite that may soon become amateur radio's first effort in the field of active space communications.

The new hobby of space-listening is covered by Mr. Leinwoll in his book. While brief, the chapter contains much practical information for anyone interested in getting started in this fascinating hobby. Tips are given for identifying satellite signals on the various bands, and what type of receiver, converter and antenna are required to hear these signals.

The two closing chapters are devoted to a discussion of the possibility of someday broadcasting radio and television programs directly into the audience's home by means of satellites. Mr. Leinwoll also takes a look at future space projects as SURVEYOR, and Moon and Planet exploration.

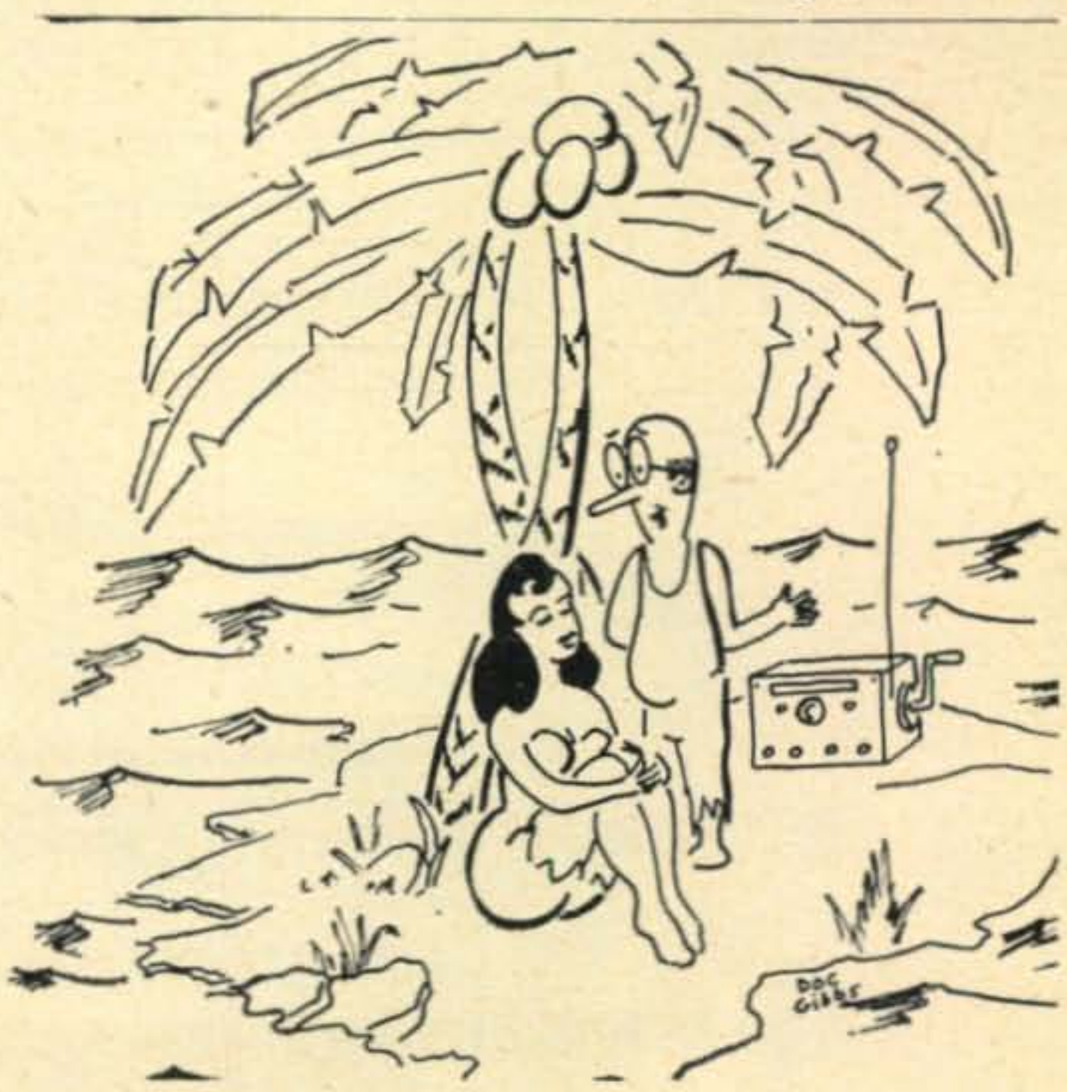
All-in-all, *Space Communications* is packed-full of useful, interesting and timely material. The book is written in such an easy-to-read manner, that chances are once you pick it up to read, you won't put it down until it is finished.

As a special offer to readers of this column, Mr. Leinwoll will personally autograph copies of *Space Communications*. These autographed copies can be obtained for $3.95, postpaid by writing directly to the Editor of this column; W3ASK, 11307 Clara Street, Silver Spring, Md. 20902.

OSCAR III

OSCAR III, the third in a family of satellites designed and built entirely by radio amateurs is now undergoing final ground testing in preparation for a launch sometime during late winter. If all goes according to plan, radio amateurs may soon be able to communicate through the satellite over distances of several hundred, and perhaps thousands of miles, on the 2-meter band. Appearing elsewhere in this issue of *CQ* is Part One of a special two-part article entitled "OSCAR III—An Active Communication Satellite For Radio Amateurs." Based on up-to-the minute information, this article describes the satellite in detail (Part One), and explains how the satellite will be used for communication and other scientific experiments (Part Two).

73, George, W3ASK



"And, if you get bored, I can teach you the Morse code."

THE VHF COLUMN

BY BOB BROWN, K2ZSQ
and ALLEN KATZ, K2UYH*

WE hope you all enjoyed our first joint column. Response thus far has been overwhelmingly favorable, although we still have our fingers crossed. Wish us luck! Perhaps our biggest change has been to place emphasis on letters instead of a form-type report. It would be easy to fill the pages of this column with stereotype sentences and dito machine copy, but line after line of this kind of stuff is superficial and in the long run, meaningless. This column is going to contain ideas, feelings, and detailed facts—and not just in the editorial section. Printing whole letters (or least the important parts, some are rather long) is one step in this direction. This means more work for you the reader, no more checks, crosses, or blanks to fill in; more work for us too; but it also means a beter column. So get busy, and let's hear from you soon!

Antenna Fact and Fallacy

For many years, now, it has been widely accepted that the more aluminum a fellow puts in the air, the more gain he obtains. In too many cases, unfortunately, this notion does not hold water. First of all it is an antenna's size not mass (number of elements, etc.) which determines its gain. Secondly, doubling an antenna's size *does not* insure getting a 3db gain, the theoretical maximum for a perfect installation. In some cases an increase in size has actually resulted in a *decrease* in gain. If anything is to be said; it should be that the larger the antenna, the harder it is to get the gain one rightfully deserves.

*c/o *CQ*, 14 Vanderventer Avenue, Port Washington, Long Island, N.Y. 11050.

You may question whether a large antenna is worth the effort. Our answer can only be that it depends on what you want from v.h.f. With a moderate size beam (12 to 24 feet in length) practically all types of v.h.f. propagation can be worked—short skip, temperature inversion, aurora, etc. Even on m.s. many stations have been outstandingly successful with nothing more than a 16 element collinear.

An excellent example of the trials and tribulations of big arrays (and long yagis) can be seen in the past moon bounce attempts. Many large arrays, much larger than W6DNG's 48 elements, were tried before his ultimate success. Bill himself tried 58 previous arrays. Number 59 provided the gain it was supposed to and made the QSO possible. Len, OH1NL, followed the same formula with 24 stacked dipoles with a screen reflector. Both the dipole and the 7 element yagis (used by W6DNG) are antennas who's gain can be depended upon; when stacked properly they will produce a high-performance array. The problems encountered in correctly stacking cross-yagis may explain why a two meter moon bounce QSO was finally accomplished with linear polarization rather than the more favorable circular polarization.

At this point it might be well to digress for a short review on antenna stacking. An array is composed of a number of smaller antennas. Each of these antennas should be individually matched to open wire tranmission line. A T-match or ratio dipole driven element may be used for this purpose. Measurements on six and two meters can be made with a standard s.w.r. bridge. On the higher bands, however, we would suggest the use of a slotted line. If you don't have a slotted line, build one. This jim dandy little device can be constructed in a couple of hours and for less than 2 dollars—W6HPH's excellent article in November, 1962, *CQ*.

Once you have the antennas matched, you can proceed to putting the array together. The exact approach to take will depend on the number of antennas you have, and the way you want to position them. But, no matter what arrangement you choose, the desired result is the same—to have all the component antennas in phase and spaced just far enough apart for their apertures to touch, but not overlap. If the antennas are not phased together properly, the array will develop side lobes, and your major lobe will not be perpendicular to the array. Several different stacking arrangements are shown in fig. 1.

Caught by the v.h.f. camera are the members of the Ham Video Club of Montebello, California. Left to right, back row, we see WA6RES, WA6DZL, K6YEI, W6DYB, s.w.l. Jim, host W9PAW/6, W6UEZ, WB6FXL. In the front, kneeling, are W6VCF, WA6TDB, W6DQS. The TV camera, a Spera, was built from a kit by W6UEZ. All have a common interest in the furthering of amateur TV and many have their own stations in operation.

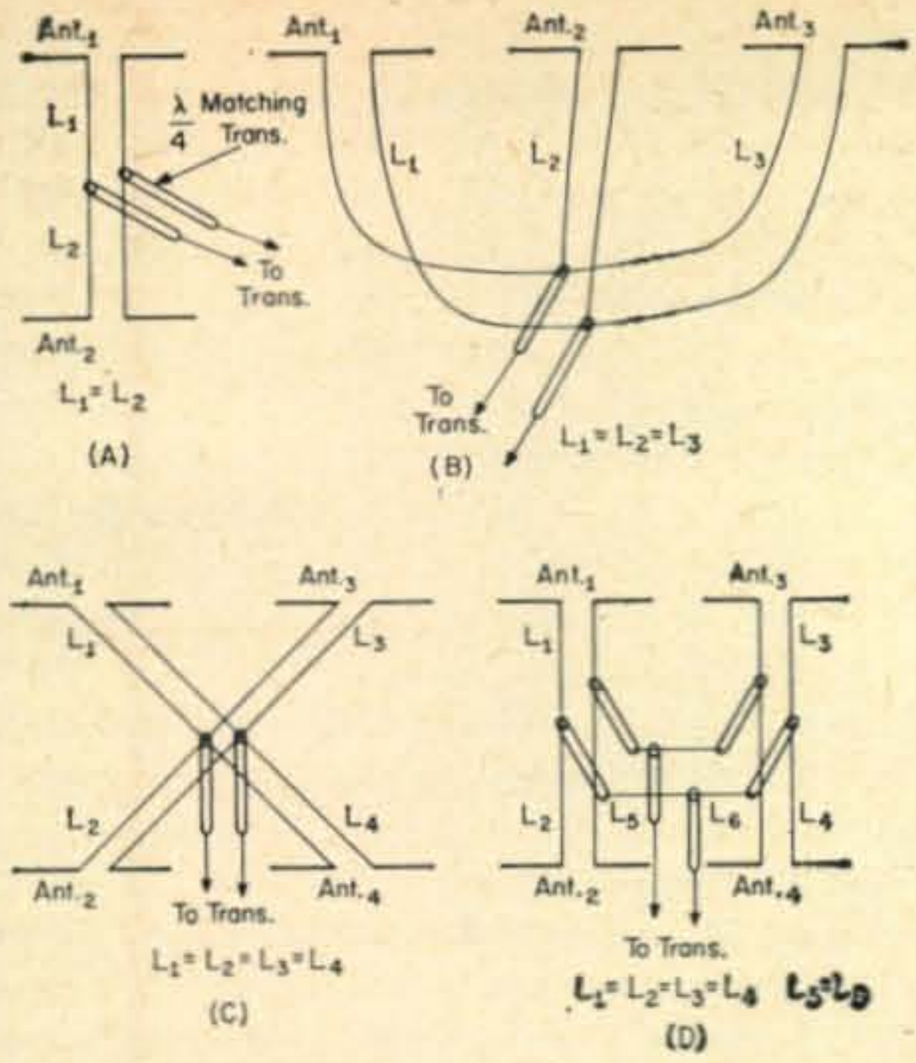


Fig. 1—Antenna stacking arrangements as discussed in text.

Parallel phasing lines should be carefully cut to equal electrical length. The slotted line can be used to check your work. Try to keep the lines away from the metal stacking frame and follow a symmetrical path, or their electrical length may be affected. At the points where the transmission lines are connected together, the impedance will be lowered by a factor equal to the number of transmission lines. If four antennas fed with 300 ohm transmission line are connected together, the impedance at the common point will be 300÷4 or 75 ohms. This impedance may be transformed back up to a useful value by means of a quarter-wave matching section. A very valuable, yet easy way to build a matching section is shown in fig. 2. By adjusting the spacing between the rods, almost any stacking configuration can be matched. In general, a minimum number of matching sections are desired in order to minimize error. Stacking distances will depend on the type of antenna you are using. The authorities are in pretty much disagreement here. A suggested rule for yagis is ¾ of the boom length. Collinears are anyone's bet. You will just have to experiment a little and see which distance suits you best.

From the Mailbag

Bill Sykes, G2HCG: The following letter fits in well with the subject of antenna gains. It describes some of the pitfalls of gain measurements. For a more detailed discussion of the subject see the November, 1962, *CQ*. This article is also by W6HPH, who really gets around.

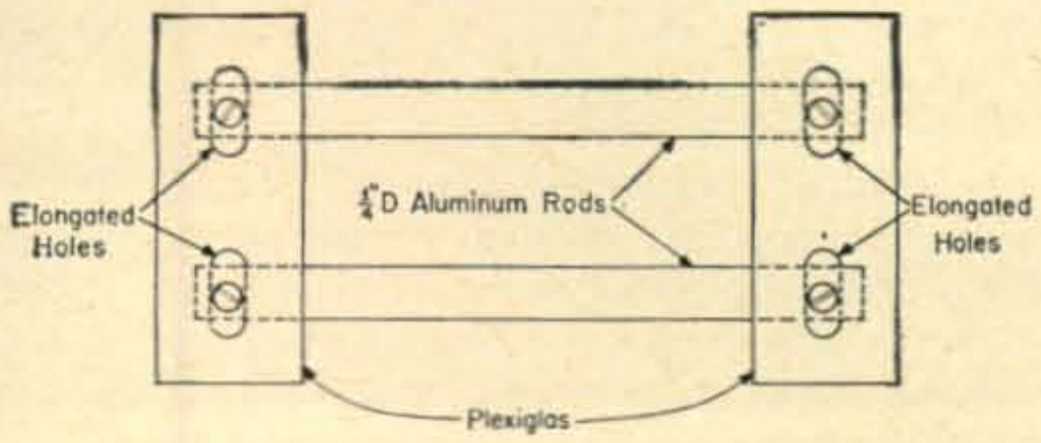


Fig. 2—Adjustable ¼ wave matching transformer.

"The gain of an antenna is normally expressed in db over a half-wave dipole. The figure of gain is simply obtained by substituting a half-wave dipole for the antenna under test and noting the difference. This sounds very simple but when a number of tests are undertaken on the same antenna in different locations results are found to differ widely. There are many sources of inaccuracy in antenna gain measurement, probably the greatest being the difference in propagation characteristics of the antenna under test, and the dipole which is to be substituted. The dipole may be receiving not only the direct signal but also a signal reflected from the ground. The reflected signal may be out of phase with the direct signal causing cancellation and an apparent reduction in dipole performance, or in phase augmenting the signal received. The sharpness of the radiation pattern of the test antenna, however, will result in a considerable reduction in intensity of the reflected signal, which will thus have little effect.

"The problem, therefore, is not so much that of measuring the performance of the test antenna, but measuring the performance of the dipole with which to provide comparison.

"The amount of space required for an accurate antenna testing range is quite large. Tests undertaken using normal dipole substitution methods on inadequate ranges only result in misleading results. The main requirement is that there should be no reflections, or, if reflections do occur, the path length should be similar to that of the direct path. Similar path lengths can be obtained by spacing the antennas a large distance apart, and keeping them reasonably low down. A simple formula for this spacing is: $R = (4D^2) \div W$ where R is the spacing and D is the largest physical dimensions of one antenna and W is the wavelength in use.

"Pursuing the fact that the most difficult parts of the measurement is that of the dipole itself, it is very advantageous to use an antenna of known gain for substitution. Considerable effort can be expended on measuring the gain of a known antenna which typically could be a 6 element yagi.

"There are, of course, many other methods of measuring gain which minimize the problems mentioned here; a very well known one being the measurement of beamwidth from which gain can be calculated. This method should be treated with a considerable amount of mistrust, since no allowance is made in this method for losses in the antenna itself, and these can be considerable at v.h.f. and u.h.f."

The above letter is referring to actual antenna gain figures. Although the gain values may vary by one or two db, the method does tell which antenna is better.

Vic Vicksell, W5HPT: Here are some comments on activity down Texas way.

"432 seems to have been real good down this way. K5SDM and W5AJG work each other

Recent view from the portable contest location of Alois Pendel, OE6AP, as shot from a windswept peak in the Austrian Alps. Two meter results from this location have been phenomenal OE6AP is v.h.f. co-ordinator for Austria.

regularly. W5LDV and W5LLL at Houston were also heard and worked often by W5AJG. W5LLY, San Antonio works into Dallas well too.

"I am not doing as well at present. I thought it was my converter, but it checked out at W5AJG's location. Worked fine there. So I guess it is the feedline or antenna?

"W4HHK was worked by W5AJG this month on 432 mc. HHK using his big dish. Paul heard this station, but I could not copy him. Another opportunity missed.

"Nothing in Dallas area on the 432 moon bounce tests from Puerto Rico, however, Houston gang heard the station using a collinear as well as a big dish. Signals were very good, judging from the tapes I have heard.

"W5YKQ heard from Baton Rouge on 432 mc; he worked W5AJG. YKQ is running a k.w. to a modified M.O. valve configuration, W4LTV using same set up, but hasn't been heard in this area yet."
[*What's M.O. valve configuration?*]

"Hope to find my trouble soon, so I can say I have worked these stations instead of reporting others who have."
[*You sure do deserve some better luck.*]

"Built a new 144 s.s.b. mixer and reworked 144 mc final. Seems to be much stabler. However it still isn't as stable as my 432 mc s.s.b. signal—how about that?" [*Many thanks for your consistently fine reporting. We are sure our readers appreciate it.*]

Lee Tower, K1IFK: Six meter FAX operation on six meters from Maine.

"Thought I'd drop you a line about my experiments with CRT FAX. The set up is not too pretty yet. The generator is built on an old TV chassis with extra sockets installed for tubes. The receiver has to be debugged and then I will really be ready to fly. I am making tape recordings of FAX signals now, although I have a six meter transmitter with d.c. coupled modulator in the works. I haven't found out for sure whether CRT FAX is legal on six meters." [*A4 is legal on six just as long as its bandwidth is not much more than standard phone.*]
"WA2NMX is also putting FAX rig to communicate with me on tape. [*When are you going to be operational on six? Tape is not amateur radio communication!*]

"At least Maine isn't dead, u.h.f.-wise. At least four people are working on Ham TV beside me. Six meters is picking up too. Maine has been represented at just about every opening and I even got a skip station to ragchew up the band with me!" [*Lee, would like to hear from other stations operating or planning to operate FAX on v.h.f.*]

Another Look At Europe

The following is by DL3FM: "Several months ago I sent you a report on what was going on here in Germany on v.h.f. You were kind enough to eliminate all mistakes and publish the whole thing in *CQ*. An unexpected echo has been the result of my little effort. A couple of American v.h.f. amateurs wrote me lengthy letters dealing with the feeling that it would be good to be informed more carefully on the European style of v.h.f. living than has been the case before. Up to this moment I have been unable to answer all the letters but please let the fellows know that I did not use their papers to fill my wastebasket.

"Close-up on DL3YBA. As it has been the rule since the very beginning, DX work is still the main goal of all German v.h.f. enthusiasts. And according to the pattern the American v.h.f. men have been involved in the phenomena of aurora and meteor scatter are the means to enter the dreamland. One of the most successful European meteor scatter workers is DL3YBA, an ardent v.h.f. operator. He is living in the flat areas of North West Germany, in Lower Saxony.

"Ten years or so ago he built a steel tube mast 160 ft. high. You may know what it means to erect such a monster as a single unit! A rookery can be found a bit below the top and it has been from here that DL3YBA adjusted a 48 element phased array, consisting of four sets of three fullwave dipole backed by reflectors. A motor-driven system, formerly used to move the bells of a church, rotates the antenna. A homebrew open-wire feedline is used between feedpoint and shack, the latter being a little house built solely for the purpose of being the cavern of a real DX lion.

"DL3YBA is running 250 watts on 2 meters and is the owner of a special high power license

so that he can run a pair of QB 3/300's up to a full gallon. Fritz has worked the DX. His latest success has been a meteor scatter contact with LZ1AG, a distance of 1000 miles. DL3YBA has worked 21 different countries on 145 mc. He is our top man.

"Warning System. Since the IGY we have had a special aurora warning system, based on the facilities of a few hams who have the chance to get scientifically-based weather and ionospheric reports and are kind enough to spread the news by telephone to v.h.f. stations located all over Germany. Additionally, v.h.f. DX forecasts are given every Sunday morning on 80 meters as part of a DARC broadcasting. So, whenever an aurora opening can be reckoned with, beam antennas are tuned to the North throughout Germany. Countries as GI, GM, OZ, LA, SM, SP and U can be heard and worked then, to name only the more exotic ones.

"You in the States should be informed that v.h.f. activities in Russia have reached a high calibre now, as far as the North West part of that continent in a continent is concerned. UR2BU has been the germ cell of the whole evolution. And it has been around his location that the progress has taken place. Several stations in UR, UP and UQ are on the air now, using very modern equipment, home built for obvious reasons. Among the top men is UA1DZ, who is running something on the order of a full gallon level, using metal ceramic tetrodes of Russian provenance in his 2 meter rig. DL3YBA, among others, has worked UA1DZ.

"You are wrong if you think there is no v.h.f. activity in the more Eastern parts of the USSR. Signals, at least on 2 meters, can be heard everywhere, but the very great distances that must be covered are calling for the most sophisticated equipment available, and it may be that such a standard could not yet be developed everywhere."

More from DL3FM next month.

Lend A Helping Hand

From Bethesda, Maryland: "Cap" Capetry writes, "I have been picking up *CQ* on the newsstands from time to time and find it most interesting. I have acquired a 50 watt f.m. transceiver and wish to put it on the 144 mc band. Can you put me in touch with someone in the Washington, D.C.-Baltimore area who may be active on f.m.? Would like to get on the air again after thirty-five years!"

What say, fellas? How about giving Cap a boost? His address is 6820 Millwood Road, Bethesda, Maryland.

More F.M. News

Two meter f.m. news from New York: On July 29, 2-meter f.m. groups in the New York City metropolitan area met in Huntington, Long Island. The major topic under discussion was the increased congestion on the 146.94 mc National Calling Channel, and the selection of a secondary working channel by the Suffolk County group led by W2OQI. The frequency 146.82 mc was considered at the meeting and its occupancy will be studied.

The extent to which these items have been investigated and explored by these groups is much to be admired and something worth thinking about. Organization is essential in everything we do and debate and discussion is our only key to progress. We would be interested in hearing from other societies on similar meetings. Our hats are off to these boys for their year-in-and-year-out devotion to progress in 2 meter f.m. development.

FM Net Directory

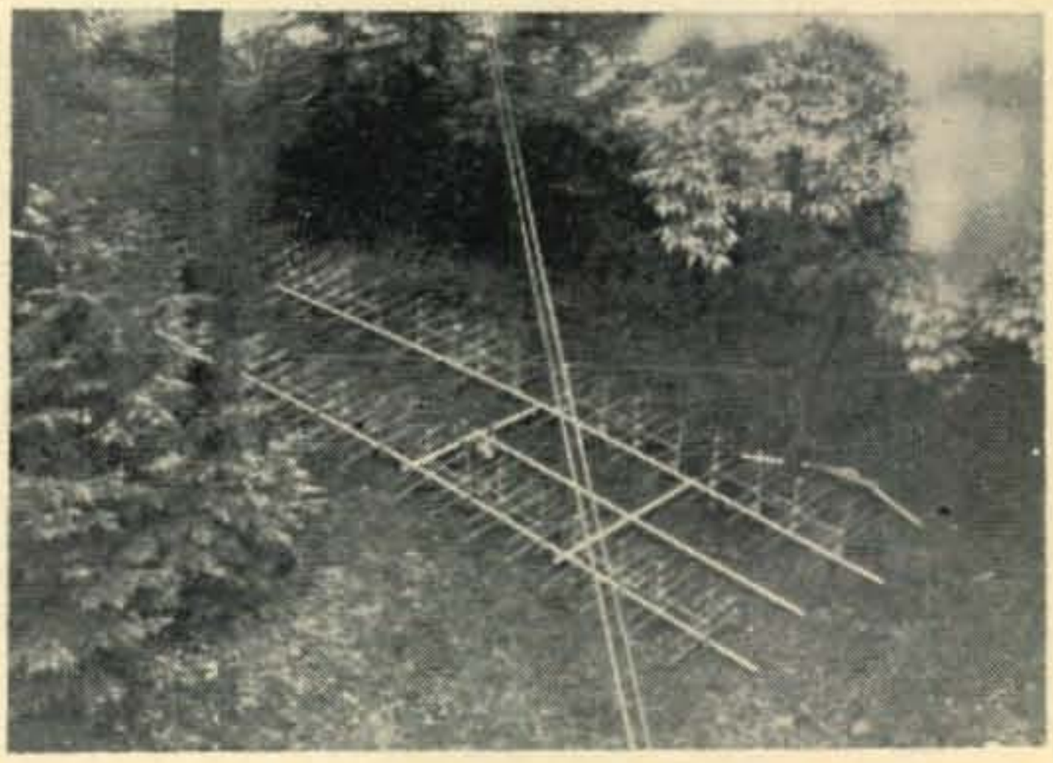
If it is at all possible that there are those who are still not aware of it, let us hasten to inform you of amateur radio's *F.M. Net Directory* published annually by K4ZAD, K4FSU and W4DYE. The latest edition is seventeen pages long and lists every known v.h.f. f.m. net to be found.

The *Directory* lists areas of net coverage and liaison calls and is cross indexed by frequency. Each directory contains fundamental f.m. information as well as detailed f.m. problem analysis. Teletype tapes for this *Directory* are available for anyone who will pay the postage and who will return them within 30 days. Using these tapes to make your own hecto masters is strongly suggested to those who need more than a few copies. For your edition send a QSL card to T. A. McKee, K4ZAD, 1306 Grove Road, Lynchburg, Virginia 24502 (Phone 703-239-5002).

Windup

And again let us thank those devoted readers who take the time to support this column regularly through their contributions. Of course, you too can help. All letters received here are answered as best we can and all suggestions appreciated. Till next month, check that antenna installation making sure it is secure for the cold winter winds ahead. This may be your last chance to get at it before the freeze sets in!

73, Allen, K2UYH and Bob, K2ZSQ



This beautiful mass of metal is actually a 192 element collinear array at K2TKN's QTH in New Jersey. Designed by CushCraft of New Hampshire, it is now on the air and performing well for Bill.

HAM CLINIC

CHARLES J. SCHAUERS,* W4VZO

THIS is the time of the year when we hams begin to think about our antenna installations — at least those of us who must contend with deep snows, ice and strong winds. Hams who live in California, Florida and other fine climate areas are lucky.

Some hams I know have antenna installations as old as 8 years or more and continue to operate year in and year out without trouble. On the other hand I know other hams who just cannot seem to get the results from their antennas that they expected.

Seldom do we receive a batch of mail without at least one letter from some ham having "antenna trouble". Some of the problems are not easy of solution.

For example, one ham wrote in complaining that he had tried many antennas trying to overcome the noise radiated from a 44,000 volt power line nearby. Another ham had the problem of insufficient space and was afraid that his neighbors would complain if he erected a 60 foot tower for a beam. Still another ham complained that he lived on a rocky hill and had a tough time getting a suitable ground.

The questions we receive from the ham newcomer or novice invariably pertain to antenna selection.

"Tell me", begins the question received most often, "how does the brand 'A' compare with brand 'B'?" This is often a difficult question to answer if we do not have full technical information on both and also personal reports. We know of instances where brand "A" out-performed brand "B" but the installation at the brand "A" site included a 60 foot tower and the brand "B" antenna was only 25 feet off the ground. There are too many variables involved to be truly specific. We do try however, to give the ham who writes us the information he seeks. Today, most beams are relatively close in performance—regardless of who makes them; but when mechanical details are considered there is a difference! For example, I know of one beam that will operate along side its higher priced "brother" day in and day out, but the first heavy snow and ice will put the lower priced beam out of operation but quick—especially if there is a strong wind. One gets exactly what he pays for.

One ham recently wrote in to HAM CLINIC: "I heard that as long as one has a good antenna coupler he can even load a metal rain spout, so having one I decided that I would try loading up my tri-band beam designed for 10, 15 and 20 meters, on 80. Well, what do you know, I cooked a couple of the traps. Why is this?"

Why is this? Ever try driving a Cadillac into a Volkswagon garage?

The antenna most used by hams is the good old one-half wave doublet. This antenna has given a good account of itself over the years, but there are still many hams who really do not know too much about its technical characteristics.

The doublet antenna does *not* always have an impedance of 72 ohms (or 300 ohms for the folded doublet).

The radiation resistance of a doublet (horizonal) can vary from 75 ohms at 0.2 wavelength above ground, to 90 ohms at 0.4 wavelength, down to 60 ohms at 0.6 wavelength above ground.

For a vertical dipole, the radiation resistance can vary from 90 ohms (on the ground) to 72 ohms for 0.2 wavelength above ground, and for values from 0.4 wavelength to 2.8 wavelengths will stay between 70 and 75 ohms. See *Radio Antenna Engineering* by Laport, McGraw-Hill).

Matching an impedance of a half-wave dipole cannot be done with an accuracy of more than 10%. As Laport says, "because of empirical factors of end loading, conductor diameter and the complex dielectric constant of the earth underneath, the calculation of the impedance at the center of a horizontal half-wave dipole cannot usually be accomplished with an accuracy of better than 10%." As most hams know, the standard 72 ohms matching for a horizontal dipole seems to work okeh, as long as the antenna is 20 or more feet high, without too much loss. But if the purist ham were to measure the loss of the average dipole installation he would have some sleepless nights.

Before Winter Comes

The ham who wants trouble-free operation of his antenna system should inspect it while the weather is good. Antenna insulators should be cleaned (and this includes those which are used to break guy wires). Check coax for breaks in the rubber or composition insulation. Take out the rotor maintenance manual (if you use a rotator for your beam) and follow the maintenance instructions. Sealed rotors need little attention.

If you use a trap beam check the traps for moisture, unless they have been sealed. Check for loose beam elements and tighten them up.

Inspect all ground connections as well as lightning gaps (what, you don't have a lightning gap?) if you use an insulated vertical.

Camouflaging a Tower

A ham I know was worried about erecting his Hy-Gain all-band vertical antenna, because he

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

knew the minute it went up his neighbors would scream. But he solved the problem without much trouble. Using plastic-based paints he painted the tower, stubs and whip with brown, black and green to match the trees, bushes, etc. in the area. Standing 100 feet away it is *very* difficult to see the antenna!

Observation

The reason that there has been so much technical progress in amateur radio in the United States of America is because the average American ham is not satisfied with something that can be made or done better. Furthermore he has a lot of assistance and gets many ideas from the effort of firms engaged in radio-electronics research and working on the space program.

He does not have to worry about the high cost of going on the air as do the rest of the world's hams. If he will expend the effort, do it for as little as $100—yes, a hundred bucks!

The USA produces more amateur radio equipment than any other coutnry in the world so its hams do not have to worry about high import tariffs.

If you give the average European ham a choice of American or European produced ham equipment he will take the American product, and many do even with the inflated prices due to high import costs. Something should be done about this situation. Why should people who are striving to improve their technical knowledge and contribute indirectly to their country's trained manpower resources be penalized by high import taxes?

Tariffs were created for the protection of home industry, but where a country manufactures little or no ham equipment why should there be a high tariff? This is hard to understand.

Now that the reciprocal law is a reality, we should now advocate dropping tariffs on ham equipment.

Questions

More on the BC-221—First of all, the crystal referred to in the June 1964 column for the BC-221 *is* a 1000kc and *not* a 100kc unit. Thanks to the many readers who caught this. We did not see the printing error.

We know that there is much more to the '221 than we wrote, and we are aware of the many models of this fine instrument. However, those who say they saw a '221 prior to 1955 are not incorrect.

Bene Brizendine, W4ATE writes and tells us about a method he uses to ascertain the approximate frequency of a quartz crystal (plate). The plate is merely placed on the binding post of the '221 and is lightly tapped to mechanically excite it, while exploring with the main dial. At the general frequency of the crystal loud plops are heard in the headphones. As the crystal neared the desired frequency, all measurements were made with the crystal operating in the equipment and holder to be used. Thanks Gene for the info.

Intermittent Coax—"Up until about two months ago my beam antenna worked fine on 20 meters. Now after loading up on 'north position' and I swing it to 'south position' it sometimes 'unloads! I checked my antenna connections and they seem to be okeh. What's a possible cause of trouble?"

A broken center conductor in or near your coax loop. If you are using a commutator type connector, check this. It might have lost contact tension.

Noise Interference—"I have been experiencing a buzzing noise in my receiver that practically wipes out all signals. I had the power company out and they cannot seem to find the trouble. All transformers were checked etc. Now what do I do?"

First check old door-bell transformers in the basement. Next, check refrigerator operation (including relays). Then check fluorescent light starter transformers. If the noise stops when you disconnect the antenna then you can suspect a nearby diathermy machine in some doctor's office, or even an x-ray machine used for prolonged treatments. These intermittent buzzing noises can be very difficult to find. A leaking insulator on a power pole will cause the noise too (especially when the weather is wet). A small transistor BC receiver tuned around 1400 kc can often be used to locate power devices that are leaking etc.

SX101 MK III S-meter—"My S-meter on my SX-101 MK III does not operate as it did before What should I check?"

First check the S-meter tube, V_{15}. Then check the a.v.c. voltage coming to the grid of this tube from V_7. Bet it is the tube.

HQ-170 AF Amplifier—"The 6AQ5 in my HQ-170 seems to run quite hot and of late there is some distortion. What's the trouble?"

All af power tubes generally run hot. However, if you are experiencing distortion, better check the screen voltage, it should be around 260 volts.

NC 300 S-meter Sensitivity—"I bought a second-hand NC300 and like it very much, but the S-meter seems to be a bit too sensitive. Any bulletins ever published on this?"

Yes. Bulletin Nr. FSN-35 dated Feb. 17, 1956. To decrease sensitivity of the S-meter by a fixed amount, decrease the value of R_{30} (68K ½ watt). To decrease or increase the sensitivity of the S-meter by a variable amount, replace R_{43} (33 K ½ watt) and R_{30} (68 K ½ watt) with a 100k potentiometer. Connect the arm of the pot to R_{55} (470K ½ watt). See fig. 1

Apache v.f.o.—"I modified my Apache's v.f.o. in acordance with information received from

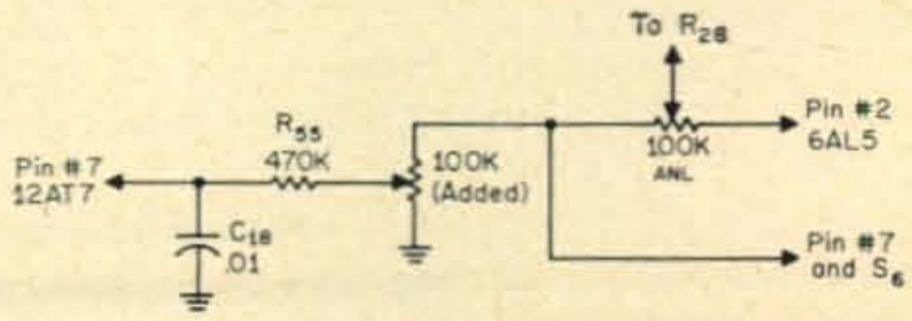


Fig. 1—Changes to de-sensitize the S-meter in the NC-300.

Heath. After about an hour the v.f.o. will settle down and stay there. I always unplug the set after operating, but I have been told that the plug should always be left in the a.c. receptacle, if I want good frequency stability. Why?"

The oscillator (v.f.o.) tube is constantly heated and the a.c. plug should be left in the a.c. receptacle. Any oscillator will drift from a cold start.

Transceiver for DX Operation—"I plan to take a good many trips around various part of the world and to operate in countries which have a reciprocal agreement with the U.S. I plan to buy a transceiver for my operations. What are the features you recommend I look for?"

Make sure first that your transceiver will operate on both 110v and 220v a.c. This is a start. I would advise you also to take along a good variable transformer, for you will encounter voltages from 100v. a.c. to 380v a.c. Also, make sure your transceiver covers the full c.w. as well as phone portions of the ham bands. These are the two most important features one must consider, for over-seas operation.

SB10 Troubles—"Since the SB-10 s.s.b. adapter came out what are the things that have caused the most trouble?"

First, tubes. Next, improper alignment. Overdriving. Bent relay contacts. Improper voltages. Insufficient drive to the SB-10 and last but not least, trying to feed the SB-10 into a non-linear stage. Please note that the troubles were not the fault of design or of component quality. The SB-10 is still the best s.s.b. adapter bargain on the market today. And now since all the bugs have been taken out (including those put in by the ham constructor), it is still the easiest and most inexpensive way to go to s.s.b. with an a.m.-c.w. rig, without much worry.

6JS6 Beam Pentode—"I understand GE has come out with a new compactron beam pentode tube which could be used to replace other similar tubes with lower plate dissipation. True?"

True. The new GE compactron beam pentode with a plate dissipation rating of 28 watts is now on the market. Called the 6JS6, it was designed for color television horizontal deflection service and can be used in some ham r.f. amplifier applications. It has 4 more watts plate dissipation than the 6DQ5 and 10 more watts than the 6DQ6B.

Cross-Modulation—"I have a transistorized all-wave receiver which I also use for portable operation on 14 mc. Tell me, what can I do to reduce the images in this set on 14 mc?"

Not very much unless you add another r.f. stage. Trying to filter 15 mc signals out is a near impossible task. The set you own no doubt has a poorly selected i.f.

HX-50 and new 6146B—"How about my installing the new RCA 6146B for more power in my HX-50?"

The design of the HX-50 is excellent as is. Write Hammarlund for the answer to this question.

Alternator noise—"I have a new car that uses an alternator instead of generator. I have not been successful in filtering out the noise. Any tips?"

Most alternator installations require no special filters except on 6 meters. Noise has been traced to bad diodes and to the regulator used. Try using coax condensers on the regulator leads.

Gonset converter conversion—"Would you please send me a diagram for converting my 3-30 Gonset converter to transistors?"

Sorry. As we have said before, we just do not simply have the time to do whole design work for readers. If any reader has the information why not write an article for *CQ* on the conversion? I am sure the editor would publish it for we certainly have had many requests for it.

TBX-8 schematic diagram—"Where can I get a schematic for a TBX-8?"

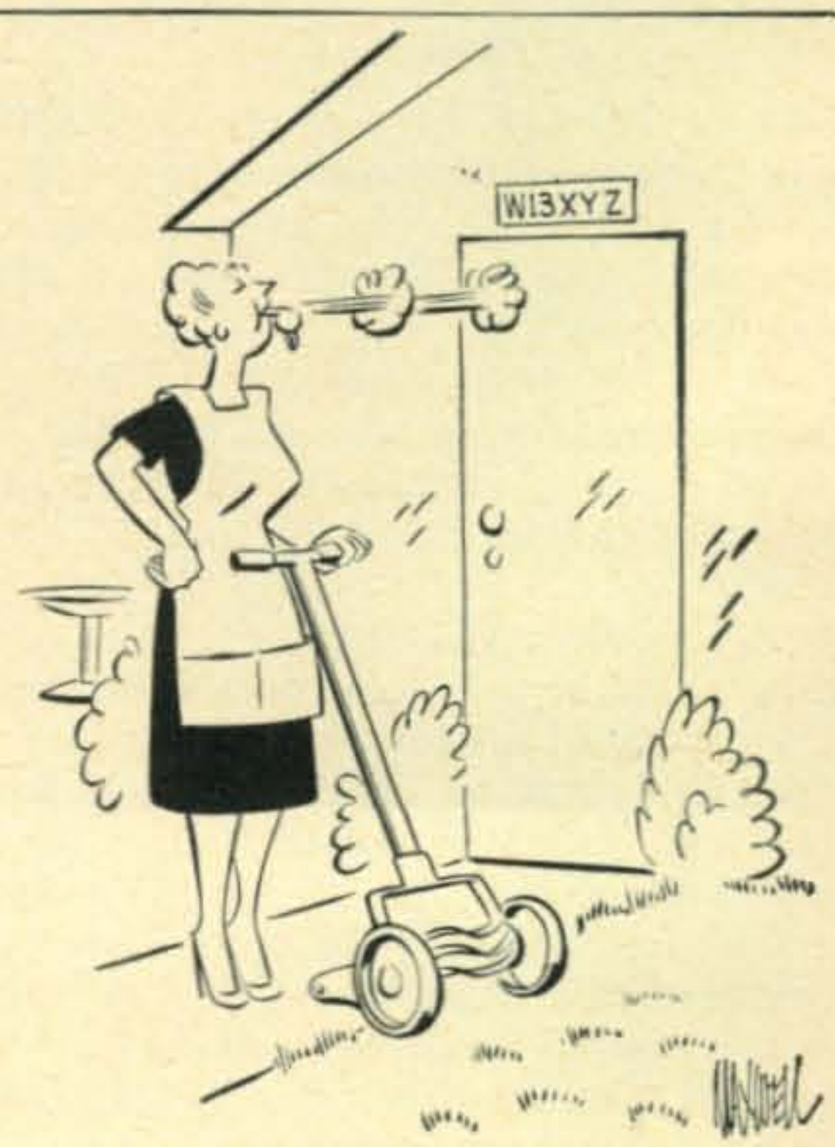
See the Sept. 1958 *CQ*. This is the same issue in which information is given for putting the super-pro on s.s.b.

BC-459 Battery—"I have a BC-459 but I cannot find a BA-41 battery for it. Any method for using standard batteries for this set?"

Yes. See *CQ* September 1959, it tells you how.

Thirty

We do enjoy hearing from the readers of HAM CLINIC. Some of you have told us that the reason you subscribe to *CQ* is for HAM CLINIC alone—and we appreciate this. On the other hand, we feel that we are only a small part of the *CQ* effort to keep you informed and to assist you with your problems. One thing you can depend on: we will never let you down if we can help it. A card to the editor telling him you like our column gives us the encouragement we need, and possibly more space. We do not have all the answers to all the questions yet by a long-shot but we try ever so hard to please you, the reader. For this month then, our best 73 to all of you. Chuck



di-dit/dah di-dit/di-di-dit
dah/di-dit/dah-dah/dit

NOVICE

WALTER G. BURDINE,* W8ZCV

AMATEUR radio operators as a whole have been singly honored. The Post Office Department announced its approval of a postage stamp commemorating the amateur radio operator. Actual date of issuance will likely be late October or early November.

This action on the part of our government shows its recognition of the value of the amateur radio service. It behooves each operator to do his part to prove that they were right in bestowing this honor upon us as a group.

Our public image is improved every time one of us gets favorable newspaper publicity as a result of doing a good deed, setting a record, tracing a satellite, saving a life or bringing two families together by phone patch etc. This kind of action does everyone some good, but we can offset it all by one bit of bad publicity. Have you ever noticed the way most people say, "He's a darned nice fellow and plenty brainy, but," and then he will go ahead and tell of some small deed that was likely committed many years ago, likely with no bearing on the subject at hand. This is one of the sordid traits of the genus Homo Sapiens, we just like to belittle our fellow man.

Let's wash our dirty linen at the radio club in private and not on the air where the world can misjudge all amateurs by the misconduct of the few. I feel quite sure that we are not helping our cause by telling the world of our troubles. I have about five rolls of tape that would discourage anyone from even thinking about becoming a ham and as with all propaganda, that even discourages me from trying to work the low frequencies as they seem to have the most propaganda stations. Mind you I'm not saying not to talk these things over, but watch the way you do it. Don't do more bad than good, and be sure of your facts.

I would give up all the hobbies in the world for my amateur license and if necessary I would move from my present home to keep my station on the air. I enjoy amateur radio, and it is not my only hobby.

Thanks

I would like to thank all of the good hams that answered my request or mention of my trying to collect old issues of radio magazines so that my reference library would be complete and I would be able to answer most of the questions received. I have been a magazine collector since about 1940 and have most copies after that. I have loaned a few copies that were never returned, some have been lost by fire, some by other means, but the file is nearly complete. I cannot afford to pay collectors prices but will pay a reasonable price. Again, thanks to all who took the trouble to write and I will answer very soon.

QSLs

In short QSL means, "I confirm communication of your station or with your station. It is the final courtesy of a QSO and a lasting tie of friendship with a friend far or near. I have quite a collection of QSL cards from a total of 98 countries. As proof of contact, they have won me many nice awards and certificates. I have contacted 113 countries with low power phone and still am aiming for that 100 cards for DXCC. Of the 15 countries that have not QSLed, my choice would be the TF and CR5UP (now CT1BW) but I'll have to work those countries again. When sending QSLs to foreign countries don't forget that it does no good to send us postage stamps, they cannot be used in any country except the USA and possessions. U.S. postal stamps can be sent to anyone using an APO or FO number. To help the foreign ham

WALTER G Burdine
W8ZCV
"NOVICE COLUMN
CQ MAGAZINE

Here is a Picture of My rig.
My DADDY MaDe me buiLd it
It took a Long time.
It is 25 watts. a 6DQ6.
The Receiver is 4 tuBes.
I AM 7 years oLD.
My call is WN7BBJ. (Big Bud John)
I Just Got it
73
Gary Lewis

Congratulations to Gary Lewis, age 7, who now holds the record as the youngest licensee to write me and send a picture. The letter tells the story of his station and volumes more. Did you say you couldn't get a license???

*R.F.D. 3, Waynesville, Ohio 45068.

with postage send International Reply Coupons, (IRCs) available at most post offices. IRCs can be exchanged for stamps in most countries of the world.

I learn more geography from a QSL than from my books. I know there is someone there with the same interests that I have. Some QSLs are works of art, others carry gems of wisdom. The QSL of John A. Janssen, PAØDOC carries this gem of wisdom, "Amateur Radio Is World Friendship." Can any sentence sum up the aims of the ham better than that one? The stamp that carries your QSL can do a lot of good in this world. When did you send your last QSL? Oh, you're waiting for him to QSL first? Why not try to be *first* this time?

TVI and Harmonics

One of our biggest problems at the present time is interference to other radio services. A number of amateurs are now off the air because of TVI, harmonics and other forms of interference. Other amateurs are busy trying to solve that problem, and it seems that the radio industry knows that the amateur will solve it too. We must give a big hand to Phillip S. Rand, W1DBM, F. E. Ladd, W2IDZ and R. L. (Bob) Drake, W8CYE for their work on this problem, doubtless there are many others. They are making it possible for us to operate any time we wish without causing interference to our neighbors.

Given a little time the amateur will solve the TVI problem. TVI can be licked and the amateur that just throws up his hands and quits isn't helping the cause at all. A number of articles have been written to help clear up these problems,[1] read these articles and clean up your signals.

A booklet was written by Phil Rand W1DBM that has just about become the TVI Bible. There should be one in your library.

A number of other articles have been written, but I have applied the ideas in these articles to my transmitters and have not had any troubles. For gosh sakes, use a *good external ground*. Again, one good way to handle TVI problems is to watch what you say to the agrieved, and be diplomatic.

Letters

The avowed purpose of this column is to help those people interested in becoming hams to achieve that goal and to help those that are licensed to operate their stations so that they gain more enjoyment from their hobby and through these operations, enhance their public image. When I feel that a letter or two from an s.w.l. will help our hobby in she goes. Most s.w.l.s are only hams at heart

The 40th country to write since I took over our column is Scotland: "Dear OM: I was extremely interested in your remarks regarding surplus equipment in the Novice section of the July *CQ*.

"Present circumstances (which will end sooner or later) prevent my going on the air." But, I do the next best thing—I am an avid listener on the ham bands—with 165 countries and 37 zones heard on phone and c.w.

"My rcvr. is a Hammarlund HQ-120X, a civilian which served with distinction in the U.S. Armed Forces. Though elderly, it still serves me well, especially on s.s.b. but I feel it needs a course of rejuvination. I do not have the manual, and I wonder if some one might have such a thing that they would part with. I would be able to pay any reasonable expense in dollars.

"By the way, I am hoping to make a trip to the USA next summer and amongst other things, I hope to visit friends who live near Glen Head, Long Island. If this is not too far from HQ at Port Washington, I hope that I will be able to visit *CQ*. I am a subscriber of nine years.

"Please pass my congratulations to the editorial staff of *CQ*.

"73. Father S. J. Smith, member RSGB."

Thanks for the letter, Father, and I am sorry that I do not have a manual for the HQ-120X but I feel sure that some one will write you about your problem. This column has many readers that are willing to help those with problems. I live quite a distance from HQ but I'm sure that the editorial staff will lay out the red carpet for you when you come to Glen Head. It couldn't be too far. Father Smith's address is: Father S. J. Smith, Saint Mary's, Bathgate, Scotland. His telephone: Bathgate 2818.

Bill Rovas, WN1APX (age 14), 29 Bellevue Street, North Dartmouth, Massachusetts, 02747, writes:

"Dear Walt: I enjoy reading your column in *CQ* very much, and believe me, it has brought enjoyment into the hearts of many Novices.

"In the past issues, before I was a Novice, you had talked about using low power for tranmitters. I thought the only way a Novice could get out was by using high power, 75 watts. Well, today I am running a borrowed 25 watt Philmore, that is about 13 years old, on 80 and 40 meters and having a ball. In the three months I have had my license, I have worked 16 states and three Canadian provinces. For a receiver I am very fortunate to have a Drake 2-B; it's the receiver that counts.

"Gee, with a half wave antenna on 40 I have banged out to New Jersey with a 5—9++, when they with their 75 watts were just getting through the QRM. If the Novices think DXing is bad, I have not tried getting across the pond yet, on 40 meter during the early evening or around breakfast time I have QSOed with Florida, Louisiana and under heavy QRM Minnesota. So please tell these other Novices before they buy a high power transmitter, to get as good a receiver as they can afford. Believe me, they *will* make the contacts.

"73, Bill, WN1APX (age 14)."

Well, Bill, I'm glad to welcome you to the group of hams that try to use operating ability to increase the output of his transmitter rather than brute force to force the signal through. I know that we can't buck a kilowatt properly operated, but we can make our sets outperform many kilowatts operated by improper methods; by people whose only aim is to try to occupy as much air time as possible. They do not worry about signal quality or interference to others on the band.

Do you remember the "super" ham that thought that the Technician was "rotting away on six" that sent the letter in the past? Here is an answer. Arthur J. Foster, KN7ZFG/K7ZFG, 730 Riverdale, Gladstone, Oregon writes: "Dear Walt: I thought I'd tell you about my rotting on v.h.f. My equipment is as follows: Challenger transmitter and collins MBF with converter for six; an ARC-5 for two; two receivers for 220 and 420, a diplexer for 10,000 mc and a planned 3300 mc polarplexier, all

[*Continued on page 102*]

[1]Fisher, S. "A Versatile TVI-Less 40 Watt Transmitter", *CQ*, Sept., 1951, p. 11.
Kuehn, R. B., "Six Meter TVI Filter", *CQ*, July, 1956, p. 21.
Ladd, F. E., "50-Mc. TVI—Its Causes and Cures (Part I)", *QST*, June, 1954, p. 21.
Ladd, F. E., "50-Mc. TVI—Its Causes and Cures (Part II)", *QST*, July, 1954, p. 32.
Marriner, E. "A TVI-Free Transmitter for 40", *CQ*, Oct., 1953, p. 28.
Schlesinger, R. "Cavity TVI Filter", *CQ*, July, 1954, p.14
Tilton, E. P., 'TVI Hints for the V.H.F. Man", *QST*, April, 1953, p. 16.
Walker, F. "RF on Your Chassis?", *CQ*, 1955, Aug., p. 25.
NOTE: This is only a partial list of the many articles on TVI.

YL

LOUISA B. SANDO,* W5RZJ

AMONG the U.S. hams attending the first Pan-American Congress of Radio Amateurs, sponsored by the Liga Mexicana de Radio-Experimentadores, and held in Mexico City last April 15-18, were Esther and Lyle Gardner, WA6UBU-K6IPJ. Equipped with a KWM-2 in their car, they made over 300 contacts using s.s.b. on 20 and 40 meters in their three weeks of travel, operating as XEØIPJ and XEØUBU.

Esther comments, "It certainly was an education to see how unions are formed." This Congress resulted in formation of the Inter-American Union of Radio Amateurs (Region II division of the IARU), comprised of about 20 radio societies in South, Central and N. America.

Of course they met many hams from all over the western hemisphere and Esther kindly sent photos of some of the YLs attending (taken by OM K6IPJ). The Gardners also attended the 32nd Convention of the LMRE at Guaymas the end of May, where they met many more hams. Esther is corresponding secretary of the Los Angeles YLRC.

Correction

Word from YLRL V.P. W6QYL corrects scores for the 1964 YL/OM Contest, published

[*Continued on page 98*]

*4417 Eleventh St., N.W., Albuquerque, New Mexico 87107.

25th YLRL Anniversary Party

Time: CW—Start—October 21, 1964, 1200 EST (1700 GMT)
End—October 22, 1964, 1800 EST (2300 GMT)
Phone—Start—Nov. 4, 1964, 1200 EST (1700 GMT)
End—November 5, 1964, 1800 EST (2300 GMT)

Eligibility: All licensed YL and XYL operators throughout the world are invited to participate. *YLRL members only* are eligible for the cup awards; non-members will receive certificates. *Only YLRL members* are eligible for the Corcoran Award. Contacts with OMs will not count.

Operation: All bands may be used. Cross-band operation is not permitted. Only one contact with each station will be counted in each contest.

Procedure: Call "CQYL".

Exchange: Station worked, QSO number, RS or RST, ARRL Section or country. Entries in log should also show the time, band, date, transmitter and power. (Please know your own ARRL Section. ARRL Section list available for SASE to W6QYL.)

Scoring: a) C.w. and phone sections will be scored as separate contest. Submit *Separate* logs for each contest.
b) Multiply number of contacts by total number of ARRL Sections and countries worked.
c) AM contestants running 150 watts input or less at all times may multiply the results of (b) by 1.25 (low-power multiplier).
d) SSB contestants running 300 watts p.e.p. or less at all times may multiply the results of (b) by 1.25 (low-power multiplier).

Awards: Highest c.w. score—gold cup (YLRL member). Highest phone score—gold cup (YLRL member). Highest phone log and c.w. log in each *district* and country will receive a certificate. Highest *combined* phone and c.w. score, YLRL member only, will receive Corcoran Award.

Addition to YLRL A.P. Awards: Given by Arlie Hager, W4HLF, there will be two combined-score cups awarded to DX YLs only: Highest combined phone and c.w. score—cup (DX YL in North and Central America, including the Greater and Lesser Antilles). Highest combined phone and c.w. score—cup (for DX YL from any other part of the world). DX YLs please send logs airmail to be sure of qualifying!

Logs: Copies of all logs must show claimed score, be *signed* by the *operator* and postmarked no later than Nov. 21, 1964 and received no later than Dec. 5, 1964, or they will be disqualified. Send only a copy of your log—no logs will be returned. Send copies of logs to Martha Edwards W6QYL, 44303 North Date Ave., Lancaster, Calif.

Among the YLs attending the Pan-American Congress at Mexico City that WA6UBU met were, Top l. to r., K4ICA, V. Mayree, YS1KLM, Dolly, XE2POF, Elena, and XE2COS, Alicia. Bottom, l. to r., XE1PNS, Matilde, XE1HHH, Marylu, and (at the LMRE Convention) XE2ZZZ, Delia.

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

BIG NEWS: The FCC finally relaxed their cumbersome dual identification rule. As of August 10, 1964, amateur radioteletype stations need transmit only their own call when identifying by means of the International Morse Code. (Heretofore it was necessary to send both your call and the call of the station being worked or called.)

For years and years RTTYers have been struggling to have the dual identification requirement completely eliminated. Early agitation was by the late WØBP, W3PYW, W9TCJ and W6AEE. The new change in the Rules is the result of separate petitions by the ARRL and by Ed Bruening, W8DTY. Now, at least, an RTTYer can use any simple automatic device to transmit the code identification since it need contain only his own call.

The FCC, though, is a bit cagey. They have tacked on, in their *Report and Order* some "important comments." These are relative to the code speed used and the frequency-shift used for identification. Also, they give some advice about the use of a.f.s.k. on s.s.b. transmitters as suggested by W6AEE. In order that there be no misunderstanding we are reprinting the release from the *Federal Register* of July 10, 1964. (Tnx to Chuck, HAM CLINIC Editor.)

Transmission of Call Signs

In the matter of amendment of § 97.87(a)(2) of the rules governing the Amateur Radio Service to delete a "dual identification" requirement for teleprinter stations; Docket No. 15267, RM-358, RM-435.

Report and order. 1. On January 10, 1964, the Commission released a notice of proposed rule making to amend § 97.87(a)(2) of its rules governing the Amateur Radio Service to delete the requirement that a teleprinter station transmit by telegraphy or telephony the call sign of the station to which it is transmitting. This notice was duly published in the FEDERAL REGISTER, January 15, 1964 (29 F.R. 354), and all comments filed in response thereto have been considered by the Commission.

2. All comments received, including those of the original petitioners, the American Radio Relay League and Mr. Edwin B. Bruening, supported the proposal. Qualified support was received from a few licensees who felt that greater relaxation of the teleprinter station identification requirements should be accomplished. In this regard, the Commission notes, as was expressed in its notice of proposed rule making, that any further relaxation of these requirements at this time would be detrimental to its monitoring and enforcement activities.

3. In addition to comments as to the proposed rule change, the Commission solicited comments and suggestions as to methods of superimposing telegraphic identification of the transmitting station upon the carrier without interrupting the teleprinter transmission. One suggestion in this respect was submitted by Mr. Merrill L. Swan (W6AEE), President of the RTTY Inc., as follows:

"Using an audio frequency shift generator, and a keyed audio generator, feeding a SSB type of transmitter, I have demonstrated the compatibility of this method. The audio tones employed were: Mark, 2125 cycles, Space, 2975 cycles and CW, 2550 cycles. A sharp cut-off 'low-pass filter' was used between the AFSK/cw generator and the * * * transmitter, utilizing LSB Mode. The transmitted signal was examined, using a panadaptor and a * * * receiver, to search for spurious signals—none were found."

Mr. Swan's method appears to have limited application but apparently can be accomplished without change of the rules. However, amateur licensees contemplating the use of audio tones via single side band suppressed carrier transmitters for the generation of A1 and/or F1 emissions are cautioned that any radiation of the carrier or suppressed side band frequencies at an intensity sufficient to cause interference in receiving equipment of good engineering design constitutes spurious radiation in violation of § 97.73.

The Commission will continue to consider these suggestions and our monitoring stations would be pleased to cooperate by observing tests of methods under development.

4. As indicated, there is no apparent objection to the proposed rule amendment. Therefore, for the reasons set forth herein and in its notice, the Commission concludes that the proposed rule making should be adopted. In adopting this rule making one important factor requires comment. This rule change will enable licensees to employ automatic devices for telegraphic station identification by International Morse code. However, the transmission of the amateur call sign automatically at more than twenty or twenty-five words per minute and/or with a frequency shift of less than about 100 cycles would make identification difficult, especially when monitoring from a mobile unit. Licensees are advised, therefore, that for telegraphic identification they will be expected to observe reasonable standards for code speed and keying methods. In the event that there are abuses in this area, the Commission will be obliged to set forth standards in the rules.

5. Authority for the amendment set forth below is contained in sections 4(i) and 303 of the Communica-

RTTY The Hard Way...No. 36

"Gee Dad, I know Lois is a good typist, but we've got a date!"

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

tions Act of 1934, as amended.

Therefore, it is ordered, This 1st day of July 1964, that § 97.87(a)(2) of the Commission's rules is amended as set forth below, effective August 10, 1964.

Released: July 7, 1964.

FEDERAL COMMUNICATIONS COMMISSION,[1]
[SEAL] BEN F. WAPLE, *Secretary*

Part 97 of the Commission's rules is amended as follows:

Section 97.87(a)(2) is amended to read as follows:

§ 97.87 Transmission of call signs.

(a) * * *

(2) The required identification shall be transmitted on the frequency or frequencies being employed at the time and, in accordance with the type of emission authorized thereon, shall be by either telegraphy using the International Morse Code, or telephony, except that, when a method of communication other than telegraphy using the International Morse Code or telephony is being used or attempted, the required identification shall be transmitted by that method and only the call sign of the transmitting station need be transmitted either by telegraphy using the International Morse Code or by telephony.

Projects Despair

Those of you who have regularly read the RTTY Column over a period of years are quite familiar with project Despair I, our effort to obtain the printed circuit boards for the W2JAV wideshift TU and the companion a.f.s.k. oscillator. Well, we did get these, and although they have been long since gone, we still get calls for them from those who only occasionally pick up an old *CQ*. (Why not subscribe, and stay on top of things RTTY?)

Now we are in the midst of Project Despair II. In the June RTTY Column we announced that we had obtained a supply of printed circuit boards and connectors for the W2JAV transistorized narrow shift TU as initially described in the September '63 column, and again in the June '64 issue where we gave a large detailed parts placement layout. The boards are available for $2.50 each, postpaid, undrilled, but with connector included. These are going fast, and it looks like we will run out of connectors before we run out of boards. So, don't get caught short again. Send money order or check, made out to me. (Don't send cash.) U. S. only.

On the Bauds

W2IPB has a TT-7/FG (military Model 15) and wants to get it on v.h.f. W2JAV is developing a simplified two-machine transistor keyer to work from his transistor TU's. Watch the RTTY Column for the details. W1BZD/2 in Plattsburg, N.Y., was worked on 80. *(KWM-2 conversion was in the RTTY Column in January, 1964.)*

W3WXB of Timonium, Md., is active on 80, 40, and 20 with Models 14 and 19, running 400 watts on 80 and 1000 watts into a 14AVS on the other bands. W3TLA of North Erie, Pa., is on 80; and K3NIO of Chevy Chase, Md., skeds K8DKC on 3640 kc. K3GIF of Bethesda, Md., was host to FG7XT in August. W3PYW of Silver Spring, Md., works the "G's" Sunday mornings on 20.

K4LZP of Falls Church, Va., is building a narrow shift TU, a la W2JAV. W6QID is operating /4 on 20 from Miami, Fla. W4MGT of Lexington, Ky., is running extensive tests on the slideback and DTC detectors for TU's. W4AIS of Taylors, S.C., uses tape on 20. W4BLK of Macon, Ga., uses tape on 80. K5URH of Alexandria, Louisiana, is looking for W2JAV wide-shift TU and a a.f.s.k. circuit boards. K5RAV of Grapevine, Texas, works 20 with tape gear. K6SZQ of Norwalk, Calif., is trying to f.s.k. a KWM-2. WA6UNK of Vandenberg AFB, Calif., has a KY-75, an AM-655/URT, an MD-165/URT, and is looking for schematics. *(Try Propogation Products, Box 242, Jacksonville 1, Florida.)*

K8GIP of New Martinsville, W. Va., is on 80. K8TUB of Taylor, Mich., is looking for dope on RTTY. *(Get the New RTTY Handbook, Frank; $3.95 from Cowan Publishing.)* K8DKC of Ann Arbor, Mich, is working with K3NIO to design the "ultimate" converter with two-tone and limiterless features. K9CZI of Sheboygan, Wis., has an HX-50 and a Model 14 printer, and has just finished the a.f.s.k. oscillator for the Twin City TU. W9HRH reports that Potter and Brumfield bought out Magnetic Devices, and P & B now has those polar relays described in the July '64 RTTY Column.

KØWMF of Rolla, Mo., is looking for a manual on the TT-63A Regenerative Repeater. Charlie is also giving away a Model D base. WØIJK of Aurora, Colorado, has built the tube-type W2JAV TU *(from the* New RTTY Handbook) and the WØHZR tuning indicator, modified for circular presentation. KØKBY of St. Louis, Mo., is on 20 meters.

KL7AKD of Fairbanks, Alaska, is building the W2JAV narrow shift TU. W6CQK, in Caracas, is awaiting reciprocal licensing in Venuezuela. XE2R is looking for the tuning fork oscillator described in the February '63 RTTY Column. *(Long since gone from the market, Al.)* DL3IR of Munich still packs a wallop at W2JTP on 20. FG7XT visited Montreal this past August, meeting VE2HY and other narrow-shifters in the area. G2HIO and I1AHN work 20 between 14,080 and 14,100 kc.

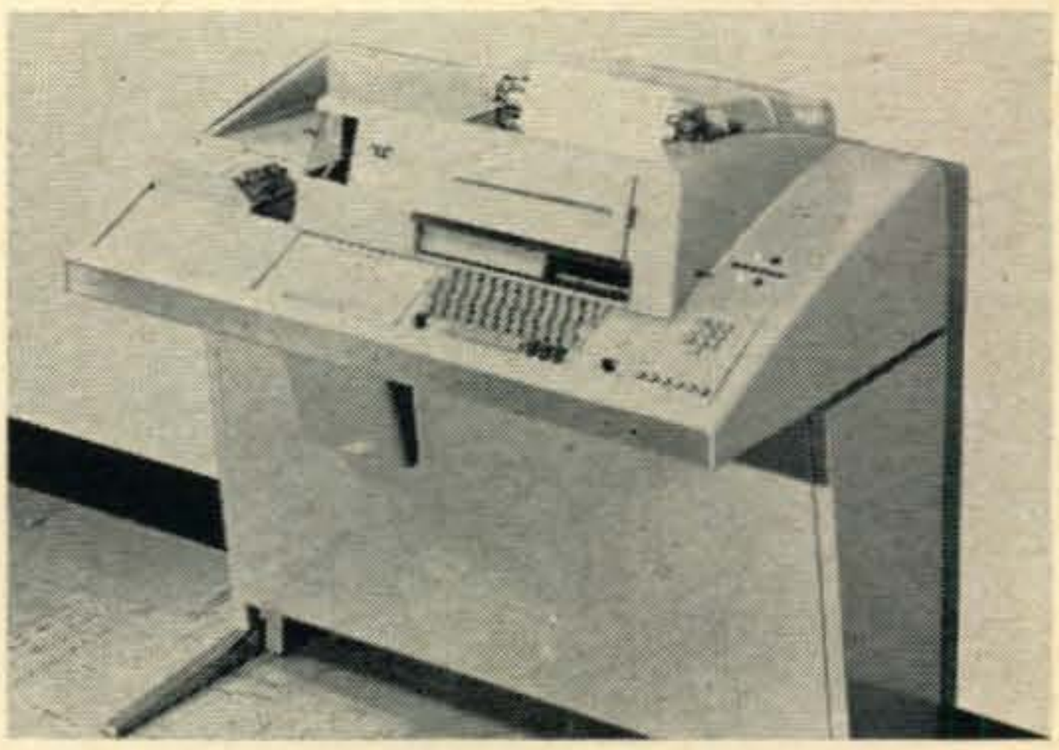
Comments on W1AW

Those of us who have operated amateur RTTY for years, and those of us who have some connection with professional long-range message communication, have been painfully aware that c.w. is now the obsolete mode for this kind of volume traffic. Don't misunderstand; we agree fully with the editorial in the August issue of *QST*. There *is* a place and a need for c.w. proficiency. *What we do not understand is why W1AW does not put out the official ARRL bulletins on RTTY.*

The matter of W1AW sending bulletins on RTTY has been brought up many times in the past years. The excuses are: (1) lack of manpower and time to prepare Teletype tapes, (2) lack of Teletype tape equipment. This is really nonsense. Separate tapes for RTTY and Morse *can* be made at the same time, on the same keyboard, by the same operator. There is equipment available to do this. And, there is plenty of Teletype tape transmitting equipment available.

We who are so familiar with RTTY are thoroughly acquainted with the advantages of RTTY for this purpose. Most ARRL Directors, Vice-Directors, and SCM's apparently are not. It is up to each one of us to brief these people with the simple fact that RTTY would *tremendously* increase the effectiveness of the OBS system. Just think: Bulletins taped off the air from W1AW on RTTY are then ready for *instant* re-transmission on other frequencies, and they can be repeated time and time again. Why are they missing such a good bet? Ask *your* Director.

73, Byron, W2JTP



The new Model 35ASR of the Teletype Corporation. Somewhat similar to the Model 28ASR, this machine is made for 8-level code and high speed operation on commercial and computer nets. Changeover of wire communication from 5-level to 8-level code to use this and Model 33 machines will eventually make more Model 28 equipment available for our use.

[1]Commissioner Cox dissenting.

Announcing [*from page 16*]

Bedford, Indiana

The Hoosier Hills Ham Club is having their third annual Hamfest at Spring Hill State Park near Mitchell, Indiana. The date of the Hamfest is October 11th with the grand prize of a Drake TR-3 and second prize of a Swan 240 transceiver being offered. This year as an added feature, there will be a Single Sideband Dinner at Mitchell High School on Oct. 10th. There are activities too numerous to mention, except that over 1,000 people came and enjoyed them last year and will probably come back for more this year. Tickets for the dinner are $2.00 each and 50¢ for the Hamfest. For tickets and information, contact J.F. Strom, K9BSL, P.O. Box 375, Bedford, Indiana.

Pittsburgh, Pennsylvania

The Western Pennsylvania Mobileers, an amateur mobile radio club, is planning its eighth annual hamfest, which they call the Fall Round-Up, on October 23, 1964. For the Round-Up they have planned a swap and shop, prizes, entertainment and refreshments. More information can be had by writing to Richard B. Wilson, K3IXN, 714 Jane Street, Pittsburgh, Pa. 15239.

Amateur Radio Courses

The Communications Club of New Rochelle will be conducting their 10th series of courses on amateur radio. The program thus far has enabled over three hundred people to either get their license or to advance the class of their license. There are three parts to the program, depending on the individual's aims. The first part is Novice code and theory (given on Monday evenings), second is the General code and theory (Tuesday and Thursday eves.), and a high speed code course (on Wednesday nights). The course starts the week of September 28th. For more information on how you can take part in the course, write to the Communications Club of New Rochelle, Box 971, New Rochelle, N. Y.

Antenna Contest [*from page 62*]

On the other hand, the gain-*versus*-size advocates contend that:

"Anyone can get a lot of gain simply by making his antenna big. The prize should be awarded on the basis of the most gain in the least space. That's what requires a sophisticated design and separates the men from the boys."

Probably the best solution to this controversy is to have two prizes; one for gain and one for gain related to size.

In order to objectively compare antennas on a most-gain-for-least-size basis, a formula involving antenna dimensions is needed. The best criteria we've found for comparing size is the *clumsiness factor*. It is simply the sum of the three linear dimensions: length, width, and height. The product (volume) can not be used for the obvious reason that it approaches zero if any of the three dimensions approach zero. (A very thin dipole could win on that basis.) The ratio of power gain to clumsiness factor we call spatial efficiency, that is: *Spatial Efficiency = power gain ÷ (length + width + height)*. The numerator is taken as gain over a dipole expressed as a ratio (not db). The denominator can be measured in inches or any convenient unit. When comparing antennas for different frequencies, the linear dimensions should be measured in wavelengths, of course.

Using inches in the above formula at 432 mc, the best spatial efficiency scored in our recent Southern California contest was 1.985. It was a 5 element Yagi built by W6DXJ and designed by the HPH method. This figure can probably be beaten, but you won't find it easy. ■

Receiving Adaptor [*from page 60*]

Construction

No details on construction are given since most amateurs will make their own version of gear such as this. I built the unit in a 7" × 11" × 2" aluminum chassis with the tubes out the back and the three switches in front, so the unit is a flat package.

The first thing to do, is to align your receiver right on the nose of the crystal filter. This is done by watching the S meter when you vary the signal generator through the i. f. frequency. My receiver has a 455 kc i. f.; actually the signal generator peaked at 455.1 with the crystal filter in the sharpest position.

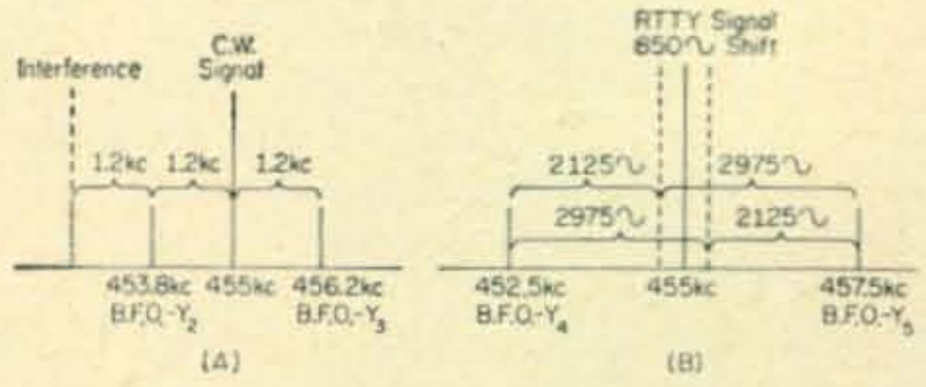


Fig. 2—(A) shows how an interfering signal may be removed from the bandpass by shifting from crystal Y_2 to Y_3. Illustration (B) shows how crystal Y_4 or Y_5 may produce the audio tones for RTTY operation.

Now that you have the i. f. frequency, the rest is simple. Use one crystal on center frequency for zero beat, two crystals, one higher one lower by 1200 cycles for c.w. and s.s.b. and two crystals ± 2550 cycles for RTTY.

Surplus FT-241 crystals, channels 44, 45 and 46, were used. Several of each were checked in the usual fashion with an LM frequency meter and those just a bit lower than necessary were sanded up in frequency. This was a two hour job with an LM meter as I worked. These crystals can be purchased with exact frequencies at reasonable prices.

Tuning Ratio

The slow speed tuning dial is merely a $1.50 planetary drive mounted on the present tuning dial of the receiver. Whatever the tuning rate is now, the drive will lower it 6 to 1. My receiver originally had a rate of 30 kc per turn and now it is about 5 kc per turn. I first ran the drive in an electric hand drill until it got warm; this made the action extremely smooth. ■

Frequency Conferences [*from page 48*]

The ARRL, it should be noted has in the past attended various communication conferences in both positions, with ARRL officials acting as members of the IARU delegation, and with other officials being members of the U.S. government delegation. This has been a wise decision, as the ARRL was able to participate in the efforts of the IARU at the conference, while having a voice on the U.S. delegation.

by hams...
for hams...
Harvey is reliability

Harvey
VALUES OF THE MONTH

CARBORUNDUM'S NEW LOW-COST, NON-INDUCTIVE "HAM LOAD" GLOBAR

• Reduces QRM • Increases Efficiency • Dissipates 250 watts output

regular price $23.75 ham net

NOW, WHILE THEY LAST
HARVEY SPECIAL $12.75

A new 50-ohm resistive dummy load that's ideal for all types of amateur service — fixed, portable or mobile. By switching the "Ham Load" into your antenna circuit, you eliminate on-the-air tuning and needless QRM. The unit also provides a dependable, non-inductive termination for testing equipment, measuring power and antenna matching.

The Carborundum "Ham Load" is supplied as a single unit with standard coax connector for easy mounting on rack or cabinet, or for designing into home-brew equipment. Although small in size, the high-temperature ceramic resistance element dissipates up to 250 watts **output** for 5 minutes! Unlike bulbs or wire-wound resistors, SWR remains essentially flat at less than 1.5:1 up to 54 Mc (with the load mounted at least 5" from metal reflecting surfaces).

SPECIFICATIONS

Resistance: 50 ohms, non-inductive. **SWR:** Less than 1.5 at 54 Mc. **Dissipation:** 250 watts (up to 5 minutes); 150 watts continuous. **Connector:** Standard coax (SO-239 type). **Size:** Approximately 13½" long by 1" diameter. **Mounting:** Any convenient location. **Caution:** Due to heating when loaded at high power, the unit should be mounted in freely circulating air.

ROTRON WHISPER FAN

The fan that moves 60 cu. ft. of air per minute . . . while running so silently you have to look to see if it's running! Removes heat to save your rig, yet uses only 7 watts. Measures 4½" square by 1½" deep. Has run for years in computers and other commercial equipment without attention — lifetime lubricated.

Operates on 110-120V. A.C.

Amateur Net.....**$14.85**

EXTRA-SENSITIVE HEADPHONES BY SUPEREX

600 ohm impedance; extra-high sensitivity for weak signals and hard-to-read stations . . . reproduction is crisp, free of distortion . . . unequalled wearing comfort over long use.

Amateur Headphone Model AP-S.

Amateur Net **$24.95**

Don't forget to include postage and shipping charges! We refund excess.

WE SPEAK YOUR LANGUAGE — and have for 37 years. It means orders from every corner of the world are handled personally and your instructions, in any language, are followed. It means we speak the universal language of all radio amateurs. And that gives you such ham-to-ham extras as consultation on your problems, meeting specific requirements, and — at your request, with no charge — opening sealed cartons for complete equipment check-out.

Send check or money order including shipping charges. We return any excess.

Harvey
RADIO CO., INC.

OUR 37th YEAR

103 West 43 St., New York 36, N. Y. (212) JUdson 2-1500

For further information, check number 49, on page 110

Under these circumstances, what then may be the defense of amateur radio? Is it realistic to construct a defense for amateur radio in view of the many problems that seem to loom ahead of us? The answer, of course, is *yes!* Even though amateur bands will continue to exist after the next Frequency Conference, efforts made in advance to defend the present amateur allocations will be most rewarding. If we amateurs leave no stone unturned in our defense, we can at least say that we did our very best to protect ourselves and we will suffer no future regrets at opportunities missed or advantages lightly cast aside. On the other hand, if we do nothing, it seems a foregone conclusion that we place little value on our frequency allocations in the h.f. spectrum. If this is the case, these holdings will be fair prey to services that value them more highly than we do!

In passing, it is well to note that efforts at self-preservation by other minority communication groups at the ITU conferences are not unknown, and some of these efforts are remarkably successful. Radio astronomers and scientists proved this important point at the recent Space Communications Conference of the ITU in Geneva, 1963, when a small dedicated group fought for and preserved various v.h.f. and u.h.f. allocations of interest to the scientific community from attack by services intent upon claiming these frequencies. A combination of *international* public service, scientific achievement, and shrewed publicity served well in this instance. The lesson learned from this successful defense of vital frequencies by a small, organized non-government group should not be lost upon radio amateurs and their societies.

[*To Be Continued*]

Tecraft Convertor [*from page 41*]

tially constant from day to day over extended periods and under varying environmental conditions.

The manufacturer's rating regarding sensitivity is .1 μv input for an output signal at least 6 db above noise; and 1μv for 20 db thermal-noise quieting. Our measurements, using more familiar terminology, indicated a sensitivity of 1 μv for 19 db signal-to-noise ratio, or .25 μv for 7 db S/N (a.m. modulated 30 percent with 400 c.p.s. tone). Fully modulated signals of .1 μv were easily readable. For s.s.b. and c.w. the readings were 1μv for 27 db s/n, or .1 μv for 7 db s/n. Although the rating methods are slightly different and in view of the fact that the very low-level output-calibration accuracy of signal generators used at 144 mc is seldom better than $\pm$ .1 or .2 μv, specifications and measurements are close enough so that both may be considered "within the ball park."

The overall gain was found to be 25 db. The range of the r.f. gain control was 20 db and no deterioration of noise figure was experienced as long as the r.f. gain was reduced to a point no more than 10 db below maximum. The i.f. output attenuator range was 25 db. Bandpass characteristics were within $\pm$ 1.5 db over the entire 4 mc range between 144 and 148 mc. I.f. signal rejection (14 mc) was —70 db.

The Tecraft Criterion converters offer a lot of value in the way of fine performance and convenient features. They should be attractive to both the neophite and the serious-minded v.h.f. amateur. The price tag is $54.95, with one crystal for 14-18 mc i.f. output. The manufacturer is The Equipment Crafters, Box 84, South Hackensack, N.J. ■

DX [*from page 66*]

ex-DL5HI	now W5LZG, Peter Grillo, 1214 Third Ave. N., Texas City, Texas.
EA8EN	Box 215, S. Cruz de Tenerife, Canary Islands.
EL2Y	American Embassy, Monrovia, Liberia.
ex-EP2AB	Mrs. Phyllis Denham, c/o Maj. John P. Denham, Det 4 USA ROTC Instr. University of Cincinnati, Cincinnati 21, Ohio.
EP2AU	APO 205, N.Y., N.Y.
ex-EP2DJ	Maj. John P. Denham (see previous address).
ET3GC	APO 843, N.Y., N.Y.
ET3JF	via DJ3GI.
F5AR	Robert Lefauconnier, Rue de la Justice, Toul, Met M, France.
FS7AA	via W5NDA.
G5KW/YI	via G2BVN.
G5KW/JY	via G2BVN.
HK5AOH	Box 1591, Cali, Colombia.
HKØAFC	via K8VDV.
HZ3TYQ	via HZ1AB.
K6OZL/KP4	James Hill, Navy 116, Box 36R4, FPO, N.Y., N.Y.
KH6BIH	via WA6MWG.
KJ6CC	Douglas Aircraft Radio Club, Box 130, APO 105, San Francisco, Calif.
KP4BFF	U. S. Navradsta (R), Bldg. #2, Sabana Seca, Puerto Rico.
LU2XL/9K3	Box 8112, Salmiya, Kuwait, Persian Gulf.
LU7GAJ	Martha V. Tirado.
LU4GAU	Gilberto Tirado-Romany, P.O. Box 134, Villa Angela, Chaco, Argentina.
LZ1SP	Box 319, Sofia, Bulgaria.
OD5AX	via W9YFV.
OH2BH/OHØ	via W2CTN.
OH2EQ/OHØ	via WA9AXX.
OH2BX/OHØ	via WB6AKZ.
OH2QV/OHØ	via WA9AXX.
OY8KR	via OZ8KR.
PY1BCR	via PYLBCR only, Box 58, Rio de Janeiro, Brazil.
PY1XW	Box 477, Victoria City, Brazil.
PX1BE	via POØBEA.
SVØWGG	via W5GMS.
SVØWKK	via K8WDC.
SVØWPP	via W5EGR.
TF2WIE	Robert Hartley CT2, Navy 116, Box 36R4, c/o FPO, N.Y., N.Y.
TF2WIU	via K5YAA.
TF2WIX	via WA9JWR.
TG9GZ	Danish Embassy, Box 25A, Guatemala City, Guatemala.
TI3AA	Box 4589, San Jose, Costa Rica.
VK9GC	via K7ADL.
VK9WP	via VK3 Bureau.
VP8HO	via KG6MA.
VR1B/A	via VK2EG.
VR1G	via W6BSY.
VR3O, VR3S	Operator "Martin" *only* via WA6AYU.
VR4EE	via K5HVW.
W9QMG/VP5	via W9QMG, Box 68, Granite City, Ill.
WA9JWR/ VO1	Bob Applegate, Box 12, Navy 103, c/o FPO, N.Y., N.Y.
all XE's	To avoid delays in receiving return QSL's from Mexican amateurs, it is suggested that you QSL direct rather than through the XE-QSL bureau.
YA1AN	via DL3AR.
YV5AIP	Box 8023, Caracas, Venezuela.
YV5BLQ	via W5ZBC.
4WID	via W2CTN.
5B4CZ	via W2CTN.
5X5JK	J. C. Carter, Box 181, Kampala, Uganda.
ex-601ND	Norm Duxbury, American Embassy, Bollzmanngasse 16, Vienna IX, Austria.
7G1IX	Box 477, Conakry.
7G1L	via W3ZBG.
9M2EV	via W7EMU.
9U5BB	via ON5KY.
9X5GS	G. L. Goodwin, Box 65, Kibuye, Rwanda.
9X5MH	via DL1ZK.

73, Urb, W2DEC

NEW! LAFAYETTE 10-80 METER DUAL-CONVERSION AMATEUR RECEIVER Model HA-350 with MECHANICAL FILTER for HIGH SELECTIVITY

99-2524WX

189.50

In the HA-350, Ultra-Sharp Selectivity is Achieved by Means of a True Mechanical Bandpass Filter in the 455 kc IF Section. The Filter Consists of 3 Sections—an Input Transducer, a Mechanically Resonant Filter, and an Output Transducer.

- **5 Ham Bands plus WWV**
- **Complete with Crystals for 80, 40, 20, 15 and 10 Meters**
- **Product Detector-Selectable Upper/Lower Sideband Reception**
- **100 Kc Crystal Calibrator and Crystal BFO**
- **12 Tubes**
- **"S" Meter**
- **Automatic Noise Limiter**
- Imported.

FREE!

LAFAYETTE
RADIO ELECTRONICS
1965 CATALOG No. 650

Over 500 Pages
Featuring Everything in Ham Gear from the "World's Amateur & Electronics Center

Mail the Coupon for your FREE 1965 Lafayette Catalog.

See the Largest Selection in Our 44-Year History:

BUY ON TIME—Use Lafayette's famous Easy-Pay Credit Plan . . . up to 24 Months to Pay

HAM GEAR . . . for receivers, transmitters, as well as the smallest accessory amateurs everywhere make Lafayette their headquarters for all their gear.

plus

CITIZENS BAND • STEREO HI-FI • TEST EQUIPMENT • TAPE RECORDERS • P.A. EQUIPMENT • TOOLS • BOOKS • and MUCH MORE

Lafayette Radio Electronics
Dept. CJ-4, P. O. Box 10
Syosset, L. I., N. Y. 11791

☐ $..... enclosed; send me # ..... (Prices do not include shipping charges).

☐ Send me the FREE 1965 Lafayette Catalog 650

Name .....

Address .....

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

For further information, check number 43, on page 110

OSCAR III *[from page 56]*

voltage readings. In Part II of this article it is planned to reproduce the calibration curves, and explain how observers on the ground can receive and decode the telemetry signals with a 2 meter receiver and a relatively inexpensive oscilloscope and audio oscillator.

Despite its important function in the satellite, the entire telemetry system, including the 25 mw transmitter, has been built as a sub-assembly unit which occupies less than 16 cubic inches. The transmitter will feed its own antenna extending from the side of the satellite.

Tracking

A third transmitter aboard OSCAR III, operating continuously on 145.950 mc, will serve as a beacon transmitter for tracking purposes. Similar to the beacon transmitters on OSCAR I and II, its signal will let the world know where OSCAR III is. The c.w. signals from this transmitter should herald the satellite's position as it first comes over the horizon, as it reaches PCA (point of closest approach to the observer), and as it moves away.

The tracking transmitter will also provide a continuous signal source for making signal strength measurements and other propagation observations. This transmitter, and the telemetry transmitter operating on 145.850 mc, bracket the 50 kilocycle segment which contains the output from the translator, and both provide convenient markers for locating the segment with ease.

The tracking transmitter has been designed for an output of 25 milliwatts. It will feed into its own antenna extending from the side of the satellite.

Power Supplies

Designing the power supply for OSCAR III was a major undertaking. The need for keeping the weight of the satellite down ruled against the use of heavy batteries, while the need for keeping the overall size down, limited the surface space available for solar cells!

The final power supply design represents a compromise; the main power supply consists of a specially cased silver-zinc primary battery with a 1.5 kwh capacity. This battery will power the translator and one of the beacon transmitters, which are expected to have a total power consumption of about three watts. This means that the battery should have enough power to keep the satellite active for 21 days. In addition, a small group of solar cells, mounted on OSCAR's surface, will provide partial power for the other beacon transmitter.

Antennas

OSCAR III will be equipped with four separate antennas, one extending from each side of the satellite. One antenna will be used for the receiving portion of the translator, and another for the transmitting portion. Each of the remaining antennas will be used with a beacon transmitter. Each antenna is a quarter-wave monopole type, using the satellite's surface as a ground.

The antennas are constructed of steel-rule type material, and will snap into position once the satellite is released from the launch vehicle. The positioning of the antennas are such that the translator's receiving and transmitting antennas are at right angle polarization to each other, as are the antennas used with both beacon transmitters. The radiation pattern of each antenna is expected to be approximately omnidirectional.

Heat Balance

As OSCAR III orbits in space, the satellite will pass from the sunlit part of the world into the earth's shadow. As it does so, the temperature on its outer surface will change from a high of about 150° F. to a low of approximately −50° F. Despite this extreme change in surface temperature, the temperature within the satellite must be held to a reasonably constant level. Without proper heat balance, high internal temperatures could cause component failure in the satellite's electronic system, while low temperatures could cause loss of transistor gain and premature battery failure. Besides these changes due to the satellite's orbit, heat generated from components within the satellite, mainly the transistorized linear amplifier, must be dissipated.

The heat control, or heat-balance, system for OSCAR III is based on information derived from OSCAR's I and II. The satellite's outer casing, made of light-weight magnesium, will be completely covered with an aluminum foil. The surface then will be striped with special paint which serves to adjust the heat flow, or temperature balance. The interior electronic assembly of the satellite will be completely immersed in an insulating material. This combination of material is expected to control the rate of heat flow within the satellite, and to control the heat conducted to the satellite's surface so that the internal package temperature is kept within safe operating limits. As the satellite passes in the sunlit part of its orbit, the materials on its surface will serve to regulate the rate of absorption of heat, so that during the illuminated portion of the orbit the heat lost during the "night" will be replaced. As the satellite passes into the dark side of its orbit, the insulation materials will retain heat to prevent the internal temperature from dropping to low values. This relatively simple heat balance system is expected to keep the internal temperature within safe limits for at least the three week period that the electronic equipment will be operating.

Part II

Part I of this article has described how the OSCAR III satellite has been designed and built, and gives a resumé of the translator, tracking and telemetry systems. Part II, scheduled to appear in next month's issue of *CQ*, will discuss the satellite's operational range, how to commu-

[Continued on page 92]

Immediate Delivery

The Newest Addition to the CQ Technical Series

Succeeding chapters are filled with ideas for:

- ★ Crystal Mounting
- ★ Changing Crystal Frequencies
- ★ Test Equipment And Its Use
- ★ Trouble Shooting
- ★ T-R Relays
- ★ Improving Your Phone Rig
- ★ Improving C.W. Operation
- ★ Receiver Hints And Modification
- ★ Ideas For Your Transmitter
- ★ Antenna Suggestions
- ★ Power Supply Tricks
- ★ Hints For VHF Equipment
- ★ Improving Mobile Operation.

Here is a collection of hundreds of hints, kinks and short cuts which should be part of the library of every experimenter ham and CB'er. A veritable gold mine that will help save you time, improve your shop technique, dress up your shack, and increase the efficiency of your equipment. A single one of these many, many suggestions may easily be worth the price of the entire book.

The first chapter is *loaded with hints to improve your workshop technique* in handling difficult soldering jobs, ticklish metal cutting and drilling problems, hints for preserving and making better use of your tools, and hints for many other shop practices which you run into day after day.

This brief description cannot begin to describe the wealth of material in this book. Under each of the main topics outlined above you will find a multitude of suggestions for easier or more efficient ways of getting the job done.

COWAN PUBLISHING CORP., BOOK DIVISION
14 Vanderventer Avenue
Port Washington, L.I., N.Y. 11050

Sirs: My check (money order) for $_____ is enclosed.
Please send me ____ copies of SHOP & SHACK SHORTCUTS

Name_____

Address_____

City_____ Zone____ State_____

New York City Residents Add 4% Sales Tax

PRICE: $3.95

SEND YOUR ORDER NOW!

OSCAR III [*from page 90*]

nicate through the satellite, what ground equipment will be required, how to track the satellite, scientific experiments that can be performed with signals from the satellite by observers who are not radio amateurs, and how to obtain a QSL card for a listener report, etc. The final installment will also contain up-to-the minute news as to the possible launch period for OSCAR III, and a complete bibliography of articles that have been written about this radio amateur space project.

[*To be continued*]

Step Attenuator [*from page 46*]

an a.c. meter (a.g.c. and a.n.l. off). Then, leaving the receiver set, add the *middle* 3 db step and turn up the noise generator until the a.f. noise output coincides with the initial meter reading. The noise figure is then read directly from the noise generator.

Other Applications

Elimination of Cross Modulation: Cross modulation in receivers due to high power signals may be eliminated by reducing the signal-level input to the receiver by means of the step attenuator. Although the r.f. gain control may be reduced to produce similar results, the a.g.c. action usually is thereby lost along with disabling of the S-meter.

The amount of attenuation needed will depend on individual situations and must be left to experimentation, but this may be quickly done, thanks to the rapid switching system of the step attenuator. It is recognized that the use of an attenuator will simultaneously knock down the desired-signal level, but the realization of more enjoyable readability under otherwise adverse conditions, make the arrangement worthwhile. Even without cross-modulation difficulties, the use of the attenuator when very strong s.s.b. signals are being received, can reduce the signal level to a point where severe a.g.c. pumping is eliminated and yet, where a reasonable amount of a.g.c. is still available. Background noise and QRM will be reduced at the same time along with the minimization of a.g.c. take-over by strong adjacent-channel signals.

A recent experience in respect to cross modulation was weird sounds produced in a receiver tuned between 3990 and 4000 kc due to cross modulation from strong teletype signals just above 4000 kc. Ten db of attenuation cured the trouble, yet left more than enough desired signal level from all stations.

Other uses for the step attenuator may suggest themselves, such as in connection with checking gain of an r.f. preselector, receiver i.f. bandwidth, a.g.c. characteristic relating to input signal level v.s. a.f. output, receiver gain between various bands, S-meter sensitivity, compression amplifier characteristics, receiver and overall transmitter linearity, etc. ■

CHICAGO AREA HAMS

Make Amateur Electronic Supply Your

COLLINS HEADQUARTERS

"DOC", W9HJS and this **OPERATING COLLINS DISPLAY** are waiting for you at our **CHICAGO STORE.** Stop in for **FREE** Demonstration.

Send Mail Orders and Inquiries to our Milwaukee Headquarters

AMATEUR ELECTRONIC SUPPLY
Dept. C, 3832 West Lisbon Avenue
Milwaukee, Wisconsin 53208
Ph (414) WE-3-3263

CHICAGO STORE HOURS

Mon., Wed., Thurs.: Noon to 9 p.m.
Tues. and Fri.: Noon to 5:30 p.m.
Saturdays: 10 a.m. to 4 p.m.

AMATEUR ELECTRONIC SUPPLY

6450 Milwaukee Ave., Chicago, Ill. 60631 • Phone RO-3-1030

For further information, check number 35, on page 110

Contest Calendar [*from page 68*]

will be used as check logs only.

We feel that keeping an accurate log and computing your score is part of contest operation. It is also the contestant's responsibility to check for duplicate contacts and country/zone multiplier.

And you fellows in far away places, don't worry about the deadline, we realize you have a problem and will take that into consideration.

Good luck, see you in the pile-ups.

73 for now, Frank, W1WY

Propagation [*from page 71*]

Time Zone: PST (24-hour Time)

WESTERN USA TO:

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

[*Continued on page 96*]

Propagation [from page 94]

Southern Brazil, Argentina, Chile & Uruguay	08-11 (1)* 11-14 (2)* 14-16 (1)* 06-08 (1) 08-10 (2) 10-12 (1) 12-13 (2) 13-15 (3) 15-16 (2) 16-18 (1)	06-07 (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)	21-04 (1) 00-03 (1)†
McMurdo Sound, Antarctica	07-09 (1)	15-17 (1) 17-20 (2) 20-01 (1) 05-06 (1) 06-08 (2) 08-11 (1)	23-06 (1)	*Nil*

SSB Transceiver [from page 31]

in center of coil form. Cover this with a layer of scotch tape. Connect the 2 wire ends to two of the terminals in the bottom plate. Wind 3 turns of #24 enameled wire on center of the 20 turn coil and connect the ends to the remaining two terminals on bottom plate. This 3 turn coil is connected to the 9 mc filter. The 330 ohm resistor can also be mounted in the i.f. can parallel to the 3 turn coil. Use only one slug.

For T_2 it is also necessary to remove both coils and disconnect both molded-in capacitors at the bottom plate. Wind a new coil with 20 turns of #26 enameled wire on center of coil form. Tap it at 3 turns from the cold end. Connect the ends and the tap to bottom plate terminals. Use one slug only.

For transformer T_7 remove one coil and use one slug only. Add capacity if necessary to cover 9 mc. This is also true for T_3, T_4, T_5.

The pi-network coil is made from Airdux 1 inch diameter stock that is both 20 and ten turns per inch. Count the turns from the junction of the 10 and 20 t.p.i. stock which is also the tapped point for the bandswitch. Cut off all but 7 turns of the 10 t.p.i. stock. This end ties to the 6DQ5 plate circut. Now, counting from the junction, cut off all but 20 turns of the 20 t.p.i. stock. The result is a coil almost 2" long with 27 turns, 7 of 10 t.p.i. stock and 20 of 20 t.p.i. stock.

Power Requirements

The power supply shown in fig. 3 can supply 700 volts at 250 ma, 260 volts at 125 ma, 0 to —50 v.d.c., 12.6 v.a.c. at 5 amps and 12 to 15 v.d.c. at 1 amp for control relays. A similar power supply circuit for mobile operation can also be assembled.

Adjustments

The alignment of this unit is pretty much standard and requires no special directions. The operation and tuning of the transmitter is simple too, except possibly for the setting of C_1 and C_2, the values of which have to be determined experimentally. The two crystals are supplied with the filter and their exact frequency must be adjusted so that the carrier falls on the —6 db point on the slope of the curve. Use of 1-12 mmf ceramic trimmers would simplify matters.

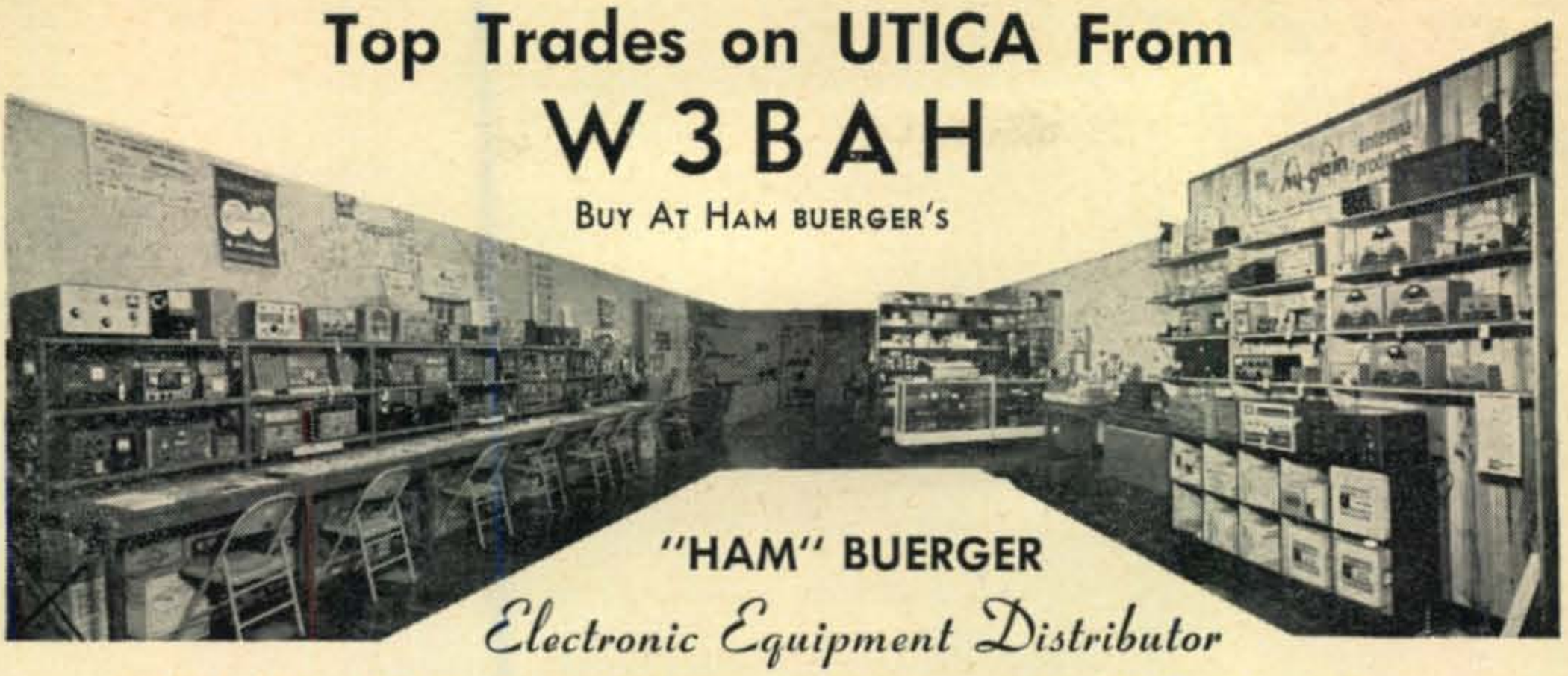
The simplest approach is to tune in an s.s.b.

Area Code 215 CApital 4-1740 Area Code 215 TUrner 7-7350

Top Trades on UTICA From

W3BAH

BUY AT HAM BUERGER'S



"HAM" BUERGER

Electronic Equipment Distributor

RICES MILL ROAD AT GLENSIDE AVENUE • WYNCOTE, PA., U.S.A.

Here's the New Improved . . . UTICA 650 6 Meter Amateur Transceiver and V. F. O.

$189.95

- Nominally rated at 22 Watts—input 100% modulated
- Built-in dual power supply for 117VAC and 12VDC operation
- Built-in adjustable BFO
- Built-in TVI filter
- Spot switch for frequency correlation
- 2 crystal sockets on front panel in addition to VFO socket
- Complete push-to-talk operation
- "S" meter and relative power indicator
- Transmitter indicator light
- Dual conversion superheterodyne receiver
- Series gated self adjusting noise limiter
- Adjustable squelch control
- Adjustable R.F. gain control
- VFO in separate cabinet

WE GIVE

S&H GREEN STAMPS

America's Most Valuable Stamps

For further information, check number 50, on page 110

Pre-tuned / pre-packaged IF strip

Model 8902 pre-tuned 455 KC IF strip provides excellent gain (55 db) and selectivity (6 db bandwith: 8 KC), No alignment is required. Included among the 21 components on the PC board are a mechanical filter, 2 transistor amplifiers and a diode detector capable of driving earphones. Overall dimensions: ½" x ½" x 1½".

Model 8901 input IF transformer adapts the IF strip for use with a converter in capacity detectors, AM and CB receivers. Both units are included for $5.75 net.

MILLER QUALITY PRODUCTS

NOW ON DISTRIBUTOR SHELVES

J. W. MILLER COMPANY

5917 SO. MAIN STREET • LOS ANGELES, CALIFORNIA 90003

For further information, check number 51, on page 110

station on 75 and adjust C_1 until the speech sounds most natural. This is, of course, only an approximate setting. Adjust C_2 for a signal on 20 meters.

Another method requires the use of an audio oscillator but is more accurate. Connect an r.f. v.t.v.m. at the plate of V_3; feed an audio signal into the speech amplifier and vary it from 20 to 5000 c.p.s. You can note the passband of the filter from the v.t.v.m. readings. Adjust C_1 and C_2 until the passband is positioned so that 250 cycles and 2500 cycles fall out at the -6 db point of the curve.

The bias for the 6DQ5 is adjusted for an idling current of 20 ma in the s.s.b. position of S_1. The plate current should rise to 100 ma on voice peaks with a meter of average damping. Actually this must be adjusted by setting the 8 mmf trimmer in the a.l.c. circuit (V_{4B}) while talking into the mike (do not whistle). If the plate curent is still too high, reduce the output of the speech amp by decreasing the value of the 330K feedback resistor connected between pins 1 and 6 of V_2.

When tuning up and loading out in the c.w. position the 6DQ5 plate current can be brought up to 190 ma. However, the 6DQ5 is very sensitive to prolonged operation in the off-resonance state. Tune up periods should be kept as short as possible.

An NE-2 neon bulb is connected from the plate line to ground as shown in the circuit, fig. 2. The two electrodes, the center pin and outer base shell, are tied together and the panel forms the outer electrode through the mounting capacity. This bulb can be used as a quick tune-up indicator.

To operate set bandswitch to the desired band. Set function switch S_1 to CW/TUNE (center position). Without key inserted, set push-to-talk button on microphone to transmit and adjust the DRIVER TUNING capacitor for maximum plate current. Tune the pi-network for proper loading and resonance. The plate current of 6DQ5 should run around 180 to 190 ma. Set switch S_1 to left or right position as desired and you are set for QSO's. Note that the proper setting for the DRIVER TUNING capacitor will be at the low capacity side on 20 and near the high capacity side on 80. Make sure that this circuit is not tuned to the v.f.o. frequency. This can easly be checked by watching the plate current meter. When in transmitting position with switch S_1 in sideband position (left or right hand) this meter should only indicate the idling current of the 6DQ5. ■

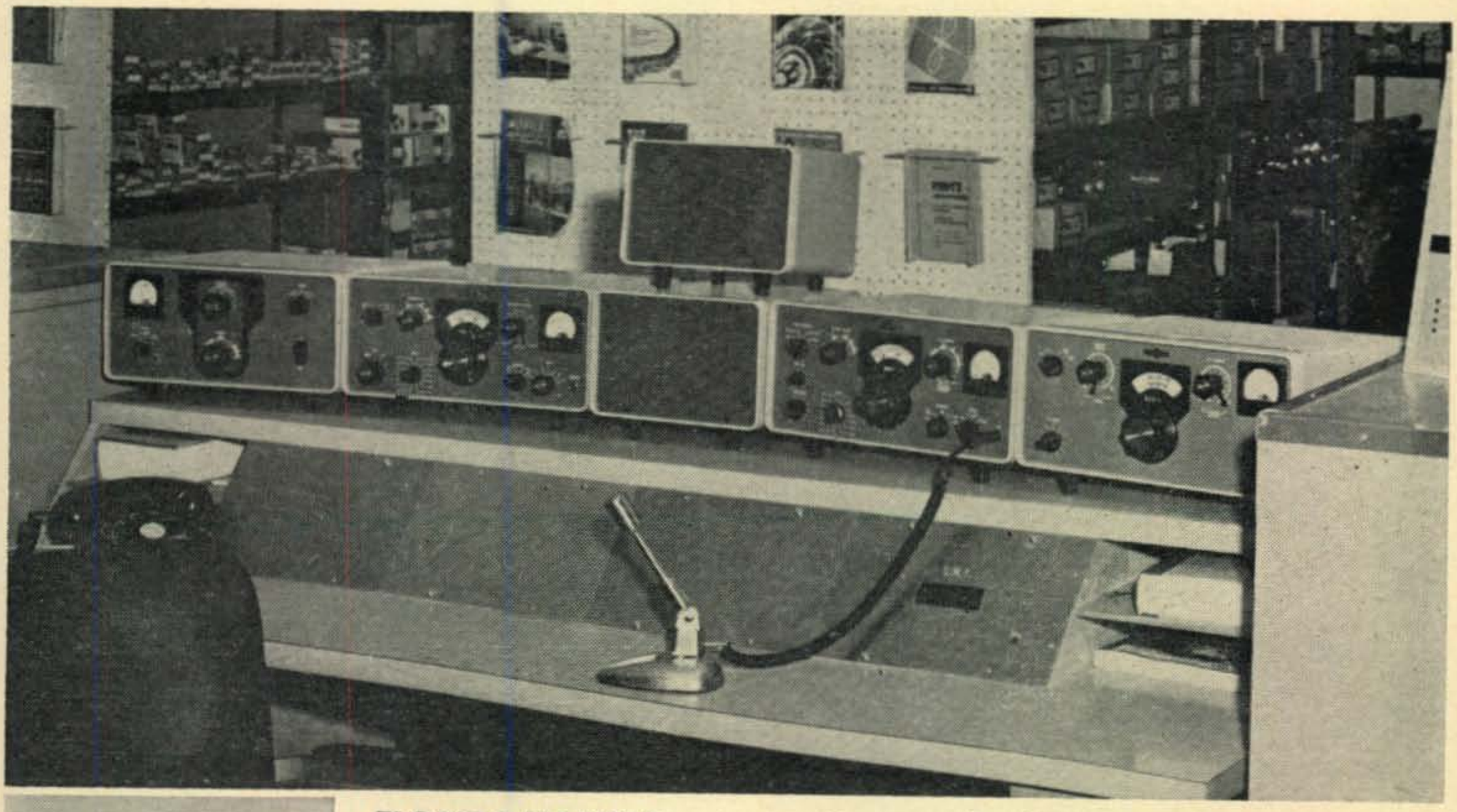
YL [*from page 83*]

in July *CQ*, as follows: Under Top Scores, YL c.w.—#2 should have been listed as WA6OET, Jessie Billon, with a score of 31,450. This would nudge KH6BTX, Gladys, into 3rd place, and means Jessie earned 2nd high score in *both* the phone and c.w. sections. Martha expresses apologies to all concerned.

Results 1964 YL VHF Contest

Also from W6QYL, here are the results of

FLORIDA HAMS
Make A.E.S. Your
COLLINS Headquarters



FLORIDA HAMS! Stop in or write me today for a TOP TRADE-IN QUOTE on any new COLLINS equipment. Pay just $5.00 down and take up to 3 years to pay. The OPERATING COLLINS display shown above is waiting to give you a FREE Demonstration. Hams not living in Florida should write our Main store at:

3832 West Lisbon Avenue, Milwaukee, Wisconsin, 53208

73's Phil K4ZKK (Mgr. Fla. Store)

19 AZALEA PARK SHOPPING CENTER
ORLANDO, FLORIDA

STORE HOURS

Mon., Wed., Thurs.: Noon to 9 p.m.
Tues. and Fri.: Noon to 5:30 p.m.
Saturdays: 10 a.m. to 4 p.m.

AMATEUR ELECTRONIC SUPPLY

For further information, check number 36, on page 110

the YL v.h.f. contest: Winner—W1HOY, Helen; 2nd—WA6AOE, Maxine; 3rd—K5RWR, Mary. So few YLs participated this contest will not be continued, but in its place there will be a v.h.f. section in the YL/OM Contest.

Silent Key

We are sorry to have to record the passing of Marie Helminski, W8MBI, in early July. Marie had been ill for some time, but served as publicity chairman for the Buckeye Belles' YLRL Convention committee until it became too great a task for her. Licensed in 1952, Marie was a member of the Toledo R.C. and the Toledo Mobile Radio Assn. Our sympathy to her OM, W8PXS.

At their installation ceremony in June new officers of the Los Angeles YLRC became Indian princesses for the day. The feathered headbands were lettered with officers' calls, and each corsage held a tiny Indian head complete with braids. L. to r., W6JCA, Betty, treas., holding leather bag of wampum (shells, beads, marbles, pennies, blue chip stamps!); K6ELO, Roxy, V.P., medicine lady, with container for sand (for making sacred sand paintings); W6QYL, Martha, president, princess of the tribe W6MWO (club call) (on table are her tomahawk, peace pipe, bow and arrow); WA6UBU, Esther, corres. secy, with tom tom (for communication if typewriter breaks down); WA6ISY, Myrtle, rec. secy, with replica of primitive drawings (lest she forget how to write). Mastermind for the ceremony was W6PJU, Mildred, who installed the officers.

Here and There

CHC YL Chap. #4 sponsors the CHC/FHC Worldwide Service Net which meets daily on 20 meters at 1800 GMT. Freq. for a.m. is 14,230 and s.s.b. is 14,340. All stations welcome to check in.

Congrats to K9QGR, Hazel, for the FB work she is doing in reading *YL Harmonics* contents on tapes to circulate to sightless YLs. Any who would be interested in having such tapes should get in touch with Hazel to be put on her mailing list.

Congrats to W3GTC, Carolyn, for serving as chairman of the communications net for AWTAR for her 6th straight year.

WA4FJF, Ellen, has reactivated the Floridora YL Novice net on 7185 kc on Thurs. at 1430 and invites all Novice and other interested YLs to check in with the Florida gals.

33—W5RZJ

READER SERVICE

NAME_____ CALL_____
(Please Print)

ADDRESS_____

CITY_____

STATE_____ ZIP CODE_____

Please send me more information on your ads in the Oct. 1964 *CQ* keyed as follows:

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77			Total Inquiries				

Void after Oct. 25, 1964

CQ MAGAZINE, Dept. RS

14 Vanderventer Ave.

Port Washington, L. I., N. Y. 11050

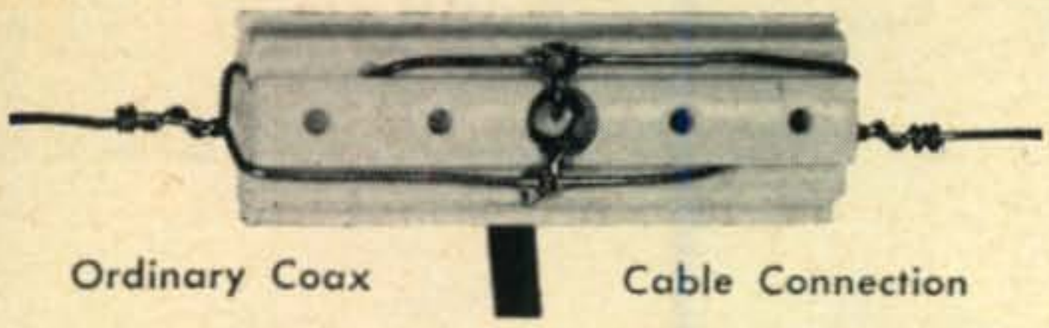
advertisers index

*Strain Axial Antenna Connector

SOLID PORCELAIN LOW LOSS STRAIN INSULATOR ANTENNA CONNECTOR

Will handle 1 Kw DC Input and 2000 Watts of P.E.P. (Will actually handle 5 Kw.)

Epoxy Cement Supplied for Coax Seal



Ordinary Coax — Cable Connection

Your Answer to All Antenna Problems. Coax Feed (see picture) — **Open Wire Line — Loading Coils** (for space problems) — **Balun Coils — Inverted "V" and many other Applications.**

Size 5" x 1¾"—Wt. 12 oz.

SIMPLE CONSTRUCTION

Send for Free Literature

COST **$3.00** POSTPAID

See Your Local Supplier or Write

YATTER LABORATORIES

BRADLEY BEACH, NEW JERSEY

*Patent Pending — SAM W2ENM

For further information, check number 61, on page 110

FOR SALE—Factory wired HT40 transmitter, Ameco nuvistor six meter converter with power supply, and HE30 rec kit. Will take best offer over $140. Larry Albert, 159 Princeton Ave. Buffalo.

FOR SALE model 28 teletypewriter, sending-receiving 60 wpm capable of 75 and 100 wpm, automatic typer console floor type, not tested used good $275.00 each. F. Agnello 575 10th Street, Brooklyn, N.Y. 11215.

WANTED: Instruction Manual for T9 Radar Tracker Radar Set AN/GPG-1 (XF-2) W6SHF, 3337 Birdsall Ave., Oakland 19, Cal.

HEATH Cheyenne mt-1 xmtr, ac supply, and mike, clean condition, will ship, $80.00 cash or best offer. R. Blakemore, Rt. 1, Box 168, Lot 53 Fort Walton Beach, Florida.

WANTED Inexpensive used gear for c.w. on 6. P. F. Bahnsen, Box 398C, Route 4, Fayetteville, N.C.

SELL Homebrew five-element, two meter beam. $3.80. Please include postage. Daniel Brandt, 6035 Acacia St., Los Angeles, Cal. 90056.

SELL OR TRADE: Hallicrafter SX-115 receiver $350. HT33A linear $350; Heath HX-10 Marauder SSB transmitter $250, professionally wired, all mint condition. D. M. Burns, 1663 Meriline Ave., Dayton, Ohio 45410. Phone 513-256-0345.

COLLINS 75A-3, 3.1 kc mech. filter, one owner, excellent condition, with manual $300. Frank Butler, W4RKH, 494 Elliott Road, Fort Walton Beach, Florida.

WØGFQ OFFERS YOU Hundreds of reconditioned equipment bargains. Write for Free Blue Book List. Samples: Galaxy 300 $229; Swan 140 $129; AF-67 $59; HT-37 $299; SX-101 $179; Valiant $199; Viking 500 $389; NC-125 $79; SP-600 $309; and Many More. Save Now. Write Leo, Box 919, Council Bluffs, Iowa.

VIKING II, 122 VFO, Globe Chief 90A, modulator, xtals, perfect SX-111. Send offers to WB2KDB, 351 Howe Avenue, Passaic, N.J.

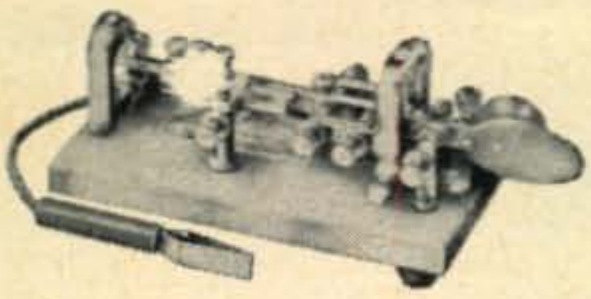
FOR SALE: 40 meter SSB Transxeiver, Collins Crystal Filter, P.T.T., V.F.O., power supply in Amplifier. All band Amplifier, 2-6146's, Monitor Scope, Metered, husky power supply. Both for $100. Hammarlund HQ-129-X, with speaker $75. College bound. Write for details. Timothy Moore, Callahan, California.

FOR SALE—31 issues of 73 Magazine, November 1961 to May 1964 inclusive. Not worth it but if you want them send $3.00 to pay for this ad and shipping charges to W4JA.

STOP paying high prices for QSL's. Add your call & handle to our low cost QSL's and you're in business. 250 for $1.50 or $1.00 for 150 cards. Haral Assoc., 133 Broadway, New York, N.Y.

SIX METER TECH STATION: Am forced to dispose of my beloved Clegg 99'er 50 mc transceiver after two years of faithful service. Worked (and confirmed) 31 states with this unit from the mobile! Price: $97.00 postpaid. Make it $110., and we'll throw in a completely transistorized speech clipper-compressor unit, used successfully in conjunction with the 99'er (designed by W6TNS). Will ship immediately on a first come basis: Bob Brown, Q2ZSQ, c/o CQ, 14 Vanderventer Avenue, Port Washington, L.I., New York 11050.

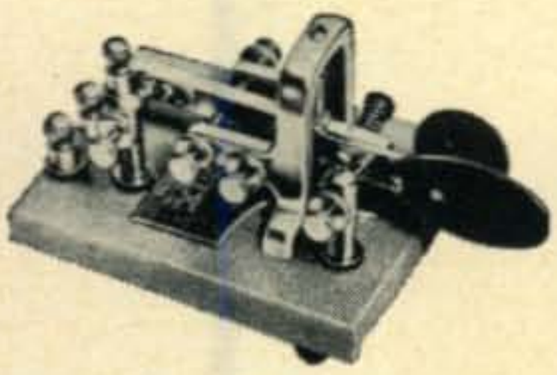
MAKES SENDING A PLEASURE With VIBROPLEX



No special skill required. Just press the lever — Vibroplex DOES THE REST. All parts precision machined and key is adjustable to any speed. Will not tire the arm. Five models, priced at $17.95 to $33.95.

VIBRO-KEYER

In building electronic transmitting units, Vibro-Keyer supplies the perfect part. With a finely polished base 3½" by 4½" and a weight of 2¾ lbs. Has same contacts and finely finished Vibroplex parts. Standard, at $17.95. DeLuxe, with Chrome Plated Base, priced at $22.45.



Order today at your dealers or direct.

THE VIBROPLEX CO., INC.

833 Broadway — New York 3, N. Y.

FREE Folder

For further information, check number 62, on page 110

LEARN CODE THE MODERN ATKO WAY

Either model will key your buzzer, oscillator or transmitter.

Model A complete as illustrated. **$49.50**

Model B identical to model A except contains no tone source or speaker. **$39.50**

AUTOMATIC TELEGRAPH KEYER CORPORATION

275 Madison Avenue, New York 10016

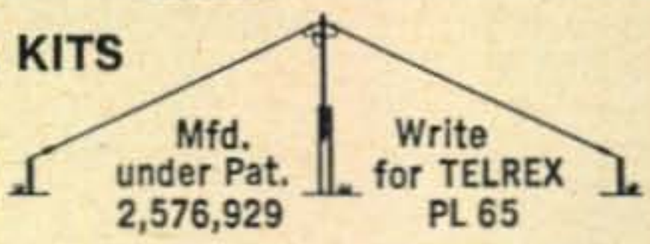
For further information, check number 64, on page 110

Telrex "BALUN" FED INVERTED "V" ANTENNA KITS

SIMPLE-TO-INSTALL, HI-PERFORMANCE ANTENNA SYSTEMS:

1 KW P.E.P. Mono-Band Kit . . . 1KMB1V/81K . . . **$16.95***
2 KW P.E.P. Mono-Band Kit . . . 2KMB1V/81K . . . **$21.00***

*Kit comprises, encapsulated, "Balun," copperweld, insulators, plus installation and adjustment instructions for any Mono-band 80 thru 10 Meters. Also available 2, 3, 4, 5 Band Models.



TELREX LABORATORIES
ASBURY PARK, NEW JERSEY

For further information, check number 63, on page 110

NEED MONEY for college this fall. Must sell entire rig. SR-150 with ac power supply, HA-1 keyer with key, Knight swr bridge. AR-22 Rotor, Bud low pass, TA-33 Jr., B&W antenna switch. All in excellent condition. (Make offer.) WA8ASV, 1211 Milbourne, Flint, Mich.

FOR SALE: TX-1 Apache. Also 40' self supporting heavy duty tower, phone patch. Local deals on TX-1 and tower. K1MTM. Call 828-4271, 1147 Wash. St., Manton, Mass.

IF WA2NHH and K9KIC will send a post card to the CQ offices we will send a free copy of the SSB Handbook by return mail.

WANTED 1945 issues of CQ magazine for CQ collection. Issues must be complete, including covers. Contact the CQ editorial offices concerning price and condition.

TOROIDS uncased 88 mh 60¢ each or 5/$2.50. Fasold, WA6VVR, Box 34, Dixon, California.

COLLINS 51J4 or 51J3 wanted. State condition, price. Phone collect P to P. Mike Ercolino W2BDS 201—775—7252.

SELL: NC-300 receiver w/calibrator. Excellent condx. $150. Write Box R, c/o CQ, 14 Vanderventer Ave., Port Washington, L.I., N.Y.

312B-3 SPEAKER Brand new. $22. Trades considered. Also have other equipment. Belvidere, Box 1103, New Britain, Conn.

TRADE—a complete set of peace silver dollars F to VF for a short wave receiver. W8EKK 3260 Wales Rd., Massillon, Ohio.

COLLINS—am wired kit $5.00! State Model! KWM-2 2 kc independent receive control $15.00! Kit Kraft, Harlan, Ky.

75A-4, excellent, two filters, $400; HT-32 $325; HT-41, used 10 hours $265; HT-45 (Loudenboomer Mark 11A) and factory supply. $400; Drake 1A, $135; Drake 2B, one mo. old, $210; TR-3, brand new factory sealed, $500; W8WGA, 3451 Ridge Ave., Dayton, Ohio 45414. Phone 513-277-0409.

COLLINS 75A-4 perfect condition. Finest receiver made. Will ship for $465. W9GXZ, 2113 N. Sherman Ave., Madison, Wisconsin.

SELL: Heath GR-18 superregen receiver, $20; Eico 723 transmitter, $35; Power supply 700/650 volts, 500 ma. (won't ship), $50; Homebrew electronic key and paddle, self completing, $20; Combination 25W modulator power supply, 350v. 200 ma., with carbon mike, $30. Tony Casciato, W3BMF, 729 Rosemont Ave., Pacific Grove, Cal. 93950.

COOL MOD. K.W. RIG. Fully metered, desk with built-in control panel, v.f.o., driver, Sp'ch amp., clipper, fone patch, pwr sup. in Bud Rack. excel cond. must be seen. xtras. Pickup, N.Y.C. $300. Egelberg, OL 3-1039.

SELL— Cheyenne Transmitter $50—Dynamoter P.E. 103A $20—ARC 7950 receiver broadcast band $15—BC 454B 8Q meter receiver $10—W2JPH, B. G. Emmerich, 118 Siwanoy Blvd., Eastchester, N.Y. Phone: DE 7-3174.

SELL: As new Johnson Thunderbolt. No modifications, ship in original packing, $325. Write. W7GYO, 1214 Beach Street, Maysville, Washington.

WANTED: Hallicrafters S-20 (not S-20R), S-21, S-22. Howard Hoagland Junior, 639 North Sierra Bonita Ave., Los Angeles, Cal, 90036.

FOR SALE: Wheatstone Perforator for c.w. tapes, model WPE-3 with wood cabinet. $75.00. Produces tapes for Boehme and ATKO Mini-Keyer. Brand new modification kit to convert WPE-3 perforators to WPE-18. Made by Teletype. $10.00 ea. Brand new wheatstone paper by LINK 30¢ per roll. Write Jack Hardman, K2MVR, 33 Laurel Place, Upper Montclair, N.J. 07043

CUSTOM BUILT Kilowatt with high level 600 watt modulator. Has nineteen G.R. Square meters and seven power supplies. A real ham power house. No reasonable offer refused. Hubert Ingalls, W1NQ, McCrillis Road, Nottingham, N.H.

COILS NEEDED! I need coil set for Central Electronics 200V in the "X" band to cover 2.5 mc to 3.5 mc or winding info needed. Write Robert L. Kennedy, K9DXB, Merom, Ind. 47861.

SALE or TRADE: HRO-M 5 coils $60; S-38-B work $10; Morrow Tri-Band $10. L. J. Kistler, 1505 E. Ford, Tampa, 10, Fla.

GARDINER CODE SENDER Type S, 22 tapes instructions, good condition, $25 postpaid. Melvin E. Kesner, KN3FXD, Accident, Md.

R-100 A RECEIVER. Perfect condition, expertly wired, $89. Dow-Key coax relay w/external contacts, $8. Dow-Key broadband pre-amp. $3. 7 novice crystals $2. Tim Kiser, K3RUR/6, Apt. 19-D, Escondido Village, Stanford, Cal. 94305.

FOR SALE: Wireless gear: deforest tubes; murdock condensers, loose couplers, honey-comb coils, 1016 transformers, etc., etc. What you want? W2DH

FOR SALE: Collins 8 Line. Thirty two S one. Seventy five S one Power Supply Speaker excellent condition. Five Hundred Dollars cash. W2KPT, Charles McKay, 85 Holland Ave., White Plains, N.Y.

MODEL 62 Nuvistaplug $15. Ex Signal Shifter with phase modulator $25. WØMGI 2095 Prosperity Ave., St. Paul, Minn. 55109.

SELL—Complete Station—Challenger xmtr—$70; HQ110A rcvr $195; All for $250. All in A-1 condition and perfectly aligned. Bob Miller, Obion, Tenn. 38240.

FOR SALE—Three 4-125 tubes used. One power transformer primary 110 or 220 secondary 3700-0-3700 at one amp.—two 10 hy chokes for above—will take best offer. Anthony Placzek, 30 Robinson, Webster, Mass.

WANTED: Commercial, Military, Alltypes, ARC, ARN, ARM, GRC, PRC, URR, URM, TS, 618S-T, 17L, 51R-X, APN, Others . . . ; RITCO, P.O. Box 156, Annandale, Va.

ELIMINATE MOBILE VIBRATOR NOISE. Revolutionary device outmodes noise-creating vibrator. Completely transistorized unit plugs directly into vibrator socket. No moving parts. Same size as vibrator. 12 Volts. Not a kit. Comes completely wired ready to use. For negative ground only. State make and model of transceiver. $11.95 ppd.—$5.00 deposit on all C.O.D. orders. Tel-Trol Systems, 2180 Bronx Park East, Bronx, New York 10462.

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 pad for your excess inventory (New only—Commercial Quantities). Metropolitan Supply Corp., 443 Park Avenue South, New York, NY. 10016, 212 MU 6-2834.

Wanted: Back issues of QST, 1925-Nov, 1924-Feb., 1923-April, May, Oct, Nov. Must be complete and in good condition. Send description & prices. K2EEK c/o CQ.

RTTY CHANNEL FILTERS. Octal mounted, tuned. Specify frequency. $3.00 each. WA6JGI, 3232 Selby Avenue, Los Angeles, California. 90034.

PERSONAL PROPERTY plaques for portable rigs with name and address deep cut engraved and black enamel filled on 1" x 3" solid brass, bronze, silver or gold finished plate, $1.50 each or 2 with same engraving for $2.50. Station call plates on same material 1" x 4" with ½" letters $2.50 each. 1½" x 7" with 1" letters $3.50 each. Custom engraving for custom built rigs, submit sketch for quote. Aladdin Engravers, Box 186, Short Beach, Conn. 16407

QSLs $2.00 per 100 postpaid. New style glossy 2-colors. Free sample. Hobby Print Shop, Umatilla, Fla. 32784.

SELL—Hallicrafter HA-5 vfo $60; Heath IG-102 rf signal generator $20 (Both used under two hours, excellent condition); CDR heavy duty rotor and accessories $20; Home Brew 120 watt 6 meter xmtr, plate modulated complete with 400 ma. power supply $75. WA2FRH, 227 North Jackson Ave., Endicott, N.Y.

FOR SALE: Heathkit Apache $170; SB-10 $70 (factory aligned); and HQ-110-C $150. WA2RFH 277 North Jackson Ave., Endicott, N.Y.

JOHNSON Invader 2000, $700. HQ 170C, $200. from estate of WA6BGS. Mrs. Eddy Quinn, 195 North Mollison, El Cajon, Cal.

TOWER, 38' wooden selfsupporting, see Jan. 57 CQ, may be disassembled for cartop transporting, $40. W2FVI, 57½ Lower Allen, Hudson Falls, N.Y.

WANTED: Buy or copy article from Dec. 1957, Sept. 1958 CQ magazine. Please write WA2UDK, 83 Sylvan St., Rutherford, N.J.

MICHIGAN STATE AMATEUR RADIO CONVENTION, Grand Rapids, 17th Annual, October 17th, 1964, Pantlind Hotel, Michigan's Best. Inquire Post Office Box 1333.

RTTY WANTED to receive and print news in isolated area. Will trade my KE93 less power supply. Like new condition. W6RIS, 526 Chino Canyon Rd. Palm Springs, Cal.

CHRISTIAN Ham Fellowship now being organized (non-profit undenominational). Christian Ham Callbook available $1. Details on fellowship write Rus Sakkers, W8DED, Box 218, Holland, Michigan.

SAM'S PHOTOFACTS—1-thru-246 in binders, plus 32 later issues in folders. Original cost near $600—will consider any reasonable offer. WA2TDD, Green Pond Road, Lake Telemark, Rockaway, N.J. Phone 201-627-3389.

FOR SALE: Viking Ranger in good condition, best offer over $100 plus shipping. KØGVH, O. R. Swift, Gilman, Iowa.

FOR SALE—Collins 75A4 receiver, serial #3265 plus matching speaker, in excellent condition. Best offer over $395. W4CBL, 5400 Susquehanna Drive. Virginia Beach, Virginia.

SP600JX17 receiver $350. HT-37 transmitter $300; HT-40 transmitter $30. Tapetone XC-5D six meter converter $20. Paul Gifford, 48 Abington Ave., Peabody, Mass.

B&W 6100 in sealed original box new $425. HQ170 Hammerlund $190. Communicator 11 two meters with mic and cables $115. W7HCJ E. 6904 Sprague, Spokane, Washington.

VALIANT TRANSMITTER, Match Box, Heath SWR, D104 mike, and Hammarlund HQ140X with speaker. Transmitting equipment 3½ years old and in new condition. Receiver in excellent condition with hardly a scratch on it. Also have custom built shot rifles, two K-Hornets and one 219 Donaldson. Describe fully what you may have to trade including guns. Send 50¢ for colored photos of guns. K4GBC, 436 Stratfield Court, Winston Salem, N.C.

SELL—Hallicrafters S-20R with Heath Q-Mult, $45. Heath "Tener" with 28.750 xtal, $35. Both Good Condition. K1YHK, 611 Taylor Avenue, Oradell, N.J.

COLLINS KWM-2 (Serial #11835) and complete mobile installation including noise blanker, mobile power supply, mobile mount, mike, antennas for five bands and speaker. Used very little—looks and works like new, but $600 less than new equipment. K6DL, 2758 Forrester Dr., Los Angeles, California 900064 (Telephone: Varmonth 8-9302).

FOR SALE—Gonset Communicator III complete with mike and book. Like new. Local sale only. $165.00. K2EEK, 75-15 177 St. Flushing 66, N.Y.

PRINTED CIRCUIT BOARDS Hams, Experimenters. Many different projects. Catalog 10¢. P/M Electronics, Box 6288 Seattle, Washington 98188.

HAMS Convert any television to sensitive, big-screen oscilloscope. Simple changes. No electronics experience necessary. Illustrated plans, $2.00. Relcoa, Box 10563, Houston, Texas.

WASHINGTON Amateur Radio News. Free copy. Foundation for Amateur Radio, 2509 32nd St., S.E., Washington, D.C. 20020.

WRITE for free lists of finest reconditioned amateur equipment. Guaranteed. On approval. Time payments. Buy the best for less. Henry Radio Company, Butler, Missouri.

TOP PRICES paid for AN/GRC-3 thru 9, GRC-26, 27 to GRC you name it. AN/URM, UPM, USM, SG-1, 2, 12, 13, any and all mil test sets. GR, HP, Meas. Corp, Boonton, ARC, Tektronix, all commercial sets, AN/ARC-27, 33, 34, 44, 52, 58, 65, etc. R-390, 389, 388, SP-600, BC-610, T-368, We pay shipping. Call, Write, Visit our store. Tech. Systems Corp. 42 W. 15th St., New York 11, N.Y. Call Ed. Charol, CH 2-1949.

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.

COMMUNICATIONS teletype, unusual surplus bargains. Free flyer, MDC, 923 W. Schiller, Phila. 40, Pa.

ANTENNA tuning unit, brand new $3.00 postpaid (cost Navy $85.00). MDC, 923 W. Schiller, Phila., 40, Pa.

REMOTE CONTROL unit, 9 tubes, AN/ARW-26, brand new, complete, $5.00 postpaid (cost Navy $125.00) MDC, 923 W. Schiller, Phila., 40, Pa.

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.

ATTENTION RTTY'ers. Typewriter ribbon re-inking device–$3.00 postpaid! WØAJL–Walter E. Nettles, 201 So. Eudora St., Denver, Colorado, 80222.

FREE Electronics parts catalog. Bargains. Save. Power transistor 2N155, $1.00. Western Components, Box 2581, El Cajon, California.

ARE YOU LOOKING for New Ham or CB gear? We have closed one of our stores and have many specials in over-stocked new equipment which might be just what you have been looking for at a price which is exceptionally low. Please inquire specifically your interest and we will quote a surprising stock reduction price. Graham Radio, Dept. BB, Reading, Mass.

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.

JOYSTICK See July **"CQ"** p75. Watch future ads in **"CQ."**

COLLINS 75A owners, Tuning Knob, 6 to 1 reduction, $7.00 postpaid. **W4VOF**, 1517 Rose Street, Key West, Fla.

RTTY Channel Filters. Octal mount, tuned. Specify frequency. $3.00 each. WA6JG1, 3232 Selby Avenue, Los Angeles, California 90034.

JOYSTICK Pending internal merchandising arrangements please order direct to Partridge Electronics Ltd., 7 Sowell St., Broadstairs, Kent, England.

Novices, Let's Go General. Free Copy of this published article and details of my Pictorial Study in radio theory. Dwight Cross, 1212 Lynch Street, St. Louis 18 Missouri.

CANADIAN "HEATHKITS" Assembled at reasonable cost. Send for List. Howard, 43 Roxborough Street, West Toronto, Canada.

SURPLUS GOODIES: ARC-1 $25.00. ARC-2 $45.00; ARC-3 Transmitter $12.50. ARC-3 receiver $16.50. T.23/ARC-5 $12.50. Collins ART-13 transmitter $35.00. BC-639 VHF receiver with AC/PS $75.00. BC-779 Super-Pro with AC/PS $65.00. APX-6 transpondors $9.50. RBL 15kc-600kc VLF receiver, built-in 115V/60 cycle power supply. The best VLF in surplus $85.00. RBM-4, 2-20 mc with AC/PS $35.00. S-36 receiver 28-150 mc am/fm $60.00. BC-620 transceiver $15.00. R-256/URD-2, 100-156 mc 115v/60 cycle v.h.f. direction finder receiver witn built-in position scope $75.00. Command transmitter 3-4 mc $7.50. 4-5.3 mc $7.50. 5.3-7 mc $7.50. 7-9.1 mc $14.50. BC-1031, 455 kc panadaptor $65.00 Slep Electronics Company, drawer 178C, Ellenton, Florida. Phone 722-1843.

JOYSTICK, Cave dwellers, Cliff dwellers. Your prayers are answered. Send only $18.15 to Partridge Electronics Broadstairs England for complete DX antenna system by return mail. Just stand it in the shack, connect to TX (or RX) and fire away all bands 160 thru 10, CB Mars frequencies. Money back guarantee.

••••BARRY ELECTRONICS••••

UTC Type F-3898 Plate Xfmr: Pri: 115 or 230 VAC @ 50/60 CPS. Sec: 5800 VCT @ 1 Amp. (2.1 to 2.9 KVA) 150 lbs packed. New **$110.**

Collins 51J-4 Receiver: .5Mcx. continuous through 30.5 Mcs. Good cond. with 2 filters. (3 and 6 Kc.) **$750.**

Millen 3" Mumetal Shield for 3" cath-ray tubes.**$2.75.**

Choke 5 Hys. @ 1.7 Amps DC. Mfd by **Thermador.** Resistance only 21 Ohms. **$24.50.**

ACRubber-Covered Power Extension Cord (UL Approved)–Brand new and grounded. **$2.95** for 50 feet. **$1.95** for 25 feet.

Multimeter AN/PSM4C: 20,000 Ohm/V. Up to 5 KV DC. Up to 1 KV AC. DC Amps: 0-1,000 Ma./0.2 A. Up to 100 Megs. Brand new. *(orig. cost $135.00)* With book and accessories–New only **$65.**

Dow-Key DK2-60B New Coax Transfer Switch: For switching Power Amplifier in and out between exciter and antenna. 1 KW. 115 VAC/52 Ohms. **$19.**

Air Dux PI#195-1. 500 W (mfd by Illumitronix). **$7.35**

Ameco Model PCL Nuvistor Cascode Preamp. 20 db more gain. 6 thru 160 Meters. Improves performance on all receivers. **$24.95.**

SALE! Cablemaster Carballoy Cutting Tool–Cuts copperweld, steel wire, etc. **$4.48.** *20%* Off on Current Ham Net prices on the following equipment *(for CASH . . . no swaps)*: **Hammarlund** HX-50, HXL-1, HQ-110AC, **Johnson** Viking Ranger II (Wired), **Clegg** Zeus, **Clegg** Interceptor, **RME6900, National** NC-400, NCX-3 (with AC or DC Pwr. Supply), **Ameco** TX-86, PS-3 for TX-86). **Telex** Boom Mike with Dual Headset, Type BCW-02. **$25.**

Special 2Mfd @ 7500 VDC Oil Capacitor. **$13.50.**

Millen #39005 Univ. Joint Coupling for ¼" Shafts **.33¢**

IN STOCK *ARRL HANDBOOK* **$3.50. Radio Amateur Call Book**–*USA*–**$5.00;** *Foreign*. **$3.00.**

National R-175A High power FR Choke. **$3.25.**

SILICON RECTIFIERS: 400 PIV @ 750 Ma. @ **.30¢** each; 600 PIV @ 750 Ma. @ **.36¢** ea.; 800 PIV @ 750 Ma. @ **.56¢** each.

B & W Vacationer Portable Window Antenna. 2-20 Meters. **$19.95.**

Antenna Insulator Sale: 4¼"L x ½"Dia. @ **.10¢;** 7½"Dia. @ **.15¢;** 6⅛"L x ¾"Diameter @ **.20¢.**

Alliance Type U-100 Antenna Rotor **$25.**

CDR Ham "M" Rotor. Sld carton **$110.**

Tiny-Tiger. 300 Watts. 115 VAC Gas Oil Generator. Brand new boxed. Puts out 12 VDC @ 12 Amps for Battery Charging. **$59.**

Tung-Sol Deluxe Transistorized Ignition System for 12 or 6 Volt system. Orig. Carton. With instructions. **$22.**

Westinghouse OZ-PAK KW Sil. Rectifier Unit. **$69.50**

Compact 125 Watt Modulation Xfmr. $3.95. 115 VAC Squirrel Blower Assembly. 2¼" Air exit. **$6.95.**

In Stock: **Zeus** 3 KW Port. Elect. Power Plant. **$431.25.**

Collins R389/URR. 15 to 1500 Kcs Digital Readout. Motor or hand tuned. Like-new cond. With book. *(a $3,000.00 value)*. Special–**$850.**

Hallicrafters HT-32 SSB Excitor. Xlnt cond. **$315.**

IT'S **BARRY** *FOR TUBES . . . . .–TUBE HEADQUARTERS OF THE WORLD! . . .–Direct Factory Distributor for* **Eimac, Westinghouse,** etc. **BUY YOUR TUBES** at *BARRY* for real saving and but at *Barry* for real quality. Write for latest list or call for quotations. We can ship immediately by air. Separate export dept. for overseas and Canadian orders. Once Tried . . . Always Satisfied . . . It's quality first. Best, biggest, Most Diversified Tube Stock there is. Try us and see. Tubes for Hams, Industry and Radio Stations our specialty. Let's hear from you.

COME IN AND BROWSE. MONDAY TO SATURDAY–Thousands of items that we cannot list in an ad. MON. TO FRI. 9 to 6. SATURDAYS 10 to 2 PM (Free parking on Street Sat.) Mon. to Fri. parking lot 501 Broadway,

BARRY ELECTRONICS DEPT. CQ-10
512 BROADWAY, NEW YORK 12, N. Y.
WALKER 5-7000 (AREA CODE 212)

☐ Enclosed is money order or check and my order. Prices FOB NYC. Shipment over 20 lbs. will be shipped collect for shipping charges. Less than 20 lbs. include sufficient postage. Any overcharge will be refunded. Fragile tubes shipped via Railway Express. Minimum order $5.00. (Any orders under $5.00 add 50¢ service charge)

☐ Send copy of new 64-page 1964 "Green Sheet" Catalog #14.

☐ Send information .....

☐ I have available for trade-in the following .....

.....

Name ..... Title

Company .....

Address .....

City ..... State .....

For further information, check number 28, on page 110

Ham Shop

Rates for the Ham Shop of 5¢ per word for advertising which in our opinion, is non-commercial in nature. A charge of 25¢ per word is made to all commercial advertisers or organizations. Since we do not bill for Ham Shop advertising, full remittance **must** accompany all orders.

Closing date is the 15th of the 2nd month preceding date of publication. Your copy should be typewritten, double spaced on one side of the page only.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein. We reserve the right to reject advertising which we feel is not of an amateur radio nature.

QSL's? WPE's? CB's? Finest samples 25¢. DeLuxe 35¢. (refunded). Sackers, W8DED, Holland, Michigan. (Religious QSL samples 25¢.)

CREATIVE QSL CARDS free, new catalog and samples. Personal attention given. Wilkins Creative Printing. P.O. Box 787-2, Atascadero, California.

QSL's Samples free. Little Print Shop, Box 9363, Austin, Texas.

QSL's . . . $1.90 . . . Dime . . . Filmcrafters . . . Martins Ferry, Ohio

RUBBER STAMPS for QSL Cards. Kits available. Free sample impressions. E & R Stamp Co., 50 Gerald Rd., Rantoul, Illinois.

QSLs At last! Something new in QSL cards! All orginal designs. Send 25¢ for samples. Yarsco Box 307, Yorktown Heights 2, N.Y.

Q-STAMPS Now $1.50! Postage stamp size photographs for QSL's! 50 large or 100 small, $1.50 per gummed-backed, perforated sheet. Free Samples. Q-Stamps, Box 149, Dept. 4A, Gary, Indiana. 46401.

QSL's Samples 25¢. Rubber Stamps; Name, Call, Address, $1.55. Harry Sims, 3227 Missouri Avenue, St. Louis, Mo. 63118.

QSL's—Brownie, W3CJI—3111 Lehigh, Allentown, Pa. Catalog with samples, 25¢.

QSL's 100/$4.00 High gloss, three color. Free samples, quick service. B&R Printing, Box 8711, Orlando, Fla.

QSL's, CB, WPE samples 10¢. Nicholas & Son Printery, P.O. Box 11184, Phoenix, Arizona. 85017.

QSL CARDS Largest selection-Lowest prices. Samples & catalog, 25¢. Refund or 25 extra cards with your first order. Debbeler Printing, 1309-C North 38th Street, Milwaukee, Wis. 53208.

QSL's-SWL's or what have you. You name it and we will do it for you as you wish. Expert art work at nominal cost, enough said? R. McGee, 6258-103rd St., Jacksonville, Fla. 32210.

PICTURE of yourself, home, equipment, etc., on QSL cards, made from your photograph. 250—$7.50 or 500—$10.00 postpaid. Samples free. Write to Picture Cards, 129 Copeland, LaCrosse, Wis.

QSLs SWLs XYL-OMs (Sample assortment approximately 9¾¢) covering designing, planning, printing, arranging, mailing, eye-catching comic, sedate, fantabulous. DX-attracting. Protopay, snazzy, unparagoned cards. (Wow!) Rogers, KØAAB, 961 Arcade St., St. Paul 6, Minn.

QSLs free samples. Fast service. Bolles, 7701 Tisdale, Austin, Texas.

RUSPRINT QSLs—SWLs 100 2-color glossy $3 postpaid. QSO file cards $1 per 100. Rusprint Box 7507, Kansas City, MO. 64416.

QSL's 3-color glossy. 100 $4.50. Rutgers Vari-typing Service. Free Samples, Thomas Street, Riegel Ridge, Milford, N.J.

CALL CARDS Badges, decals, goodies, illustrated literature with samples 25¢. Errol Engraving Att: K1VRO, Westfield, Mass.

QSLs Samples, dime. Print Shop, Corwith, Iowa.

QSL CARDS $2.50 per 100 in three colors. Samples and catalog free. Garth, Box 51C, Jutland, New Jersey.

QSL CARDS. As low as $2.50 per 100. Samples free. Radio Press, Box 24C, Pittstown, New Jersey.

NEW! Unusual QSL's. Free samples. Johnny, P.O. Box 3554, Austin 4, Texas.

EYEBALL QSL's—500 $2.99, 1,000 $3.99, delivered. Fit wallet or purse, size 2" x 3½". Samples free. Western, 3108-1 X St., Sacramento, Calif. 95817.

C.B.—WPE—QSL's. Christmas Designs. Catalogue-samples 10¢. Longbrook Press, Box 393-Q, Quakertown, N.J.

BARGAINS . . . GERONIMO . . . Buy, Sell, Trade Electronic Equipment. Ham, CB, test gear. Free copy HEED directory. No postcards, please . . . WA2NHH, 1225 Hillside Place, North Bergen, N.J.

PLASTIC CALL SIGNS. Baisden Specialties, Box 6174, Savannah, Georgia.

Novice [*from page 82*]

that is needed is a klystron for the band and I'm on. The problem is that there is no one on those bands except during the contests periods. Exciting low bands???

"73 and keep on plugging u.h.f. and v.h.f. Sincerely Jim. . . . age 13."

Jim, there must be a few of all kinds to make our hobby as interesting as possible. Let's be glad that every one doesn't try u.h.f. although there is room for many more on the u.h.f. bands. We won't be able to talk to a new city or state unless some one is there and on the air. When we get the right kind of people on the bands, then and only then will records tumble. Encourage this with our own efforts.

Help Wanted

If you could read some of the letters and personal comments that we (you and I) receive about the help we are able to render through the pages of this column and your helping hand, you would take a bow. My thanks to any and all of you that take the time to help those less fortunate than we. Here is a new list of hopeful aspirants.

Marvin L. Howe, 7447 Iaa, Wichita, Kansas, 67216, wants help with code and to give the test. The phone is JA 4-8515.

Don Carter, 2890 Sand Creek Highway, Adrian, Michigan. Phone: 265-7828 needs help with code and theory.

John Hess Jr., 635 Plymouth Avenue N., Rochester, New York needs help with code and theory.

If you need help with any problem write it down and if I can answer them I will eventually get around to answering, if not, I will put your name in the column and then you have the world wide amateur fraternity to help. Please send a stamped self addressed envelope for any letter requiring a personal answer.

73, Walt, W8ZCV

Fairy Tale [*from page 35*]

card: "I have an advanced stage of the same malady. Your son was bitten by a *Scorpius Rundfunkus* (a radio bug to you). There is no cure. Temporary respite can be effected by attaching complex electronic gear to both his hands for certain periods of time. After these treatments he will speak for brief periods, but the malady always returns, and the treatment must be repeated again and again. By the way, what is your son's name?"

"Hamlet" answered the father, "or Ham for short."

And that, kiddies, is how the first Ham got bitten by the radio bug. ■

75S-2 on 160 [*from page 42*]

reading from 1.8 to 2.0 mc. for 160 meter use. As I had a 4.555 mc crystal on hand I shoved it into the 2A socket and thus tuned from 1.4 to 1.6 mc in the broadcast band. The preselector does not tune so well here and the filters don't do a thing for rock and roll, but at least I can get news and weather!

After using this setup for a few months I have decided that it would have been better to have used larger capacitors at S_3 and S_4, allowing better response of the preselector on the lowest segment but at the time I was thinking more of the top segment of 160 where I have hung out for many years. The general operation compares quite well with the old 75A-4 and I'm sure that this isn't bad. ■

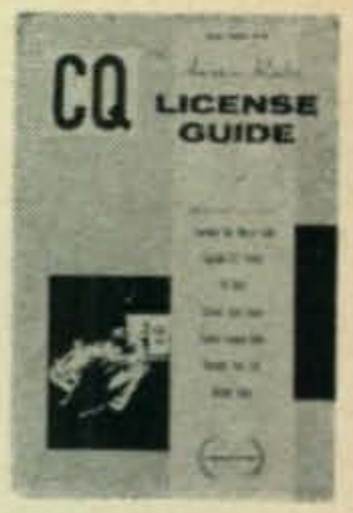
CQ TECHNICAL BOOKS

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.

THE NEW RTTY HANDBOOK

A treasury of vital and "hard to get" information. Loaded with equipment schematics, adjustment procedures, etc. A valuable asset to both the beginning and the experienced RTTY'er. Special section in getting started, all written by Byron Kretzman, a well known authority in the field. First printing sold out. Second printing on hand.

CQ ANTHOLOGY II

Top favorite CQ articles from 1952 to 1959 . . . including some you may have missed . . . compiled into one new information-packed book! No more need to try to locate sold out back copies of CQ. This Anthology includes past articles of lasting interest to every amateur radio enthusiast. Over 250 pages of text. Over 75 different articles. A definite Must for your shack!

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.

COWAN PUBLISHING CORP.
Book Division
14 Vanderventer Avenue
Port Washington, L.I., N.Y. 11050

CQ ANTHOLOGY I	$2.00	☐
CQ ANTHOLOGY II	3.00	☐
ANTENNA ROUNDUP	3.00	☐
SIDEBAND HANDBOOK	3.00	☐
VHF FOR THE RADIO AMATEUR	3.50	☐
SURPLUS SCHEMATICS	2.50	☐
CQ LICENSE GUIDE	2.50	☐
"NEW RTTY HANDBOOK"	3.95	☐
MOBILE HANDBOOK	2.95	☐
ELECTRONIC CIRCUITS HANDBOOK	3.00	☐
UNLIGHTED GLOBE	19.95	☐
ATLAS	15.00	☐
CODE RECORD	3.50	☐
REGULAR LOG SHEETS (100)	1.00	☐
SSB LOG SHEETS (100)	1.00	☐
HAM'S INTERPRETER	1.50	☐
TVI HANDBOOK	1.75	☐
BINDER—YEAR WANTED	4.00	☐
DX ZONE MAP	3.00	☐
DIODE SOURCE BOOK	2.50	☐
USA-CA RECORD BOOK	1.25	☐

SIRS: My check (money order) for $_____ is enclosed. Please send the following items to:

Name_____

Address_____

City_____ Zone_____ State_____

New York City Residents add 4% Sales Tax

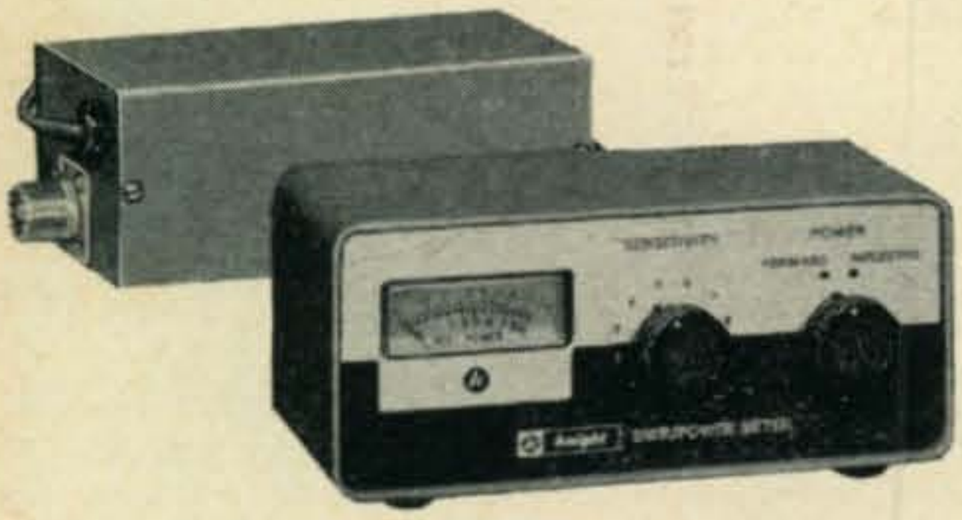
from ALLIED

now at a new low price!

knight-kit® 150-Watt AM-CW Transmitter!

GET TOP WATTS-PER-DOLLAR

- 150 Watts Peak AM/CW Input on 80 Thru 10-Meter Ham Bands
- Controlled-Carrier Modulation for Maximum Audio
- Stable VFO with Planetary Drive, "Spot" Switch
- Clean, Chirpless Keying—No HV Across Key
- Thorough TVI Shielding, Filtering, Bypassing
- Adjustable Pi-Network for 40 to 600-Ohm Antennas



Popular P-2 SWR/Power Meter Kit

ONLY **$15.95**

Now! Get the most from your transmitter and antenna! This easy-to-build "in-line" SWR/power meter measures relative power fed to antenna and standing waves reflected back from it. Lets you make your own matching adjustment between line and driven elements for maximum RF. Features flexible two unit design (coupler and indicator units) with 4-foot shielded connecting cable; has coax connectors; full KW capacity; can be left in line as constant monitor; reads SWR from 1:1 to 20:1; accuracy better than 10%; negligible insertion loss; for unbalanced 50-72 ohm lines, Amateur and CB; range from 1.8 to 432 mc; has sensitivity adjustment; no AC power or batteries required. Coupler, 2 x 5 x 2½"; indicator, 2⅞ x 6¼ x 3". Complete with all parts and instructions. Shpg. wt. 3 lbs. **$15.95**

83 Y 627GA. P-2 Kit, only .....

83 Y 546GA. As above, but factory-assembled **$19.95**

T-150A 150-Watt Transmitter Kit

ONLY **$99.95**

only $5 down

Latest version of the rig acclaimed by satisfied owners everywhere. Loaded with features to put out a solid signal that really punches thru the QRM. Controlled-carrier screen modulation for fine audio quality with negligible distortion, plenty of mike gain and top "talking power." Rock-stable VFO, fully calibrated for 6 bands, has illuminated scales, backlash-free planetary drive, and spot switch to let you "zero-in" without putting a signal on the air. 4-stage simultaneous-cathode keying circuit offers clean CW for break-in work—ideal for contests, traffic and DX chasing. Peak AM/CW inputs, 150 watts on 80 thru 10 meters. 20 watts output on 6 meters. Other highlights: Single-knob band-switching, adjustable pi-network for 40 to 600 ohm antennas; VR tube in B+ of VFO oscillator; buffer stage for isolation; standby, remote standby and power takeoff plugs; power supply using 2 silicon diodes in full-wave voltage doubler (saves filament power and eliminates heat); heater/plate voltage takeoff to power auxiliary gear, plus 117 v. for antenna relay; PCIM mike connector; key jack. With all parts, wire, solder instructions and handsome gray satin metal case, 8½ x 17 x 10½". Less mike, key, crystals. For 110-125 v. 60 cycle AC. 35 lbs.

83 YU 409GA. T-150A Transmitter Kit, only **$99.95**

PRAISED BY THE LEADING HAM JOURNALS!

satisfaction guaranteed or your money back

Use the ALLIED Credit Fund Plan—(over 24 months to pay)

ORDER TODAY FROM

ALLIED RADIO

ORDER TODAY

ALLIED RADIO
100 N. Western Ave., Chicago 80, Ill.

Ship me the following:

- ☐ T-150A Transmitter Kit 83 YU 409GA
- ☐ P-2 SWR/Power Meter Kit 83 Y 627GA
- ☐ P-2 SWR/Power Meter Assembled 83 Y 546GA

$ .....enclosed (check) (money order)

☐ Ship on Allied's Credit Fund Plan

Name_____
PLEASE PRINT

Address_____

City_____ Zone____ State_____

For further information, check number 44, on page 110

Announcing an extraordinary achievement in amateur radio

THE NATIONAL HRO-500 RECEIVER

The National HRO-500 is the result of thirty years of "improvement of the breed" From the first HRO *Senior* of 1933 to the present, the HRO series has been almost legendary. The HRO-500 continues this proud tradition, and incorporates important technological advances resulting from National's leadership in the field of solid state physics, frequency standardization, and frequency synthesis.

By any criterion, the HRO-500 is extraordinary.

1. Design Concept: The HRO-500 is totally solid state. Frequency is determined by a phase-locked crystal synthesizer* feeding a VFO-controlled tunable IF. Similar circuit techniques are found only in advanced military communications equipment.

2. Reliability: The use of transistors throughout assures amazing reliability as a result of their enormously long life and minimum heat generation. The HRO-500 is hand-wired . . . compact . . . but *not* miniaturized.

3. Versatility: The HRO-500 may be operated anywhere . . . from flashlight cells, 12 volt car battery, or from 115V/230V 50/60 cycle sources. Total battery drain is less than that required for two dial lamps.

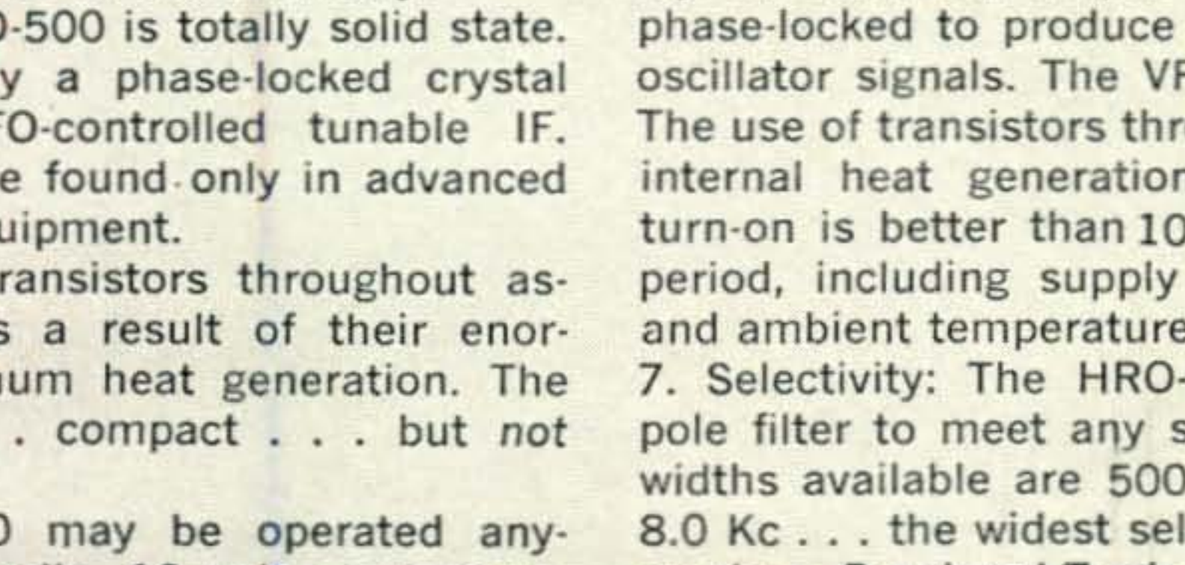
4. Frequency Coverage: *The HRO-500 covers the entire VLF through HF spectrum* . . . Five kilocycles through 30 Mc. in 60 synthesized 500 Kc bands, with equal stability and dial accuracy throughout its tuning range. No need to confine operation to ham bands only . . . the HRO-500 provides total coverage of MARS, commercial, foreign broadcast, marine, VLF communications, test and experimental frequencies. All required heterodyne frequencies are generated by the frequency synthesizer.

5. Dial Calibration and accuracy *over the entire tuning range* is one kilocycle, employing a linear VFO and National's famous PW epicyclic dial mechanism. 1 Kc divisions are ¼" apart, allowing easy interpolation to 200 cycles or better. VFO tuning rate is identical on all bands.

6. Stability: The HRO-500 employs a 500 Kc reference crystal standard, output of which is synthesized and phase-locked to produce crystal-stable high frequency oscillator signals. The VFO is electronically regulated. The use of transistors throughout practically eliminates internal heat generation. Long term stability from turn-on is better than 100 cycles over any ten-minute period, including supply voltage variation of ±10% and ambient temperature variations of 30° C.

7. Selectivity: The HRO-500 employs a *tunable* six-pole filter to meet any selectivity requirement. Bandwidths available are 500 cycles, 2.5 Kc, 5.0 Kc, and 8.0 Kc . . . the widest selectivity range of any amateur receiver. *Passband Tuning* in the 500 cycle and 2.5 Kc positions provides ease of sideband selection and adjacent channel interference rejection found in no other receiver manufactured today. A *Rejection Tuning* network allows rejection of interfering heterodynes by 60 db.

8. HRO-500 sensitivity and noise figure is substantially superior to the previous standard of comparison, all earlier HRO models!



Amateur net price will be approximately $1000.00, with delivery this fall. If your requirements demand the finest amateur receiver obtainable at *any* price, the National HRO-500 is your only choice.

*Patent Pending

NATIONAL RADIO COMPANY, INC. **37 Washington Street, Melrose, Mass. 02176**

World Wide Export Sales: Ad. Auriema, Inc., 85 Broad Street, NYC Canada: Tri-Tel Associates, 81 Sheppard Ave. W., Willowdale, Ontario

A special message to every Amateur
using a 6146, 6146A, or 8298

33⅓% HIGHER POWER INPUT

—with this new beam power tube

If you are now using a 6146, 6146A, or 8298 in class AB_2, B, or C—you can replace it with a new RCA-6146B/8298A and increase your power input in these services by one-third. A single tube takes up to 120 watts plate input, ICAS; *two take nearly a quarter kilowatt!*

What must you do? You simply pull out the old tube. Plug in a 6146B/8298A. Increase screen voltage slightly. Then load up. All you need then is the extra reserve in your power supply.

And there is more about this tube than just high power. "Dark-Heater" design lengthens heater life—makes it possible for the tube to deliver full power output over wide swings in heater-supply voltage. Plate dissipation rating exceeds any design in the 6146 family. And when this new tube operates at 6146 plate input, life expectancy goes up substantially.

Install RCA-6146B/8298A's. Increasing your power was never easier.

Available from your Authorized RCA Industrial Tube Distributor.

ICAS Operating Conditions
(Heater voltage range, 6 to 7.5 volts)

Class of Service	DC Plate Volts	Plate Dissipation Watts	Plate Input Watts
SSB	750	35	120
Class C AM	600	23	80
Class C CW	750	35	120

*Full input to 60 Mc; reduced input to 175

For technical bulletin on new RCA-6146B/8298A, write: Commercial Engineering, Section J-15-F, Electronic Components and Devices, Harrison, N. J.

The Most Trusted Name in Electronics