July 1967
75¢

CQ

ICD

Don Miller Paces CQ W.W. DX C.W. Contest From 1G5A Geyser Reef!

Complete Results in this Issue.

CQ Lab Tests the SWAN 250

The Radio Amateur's Journal

Traveling Companion

Over the Rockies in a camper. Umpteen weekends on the lakes. A workhorse during the spring flood. To southern Mexico and back in a jeep. Hunting trips up north. All the Collins KWM-2 Transceiver asks out of a robust life is to go where you go, do what you do, and tell the world about it.

For further information, check number 4, on page 126

COLLINS

NOW

A low cost Crystal for the Experimenter

International *type* "EX"

- LOW COST
- MINIMUM DELIVERY TIME

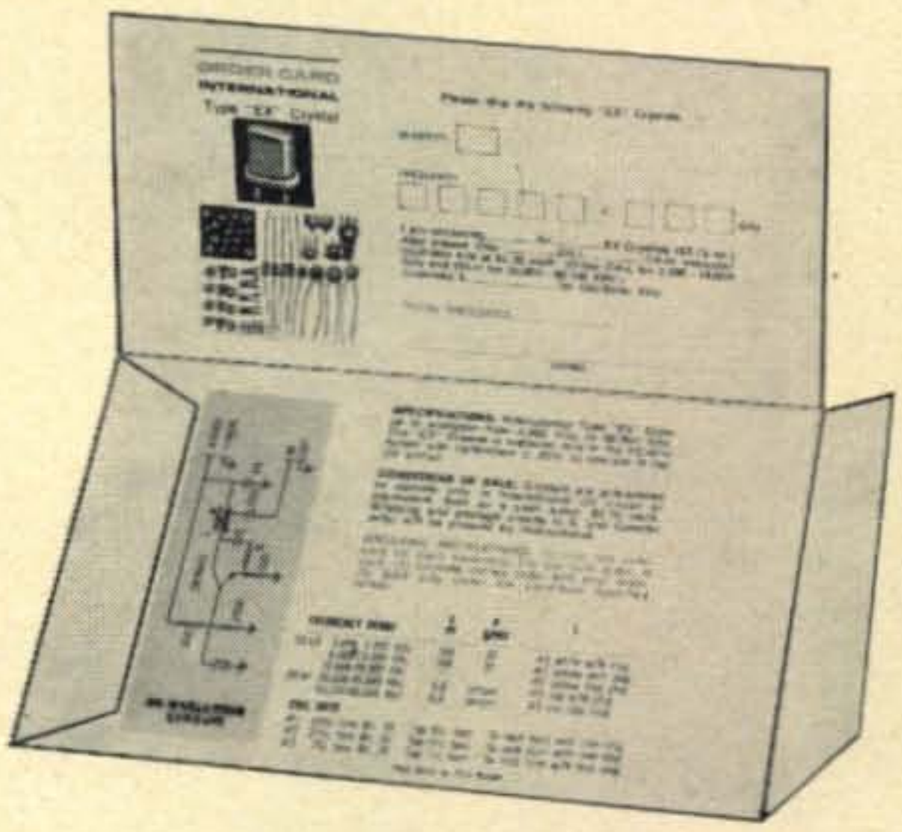
3,000 KHz to 60,000 KHz

$3.75 Postage Paid

SPECIFICATIONS: International Type "EX" Crystal is available from 3,000 KHz to 60,000 KHz. The "EX" Crystal is supplied only in the HC-6/U holder. Calibration is ± .02% when operated in International OX circuit or equivalent.

CONDITIONS OF SALE: All "EX" Crystals are sold on a cash basis, $3.75 each. Shipping and postage (inside U.S. and Canada only) will be prepaid by International. Crystals are guaranteed to operate only in the OX circuit or its equivalent.

MINIMUM DELIVERY TIME We guarantee fast processing of your order. Use special EX order card to speed delivery. You may order direct from ad. We will send you a supply of cards for future orders.

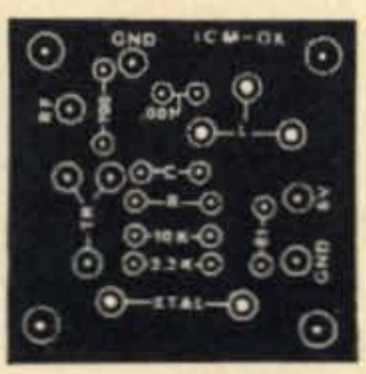


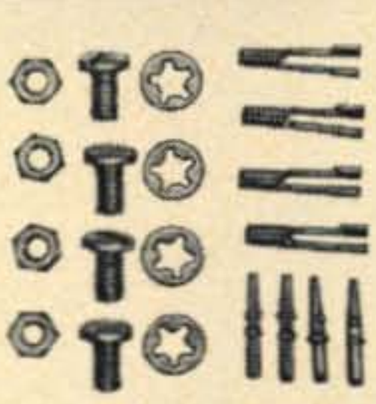
ORDERING INSTRUCTIONS

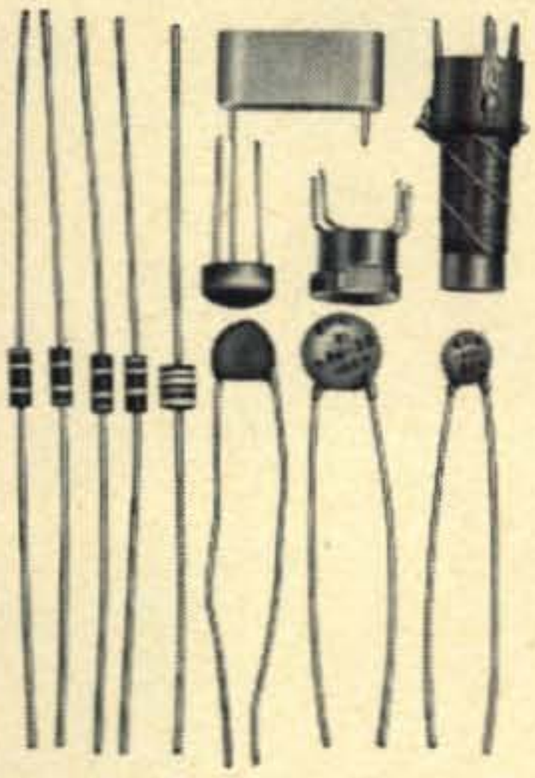
(1) Use **one** order card for each frequency. Fill out both sides of card.

(2) Enclose money order with order.

(3) Sold only under the conditions specified herein.







COMPLETE OX OSCILLATOR KITS

Everything you need to build your own oscillator. Two kits available. "OX-L" kit 3,000 to 19,999 KHz. "OX-H" kit 20,000 to 60,000 KHz. Specify "OX-L" or "OX-H" when ordering. **$2.35** Postage Paid

INTERNATIONAL

CRYSTAL MFG. CO., INC.

10 NO. LEE • OKLA. CITY, OKLA. 73102

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CQ

The Radio Amateur's Journal

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DEPARTMENTS

Offices: 14 Vanderventer Avenue, Port Washington, L. I., N. Y. 11050. Telephone: 516 883-6200.

CQ—(Title registered U. S. Post Office) is published monthly by Cowan Publishing Corp. Second Class postage paid at Port Washington and Miami, Florida. 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.

Postmaster: Please send form 3579 to CQ Magazine, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050

To guarantee you'll get the gear you ask for . . . Waters announces a new policy . . .

We have been concerned for quite some while at Waters over the inability of many hams to find our products readily available in the general market. Many letters of complaint attest to this.

The amateur radio picture has changed greatly in recent years. Ham shacks simply ain't what they were! And neither are the old time, full-service amateur dealers. Many have fallen by the wayside. Many more have switched their major efforts to CB, TV, appliances and the like with ham radio relegated to somewhat scanty stocks on hand. Modern, full-service dealers are relatively few in numbers today and are located almost without exception in the larger metropolitan areas.

So we had to conclude that if we were to provide the amateur operator with service and good products, we must also provide easy access to this service and our products. A major change in our marketing set-up was necessary.

As of July, 1967, Waters products may be purchased in the United States through 9 reputable dealers. Orders may also be placed directly with the factory. Each of these dealers will maintain complete stocks of ALL Waters products at ALL times.

If you reside within the area of a dealership, you should order from that dealer. If you live outside of dealer areas, you may order directly from Waters using our catalog and order forms. Installment credit may be arranged.

With this new system, Waters products are as near as your mailbox. You will no longer be subjected to Brand X switching and the fast sell! Your QSL card or a postcard will bring our new catalog by return mail.

BOB WATERS W1PRI

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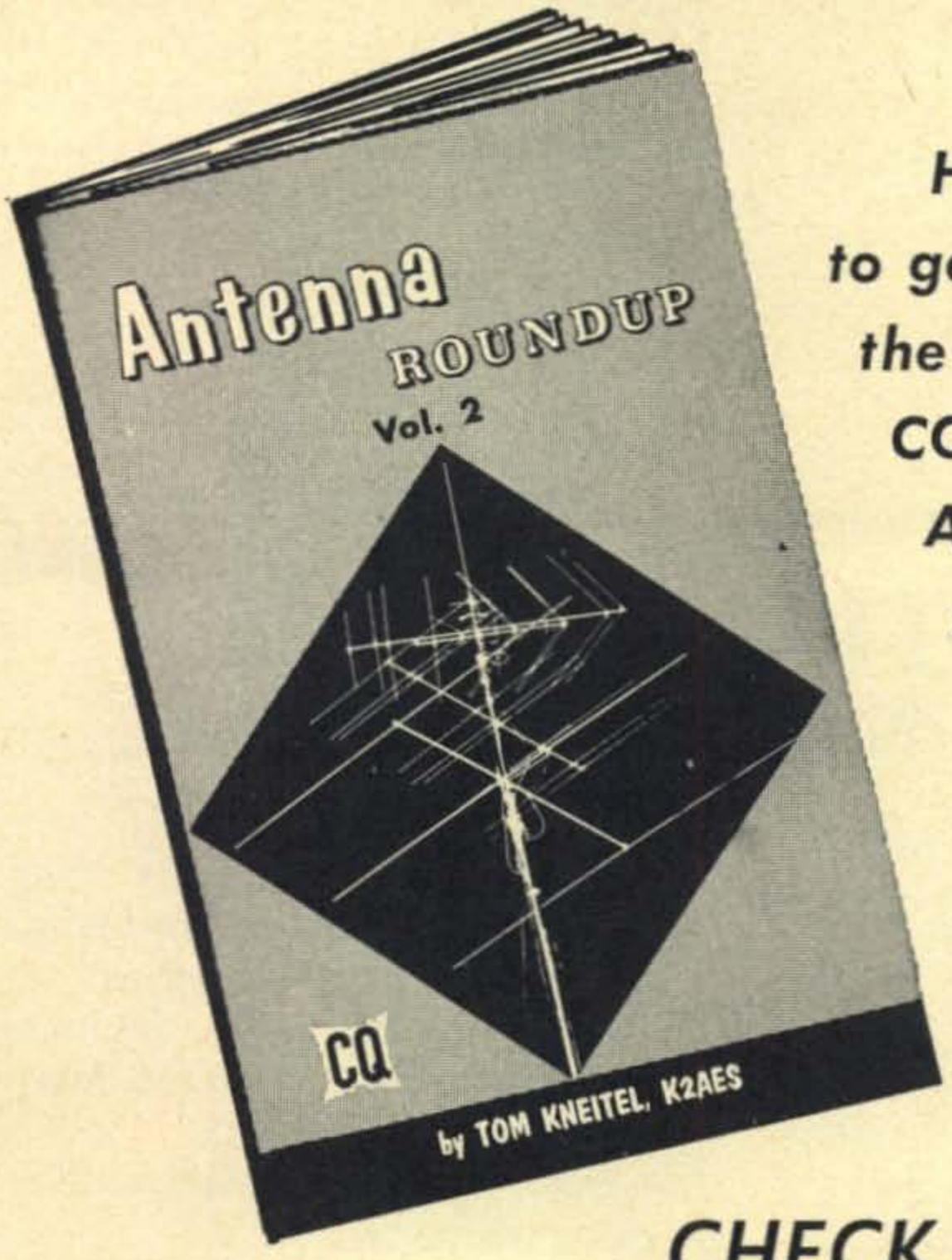
WAYLAND, MASSACHUSETTS

Canadian Hams: You May Now Order Direct from M. J. Howard & Co., Ltd., 1300 Carling Ave., Ottawa, Ont.

For further information, check number 5, on page 126

HOOKED ON SKY HOOKS?



Here's your chance to get an early copy of the latest addition to CQ's famous ANTENNA ROUNDUP series. Volume II covers antennas spanning frequencies between 10 cps and 2450 mc.

CHECK THESE FEATURES

- 10 BIG theory features!
- 10 WILD low band verticals to build!
- 20 DB MAKING low band horizontals and beams to build!
- 20 SMASHINGLY GOOD antennas to build for VHF!
- 9 CUNNINGLY CLEVER features on tower construction, coax, switching, etc.!
- 23 OTHER construction projects covering antennas for CB base and mobile use, for use on the shortwave broadcasting bands, etc.
- 92 ARTICLES in all, covering longwires and dipoles right up to 17 element super-giants and Sterba Curtain arrays!

You can have this information for less than 4.348¢ per feature!

YES—THE ANTENNA ROUNDUP, Volume II, is now available. Copies are being shipped on a rush basis! You can have your dream antenna in a few days. Get your copy by sending $4 for your postpaid copy—DO IT NOW!

COWAN PUBLISHING CORP., BOOK DIVISION
14 Vanderventer Avenue
Port Washington, L.I., N.Y. 11050

Gentlemen: Enclosed is $_____ for _____ copy(ies) of the brand new ANTENNA ROUNDUP, Volume II. Please rush me one of the first copies hot off the press!

*New York City and State residents must add sales tax applicable to your area.

Name _____, Call _____

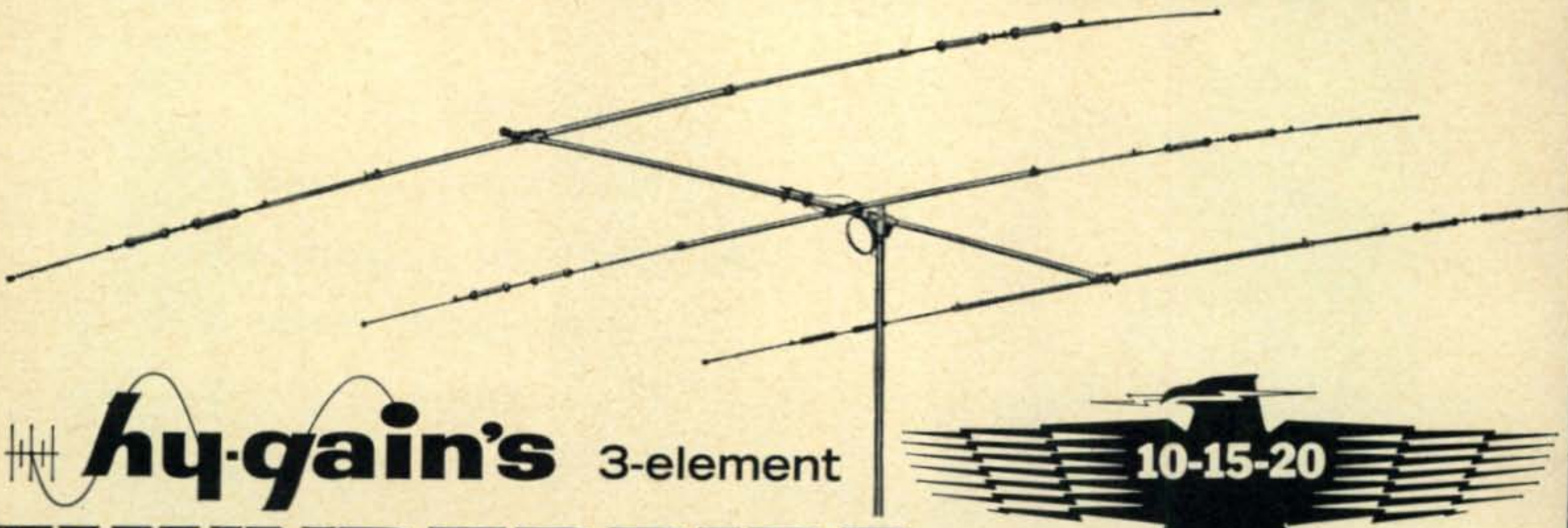
Address _____

City _____ State _____ Zip _____

PRICE: $4.00*

SEND YOUR ORDER NOW!

So good it defies comparison...

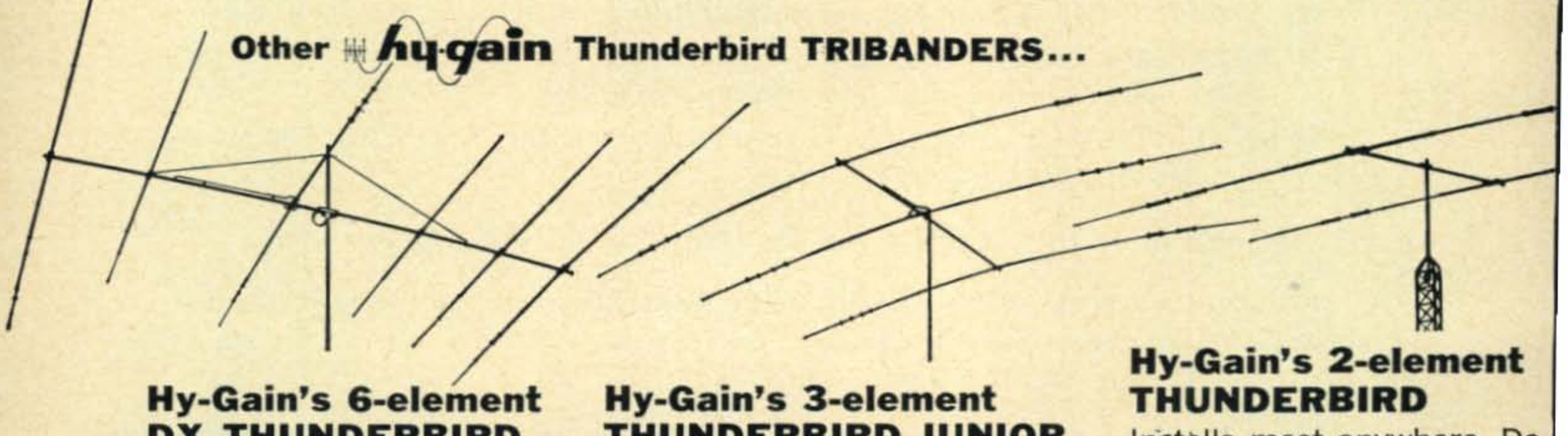


hy-gain's 3-element THUNDERBIRD TRIBANDER MODEL TH3Mk2

- **Delivers uncompromised full-sized performance on 10, 15 & 20 meters**
- **Takes maximum legal power**
- **Exclusive time-proven Beta Match**

Try as you may, you just won't find another three-element tribander for 10, 15 and 20 meters that will even begin to compare with Hy-Gain's Model TH3Mk2. Some say it's the individually tuned, large diameter Hy-Q traps that make the difference by providing full-sized performance on each band. Others say it's the spacing of the elements on the 14 foot boom. Still others claim it's the exclusive, time-proven Beta Matching System that provides the optimum gain and maximum F/B ratio you get with the Model TH3Mk2. Actually, it's a combination of all of these factors plus rugged heavy gauge, taper-swaged seamless aluminum construction...solid aluminum trap housings using air dielectric capacitor...weather impervious molded high impact cycolac insulators... and Hy-Gain's over-all engineering excellence, that makes the Model TH3Mk2 so good it defies comparison. Get the best in 3-element tribanders—get a Model TH3Mk2.
Model TH3Mk2..... **$114.95** Net

Other hy-gain Thunderbird TRIBANDERS...



Hy-Gain's 6-element DX THUNDERBIRD
Provides the very ultimate in tribander performance. Takes maximum power. 24′ boom. Exclusive Hy-Q traps and time-proven Beta Match.
Model TH6DX **$149.50** Net

Hy-Gain's 3-element THUNDERBIRD JUNIOR
Fantastic performance in limited space. Takes 600 watts P.E.P. 12′ boom. Exclusive Hy-Q traps and Beta Match. Rotates with heavy duty TV rotator.
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Hy-Gain's 2-element THUNDERBIRD
Installs most anywhere. Delivers outstanding performance. Takes maximum power. 6′ boom. Exclusive Hy-Q traps and time-proven Beta Match.
Model TH2Mk2 **$74.50** Net

Available now from your Hy-Gain distributor or write...

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Dept. AC5, N.E. Highway 6 • Lincoln, Nebraska 68501

For further information, check number 23, on page 126

A 3-band SSB Transceiver Kit for $189.95
An Electronic Keyer Kit for $49.95
A Solid-State AC Power Supply Kit for $79.95

SPECIAL SALE OFFER
$AVE
753 KIT NOW $149.95
751 KIT NOW $59.95
752 KIT NOW $59.95
SEE YOUR EICO DEALER NOW!

Who gives you ham gear so COMPLETE at prices so low?

Who else but EICO

Pro **all the way, from concept to execution — that's what ham editors say about EICO. Critical customers agree, and like the low price, too. They've made the 753 kit, for example, the industry's hottest seller. And the new 717 Keyer seems headed for the same fate. Highlights of both give you some inkling why:**

The EICO 753 is a complete 3-band transceiver, offering SSB/AM/CW operation with conservatively rated 200 watts PEP on all modes (rated for maximum efficiency rather than maximum possible input power). A new Silicon Solid State VFO provides full coverage of the 80, 40, and 20 meter bands. Assembly is made faster and easier by VFO and IF circuit boards, plus pre-assembled crystal lattice filter. Rigid construction, compact size, and superb styling make this rig equally suited for mobile and fixed station use. The EICO 753 is at your dealer now, in kit form and factory-wired.

FEATURES: High level dynamic ALC prevents flat-topping even with extreme over-modulation. Automatic carrier level adjustment on CW & AM. Receiver offset tuning (10 kc bandspread) without altering transmit frequency. Front panel selected STANDBY, VOX, or P-T-T operation. Unique ball drive provides both 6:1 rapid band tuning and 30:1 vernier bandspread with single knob.

SAVE $40.00—753 KIT NOW $149.95

EICO Model 751 AC Supply/Speaker Console: Provides all necessary operating voltages for Model 753. Incorporates PM Speaker, conservatively rated components and silicon rectifiers for minimum heat and extended trouble-free life. Includes interconnecting plug-in cables.

SAVE $20.00—751 KIT NOW $59.95

SPECIFICATIONS: Output Voltages: 750 volts DC at 300ma, 250 volts DC at 170ma — 100 volts DC at 5ma, 12.6 volts AC at 4 amps. INPUT VOLTAGE: 117VAC.

EICO Model 752 Solid State Mobile Power Supply: (Not Shown). For use with 12 volt positive or negative ground systems. Full protected against polarity reversal or overload. Output voltages identical to Model 751. Input voltage 11-14 volts DC.

SAVE $20.00—752 KIT NOW $59.95

The ideal accessory for the CW ham—the **fully automatic 717 Electronic Keyer.** It provides self-completing clean-cut dots, dashes, and spaces accurately timed and proportioned from 3 to 65 WPM in four overlapping switch-selected ranges with vernier control of all speeds within each range. Matches EICO 753 in appearance to make it a perfect table-top companion unit.

FEATURES: Output Contacts — 25 volt-ampere dry-reed SPST relay. Built-in adjustable tone and volume oscillator with a 3 x 5 inch speaker for monitoring. Can be used as a code practice oscillator.

Kit $49.95 Wired $69.95

For FREE catalog and Amateur Radio brochure write to EICO 131-01 39th Ave., Flushing, New York 11352 EICO

For further information, check number 18, on page 126

COLLECTOR'S ITEM

SWAN 500

5 BAND — 480 WATT SSB TRANSCEIVER
FOR MOBILE — PORTABLE — HOME STATION

Whether working a station across the country or around the world, Swan 500 owners know that solid contacts are the rule, not the exception. With its unbeatable combination of high power and crisp, clean audio, the Swan 500 will literally punch holes through the QRM.

At the top of the Swan line, the 500 offers many extra features: Automatic noise limiter, selectable upper and lower sideband, 100 kc crystal calibrator, and provision for installation of an internal speaker.

The new 500 is equipped with the finest sideband filter used in any transceiver today. With a shape factor of 1.7, ultimate rejection better than 100 db, and a carefully selected bandwidth of 2.7 kc, this superior crystal filter combines good channel separation with the excellent audio quality for which Swan transceivers are so well known.

Frequency coverage of the five bands is complete: 3.5-4.0 mc, 7.0-7.5 mc, 13.85-14.35 mc, 21-21.5 mc, 28-29.7 mc. (In addition, the 500 covers Mars frequencies with the 405X accessory crystal oscillator.)

If you are a QSL collector, then the new Swan 500 is the item for you. **$495**

ACCESSORIES:

12 Volt DC Supply, for mobile operation. Model 14-117.	$130
Matching AC Supply. Model 117XC	$ 95
Plug-in VOX Unit. Model VX-1	$ 35
Full Coverage External VFO. Model 410	$ 95
Miniature Phone Band VFO. Model 406B	$ 75
Crystal Controlled Mars Oscillator. Model 405X	$ 45
Dual VFO Adaptor. Model 22	$ 25

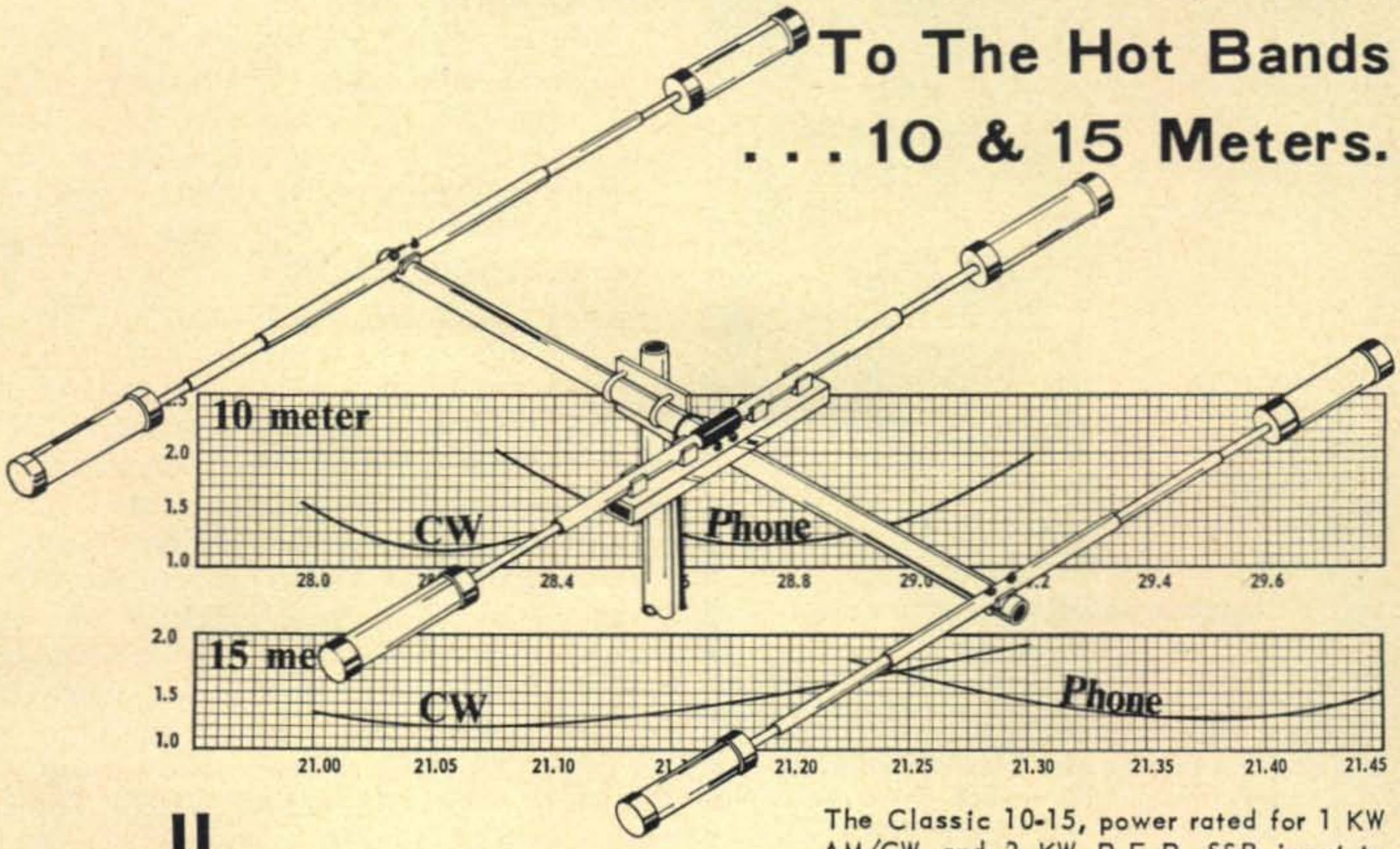
SWAN ELECTRONICS Oceanside, California

For further information, check number 14, on page 126

The Classic 10-15

Mosley TRAP MASTER

The New 'CLASSIC' Approach To The Hot Bands . . . 10 & 15 Meters.



Have you tuned 10 and 15 meter bands recently? They'er quite active again! The 15 meter band is now considered the best daytime DX band and 10 meters is gaining more ground every day. An All New approach to these bands is the Classic 10-15. The newest addition to the Classic Trap-Master beam family. Incorporating the very latest in matching systems, Broad Band Capacitive matching (Pat. Pend.), first introduced last year in the now famous Classic 33.

The Classic 10-15, power rated for 1 KW AM/CW and 2 KW P.E.P. SSB input to the final. Gain, a FULL 8 db. compared to reference dipole or 10.1 db. over isotropic source. Incorporates durable metal encased traps made famous by the Trap-Master TA-33. Maximum front-to-back. And so lightweight (only 27.5 lbs. assembled weight) it may be easily stacked with your present 20 and/or 40 meter beam.

The Classic 10-15 . . . another reason why you select quality when you specify Mosley. Write for more information.

Write Dept. No. 131

Mosley Electronics, Inc. 4610 N. Lindbergh Blvd., Bridgeton Mo. 63042

For further information, check number 1, on page 126

SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

Boy oh boys, guess what Scratchi are doing—he winning our amchoor radio club's hidden xmitter hunt! Yes indeedy, old foxy Scratchi reely showing up the Young Squirts.

Are I winning on acct. of my grate tecknical geenyus? No, Hon. Ed., not reely. Are winning on acct. being like Hon. Indian—having lotsa injinuity.

But, letting me tell you about it. Our club, the good old Range Riders, are desiding that this yeer we running hidden xmitter hunt in sum different way. Instead of having cupple amchoors putting hidden xmitter in sum secrut place, this yeer we putting xmitter where nobuddy knowing where it is. That way we not having any slip-ups, and everybuddy can be in on fun.

How's that, Hon. Ed? How can we placing xmitter so nobuddies knowing where it hidden? Easy. Just putting parashoot on it and dropping from Hon. Airplane. It floating down and landing sum place on desert.

We fixing up reel neat xmitter. Using metal box about size of pack of cigarettes, and in it putting batteries and xtal-controlled transistor rig with outputs on six-meter band.

For antenna we making sumthing reel speshel. On top of box we putting loop antenna several inches in diameter, and with several turns of reel heavy wire. It having direcksunal pattern, but this just making hole xmitter hunt more interesting.

On big day, we arranging for local fly-boy to taking xmitter up in his airplane and dropping it in desert between two points about ten miles apart. We telling him to dropping it anywhere he like between those two points.

Meanwhile all Range Riders are meeting at locayshun quite a few miles away, so we can't watching hidden xmitter parashoot to earth. Then, when time coming for xmitter

← For further information, check number 8, on page 126

to be landing on ground, everybuddy starting off.

It taking maybe half hour to driving to getting neer where xmitter might be landing, but Scratchi knowing short-cut, so are able to arrive in general area cupple minutes ahead of the pack.

I turning on reseever, picking up signal reel quick-like, taking reeding, and hedding off across desert in good old jeep. After little while, stopping and taking another reeding, then I'm off again. Are reel anxious to getting hidden xmitter in Hon. Jeep so can winning first prize. That are rule of contest —you must having xmitter in your possesshun.

Are taking third reeding, and noticing sumthing funny. Signal seeming to come from different direckshun. Not only that, signal seem to be fading in and out as I taking reeding.

Scratchi going off in new direckshun, stopping to take reeding, and again signal coming from brand new direckshun. After this happening cupple moretimes other amchoors are beginning to show up, so now Scratchi are in midst of lotsa cars and trucks.

Everybuddy else seeming to be as confused as Scratchi, on acct. signal keeps moving from point to point, like it not staying still. All of us dashing like sixty one direckshun, taking reeding, then dashing off in another direckshun. Hon. Ed. it chaos.

Just when everybuddy about to calling things off, hole problem becoming apparent. As we dashing off to north, we seeing, in clearing ahead of us, grate big jackrabbit making like coyote chasing him. He going like sixty with ate-foot leaps in air. Going along with him are remains of parashoot, and on his body are loop antenna, with hidden xmitter hanging down around his stomach.

Hon. Ed., it hard to buleeving, but somehow jackrabbit are jumping through antenna, and it sticking on his body so he now carrying it along with him wherever he going. Talk about your exciting hidden xmitter hunts, Hon. Ed., we having one where hidden xmitter are moving, and we having to chasing it!

Well, that not stopping old Range Riders Hidden Xmitter Hunt—not on your tinnytipe. Everybuddy now roaring off after big old jackrabbit. Everybuddy but Scratchi,

[*Continued on page 110*]

Announcements

Pittsburgh, Pa.

The South Hills Brass Pounders and Modulators' 27th annual Hamfest will be held August 6, 1967, at St. Clair Beach (5 miles South of Pittsburgh on Route 19). For complete details contact Irwin I. Tryon, W3WFR, 1500 Tretter Dr., Pittsburgh 27, Pa.

St. Louis County, Mo.

Second Annual Hamfest of the Suburban Radio Club to be held on July 30, 1967, at the Creve Coeur Lake Park, St. Louis County, Mo., from 10 A.M. Attendance prizes, Heath HW-32A and many others. Advance registrations $1 from KØAHD, 10217 St. Daniel Ln., St. Ann, Mo., 63074.

Stolen Equipment

Recently the Stanford Radio Club Station, W6YX, was broken into, and the following pieces of Collins radio equipment were stolen: 32S-1 Transmitter #10790; 75S-1 Receiver #3018; 312B-4 Station Control #293; 516F-2 Power Supply #3611; 75A4 Receiver #5091. The cabinets of the S-line equipment were spray painted a bright red and orange. The 75A4 receiver had home-built crystal filters in place of the mechanical filters. If you have any information, please contact Victor R. Frank, Research Associate, Stanford Electronics Laboratories, Radioscience Laboratory, Stanford, California.

Okanagan Falls, British Columbia

The 1967 Okanagan International Hamfest will be held on July 29 and 30 at the Dolly Varden Auto Court, Okanagan Falls, British Columbia. Further information can be obtained from John Munro, VE7AO, 949 Hull Street, Penticton B. C. Canada.

Palmyra, Illinois

The Quad-Co. Radio Club, Inc. will host a "Breakfast Club Hamfest" on July 15 and 16 at Terry Park near Palmyra, Illinois. This is the 10th annual get-together. The program will officially open at noon on Saturday, July 15, and continue until 4 P.M., Sunday, July 16. Something big will be happening all the time! The program will include hidden transmitter hunts, games, contests, square dance on Saturday night. For further info contact Errol N. Workman K9CIL, Chairman, Prize Committee, Quad-Co. Radio Club, Inc., P. O. Box 323, Chatham, Illinois, 62629.

Washington, Mo.

The Zero Beaters Radio Club will hold its annual Hamfest at the Washington, Missouri, City Park on Sunday, August 6. The site is a large open pavilion, plenty of room for all on Traders Row, or for commercial exhibitors., Come early and enjoy the delicious lunch and refreshments. There will be attractions for the XYLs and YLs plus a swimming pool for the Harmonics. Registration will be $1.00. For information or advance registration write to Zero Beaters ARC, P. O. Box 24, Dutzow, Missouri, 63342.

Boone, Iowa

The Iowa 75 Meter Phone Net will hold its annual picnic on Sunday, August 13th. The picnic will be held at McHose Park in Boone, Iowa. Hams and their families are invited. People planning to attend are requested to bring a covered dish and their own table service. Soft drinks will be available for the children. There will be several prizes and a guest speaker. For further information contact Ray Pollock, WAØFFN, at Mt. Auburn, Iowa.

Mississippi Hamfest

The Jackson Amateur Radio Club is sponsoring the 1967 Mississippi Hamfest on July 23 at the State Fairgrounds, Jackson, Mississippi. A "Hamfest" dinner will be held the preceding evening at the Millsaps College student center starting at 7:00 P.M. Write P. O. Box 8371, Jackson, Mississippi for information.

Los Angeles, California

The 1967 Combined Southwestern/Pacific Division ARRL Convention, sponsored by the Los Angeles Area Council of Amateur Radio Clubs, Inc., will be held Friday noon through Sunday, September 8-10, at the Ambassador Hotel, the home of the world famous Cocoanut Grove, in Los Angeles. The convention will offer top guest speakers, manufacturer's clinics, open forums, contests, mobile judging, ladies luncheon, SWOOP initiation, Royal Order of the Wouff Hong, and many other interesting events throughout the convention period. Registration is $2, combined banquet and registration $10, until August 15; $3 and $12 after that date. Make checks payable to ARRL Convention, and send to P. O. Box 3151, Van Nuys, California, 91405. Room reservations should be made directly with the Ambassador Hotel, 3400 Wilshire Boulevard, Los Angeles, California, 90005.

Burlington, Vt.

International Field Day starts 9 A.M., August 13, 1967, at Cliffside Country Club, Burlington, Vt. (Go West on Flynn Ave. to end) sponsored by Burlington Amateur Radio Club, Inc. A full day for the OM, XYL, and all Harmonics. Remote control demonstration, antenna raising contest, mobile r.f output contest, junk box amplifier contest, bingo for the ladies, free trailer parking, 807's etc. available, chicken bar-b-que at noon, special trio for teenagers. Bring gear for Swap Shop and Auction Sale (tag everything). Net meetings, swimming, boating, rag chewing-eye-ball style, talk-in frequencies 3909 ssb, 3855 A.M., 146.94 f.m., 146.34 f.m. (Rep.). Door prizes and raffle drawing last event, $3.00 at the gate, $2.50 Early Bird registration. Contact K1PPW for reservations and accommodations, W1DQO, chairman for information.

Steubenville, Ohio

The Steubenville Area Amateur Radio Club's first Hamfest-Picnic will be held from 10:00 A.M. on at Lake Marvin Park on July 30. Lake Marvin is located a couple of miles off Route 7, one mile south of East Liverpool, Ohio. Activities will include a raffle and a swap table. Food must be brought or purchased at the Park. The only fee is the 35¢ per person Park entrance fee. Any inquiries can be addressed to Joe Plesich, W8DYF, 812 1/2 N. 4th St., Steubenville, Ohio, 43952.

Jacksonville, Illinois

The annual Jackonsville Area Amateur Radio Club Hamfest will be held on July 9, 1967, at the Morgan County Fairgrounds in Jacksonville, Illinois. For more information contact Roland L. Wallis, Sec. R. R. #5, Jacksonville, Illinois.

Henderson, Ky.

The annual Hamfest of the Henderson Amateur Radio Club will be held on Sunday, July 30, 1967, rain or shine at the Audubon Raceway. For more information, contact W4TBU, Box 83, Henderson, Ky.

West Paterson, New Jersey

The Knight Raiders VHF Club will hold its First Annual Picnic-Style Hamfest on Saturday, July 22, 1967, from 10 a.m. until dark. Location is Weasel Drift Picnic Grove, Garret Mt. Reservation, West Paterson, New Jersey. Talk in stations on 146.898 mc and 50.4 mc. For more info contact K2DEL, P. O. Box 1054, Passaic, New Jersey.

Yakima, Washington

Announcing the third annual Washington State Hamfest to be held in Yakima, Washington, on July 8 and 9, at the Central Washington Fairgrounds. Camping space available on the fairgrounds, or nearby motels and hotels will reserve rooms. Mobile hunts, mobile judging, resistor hunt, eyebank net display, QCWA display, manufacturers' displays, informal dinner, activities for XYL's and youngsters, and many, many other activities. Lots of prizes. For further information or reservations, contact: W7BUN, 1601 S. Madison Street, Tacoma, Washington, 98405.

Moline, Ill.-Davenport, Iowa

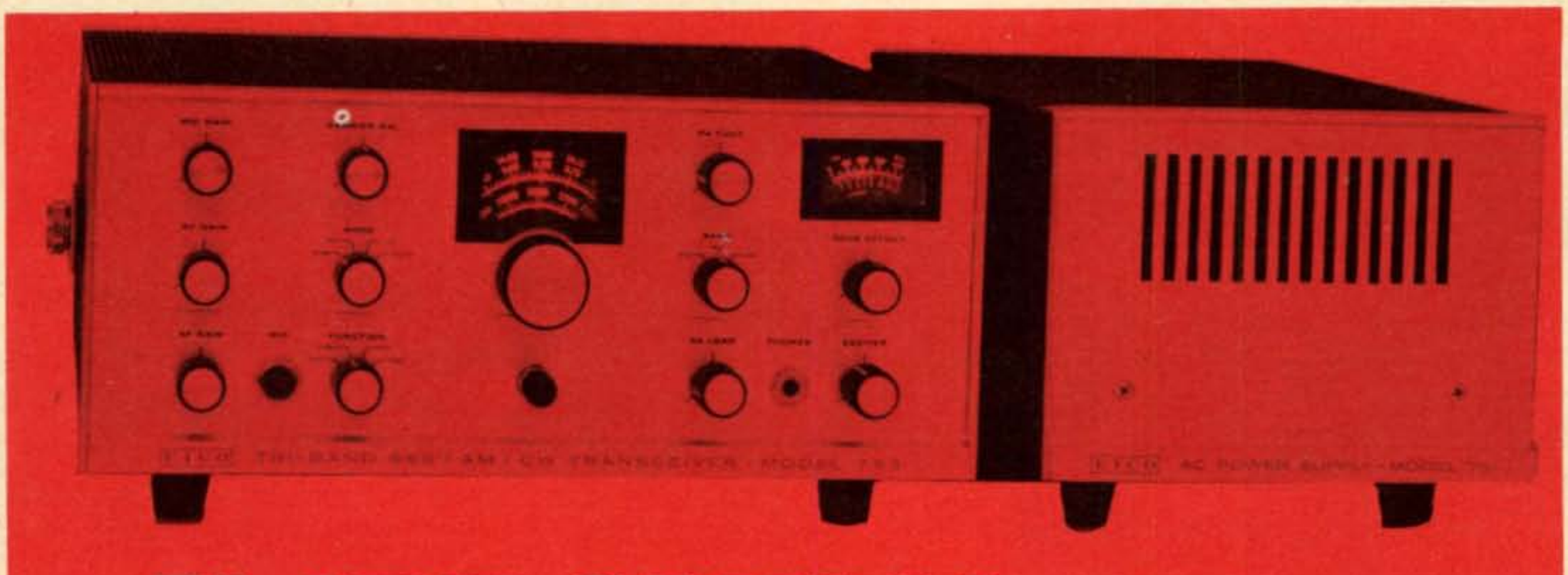
The Quad City Amateur Radio Club (W9YCR) and The Davenport Amateur Radio Club (WØBXR) will hold a hamfest Sunday August 20, 1967, at Fairy Land Park, located on Rt. 61, 12 miles North of Davenport Iowa. Hours 8:00 A.M. to ?? P.M. Free coffee and doughnuts 9:30 A.M. to 10:00 A.M. Lunch, refreshments, and unlimited parking. Trunk sales, prizes, and hidden Transmitter hunt (6 meters and CB).

Advance Tickets donation: $1.50 or 3 for $4.00, $1.50 at the door. For additional information and advance tickets, contact Wayne Youngberg (WA9RDC) 2308 Stadium Dr., Rock Island, Ill.

Nashville, Indiana

The Indiana Radio Club Council, Inc., an affiliation of some sixty radio clubs of the State of Indiana, will hold its annual Hamfest and family picnic on July 9, 1967. The site of the Hamfest for this year will be: Brown County State Park, near Nashville, Indiana. For more information contact John C. Jones, W9FZW, IRCC Chairman, 3338 East New York Street, Indianapolis, Indiana, 46201.

PLEASE include your ZIP code number on all correspondence.



IMPROVING THE EICO 753 TRANSCEIVER

BY DEVERE "DEE" LOGAN,* WB2FBF

The author was among the first to build the EICO 753 s.s.b. transceiver kit, and in the past year, has made several modifications to improve its performance and v.f.o. stability.

WHEN we decided to build the EICO 753, we felt the unit represented the best way to go sideband with the least investment. In the past year our on-the-air experience confirms our original thoughts. The rig puts out a potent signal with good audio, and includes features (vox, a.g.c. and a.l.c.) usually not found in tri-band transceivers of this price class. There were some problems, notably v.f.o. drift, some due, I think to unexpected variations in parts quality.

Factory specifications for the v.f.o. are 3 kc drift within the first hour, and 400 cycles thereafter. Our unit is now on the button, but before the modifications, we had to operate with one hand on the v.f.o. Some units on the air today still have obvious wanderlust.

Check Points

V.f.o. stability should improve after a clinical investigation of the unit's mechanical stability, voltage regulation, component quality and layout. You can first isolate your problem, or make changes in all categories. We found that there was generally room for improvement in most.

In all modification steps, take extra care to avoid excess heat on components. Some substitutions we made flushed out the ultra-sensitivity of parts, and we had to repeat the steps. Use a small iron and heat sinks, and try to work with the printed circuit board upside down so that heat from your iron does not cause an additional problem.

Voltage Regulation

There were some bad vr tubes and zener diodes discovered among some early kits. We had a poor-performing European brand 0B2 that lit, but did not regulate. Substitution of a domestic brand should do the trick. If your zener diode, CR_7, is silver, it should be replaced with a 20 volt, gold-cased substitute from the factory or a known-quality stand-in.

Further upgrading of the internal voltage dropping resistors to 5% types was done in some key areas such as in the transistor bias networks.

If you feel that there is nothing amiss in your supply, double check by breaking the B plus line and running the v.f.o. tempo-

*21 Judith St., Nanuet, N.Y. 10954.

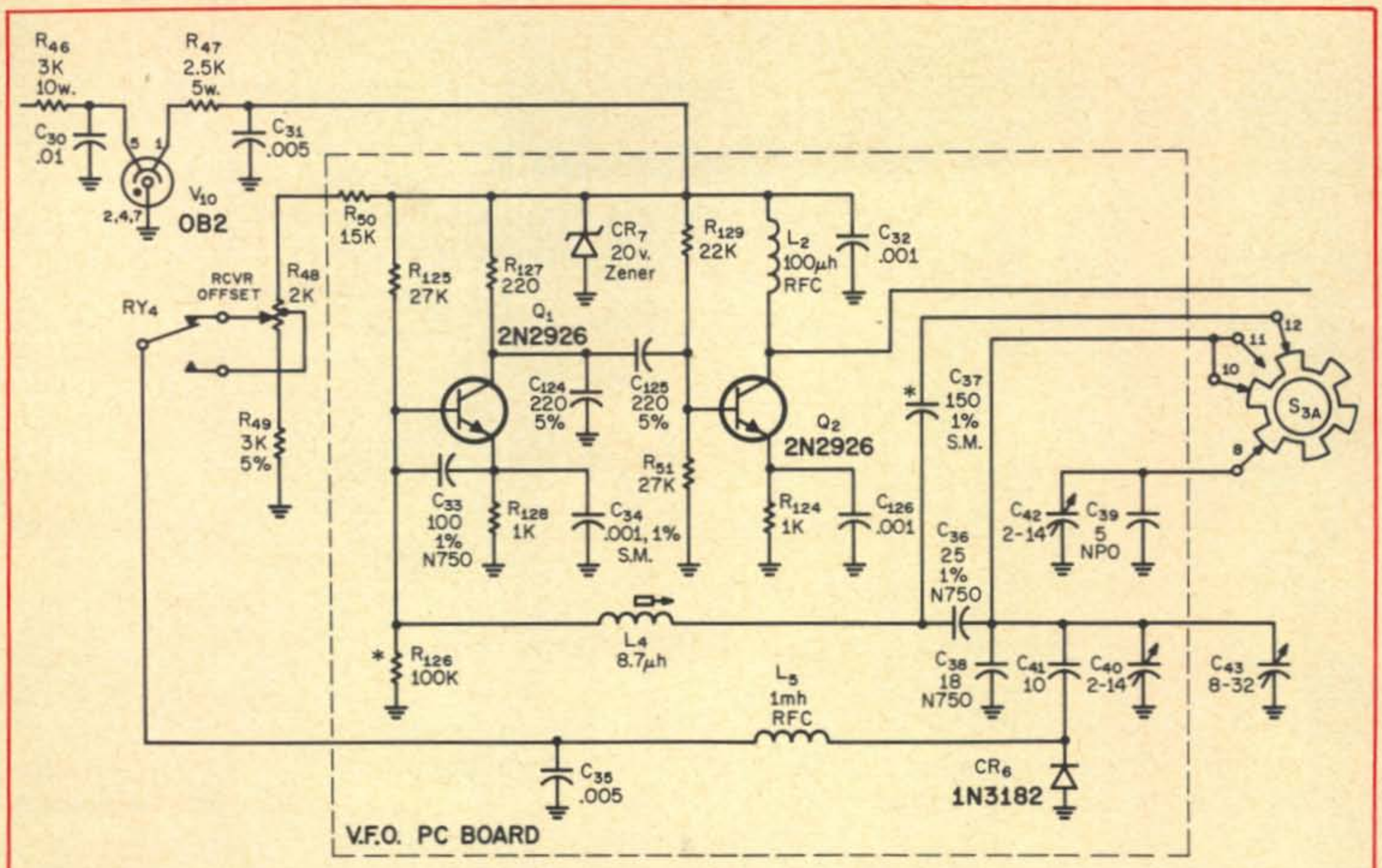


Fig. 1—Circuit of the v.f.o. portion of the Eico 753 transceiver. The parts marked with an asterisk were changed to improve stability.

rarily from a battery. Monitor you a.c. line, too. A call to the power company may be in order.

V.F.O. Changes

Replace R_{126}, 68K, with a new 100K, one watt resistor. Change C_{37}, the 145 mmf mica NPO capacitor to a 150 mmf tubular ceramic N470; use very little heat on C_{37}. The resistor primarily affects 40 meters, while C_{37} affects 80 and 20 meters. Change C_{32} from 0.001 to 0.01. These changes are shown in fig. 1.

Remove grease from front bearing of v.f.o. tuning capacitor.

At the rear of the v.f.o. tuning capacitor, remove the mounting screw and substitute a nylon screw with an insulated washer between the capacitor bracket and the chassis. The rear of the capacitor frame should *not* make contact with the chassis. The capacitor should be grounded to the chassis at the *front only*.

Be sure that wires running near the underside of the v.f.o. printed circuit board are dressed away from the board. Tape them if necessary.

Clean the circuit board with alcohol, and be sure there are no solder bits shorting solder points.

If oscillator transistors Q_1 and Q_2 have any color dot other than red, substitute red dot (lower beta) 2N2926 types.

We made another part substitution by putting in a 0.01 mf capacitor, C_{32}. If you have receiver noise, this step may be added.

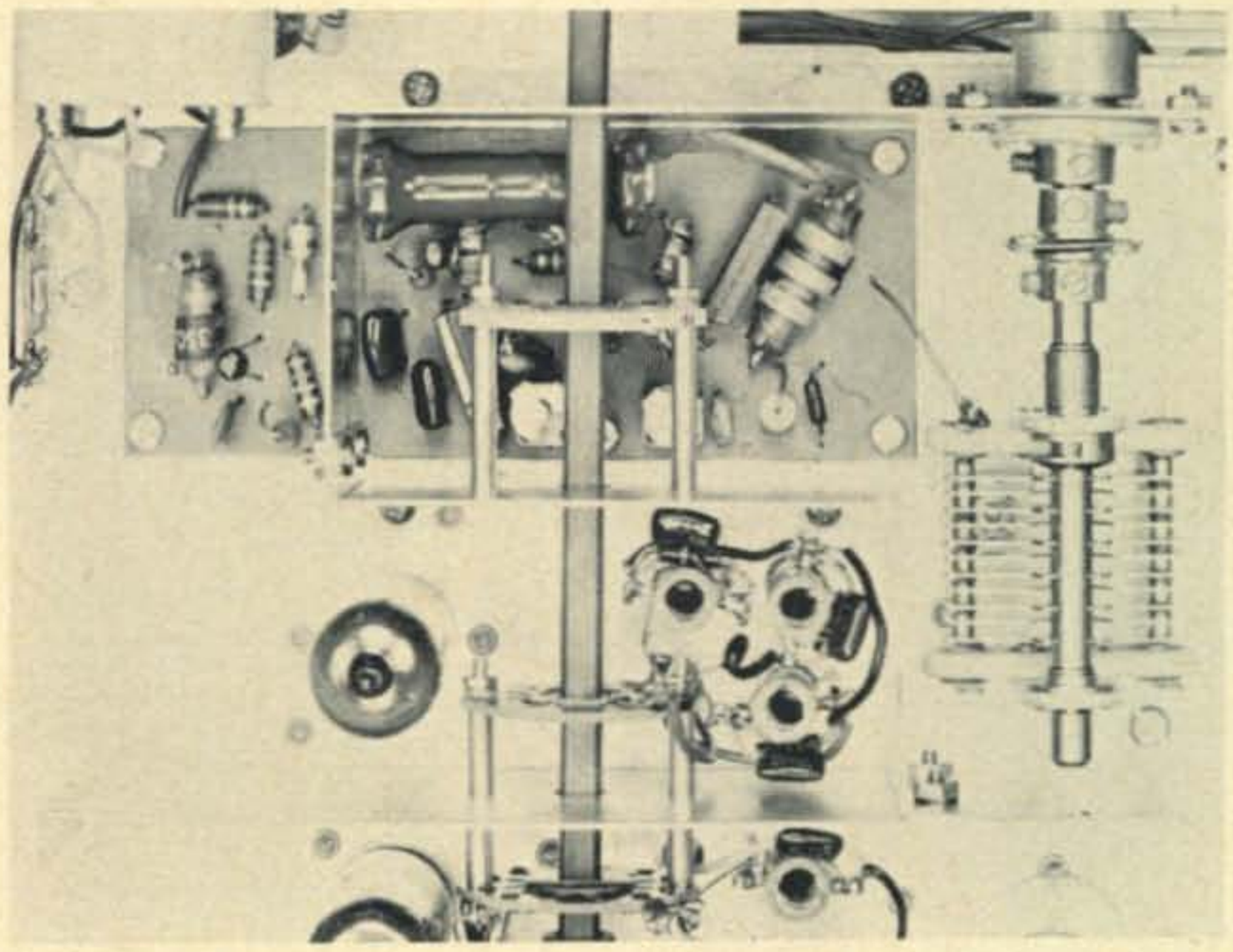
Frequency Shift

Changes in frequency when going from transmit to receive occured in our unit, but cleared up after improving voltage regulation and eliminating temperature-sensitive components.

Even millivolts of change in the receiver offset control can introduce unwanted capacitance in the v.f.o. circuit, since the capacity of the 1N3182 Varicap diode in the circuit changes with voltage. Also, if any unwanted voltage exists in the offset circuit, the transmitted and received frequencies may not be identical.

Our opinion was that these offset circuits were pests anyway, and so disconnected the control by breaking the tie point between R_{125} and R_{50}, removing the Varicap and grounding capacitor C_{41}.

If you want to continue use of the offset network, we suggest substitution of industrial



An interior view of the EICO 753 v.f.o. section. This is the standard unit prior to modification.

type resistors rated at 5% or better.

Also, be sure the mechanical and electrical zero points are the same on the offset control, R_{48}.

F.M. Or Chirp

If the c.w. signal is for the birds, voltage regulation is the prime suspect. Also, note comments on lead dress around the output loading capacitor in *CQ* for April, '66.[1] A poor buffer transistor, Q_2, may also be at fault.

Mechanical

Bandswitch wafer S_{3A} developed crimped contacts in our unit. This mechanical instability, plus some standing waves and stray capacitance thus introduced, proved to be a sleeper. We found that by replacing S_{3A}, the situation improved.

Another important checkpoint is the oscillator coil, L_4, an 8.7 μh slug-tuned type. A bum part here is often the cause of v.f.o. woes. Our original piece had a cardboard insert in which the slug turned. We substituted one with a plastic liner instead of cardboard. You may wish to experiment with Variductor (UTC # HVC-8) but since it costs several dollars it might be prudent to make the other modifications before blaming L_4.

Be sure the v.f.o. printed circuit board, the oscillator tuning capacitor C_{43}, and the wiring to the switch S_{3A} is firmly in place with good ground connections where necessary.

Our comments pertain to the solid-state v.f.o., and we strongly suggest that if your 753 is equipped with the tube-type v.f.o. that you scrape up ten bucks for a modification kit available from the factory. ■

[1] Scherer, W. M., W2AEF, "*CQ* Reviews: The Eico Model 753 Transceiver," *CQ*, April '66, p. 56.

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For further information, check number 2, on page 126

PROJECT: MOONRAY

Ham from the Moon? Why not!

N.Y.'s NASTAR group will give it a try.

WHEN will the first amateur radio station go into operation on the moon? NASTAR, the Nassau [New York] Satellite Tracking Amateur Radio Society, thinks that the first lunar rig should be on the air minutes after our astronauts make their third successful LEM landing.

The Long Island group bases its thinking —and hopes—on these facts: 1—"The word," from NASA and other sources, that there could be space for an amateur 'transponder' on that third LEM trip.

2—NASA's agreement to study a NASTAR proposal for a Moon Amateur Relay, dubbed Moonray, which will be submitted this summer. The unit will also be a long-term site beacon and serve, if needed, as an emergency communications package for the astronauts.

3—A promise of environmental testing help from NASA, Grumman and RCA when the Moonray prototype is ready in 1969.

Nick Marshall, W6OLO/2 at the blackboard during a NASTAR technical meeting. NASTAR's satellite tracking course last winter was the country's first.

NASTAR is an independent, three-year-old ham group which was given its own building and a mile of space for an antenna farm, for its experimental work—by Nassau Community College. The group does not plan to "go it alone" on the Moonray project. Nicholas Marshall, W6OLO/2, president of the outer-space-oriented group and formerly technical director of the OSCAR satellite program, says, "We hope to involve amateurs all over the world in this project.

"There are many other organizations such as ours, as well as individual amateurs, who can contribute vital thinking and technical assistance." Marshall hopes for a swift flood of responses to help in resolving some serious questions which must be answered before the preliminary Moonray proposal goes to NASA next summer.

A decision must be made on the band, or bands, to be used for reception and retransmission. NASTAR leans to the use of 432 mc, but is anxious to hear from others who have reasons for multi-band operation or another band in mind. The power output, bandwidth, antenna system and the type and extent of beacon telemetry must also be decided. Three parameters of Moonray are already fixed:

1—The tiny package must be operable as an independent, final backup emergency voice communications package for the astronauts if they have trouble with their regular radio gear.

2—The unit must also serve as a low-power beacon to be used for re-locating the LEM landing site up to a year or two after the astronauts have left the site. Moonray's

W6OLO/2 and NASTAR members check OSCAR frequency chart. Left-hand panel holds Bristol paper recorder for satellite passes.

service as potential backup equipment for the astronauts and as a marker beacon are the reasons NASA is willing to consider the package's inclusion on a moon-flight.

3—The third fixed parameter is that the transponder will be nuclear powered, so it can run through the lunar night, when solar cells would be inoperative.

NASTAR already has an "almost solid" promise of a five-pound, 10-watt nuclear battery with a 25-year half-life. Besides powering the receiver, transmitter and marker beacon, the battery will also heat the package during the minus-275 degree lunar night.

The Moonray concept was originated by NASTAR's president, Marshall. A ham for 31 years, he is an electronics consultant for NASA, the Lamont Geophysical Observatory and electronics firms. He says, "We have the know-how to build a relatively sophisticated package like Moonray. We've proved that by the success of the OSCAR program. What we are hoping is that Moonray will be a truly collective ham effort, based on advice and help from hams everywhere. We'd like to be able to say that Moonray is a product in which the whole ham fraternity had a hand."

Leonard Victor, W2DHN, the group's executive vice president, added that "right now we're worrying about keeping our bands. This project is the type we need to prove that amateur radio still has something to contribute to the state of the art."

Victor also points out that "a couple of transponders capable of allowing contacts between any two points on the half of the earth facing the moon at the time might even make a dent in the load on 20!"

One thing Moonray will do, he promises, is shorten QSO's because of the time lag caused by a signal's round trip to the moon.

[*Continued on page 125*]

Here's Low-Cost "Transceiver" Performance

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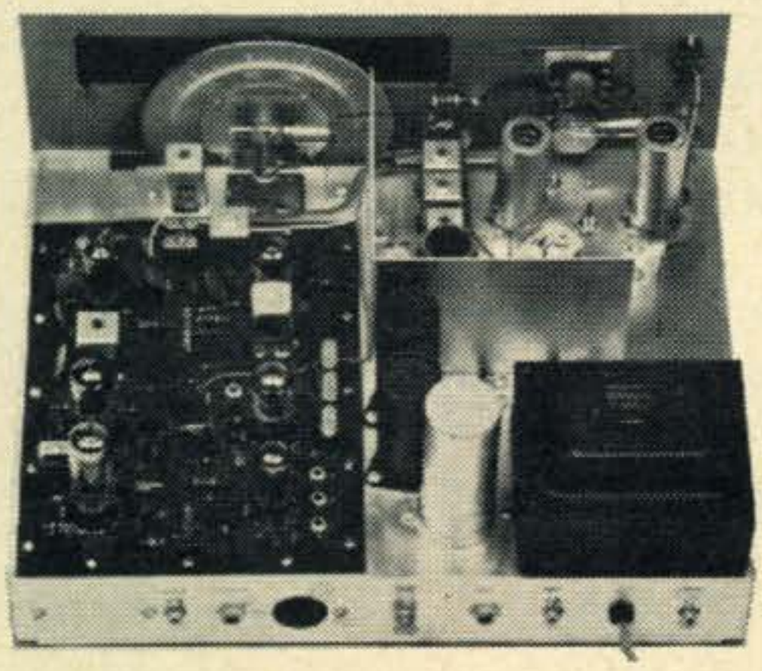

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Kit HS-24, Speaker.....**$7.00**
Kit HD-10, Electronic Keyer (for HW-16 or DX-60A)..**$39.95**

HW-16 SPECIFICATIONS — TRANSMITTER: RF Power input: 50 to 90 watts (adjustable). **Frequency control:** 80-meter crystal or VFO on 80-meter band. 80 or 40-meter crystal, or VFO on 40-meter band. 40-meter crystal or VFO on 15-meter band. **Keying:** Grid-block. Break-in with automatic antenna switching and receiver muting. **Output impedance:** 50 ohm unbalanced. **Sidetone:** Neon lamp relaxation oscillator. **RECEIVER: Sensitivity:** Less than 1 microvolt for 10 db signal-plus-noise to noise ratio. **Selectivity:** 500 Hz at 6 db down. **Intermediate frequency:** 3396 kHz. **Antenna impedance:** 50 ohm unbalanced. **External speaker impedance:** 8 ohms. **GENERAL: Frequency coverage:** 3.5 to 3.75 MHz. 7.0 to 7.25 MHz. 21.0 to 21.25 MHz. **Power:** 120 VAC 50-60 Hz. **Transmitter tube complement:** 6CL6 Crystal Oscillator; 6CL6 Driver; 6GE5 Final. **Receiver tube complement:** 6EW6 RF amplifier; 6EA8 Heteroydne mixer-oscillator; 6EA8 VFO mixer-oscillator; 6EW6 IF amplifier; 12AX7 Product detector-oscillator; 6HF8 1st audio and audio output. **Transistor complement:** 2N1274 muting circuit. **Dimensions:** 13¾" W. x 11½" D x 6½" H.

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For further information, check number 10, on page 126

A 2.1 kc Filter FOR THE 75A-4

BY E. DROZDICK,* W1NBM

How to modify the inexpensive 2.1 kc filter for use in the Collins 75A-4.

THE 75A-4 receiver has provisions for a 2.1 kc filter but for those who lack this filter a moderately priced 2.1 kc unit is marketed by Lafayette. It is an imported unit, (catalog 673, page 14, part number 99F0123) priced at $9.95.[1] Unlike the Collins filter the Lafayette unit must be modified slightly and a simple mounting bracket fabricated.

Filter Modification

A drawing of the top and bottom views of the filter are shown in fig. 1. The modifications shown in the bottom view are: 1) the drilling of two holes through the fibre large enough to clear 4-40 screws; 2) removal of the etch from the printed board around the ground pin on the grid side (shown by the cross-hatched area).

Mounting Bracket

The mounting bar is fabricated from a 1⅜" length of ¼" × ¼" brass rod drilled and tapped as shown in fig. 2. The two 4-40 holes are used to secure the filter to the brass rod. The ⅛" hole is used to pass one of the connecting wires through the block and the hole for the wing nut is used to secure the assembly to the mounting bracket in the 75A-4.

*30 Nebo Street, Medfield, Mass. 02052.

[1] This filter was reviewed by *CQ* in March, 1965, page 43.

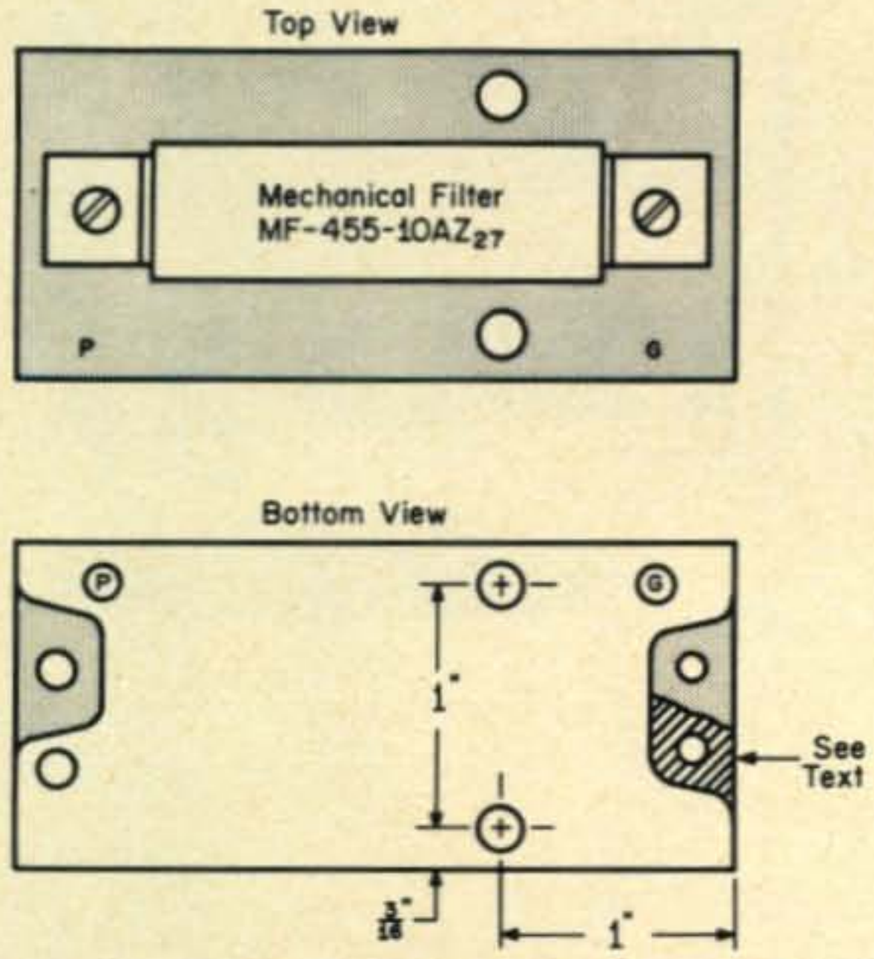

Fig. 1—Top and bottom views of the Lafayette 2.1 kc (455 kc) mechanical filter modified for use in the 75A-4. The input and output transformers are at each end of the filter.

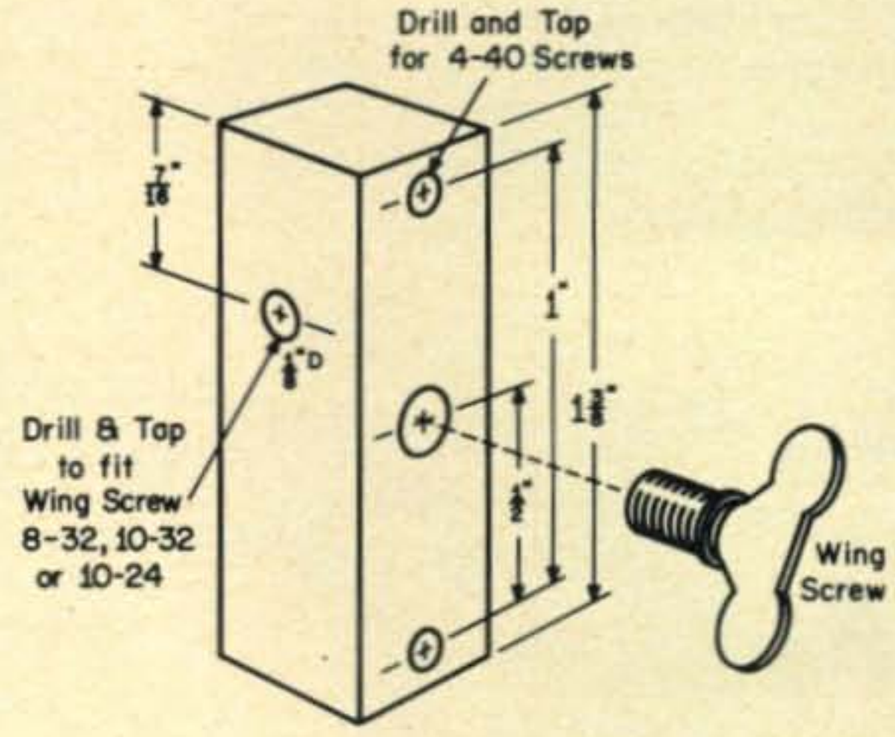

Fig. 2—Details of the ¼" × ¼" × 1⅜" brass rod needed to mount the Lafayette 2.1 kc filter in the 75A-4.

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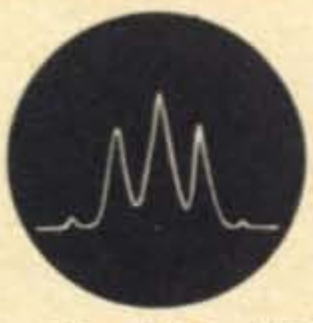

Analyzing Function — 10 kHz preset sweep width — indicate carrier 100% modulated by 2 kHz tone-log scale.

Scanning Function — approximately 250 kHz sweep width — indicates two signals above and three below the received signal, the strongest signal about 30 kHz down the band, down frequency being to the right.

The New Heathkit "Scanalyzer" Boasts Up To A Full 500 kHz Wideband Display — Plus 10 kHz Single-Signal Display. Displays up to 250 kHz either side of receiver tuned frequency (up to 100 kHz for 455 kHz IF's) . . . allows you to easily monitor band activity during contests or openings without going through the tedious hunt-and-tune procedure. The new SB-620 also brings accurate signal analysis to amateur radio . . . allows measurement of carrier, sideband, and distortion product suppression. A quality test instrument. Styled to match the Heath SB-Series equipment, the SB-620 operates with practically all receivers (see specifications). Here is a useful prestige instrument for your amateur station.

Kit SB-620, 15 lbs. **$119.95**

SB-620 SPECIFICATIONS — RF AMPLIFIER: Input frequencies: One of the following; 455 kHz, 1000 kHz, 1600 to 1680 kHz, 2075 kHz, 2215 kHz, 2445 kHz, 3000 kHz, 3055 kHz, 3395 kHz, 5000 to 6000 kHz. **Frequency response:** ±0.5 db at ±50 kHz from receiver IF. **IF frequency:** 350 kHz. **Sensitivity:** Approximately 10 uv input signal provides a visable signal (40 db mark) at full pip gain setting. **Spectrum analyzer:** Test signal input frequencies up to 50 MHz. **HORIZONTAL DEFLECTION: Horizontal sweep generator:** Sawtooth sweep produced by neon lamp relaxation oscillator. **Sweep Rate (Approximate frequencies):** 10 kHz preset: 0.5 Hz. 50 kHz preset; 2 Hz to 2.5 Hz. Variable: 5 Hz to 15 Hz. **Preset sweep width:** 10 kHz preset: 10 kHz. 50 kHz preset: 50 kHz. **Variable sweep width:*** 455 kHz (10 to 100 kHz); 1000 kHz (50 to 100 kHz); 1600 kHz (50 to 500 kHz); 1680 kHz (50 to 500 kHz); 2075 kHz (50 to 500 kHz); 2215 kHz (50 to 500 kHz); 2445 kHz (50 to 500 kHz); 3000 kHz (100 to 500 kHz); 3055 kHz (100 to 500 kHz); 3395 kHz (100 to 500 kHz); 5200 kHz (100 to 500 kHz); 6000 kHz (100 to 500 kHz). **Resolution:** 1 kHz. Note: Resolution is defined as the frequency separation between two equal adjacent signals such that the intersection between their respective pip indications is 30% below the apex amplitude. **Amplitude scales:** Linear: 20 db (10:1) range. Log: 40 db (100:1) range. —20 db Log: (Extends calibrated range to 60 db). **POWER SUPPLY: Type:** Transformer operated; fused at ½ ampere. **Low voltage:** Full-wave voltage doubler circuit, using four silicon diodes. **High voltage:** Full-wave voltage doubler circuit, using two seleium diodes. **Bias voltage:** Full-wave bridge circuit, using four silicon diodes. **Power requirements:** 120 or 240 volts AC, 50/60 Hz, 40 watts. **GENERAL: Tube complement:** (1) 3RP7 CRT, high persistance (yellow trace with screen filter). (1) 6AT6, detector vertical amplifier. (1) 6AU6, IF Log amplifier. (1) 6EA8, sweep oscillator, mixer. (1) 6EW6, RF amplifier. (1) 6EW6, IF amplifier. (1) 12AU7, horizontal, push-pull amplifier. **Diode complement:** (8) Silicon diodes, low voltage rectifier, DC filament rectifier. (2) Selenium diodes, high voltage rectifiers. (1) Silicon diode, voltage-variable capacitor. **Dimensions:** 10" W x 6⅝" H. x 10½" D.

*These sweep widths are minimum values. Actual sweep width ranges will be greater than those listed, depending on the receiver IF frequency for which unit is wired.

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Prices & specifications subject to change without notice. AM-184

For further information, check number 11, on page 126

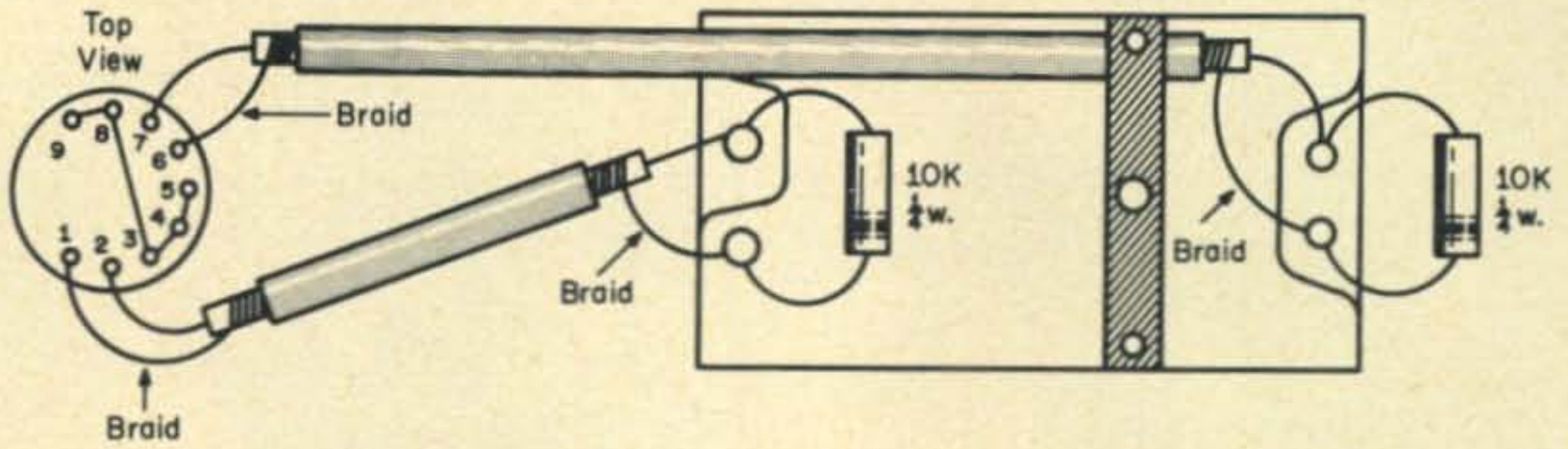


Fig. 3—Wiring for the Lafayette 2.1 kc filter for use in the 75A-4.

Wiring

Cut two lengths of plastic covered shielded wire or coaxial cable about 1/10" in diameter, one 4" long and the other 2" long and dress the lead ends as shown in fig. 3. Shunt the filter terminals with 10K, ¼ watt resistors and connect the shielded wires. The 4" length of shielded wire connects to the grid terminal with the braid connecting to the pin from which the etch was removed. This braid should not be grounded.

The 2" length connects to the remaining two terminals with the braid connection made as shown in fig. 3. The connections are made to a 9 pin male plug to fit the filter socket.

Adjustment

Connect the filter in the 2.1 kc filter socket but do not mount it against the bracket yet. Turn the receiver on and tune to 3.4 kc with the calibrator on.

Place the selectivity switch on 3.1 kc or the 6.0 kc position (but not 2.1 kc) and peak the tuning for maximum S-meter reading and note the reading carefully.

Switch to the 2.1 kc filter and adjust the input and output transformers located on the new mechanical filter until the S meter reading is the same as it was in the 3.1 kc or 6 kc filter position. Also check to be sure the bandpass is as flat as possible. Now mount the filter with the wing bolt.

The shape factor of the Lafayette filter was checked against that of a Collins 2.1 kc unit and was found to be almost identical. ■

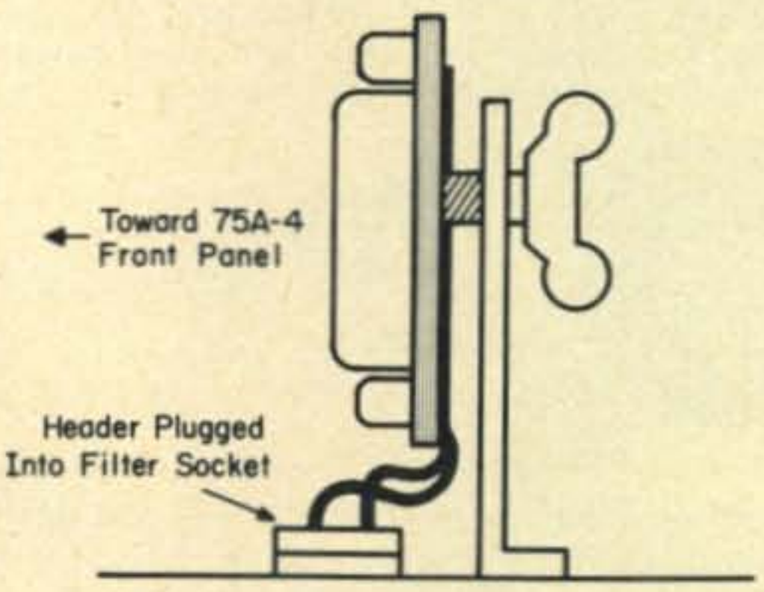


Fig. 4—Filter mounting and connection.

New Amateur Products

Gonset

A NEW mobile v.h.f. linear with built in solid state supply has been announced by Gonset. The "Comtron" mobile linear covers the entire two meter band and may be driven to 180 watts p.e.p. by an exciter in 5 to 30 watt range. It is priced at $299.00. For full specs write to Don Ward, Sales Manager, Gonset, Inc., 1515 S. Manchester Ave., Anaheim, California, 92803, or circle 65 on page 126.

Stanley

STANLEY introduces a new driver that accommodates 15 standard sizes of hex nuts and screws. For further information write to: Dept. PID, The Stanley Works, New Britain, Conn., 06050 or circle 66 on page 126.

EURO-OSCAR

A STATUS REPORT

ON the 17th of March, a relayed telephone call announced that a passenger on United flight 64 would arrive at the San Francisco airport with a package destined for project OSCAR. It was Euro-OSCAR, the DJ4ZC satellite. Since the call arrived too late to meet the courier at the airport, the package was picked up at his home in Palo Alto. From there it went to Lance Ginner's QTH where the satellite was uncrated and inspected. Aside from a loose core in one of the slug-tuned coils, the unit was intact. A note in the package advised not to apply power until instructions arrived via regular mail—these arrived about a week later.

Physical and electrical evaluation of the package is now under way. Physically, the unit looks usable although some of the components will have to be mounted more securely to prevent possible damage during launch. The shock and vibration during the first minutes off the pad can be devastating unless everything is securely fastened down.

In addition to any physical and electrical rework, there remains the job of mounting it into a new framework, incorporating a 432 mc beacon (with antenna), and installing a power supply. Once this work has been scheduled with some degree of certainty, the political efforts to obtain launch and operating approvals can begin. Progress is definitely being made and things look very promising at this time.

In general, the functions of the DJ4ZC package are similar to OSCAR 3. Another way to think of the package is to visualize a conventional s.s.b. transceiver. Now convert it to solid-state, reduce its size by a factor of ten, throw in a code generator for the HI's and you will have some idea of the complexity of Euro-OSCAR. A more detailed article on Euro-OSCAR will be published at a later date.

The Euro-OSCAR unit incorporates an antenna system that will give circular polarization. With this fact in mind, the average amateur will want to use linear polarization for tracking and for transmitting to the satellite. For those with more advanced ideas, this would be a good opportunity to try out polarization diversity systems for an additional 3 db improvement in reception performance. If any of you try this, it would be of interest to record the polarization sense changes as a means of evaluating the tumble orientation and rate.

Launch Schedule

If the schedule for OSCAR 5 accelerates and a launch grows imminent before the next regular Newsletter in July, a special bulletin will be distributed. In the meantime, the OSCAR information net will be reactivated. W6ASH will be transmitting OSCAR bulletins on Thursdays at 7 P.M. PDST (0200 GMT, Friday) on 14.030 mc starting 2 May 1967. He will also transmit these bulletins on Thursday at 10 P.M. PDST (0500 GMT, Friday) on 7.015 mc. These will be short OSCAR information bulletins or progress reports and he will stand by on frequency for any questions or OSCAR traffic. (*Tnx Project OSCAR*). ■

"Designed for Application"

BY DAVID F. PLANT,* K9LAJ/2

THERE is a story behind those unchanging Millen ads that appear year after year in *CQ*. It is the story of a man who pioneered in the state of the art many of the things that we now take for granted, for r.f. chokes, coil forms, variable capacitors, and the famous Millen dials all owe at least part of their existence to his influence. James Millen fathered the concept of superior mechanical, as well as electrical design that has become a standard in the electronics industry.

Early Days

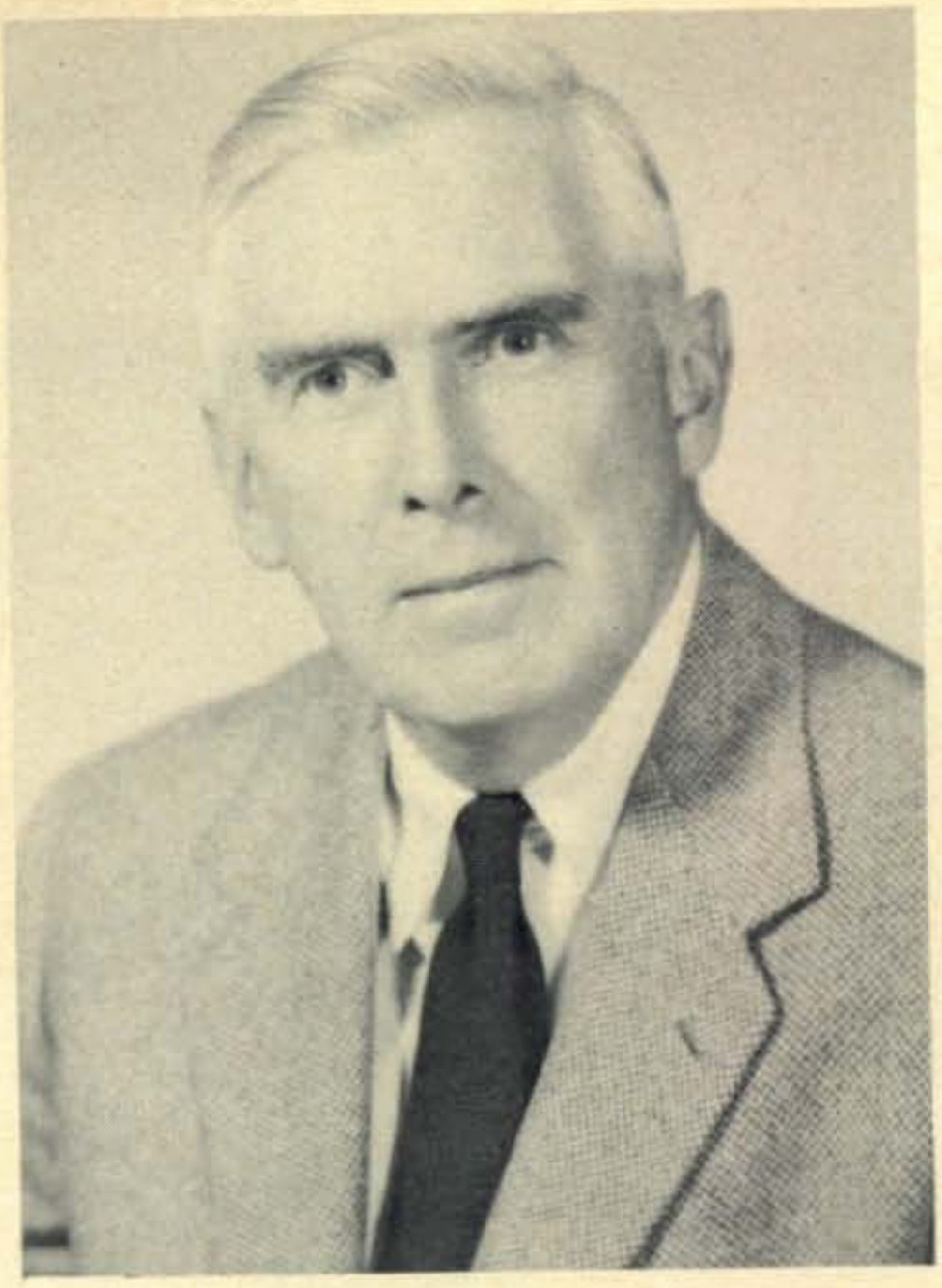
Radio has a lure all its own and it can strike at any time or stage in a man's life. It hit Jim Millen while he was attending high school in Forest Hills, Long Island. The fascination of communication by wireless. . . By 1916 Jim had a station on the air.

In those days ham radio was a bit different. You took a spark coil from a Ford motorcar and souped it up by adding larger contacts so it could handle the 110 volt d.c. house current instead of the 6 volts for which the coil was designed. This coil then excited a helix coil affair which was tuned by a large home made capacitor. The *Q* was very low and the resultant signal was quite broad, being somewhere around the upper part of the present broadcast band. This spark signal was received with either a galena or electrolytic type of detector and a set of headphones, and sounded like a raspy buzzy note that wasn't the most pleasant sort of thing. Those who wanted to improve the sound of the transmitted signal used a rotary spark-gap, imparting a high audio frequency whine which acted to modulate the transmitted signal. This was the state of the art before the First World War.

After the war to end all wars was over, and the world went back to what it was

*247 W. 11 St., New York, N.Y.

The Story of James Millen, W1HRX



James Millen, W1HRX, put National Company in the radio business, and later became the founder of his own precision electronic components company.

doing before, amateur radio operators went back to experimenting with several new pieces of apparatus developed for the war effort. The most noted was a tube called the J-type manufactured by the Western Electric Company and it found widespread use in both transmitting and receiving modes. It replaced the spark transmitter when used as a keyed triode oscillator, and as a grid-leak detector proved superior to the crystal set. Jim was among those experimenting and learning on the ham bands around 200 meters.

Herbert Hoover Sr., 6DH personally signed all licenses issued by the Department of Commerce and Jim Millen was given the call 2BYP in 1921.

Upon graduation from high school Jim studied mechanical engineering (there being no formal course of study in electronics at that time) at Stevens Institute. During the 4 year course of study, 1922-1926, Jim Millen started making receivers as his first commercial enterprise and the October 1922 issue of *Radio News Magazine* carried the original Millen advertisement.

Other magazines also started carrying the Millen name, first with pen and ink drawings of radio diagrams, then a question and answer column, and finally Jim ended up writing a monthly technical article. Starting as a means to help pay tuition, writing was to become a very important part of a fascinating career.

The 4 years spent at Stevens earning the M.E. degree were interesting ones as many of the pioneers of the electronics field either taught, or were classmates of Jim's. Dr. Alan Hazeltine, the designer of the Nuetrodyne circuit; Paul Ware, founder of Ware Radio; and Larry Horle, of Federal Radio were on the staff and Ted Smith, later of RCA, was a fellow student.

Upon graduation from Stevens, Jim worked on the editorial staff of *Radio Broadcast Magazine*, published by the

During the '30's, the Millen shack took on the elaborate configuration shown above. It was with this station that the famous 5-meter tests were conducted with Ross Hull.

Doubleday-Page Company. Contributions were also made to the other radio magazines.

James Millen then decided to put his experience to use in consulting work and a company was formed. Working closely with companies that were to become famous in the electronics field, clients included the American Appliance Company (called Raytheon a year later), the Ceco Tube Company of Providence, R.I., and the National Toy Company. RKO Studios also became a customer when they came to New York to make their first two "Talking Pictures."

During this period of time Arthur Lynch took over management of radio WRNY and *Radio News Magazine*. He also had started a resistor manufacturing company developing among other things a solid-state diode long before current solid-state technology. Millen had worked with him while attending Stevens, and continued while doing consulting.

One of Jim's clients, the National Toy Company, was attempting to break into the "new" radio industry and made a deal with him to put them in this field. In 1928 Jim took over operation of National and entered a very fascinating part of his career.

The National Radio Days

The first step was to have National enter the amateur receiver market. Combining his mechanical engineering background with electronic experience gained through operating and experimenting, Jim produced the first of a long list of good receivers. The model was called the SW-5 and it met with immediate success, as it enabled the shortwave listener or ham to have a good factory wired receiver at a reasonable cost.

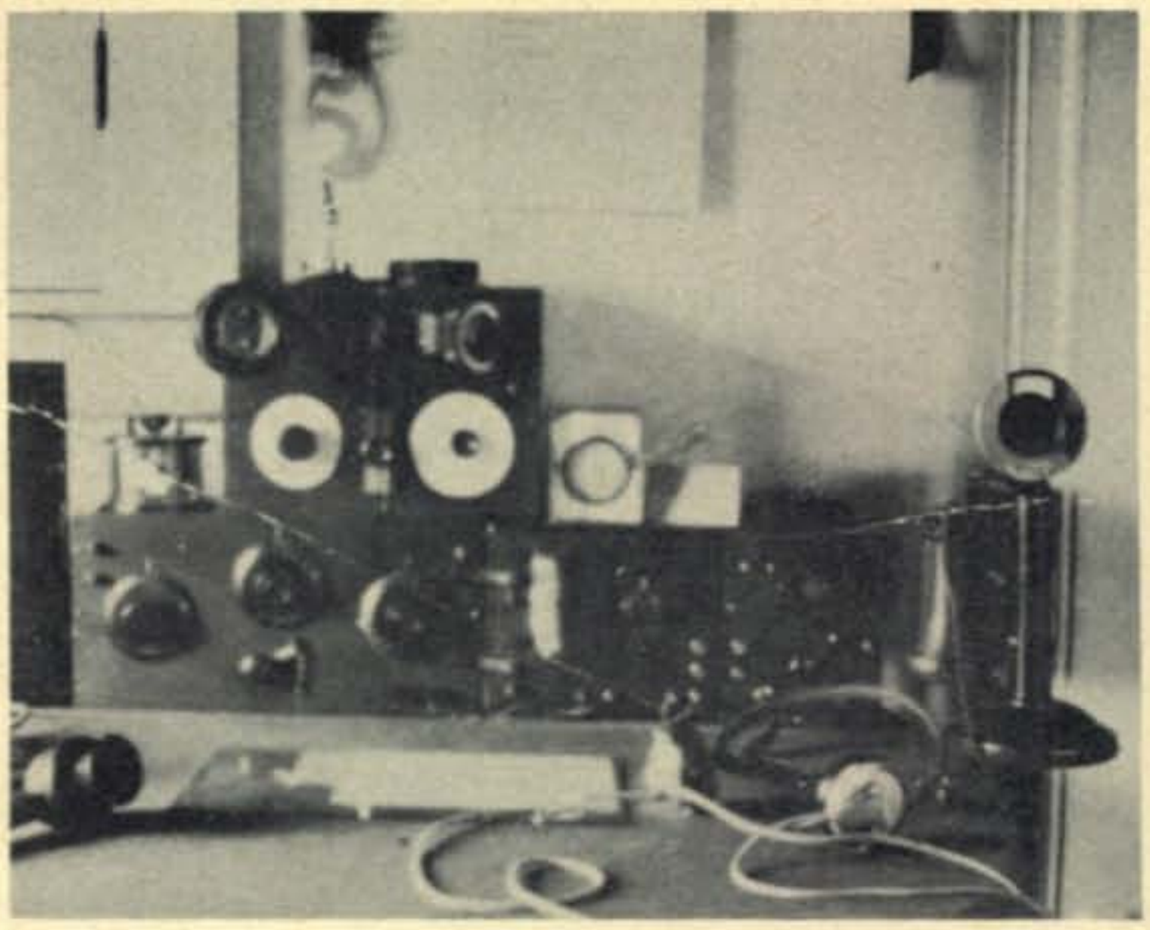
The SW-5 was originally a battery powered unit and required husky batteries for the filament supply, so research was done to see if it would be feasible to run a shortwave radio from the power lines. The prob-

lems encountered seemed insurmountable at first; for a.c. on the filaments of the tubes caused a hum in the loudspeaker, and instability at the higher frequencies. Better tubes and a lot of research time in the laboratory overcame the hum problems finally and the shortwave listener could eliminate the bulky storage battery. Trying to rectify the power line voltage to provide d.c. voltage for the plate supply was the next step, and problems were met here also because the c.w. signals from the receiver had an annoying ripple until power supply filtering techniques were perfected.

Jim and his group seemed to thrive on challenges. After a model was built they looked for ways to make it better, less expensive, or more universal. After the SW-5 came the SW-3. It was more compact, lighter (suggested use in aircraft) and required less current from batteries. The SW-4 and FB-7 evolved next, then the classic National HRO was developed followed by the NC-100, NC-200, etc. Men that helped in the design of these receivers included Dave Grimes, R. S. Kruse, and Zeh Bouck.

Going north along Route One from Boston brings one to Malden, Massachusetts, the home of the National Radio Company. The Millen home, located nearby, proved a natural for testing new designs, antennas, or frequencies. The location also had other advantages. This writer found it peaceful and beautifully scenic—just the place to experiment and operate, or write.

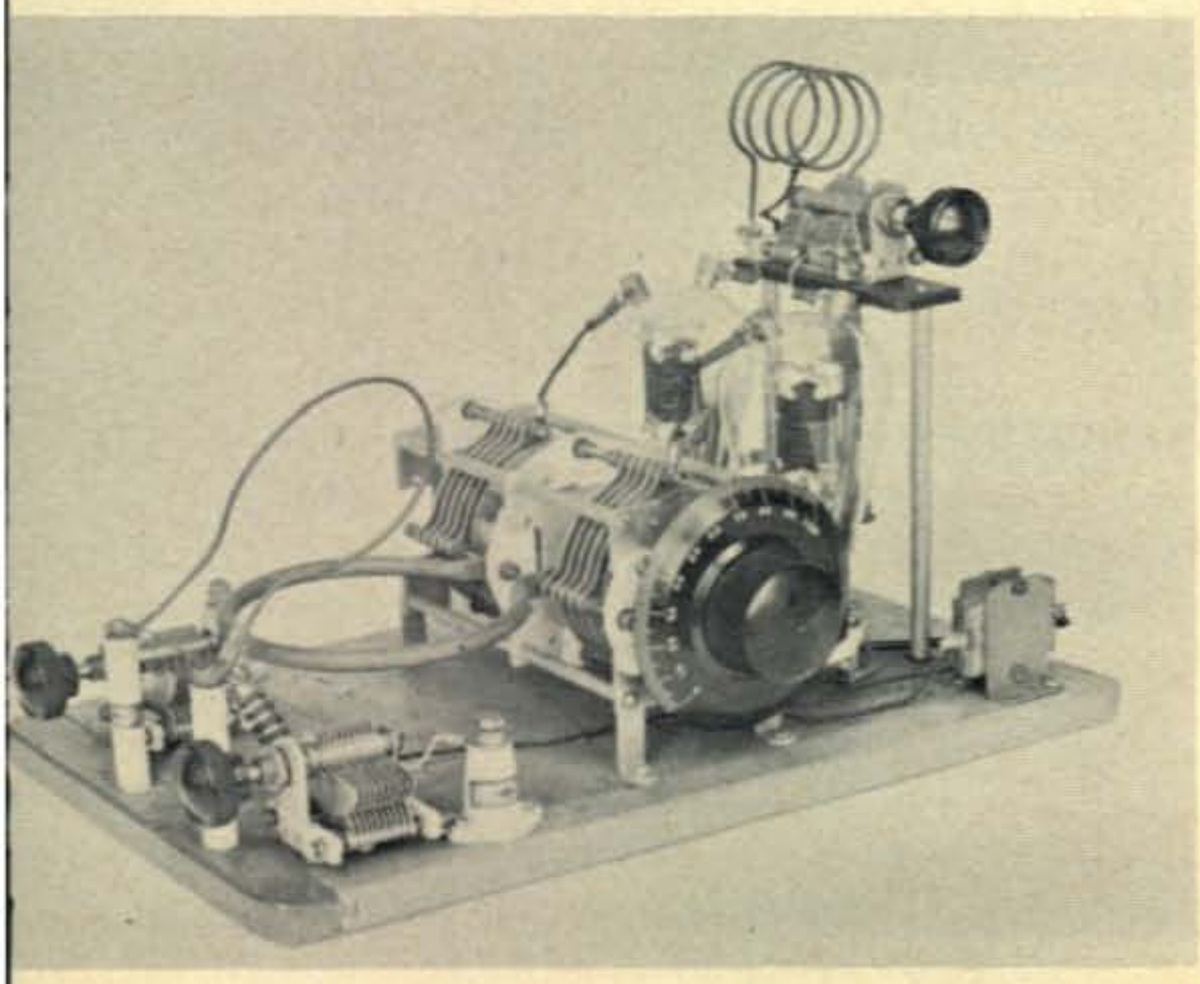
QST at that time was being run by Ross Hull, and he and K.B. Warner, the League's manager, were close friends with Jim Millen. The close cooperation of these men made possible the sharing of new developments with the amateur fraternity almost on a monthly basis, as much of the experimenting and editorial work for QST was done at the Millen shack.



Amateur station of Jim Millen—1920.

The Radio Amateur's Handbook as we know it today also came about through the Millen-*QST* relationship. In the early 30's it was a pamphlet-sized affair until Jim underwrote the cost of a larger and more complete book. National Radio, under Millen, became the first advertiser.

This period of time also brought about some historical v.h.f work. Under the leadership of Ross Hull, Jim Millen participated as the Boston station of a triangular setup with each leg consisting of a 100 mile path. Recorders were set up to measure the reliability of the nightly transmissions on the 5-meter band. The favorable results of the experiment paved the way for the later allocated 2 and 6 meter bands. Ross Hull was killed in an accident before he was able to compile all the data, but he did give several talks before scientific societies in Washington. The equipment used consisted of push-pull 800's running over a hundred watts and feeding a large 8-element array at each station. The receivers used were of National manufacture and were superregenerative.



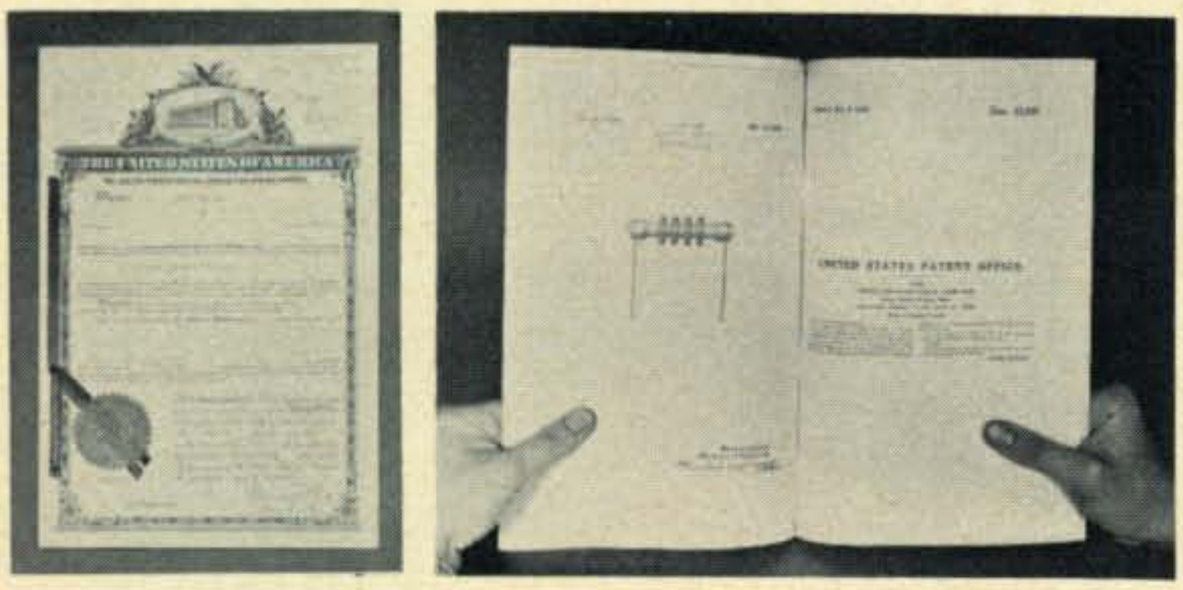
This five-meter final amplifier served during the early thirties as part of the station equipment used during Ross Hull's historic v.h.f. experiments. Jim Millen's station, W1HRX, served as Boston corner of the triangular setup with 100-mile legs. That's a real breadboard, fellows!

Other "Firsts" during Jim's stay at National include the backing of Jim Lamb on his single signal crystal filter work, the use of Red Cross TB stamps affixed to a National ad in *QST* as a charity gesture, and the initiation of the monthly series of "Personal Message" type of advertisements starting with the March 1934 issue of *QST*. This form of advertising is still being carried on by others.

Perhaps one of the most important contributions to the state of the art occurred in 1934 when the present design of the r.f. choke was developed. Prior to that time chokes were wound on high value resistors or wooden sticks, much the same way we do now if an experimental choke is needed. Many chokes were made and tested to determine hot spots and frequency range, and finally a predictable and mechanically sound choke came about. Jim was issued a patent on October 2, 1934, and the 2.5 mhy choke quickly became a standard throughout the industry.

James Millen also continued his writing and many of the designs of the National Company were shared with hams through magazine articles and a number of books including *Radio Design Practice*, and an excellent v.h.f. text, called *Below Ten Meters*. Numerous pamphlets were also printed so that amateurs could duplicate National's designs.

The newly developed air transportation services discovered that ham radio equipment worked well for ground to air communication and in the late 20's and early 30's became a large, but little known customer of the National Company. National was doing well.



The original patent, issued in 1934 to James Millen for the "design for an electrical choke coil," the familiar pi-wound choke which has since become a standard among amateurs.

In 1939 the National Radio Company went "Public". During the same year James Millen made a friendly withdrawal from the company, and along with several associates started the James Millen Manufacturing Company. An announcement of the newly formed company was run in the May, 1939 *QST*.

Jim had started a policy early in his career of working with the very best talent possible and made no exception when the manufacturing company was started. John Di Blasi, 2FX, and Charlie Cooper, both well known men in their fields, were among those that Jim brought with him.

John, 2FX, is perhaps best known to the readers of *CQ* as the founder and president of the Quarter Century Wireless Association. He is also the New York representative of Millen Manufacturing.

The late Charlie Cooper had also an interesting life. He was an early associate of DeForest, and later founded the Ship Owner's Radio Service. The latter provided wireless for boats and eventually became part of RCA. Charlie was also a poet and often delighted the company with verse.

The summer of '39 was an active one as many items of manufacture were reviewed by Millen and his associates to see what improvements could be made. Tools were designed and made, and a factory was leased in the fall. A catalog was then released and James Millen was in business.

The importance of good mechanical design in the manufacture of electronic components was always stressed during Jim's career. At National Radio a good example of this approach could be found in the HRO receiver. Here, the main emphasis was placed on the tuning capacitor and dial combination. The time was well spent as the receiver met with great success. The practice of good mechanical and electrical design was carried over to the Millen Company and the company slogan "Designed For Application" became well earned.

Although the Millen factory originally started making components, they soon began the manufacture of electronic equipment. Oscilloscopes were built for RCA, and the first commercial two-way f.m. radio equipment was designed and built for G.E.

Looking for ways of combining electronic with mechanical design has brought James Millen to many places throughout the world. Trips to Europe enabled the American man-

ufacture of items such as coil forms, tube sockets, sheets and tubing made with polystyrene and other low loss injection moldable plastics shortly after their European discovery.

Another important type of component developed at Millen was the magnetic metal shield. Using commercially available ingots of Mu Metal made in Trenton, New Jersey by the Henry Porter laboratory, the Millen people pioneered in the manufacture of custom and stock magnetic shielding for cathode ray tubes, photo multipliers, and klystrons.

During the Second World War the Millen Company worked with G.E. to produce the "continuous" type of delay cable and the necessary machinery for its production. Twenty years later finds the Millen Company still the exclusive manufacturer of this component group.

One of the best known items in current manufacture is the Millen Grid Dip Meter. This precision device combines the excellent mechanical design of the Millen Works with the electronic experience of *CQ*'s own Bill Sherer, W2AEF, and is found in many labs and shops.

Although many items at the Millen factory are components and assembled units for private industry, laboratory work, and government; the major emphasis is still design in the communications field.

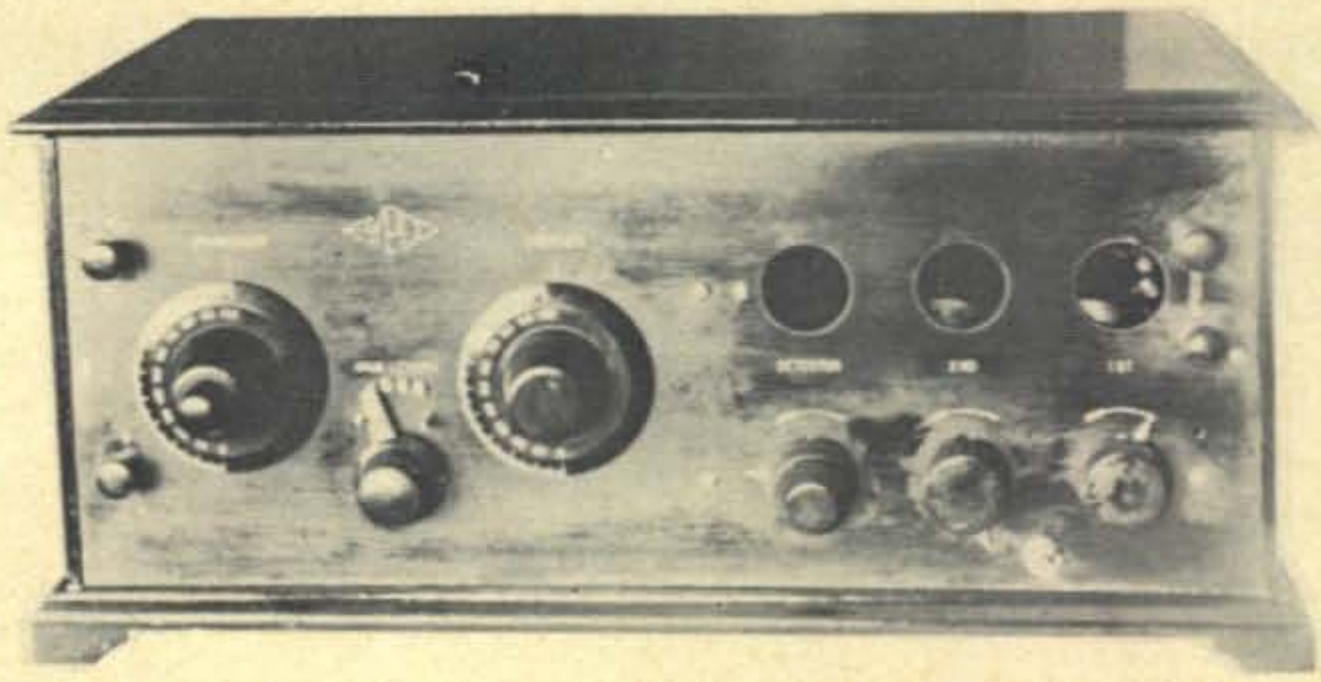
Among the many parts found in the current catalog are a complete line of variable capacitors for both transmitting and receiving, coils of many shapes and values, sockets and terminals, oscilloscopes and their accessories, and many types of special hardware. Of special interest to the radio amateur is the transmitting equipment, antenna matching devices, and the famous grid dipper. The Millen dials and couplings have also found popularity among hams.

A recent development from the Millen Works is their "No-String" dial and it has already found wide acceptance in the amateur ranks for v.f.o.'s and other tuning applications.

The Millen plant is completely self contained so they can perform all stages of manufacture including the making of tools and dies. This approach allows the company to immediately change or design an item without having to go through the usual time-consuming channels. Better quality control is also assured.

With the company well established, Jim now has the time to follow other interests. These include the Vice Chairmanship of a large suburban Boston bank, and boating. Also maintained is a complete electronics library including all publications pertaining to radio from the very beginning. Early catalogs, complete collections of *Radio, QST,* and *CQ* are kept as well as many books and magazines now out of print. Also in the library is a complete ham station that Jim uses to keep weekly skeds on 75 s.s.b.

Spanning over 50 years in the radio business, the life of James Millen surely ranks as one of the most productive we're likely to see. "Designed for Application" will continue to be a way of life to this vigorous, brilliant and imaginative pioneer of the electronics industry. ■



One of the first products to be manufactured and sold by Millen was this broadcast receiver made while he was still a student at Stevens Institute from 1922 to 1929.

An F.E.T. Product Detector

BY JOHN J. SCHULTZ,* W2EEY/1

This article presents a simple product detector/crystal-controlled b.f.o. accessory that can be used with almost any receiver to improve s.s.b. reception. The product detector uses a new type of FET for improved dynamic range and low distortion. A general description of FET's is included for those who do not yet appreciate the many uses of this transistor device.

THE main purpose of this article is to describe a simple product detector circuit construction using a field-effect transistor (FET) which performs considerably better than the normal vacuum tube or diode type unit. However, since FET's are being used for so many circuit applications, usually in conjunction with normal transistors, perhaps a brief review of the nature of FET's will be valuable for those readers who are not yet acquainted with this device.

FET Principles

To those who are somewhat confused by normal transistor circuitry because of the multiple ways in which the elements can be connected, FET's provide a refreshingly simple analogy to vacuum tube circuitry.[1] For instance, fig. 1 shows in simplified form how an FET is constructed. Forgetting about the so-called gate connection and N type material indicated for a moment, there remains only a piece of p-type semiconductor material with a voltage applied across it. The p type semiconductor material is lightly doped so that it is resistive. Increasing the applied voltage simply increases the current flow through the bar. The introduction of the N type material is analogous to the use of a grid in a vacuum tube. A voltage placed on the N type material (gate connection) will control the current flow from source to drain (assuming the potential between drain and source is fixed such as the plate voltage on a vacuum tube). The essential point that makes the FET different from other transistors is that it is basically voltage on the gate that regulates the current flow and not current flowing through the gate connection. Therefore, like a grid in a vacuum tube, the gate presents a high impedance input that does not load down the input signal. All of the high impedance tuned circuits and coupling methods used with vacuum tubes can be used with FET's and none

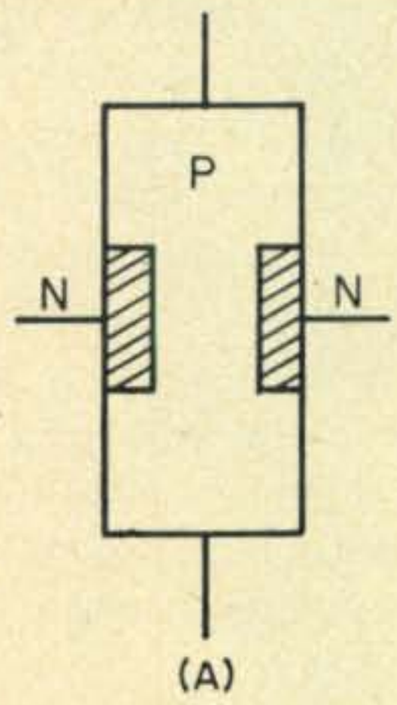


Fig. 1—A P junction FET at (A) is represented by the symbol shown at (B). An N junction FET would be shown with the arrow in the gate lead reversed and the drain and source polarities would be reversed. Either FET is employed using circuits almost identical to tube circuits (C).

*40 Rossie Street, Mystic, Connecticut.

[1]For a more extensive description of FET's refer to Hyder, H. R., "Understanding Field Effect Transistors," *CQ*, August 1966, p. 38.

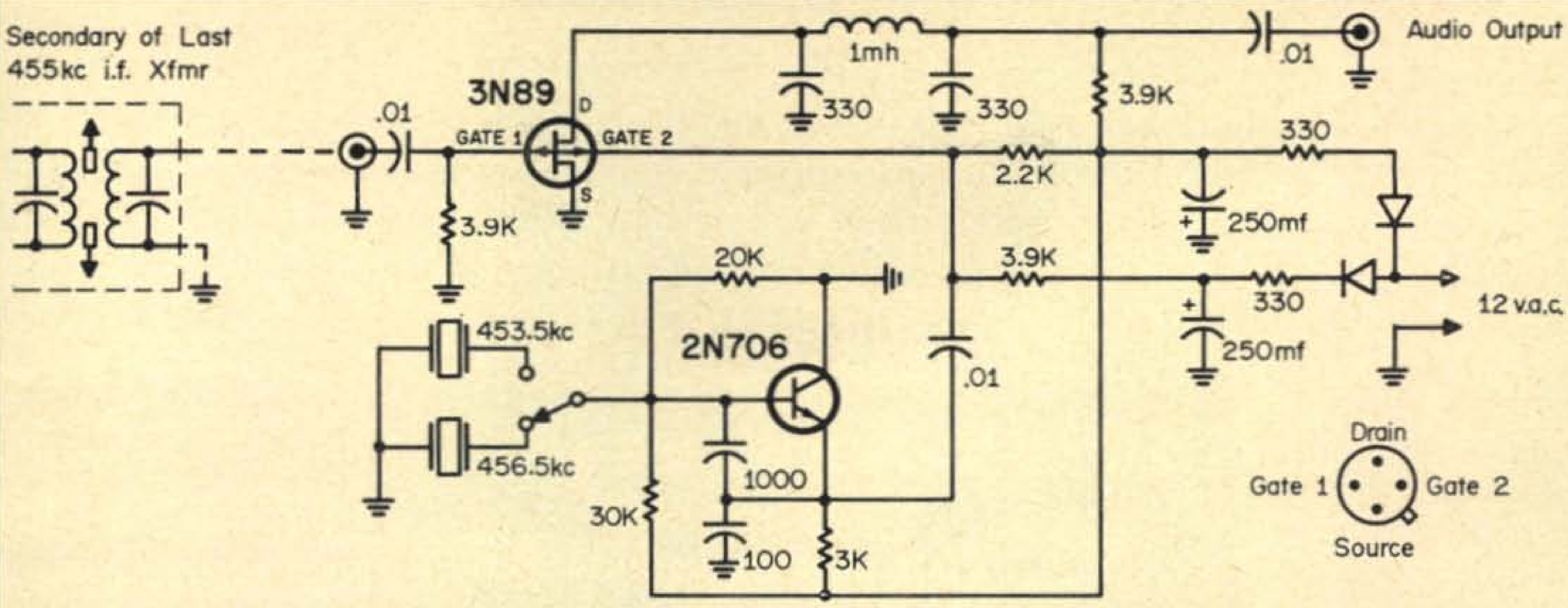


Fig. 2—Dual-gate FET is used as a product detector and a conventional transistor as a crystal controlled b.f.o. in this adapter unit designed for use with a receiver lacking a good product detector/b.f.o. combination for s.s.b. reception. The 3N89 is manufactured by Siliconix, Sunnyvale, Calif. All resistors are ½ watt and all capacitors greater than one are in mmf. Capacitors less than one are in mf unless otherwise noted.

of the special tricks of tapping down on coils or other low-impedance coupling techniques that most transistor circuits require need be used. The term "field-effect" transistor has to do with a theoretical explanation of how an electric field set up by application of a potential to the N material controls the current flow. The term "voltage-controlled" could just as well have been used.

An FET amplifier can be biased much like a vacuum tube. In fig. 1 the resistor in the source lead functions the same as a cathode resistor would in a tube circuit. The value of the resistor determines the operating point (for a given drain voltage and load resistance) and can be chosen so operation is over a linear or non-linear portion of the drain voltage versus drain current curve, as desired. This is the same as choosing the operating point for a desired class of operation with a vacuum tube. A negative voltage swing of the gate voltage will increase the drain current and a positive swing will decrease the current. The output is therefore 180° out of phase with the input, the same as for a vacuum tube. There is only one significant difference as compared to tubes in that complete drain current cut-off cannot be achieved, although at room temperature it may amount to only a few microamperes.

Additional gates can be added to an FET to build the equivalent of multigrid tubes although the similarity ends quickly when one encounters FET's with as many as 25 gates! Such multi-gate FET's are built mainly for specialized switching applications, however, and the amateur will be mainly concerned with the FET equivalents of triodes and tetrodes. As the latter are used, FET's can also be used as r.f. amplifiers, mixers, i.f. amplifiers, oscillators or even audio amplifiers, although normal transistors will usually be less expensive for the latter application. As r.f. amplifiers FET's provide at least as good or better dynamic range than triode stages. Of course, the FET cannot stand anywhere near the absolute value of input voltage that a vacuum tube can and can be "burned-out" by excessive input the same as any other transistor. However, within its operating range, the output of an FET will increase linearly with input for as great a range in db (80 to 100 db) as a vacuum tube.

[*Continued on page 118*]

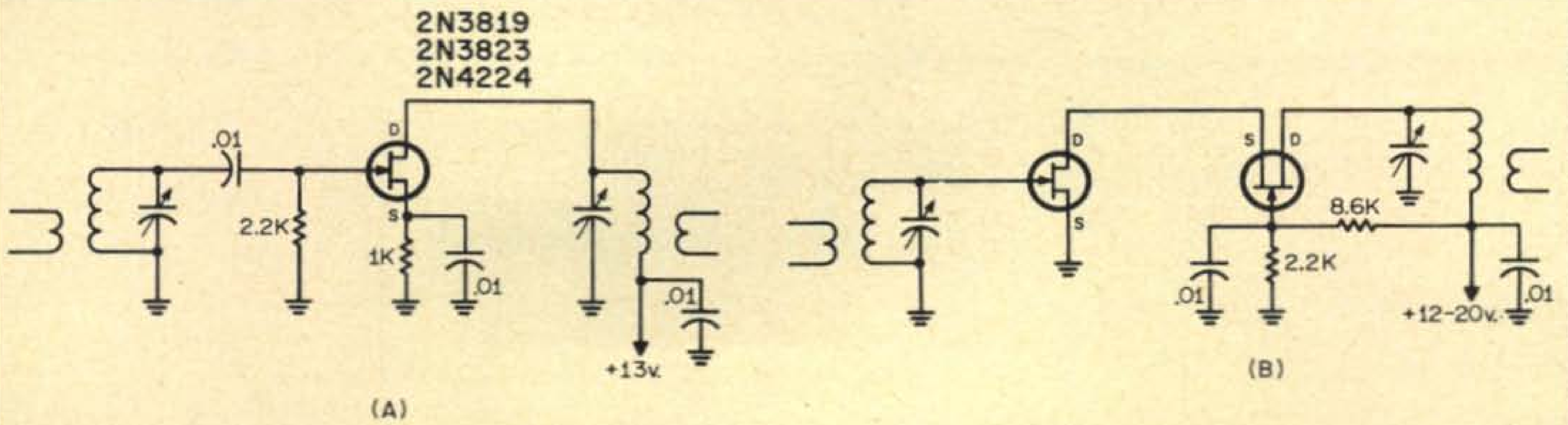


Fig. 3—Single gate FET's can be used in r.f. amplifier circuits very similar to tube type grounded cathode (A) and direct coupled cascade circuits (B). Low cross modulation and Noise Figure (about 5 db) are characteristic of FET amplifiers and compare very favorably with the best of vacuum tube amplifiers.

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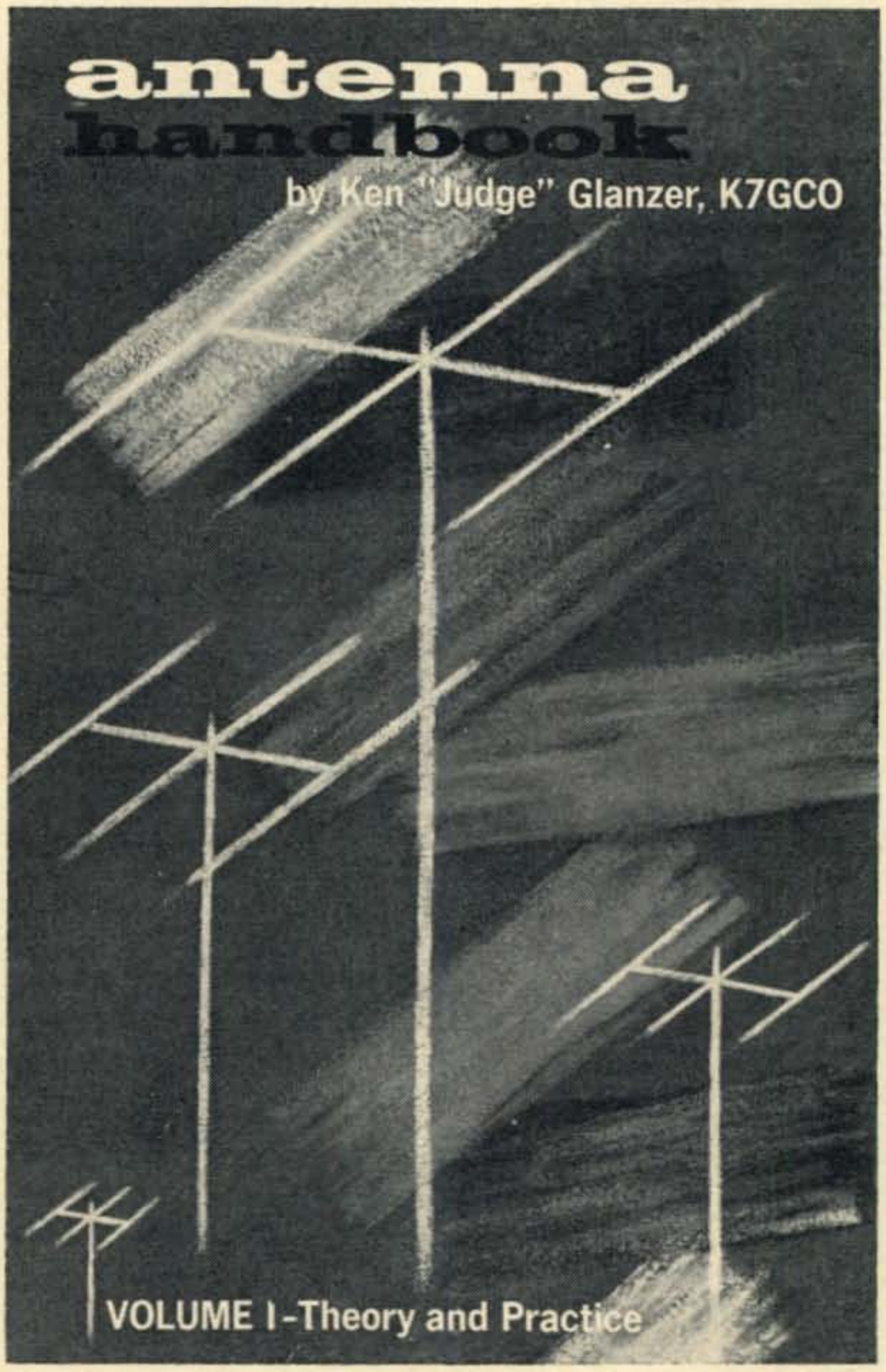

matching, devices, what happens to all that reflected power, which end of feed is more important to match, how to use open wire feed on beams, gamma matches, T-matches, feeding T-match with dual coax, transforming balanced 100 ohm coax lines to 200 or 50 ohms, capacitive match for balanced transmission lines, inductive (hair-pin) match, quarter wave and short bazookas for balanced feed, broad band baluns and effect on feedpoint current, effect of surrounding objects and power lines on feedpoint current, folded dipole matching for beams, feeding stacked beams individually or together.

Watch for the announcement of volumes II and III.

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BY RONALD LUMACHI,* WB2CQM

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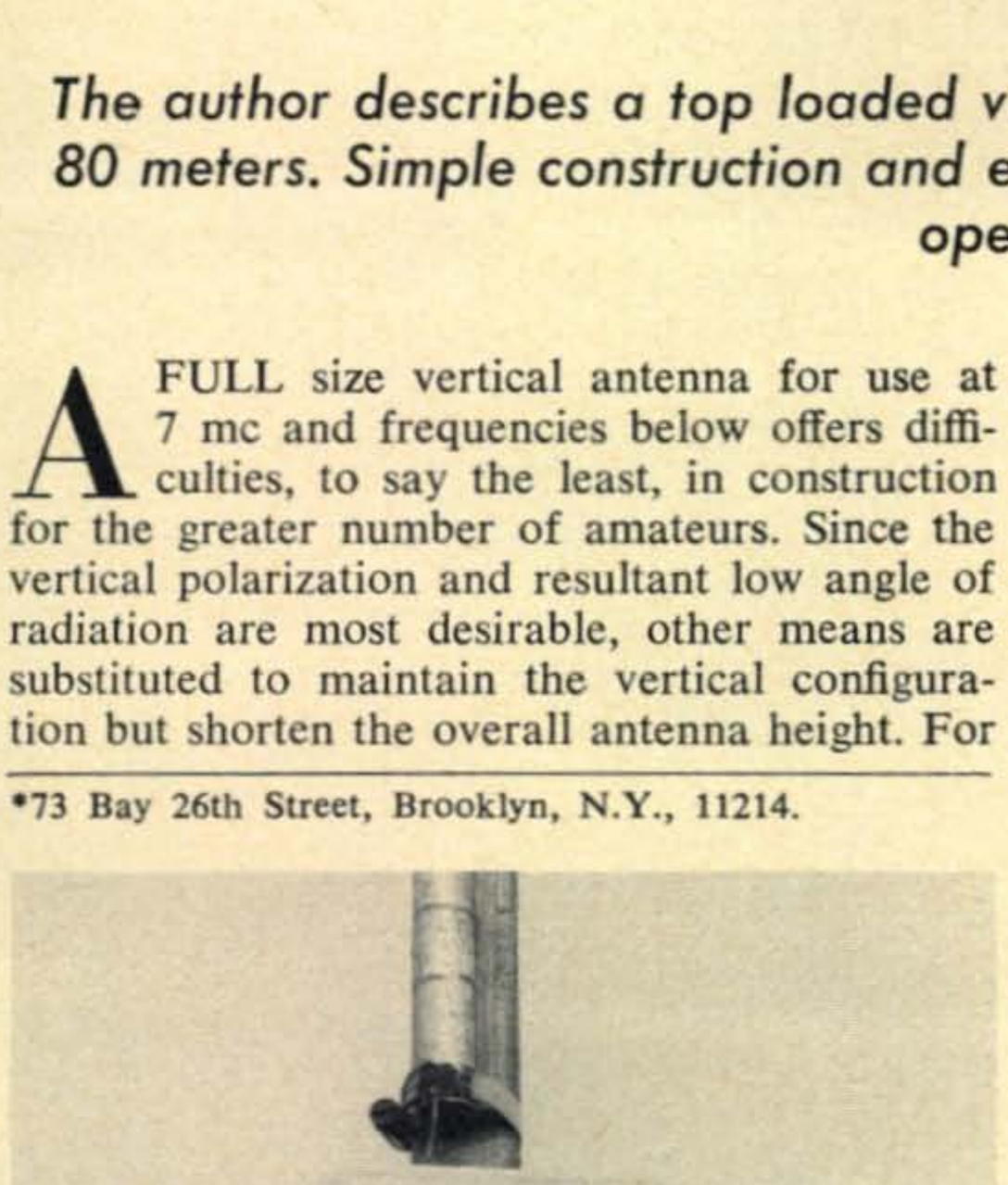
Although we have shortened the antenna by one half its length, it would still pose a problem in construction for even 40 meter quarter wave operation. Still further shortening of the array

*73 Bay 26th Street, Brooklyn, N.Y., 11214.



View of the lower portion of the vertical antenna with coil-capacitor combination. Note the connection of the coax braid to the three ground connecting wires. The antenna is mounted on a Bantam TV tower and bracketed to a wooden dowel insulator with two stainless steel hose clamps.

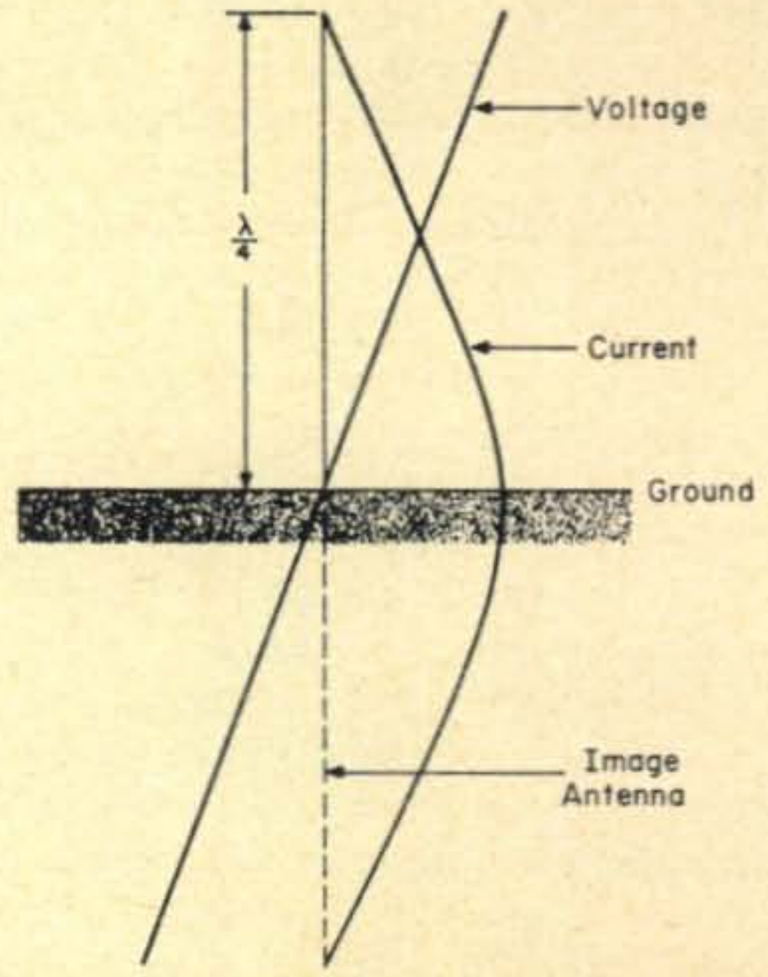
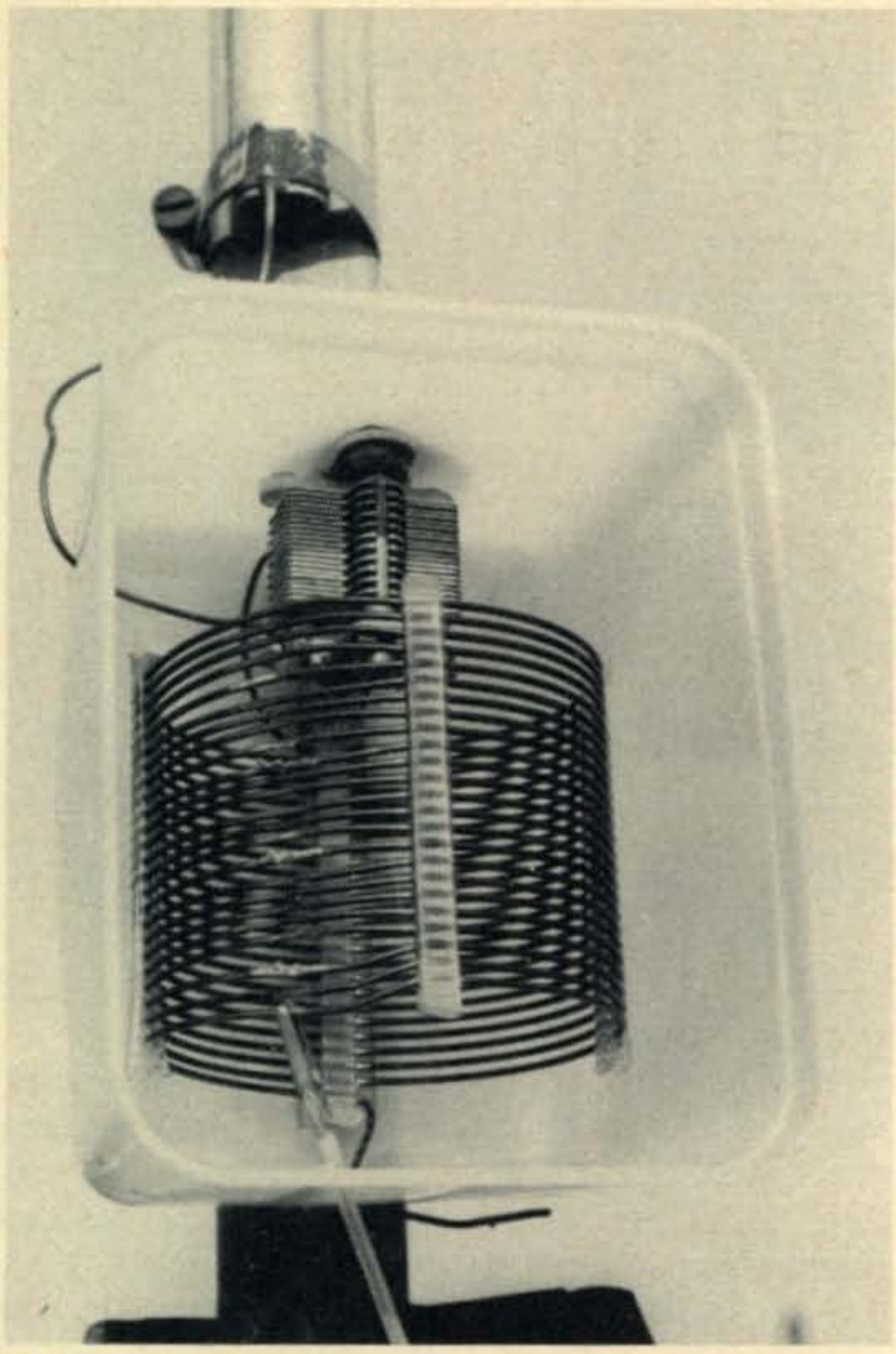


Fig. 1—Distribution of current and voltage in a grounded quarter wave vertical antenna.



Interior view of the plastic housing showing the loading coil and the series capacitor. The single spaced variable was used with low power. The double spaced variable is required for high power.

can be accomplished by substituting a loading coil at the base of the antenna. This will resonate the system in the proper amateur band and making the vertical array shorter and still less cumbersome as shown in fig. 2.

The distribution of voltage and current is affected slightly, but the low current point is still at the antenna base. It is apparent from the diagram that in the base loaded array the voltage-current distribution along the element length is somewhat skewed, however, it does not materially effect the antenna nor detract from its inherent vertical qualities. If the system were viewed from the top, its radiation pattern would appear circular or otherwise stated, omni-directional at the horizontal plane.

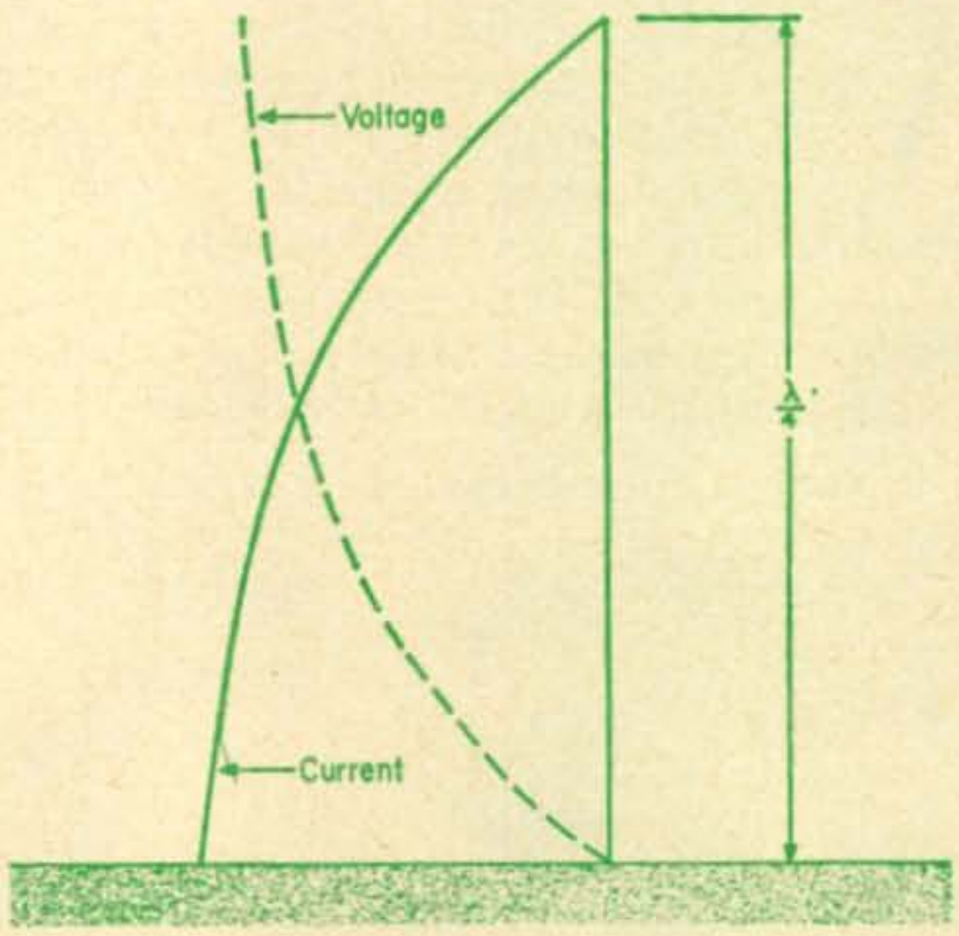
Antenna Impedance

The radiation resistance of a grounded quarter wave antenna is just half that of a half wave version. Stated generally, the impedance of a vertical system is a direct function of its length with a slight factor given to its actual structural form. For example, an aluminum tubing-type system would reflect a greater input impedance than a wide based crank-up tower with equal height and inductive components.

Since the impedance of a vertical antenna is considerably lower than 50 ohms, it will be necessary to increase the resistance of the antenna since the power dissipation factor is directly proportional to the radiation resistance ($P = E^2R$). Various approaches are available to the amateur. One briefly touched upon is the necessity of a good ground and the problem of achieving a good mechanical connection to this ground. Although a thorough analysis of antenna grounds and ground connection considerations are beyond the scope of this discussion, they briefly include the placement of interlaced wire and mesh over a large area around the antenna system; metal rods driven into the ground, and even outright treatment of soil to reduce its resistivity for a true closed circuit.

Top Loading

Another method of increasing the transmitting resistance of the antenna includes the placement of a concentrated amount of (self) capacitance



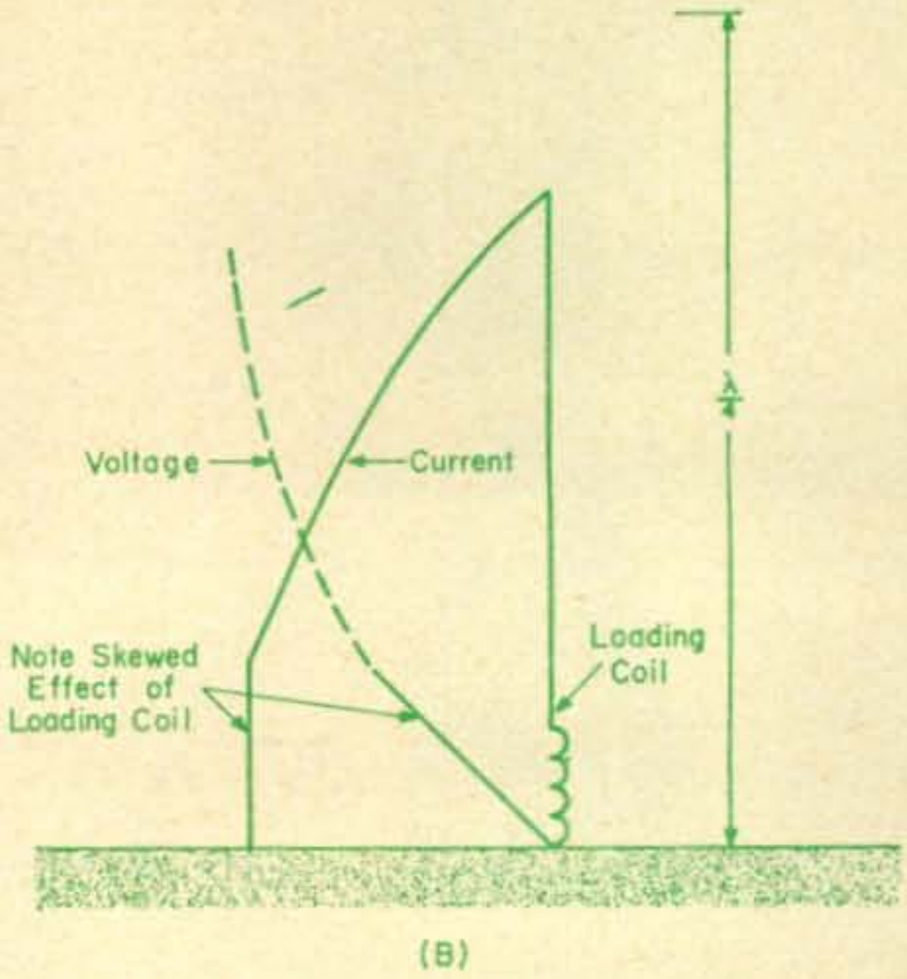
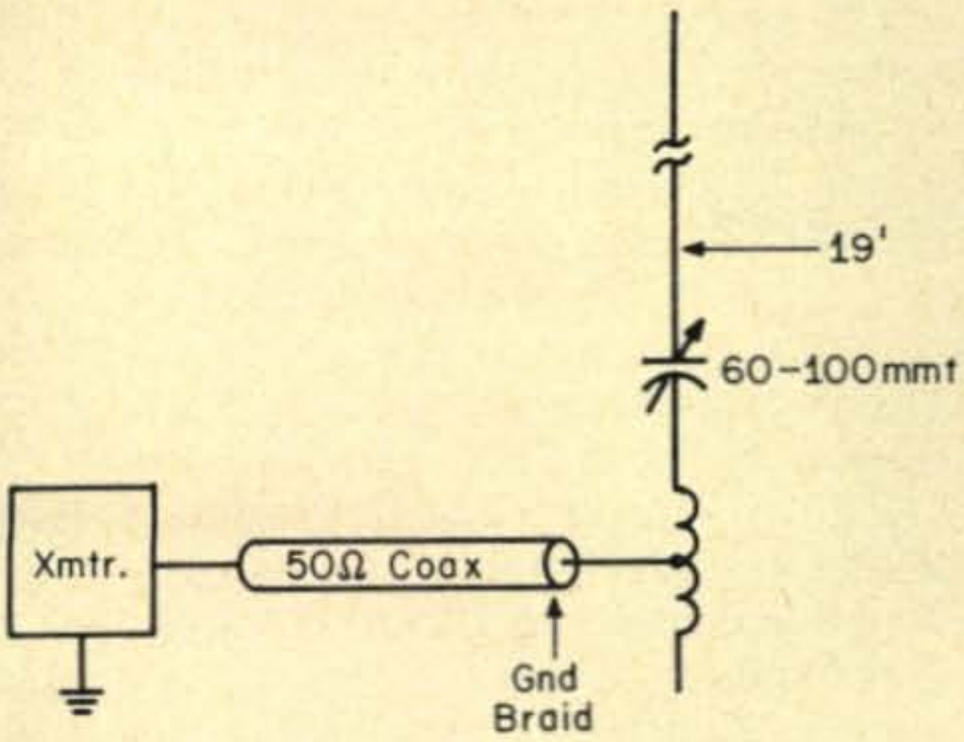


Fig. 2—Distribution of current and voltage along a quarter wave vertical antenna; (B) Distribution of current and voltage along a quarter wave vertical with a loading coil at the base.



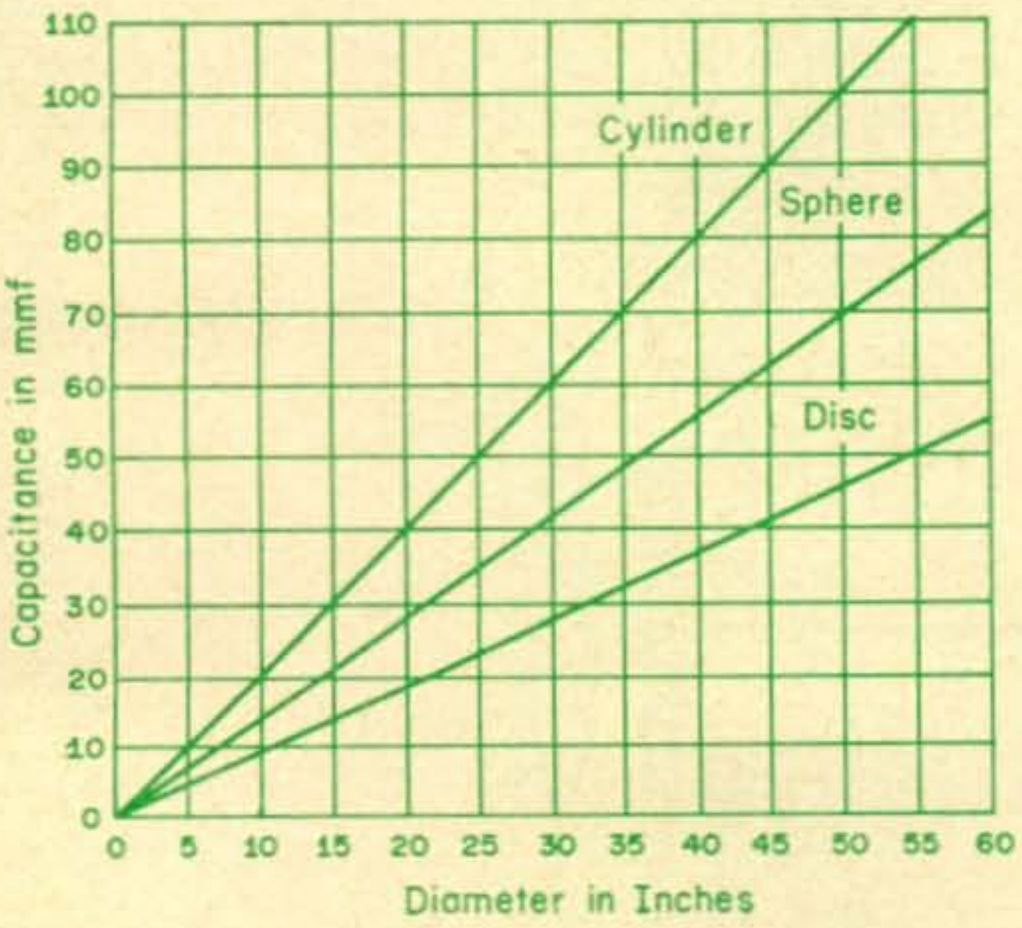


Fig. 3—Relative value of self-capacitance for various shapes of top-hats.

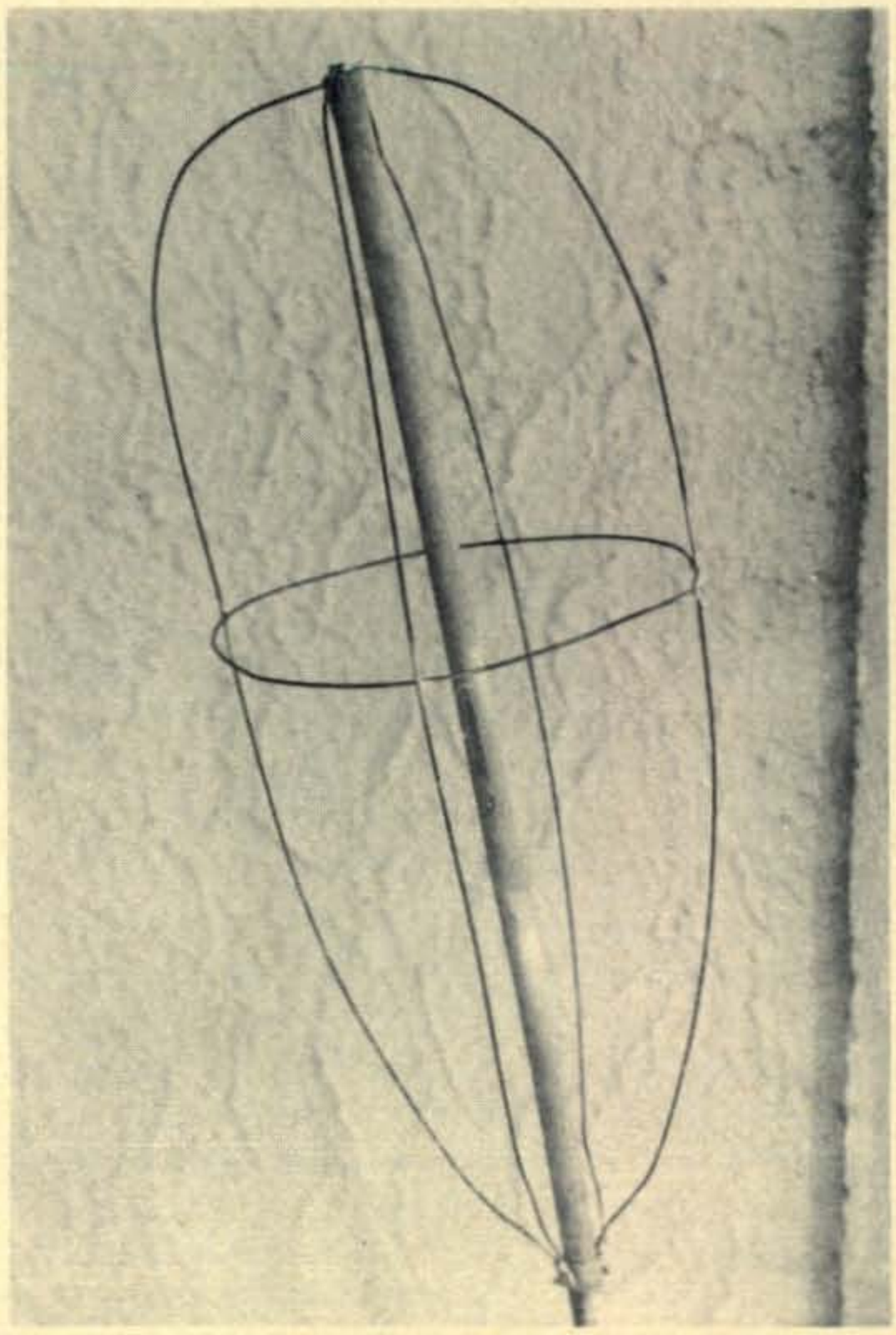
at the far end of the vertical. This is generally referred to as "top loading" and accomplished by the placement of a disc (or some other geometric figure) made from wire or mesh. It provides a measure of self capacitance for each inch of disc diameter. Since resistance is a function of antenna height, it naturally benefits the amateur to at least increase the electrical length of his system by incorporating the top-hat method. By the careful design and placement of a suitable top component, advantages such as a lower s.w.r. and greater power radiation results.

This component generally takes the shape of a sphere disc, or cylinder. Investigation has shown the cylinder shape as the most desirable since its inherent charateristics reflects the greatest value of capacitance. The relative merits of the three geometric figures are shown in fig. 3. Although the values presuppose a solid form, a wire skeleton can be substituted with only a negligible capacitor-loss factor. Needless to say, actual construction will be greatly simplified.

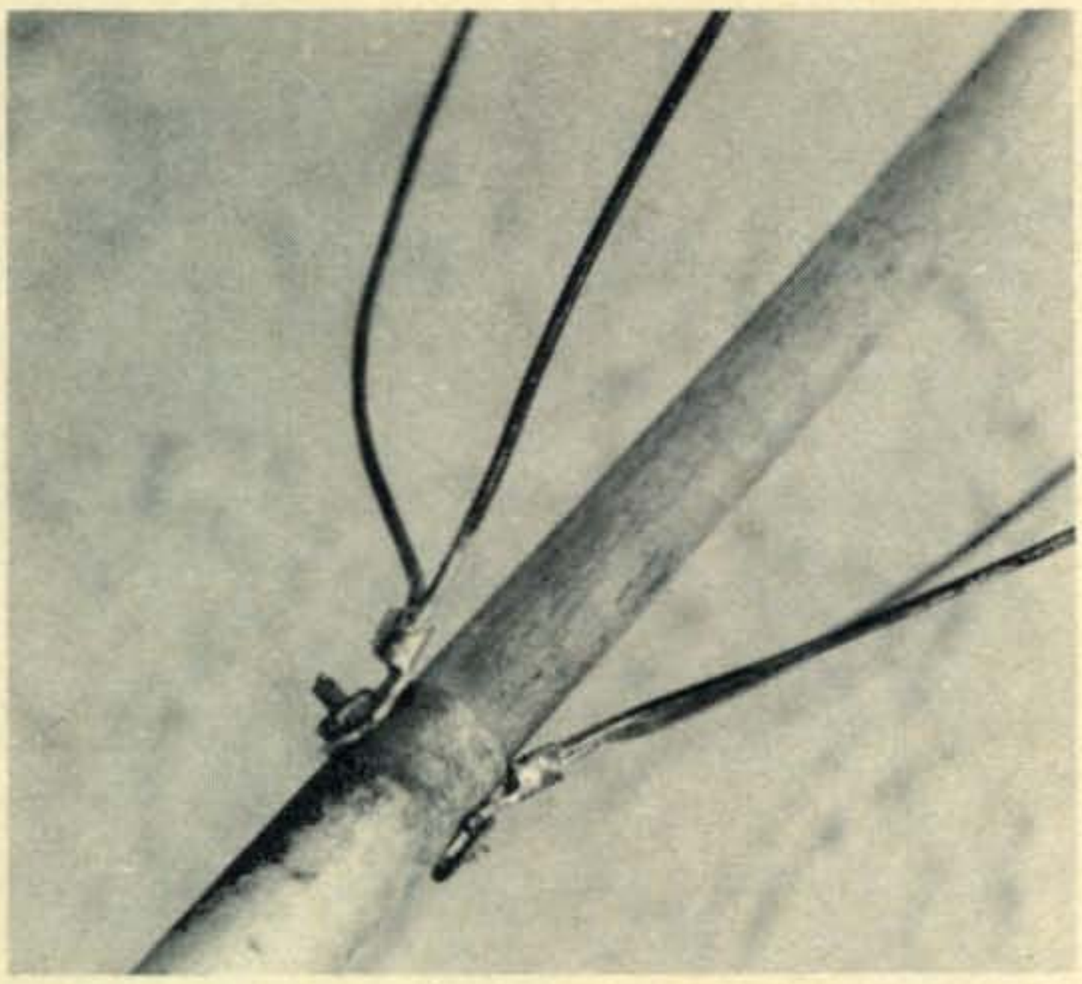
In the determination of antenna radiation resistance, some importance should be placed on the material used in the actual construction of the vertical, however, it is of little importance in the practical consideration and can be overlooked. Bear in mind however that a larger conductor will, as a consequence of its diameter, reflect a lower impedance. This factor may be of significance if a particular antenna installation reflects too high a radiation resistance factor and the vertical antenna material can be replaced with other diameters.

A Practical Application

Since the Novice is privileged to operate for only a one year period of time, a quickly assembled antenna system with good radiation characteristics is an absolute necessity. The vertical's ease of construction, low cost, and simple matching technique should command almost universal acceptance. Although the text has applicability for the Novice, the General operator can benefit materially from the vertical's low angle of radiation, rapid band switching, and DX possibilities. Admittedly this system is not the most favored as its lack of directivity is of chief concern; however, it is far better than the average means of getting a signal into the air. As far as the Novice is concerned, antenna



View of the top loading feature of the vertical supported by a ⅝" dowel.



Connecting point of the top hat to the upper-most portion of the vertical. Note the insertion of the nut-bolt combination through the solder lugs, wooden support insulator and through the tubing.

sophistication comes with the higher grade license once the pressures of theory and code accomplishment have been overcome.

Construction A 40 Meter Vertical

A 40 meter vertical antenna is constructed from two 10′ lengths of 1⅞″ telescoping tubing (0.058″ wall thickness) and adjusted to measure 19′. Bind the telescoped lengths with a stainless steel self tapping screw for a good mechanical bond.

The base loaded coil is series installed at the lower portion of the antenna. Wind the coil on a 3½″ form with 8 t.p.i. Use #14 enameled wire and wind 16 turns if 80 meter operation is contemplated. A reasonably spaced capacitor of about 60-100 mmf may be series installed between the coil top and the antenna base to assist in tuning. This component is in essence a means of fine tuning the individual system once the proper tap on the coil has been selected.

It is advisable to incorporate some means of protecting the coil from the weather. Rain, for example, can materially alter the inductance of the coil and upset the resonant frequency of a finely tuned array.

Wiring is rather straightforward. Keep leads short and solder all permanent mechanical connections. If the system will ultimately be installed on top of a roof, provide a good ground. Generally a vent pipe protrudes through the roof and allows for the connection to the necessary ground. Use 50 ohm coaxial line and attach the braid to the earth ground. The point at which the center conductor connects to the coil will determine the band and can either be moved manually or through some remote switching arrangement.

The top hat component is made from two lengths of #12 wire cut to 53″. Attach four solder lugs, one at each end. From the photograph it is seen that this unit resermbles a somewhat elongated oval thereby encompassing a degree of rigidity with the high capacitance factor of the cylinder. The diameter of the oval's center measures 8½″ and its form is maintained by securing a circular shaped length of wire at the four intersecting points about midpoint of the oval. For additional support of the oval, extend the vertical by installing a 26″ length of ⅝″ wooden dowel. Insert 3″ of dowel into the end of the vertical. Drill a hole through the tubing and dowel and insert at 1″ nut and bolt combination through the solder lugs, tubing, and dowel and tighten securely. A small "U" tack hammered into the top end of the dowel will complete this phase of construction.

The 40 meter band will resonate about 8½ turns from the vertical's end of the coil. If other ferquencies are of interest simply grid dip the coil while adjusting the coil length. Bandwidth is rather good and only major frequency changes will require additional coil-tap consideration. ■

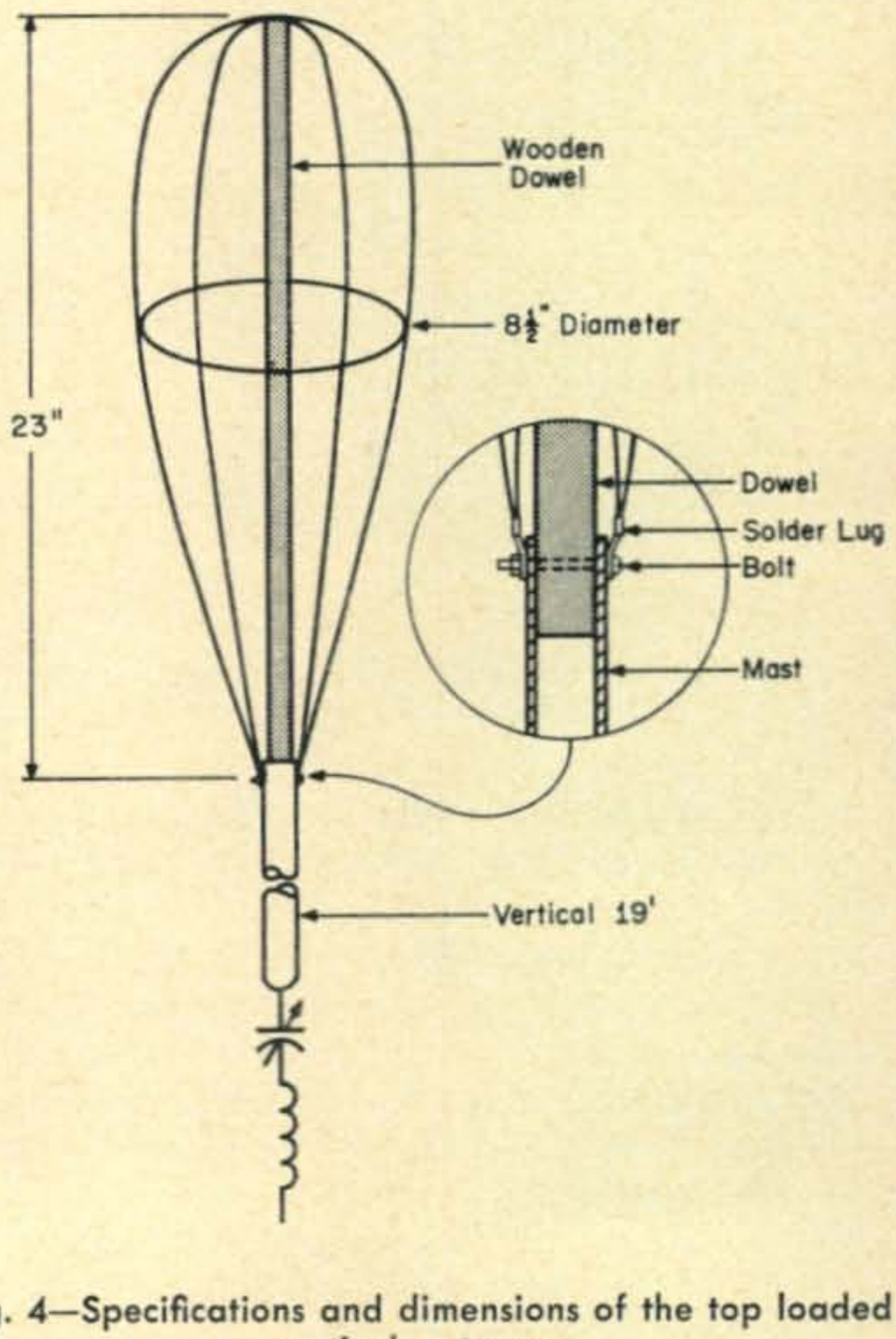


Fig. 4—Specifications and dimensions of the top loaded vertical antenna.

PARTS LIST

1—length of 10′ alum. tubing, 1″ dia. (0.058″ wall).
1—length of 10′ alum. tubing, ⅞″ dia. (0.058″ wall).
1—length of ⅝″ wooden dowel, 26″ long.
1—coil, 16t. # 14e., 8 t.p.i.
12′—#12 copper wire.
4—¼″ solder lugs.
1—60-100 mmf double spaced variable capacitor.
1—plastic container to house coil and capacitor.

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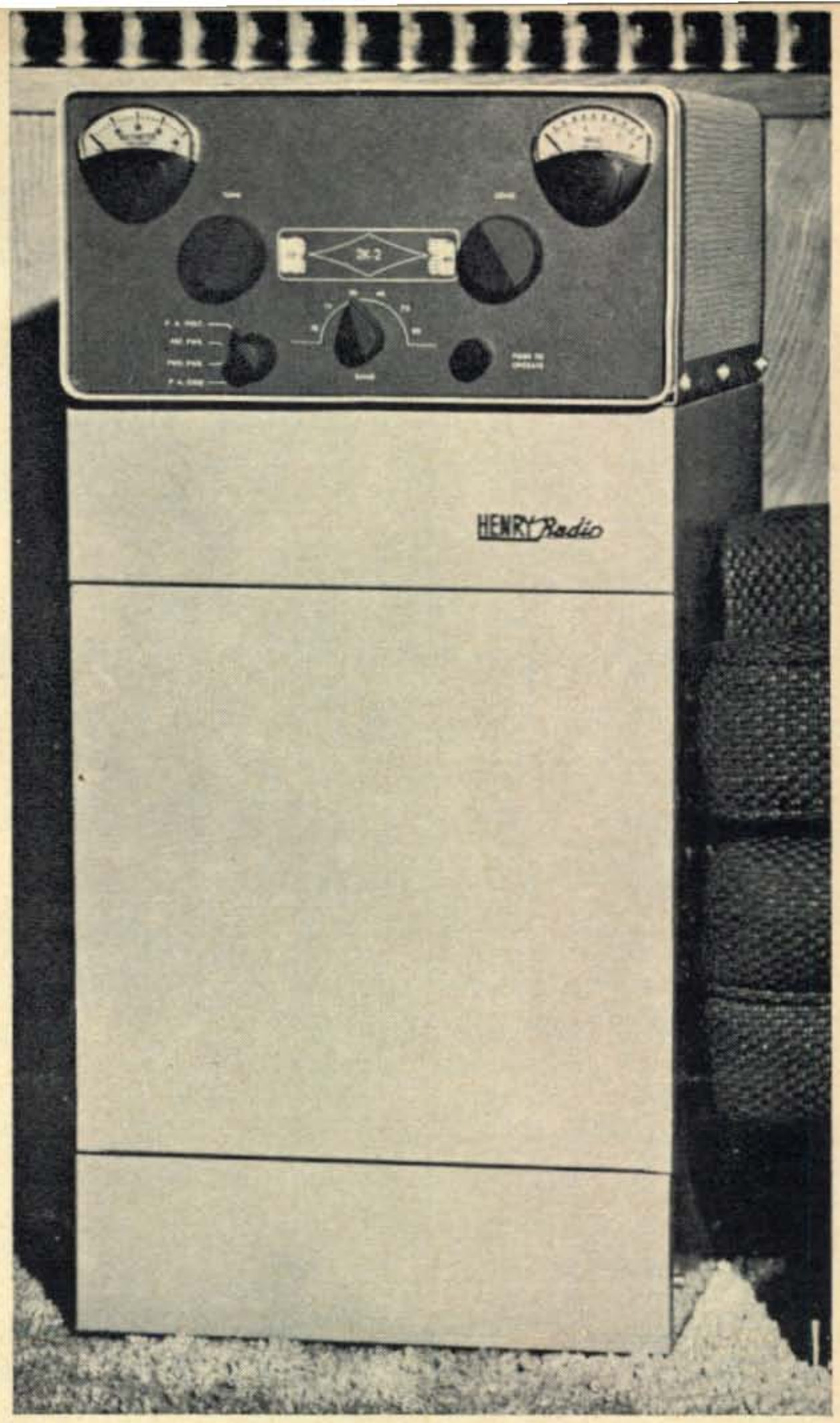

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A Primer of THIN FILM TECHNIQUES

BY JERRY F. WHITE*

A few years ago the entire electronics industry was completely revolutionized by the perfection of the transistor. Although the transistor was an electronic advancement, it did not solve all of the problems, nor did it satisfy all of the demands of a "Space Age," technically oriented society. Consequently, further research and development led to the realization of very reliable and relatively inexpensive miniature circuits known as integrated circuits. There are two main types of integrated circuits, the monolithic diffused variety and the thin-film variety. In this paper thin-film integrated circuits are considered because (although they are becoming an integral part of modern technology) few people seem to really understand much about the composition and fabrication of them. This article therefore, deals primarily with individual components considering in turn resistors, capacitors, inductors, and active elements. Both the physical components and their application are discussed.

IT HAS been suggested that the scientific philosophy of the great American inventor, Thomas Alva Edison, was "there is a better way to do it—find it." This philosophy has since been essentially adopted by the modern electronics industry. Edison's logic was assumed because the technological requirements of the Space Age placed stringent demands upon the existing electronics industry for more reliable components, more compact devices, and more economic manufacturing processes. The principle of "find a better way to do it," therefore, became not a philosophical abstract but instead an indispensable industrial attitude.

These stringent demands on the industry were the primary factors that brought about the so called revolution in electronics known as microelectronics. As this revolution in research and development progressed, the thin-film circuit, composed of thin-film components, came into being.

The thin-film circuit of today is, as a consequence of its construction, a member of the integrated circuits family. (An integrated circuit may simply be defined as a microelectronic circuit that is considered as a functional unit.) This integrated circuits family is composed of two generic classifications, that is to say, two approaches involving entirely different design and fabrication principles. These two approaches are the semiconductor integrated circuit, sometimes called the all diffused monolithic integrated circuit, and the thin-film integrated circuit. Inspection of the characteristic features of the two approaches reveals that the semiconductor integrated circuit "consists of a silicon substrate," the basic starting block, "into which all of the circuit parts are fabricated by diffusion and related processes

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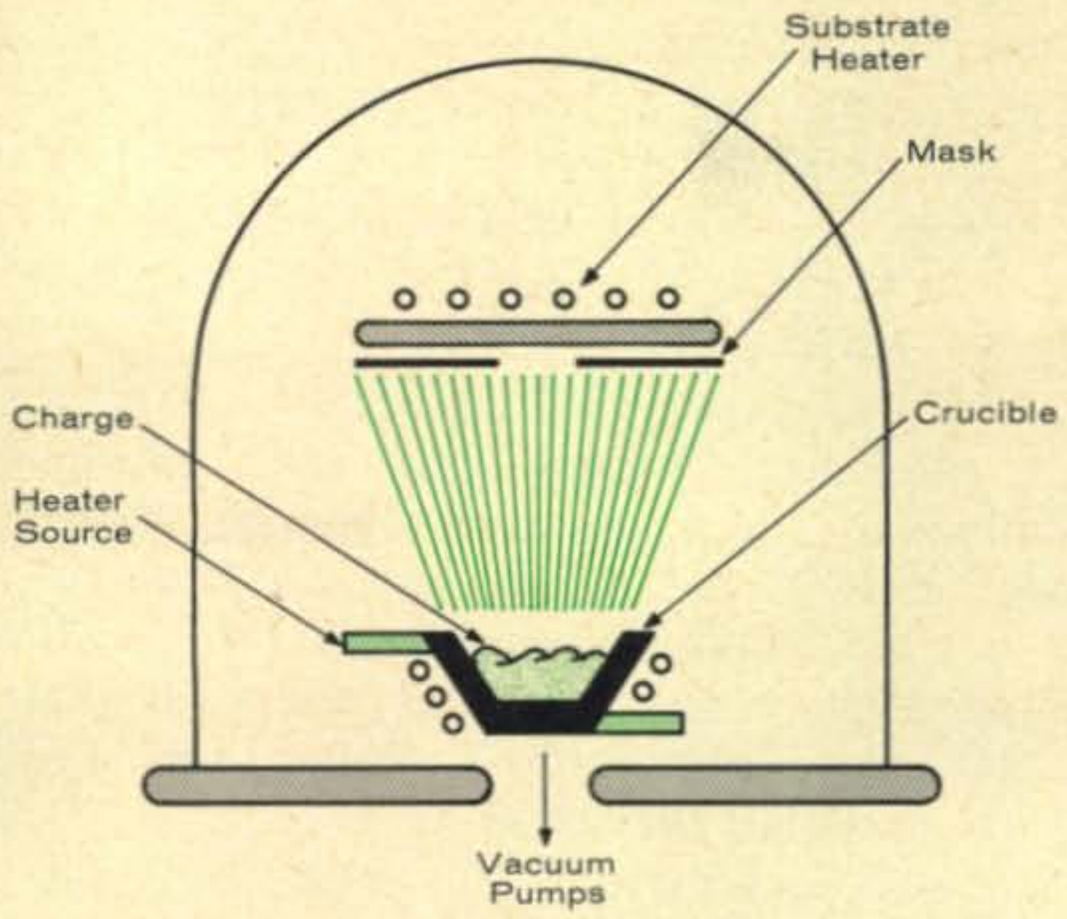


Fig. 1—Vacuum evaporation apparatus for thin-film deposition

that have been developed for transistor fabrication."[1] On the other hand, the thin-film circuit is based upon the principle that "thin-films of a large number of materials may be deposited on a suitable substrate, usually glass or ceramic, to produce layers which may be resistive, conducting, dielectric, semiconducting, magnetic and in some cases superconducting at low temperatures."[2]

Thin-Film Procedures

In order to realize a finished thin-film device, detailed fabrication procedures must be carried out. Perhaps the most essential basic fabrication process is that of depositing a given substance onto a given substrate. Consequently, several different techniques of deposition have been perfected and may be employed in thin-film device construction. The most widely used technique is that of vacuum evaporation deposition. This technique can deposit nearly all metals, inorganics, and glasses. It can be used to control precisely the film dimensions and purity. Furthermore, the other common processes of deposition usually incorporate vacuum evaporation as part of the fabrication procedure.

This vacuum evaporation method may be easily understood by referring to the diagram in fig. 1. It is seen that "if the crucible containing the evaporant, in a perfect vacuum, is raised in temperature, the evaporant vaporizes to generate a vapor pressure exponentially related to the temperature. The evaporant molecules move in straight lines and are deposited on the first cool surface they encounter, in this case, the circuit substrate. The film thickness is controlled by the deposition time, vapor source geometry and temperature, and the separation of the substrate from the vapor source. If a substantial amount of gas were present in the evaporation chamber, the molecules would collide with the gas molecules, to be deflected or even to form new compounds. The result might be no film at all, or very poor films at best. Consequently, vacuum chamber pressures of one billionth atmospheric pressure are common."[3]

Another widely used technique of depositing thin films is that known as "sputtering." This method is frequently used because many desirable thin-film materials cannot be evaporated. To deposit these materials "the sputtering process in effect 'splashes' atoms from the surface of the desired material by bombarding it with gas molecules propelled by a very high energy electric field."[4]

In addition to these methods, thin films have also been electroplated or deposited by the chemical deposition of gaseous or liquid compounds. Also, an anondization and a chemical etch-back process have been used.[5] All of these processes produce thin films

[1] King, D., "Designing Monolithic Integrated Circuits," *Motorola Semiconductor Products Application Notes,* No. AN-157 p. 2, January, 1965.

[2] Pitt, K.E.G., "Some Aspects of Thin Film Microelectronics," *IEEE Student Journal,* Vol. 4, No. 3 pp. 3-7, May, 1966, hereafter referred to as Pitt.

[3] Liben, W., "Microelectronics—Unlocking the Treasure Chest," *Astronautics and Aeronautics,* Vol. 2, No. 4, April 1964, hereafter referred to as Liben.

[4] Staff, "Technology," Fortune, p. 178. August 1962.

[5] Liben, p. 24.

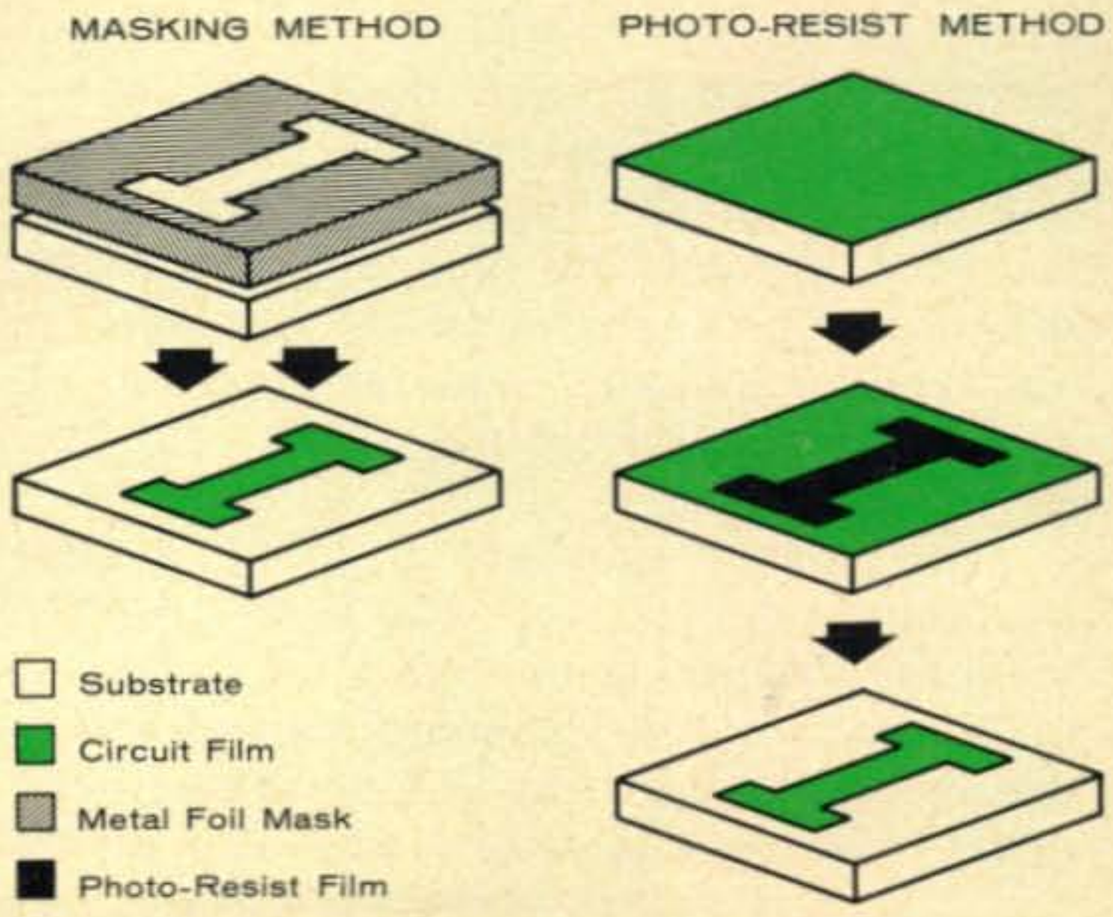


Fig. 2—Basic diagram of masking and photo resist methods of shaping thin-film components.

which are between one hundred and one hundred thousand angstrom units, or one millionth to one thousandth of a centimeter thick.[6]

Shaping

When the material to be deposited and the method of depositing it are decided upon, the problem of shaping an individual thin-film circuit component presents itself. There are two main ways to shape the individual components. The first of these is called the masking method and is shown in fig. 2.

The beginning step of this method is to prepare a "large drawing that shows the exact appearance of the desired circuit. This drawing is then photographed. The photographic negatives are the same size as the desired circuit and represent a size reduction of as much as 50:1 from the original drawing. The negative is then used to produce a series of thin metal masks fabricated by conventional photoetching or electroforming techniques. Apertures in the mask correspond to areas where films will be deposited on the substrate. For thin-film deposition, the mask is placed in close contact with the substrate material and the masked substrates are placed in the vacuum chamber. When a high vacuum has been attained, the material to be deposited vaporizes and condenses on all surfaces within the vacuum chamber. The areas of the substrate that are not masked, receive a deposit of the material which actually becomes molecularly bonded to the substrate. Deposition is continued until a coating thick enough to give the desired electrical properties is 'built up.' When two different materials are to be deposited, as in a resistor network, several different masks and deposition cycles are necessary."[7]

In the other thin-film component manufacturing process, the photoetch technique, shown in fig. 2, the substrate is placed in the vacuum chamber without masking. "It is given a uniform coating of material over its entire surface."

"The coated substrate material is then stored until it is needed. The next step is to form the detailed geometry of the circuit. A photosensitive resist material is applied to the substrate. With the aid of the negative made from the large-size art work, a photographic image of the desired circuit is produced on the resist material. Further processing opens up apertures or windows in the photo resist material making a mask. Selective etching in acid removes the unmasked portion of the material on the substrate, leaving the desired micro-circuit."

"Both processes give the same end result. The masking technique lends itself to high production since the masks can be reused indefinitely. Some circuit designs, however, do not lend themselves to the masking technique because the apertures are such that a one piece metal mask would not hold together. If so, the decision in favor of the photoetch technique is easily made. When production quantities are low, economics favor the phototech technique since no "hard" tooling is necessary."[8]

A revolution in this area of fabrication could be imminent. Recently the Mallory-Xerox Company announced that it had produced a machine similar to the standard xerox office copier which would print out a completed thin-film circuit by merely placing a circuit drawing on the copying window.[9]

All of these processes obviously lead to the same end result. That result is the production of thin film components for thin film circuits. These components produced fall into several different classification groups. The most common component is, of course, the resistor. The thin film resistor is fashioned or deposited in the form of a narrow rectangle or a folded rectangle as shown in fig. 3.[10]

The resistance value of the component is given by the equation:

$$R = \frac{(rho)\,L}{t \quad W}$$

"In this equation *rho* is the resistivity of the material used and L, W, and t are its length, width and thickness respectively. If the film is square, L equals W and the resistance is then inversely proportional to the thickness. This ratio is designated as the ohms/square or sheet resistance. The commonly used values of sheet resistance are one hundred to

[6] Pitt.

[7] Staff, "Thin Film Integrated Circuits," *Engineering*, Vol. 201, No. 5207, p. 253, February 4, 1966.

[8] Black, T.W., "Thin Film Microcircuits," *The Tool and Manufacturing Engineer*, Vol. 52, No. 5, p. 78, May 1964.

[9] Staff, "Electronics Review," *Electronics*, XXXVII (October 5, 1964) p. 27.

[10] Pitt, p. 6.

five hundred ohms/square. The width usually lies between 0.001 and 0.01 inches. Very narrow lines are more difficult to control, and can only be used where wide tolerances are specified or where the finished component can be trimmed to value.[11] There are cases, however, where it is necessary to have a very narrow deposition. In this case an electron beam may be used to trim the thin-film resistor to exact specifications. Also, in some cases it is necessary to produce a resistor with an extremely small tolerance value. This is most frequently accomplished by first depositing the resistor in a thicker layer than is desired. The deposited material is then oxidized on the surface (that is, changed from conductor to insulator) to a depth that gives the exact resistance required.[12]

The resistivity of a thin-film resistor depends to a degree, as has been mentioned, upon the resistor's composition. Some of the common materials used in the manufacture of resistors are metals such as chromium and tantalum, alloys such as nichrome, and cermets (metal-insulator mixtures) such as tantalum/tantalum nitride and chromium/silicon monoxide. Due to size restrictions and limited technology, the practical range of values of thin film resistors is between ten ohms and one hundred kilohms. As far as stability is concerned, drifts in values of resistance of less than 0.05 per cent per one thousand hours at one hundred degrees centigrade with a loading of six watts per square inch of film have been achieved.[13]

Capacitors

Another in the family of thin-film components is the capacitor. Thin-film capacitors are made by first depositing a conductive film on a suitable substrate as shown in fig. 4. Then, on this conducting film is formed a dielectric film of controlled thickness. Finally, a second conducting film is deposited. The result is the configuration of the classical parallel plate capacitor consisting of a sandwich of dielectric between conducting plates. The basic guiding formula for dimensions is that for simple parallel

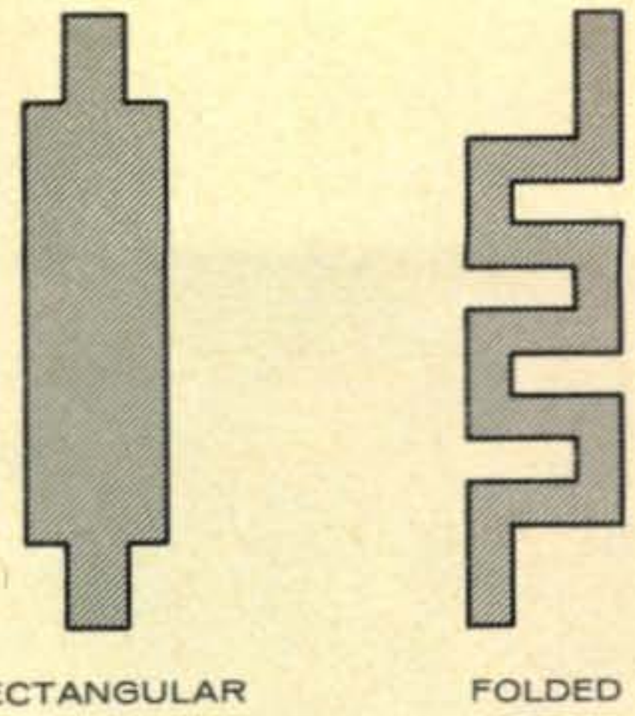


Fig. 3—Physical diagram of the two types of thin-film resistor.

plate capacitance given in the equation: [14]

$$C = e_r \; e_o \; \frac{A}{d}$$

In this equation C is the capacitance, e_r is the relative permittivity of the dielectric, e_o is the permittivity of air, A is the area of the plates and d is the distance between the plates. Here again the value of the component is integrally related to the materials used. Some common materials used for the capacitor plates are conductors such as gold, copper, tantalum, or aluminum. Typical dielectric materials are silicone monoxide, tantalum pentoxide, titanium oxide, alumina silicate and various polymers. Presently, thin-film capacitors can be made in the range of values from ten mmf to ten mf. A breakdown voltage approaching three hundred volts/micron has been attained. In addition, through the use of low resistance electrodes and careful design, it is possible to operate thin-film capacitors at frequencies up to several hundred megacycles.[15]

Inductors

Another in the family of thin-film passive components is the inductor. The inductor is much more difficult to produce than either the resistor or capacitor and is much less efficient. A flat spiral inductor made on glass as shown in fig. 5 may be in the zero to two microhenry range, but unless the film is plated to a considerable thickness the Q factor is unusually low.

Space limitations have forced integrated circuits designers to consider other ways of

[11] Liben.

[12] Staff of Harlow Research Laboratories, "Thin Film Integrated Circuits," *Engineering*, CCI (February 4, 1966), p. 253.

[13] Pitt.

[14] Shenkel, F.W., "Thin-Film Capacitance Elements: Which Is Best for Your Purpose?" *Electronics* XXXVIII (January 25, 1965) p. 67.

[15] Pitt.

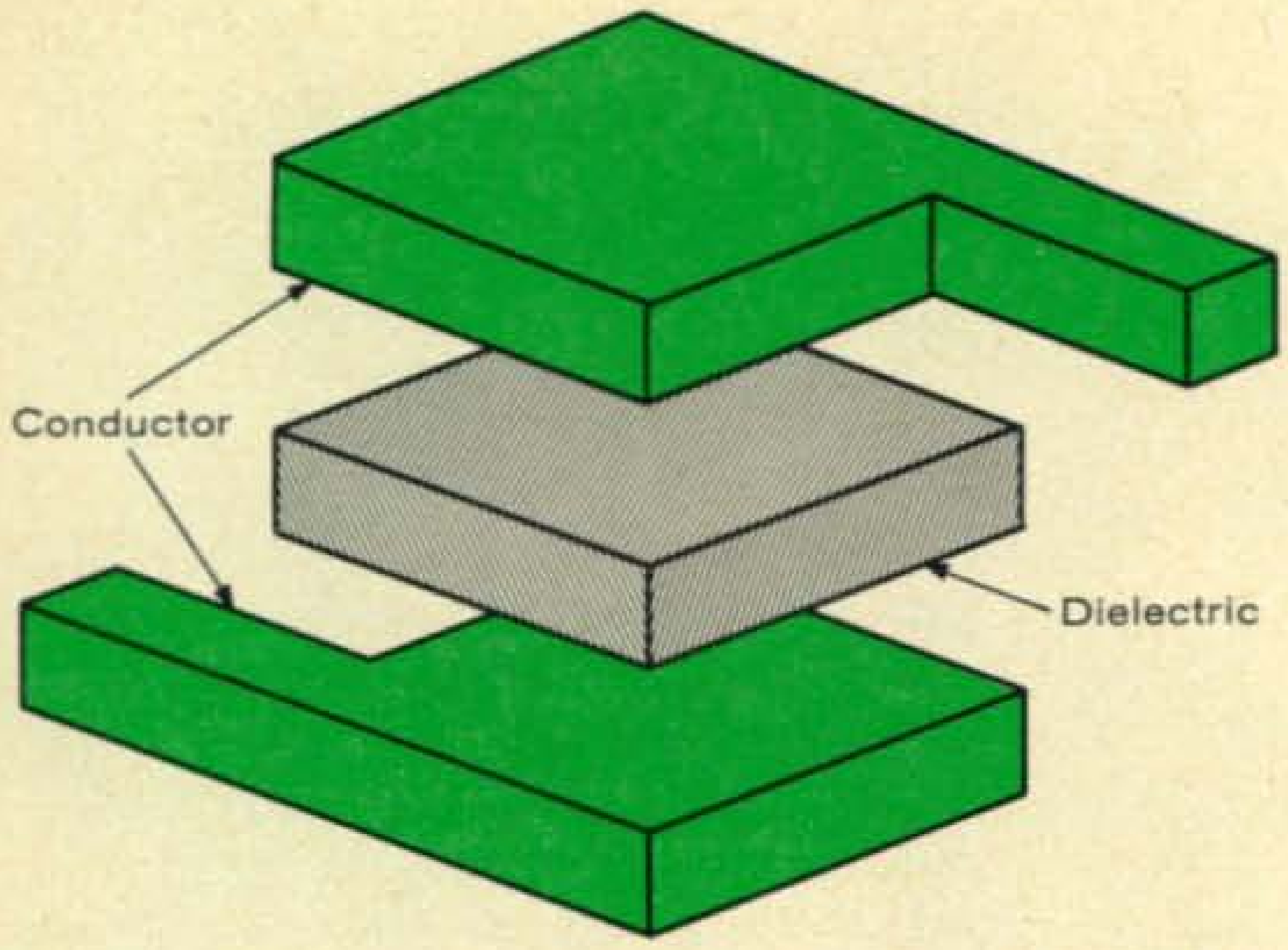


Fig. 4—Diagram showing the parts of a thin-film capacitor.

tuning circuits, as it does not seem possible to construct sufficiently high-inductance, high-Q inductors in integrated form.[16] There is an alternative, however, that theoretically any effect produced by a given inductor can be duplicated by the proper arrangement of resistors and capacitors. In fact this is the subject of much recent research, and so far devices such as RC notch filters, negative impedance converters, digital filtering circuits and semiconductor delay lines are being successfully experimented with.[17]

Active Elements

The other members of the thin-film component family fall into the active element classification. Unfortunately, this is the area of production that plagues the thin-film industry. To date, no one has devised an economically producible thin-film active component. As a result, semiconductor integrated circuits, in which active elements are easily formed, are preferred to thin-films in many applications. Because of this situation, any developments made by manufacturers in the field, are kept confidential and little information on the subject of thin film-diodes and transistors is made public. The Sylvania Company claims to have deposited up to nine single crystal silicon diodes with diameters up to one tenth of an inch on ceramic wafers measuring one half inch square with a yield of one hundred per cent. However, details concerning the process are not available.[18]

[16] Pitt.

[17] Uzungolu, Vasil, "Noninductive Tuned Circuits," *IEEE Student Journal,* IV (May 1966) p. 15.

[18] Klass, P.J., "Thin Film Diodes Achieved on Ceramic" Aviation Week and Space Technology, pp. 70-72, April 30, 1962.

In order to see how all of the varied fabrication processes are profitably combined to form a thin-film device, a specific example will be considered. The device of this example is a 64 kilocycle flip-flop circuit module. This particular module is like the 1,360 versions which were fabricated for the Orbiting Geophysical Observatory space vehicle. The cordwood model of the modules is generally satisfactory and its electrical characteristics are superior to those of semiconductor integrated circuits. The module contains twenty-two miniaturized electronic parts, including eleven resistors, five diodes, four transistors and two capacitors.

When this flip-flop circuit module is fabricated in thin-film form, however, it is found that the thin-film version is approximately one-third the size and one-fifth the weight of the cordwood module. The ninety-seven internal electrical connections in the cordwood version are reduced to fifty-one in the thin-film module. Volume is reduced from 0.48 cubic inches to 0.15 cubic inches and weight from twelve grams to two and one half grams.

In this example, only the resistors and capacitors are converted to thin-films. The diodes and the transistors are the same as those in the cordwood module. All eleven resistors, which make up one half of the total number of parts were vacuum deposited on a single glass substrate measuring one half by one half by four hundredths inches.[19] This example shows the tremendous advantages offered by thin-film circuits and sug-

[19] Rodke, R.P., "Thin Films: Dark Horse in Electronic Packaging," *SAE Journal,* Vol. 72, No. 9, pp. 64-65, September, 1964.

[*Continued on page 115*]

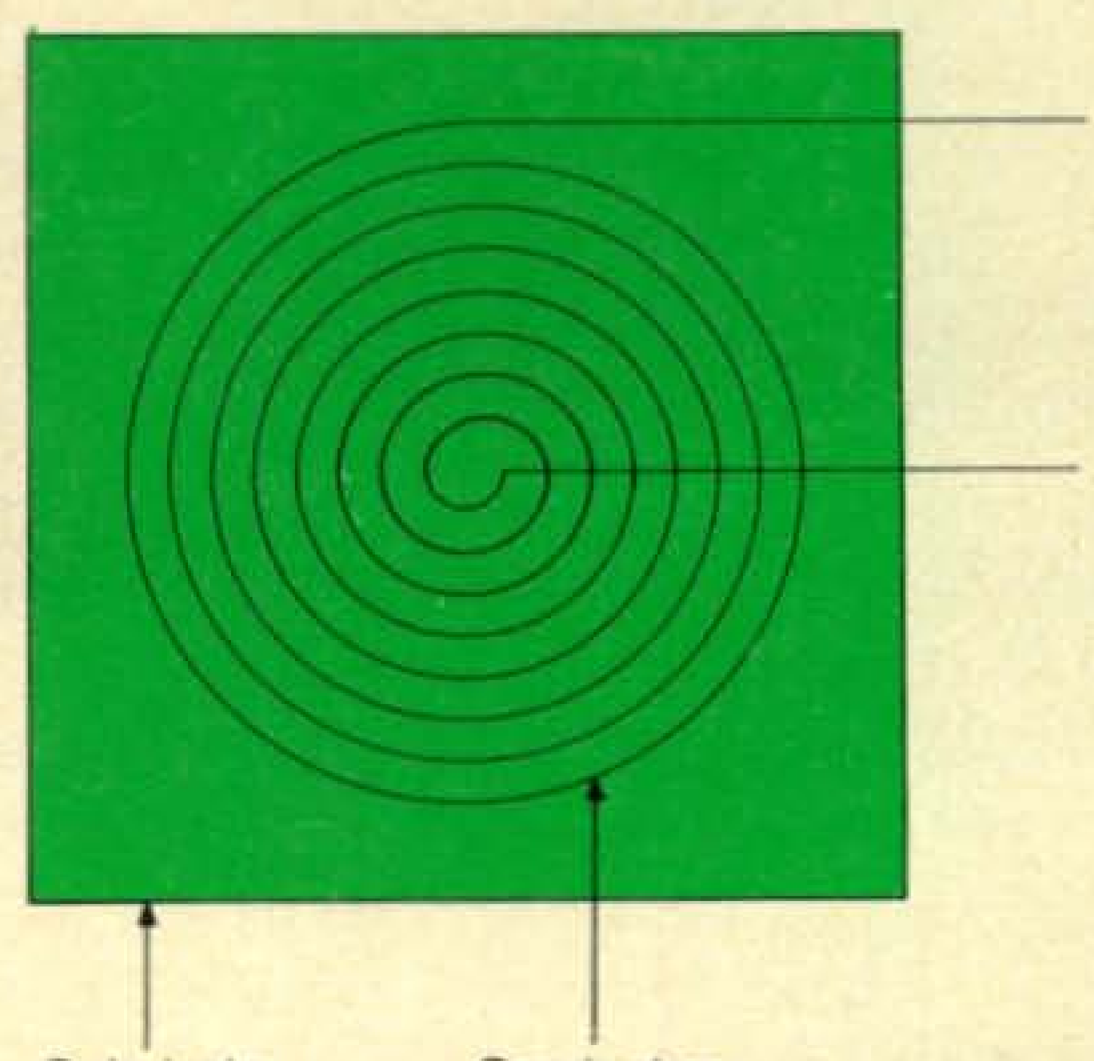


Fig. 5—Diagram of a typical thin-film spiral conductor.

Grumbles

by Sam

HAMS are priceless, a unique blend of scientist and hobbyist. Any experienced ham can spot another of his own ilk from a distance of 50 feet in a dimly lit room.

How? It's easy if you stop to divide hams up into specific generic groups.

First there's the old timer; he was on the air when they opened the bands. If you want to get along with him you've got to reminesce about HK-354 Gammatrons and spark gaps. Trademarks: always several pencils protruding from the handkerchief pocket of the jacket, always a callsign pin in the lapel.

Next we have the average ham, he's keen on telling you about the time he worked Barry on 80 or how he doubled the output of his rig by snipping a wire.

Our last true-blue ham is the newly licensed youngster, in his late teens mostly. He's quick to try and argue down any pet theory you may have and has fortified himself with dozens of handy little facts for the occasion. He knows Don Miller personally, says he has a buddy-buddy relationship going with Wayne, and is quick to point out the differences between hams and CB'ers (he was one himself only a few weeks before).

You're probably saying to yourself that these guys must have very little in common with which to share a hobby. You're right, except there is one common denominator; mostly they are boors. Ham radio seems ready to attract every social outcast drifting around the edges of society.

Most hams I have met at conventions or over the air would not be welcome guests in my home. They are humorless, often rude, ignorant of even the most basic elements of culture, have a definite aversion to the opposite sex, and unless you are prepared to discuss ham radio with them you have them at a distinct disadvantage.

I once did a little research project which included getting random operators engaged in a QSO and after 5 minutes of gabbing about tuning up the final and buffing the buffers I suddenly switched the topic of conversation to a non-ham topic. Sometimes I would bring up a few recent films, or a current book, possibly sports, once in a while I would inquire about something as offbeat as his opinions on fluoridation of public water supplies. The introduction of these topics generally heralded the immediate demise of the contact; he suddenly remembered that he had to pick up his wife at karate school or there was a strange odor coming out of the v.f.o. In any event, I would release him from further pain and then listen on the band. Sure enough, within 3 minutes he was going full blast with some other creep about 6146's, speech envelopes, Tri-banders, and the whole bit. As an actual count, I found out that of 50 such trials I was ditched (in one polite way or another) by no less than 32 hams (that includes 3 borderline ditchings which were done with so much finesse that I never really knew what hit me).

I'm not setting myself up as a snob. I feel that being able to discuss current events at even the most elementary level is almost a requirement of being a fully functioning human of the 20th century. The 18 hams

[*Continued on page 115*]

*c/o *CQ*, 14 Vanderventer Ave., Port Washington, L.I., N.Y., 11050.

Results of the

1966 CQ World Wide DX (C.W.) Contest

BY FRANK ANZALONE,* W1WY

AFTER the fabulous conditions we experienced during the Phone section of the contest, everybody was geared up for another productive weekend. However, we were not as lucky for this one although it was still a very successful activity and the returns this year exceed last year's by 212 logs, an increase of over 15 percent.

Records were broken by the multi-multi crew at K2GL and the multi-single crew of 4L7A. In the single operator category VO1FB set a new high on 160, while UC2AA gives the boys on 80 a new mark to shoot at.

No, we havn't forgotten 1G5A on 14 mc. Don Miller has done it again with a score that will probably stand up for a long time. At this writing the country status of Geyser Reef has not been officially established. However, this has no bearing on the status of 1G5A in the contest. It's amazing how almost everyone knew the name of this new spot, those that didn't, had it down as "Miller's Reef" or some other equally descriptive name.

Over here in the U.S.A. Lenny Chertok became the first single operator to break a million on all bands. And Vic Clark established a new high on 21 mc. Vic also holds the 14 mc record for the United States.

All the other single operator records still stand and we refer you to page 20 of the November 1966 *CQ*. You can make your own comparisons with the all time records.

Like all contests there are always some exotic calls that have no identity, but before the contest is over almost everybody knows who they are. This year was no exception.

The first one to show up was 4L7A on 40. This turned out to be a group of students from the Kaunas Politechnic Institute of Lithuania. They had organized this DX-pedition especially for our contest and had wisely chosen a spot across the border in Georgia so that they could take advantage of all those 3 pointers in Europe. We are happy to present them the W3AOH Trophy. This of course counted the same as UF6 and those that took extra credit lost a multiplier.

Another one that had the boys guessing was 4MØA on 14 mc. Here again it was not a new one but just another YV, the Archipielago Los Monjes off the coast of Venezuela, where YV5FI was on a little DX-pedition.

And of course 1G5A which was good for another multiplier.

Once again we refer you to the listing of the scores, the box showing the top scorers in the different categories and the other special listings. These tell the story better than pages of description.

You will note that Larry LeKashman who has been the donor of many Trophies down thru the years, will finally be the recipient of one himself. (W3GRF was a winner 2 years ago therefore not eligible, but does receive a special award.)

And for close scores for top honors, how

The OH-DX-Ring club station OH2AM found the going on C.W. not as favorable as the previous month in the Phone contest. Crew and operating positions. Front row—OH2SB 28 mc, 2BC 14 mc, 2KH 1.8 mc, Middle—OH2BQ 7 mc. Back row—OH2BH 14 mc, 2BBM 21 mc, 2BBR 21 mc, 2QV 7 mc and 2BS 3.5 mc.

*Contest Committee Chairman, *CQ*.

TROPHY WINNERS

Single Operator, All Bands, U.S.A.
North Jersey DX Association Trophy
won by Larry LeKashman, W9IOP
Single Operator, All Bands, Europe
W3MSK Operators Trophy
won by Franc Bogataj, YU3BC
Single Operator, All Bands, World
W9IOP, Larry LeKashman Trophy
won by J. R. Beck, ZD8J
Single Operator, Single Band. (14mc)
K2HLB, Dr. Harold Megibow Trophy
won by Don Miller, 1G5A
Multi-operator, Single Transmitter
W3AOH, Dr. Anthony Susan Trophy
won by Station 4L7A
(Oprs. UP2CY, UP2NK, UP2NV, UP2OF, UP2OK, UP2OO, UP2PT)
Multi-operator, Multi Transmitter
Radio Club Venezolano Trophy
won by Station W4BVV (Oprs. W4BVV,
won by Station W4BVV
(Oprs. W4BVV, K1ANV, K3NPV, K4WVH, W1ARR, W1BGD, W4GEQ, W4YHD)

SPECIAL CQ PLAQUES

U.S.A. Champion
Single Operator, All Bands
Leonard Chertok, W3GRF

World Champion
Multi-operator, Multi Transmitter
Station K2GL (Oprs. K2GL, K2KUR, K2UYG, W1GYE, W1MDO, W2IWC, W4DQS, W6KFV)

World-High Club Score
CQ Club Plaque
won by the Potomac Valley Radio Club

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
K2GL 3,760,848	1.8	8	5	5	17
	3.5	210	20	49	596
	7.0	615	33	79	1815
	14.0	696	37	107	2052
	21.0	557	33	94	1628
	28.0	266	24	60	780
	TOTAL	2352	152	394	6888
W4BVV 3,637,150	1.8	12	5	7	23
	3.5	198	20	51	557
	7.0	532	31	83	1546
	14.0	697	38	112	2040
	21.0	538	32	87	1578
	28.0	299	24	60	869
	TOTAL	2276	150	400	6613
W3MSK 3,618,968	1.8	20	6	8	39
	3.5	145	18	44	387
	7.0	417	28	76	1211
	14.0	826	40	121	2430
	21.0	560	31	85	1640
	28.0	297	26	68	861
	TOTAL	2265	149	402	6568
OH2AM 2,837,133	1.8	102	2	10	100
	3.5	404	14	49	470
	7.0	654	27	73	1171
	14.0	764	36	96	1936
	21.0	527	36	102	1296
	28.0	168	27	59	370
	TOTAL	2619	142	389	5343
K1JGD 2,805,660	3.5	242	18	46	684
	7.0	301	21	61	883
	14.0	851	36	116	2524
	21.0	494	31	78	1457
	28.0	154	17	44	447
	TOTAL	2042	123	345	5995
W4KXV 2,769,687	1.8	10	5	5	14
	3.5	167	15	46	466
	7.0	307	28	72	888
	14.0	748	38	119	2200
	21.0	396	29	77	1153
	28.0	236	22	57	678
	TOTAL	1864	137	376	5399

Band-by-band breakdown of the multi-band, multi-op leaders.

about that of 9J2BC and 9J2WR on 28 mc. Both are being awarded a certificate.

And there were also times of frustration, like that experienced by VK5KO who tried to get something going on 160 from his distant QTH. He heard and called 32 Europeans, pulled every trick he had learned the past 40 years, but to no avail. "It was enough to make a monkey bite his uncle," says John. But how about those 32 Europeans who were getting thru and didn't hear you, John?

At W6EOU Tony noticed that the s.w.r. on his 15 meter position grew increasingly higher as the contest progressed and that it became more difficult to raise the DX. Later he discovered the cause, woodpeckers had filled the match-box with acorns. Toasted acorns anyone?

WA4VAI found the going on 10 fine, but the weather outside was equally inviting. Wonder how he will feel when he finds out that an outsider, K6ILB/4 took over the 28 mc award while he was enjoying 18 holes of golf.

We realize the competition is rough, K4ZCP wants us to make awards by states. Says he can't compete against "big guns" like W4KFC, W4BVV and etc. on all bands. Fact is however, Vic went single band this year and W4BVV is a multi-operator setup. With the many available categories in our contest you can choose your own competition.

GM3JDR thinks the propagation is better in the Spring and that we should hold our contest in March. Guess he doesn't read that other magazine and has never heard of their "marathon."

Both GM3KLA and GM3SVK are located in the Shetland Islands and therefore

count as a separate country multiplier. We use the ARRL DXCC country list and the WAE list for Europe, so a few additional country multipliers are available under the latter. This month's CALENDAR has the complete WAE country list and we recommend that you retain this for future reference.

That 9M2OV you worked is none other than DJ2OV. Herb tried to give more of you a contact but Murphy's Law got him. His 7 mc ground plane, gone with the wind. His headphones, intermittent open circuit. The power supply, S9 noise generator on 20. The PA tube, kaput. So guess we cannot blame him for oversleeping and missing the 21 mc opening to the East coast. (QSL via DJ1AK).

Low power is not recommended for contest competition but WA8RQQ only had 5 watts going on 40. (What happened to Jake, W8FGX?) And OH2YI says he's still going strong with his QRP, 4 watts on 10, graduated up to 12 watts on 80. Many of the JAs are also confined to very low power.

A group in the West Midland area of England were out to have a leading station in each of the single operator categories, and they almost made it. G3HDA on all bands, G2BOZ on 28 mc, G3HCT on 21 mc and G3FKM on 14 mc. However, G4CP missed out on 7 mc. What makes it more interesting is the fact that three of the above winners are named Bazley. Wonder if it's a family affair.

CX1AAC rushed home from Punta de Este for the contest week-end. It paid off for Carlos as you see, world high on 21 mc, just missing the all time record made by ZS6IW last year.

WØGTA/8F4 was well prepared for this one as he was in the phone contest but there are too many miles between Sumatra and all those lush European multipliers. Bob's biggest thrill was working EI9J on 80 and 160. (Where's your log, Paddy?)

We always like to mention the YLs that participate but afraid of leaving out some well known competitors. (How could I have possibly missed KP4CL last month? Sorry, Alicia.) Leading the field is PY2SO, Sonia just missed winning another Trophy, and such a gallant try too. And then there was Mirja OH2DI, Kaarina OH2YL and JA1YL.

The club competition seems to be getting more aggressive each year. As you can see the aggregate totals have reached unheard

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
ZD8J 1,597,726	3.5	31	7	7	90
	7.0	237	17	29	704
	14.0	563	32	80	1658
	21.0	695	25	69	2054
	28.0	142	22	38	395
	TOTAL	1668	103	223	4901
PY2SO 1,499,020	3.5	2	2	2	3
	7.0	63	17	26	178
	14.0	949	34	80	2803
	21.0	450	30	66	1319
	28.0	178	19	35	517
	TOTAL	1642	102	209	4820
WØGTA /8F4 1,221,858	1.8	6	3	3	12
	3.5	25	9	16	70
	7.0	112	21	40	346
	14.0	183	32	63	528
	21.0	647	34	70	1821
	28.0	205	23	49	589
	TOTAL	1178	122	241	3366
KZ5TW 1,105,190	3.5	138	13	23	309
	7.0	407	17	36	891
	14.0	471	26	56	1028
	21.0	420	23	44	911
	28.0	302	17	35	672
	TOTAL	1738	96	194	3811
W3GRF 1,004,450	1.8	3	3	4	4
	3.5	62	12	27	170
	7.0	210	22	52	613
	14.0	291	32	81	857
	21.0	211	27	60	610
	28.0	144	17	44	410
	TOTAL	921	113	266	2650

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
W9IOP 892,392	3.5	15	10	12	31
	7.0	171	21	61	495
	14.0	295	35	84	865
	21.0	318	28	68	930
	28.0	52	15	27	151
	TOTAL	851	109	252	2472
YU3BC 777,756	3.5	96	9	36	119
	7.0	301	21	53	584
	14.0	282	29	66	637
	21.0	333	26	55	888
	28.0	47	15	19	136
	TOTAL	1059	100	229	2364
W2JAE 713,700	3.5	38	8	17	106
	7.0	165	17	45	479
	14.0	311	33	76	898
	21.0	211	21	45	609
	28.0	85	12	31	248
	TOTAL	810	91	214	2340
KH6IJ 710,365	3.5	28	5	3	92
	7.0	177	10	10	532
	14.0	628	30	42	1880
	21.0	562	17	21	1679
	28.0	134	9	8	400
	TOTAL	1529	71	84	4583
KA7AB 701,435	7.0	226	21	40	566
	14.0	379	26	47	1077
	21.0	380	29	52	1105
	28.0	42	15	15	115
	TOTAL	1027	91	154	2863

Top-ten single-operator, multi-band score breakdown.

of figures. The Frankford Radio Club made an all out effort and had the highest total in single operator scores, but once again it's the Potomac Valley gang that wins the *CQ* Club Plaque. Their "big guns" in the multi divisions dominated both week-ends.

The big surprise was the North Jersey DX Assoc. whose members turned out in mass and achieved their total with only one multi station, and that in the single transmitter category.

Out on the west coast the Southern Cal. group turned the tables on the Northern Cal. boys. Here again it was the big multi scores that gave the margin of victory.

Overseas it was a newly formed club, the Rhein Ruhr DX Assoc. that placed very high for their first effort. And like last year the Venezolano boys do an excellent job in the phone section but completely fold up in the c.w. week-end.

You will also note that some little heard of clubs are up high on the list this year.

It's an unpleasant task and we certainly don't relish doing it but the Committee found it necessary to disqualify UB5CI for violations under section XII. A few others also came close to being scratched. Watch those duplicate contacts fellows, as well as your Zone/Country multipliers.

We had a mountainous task on our hands, not only in the number of logs but in their size, especially the multi's which seem to be getting thicker each year.

The last meeting of the Committee, Freddie staggered in with a big suitcase full of logs. We weighed it. Would you believe 60 pounds? So we made an estimate of the logs for the whole contest and arrived at a figure of almost 250 lbs. Later I got out a ruler and estimated that if they were stacked it would make a pile just under 10 feet high.

We had an unexpected assist from overseas this year. The Central Radio Club of Czechoslovakia sent us 6 neat packages containing over 150 logs; all had been checked and properly scored and sorted into the different categories, including a complete summary of all the logs sent by Milos Prostecky, OK1MP. Thanks a million, fellows.

Equally helpful were the entries received from Poland, handled by Jan Osowski, SP6AAT traffic mgr. of the PZK. The DM entries handled by Klaus Voigt, DM2ATL the DM contest manager. And the Rhein Ruhr DX Club's entries compiled by Walter Skudlarek, DJ6QT.

Now if the boys at Box 88 would do the same thing we would be eternally grateful, especially Andy Bodony. For that matter all clubs could render a great service by instructing their members in the proper procedure in scoring their logs.

The returns for this section of the contest were substantially higher than last year, 1553 to be exact. This added to the phone's 1067 gives us a grand total of 2620, over 16 per cent above our high figure of last year. A total of 412 certificates will be

[*Continued on page 116*]

Foreign Club Scores

Rhein-Ruhr DX Association	11,605,538
Radio Club Venezolano	9,135,236
OH—DX—RING—R.Y. (Finland)	8,302,743
Uruguay DX Club	6,513,128
Kaunas Polytechnic Institute R.C.	4,495,001
Swiss DX Club	2,566,825
DM DX Club (East Germany)	2,438,689
Club Brasileiro de DX	2,128,965
Far East Auxiliary Radio Club	1,722,077
DX Club of Puerto Rico	1,498,271
Lvov DX Club (Ukraine)	1,219,750
Wetterau DX Association (Germany)	1,108,599
SP DX Club (Poland)	887,693
YU DX Club (Yugoslavia)	777,756
YO DX Club (Romania)	436,332
Japan DX Radio Club	325,652
Moscow Radio Club	258,657
Far East DX Ploiters (Japan)	241,758
Radio Club of Tallinn (Estonia)	136,673
Hammarbyhoejden Wireless Society (Sweden)	85,964
Warszawa Radio Club (Poland)	59,566
Coral Isle A.R.C. (Guam)	58,006
LOK Radio Club (Poland)	44,800
Moscow University R.C.	29,120
Linupings Radio Club (Sweden)	28,380
Vasteras Radioklubb (Sweden)	23,716
Dalsjotoras DX Club (Sweden)	23,268
Royal Signals A.R.S. (England)	21,528
Plovdiv Regional R.C. (Bulgaria)	12,006
Beograd Radio Club (Yugoslavia)	8,106
Mark Radio Society (Sweden)	7,992
Woomera A.R.C. (Australia)	6,358

United States Club Scores

Potomac Valley Radio Club	**20,237,534**
Frankford Radio Club	18,365,328
North Jersey DX Association	8,678,479
Southern California DX Club	7,961,962
Northern California DX Club	5,732,444
Florida DX Club	2,033,467
Rochester DX Association (N.Y.)	1,558,596
Order of Boiled Owls (N.Y.)	1,211,409
Tiajuana Tigers (Calif.)	1,177,442
128 Contest Club (Mass.)	790,640
Orange County DXCC (Calif.)	655,405
Catalpa Amateur Radio Society (Mich.)	593,136
Connecticut Wireless Association	508,305
Suffolk County Radio Club (N.Y.)	439,730
QCWA DX Club of New York	310,077
Angel's Roost Mountain DX Club (Tex.)	306,723
Southeastern DX Association	281,059
North Alabama DX Club	268,304
York Radio Club (Ill.)	255,989
Morris Radio Club (N.J.)	236,352
Willamette Valley DX Club (Ore.)	230,172
Northeast DX Association	201,453
Western Washington DX Club	200,372
Long Island DX Association (N.Y.)	178,827
Hamfesters Radio Club (Ill.)	135,700
West Gulf DX Club	133,350
Seven-Eleven Amateur Radio Club (N.J.)	133,152
Greater New Orleans A.R.C.	46,945
Tri-City Radio Club (Conn.)	42,920
Ohio Valley Amateur Radio Assoc.	17,664
Nashua Mike and Key Club (N.H.)	10,846
Roosevelt High School A.R.C. (Iowa)	4,018

Top Ten

ALL BAND
SINGLE OPERATOR

ZD8J 1,597,726

PY2SO	1,499,020	**W9IOP**	**892,392**
WØGTA/8F4	1,221,858	**YU3BC**	**777,756**
KZ5TW	1,105,190	W2JAE	713,700
W3GRF	**1,004,450**	KH6IJ	710,365
		KA7AB	701,435

Top Six

MULTI-OPERATOR
SINGLE TRANSMITTER

4L7A	**2,209,266**	W3MVB	905,472
CX2CO	2,199,694	G3SSO	756,288
CR6DX	1,306,860	DJ6QT/LX	745,778

Top Six

MULTI-OPERATOR
MULTI-TRANSMITTER

K2GL	**3,760,848**	OH2AM	2,837,133
W4BVV	**3,637,150**	K1JGD	2,805,660
W3MSK	3,618,968	W4KXV	2,769,687

U.S.A. Runners-Up

All Band	**W3BES**	**697,970**
28 mc	W8WZ	49,572
21 mc	K2SHZ	135,596
14 mc	W6GHM	238,263
7 mc	K1HVV	98,448
3.5 mc	W1SWX	10,846

Continental Leaders—Single Band

28 mc

9J2BC	140,760
9J2WR	140,420
K1IMP	50,052
G2BOZ	40,860
VK2BKM	32,040
PY1NEW	13,892
JA1HKP	8,299

21 mc

CX1AAC	438,616
G3HCT	233,988
W4KFC	211,106
4X4TP	162,104
EL2D	161,040
K6CAA/KH6	50,032

3.5 mc

SM6MX	32,128
OK2RO	31,146
W8NBK	20,160
KH6EPW	7,068
JA1PCG	3,480

14 mc

1G5A	**792,370**
PY2BGL	495,450
W2AIW	242,133
KR6CO	209,520
G3FKM	166,344
VK2APK	114,837

7 mc

OK1ZQ	125,130
OK1BY	122,760
W4BGO	107,429
4X4RD	100,232
VK3ADB	84,456
YV5BKA	27,594

1.8 mc

VO1FB	4,165
DL1FF	2,088
OK1WT	1,734

Number groups after call letters denote the following: Band (A-all); Final Score: Number of QSOs; Zones and Countries. Certificate winners are listed in **bold face.**

C.W. Results

SINGLE OPERATOR

North America

United States

W1MX	**A**	**518,195**	**591**	**90**	**215**
W1BIH	**A**	**508,305**	**574**	**95**	**214**
W1WY	A	174,876	281	77	151
W1EZD	A	97,335	245	46	89
K1LMS	A	91,256	232	40	96
W1DIT	A	42,920	134	44	72
WA1FHU	A	37,646	155	40	74
K9CVO/1	A	20,128	99	25	49
W1CNU	A	10,855	58	25	40
K1IMP	**28**	**50,052**	**202**	**27**	**59**
K1DAT	**21**	**58,551**	**230**	**25**	**62**
W1DYE/1	21	15,989	96	17	42
W1PLJ	21	3,740	40	11	23
W1UUK	**14**	**103,005**	**325**	**30**	**79**
WA1ANR	14	35,700	174	20	50
K1NHR	14	21,827	105	24	49
K1UHY	14	17,622	72	28	61
W1NJL	14	1,872	26	9	17
K1HVV	**7.0**	**98,448**	**401**	**22**	**62**
W1SWX	**3.5**	**10,846**	**67**	**17**	**41**
W2JAE	**A**	**713,700**	**810**	**91**	**214**
W2HTI	**A**	**587,856**	**621**	**101**	**230**
W2BXA	**A**	**580,599**	**717**	**83**	**196**
W2MEL	A	525,847	613	94	207
W2HZY	A	357,552	587	60	148
W2DNG	A	318,176	453	80	164
WA2UJM	A	302,575	405	88	180
K2LAF	A	227,360	354	77	147
W2JVU	A	207,760	367	66	130
W2SHC	A	198,360	420	48	123
W2MJ	A	195,636	334	68	136
WA2HUV	A	194,930	336	65	137
W2GKZ	A	152,880	253	73	137
W2PXR	A	144,584	236	78	134
W2RGV	A	133,000	247	65	125
W2BHM	A	123,200	218	71	129
W2QDY	A	118,818	253	54	107
WB2CRX	A	117,135	244	54	117
WA2DIG	A	114,030	225	59	122
K2CPR	A	103,598	207	64	123
W2IWP	A	97,868	199	59	113
K2BZT	A	97,200	211	47	115
W2ZTV	A	90,432	217	44	100
W2EQS	A	85,565	208	53	104
W2HL	A	72,726	186	49	89
W2LV	A	67,431	178	47	86
W2AZS	A	53,360	156	39	76
W2YTH	A	47,971	181	30	59
W2GZZ	A	44,955	141	41	70
K2DNL	A	42,408	113	44	80
K2ISP	A	39,990	156	27	59
W2WZ	A	39,091	136	34	63
DJ1ZN/WT	A	30,132	118	33	60
WB2GGO	A	24,200	95	28	60
W2ZV	A	23,232	91	32	56
W2JKH	A	22,795	86	38	59
WA2JGL	A	19,244	103	34	64
WA2OIL	A	18,368	78	26	56
W2TP	A	16,013	85	24	43
W2GT	A	12,474	65	21	45
K2OEA	A	7,600	52	15	35
W2JB	A	7,084	54	17	29
W2PHT	A	7,074	46	20	34
WA2ELS	A	4,602	28	13	18
W2LYO	A	2,001	25	11	18
W2NEP	**28**	**17,110**	**105**	**18**	**40**
W2SAW	28	16,560	126	15	30
WB2CZZ	28	14,016	77	21	43
K2SHZ	**21**	**135,596**	**421**	**32**	**77**
WA2BEX	21	105,237	362	30	69
K2ZWI	21	82,925	268	31	76
WA2ZEZ	21	72,096	256	28	68
WB2PRF	21	63,510	225	25	62
K1YRB/2	21	25,200	125	22	48
WB2CON	21	9,028	53	22	39
W2HAE	21	5,032	52	11	23
WB2UDF	21	2,494	29	10	19
W2AIW	**14**	**242,133**	**628**	**34**	**95**
W2BOK	14	171,000	484	33	87
WB2FON	14	117,379	375	30	77
W2DOD	14	36,150	163	22	53
W2RUJ	14	30,014	121	27	59
W2AGW	14	29,493	118	29	58
W2LNB	14	28,644	117	26	58
W2CKR	14	16,470	94	18	43
W2CAE	14	14,056	86	17	39
K2SBW	14	5,289	49	14	27
W2FZY	14	2,800	27	19	21
WB2PCF	14	400	9	7	9
W3GRF	**A**	**1,004,450**	**921**	**113**	**266**
W3BES	**A**	**697,970**	**716**	**103**	**235**
K3NHL	**A**	**481,218**	**606**	**88**	**190**
K3JH	A	469,295	678	76	159
W3MSR	A	460,180	601	86	180
W3MWC	A	457,578	626	85	166
W3NOH	A	455,125	570	83	192
W3VKD	A	342,914	481	74	168
W3DBF	A	311,520	484	69	151
W3MCG	A	299,376	399	86	178
K3HTZ	A	238,492	386	72	146
W3QQL	A	225,568	352	72	152
K3WJV	A	139,878	285	55	116
W3EQA	A	138,408	264	49	109
W3AXW	A	111,502	215	68	129
W3BYX	A	103,965	245	42	103
W3KA	A	79,213	235	34	79
K3AIG	A	59,605	162	42	89
W3ISE	A	59,211	167	46	83
W3KT	A	49,288	168	28	73
W3DRD	A	46,609	133	41	86

This was the first **CQ** contest for the Radio Club Rosario. That's Faustino, LU6FBR at the key and Basilio LU6FA standing in back of him. They were the operators of the club station LU4FM. The others also club members, Rudy LU8FAO, Aldo 2FAO and Sarafin 8FP are phone men and were just kibitzing.

Camp and set-up of the 4L7A contest DX-pedition was located near Sukhumi, Georgia, USSR. That's the 7 mc G.P. at the left and the 14, 21 and 28 mc trap beam in the center. The 3.5 mc inverted Vee is in the background by the tent. The crew stripped for action, L. to R.—UP2OF, 2PT, 2NV, Juozas of 2KNP, 2OK, Jonas also of 2KNP, 2CY and 2OO.

W3GRS	A	45,880	131	53	71
K3JYZ	A	43,623	135	37	74
W3CGS	A	42,292	131	32	77
W3HVM	A	32,033	109	40	63
W3AZD	A	29,568	136	26	51
W3QMZ	A	16,849	71	23	50
W3AYD	A	8,586	54	16	38
W3CBF	A	8,064	50	20	36
W3EVW	A	6,786	48	23	35
K3BNS	A	5,402	51	11	26
K3JLI	A	3,978	37	14	25
WB2MZJ/3					
	21	**56,133**	**248**	**23**	**58**
W3AZR	21	53,844	226	24	60
W3AYS	21	45,878	211	30	73
WA3DSD	21	1,197	18	6	13
W3AFM	**14**	**178,345**	**414**	**36**	**112**
K3VCH	14	1,425	26	6	13
K2VCO/3	14	589	11	8	11
W3DFL	**7.0**	**65,237**	**256**	**25**	**64**
K3CYA	7.0	55,722	271	21	53
W3MFW	7.0	53,298	226	22	59
W3RRV	7.0	10,120	79	14	32
K4SHB	**A**	**251,229**	**360**	**84**	**169**
W4ZXI	**A**	**223,774**	**303**	**84**	**170**
W4NBV	A	208,336	316	79	153
W4BJ	A	194,370	350	61	129
W4ZSH	A	190,490	302	66	149
W4HOS	A	137,160	230	77	139
W4FRO	A	114,478	217	59	123
W4ZM	A	106,020	208	63	116
K4ZCP	A	91,800	212	56	97
K4ORQ	A	90,624	239	45	83
K4EZ	A	86,995	221	43	94
W4GF	A	67,306	161	55	91
W4WBC	A	53,317	152	50	81
W4OMW	A	52,440	161	40	80
W4PTR	A	51,240	153	47	73
W4TMR	A	26,972	106	37	59
W4DXL	A	11,388	59	30	43
W4GRG	A	8,432	67	25	37
W4WSF	A	2,765	27	15	20
W4YGO	A	770	17	13	17
K4KJD	A	120	5	4	4
K6ILB/4	**28**	**29,880**	**144**	**21**	**51**
WA4VAI	28	23,725	125	18	47
WB4BMV	28	22,852	132	17	41
WA4IKU	28	22,365	111	21	50
WA4WIP	28	14,784	83	20	44
W4KFC	**21**	**211,106**	**609**	**32**	**87**
WA4GCS	21	69,600	249	26	70
W4MMD	21	35,070	172	23	47
K4RZK	21	17,664	94	20	44
W4ZOK	21	3,332	25	16	23
W4NTE	21	646	14	9	10
W4YGY	**14**	**148,356**	**434**	**31**	**86**
W4SNU	14	83,600	259	30	80
W4LVV	14	76,284	226	33	84
W4ETO	14	6,020	47	14	29
W4NXE	14	84	4	3	4
W4BGO	**7.0**	**107,429**	**357**	**27**	**76**
W4YWX	7.0	58,225	240	23	62
W4BYB	7.0	44,536	215	21	55
W4BCV	7.0	24,700	133	19	46
K4YYL	7.0	17,595	141	13	32
W4WHK	**3.5**	**6,435**	**62**	**12**	**27**
W5BRR	**A**	**390,879**	**492**	**98**	**181**
W5BUK	A	128,125	236	76	129
W5ODJ	A	60,800	170	55	73
W5LJT	A	56,682	140	53	88
WA5EID	A	3,276	30	21	21
WA5GVB	A	423	10	8	9
WA5MUE	**28**	**7,450**	**62**	**18**	**31**
W5LGG	**21**	**109,654**	**346**	**33**	**76**
W5KC	21	80,219	294	29	68
K5IIN	21	72,180	278	29	61
K5VTA	21	28,880	128	26	54
W5NOP	**14**	**64,974**	**220**	**28**	**74**
K5BXG	14	44,832	163	29	67
W5OBS	14	41,769	162	30	61
W5WZQ	**7.0**	**67,332**	**250**	**28**	**65**
K5JVF	7.0	17,256	97	24	38
K5JZY	7.0	15,602	93	23	35
W6ITA	**A**	**646,905**	**751**	**110**	**195**
K6ERV	**A**	**530,385**	**644**	**104**	**181**
W6CUF	**A**	**484,512**	**593**	**106**	**188**
W6NJU	A	323,807	467	91	148
W6WX	A	318,760	440	99	161
W6TZD	A	226,848	399	85	119
WA6UFW	A	196,636	321	86	132
K6ALH	A	170,675	307	82	113
W6ERS	A	160,388	312	86	116
W6EWN	A	142,842	226	69	110
K6CEO	A	137,203	296	64	99
W6SRF	A	134,832	282	65	104
WA6IVN	A	129,860	299	63	88
W6HOC	A	126,720	249	73	107
WB6IQI	A	126,201	292	75	102
W6VNJ	A	118,320	253	74	96
W6TI	A	113,399	249	64	105
W6DZZ	A	92,310	197	69	101
W6SR	A	88,182	230	62	76
W6EOU	A	81,844	189	72	76
W6VVR	A	80,938	202	59	84
W6BJH	A	78,678	197	62	79
W6QMC	A	76,897	214	59	72
K6HOR	A	73,050	179	69	81
W6NBE	A	61,380	191	55	69
W6KHS	A	60,288	170	47	81
W6BIP	A	55,418	166	49	72
W6JKJ	A	40,484	130	53	63
W6ESI	A	38,164	152	45	49
WA6HAE	A	33,966	112	46	56
W6LDD	A	32,204	112	38	59
W6GQK	A	31,220	99	46	68
W6CYV	A	28,730	119	31	54
W6PLS	A	28,244	112	41	51
WA6DMN	A	14,770	77	34	36
K6DQB	A	13,825	68	33	41
K6TZK	A	7,540	50	29	29
W6CLM	A	5,885	40	25	30
WB6KOS	A	5,304	42	24	27
W6EJA	A	2,000	28	12	13
WA6ZQU	**28**	**8,880**	**67**	**20**	**28**
W6ISQ	**21**	**82,741**	**299**	**29**	**68**
W6KNE	21	60,480	252	28	56
W6PQW	21	57,876	221	28	63
WB6KRW	21	16,536	112	22	31
W6BSY	21	11,940	73	24	36
WB6REO	21	6,435	61	16	23
W6GHM	**14**	**238,263**	**621**	**34**	**95**
W6AFI	14	82,764	292	30	69
WB6KIL	14	72,726	243	30	63
WA6PMK	14	26,400	117	27	48
W6FLT	14	6,360	54	17	23
K6BPR	**3.5**	**2,997**	**47**	**12**	**15**
W7AYY	**A**	**119,776**	**282**	**66**	**86**
W7MX	A	98,452	227	63	88
WA7CGR	A	51,948	183	51	60
W7ENA	A	19,516	86	36	46
W7RGL	A	18,559	99	25	42
K7CPC	A	13,260	83	35	33
W7VY	**14**	**73,842**	**268**	**31**	**62**
W7JLU	**7.0**	**8,200**	**73**	**17**	**23**
W7CFJ	**3.5**	**2,125**	**38**	**11**	**14**
WA8GUF	**A**	**266,961**	**427**	**73**	**146**
W8GOC	A	35,739	130	38	61
W8YGR	A	33,394	102	43	75
W8KC	A	19,789	89	30	47
WA8KPO	A	9,861	61	18	39
WA8GPX	A	2,432	25	18	20
WA8QYK	A	1,350	16	14	16
W8VDF	A	432	10	8	8
W8WZ	**28**	**49,572**	**224**	**24**	**57**
WA8CZH	**21**	**121,476**	**430**	**31**	**75**
W8HCJ	21	65,436	271	26	56
K8UDJ	21	41,195	186	23	54
W8DSO	21	9,430	71	14	32
W8PCS	21	6,174	43	14	35
WA8CIA	**14**	**42,398**	**170**	**26**	**60**
W8EW	14	30,532	140	26	51
K8UZX	14	2,935	38	7	20
WA8RQQ	7.0	99	7	5	4
W8NBK	**3.5**	**20,160**	**138**	**15**	**41**
W9IOP	**A**	**892,392**	**851**	**109**	**252**
W9EWC	A	327,320	526	79	117
WA9HJM	A	46,761	162	41	68
K9IHG	A	24,563	78	51	70
WA9JDT	A	12,903	122	18	33
K9VQK	A	12,852	68	26	42
W9LKJ	**28**	**32,494**	**148**	**24**	**53**
K9CSW	**21**	**129,375**	**402**	**30**	**85**
W9ZTD	21	85,744	324	28	64
W9LKI	21	49,728	111	28	56
WA9MFY	21	4,781	40	14	23
K9ECO	**14**	**156,087**	**384**	**39**	**102**
W9WKU	14	46,233	162	30	66
W9JOO	14	11,859	75	20	39
W9HUZ	**7.0**	**32,643**	**151**	**25**	**56**
W9YYG	7.0	6,716	52	16	30
WØAIH	**A**	**451,360**	**594**	**101**	**179**
WØVXO	A	387,192	474	105	187
WØLQN	A	49,572	159	40	68
KØBYC	A	1,947	21	14	19
WØLBS	28	2,656	30	13	19
WAØHYI	**21**	**15,067**	**91**	**22**	**39**
KØGVB	**14**	**134,016**	**388**	**35**	**93**
WØKAW	14	59,262	201	29	73
WAØEMS	14	46,555	175	29	66
WAØKDI	14	21,840	100	23	45
WAØKXJ	14	1,550	30	11	14
KØJPL	14	774	15	8	10

Alaska

KL7FRY	**A**	**358,872**	**968**	**72**	**80**
KL7FPU	A	73,968	518	35	32

Bermuda

W5HWR/VP9					
	1.8	**1,287**	**58**	**5**	**6**

Canada—Zone 5

VE2WA	**A**	**101,010**	**226**	**69**	**113**
VE1TG	**21**	**121,770**	**549**	**23**	**67**
VE1EK	21	3,770	46	8	21
VE1AE	**14**	**17,904**	**139**	**14**	**34**
VO1FB	**1.8**	**4,165**	**92**	**4**	**13**

Canada—Zone 4

VE6VO	A	2,976	45	12	12
VE3BMB	**21**	**27,880**	**142**	**20**	**48**
VE3GCO	21	23,966	200	14	32
VE3IJ	21	3,864	50	7	21
VE3BHS	**14**	**159,893**	**447**	**34**	**93**
VE3ES	14	69,736	268	27	65
VE3WB	14	12,593	104	17	32

Canada—Zone 3

VE7EH	**A**	**286,665**	**886**	**66**	**79**

Canal Zone

KZ5TW	**A**	**1,105,190**	**1738**	**96**	**194**

Cuba

CO2BO	**A**	**404,280**	**1063**	**71**	**109**
CM2BL	A	29,436	286	18	24
CO2RL	A	9,728	256	11	8

Dominican Rep.

HI8LC	**14**	**11,622**	**132**	**14**	**25**

Honduras

HRIAT	**14**	**13,395**	**217**	**14**	**17**

Mexico

XE2HHD	**A**	**32,175**	**284**	**28**	**27**

Puerto Rico

KP4CQZ	**A**	**497,802**			
			1380	**63**	**105**
KP4BJM	A	209,825	600	69	106
WIFZJ/KP4					
	3.5	**8,040**	**122**	**10**	**20**

San Andres

HKØAI	**A**	**299,051**			
			1508	**36**	**61**

St. Pierre & Miquelon

FP8CQ	**A**	**158,598**	**824**	**38**	**51**

AFRICA

Angola

CR6AI	**A**	**276,736**	**518**	**61**	**127**

SM4CLU had the most contacts for the all-banders in Sweden, but Len lacked the multiplier for the #1 position.

CR6EI	A	92,466	322	39	60
Ascension Is.					
ZD8J	A	1,597,726	1668	103	223
Egypt					
SU1DL	A	59,841	189	30	79
Geyser Reef					
IG5A	14	792,370	1594	37	133
Kenya					
5Z4SS	A	33,764	136	36	56
Liberia					
EL2D	21	161,040	678	22	58
Libya					
5A4TL	A	91,881	253	40	83
Malgasy					
5R8CQ	A	2,630	23	11	15
Mozambique					
CR7IZ	A	185,810	382	60	110
CR7LU	A	164,346	395	55	92
Nigeria					
5N2ABF	A	75,141	221	42	79
Rhodesia					
ZE3JJ	A	253,432	552	58	100
ZE3JO	28	59,150	308	18	47
ZE5JJ	21	59,094	297	24	43
ZE2KV	14	21,655	136	25	36
Seychelles Is.					
VQ9BC	21	132,431	506	25	68
VQ9AR	14	77,814	302	29	70
Somalia					
606BW	A	236,320	594	52	88
South Africa					
ZS2RM	A	233,168	529	54	98
ZS6AJO	A	97,545	315	38	67
ZS1O	A	24	2	2	2
ZS2HI	14	244,728	770	30	78
ZS5UP	14	80,899	314	29	62
ZS6AYU	14	61,439	314	28	39
Spanish No. Africa					
EA9EO	14	19,038	167	11	27
Swaziland					
ZD5M	A	43,860	154	39	63
Tristan Da Gunha					
ZD9BE	A	37,962	177	25	49
Zambia					
9J2W	A	380,988	768	57	114
9J2BC	28	140,760	563	24	61
9J2WR	28	140,420	556	23	62

ASIA

Hong Kong

VS6FO	7.0	8,400	51	10	10
India					
VU2GW	A	28,188	139	34	53
VU2CK	14	14,200	119	17	33
Iran					
EP2BQ	A	126,555	305	49	94
EP2RV	A	83,210	260	30	76
Israel					
4X4TP	21	162,104	640	25	67
4X4RD	7.0	100,232	526	19	48
Japan					
JA4BJO	A	483,570	707	94	149
JA2HO	A	339,600	601	81	119
JA8CKC	A	244,352	526	70	96
JA1EZT	A	228,114	479	73	98
JA2JAA	A	213,530	466	68	95
JA1CG	A	195,426	503	62	92
JA8QA	A	147,065	439	51	68
JA7AKQ	A	107,169	291	59	80
JA7FC	A	77,364	240	57	69
JA3LGG	A	71,126	218	50	72
JA2CEC/1	A	62,766	244	43	56
JAØAC	A	42,722	190	40	42
JA1TSP	A	41,760	181	41	49
JA2DN	A	35,524	125	46	61
JA3IG	A	34,821	199	20	33
JA7CVB	A	31,546	176	33	37
JA3KYU	A	18,060	117	27	33
JA4AQR	A	15,665	92	30	35
JA3DEO	A	14,820	74	35	43
JA6CLO	A	13,715	86	27	38
JA7RH	A	12,261	99	32	35
JA3GHN	A	11,492	68	33	35
JA2CPK	A	8,064	73	22	20
JAØOP	A	7,938	56	23	26
JA1SMA	A	7,614	64	22	25
JA8CXV	A	6,273	58	23	28
JA1JQY	A	6,106	58	22	21
JAØBPY	A	4,440	52	18	19
JA2HFB	A	3,578	37	18	19
JA8SW	A	2,200	34	9	13
JA2YFU	A	962	17	13	13
JA1NEC	A	750	14	12	13
JA1HKP	28	8,299	70	19	24
JA1JUQ	28	5,450	77	10	15
JA2GRM	28	2,184	33	13	13
JAØAIF	21	121,600	528	25	55
JA6TQ	21	113,524	398	33	68
JA6AKW	21	56,000	284	22	48
JA3HIL	21	44,044	216	28	49
JA8QN	21	41,004	221	23	44
JA1MIN	21	35,420	165	26	51
JA1KVT	21	33,540	183	25	40
JA3BRI	21	20,644	143	21	31
JA6YAF	21	18,300	114	23	37
JA1EM	21	17,160	111	21	34
JA1THL	21	16,536	113	21	32
JA3BCC	21	15,486	100	22	36
JA8AWH	21	11,515	92	20	27
JA2ITA	21	11,132	94	20	26
JA2YBG	21	10,742	96	19	22
JA2DNA	21	10,626	86	19	27
JA2ITH	21	7,350	70	19	23
JA2FCR	21	6,594	62	20	22
JA1BZM	21	6,396	58	19	22
JA1KRV	21	4,850	71	12	13
JA6FUV	21	4,428	45	16	20
JA3HCJ	21	3,663	41	14	19
JA2FYL	21	3,444	43	15	17
JA2IIT	21	3,306	38	18	20
JA2YAZ	21	2,988	34	17	19
JA5BWV	21	2,580	40	15	15
JA1WRG	21	1,339	39	6	7
JA1SKE	21	1,254	25	8	11
JA5BZL	21	513	11	9	10
JA6AD	14	164,955	553	32	73
JA1CIB	14	109,632	414	31	65
JA8AA	14	70,980	364	24	46
JA1BK	14	70,280	352	26	44
JA7MN	14	43,978	262	23	35
JA1GTF	14	42,277	227	25	42
JA2TH	14	38,024	244	22	34
JA8GR	14	26,820	175	24	36
JA7KE	14	17,952	141	18	30
JA1IDY	14	17,384	142	21	32
JA7JW	14	13,684	126	18	26
JA6PN	14	12,726	74	24	39
JA1DFQ	14	9,468	92	16	20
JA3HLJ/3	14	7,434	84	19	23
JA7BP	14	5,418	57	20	23
JA1KVG	14	4,760	64	11	24
JA1PAQ	14	4,066	45	18	20
JA3HIG	14	3,770	53	12	17
JA2BNN	14	3,248	53	13	16
JA8AGI	14	2,465	40	14	15
JA3EGC	14	1,449	36	10	13
JA7DHZ	14	1,012	23	11	12
JA3HUL	14	104	7	4	4
JA1YL	7.0	51,430	264	28	46
JA1LQC	7.0	19,500	152	19	33
JA3CAF	7.0	17,700	113	23	37
JA6YB	7.0	14,766	120	18	28
JA1LYZ	7.0	12,240	125	17	23
JA1QXC	7.0	6,330	86	14	16
JA1HLR	7.0	2,046	22	10	12
JA1VHO	7.0	1,296	35	8	10
JA1VBW	7.0	288	15	5	3
JA1PCG	3.5	3,480	51	14	15
JA1FFP	3.5	2,376	45	12	12
JA7CDV	3.5	231	12	6	5
JA7CDU	3.5	126	10	4	5
KA7AB	A	701,435	1027	91	154
KA9AK	7.0	16,900	99	25	40
Korea					
HL9KB	A	19,768	106	30	41
HM1DE	21	10,368	137	12	20
Macau					
CR9AH	A	135,135	510	52	91
Malaysia, West					
9M2OV	A	197,346	507	68	118
Ryukyu Islands					
KR6UD	A	322,770	668	74	129
KR6AG	21	40,533	292	20	39
KR6CO	14	209,520	769	31	77
Saudi Arabia					
HZ3TYQ	14	12,348	82	21	42
Singapore					
9V1MT	A	78,110	424	44	70
Turkey					
TA2AC	14	149,058	661	23	55

Union of Soviet Socialist Rep.

Asiatic

UA9WS	A	337,260	596	48	162
UA9EV	A	138,520	325	44	116
UA9SB	A	53,462	231	28	69
UA9MR	A	51,189	170	35	78
UA9OO	A	29,625	163	21	54
UA9FN	A	26,994	162	19	47
UA9FM	A	16,117	85	24	47
UA9KDK	A	12,040	82	19	37
UA9OK	A	10,421	105	12	35
UA9MT	A	8,835	70	18	39
UA9MS	28	11,470	109	11	26
UA9UG	21	103,180	618	21	55
UA9SH	21	14,616	136	12	30
UA9HN	21	520	23	7	13
UW9OA	14	67,830	264	29	73
UW9AO	14	63,716	337	20	48
UA9AB	14	54,242	272	21	53
UA9UC	14	44,064	280	21	47
UW9PT	14	27,348	121	29	57
UA9VQ	14	20,864	134	23	41
UW9OU	14	12,663	69	23	44
UA9GE	14	10,336	119	9	23
UA9PO	14	2,861	40	8	19
UA9KVN	14	1,139	40	8	13
UA9EU	3.5	30,081	278	8	29
UA9RD	3.5	784	21	5	9
UAØKKB	A	187,952	627	64	72
UAØAG	A	92,736	307	37	75
UAØLS	A	22,125	177	37	38
UAØGF	A	16,536	182	26	26
UAØYD	A	12,773	118	22	31
UWØFB	A	5,900	103	18	17
UAØZS	A	2,960	93	11	9
UWØIN	14	154,352	626	28	60
UWØIX	14	59,109	376	24	37
UAØTR	14	23,320	239	14	30
UAØML	14	936	47	7	6
UWØAF	3.5	1,485	49	6	9

Azerbaijan

UD6BZ	A	52,871	248	27	59
UD6AM	21	51,824	314	26	53
UD6BV	14	10,707	101	15	28
UD6BD	7	13,650	120	9	30

Kazakh

UL7HV	A	30,968	195	15	41
UL7CT	A	21,516	118	22	44
UL7RL	A	20,880	182	17	31
UL7BG	14	135,926	503	30	68
UL7CG	3.5	36,566	284	110	37

Kirghiz

UM8KAA	14	51,692	322	23	49
UM8AV	14	3,255	59	6	15

Turkoman

UH8BO	A	131,454	363	44	90
UH8DC	A	103,284	332	32	82
UH8DH	14	13,064	114	14	32

Uzbek

UI8AI	A	139,482	420	38	85
UI8CD	14	42,984	247	22	50
UI8CV	14	1,360	30	5	12

EUROPE

Austria

OE1ZDA	A	387,774	770	82	176
OE6PWG	A	20,976	100	44	70
OE3AX	A	3,139	61	15	28
OE1WO	3.5	9,800	137	13	43
OE1KU	1.8	500	52	3	7
Belgium					
ON4TX	A	401,478	671	73	158
ON4XG	A	284,406	582	65	149
ON4CK	14	56,385	232	31	74
ON5AZ	14	23,300	260	15	35
ON4NG	14	19,448	219	14	30
Bulgaria					
LZ2ZZ	A	118,400	619	32	96
LZ2KHN	A	10,070	171	12	41
LZ1AG	28	12,006	83	21	37
LZ1DV	21	133,644	568	31	80
LZ1BK	21	77,832	440	27	65
LZ1CF	21	50,776	311	25	65
LZ2GS	14	352	16	5	11
LZ2RF	7.0	11,476	191	6	36
LZ1GG	7.0	300	22	4	11
LZ2SA	3.5	19,600	324	9	40
LZ1EP	3.5	5,379	156	7	26
Channel Is. (Jersey)					
GC4LI	A	62,000	273	40	84
Crete					
SVØWL	14	1,173	37	7	16
Czechoslovakia					
OK1KKJ	A	350,997	841	74	163
OK3OM	A	270,722	665	60	163
OK2PO	A	260,142	699	60	131
OK1AFN	A	205,662	477	68	159
OK1BMW	A	203,086	451	69	145
OK1AHZ	A	195,597	509	66	145
OK1MG	A	174,936	429	62	135
OK3DG	A	166,268	402	64	133
OK1GO	A	83,268	221	48	114
OK3CCC	A	80,465	400	36	97
OK1ADM	A	78,603	179	63	124
OK1ARN	A	58,195	307	28	85

The YV1JV crew had a YL, Erliz YV1UU, in their multi operation. L. to R.—Domingo YV1EN, Obed 1UU/2, Erliz 1UU and Charles 1OB.

OK3CES	A	46,325	255	31	78
OK2BOB	A	43,232	271	27	85
OK3IR	A	36,531	192	31	92
OK3BCH	A	28,220	174	23	60
OK2LN	A	28,035	227	33	72
OK3CEG	A	27,156	194	24	49
OK1AIR	A	22,088	193	21	57
OK1KIY	A	12,948	118	22	30
OK1APV	A	8,676	89	18	36
OK2KFK	A	8,340	114	17	43
OK3CGZ	A	6,392	114	9	25
OK2AOP	A	5,681	49	21	30
OK2OL	A	4,959	39	23	34
OK2BCZ	A	4,700	76	12	38
OK1AMU	A	3,486	61	13	29
OK2BCI	A	3,312	32	19	27
OK1ANG	A	1,320	25	9	15
OK1OO	A	434	14	7	7
OK1DC	A	125	5	4	5
OK1SV	**28**	**16,830**	**117**	**23**	**28**
OK1GT	28	10,665	86	19	26
OK1MP	28	5,644	61	15	19
OK3XW/1	28	4,914	44	16	26
OK1PG	28	4,719	50	15	18
OK2WEE	28	4,510	41	12	18
OK2VP	28	3,219	40	13	16
OK1ZL	**21**	**173,979**	**547**	**32**	**85**
OK1VB	**21**	**65,379**	**268**	**31**	**62**
OK1IK	21	60,918	299	26	52
OK1NG	21	51,348	291	21	45
OK1ABB	21	43,120	212	23	54
OK2KR	21	41,800	190	27	61
OK1MX	21	20,900	160	20	30
OK3KGI	21	17,640	126	21	39
OK1AEZ	21	15,240	94	21	39
OK1AII	21	8,410	51	25	33
OK1ALY	21	2,701	40	13	15
OK1CX	21	572	16	7	6
OK2OG	21	522	11	8	10
OK3CDP	**14**	**109,344**	**408**	**39**	**97**
OK2QX	**14**	**67,613**	**390**	**28**	**63**
OK1FV	14	39,108	180	22	54
OK1UK	14	26,845	218	21	44
OK1ALE	14	21,896	245	13	43
OK1APJ	14	19,459	145	17	44
OK1AGP	14	10,120	125	14	32
OK2BNA	14	9,400	128	11	36
OK1ADH	14	7,650	82	14	36
OK1SQ	14	7,616	129	9	23
OK2BPF	14	7,385	102	12	23
OK2KFR	14	5,880	117	11	29
OK2WDC	14	4,158	86	9	24
OK1BV	14	1,127	31	9	14
OK2BBQ	14	276	21	4	8
OK1ZQ	**7.0**	**125,130**	**783**	**28**	**69**
OK1BY	**7.0**	**122,760**	**728**	**28**	**62**
OK3CFL	7.0	36,180	400	14	53
OK1ACF	7.0	17,384	215	13	40
OK2BBI	7.0	16,308	198	14	40
OK3JV	7.0	14,646	167	14	44
OK3CBN	7.0	9,252	221	9	27
OK1AIA	7.0	5,760	94	9	31
OK3CFF	7.0	4,118	137	6	23
OK2BHK	7.0	3,038	79	7	24
OK1AEH	7.0	1,860	63	6	24
OK1AOV	7.0	1,768	52	7	19
OK1UY	7.0	1,000	39	5	20
OK2RO	**3.5**	**31,146**	**437**	**12**	**46**
OK5RAR	**3.5**	**28,188**	**393**	**12**	**46**
OK2BHX	3.5	18,540	402	8	37
OK1WC	3.5	12,987	330	7	30
OK2HI	3.5	10,665	228	7	38
OK1KPK	3.5	9,702	211	7	35
OK1AJC	3.5	5,168	119	6	28
OK3BG	3.5	4,144	108	7	30
OK3KEU	3.5	3,354	125	5	21
OK2BIT	3.5	2,624	80	6	25
OK1AMF	3.5	2,232	64	6	25
OK1ARH	3.5	2,185	97	5	18
OK2BKT	3.5	2,112	61	6	27
OK1FA	3.5	1,431	30	6	21
OK2KSU	3.5	1,020	52	5	15
OK2BKO	3.5	580	29	4	15
OK1XC	3.5	110	11	3	7
OK1WT	**1.8**	**1,734**	**103**	**3**	**14**
OL4AFI	**1.8**	**1,664**	**102**	**3**	**13**
OL4ADU	**1.8**	**1,515**	**97**	**3**	**12**
OL5ADK	1.8	900	65	4	14
OK1AES	1.8	896	62	3	11
OL4AER	1.8	689	61	3	10
OL6ACO	1.8	363	42	2	9
OL1ADV	1.8	330	36	2	9
OL1AEM	1.8	308	37	2	9
OK2BJJ	1.8	286	26	2	9
OK1AAU	1.8	209	20	2	9
OL6AAF	1.8	204	22	3	9
OL6AAE	1.8	180	23	2	8
OK1AMI	1.8	135	18	2	7
OK1KPR	1.8	120	18	2	6
OK1XC	1.8	77	11	2	5

Denmark

OZ5DX	**A**	**366,976**	**740**	**80**	**164**
OZ1LO	A	111,020	419	44	86
OZ7OF	A	72,534	294	50	104
OZ3PO	A	47,502	203	37	80
OZ7ABC	A	36,960	153	44	59
OZ4H	A	16,985	143	29	50
OZ4DX	A	3,885	89	8	29
OZ3Y	**21**	**33,780**	**225**	**21**	**39**
OZ7G	21	20,700	155	16	34
OZ7BG	**14**	**38,702**	**208**	**23**	**51**
OZ7CF	**7.0**	**15,376**	**136**	**18**	**44**
OZ4GB	7.0	2,574	95	6	20
OZ5AR	7.0	1,364	39	5	26

England

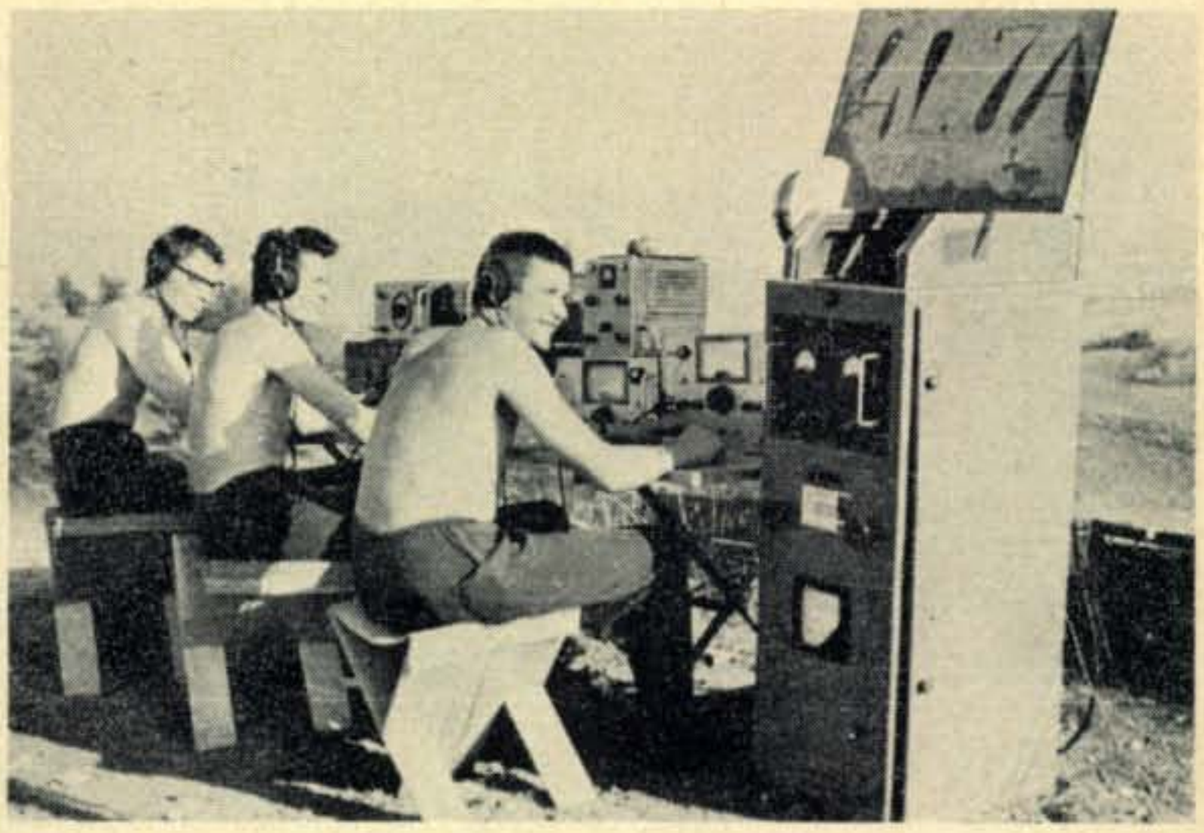
G3HDA	**A**	**683,844**	**957**	**87**	**207**
G2DC	A	224,046	433	72	171
G3DYY	A	211,718	451	72	149
G3TWV	A	102,951	413	42	81
G2AJB	A	88,330	293	48	98
G8DI	A	58,250	267	37	88
G3TXF	A	29,250	241	26	50
G3NVK	A	21,528	143	27	65
G3JKY	A	19,224	169	17	37
G2BOZ	**28**	**40,860**	**250**	**22**	**38**
G4JZ	28	15,512	194	20	28
G3EUE	28	3,500	64	9	11
G3MWZ	28	2,822	63	8	9
G3HCT	**21**	**233,988**	**821**	**30**	**81**
G3PJW	21	36,993	261	15	44
G3NSY	21	13,840	191	13	29
G3FKM	**14**	**166,344**	**569**	**34**	**82**
G3SHM	14	34,290	266	17	37
G3IOI	14	20,862	176	20	41
G2HDR	14	4,658	77	9	25
G3WP	14	380	14	5	14
G3RRJ	**7.0**	**117,208**	**567**	**27**	**65**
G4CP	7.0	65,705	437	24	61
G3ESF	7.0	32,292	390	11	43
G3IGW	**3.5**	**27,384**	**362**	**11**	**45**

Faroes

OY2GHK	21	976	27	7	9

Finland

OH2BCZ	**A**	**172,400**	**487**	**57**	**141**
OH3YI	**A**	**82,251**	**328**	**42**	**129**
OH8PE	A	57,517	297	35	78
OH5RZ	A	45,696	229	35	77
OH3MU	A	30,345	194	34	81
OH3WW	A	28,797	126	36	51
OH6AF	A	25,750	186	30	77
OH2YL	A	24,308	110	32	71
OH3TT	A	20,915	91	35	54
OH3MF	A	15,096	106	26	76
OH4NS	A	6,804	42	28	35
OH2BFQ	A	3,828	54	22	36
OH3PJ	A	1,258	37	11	26
OH2BGE	A	1,024	25	13	19
OH2XK	A	816	14	10	14
OH2BAC	**28**	**9,408**	**72**	**18**	**31**
OH1AG	28	3,570	38	13	22
OH3NY	28	455	13	6	7
OH1TN	**21**	**64,890**	**278**	**31**	**74**
OH3WP	21	18,659	153	16	31
OH5WH	21	8,836	103	17	30
OH3XZ	21	6,480	75	12	24
OH2BR	21	4,485	78	10	29
OH3MK	21	2,850	29	15	23
OH6UW	21	2,470	39	11	27
OH5WF	21	1,456	42	7	21
OH2RD	21	143	7	5	6
OH1XX	**14**	**128,232**	**536**	**32**	**85**
OH2BDP	14	76,558	370	29	72
OH6UX	14	8,374	75	15	38
OH7RR	14	8,100	114	12	33
OH9RI	14	7,683	105	11	28
OH3NR	14	5,148	81	9	30
OH3QA	14	2,001	35	10	19
OH5VT	14	1,403	35	8	15
OH2JQ	14	195	12	4	9
OH5UQ	**7.0**	**27,324**	**254**	**19**	**50**
OH3ZD	7.0	8,900	125	11	39
OH5PB	7.0	4,368	100	7	32
OH2BGH	7.0	2,523	66	6	23
OH5WJ	7.0	357	20	13	21
OH1SH	**3.5**	**20,790**	**235**	**14**	**49**
OH2DI	3.5	3,745	96	7	28
OH1UR	3.5	3,410	103	6	25



At the operating position of the mystery station of the Contest, 4L7A winner of the Multi-Operator, Single Transmitter Trophy. L. to R.—Juozas UP2KNP, Zigmas UP2PT and Vladas UP2NV.

OH6WO	3.5	756	43	3	15
OH6VF	3.5	630	31	4	14
OH2DS	3.5	588	24	5	16
OH2BHM	3.5	132	14	3	8

France

F3AT	**A**	**161,600**	**502**	**58**	**102**
F8TM	A	151,800	482	51	113
F9LX	A	123,500	425	43	82
F3PK	A	114,768	327	52	92
F9RM	A	61,490	185	54	89
F3IZ	A	33,520	218	21	59
F8RU	A	27,636	121	36	58
F8JH	A	5,661	85	13	24
F9AP	A	2,046	31	15	18
F5AI	A	1,674	35	12	15
F9OE	**14**	**11,362**	**96**	**18**	**28**

Germany

DL7AA	**A**	**422,802**	**524**	**98**	**185**
DL6WD	**A**	**276,822**	**666**	**58**	**124**
DL7BQ	**A**	**262,870**	**530**	**68**	**126**
DJ4DN	A	228,771	468	76	153
DJ2HH	A	208,266	489	66	140
DJ2GG	A	194,000	523	55	107
DJ3ZV	A	177,192	383	67	147
DL8KJ	A	171,360	420	60	110
DJ2RT	A	162,288	422	52	132
DJ8IF	A	159,360	502	53	113
DJ3WU	A	138,322	392	60	134
DL1JF	A	133,770	342	60	122
DL8BS	A	131,176	407	52	100
DJ6BW	A	102,124	433	43	78
DL1AM	A	97,631	288	52	111
DL7CF	A	85,013	264	51	100
DJ4AX	A	83,080	297	41	83
DJ2HI	A	82,661	308	47	84
DL8DD	A	74,906	270	44	90
DJ7PB	A	59,472	322	22	50
DJ8FF	A	54,756	265	32	85
DJ4HR	A	52,826	210	42	80
DL8AJ	A	52,625	185	46	79
DJ9MH	A	50,400	270	31	89
DJ2TI	A	44,958	238	36	82
DL3CM	A	43,318	186	38	83
DL1ES	A	40,894	214	35	92
DJ1FC	A	39,592	161	36	65
DJ4ZR	A	38,808	196	26	58
DJ3BB	A	30,160	176	30	86
DL1MD	A	27,141	134	33	50
DL6BP	A	21,580	141	25	58
DL7GQ	A	15,280	140	23	57
DL1JC	A	15,170	114	28	46
DJ6WD	A	13,115	90	23	38
DL9EM	A	7,296	71	21	27
DK1HO	A	4,840	61	18	37
DJ2RE	**28**	**8,428**	**106**	**11**	**17**
DJ2PJ	28	6,696	75	13	17
DL6DF	28	6,206	79	12	17
DJ2BW	**21**	**201,357**	**620**	**34**	**83**
DL8ANA	21	61,383	294	27	52
DLØFT	21	35,836	220	23	45
DL9PE	21	20,349	138	22	35
DJ6OM	21	15,392	121	19	33
DL8IG	21	2,440	52	8	12
DL8ML	**14**	**100,311**	**446**	**27**	**60**
DJ9IE	14	53,760	361	20	50
DL1GN	14	11,136	120	13	45
DJ6RX	**7.0**	**43,550**	**422**	**17**	**50**
DL1KS	7.0	37,143	279	18	53
DL1TH	7.0	8,910	169	7	38
DJ4QU	7.0	4,080	99	7	27
DJ5DT	**3.5**	**23,814**	**268**	**14**	**49**
DL1QT	3.5	7,540	112	11	41
DL1FF	**1.8**	**2,088**	**111**	**5**	**13**
DL4RO	**3.5**	**17,108**	**379**	**8**	**39**
DM2AUF	**A**	**136,655**	**342**	**58**	**123**
DM2BTO	**A**	**113,564**	**360**	**55**	**123**
DM3YPA	A	99,383	468	39	110
DM3VGO	A	65,024	283	36	91
DM2AUD	A	27,324	187	35	73
DM2BBE	A	17,040	145	22	58
DM2ADC	A	11,102	100	24	37
DM2AQF	A	6,716	133	12	34
DM2CDO	A	5,358	69	14	33
DM3ZCG	A	4,371	44	23	24
DM2BQI	A	3,350	66	14	36
DM3WYF	A	3,116	63	12	29
DM3RMA	A	2,546	71	8	30
DM4SI	A	2,546	53	10	28
DM2AXO	A	2,115	48	13	32
DM4ZL	A	1,260	54	8	20
DM4WKL	A	840	29	8	20
DM2BHG	28	378	10	7	7
DM3RYO	**21**	**10,633**	**90**	**20**	**28**
DM3LOG	21	1,368	21	12	12
DM2AUO	**14**	**52,143**	**310**	**25**	**66**
DM3YK	14	6,118	87	11	35
DM2BDG	14	3,298	46	10	24
DM2AIF/A	14	2,914	48	10	21
DM2BDD	14	1,134	26	8	19
DM3YYA	14	648	20	7	11
DM3YPD	**7.0**	**15,561**	**143**	**13**	**44**
DM2AQI	7.0	12,138	177	11	40
DM3UFJ	7.0	6,623	133	7	30
DM5DL	7.0	6,216	129	10	32
DM4ZWL	**3.5**	**4,250**	**116**	**6**	**28**
DM4WNL	3.5	3,589	86	6	31
DM2CKN	3.5	2,838	79	7	26
DM2BCF	3.5	680	59	4	13
DM2AMF	3.5	252	17	4	14

Hungary

HA7PJ	**A**	**154,878**	**496**	**48**	**118**
HA5FE	**A**	**133,420**	**461**	**50**	**130**
HA3MJ	A	33,672	145	30	62
HA3MB	A	30,672	158	37	71
HA1ZH	A	17,688	190	16	50
HA8UF	A	14,553	143	21	42
HA6NC	A	14,288	120	29	47
HA4YL	A	7,938	155	18	31
HA1VA	A	6,578	105	19	27
HA5AX	A	4,752	68	16	28
HA5DA	**21**	**21,480**	**150**	**23**	**37**
HA5BI	21	396	24	6	5
HA1SB	**14**	**37,820**	**274**	**17**	**44**
HA4KYH	14	8,316	109	18	24
HA5KDQ	**7.0**	**85,848**	**604**	**24**	**60**

KA7AB—It was Sonia, PY2SO who persuaded John to give the c.w. section a try. As you see it was worth while, with KA7AB in the Top Ten.

Iceland

TF2WJN	14	54,002	449	18	44

Ireland

EI5F	A	9,802	91	21	37

Isle Of Man

GD3AIM	A	27,838	280	19	43

Italy

IINT	A	543,720	1032	61	169
I1XXX	A	51,870	305	33	72
I1HL	A	28,952	174	30	47
IISF	28	30,876	145	26	57
I1HC	28	12,240	103	19	26
IIKE	21	105,248	438	29	63
IIPPI	14	29,127	170	22	51
I1SOP	14	3,240	72	9	27
IIAND	7.0	15,370	199	11	42
I1PEP	7.0	14,398	219	12	34
I1CZQ	7.0	13,448	239	9	32
I1EVK	7.0	12,276	221	10	34

I. T. U.

4U1ITU	A	449,698	1038	66	140

Luxembourg

DJ6SI/LX	A	44,411	238	33	56
LX1LF	21	2,176	60	6	10

Netherlands

PAØXPQ	A	256,200	601	59	124
PAØSNG	A	193,980	585	52	131
PAØLOU	A	68,992	233	43	85
PAØLV	A	53,336	323	34	79
PAØFLX	A	32,763	234	27	40
PAØWAC	A	5,848	90	14	20
PAØYN	A	3,876	54	13	25
PAØQT	21	6,440	62	19	27
PAØZV	7.0	9,870	172	9	38

Norway

LA8SJ	A	80,028	281	60	111
LA2Q	A	21,440	199	19	48
LA4UH	A	1,628	29	10	12
LA5YJ	28	1,672	29	10	19
LA7HJ	21	6,513	66	14	23
LA4LE	14	12,096	127	13	35
LA5IH	14	4,797	93	9	30
LA8WG	7.0	6,764	171	7	31
LA2QK	3.5	1,900	69	5	20

Poland

SP8MJ	A	99,792	443	37	107
SP9ZD	A	82,950	314	48	102
SP5AFL	A	69,293	393	41	92
SP3AIJ	A	60,720	257	38	72
SP6ALL	A	45,850	171	49	82
SP6AKK	A	30,144	134	41	55
SP9AGS	A	19,327	182	21	56
SP2IU	A	17,088	90	36	53
SP3BBH	A	15,504	170	16	52
SP5CR	A	3,978	62	15	36
SP3AK	A	3,864	68	15	27
SP4AWE	A	2,765	57	11	24
SP9BKK	A	924	45	5	17
SP9AOX	21	40,353	216	24	46
SP9AOA	21	2,788	31	12	22
SP3AOT	21	1,768	31	11	15
SP6PWR	21	434	13	6	8
SP2KAC	14	44,800	379	19	51
SP5ZA	14	39,078	249	21	57
SP5YQ	14	20,488	230	14	38
SP5ARP	14	10,951	129	16	31
SP6AZY	14	5,418	60	14	28
SP9DH	7.0	43,026	393	17	54
SP8AG	7.0	15,239	266	10	39
SP1UM	7.0	12,374	207	10	36
SP5BCL	7.0	9,010	135	11	42
SP9KAT	7.0	4,760	107	9	31
SP3HC	7.0	4,422	119	8	25
SP6AYP	7.0	1,836	54	6	21
SP6TQ	3.5	21,338	420	7	40
SP7GH	3.5	20,564	315	11	42
SP2LV	3.5	9,696	183	8	40
SP3KAU	3.5	3,584	103	6	26
SP5BMU	3.5	1,292	72	4	15

Portugal

CT1OI	A	65,065	311	35	56
CT1HT	A	45,609	273	27	42

Romania

YO3CR	A	280,108	689	75	164
YO2FU	A	171,143	613	47	132
YO8DD	A	98,900	414	47	125
YO8FZ	A	37,338	243	28	70
YO6UX	A	31,588	237	23	83
YO5TO	A	6,063	107	12	35
YO2BA	A	5,390	86	15	34
YO8AGZ	A	3,990	95	13	29
YO9HH	A	1,100	38	14	16
YO5LD	A	713	17	11	12
YO5AGO	A	594	24	5	13
YO5LU	A	442	10	8	9
YO9HI	A	196	14	6	8
YO3RT	28	738	16	8	10
YO3JW	21	16,038	204	13	33
YO3RF	21	7,585	108	14	27
YO3RG	14	7,425	105	11	34
YO3KBC	14	154	10	5	6
YO8FR	7.0	16,543	268	8	41
YO8OK	7.0	6,708	158	8	31
YO5AIR	7.0	2,700	76	6	24
YO6ADW	7.0	2,352	60	8	20
YO3JA	7.0	1,224	56	5	13
YO8KGE	3.5	1,533	71	5	16

Scotland

GM3JDR	A	107,085	497	35	86
GM3EOJ	A	104,575	302	56	109
GM3CFS	A	84,744	343	42	90
GM6RV	A	29,548	181	24	59
GM5ABN	A	26,474	163	26	36
GM3JZK	7.0	16,550	192	12	38

Shetland Is.

GM3SVK	A	138,387	415	52	111
GM3KLA	3.5	8,874	151	9	42

Sicily

IT1AGA	A	40,299	207	26	75

Spain

EA3KT	A	56,388	281	37	74
EA2CR	A	10,836	107	17	25
EA2CL	A	2,736	44	15	21

Sweden

SMØCCE	A	306,510	570	75	180
SM4CLU	A	304,997	717	74	159
SM5CEU	A	169,021	581	55	118
SMØBNX	A	158,632	555	50	108
SM5CNF	A	152,416	483	57	119
SMØAHQ	A	129,600	385	58	142
SMØBDS	A	51,504	241	36	80
SM5CVH	A	43,815	174	45	82
SMØKV	A	36,701	253	31	76
SM7DVF	A	35,360	181	38	47
SM5CAK	A	28,380	148	32	78
SM5ACQ	A	23,716	172	33	65
SM7QY	A	23,436	95	42	66
SM6CUK	A	23,268	123	28	56
SM5DSF	A	19,295	162	24	61
SM5BXT	A	19,012	115	35	62
SM5BDY	A	3,479	47	21	28
SMØAJU	28	10,504	75	19	33
SM4DXL	28	8,640	69	19	26
SM4ARQ	28	6,510	55	18	24
SM5BOE	28	2,200	30	11	14
SM2DPB	28	684	7	6	6
SM3CNN	21	95,646	346	32	82
SM6CAW	21	36,456	226	21	41
SM3CXS	21	28,993	175	23	56
SM6AFH	21	25,506	136	25	53
SM4COK	21	11,256	120	13	29
SM6DHU	21	7,992	99	13	24
SM2CTY	21	3,666	56	10	29
SM5AD	14	50,800	321	23	57
SM5API	14	45,510	340	23	51
SM6ARH	14	39,609	255	22	59
SM2CXU	14	36,991	239	19	52
SM2CXX	14	16,933	119	17	42
SM5WT	14	14,160	111	23	36
SM7TV	14	7,700	132	10	34
SM7JY	14	2,541	72	10	23
SM6DKH	7.0	53,836	371	22	64
SM2CZT	7.0	33,792	250	16	50
SMØKU	7.0	22,825	299	12	43
SM3DNI	7.0	7,009	126	10	33
SM2BYD	7.0	3,696	99	6	27
SMØUQ	7.0	1,775	70	4	21
SMØDNV	7.0	722	31	5	21
SM6MX	3.5	32,128	366	14	50
SM5CIL	3.5	5,000	116	7	25

Switzerland

HB9UB	A	514,745	1004	76	169
HB9JG	A	419,167	671	83	174
HB9ZY	A	414,144	639	89	199
HB9RX	A	33,031	202	27	40
HB9QA	A	6,601	59	23	44
HB9UD	A	6,325	62	22	33
HB9PQ	28	1,200	24	9	11
HB9DX	21	57,408	283	26	52
HB9IX	21	2,754	60	8	9
HB9B	14	15,351	160	20	31
HB9KC	7.0	22,214	217	14	44
HB9NL	1.8	1,650	105	3	12

Wales

GW3GHC	28	9,248	101	14	20

Yugoslavia

YU3BC	A	777,756	1059	100	229
YU1EXY	A	306,504	797	62	136
YU4HA	A	34,241	251	21	76
YU1NOL	A	11,352	125	16	50
YU2NEG	14	68,136	346	27	75
YU1MV	14	13,224	87	22	54
YU1SJ	21	8,106	94	15	27
YU2AKL	7.0	17,000	265	13	37
YU1SF	7.0	9,760	262	7	33
YU1NFP	3.5	11,130	247	7	35
YU3WP	3.5	9,361	230	7	30

Union of Soviet Socialist Rep.

Estonia

UR2LO	A	54,240	339	32	88
UR2CW	21	81,433	320	30	79

European

UA3UJ	A	262,944	613	70	179
UA6AL	A	197,268	635	56	150
UA3NP	A	161,381	505	49	138
UA1CE	A	134,139	547	49	134
UA3KHR	A	108,976	485	42	134
UA4CH	A	105,700	379	46	105
UW3RY	A	38,760	195	30	90
UA3RO	A	36,850	221	33	77
UW6AO	A	30,870	212	25	73
UA3GM	A	26,048	221	25	73
UA6KAS	A	23,800	227	16	54
UA1UD	A	19,712	178	22	55
UW4IB	A	18,396	148	25	59
UA1JS	A	17,082	173	21	57
UA3WU	A	15,236	151	24	55
UA3FT	A	15,228	105	36	58
UA3DB	A	13,668	89	29	39
UA1MV	A	12,935	111	21	54
UA4KNA	A	12,567	117	23	48
UA3KRB	A	7,200	100	13	35
UA3KHA	A	5,253	75	16	35
UA1DG	A	4,187	62	16	37
UA1IO	A	1,742	62	7	19
UA3GO	A	1,470	34	11	17
UA3RR	A	1,344	25	13	19
UA3XL	A	1,325	32	14	21
UW4IY	A	1,320	36	11	19
UA2CK	A	1,080	42	7	17
UA4BB	A	1,015	38	9	20
UW3KHJ	A	952	20	11	17
UA3TA	A	868	23	9	19
UW3AU	28	368	11	8	8
UA4HW	21	21,939	181	21	50
UA3DV	21	21,840	130	25	53
UA3BK	21	14,210	157	16	42
UA4NE	21	13,969	179	17	44
UV3XX	21	9,960	93	18	42
UW3EH	21	7,700	118	16	28
UA3IM	21	5,891	59	15	28
UW3AO	14	84,258	493	27	66
UA4QM	14	51,128	351	22	55
UA1ZW	14	42,904	272	21	41
UA1ZH	14	25,956	275	18	45
UA4SM	14	18,150	195	16	50
UW6BK	14	11,704	126	16	40
UA1YY	14	11,653	111	12	31
UW1BT	14	9,159	126	13	30
UW3IT	14	7,258	125	10	28
UA3JD	14	6,880	100	12	28
UW3EG	14	5,632	75	11	33
UW3HD	14	3,840	84	10	20
UA3HE	14	2,805	61	7	26
UA3WX	14	1,848	52	6	18
UW3AX	14	1,276	32	9	13
UA3KBO	7.0	29,120	276	19	46
UA3JW	7.0	26,785	395	12	43
UW3XL	7.0	912	36	6	18
UV3AZ	3.5	20,188	370	10	39
UA1DH	3.5	15,043	249	10	39
UA4FR	3.5	10,535	218	10	33
UA1DX	3.5	4,641	101	8	31
UA1AJ	3.5	416	30	4	9

Kaliningrad

UA2KAP	A	66,815	425	30	85
UA2DM	7.0	558	29	4	14
UA2WO	14	9,156	137	14	28

Latvia

UQ2MG	A	5,069	119	13	38
UQ2CC	A	1,175	35	10	15
UQ2AB	14	45,978	270	26	53
UQ2GA	7.0	4,470	96	8	22

Lithuania

UP2NK	A	165,094	498	61	133
UP2ON	A	134,904	434	56	112
UP2KBC	A	128,275	344	50	125
UP2AY	A	29,240	199	26	59
UP2CV	A	7,050	101	14	36
UP2BU	A	5,350	49	22	28
UP2OU	28	2,117	30	13	16
UP2CG	21	60,552	292	27	60
UP2AV	14	6,384	106	9	29
UP2NX	14	5,022	104	8	22
UP2NW	7.0	2,037	100	4	17
UP2AW	7.0	1,917	67	5	22
UP2NG	7.0	1,200	47	5	19

Moldavia

UO5AA	A	89,232	298	46	110
UO5WU	A	14,639	103	15	39
UO5DN	14	11,648	158	15	37

Ukraine

UB5WF	A	686,205	1015	88	211
UT5HP	A	136,338	478	48	138
UB5WK	A	94,809	410	41	102
UB5IB	A	84,940	467	39	85
UB5IU	A	82,040	411	35	105
UB5PG	A	61,275	306	36	93
UT5BY	A	57,248	284	44	74
UB5WL	A	46,242	279	23	70
UB5KCN	A	27,108	173	34	74
UB5ML	A	21,252	217	23	54
UB5QA	A	12,670	110	22	48
UB5SP	A	9,982	128	15	47

UT5MD	A	2,160	80	5	22
UY5DB	A	1,904	68	9	19
UY5AP	A	1,316	37	7	21
UY5LM	A	297	27	4	7
UY5LK	28	350	21	3	11
UT5EH	**21**	**51,744**	**359**	**22**	**55**
UB5FL	21	43,542	289	21	61
UT5BX	21	18,648	120	23	51
UB5DW	21	6,942	67	15	24
UB5JR	21	2,652	99	9	17
UB5LV	**14**	**30,536**	**163**	**25**	**63**
UB5PO	14	14,014	161	14	35
UB5RS	14	9,324	120	15	49
UT5HT	14	4,329	61	10	20
UY5LC	14	3,813	76	9	22
UB5AE	14	2,146	48	11	18
UB5VL	14	520	22	5	18
UT5BH	14	99	7	4	7
UB5KLD	**7.0**	**75,700**	**467**	**28**	**72**
UT5WW	7.0	33,957	283	21	56
UT5SN	7.0	2,573	59	7	24
UB5VK	7.0	1,932	84	5	18
UB5RN	7.0	1,740	73	6	20
UB5CV	**3.5**	**27,671**	**385**	**12**	**47**
UB5WJ	3.5	24,920	376	12	44
UB5TQ	3.5	16,280	327	7	37
UB5QK	3.5	5,848	157	6	34

White Russia

UC2WP	**A**	**103,530**	**438**	**44**	**101**
UC2LU	A	27,040	281	20	60
UC2IG	A	3,920	75	14	35
UC2WJ	**14**	**52,788**	**393**	**25**	**58**
UC2AR	**7.0**	**8,330**	**120**	**10**	**39**
UC2AA	**3.5**	**83,496**	**714**	**20**	**64**

Oceania

Australia

VK2EO	**A**	**530,640**	**884**	**75**	**126**
VK2GW	A	203,000	500	62	78
VK2PV	A	117,852	295	59	79
VK2RA	A	1,350	19	12	13
VK2BKM	**28**	**32,040**	**242**	**19**	**26**
VK2QK	**21**	**7,449**	**67**	**15**	**24**
VK2APK	**14**	**114,837**	**402**	**30**	**71**
VK3AXK	**A**	**154,845**	**481**	**46**	**65**
VK3XB	A	6,440	51	21	25
VK3ABR	A	3,432	56	12	10
VK3RJ	**28**	**7,424**	**90**	**14**	**15**
VK3ADB	**7.0**	**84,456**	**435**	**22**	**46**
VK3APN	7.0	31,161	221	16	31
VK3OP	7.0	5,712	112	9	8
VK4UC	14	2,592	36	12	15
VK4SS	**7.0**	**8,700**	**103**	**14**	**15**
VK5KO	**A**	**2,730**	**33**	**17**	**13**
VK5WC	**14**	**6,358**	**70**	**15**	**19**
VK5RX	14	798	14	8	11
VK7SM	**A**	**308,967**	**589**	**69**	**112**

Fiji Islands

VK2DK	**A**	**103,378**	**306**	**61**	**66**

Guam

KG6AAY	**14**	**58,006**	**213**	**34**	**63**

Hawaii

KH6IJ	**A**	**710,365**	**1529**	**71**	**84**
KH6EBQ	A	80,925	380	36	39
K6CAA/KH6	**21**	**50,032**	**291**	**26**	**33**
KH6FON	**14**	**24,276**	**247**	**17**	**17**
KH6FLC	14	7,332	66	17	22
WØPAN/KH6	14	3,650	59	11	14
KH6EPW	**3.5**	**7,068**	**132**	**9**	**10**

Indonesia

WØGTA/8F4	**A**	**1,221,858**	**1178**	**122**	**241**

New Zealand

ZL4BO	**A**	**456,057**	**838**	**70**	**119**
ZL1DV	A	325,811	609	45	112
ZL1HW	A	174,688	540	43	60
ZL1AFW	A	66,300	302	35	40
ZL1HW	**14**	**59,458**	**326**	**24**	**38**

Philippines

DU1FP	**A**	**35,100**	**213**	**24**	**30**
W5YSM/DU1	**14**	**27,342**	**198**	**22**	**27**

Wake Island

KW6DS	**A**	**416,658**	**836**	**84**	**93**

South America

Argentina

LU8BAJ	**A**	**116,850**	**405**	**44**	**51**
LU8DQ	**21**	**226,900**	**771**	**31**	**69**
LU3DSI	**14**	**23,112**	**160**	**23**	**31**
LU4LO	14	5,668	85	12	14

Brazil

PY2SO	**A**	**1,499,020**	**1642**	**102**	**209**
PY1NEW	**28**	**13,892**	**104**	**19**	**27**
PY7ACQ	28	9,472	89	15	22
PY4BR	28	3,078	41	14	13
PY1MCC	**21**	**175,560**	**663**	**28**	**67**
PY4AP	21	86,728	308	26	70
PY1NO	21	85,362	354	27	55
PY1CKV	21	2,322	45	9	9
PY2PH	21	1,071	19	8	13
PY2BGL	**14**	**495,450**	**1124**	**36**	**114**
PY4OD	14	435,375	1142	35	94
PY1BCA	14	149,850	567	29	61
PY7APS	14	91,035	487	21	42
PY7VKS	14	62,766	327	23	43
PY7VNY	3.5	105	5	4	3

Chile

CE6EF	**A**	**169,464**	**433**	**59**	**79**
CE6EX	**14**	**10,780**	**111**	**17**	**18**

Colombia

HK3BAE	**A**	**242,528**	**933**	**40**	**48**
HK3RQ	**14**	**283,631**	**973**	**29**	**68**
HK3ASJ	**7.0**	**12,096**	**193**	**9**	**12**

Ecuador

HC1TH	**A**	**9,568**	**126**	**13**	**13**

Peru

OA4PF	**A**	**338,388**	**677**	**75**	**98**

Venezuela

YV5BOA	**21**	**28,416**	**198**	**16**	**32**
YV5AGD	**14**	**177,343**	**561**	**31**	**78**
4MØA	14	111,435	741	22	29
YV5BKA	**7.0**	**27,594**	**219**	**15**	**27**

Uruguay

CX1AAC	**21**	**438,616**	**1353**	**31**	**78**

MULTI-OPERATOR

Single Transmitter

North America

United States

W2JT	**519,680**	**641**	**79**	**201**
(W2JT—DEC)				
WA2OJD	505,425	613	92	201
(WA2OJD—W1RAN)				
WA2CFG	42,315	169	35	58
(WA2CFG—W2YWO)				
W3MVB	**905,472**	**801**	**110**	**283**
(K8MFO—W8CQN)				
W3GHS	397,029	521	78	189
(W3GHS—K3YUA—WA3BHB)				
W3OK	136,110	361	46	84
(W3IZI—WA3BME—FGS)				
W4JD	**315,296**	**472**	**76**	**160**
(W4JD—WA4HHW)				
WA4WFQ	152,352	302	63	121
(WA4WFQ—ZMH)				
W6UMI	**251,328**	**406**	**87**	**137**
(W6UMI—WA6SII)				
WA6YMX	130,390	263	64	106
(WA6YMX—WB6RCC)				
W7TDK	**394,572**	**548**	**97**	**154**
(W7TDK—K7ADL)				
W8UM	**373,848**	**453**	**97**	**199**
(W8FAW—WB2FIT)				
W8UCI	241,813	366	88	159
(W8UCI—SRK)				
W9YT	**189,210**	**338**	**73**	**137**
(K9LBQ—ZMS)				
WAØCPX	**32,536**	**121**	**37**	**61**
(WAØCPX—CPY—KØBLT)				
WAØNLP	9,300	54	28	34
(WØKWK—CHT—KØDAV—EOK—WAØPTJ)				

Alaska

KL7JDO	**215,940**	**817**	**56**	**66**
(KL7JDO—EDY)				
W4FAY/KL7	56,780	251	39	46

Canada

VE5US	**499,616**	**1014**	**83**	**125**
(VE5UF—DK—A. LEGANCHUK)				
VE2DCW	**62,130**	**229**	**39**	**70**
(VE2DCW—BOW)				

Africa

Angola

CR6DX	**1,306,860**	**1608**	**85**	**172**
(CR6DX—DA—GO)				

Liberia

EL2FD	**122,584**	**475**	**30**	**58**

Asia

Cyprus

ZC4TX	**273,957**	**587**	**48**	**111**
(Club Station)				

Japan

JA5BEI	**105,462**	**320**	**54**	**72**
(JA5BJC—BEI)				
JA1YFL	78,438	285	44	58
(JA3KBW—ØAWF)				
JA1YNE	76,049	245	51	62
(JA1BAL—KHB—NEC)				
JA4YAR	63,365	227	49	66
(Club Station)				
JA6YCU	53,972	202	42	61
(JA6BXA—ECF—ENR)				
JA3YEE	43,281	242	23	40
(JA3DJ—HOF)				
JA6YFL	39,783	177	40	49
(Club Station)				
JA2YAU	25,491	125	39	48
(Club Station)				
JA7YAF	16,800	96	30	40
(Club Station)				
JA3YCZ	8,008	61	28	28
(JA3FOC—FSV—IMC)				

U.S.S.R.
Club Stations

Asiatic

UA9KQA	**601,830**	**801**	**74**	**196**
UA9KWA	501,228	755	62	176
UA9KAG	398,934	645	60	162
UA9KCB	320,866	697	57	125
UA9KAM	270,654	620	41	117
UA9KMD	68,817	291	31	56
UA9KJA	32,370	179	19	46
UA9KMA	6,290	62	14	23
UA9KOG	5,760	68	10	22
UAØKCA	**40,460**	**273**	**33**	**37**
UAØKZB	40,404	328	26	26
UAØKSB	32,766	175	29	57
UAØKKT	23,435	339	24	19
UAØKAD	20,250	173	15	30
UAØKYA	13,975	154	14	29

Azerbaijan

UD6KAB	**440,412**	**444**	**50**	**146**
(UD6AU—6AY—6BW)				
UD6KED	203,756	535	32	101
UD6KZZ	24,600	207	9	31

Georgia

4L7A	**2,209,266**	**1832**	**112**	**305**
(UP2CY—NK—NV—OF—OK—OO—PT)				
UA6KAF/UF6	814,725	1115	69	186
UF6KPA	57,114	351	14	43

Kazakh

UL7KCB	7,896	129	20	27

Europe

Bulgaria
(Club Stations)

LZ2KLC	**57,330**	**408**	**25**	**73**
LZ1KKZ	51,590	350	29	81
LZ1KSX	42,240	464	16	48
LZ1KDZ	30,562	349	14	45
LZ2KRZ	26,970	216	21	66
LZIKSA	26,019	370	14	45
LZ2KRS	10,461	261	7	26
LZ1KEZ	5,768	150	7	25
LZ2KAF	2,704	98	5	21
LZ2KBI	1,278	67	4	14

Czechoslovakia
(Club Stations)

OK1KUL	**581,256**	**1080**	**86**	**157**
OK3KAG	**536,610**	**979**	**90**	**220**
OK3KMS	216,018	601	58	140
OK1ZC	207,060	597	58	145
OK1KTL	128,480	425	51	95
OK1KOK	86,433	431	37	104
OK2KMR	85,680	432	39	87
OK3KFV	73,680	505	28	92
OK1KDO	46,729	303	23	60
OK1KCD	18,130	129	25	45
OK1KDT	10,824	142	12	32
OK2KHD	1,740	60	10	20

Denmark

OZ5EU	**15,752**	**326**	**7**	**30**
(OZ4OO—5AR—EU—9DL)				

England

G3SSO	**756,288**	**1074**	**91**	**221**
(G2HDU—3CNW—HXA—LCJ—MSV—PEO 8FF—KG)				
G3SBI	323,136	673	64	140
(G3JIJ—KJW—RIK—RRM—Brian)				
GB2USA	276,974	709	58	100
(G3IEW—KVF—NFJ—SXZ—5AAB—ACP—6VC)				

This was CR6DX's first multi-op experience, and they did very well indeed. Jesus, 6DA, is at the key; Manuel, 6DX, is checking log for dupes and George 6GO is ready to take over.

HK3BAE, Top all bander for Colombia. Alberto was only licensed a year and a half ago and this is his first contest. Get a load of those crazy ear muffs.

G5BK 165,390 503 55 130
(G3CEG—CGD—HCV—LDA—OLN—UKV)
G3SKY 57,065 307 33 68
(G3SDD—UCW—VDZ)
G3FVA/A 1,378 106 2 11
(G3SVW—TYK)

Faeroe Is.

OY6FRA 142,788 770 36 110

Finland

OH2TI 645,531 916 92 229
(Club Station)
OH4OP 188,032 465 65 161
(OH4OP—OO)
OH2AA 77,220 305 45 85
(OH2BEB—BEF—BFF)
OH6AA 17,290 116 30 65
(OH6WI—XP)

Germany

DJ2YA 570,611 868 80 189
(DJ2YA—IQP)
DLØAA 545,136 970 80 166
(DL3BK—OH—DJ4XG—5DA)
DL8CM 329,560 759 68 152
(DL8CM—CH—FR)
DJ9YG 308,370 750 63 127
(DJ9YG—YH—7MGA—DK1FZA)
DK1DO 276,900 699 63 150
(DK1DO—DJ2JE—LD—5LE—8PU—9KZ—DL2OM—3YQ—9VN)
DJ2XP 238,865 523 56 159
(DJ2XP—DL8HA)
DL3BA 225,018 517 69 174
(DL3BA—4AK—DJ9CN—RT)
DLØRO 186,760 482 58 126
(DJ3XP—8SI—DK1IZ—DL2MG—3VE—ZI)
DLØJK 161,590 724 40 90
(DJ6FO—DK1DU—DV—HA)
DLØJD 153,306 413 60 107
(DJ1CY—XI—8UU)
DL2JO 123,026 356 48 89
(DL2JO—DJ8RR)
DL9RP 62,400 241 39 65
(DL9RP—DJ3YU)
DL2KM 44,096 201 33 73
(DL2KM—DJ4XA)
DM6AK 34,342 382 17 60
(DM2BOK—3XPH—6AK—WAK)
DM3UE 29,294 175 32 65
(Club Station)
DLØJA 15,024 131 19 29
(DL2XH—9XY—ØJA)
DM6AA 1,232 43 9 19
(Club Station)

Hungary (Club Stations)

HA5KBB 398,574 879 67 175
HA1KSA 238,060 718 64 156
HA4KYB 159,894 674 54 108
HA9KOB 122,450 581 40 118
HA5KDI 31,152 382 22 66
HA9KOL 30,260 300 21 64
HA3KNA 24,552 208 30 69
HA3KMF 2,079 46 8 13

Luxembourg

DJ6QT/LX 745,778 1213 93 218
(DJ1VP—6QT—7IK)

Netherlands

PI1PT 66,248 323 35 69

North Ireland

GI3GAL 116,964 415 41 86
(GI3GAL—JXS)

Norway

LA1H 413,328 874 65 172
(LA9OI—XH)
LA8D 109,710 431 52 107
(LA3FG—7QI)

Poland

SP8PCG 106,872 493 41 105
(SP8AAH—AWP—XE—ZR)
SP3ZHC 15,680 241 13 33
(SP3BES—BGD—BQR)

Romania

YO3KSD 218,751 765 57 132
(YO3AAQ—AAR—AAS—GU)
YO3KAA 104,228 528 39 103
(YO3ABE—AV)
YO5KAW 16,720 148 19 57

Scotland

GM3RNZ 31,776 239 25 71
(GM3RNZ—SFH)

Sweden

SM6AOE 515,426 923 83 190
(SM6AOE—BJI—CKV)

Switzerland

HB9Z 59,653 282 40 81
(HB9AFG—AGH)

Wales

GW6GW 54,327 434 27 70
(GW3PPW—RNP—TKZ—TUG—G6BK)

Yugoslavia

YU1BCD 561,064 929 82 206
(YU1NQW—1PCF—1QBC)

U.S.S.R.

(Club Stations)

Estonia

UR2KAN 231,297 987 47 116

European

UA3KAH 542,592 999 94 220
UA1KBW 435,500 816 73 195
UA1KBB 319,396 793 61 183
UA1KIA 317,772 589 65 184
UA4KKC 307,125 708 71 202
UA3KFB 283,444 864 51 161
UA1KBR 244,818 740 50 151
UA6KTB 229,080 570 72 177
UA3KZO 217,742 710 52 154
UA4KPA 162,996 548 54 150
UA3KAO 151,283 557 51 136
UA3KWA 150,074 510 52 135
UA6KAA 120,978 721 27 72
UA3KYA 117,523 406 45 118
UA1KMF 71,258 244 46 112
UA1KUZ 67,894 320 34 59
UA3KWB 63,758 302 37 106
UA1KMC 57,840 353 30 90
UA1KEO 49,830 237 31 49
UA3KWI 38,556 296 23 79
UA4KCE 37,248 268 23 73
UA1KAG 19,113 186 23 46
UA4KSA 9,370 120 22 44
UA3KUO 8,702 112 23 54
UW3KAR 8,576 122 18 46
UA6KOE 8,460 128 12 35
UA1KBC 8,007 120 15 36

Kaliningrad

UA2KAW 308,616 991 46 121
(UA2BO—2CA—2CD)
UA2KBD 6,623 124 14 23

Latvia

UQ2KCR 48,868 517 17 59
UQ2KAY 12,236 89 26 50

Lithuania

UP2NM 304,809 740 61 152
(UP2NM—2KNP—LY1BX)
UP2KBA 149,760 584 36 108
UP2KCB 32,370 376 12 66

Moldavia

UO5KBR 25,830 227 26 64
UO5KRU 19,000 184 24 52

Ukraine

U5ARTEK 273,492 786 63 151
(Boiss & Anatole)
UB5KFF 220,214 658 60 146
UB5KBA 153,540 499 47 133
UB5KAB 93,654 431 41 97
UB5KHQ 84,000 427 32 88
UB5KBV 80,132 388 35 99
UB5KNF 60,990 294 35 79
UB5KBE 42,434 297 26 72
UB5KAI 35,017 296 28 69
UB5KDS 28,372 210 24 58
UB5KNH 26,663 202 32 59

White Russia

UC2KBC 228,408 860 51 135
UC2KAB 36,754 250 26 68
UC2KGF 6,426 108 17 34
UC2KAV 330 22 5 10

South America

Argentina

LU4FM 87,675 426 27 48
(LU6FA—FBR)

Uruguay

CX2CO 2,199,694
2278 104 225
(CX2CO—1BY—3BBD—7CO)

Venezuela

YV1JV 502,496
1037 61 103
(YV1EN—OB—UU—UU/2)

MULTI-OPERATOR

Multi-Transmitter

North America

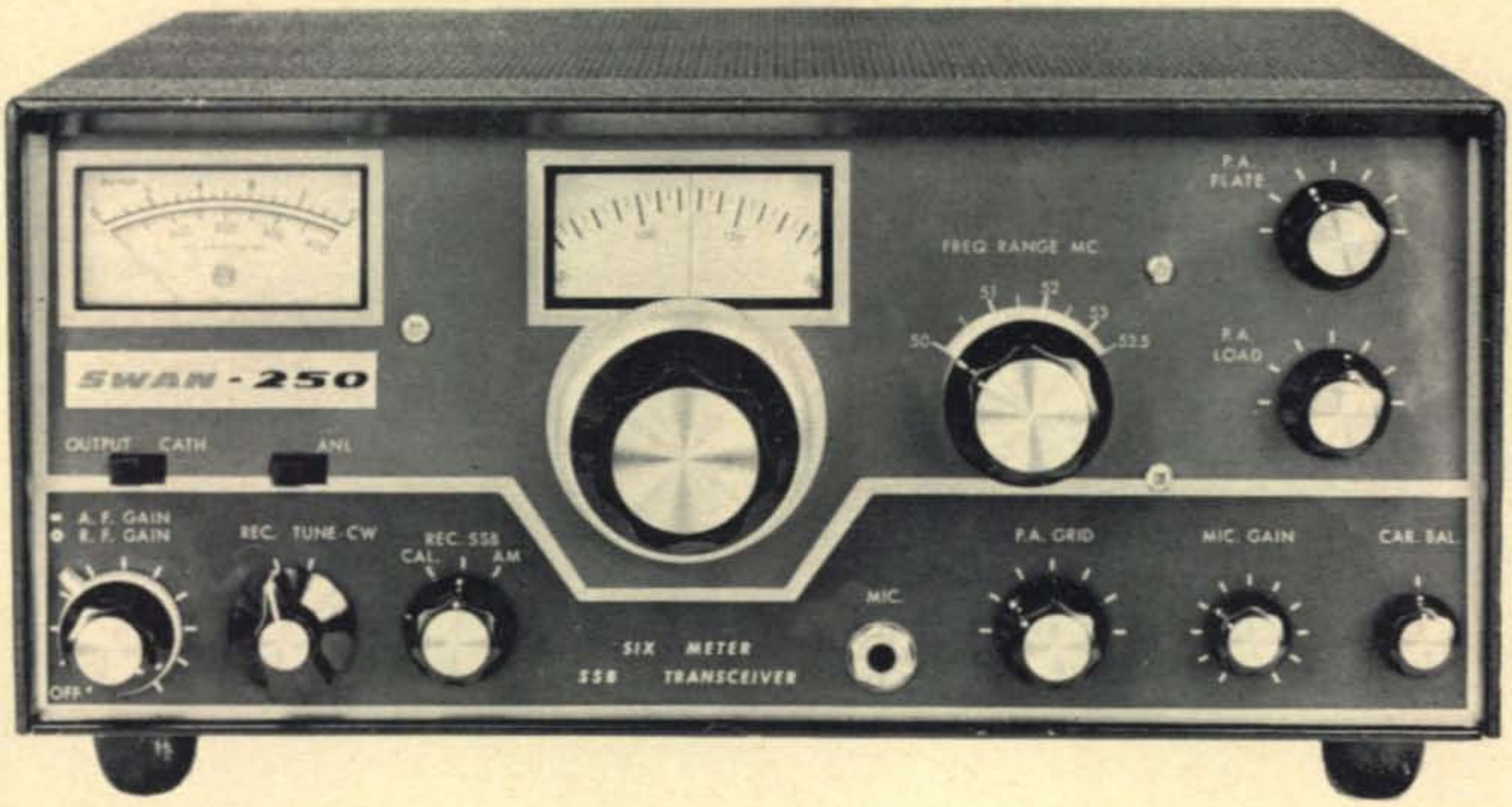
K2GL 3,760,848
2352 152 394
(K2GL—KUR—UYG—W1GYE—MDO—2IWC—4DQS—6KFV— & ALEX)
W4BVV 3,637,150
2276 150 400
(W4BVV—K1ANV—3NPV—4WVH—W1ARR—BGD—4GEQ—4YHD)
W3MSK 3,618,968
2265 149 402
(Same Old Gang)
K1JGD 2,805,660
2042 123 345
(K1JGD—D1R—LW1—OTA—TZQ—W1BPW—3WPG—9WJB)
W4KXV 2,769,687
1864 137 376
(W4KXV—YZC—K2DXV—UFT—VGR—4BAI—PQL—WA4LNV—GHV—WB4CWN)
W3WJD 2,492,952
1896 123 333
(W3WJD—DQG—K3JCT—JJG—MCO—WB2APG)
K6JIC/6 1,899,571
1628 136 297
(K6JIC—EVR—SEN—W6GFE—JZH—UED—VPH—YMD—WA6ZZK)
W3YUW 1,464,295
1285 107 284
(W3BGN—K3FGO—FPY—WB2OAE)
W6RW 1,366,992
1227 129 267
(W6RW—BXL—K2PHF—6MQG—9ELT—WA6TGH—WB6KVG—TMC)
W2PCJ 1,158,049
1034 111 286
(W2PCJ—LXK—SUC—2KQ—WB2CKS)
WA6SBO 1,126,862
1088 127 247
(WA6SBO—W1YNP—6EPZ—ITY—K6QPH—SDR—VZA—WB6CWD—EFA—LFR)
W7SFA 462,574 611 95 171
(W7SFA—DL—K7HAX)
W3IYE 362,020 545 70 160
(W3IYE—TGF)

Asia

JA1YKX 103,680 338 51 69

Europe

OH2AM 2,837,133
2619 142 389
(OH2BC—BH—BQ—BS—KH—QV—SB—BBM—BBR)
DLØITU 1,339,475
1518 119 290
(DL1FL—DJ4FZ—5AZ—6TN—TK—7SW)
OH1AA 1,207,797
1882 99 268
(Club Station)
DM7DL 1,003,366
1763 84 214
(DM2AQL—ATL—BEL—CEL—3EML—ML—MEL—ZKL—4EL—XGL—YEL)
SM5BOU .. 936,642
1124 117 289
(SM5BOU—BLA—BPJ)
OK3KAS 767,382 888 79 223
(Club Station)
GB2SM 622,150
1315 71 159
LZ1KPG 1,282,747
1946 103 270
(Club Station)
DJ3JZ 597,240
1388 53 136
(DJ3JZ—1BP—4LI—DL1CR—3AO—6KC—9CI)
DM7M 568,386
1229 78 195
(DM2BFM—AXM—CCM—CFM—CIM—CLM—COM—3EBM—MBM—NM—SBM—VBM—XKM—4LM—2CM—2OM)
PE2EVO 416,240 889 71 149
(PAØIB—PAZ—PWF—RE—VB)
UB5KED 303,892 916 60 158
(Club Station)
SP8KAR 262,350 714 70 155
(SP8AJK—BWV—SP8-029)
UP2OM 240,559 709 57 152
(UP2OM—NY)



CQ Reviews:

The SWAN 250

A six-meter s.s.b. transceiver

BY WILFRED M. SCHERER,* W2AEF

FROM observations made on the 3.5-30 mc amateur bands, it is quite evident that phone operation on these bands is now predominantly conducted on single sideband. On the other hand, relatively few 50 mc operators have taken advantage of the superiority of s.s.b. over a.m. for better reliability and effectiveness with voice communications; however, the tide is eventually bound to turn as more 50 mc s.s.b. equipment becomes available. One such piece of gear is the Swan Model 250 6-Meter S.S.B. Transceiver. Not only does it provide for s.s.b. operation, but it also includes a.m. facilities that may be desired in areas where as yet there is limited s.s.b. activity. C.w. operation also is included.

Other features of the 250 are: full coverage of the 50 mc band, dial calibrated in 5 kc steps, high order of frequency stability, filter-type s.s.b. operation (upper sideband only with 2.8 kc filter), power input of 240 watts p.e.p. on s.s.b., 180 watts on c.w. and 75 watts carrier on a.m. (one sideband with carrier), transmitter metering, adjustable Pi-network for 150-500 ohm loads, p.t.t. operation, product and envelope detection, noise limiter. Operation may be had from 117 or 230 v.a.c. or 12 v.d.c. sources using separate power supplies. Accessories include a 500 kc crystal calibrator and a v.o.x. control affair.

(*Continued*)

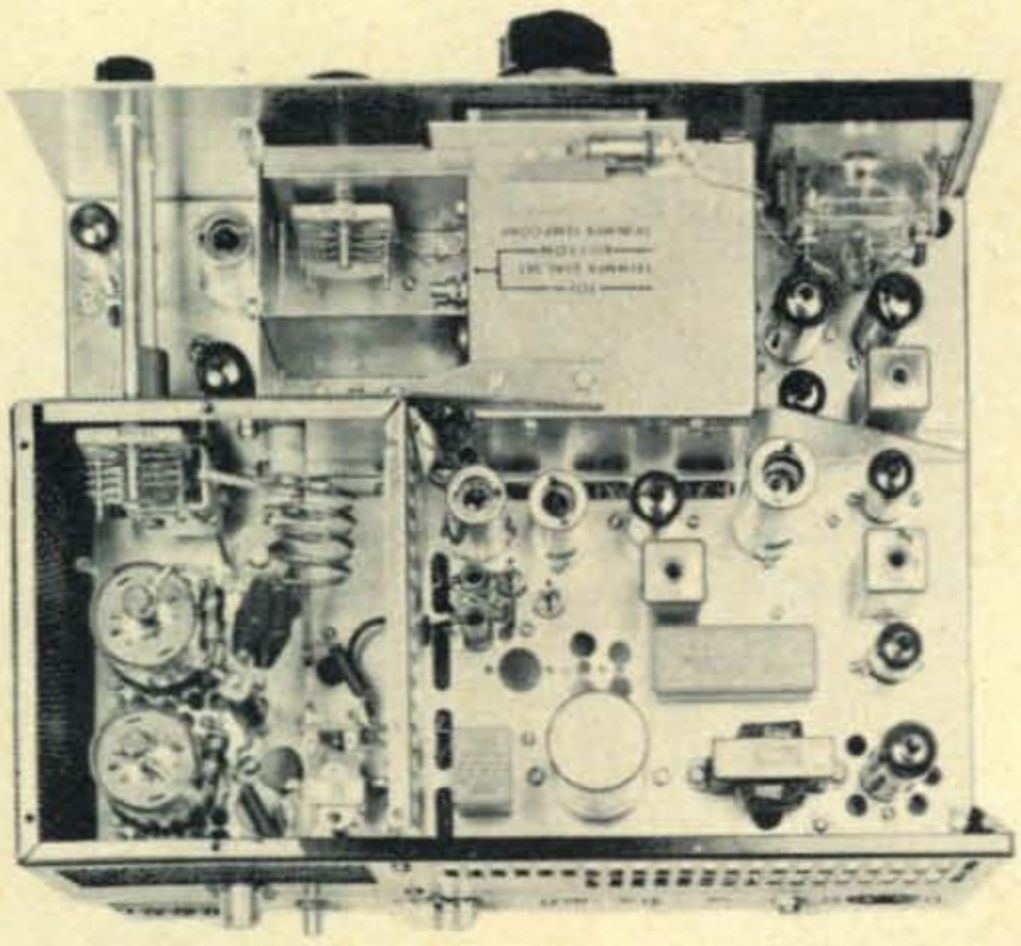
*Technical Director, *CQ*.

240 Watts p.e.p. SSB in a single-package transceiver for six meters. CW and AM, too!

CQ Reviews:
The SWAN 250
Transceiver
(cont.)

Single conversion with a 10.7 mc i.f. and filter-type sideband selection are used on both receive and transmit as shown at the block diagram, fig. 1.

The receiver r.f. stage and mixer each employ a 6HA5 hi-mu triode with circuitry as indicated at fig. 2. The grid-plate capacitance of the 6HA5 is considerably lower than that of most triodes; nevertheless, neutralization of the r.f. stage is required for stability and low noise. Bandpass circuits at the input and output of this stage are fix-tuned, except for one section at the tube plate which can be peaked manually.



Top-chassis view of the Swan 250. The cover has been removed from the p.a. enclosure at the lower left. The tank-circuit elements for the v.f.o. are located in the box at right of upper center. In the shielded section at the left of it is the mc-range-setting capacitor.

A transistorized v.f.o. operates in a grounded-base Colpitts circuit and tunes from 13.1 to 14.4333 mc. These frequencies are tripled to 39.3-43.3 mc to provide heterodyning signals that convert the 50 mc r.f. input signals to a 10.7 mc i.f. Full band coverage is obtained in 500 kc segments as explained later. The frequency multiplier is a 6EW6 vacuum tube the output of which is gang tuned along with the r.f. stage plate circuit. Two transistorized buffer stages between the v.f.o. and the multiplier minimize varying loading effects on the v.f.o. A regulated potential of −10 volts for all the transistors is obtained using a zener-diode regulator operating from the bias supply for the set.

The 10.7 mc crystal filter is designed for a bandwidth of 2.8 kc at the 6 db points and 9.5 kc at 60 db, resulting in a related bandwidth ratio of 3.4:1.

The product detector is a triode using conventional circuitry with b.f.o. signal injection at the cathode which is above r.f. ground potential. For a.m. reception, the tube cathode is grounded and the grid-return resistance is raised from 10,000 ohms to 280,000 ohms, allowing the tube to function as a grid-leak detector. The b.f.o. is disabled at the same time.

The noise limiter employs back-to-back solid-state diodes shunted across the input

to the first a.f. amplifier. The circuitry is similar to that often used at the i.f. level.

The r.f. gain control is located in the cathode return for the r.f. and two i.f. stages. A.g.c. is the audio-derived type with the output of the first a.f. stage amplified and rectified to produce a d.c. a.g.c. potential which is applied to the two i.f. stages. The r.f. stage operates full time at maximum gain. In order to allow the full a.f. level to be applied to the a.g.c. amplifier, the a.f. gain control is located *after* the first a.f. stage and at the grid of the output amplifier. The a.g.c. circuitry is given at fig. 3.

Transmitter

On transmit, the a.f. from the two-stage mic amplifier and the r.f. from the 10.7 mc b.f.o. (carrier oscillator)[1] are combined in the balanced modulator which uses a 7360 in the conventional manner to produce a suppressed-carrier double-sideband signal. This is fed to the crystal filter where the lower sideband is rejected and from which the upper sideband is passed on to the first i.f. amplifier. The 10.7 mc s.s.b. signal is then converted at the mixer to 50 mc and applied to the driver for the final p.a. The latter utilizes two parallel-connected 6146B's operating in Class AB_1. The output circuit is a Pi-network with adjustable loading. Conventional capacitance-bridge neutralization is engaged.

The transmitter mixer and driver outputs are gang tuned along with the receiver r.f. plate and the v.f.o. multiplier, so all circuits are therefore simultaneously peaked both in the receive and transmit modes.

Transfer between receive and transmit is handled by a relay which is operated by a push-to-talk circuit. A vox accessory also is available. On receive, screen voltage is removed from the p.a. and muting bias is applied to the transmitter mixer and driver;

[1] The b.f.o. is crystal-controlled using a Pierce-oscillator circuit in conjunction with the control and screen grids of a pentode. Electron coupling to an untuned plate circuit provides output to the balanced modulator. Oscillator signal for the product detector is obtained from the b.f.o. cathode.

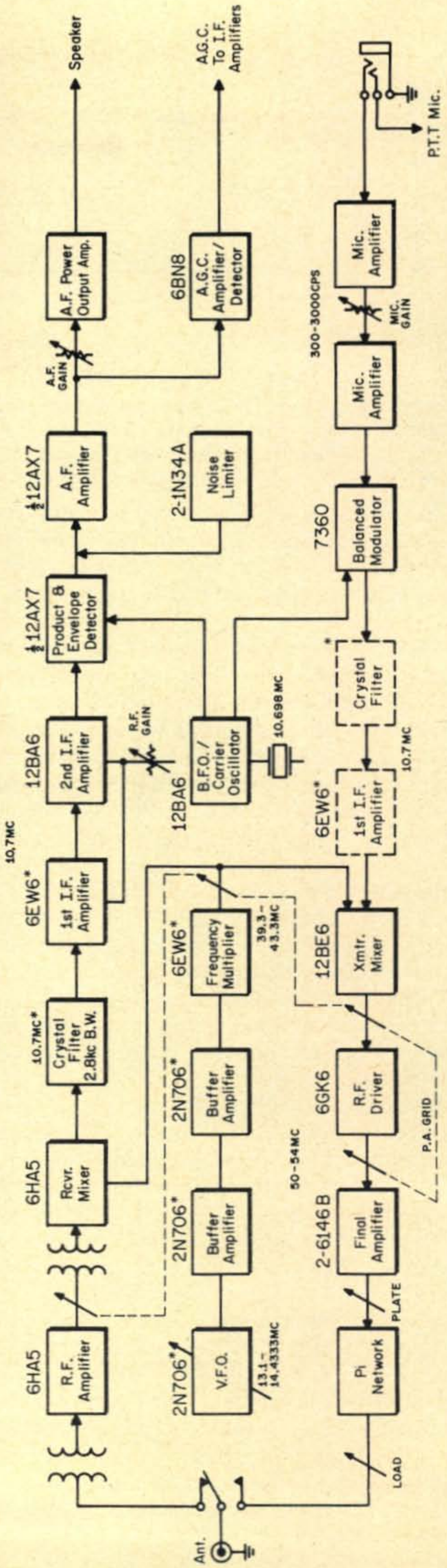


Fig. 1—Block diagram for the Swan 250. Elements marked with an asterisk are used both on receive and transmit. See text for details.

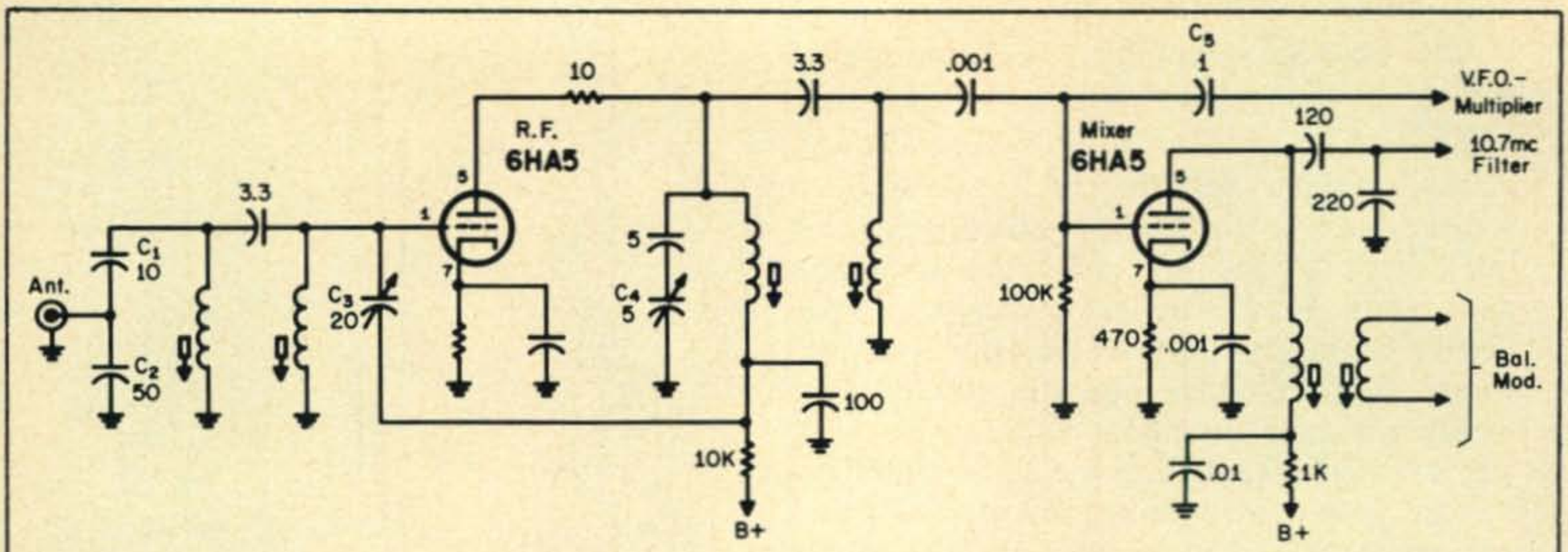


Fig. 2—Circuitry for r.f. stage and mixer used in the Swan 250. C_1 and C_2 constitute a capacitive divider for input-impedance matching. Neutralization is accomplished with C_3. C_4 is gang-tuned with the v.f.o.'s frequency multiplier, the transmitter mixer and driver. On transmit, the balanced modulator is fed through the mixer plate circuit.

while on transmit, B-plus is removed from the r.f. and mixer stages and from the screen of the 2nd i.f. Muting bias is applied to the a.f. stages and the a.g.c. line is grounded.

The carrier-balance control for s.s.b. is located on the panel. For a.m. operation it is readjusted for the required amount of carrier. On tuneup and c.w. transmit, the carrier is automatically unbalanced with the function switch which also alters the capacitance across the carrier-oscillator crystal by an amount that rubbers the frequency 800 c.p.s. into the passband of the filter. This shift not only allows an adequate carrier level to be obtained through the filter, but it also automatically offsets the transmitter frequency from that of the receiver, in order to provide an audible beat-note on a received c.w. signal when the transmitter frequency is near zero-beat with that of the c.w. signal.

Blocked-grid keying for c.w. is used at the transmitter mixer. Also on this mode, the 2nd mic amplifier is disabled by opening its cathode circuit to prevent accidental voice modulation.

The panel meter can be switched to read either the p.a. cathode current or the relative r.f. power output. There are no provisions for S-meter operation.

Construction

The Swan 250 is built on a heavy-gauge open-ended chassis that is rigidly braced by brackets or shields between front and rear panels and by an enclosure for the p.a., making it highly resistant to mechanical twisting or warping. This is further ensured by a one-piece wrap-around upper-half of the perforated cabinet the sides of which are screwed to the ends of the chassis. The bottom plate also is a rigid affair with its side edges folded up and itself secured with many screws.

An interesting arrangement is that the v.f.o. transistor is installed on a small phenolic board that is mounted at a cutout on the bottom plate. The transistor leads are an inch or so long and run over to a printed circuit board on which the v.f.o. components are mounted. This setup allows the transistor to protrude outside the cabinet where a lower and more constant temperature may be maintained during operation. Physical damage to the transistor is prevented by a protective cover in which foam padding is installed.

The vernier dial for the v.f.o. is calibrated over a 0-500 kc range in 5 kc steps spaced about ⅛" apart. A dual-speed tuning control is used to allow rapid coverage over the range or slow tuning on a specific signal. The fast tuning covers the range with 5 turns, 30 turns are required with the slow speed. A separate control sets the mc-range. It is a variable capacitor that also tunes the v.f.o., but it is calibrated only at 0.5 mc intervals from 50 to 53.5 mc. When it is set at any interval, the frequency readout is the mc-range setting plus the vernier-dial reading.[2] The mc-range control has been adjusted to turn quite stiffly, in order to eliminate the possibility of its being accidentally bumped off the desired setting.

The accessory crystal calibrator is a 500

[2] Due to a harmonic from the v.f.o., there is *one* frequency at which transceiver operation cannot be conducted, namely: 53.49 mc.

kc job which thus avoids the possible confusion in identifying a 0.5 mc point for setting the mc-range control, as might otherwise be the case if a customary 100 kc calibrator were used instead.

Controls

Besides the plate tuning control, the p.a. output has an adjustable loading control to permit optimum matching to unbalanced, essentially resistive, loads of 15-500 ohms; however, where the load is a balanced affair, such as with open-wire transmission lines, the addition of a suitable antenna tuner/coupler is recommended.

Slide switches are used for the A.N.L. ON-OFF and for the meter functions. There also is a standard type 3-way mic jack for p.t.t. operation. The v.o.x. accessory plugs in at the rear of the set where the c.w. key jack is also found along with a bias adjust. A screw-type terminal strip provides for external connections to s.p.d.t. auxiliary contacts on the transfer relay. Loudspeaker or headphone connections are made at the rear power plug or through a jack on the power-supply unit.

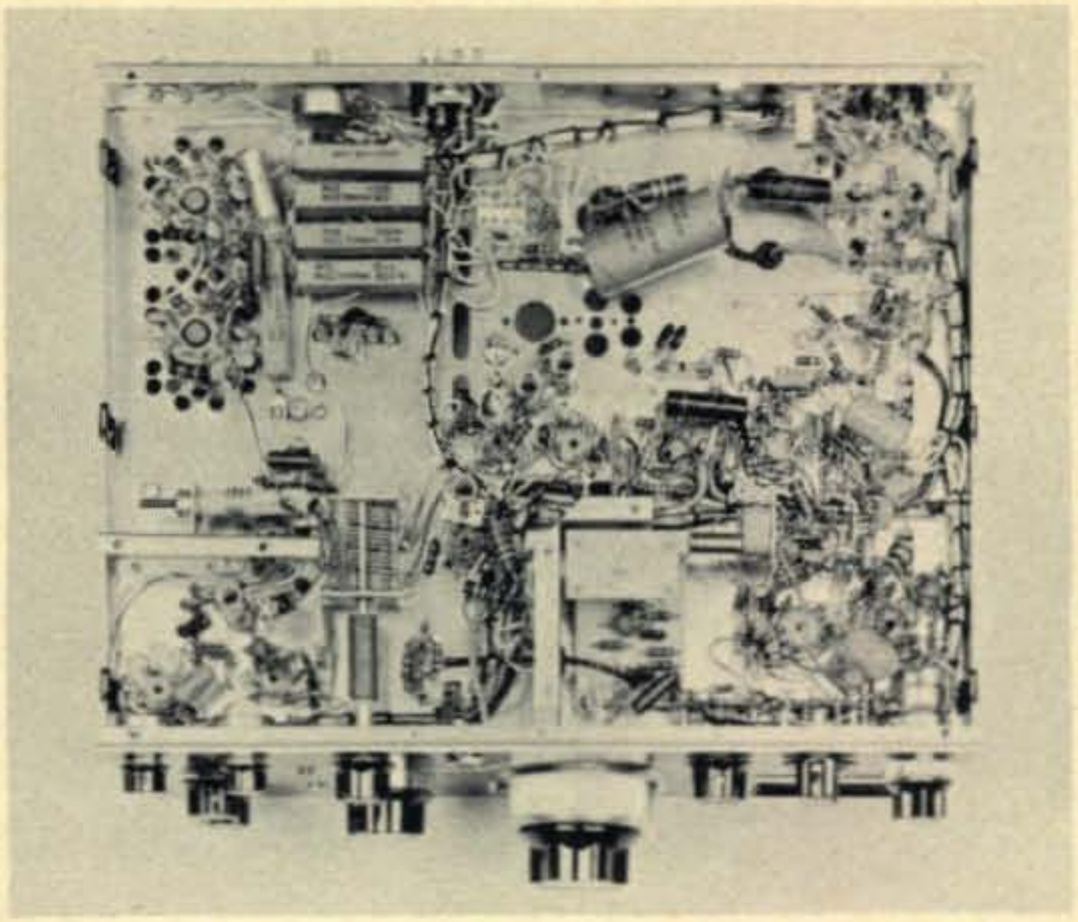
Power Supply

The nominal power requirements for the Swan 250 are: 12.6 v.a.c. or d.c. @4.5 a., 12 v.d.c. @250 ma (for relay), −110 v.d.c. @100 ma, 275 v.d.c. @150 ma and 800 v.d.c. @300 ma. These are obtained from separate power supplies of which various models are available. They include complete console types (with self-contained speaker in matching cabinet).

Specifications and Performance

The receiver sensitivity is rated at 0.5 μv for 10 db s/n (at 50 ohms input) with a noise figure of 3 db. The sensitivity was found as stated, while the noise figure, averaged over the band, was closer to 6 db. The gain was highest at the band segment at the low end of the range, evidently due to alignment made in this region where most 50 mc s.s.b. operation is conducted. Unwanted-sideband suppression at 1 kc was 40 db as rated. The a.g.c. characteristic was quite flat with an a.f. output change of 7 db with 60 db r.f. input variations.

The frequency stability is rated at 2 kc during the first hour from a cold start, with negligible drift after the warm-up period. Measured at 50.1 mc, the drift was 500 c.p.s. during the first 15 minutes from cold start at 75-degree ambient, an average of near 400 c.p.s. per hour thereafter. With line voltage variations of ±10%, the frequency held to within 2 c.p.s.! Banging the case showed no evidence of frequency shift or microphonics. Shaking the set back and forth exhibited a slight frequency shimmy, a characteristic we've often experienced with solid-state v.f.o.'s.



Bottom view of the Swan 250. The oblong object near front center is a phenolic board with the v.f.o. transistor on it. The board mounts on the bottom plate of the set and places the transistor outside, away from heat-producing elements. Below the board is a printed-circuit board for other v.f.o. components.

Transmitter

Operating at the input-power ratings given earlier for the transmitter, the r.f. output was 135 watts p.e.p. on s.s.b., 100 watts on c.w. and tuneup, 25 watts a.m. carrier. Good two-tone test patterns were obtained and although there is no a.l.c., excessive flattopping during voice modulation was not evidenced, even with the mic gain wide open. Carrier suppression was near the rating of 50 db, with sideband suppression the same as on receive. C.w. keying was clean and without chirp or noticeable key clicks, but if the latter should occur, the keying may be softened by adding capacitance across the key as suggested in the manual. Transmit-receive transfer with c.w. must be conducted manually with a panel switch, thus precluding break-in operation.

There is no sensitivity control for indexing the relative power-output reading on the meter. With low-impedance loads the meter

Model 117 XC, matching a.c. supply.

will read lower than with high-impedance ones.

The s.s.b. quality on receive was excellent with clean-sounding audio. Normal a.m. reception was good in spite of the small bandwidth of the filter; however, better results often can be obtained on well-modulated a.m. signals by using the product detector and tuning to zero beat; provided, the transmitted carrier is stable and without f.m.

The a.g.c. release time appeared to be a bit fast, allowing background noise to rise somewhat between words during s.s.b. reception and since the a.g.c. is obtained from the a.f. amplifier, background level similarly tends to vary in between times as the a.g.c. signal follows the a.f. component on a.m.

The good inherent frequency stability also avoids the need for constant retuning or chasing signals around the band. Although the noise limiter is not a cure-all, it takes the edge off sharp noise spikes.

The transmitted s.s.b. signal also was found to be of nice quality and no evidence of f.m.'ing was found with either s.s.b. or a.m.

In respect to a.m., it must be realized that such transmissions with the Swan 250 (or similarly arranged s.s.b. gear) are a compromise that produces only a single sideband with carrier and thus the a.f. signal recovered at the receiver may not be as effective as that realized with conventional double-sideband a.m. Nevertheless, if you're in a location where most operation is still conducted on a.m., the compromise keeps you from being "left out in the cold" until such time as more s.s.b. stations get into operation.

The v.f.o. tuning for the vernier dial is velvet-smooth. Its calibration increments are not as accurate for segments at the upper half of the band as for those at the lower end where they are within 10 kc.[3] This is due to a change in the bandspread *ratio* relative to the various portions of the band. The accuracy also is dependent on how closely the mc-range control is set for the desired segment. This is best checked with a crystal calibrator.

Where operation is desired on MARS frequencies below 50 mc, the v.f.o. can be internally readjusted in a manner that shifts the mc-range points down one 500 kc segment, in which case all the 0.5 mc points are likewise offset and the top band segment will be 53-53.5 mc.

The transceiver is styled in the traditional Swan manner in a square-cornered perforated cabinet with the panel finished in black and dark gray with silver-colored trim. The size of the unit is 5½" × 13" × 11" (H.W.D.) and it weighs 17¼ lbs.

The Swan 250 is priced at $325.00, less power supply. The Model 117 XC console-type 117 v.a.c. power supply with built-in loudspeaker and phone jack is $95.00. Prices and data on other type power supplies and accessories such as the 500 kc crystal calibrator, v.o.x. module, separate v.f.o. for independent frequency control of receiver and transmitter, may be obtained by writing to Swan Electronics, Oceanside, California.—*W2AEF*

[3] The error is considerably higher near the upper end of the 50 mc band, in which case the calibrations are primarily useful as a logging scale.

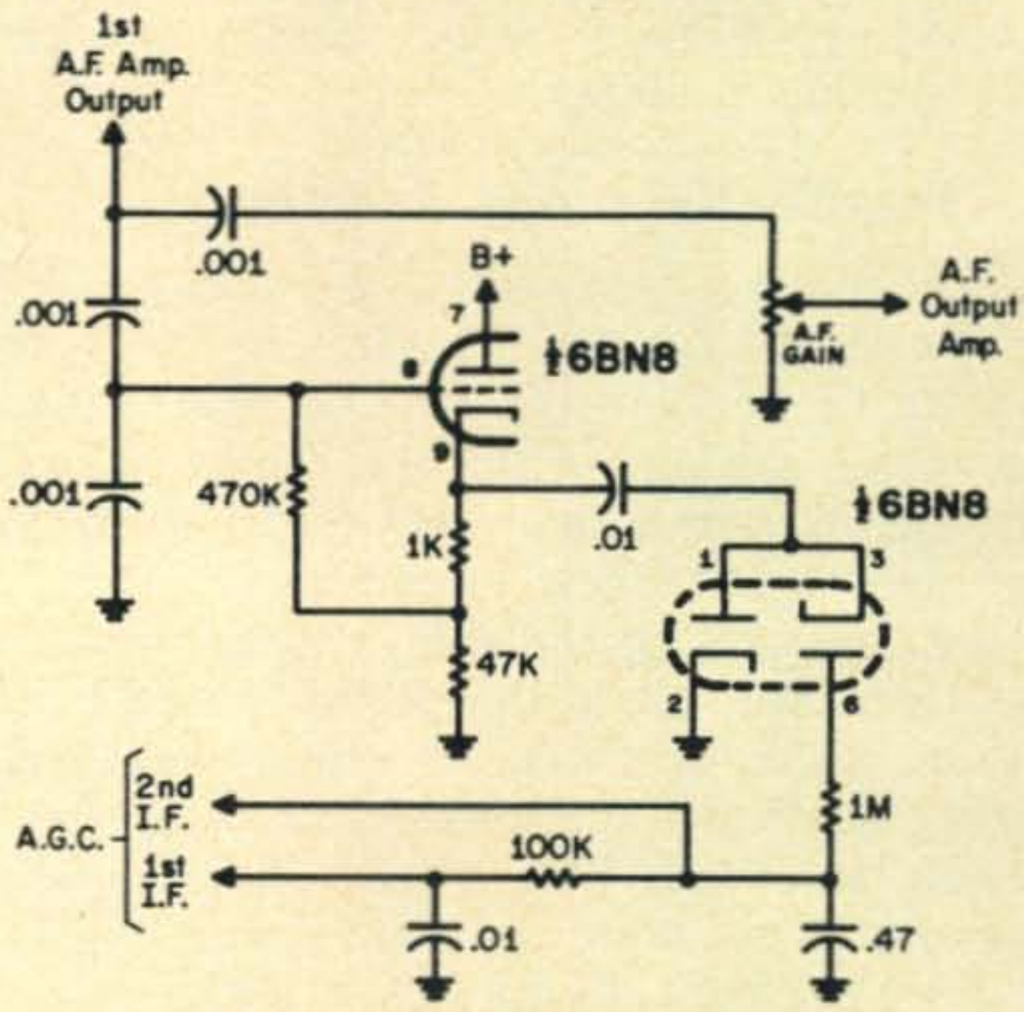


Fig. 3—Audio-derived a.g.c. system used in the Swan 250. The output of the first a.f. amplifier is further amplified and then rectified to produce a d.c. potential for a.g.c.

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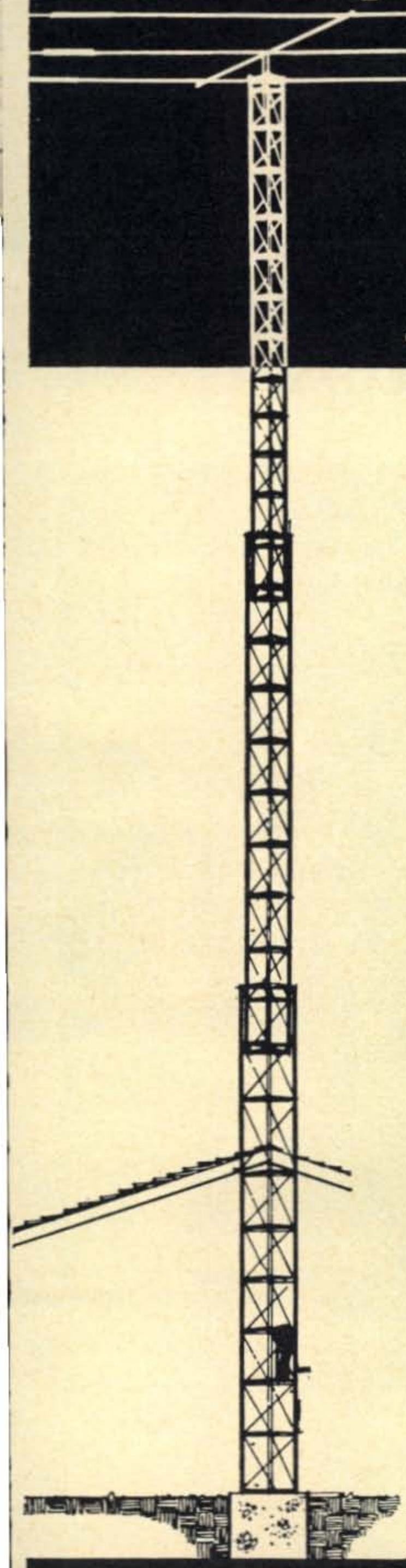

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A SIMPLE MULTI-FUNCTION TUNING AID

BY JOHN J. SCHULTZ,* W2EEY/1

This article describes an r.f. voltmeter, s.w.r. indicator and field-strength meter combined into one small package. A minimum of components is necessary to achieve all three functions and calibration is particularly simple and straightforward.

USING only slightly more than ten components, the circuit of fig. 1 performs several useful functions for use in adjusting an antenna system or the tuning of an antenna coupler. The ease of construction and adjustment make this tuning aid an ideal project for the newcomer. It can be used in a coaxial line of any impedance without requiring any wiring changes. As shown, it can be used as a minimum s.w.r. indicator, r.f. voltmeter and field strength meter. Only one simple calibration is required for the s.w.r. function. If desired, with further calibration, power output and absolute s.w.r. can be measured. With a simple component change, it can be used as an antenna impedance measuring bridge.

Circuit

If S_1 and S_2 in fig. 1 are both in the position marked *A*, the 3.3K and 1K resistors form a voltage divider across the coaxial line. The r.f. voltage is rectified by the diode CR_1 and used to drive the meter. The meter itself can be any type with a full scale deflection of up to 1 ma, although a unit with a sensitivity of 500 microamperes or less is preferable, especially if a very sensitive r.f. voltmeter function is desired for transmitter neutralization adjustments.

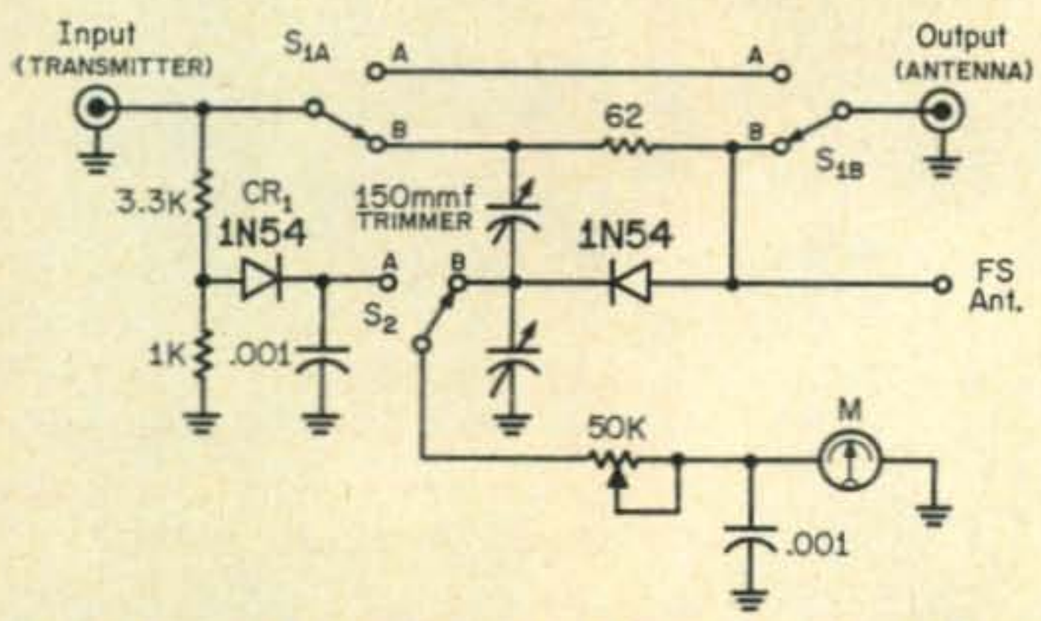

Fig. 1—Circuit of tuning aid. Switch S_1 should be a wafer type while S_2 can either be a wafer or a toggle switch. The meter should preferably have a 500 μ amp or less movement. All resistors are 2 watt units.

With both S_1 and S_2 in the position marked *B*, the circuit becomes that of a *RC* type bridge to measure s.w.r. The basic circuit of the bridge is shown in fig. 2. When the ratio of the resistor and capacitor arms are equal, the voltage *V* is zero. If the resistance *R* changes in value, the capacitor ratio can be adjusted to make the voltage *V* zero again. Thus, the capacitor settings can be calibrated in terms of *R*. Also, the capacitor arm can be set so the voltage *V* is zero only when the resistor *R* is a specified value. The first type of operation allows the use of the circuit, once calibrated, as a bridge to determine the value of an unknown antenna impedance. The second mode of operation allows the circuit to be used as a minimum s.w.r. indicator when placed in a coaxial line of a certain impedance.

If the fixed resistor in the resistance leg is made sufficiently low in value no appreciable power is lost in the resistor and the bridge can be used in a coaxial line with a transmitter operating at full output. Commercial bridges have used this principle where the resistance is reduced to a fraction of an ohm. The construction of such a bridge becomes complicated, however, and the circuit of fig. 1 uses a relatively high fixed resistor thus making it unusable as a device to be left in the line continuously. However, construction is greatly simplified and only a few watts of r.f. input are necessary to obtain easily visible meter indications. For most tune-up function, this is all the power that is desirable anyway.

With S_1 at position *B* and S_2 switched between position *A* and *B*, voltages proportional to the forward and reflected voltages on the coaxial line can be measured. Once calibrated, the meter will then indicate the actual s.w.r.

With S_1 in position *A* and S_2 in position *B*, the unit acts as a simple untuned field strength meter while the coaxial line is connected straight through. If desired, S_1 can be expanded with

*40 Rossie Street, Mystic, Connecticut 06355.

more contacts so it can also act as an antenna selector switch.

Construction

The unit constructed by the author and shown in the photograph was assembled in a 5 × 2¼ × 2¼" Minibox although any similar enclosure can be used. As shown in the photograph, the meter and switches were mounted on the portion of the enclosure separate from that which contains the coaxial line connectors. This was done in error and actually all the components should be mounted on the portion of the enclosure containing the coaxial connectors to avoid interconnection wiring between the two parts of the enclosure. Small terminal strips of 3 to 4 lugs each mounted below the panel switches will accommodate all the circuit components. No particular arrangement of the components is required except that all leads be kept as short as practicable. R.f. type phono connectors are shown used and are generally suitable for the output of most transceivers in the 100-300 watt class. For higher power, SO239 connectors are preferable. The field-strength antenna connector is a simple pin jack meant to connect to a piece of hookup wire of several feet in length which serves as a pickup antenna.

Calibration

For use as a simple minimum s.w.r. indicator, only one quick calibration procedure is required. With both switches in the *B* positions, a 2 watt composition resistor of the same value as the desired coaxial line impedance is connected across the output terminals. Both trimmer capacitors are set at their mid-point. Input power of not more than a few watts is supplied at the highest frequency at which the unit will be used (usually 10 or 6 meters). With insulated screwdrivers one capacitor is increased in value and the other decreased in value (and then vice versa) until the meter nulls at zero reading.

Thus calibrated, the meter will indicate when the s.w.r. is more than unity. To calibrate the meter to read SWR, the input power is adjusted so that for a fixed setting of the 20K potentiometer, the meter reads full scale with S_2 in position *A*. Assuming the calibration for minimum s.w.r. to have been done as described above, the meter is switched to position *B* and resistors to simulate various line s.w.r.'s placed across the output (twice or half the minimum s.w.r. resistance to simulate a 2:1 s.w.r., three times or ⅓ the resistance for a 3:1 s.w.r., etc.). The meter can then be calibrated directly in s.w.r. It should be checked that the forward voltage reading (S_2 at position *A*) remains at full scale during the calibration procedure and, of course, must be so set when the unit is used to measure the s.w.r. with an actual load connected.

The meter can also be calibrated to read approximate transmitter output if sufficient test equipment is available. With both switches in

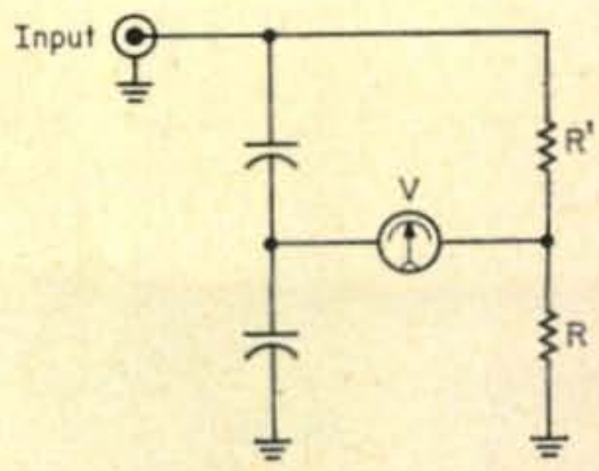

Fig. 2—Basic circuit of the RC bridge used. When the ratio of the *R* and *C* legs are equal, *V* is zero. *R'* does not have to be the same value as *R*.

position *A* and a resistive dummy load connected across the output equal to the line impedance, the r.f. voltage across the dummy load is measured with a v.t.v.m. and an r.f. probe. The power output is calculated from the r.m.s. value of the r.f. voltage (E^2/R) and the 20K potentiometer setting recorded to achieve some arbitrary meter reading (½ or full scale). Thus for various power outputs, the potentiometer dial can be calibrated in terms of power when always set for the same arbitrary meter set point. The calibration should be tried out on both the lowest and highest band used because the rectification action may vary somewhat with frequency. The calibration will, of course, only be accurate when used with an actual load when the s.w.r. is unity or very close to it.

Modification

The bridge s.w.r. circuit can be used to determine the actual resistive component of an unknown load by using a front-panel controlled variable capacitor which is calibrated in ohms. Since the value of one capacitor must increase or decrease in value while the other capacitor does the opposite, a differential capacitor is used to replace the two units in the circuit of fig. 1. A Hammarlund HFA-50-50B, Johnson 148-306 or 167-33 units or similar type should be suitable. Resistances of different values (from about 10 to 300 ohms) are connected across the output and the setting of the capacitor needed to achieve a zero null on the meter (S_2 in position *B*) are then noted.

The value of this feature, although it does not measure both components of a complex impedance, is that it gives a good indication of what impedance matching device to try when the s.w.r. is not unity. For instance, a moble antenna or fixed antenna at certain elevations or in obstructed surroundings may indicate a high s.w.r. The s.w.r. indicator does not tell whether the antenna impedance is higher or lower than that required for matching to the transmission line s.w.r. is not unity. For instance, a mobile antenna the calibrated resistance bridge, the direction of the mismatch can be determined usually and time saved in deciding on the type of stub or impedance of a transmission line transformer necessary to correct the s.w.r. ■

MORE VERSATILITY for the HEATH HA-14 LINEAR

On the front panel of the HA-14 only three extra meter switch positions are marked; these are for plate current, plate voltage and grid current. No other changes to the front panel are required.

BY JOHN J. SCHULTZ,* W2EEY/1

The author presents various ideas to improve the versatility of the Heathkit HA-14 linear, especially for home station operation. The ideas are applicable to many other linears as well.

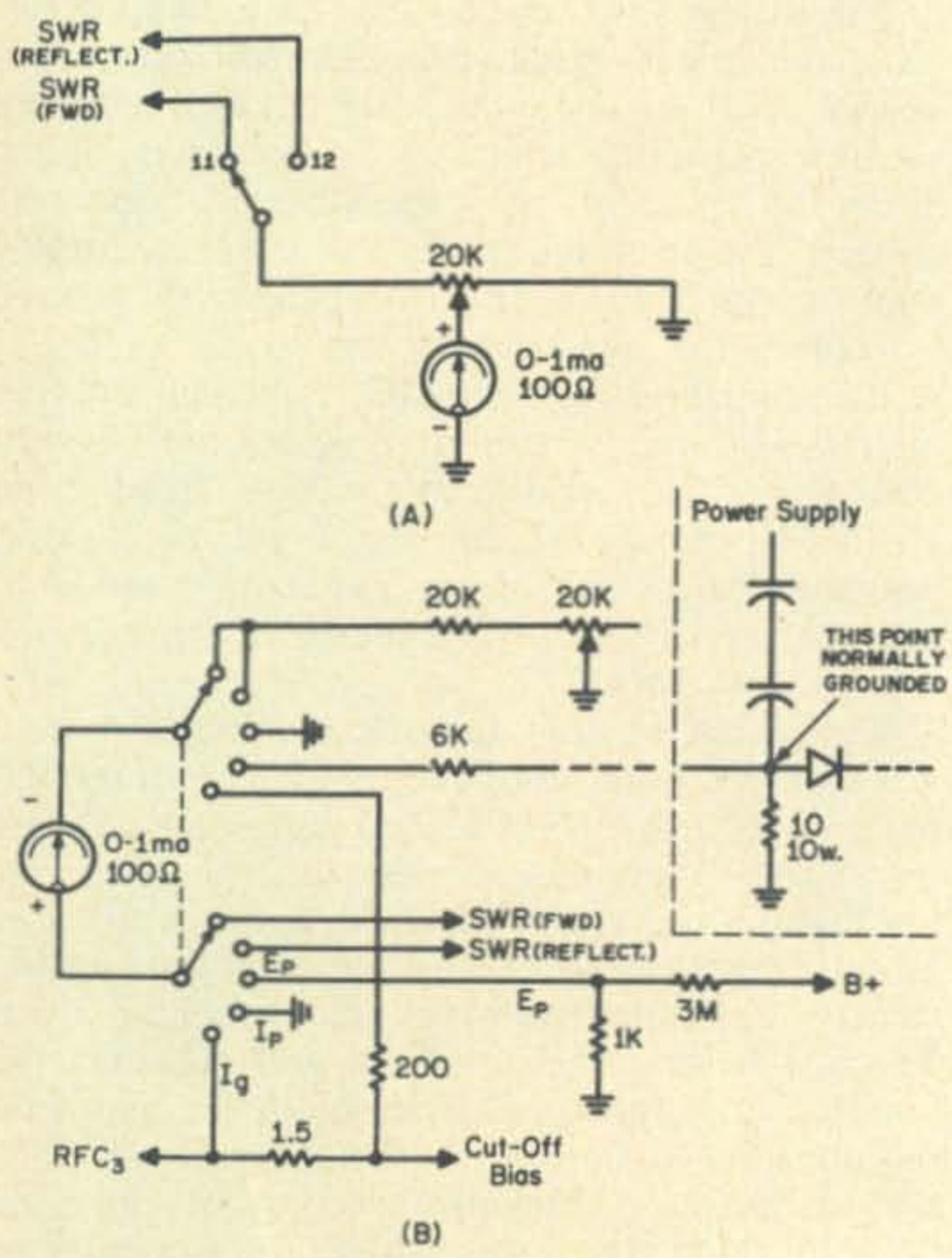

Fig. 1—Original metering circuit (A) and expanded circuit (B) to permit measurement of plate voltage and plate and grid current.

THE Heathkit HA-14 or "KW Kompact" linear is probably used for home station operation as much, if not more, than for mobile operation. The author was asked for some of his ideas on what features could be added to the linear to make its operation more flexible, especially since the linear is designed primarily for mobile operation and operating controls, adjustments, etc., were deliberately kept at a minimum in order to simplify quick tune-up and to reduce cost. Many of the ideas which developed and which were tried out are also applicable to other similar linears of commercial or homebrew origin. Most of the ideas are very simple; others require a bit of experimentation.

Metering

Using the mobile supply for the HA-14, it is not possible to run the linear on c.w., except at very low power, since the voltage output of the d.c. supply automatically drops under sustained load. However, with the a.c. supply the linear can be run to 1 kw d.c. input on c.w. The linear has only provision for measuring the s.w.r. forward and

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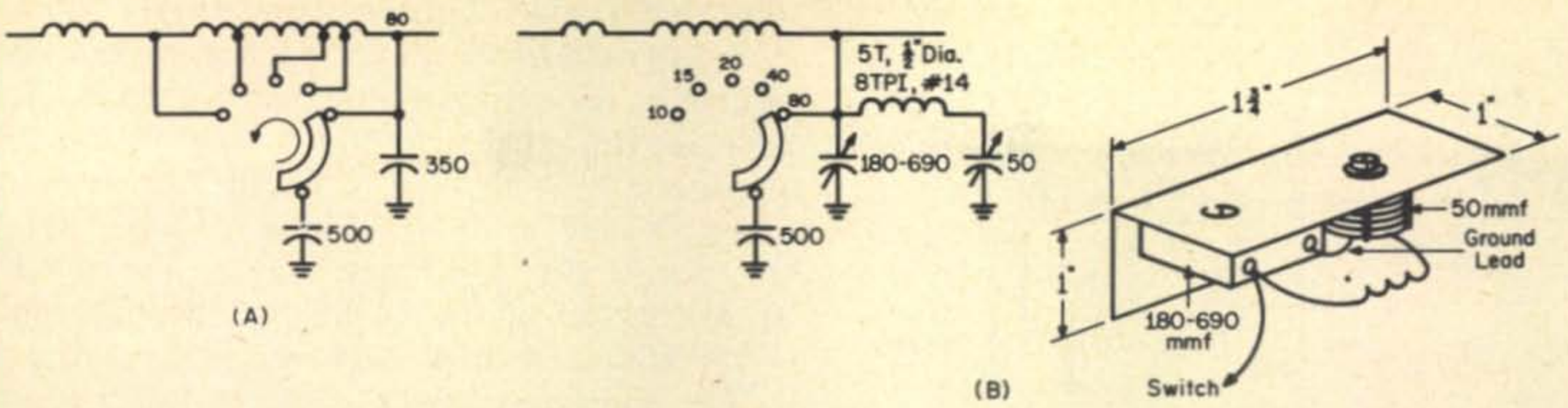


Fig. 2—Original fixed output loading (A) is replaced by variable loading capacitor and series TVI trap for the lower TV channels. Bracket is mounted as described in the text.

reflected voltages with the built-in meter function. This would not satisfy FCC requirements for c.w. operation which require a transmitter operating at more than 900 watts d.c. input to have a provision for measuring the power input. Also, it still would be a definite tuning convenience to be able to measure the grid current, plate current and the plate voltage.

This function is easily built into the HA-14 by modification of the meter switch. The original two pole wafer on the meter switch is replaced with a standard, non-shorting two pole five position wafer (Centralab PA series, for instance). The switch position cam is cut out to provide for three extra switch positions by first removing the locking washer on the end of the front screw thread in order to release the shaft. With a bit of care, the replacement of the switch wafer is easily made. The switch is then wired as shown in fig. 1. With the values shown, the grid current range is 0-200 ma (approximately 30 ma per division on the 0-6 relative scale of the meter); the plate current range is 0-600 ma (100 ma per division on the meter) and the plate voltage range is 0-3 kv (500 volts per meter division).

The resistors for the plate voltage measurement circuit should be encased in a protective plastic sleeve. The lead from the 10 ohm resistor in the negative lead of the power supply (used to measure plate current) can be connected to the linear using any of the unused pins on the power supply socket (4 or 5).

In normal c.w. tune up, the plate voltage should be about 2 kv, the plate current 500 ma and the grid current should not exceed 100 ma for linear operation.

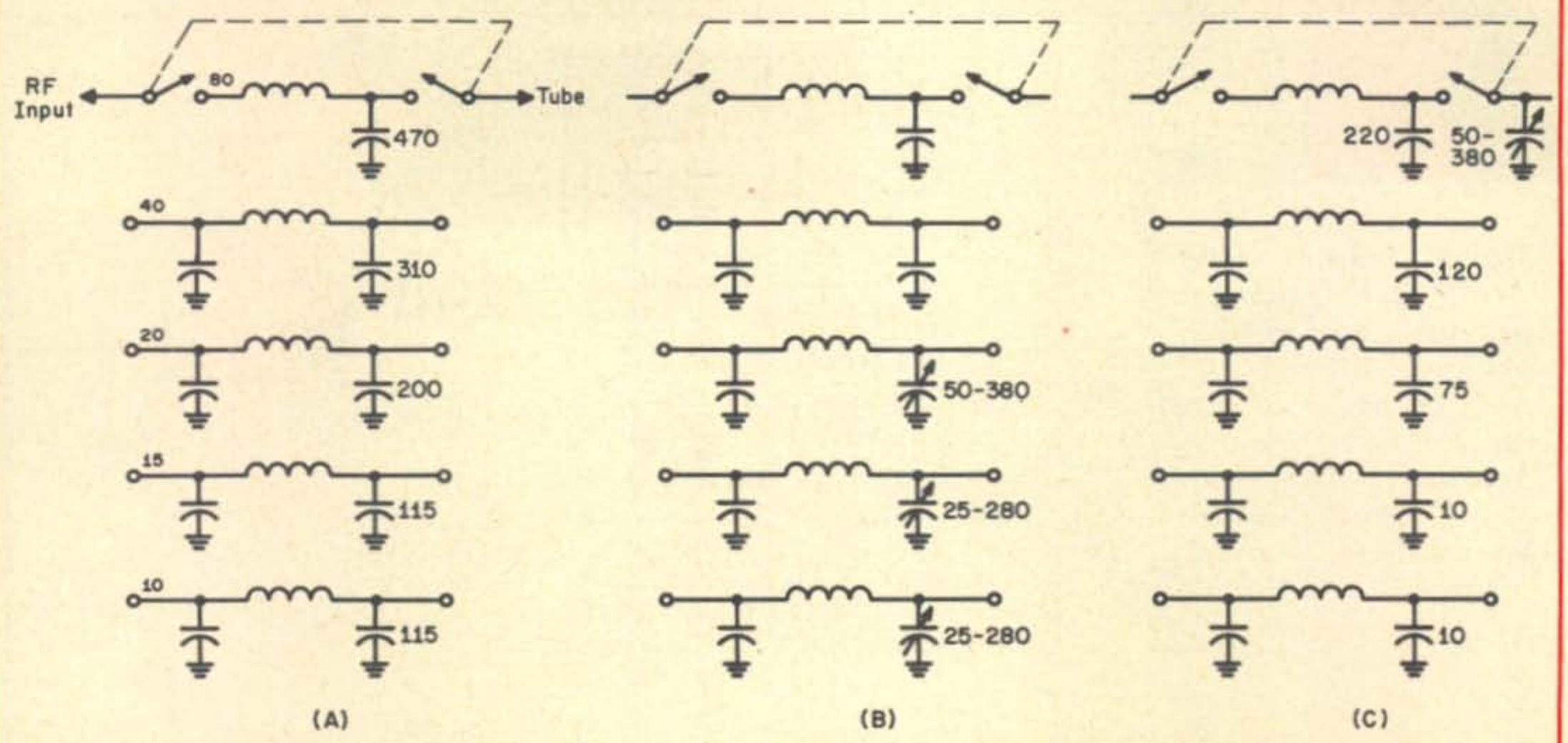


Fig. 3—Present input circuit (A) can be modified to provide tuning adjustment on just 20, 15 and 10 meters by use of trimmer capacitors (B) or all bands (C) by use of an additional tuning capacitor.

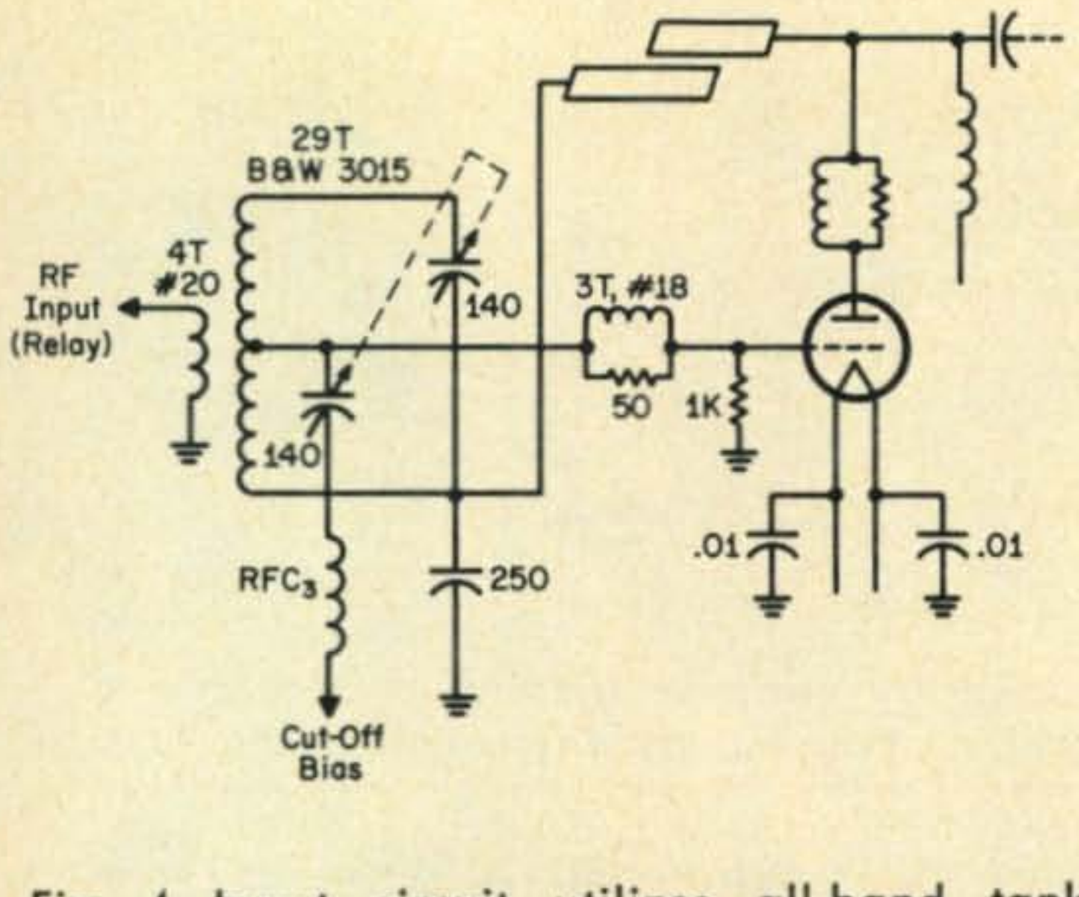


Fig. 4—Input circuit utilizes all-band tank circuit for grounded-cathode operation. Metal tabs are used for neutralizing capacitor as described in the text.

Variable Output Loading

Another simple modification is to replace the fixed output loading capacitor with a variable one. Although a mobile antenna can be peaked for a particular frequency to present exactly the right load to the transmitter, most home station antennas will not present such a constant impedance as one tunes between the c.w. and phone portions of a band. Therefore, variable loading is useful in obtaining maximum power output in all portions of a band. At first, providing variable loading seems quite complicated because of the limited space in the HA-14.

Forgetting any outboard arrangement, the best possibility for an integral unit is to mount a small "L" bracket of aluminum on the shield plate between the output tank coil and relay. No mounting holes need be drilled as enough mounting screws are available on the shield. A high-voltage trimmer capacitor with a range of about 180 to 690 mmf should be used (Elmenco type 30). The screw slot adjustment can easily be set from the top of the enclosure, through the perforations, with a small screwdriver.

The addition of the "L" bracket also provides a convenient mounting for another miniature variable capacitor to be used with a suitable coil as a series TVI trap on the linear output. Many linears do not require a low-pass filter and the TVI production, which seems to concentrate on one TV channel, can usually be cured by means of a simple series trap. Figure 2 shows the change in the HA-14 output circuit and dimensions for a "L" bracket.

Input Circuit Tuning

The input circuit to the linear is through a series of pi-networks, one for each band (fix-tuned). In cases where drive is marginal or the exciter has no variable output loading to compensate for cable effects, particularly on the higher bands, some improvement will be obtained by tuning the input circuits. The improvement depends a great deal on how badly the mismatch is; the input circuits are not particularly high-Q and their tuning will not produce any great improvement if the impedances differ only slightly.

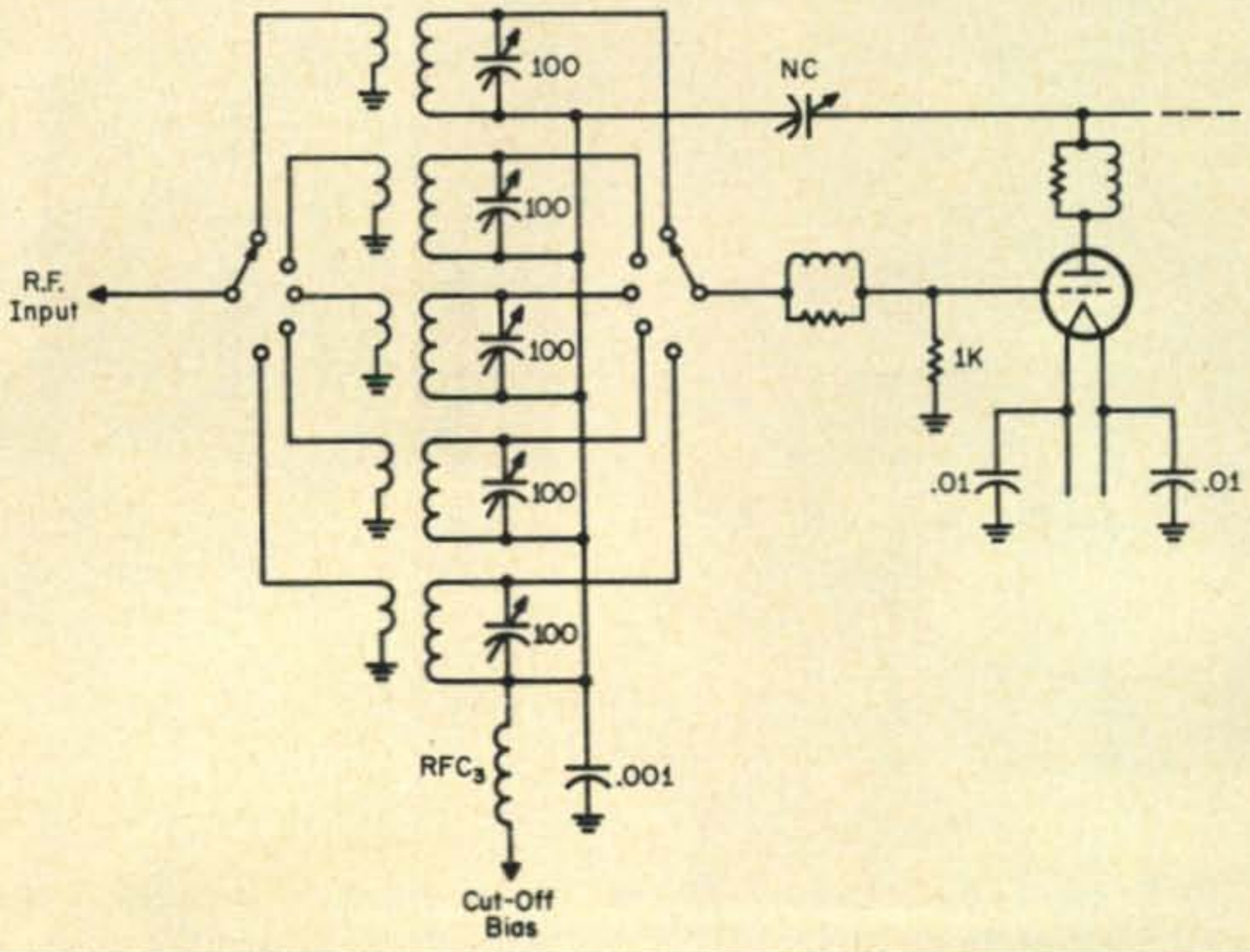


Fig. 5—Present input circuit coils can be provided with a link, parallel tuned and used as input circuits for grounded cathode operation. The original input circuit bandswitch is used.

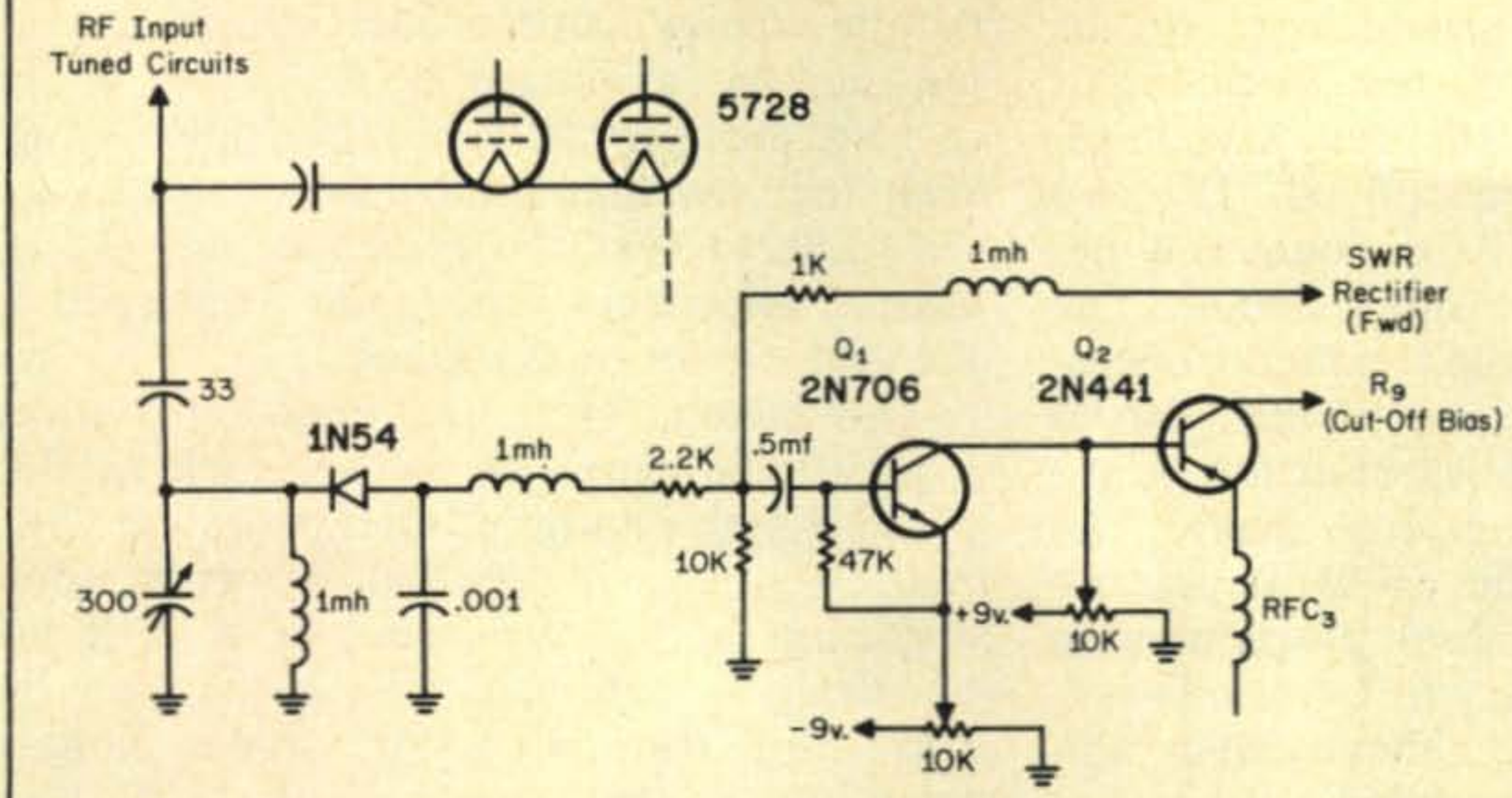


Fig. 6—A.l.c. circuit which operates by sampling input and output voltage forms. Bias voltages can be obtained by simple half-wave rectifier circuits from the 12 volt filament line.

Figure 3 shows how the input circuit can be modified. Either trimmers can be used to replace the fixed capacitors on just the 20, 15 and 10 meter coils, for these bands on which marginal drive conditions usually exist, or all the capacitors can be changed to permit the use of a single trimmer for input circuit tuning on all bands. The single trimmer is mounted on an "L" bracket (similar to that for the variable output loading capacitor) which is mounted on the chassis partition which mounts the input coils. It can be supported from the screw which mounts the bandswitch. Tuning is done with a screwdriver through the perforations in the enclosure.

Grounded-Cathode Operation

Some thought was given to revamping the input circuit to the extent that the linear could be operated in a grounded-cathode circuit. This would allow the linear to be used with exciters capable of only 20 to 30 watts output instead of requiring 100 watts drive for full output as at present. A modification of this sort was not tried but would seem to be quite feasible because of care already paid to good input/output circuit isolation. Figure 4 shows the possible modification to the input circuit for grounded-cathode operation. Components C_1 and L_1 constitute an all-band input circuit for 80-100 meters. Coil L_1 could be mounted in place of the present input coils and C_1 mounted in place of the power on-off switch (this function would be controlled directly at the power supply). The neutralizing voltage output from the all-band input circuit could be brought to a feed-through insulator mounted between the tube sockets. A ½" × 5" flat aluminum tab extending from this feedthrough and from the top screw of the plate r.f. choke would act as the neutralizing capacitor.

The possibility of using the present input circuits in a grounded cathode circuit is complicated by the need to provide a neutralizing voltage, although the presently installed input circuit bandswitch neatly provides all the necessary switching contacts as shown in fig. 5. The present input coils can be parallel resonated and provided with a 2 to 3 turn input link. The neutralizing capacitor can be the same as previously described although, of course, a commercial unit could also be used (if one can find a supplier still stocking them these days) of about 2-12 mmf.

Both filament pins of each tube should

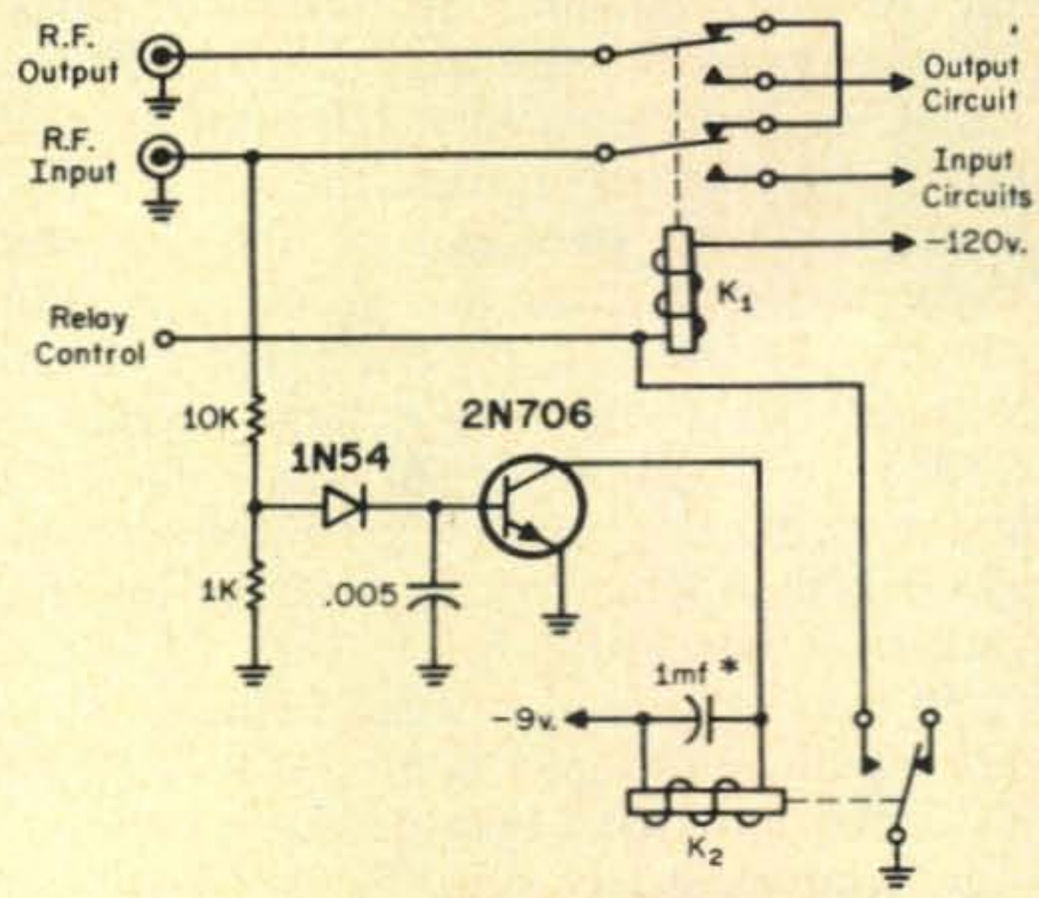


Fig. 7—Automatic circuit to switch the antenna relay shown above, is described in the Text. K_2 is a Dunco reed relay, 72 ohms. The value of the 1 mf capacitor can be varied as the size determines the time delay before the relay de-energizes.

be bypassed directly to ground with .01 mf disc capacitors. Also, if any grid circuit parasitics are noted, a 50 ohm/2 watt resistor with 2 to 3 turns of no. 18 wire wound around it should be connected between the grids and the input circuit. The modifications for grounded cathode operation may take a little care but they should result in the linear being usable at full power with almost any s.s.b. exciter made. The only possibly tricky point could be neutralization but, if the standard procedures as outlined in any elementary text are followed, there should be no more difficulty than with the hundreds of 811 grounded-cathode linears built in the early days of s.s.b.

Internal A.L.C.

With either the grounded grid or grounded cathode circuit the possibility exists of overdriving the linear. The HA-14, as do most other linears, provides an a.l.c. feedback voltage for exciter control. However, not all exciters have provision for accepting such a voltage from a linear and, even if they do, the a.l.c. circuits are not usually comparable when the exciter and linear are of different manufacture. Therefore, the incorporation of some form of a.l.c. within the linear itself has merit.

The circuit tried was derived from that used with the Collins and Galaxy linears and is shown in fig. 6. Since the HA-14 already has an s.w.r. bridge built-in, a sampling of the output voltage is taken from the forward position of the s.w.r. circuit. (If this were not the case, a 10 mmf mica capacitor in series with a 220 mmf capacitor could be placed across the plate tuning capacitor with one end of the 220 mmf capacitor connected to ground. A diode rectifier is used to produce a d.c. control voltage from the r.f. voltage across the 220 mmf capacitor.) A sampling of the input voltage is obtained by the capacitor divider/rectifier circuit across the input circuit as shown in fig. 6.

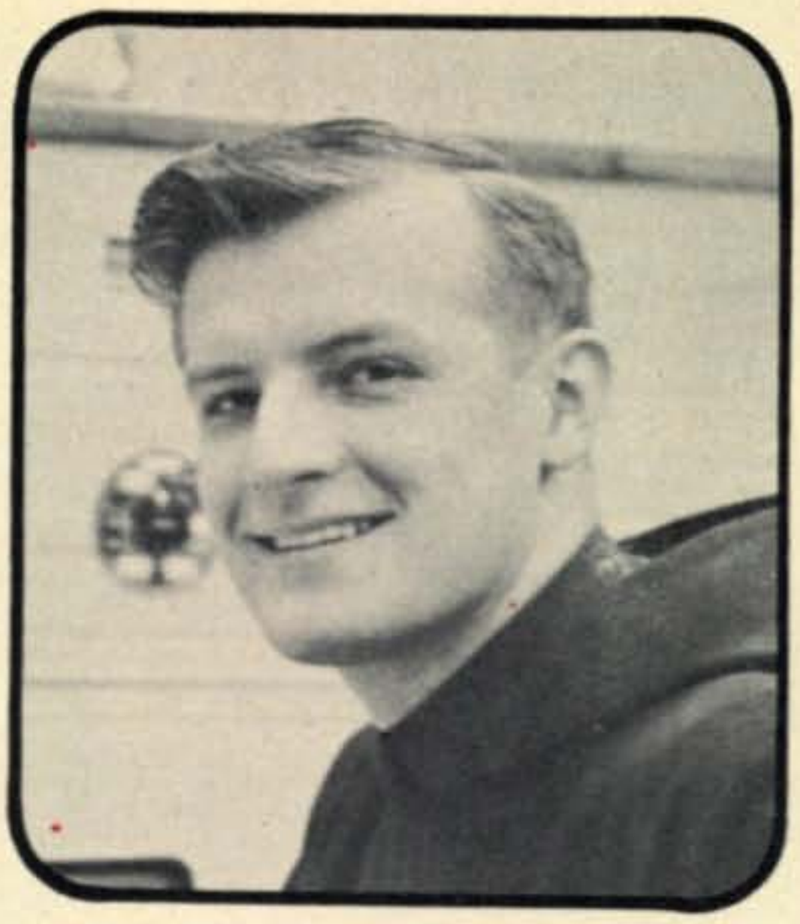
If the input and output voltage samples are equal, no voltage is produced across the 10K common load resistor because the voltage samples are of opposite polarity. If the output voltage sample does exceed the input sample, a voltage is developed which in turn changes the operating point of Q_1 such that the bias on Q_2 is overcome and the collector/emitter resistance of Q_2 increases effectively raising the resistance in the grid circuit of the tubes.

This method of control does not produce a very wide range of control such as that possible with multigrid tubes operating Class AB[1]. However, it does help to avoid some distortion in the linear output if it is not drastically overdriven. The setting of the 300 mmf trimmer in the input voltage sampling circuit as well as the 10K ohm potentiometers can only be done properly when using some test setup, such as a two-tone generator and oscilloscope display, which shows the amplifier linearity. The capacitor and potentiometers are adjusted so the circuit takes effect when the amplifier is driven into non-linearity.

Automatic Changeover

In conjunction with the a.l.c. circuit or independently, one can use a system which samples the input signal to also provide automatic turn-on of the linear when the exciter is transmitting. The sampling of the input to the linear must, of course, take place directly at the exciter input to the linear, before the antenna relay. Figure 7 shows a possible circuit. Turning off the primary power to the linear automatically disables the circuit since no power is available for the relay coil. Generally, such a circuit has value only when the exciter has no provision for linear relay control or if the linear is used with more than one exciter and it is desired to reduce the number of circuits that must be switched. The components for the circuit as well as those for the a.l.c. circuit can be assembled on a piece of vector board which is mounted in the space between the front panel and tube socket panel in the HA-14.

The above modifications were described as being applicable to the HA-14. However, there is practically no linear on the market which cannot utilize some of the ideas presented to improve their performance. ■



News from the INTERNATIONAL MISSION RADIO ASSOCIATION

BY TOM AQUINAS COX, O.F.M. CAPUCHIN W2CBX*

LAST month I promised to clear up the problems behind the "Cicero" letters that appeared in the June issue of *CQ*. I have tried, but no luck so far. Try again, I will.

I just thought I would mention that one of those "Cicero's," ZS9? did receive his call letters and is trying to get on the air. He needs equipment badly. According to his report, there is only one other ZS9 active at the moment. If we can help this Peace Corps Volunteer, there will be two. With one simple act IMRA will be able to double amateur radio activity in Botswana. Your aid will help "up" the cause of amateur radio 100 percent in this area.

IMRA At '67 Swampscott Convention

In April IMRA took part in the program at the Swampscott ARRL Convention. Gil Leduc, K1EMQ, IMRA President, was on hand there to tell more people about our association. He has sent back glowing reports.

"Sir, you hams certainly love one another regardless of creed, color, or country, don't you?" This statement, mouthed by an elderly woman at the IMRA display table, assesses the worth of our association and its work in the amateur world. The motto of IMRA repeats the same message: service to all is the purpose of IMRA.

Another person asked what he as one humble ham could do to help IMRA create more International good will. This question was repeated many times. The answer never varies. The more a ham learns of the needs and the wants of fellow hams throughout the world, the more he wants to help them and the greater is the bond of fraternity among all hams. The man or woman with the ability to meet people around the world has a great advantage in understanding all men. Through his person to person contacts he becomes a better person himself. He becomes a better ambassador of good will.

The prevailing interest among the many who stopped at the display table was the question of implementing the goals and purposes of our association. Here again, the answer never varied: membership in IMRA, an active participation in the nets with a view of handling traffic where needed, obtaining monies for the purchase of equipment for the missionaries.

We soon learned to our joy that IMRA

Fr. Gil Leduc, K1EMQ, and Fr. Dan Linehan, S.J., W1HWK man the IMRA booth at the Swampscott hamfest.

*Mary Immaculate Friary, Garrison, New York.

Many IMRA members visited the booth at the show. Among them were Jack Traub, WA1ERM and his XYL Ann Marie with Fran Legere, and Gil Leduc, K1EMQ.

is an easy product to sell. But the product needs to be advertised in season and out of season. After a very apt introduction by Bob Waters, W1PRI, Father Dan Linehan, S.J., W1HWK, gave a talk on IMRA. This talk stimulated many listeners to flock to the display table for membership applications and literature. There is no doubt in our mind that IMRA is fast becoming an established organization in the world of amateur radio.

Words of generous thanks must be addressed to the Committee members of the Swampscott Hamfest who answered all our needs with so much solicitude; to Bob Waters, and Dan Linehan for their stimulating talks on IMRA; to Bob Darsney, K1LOW, Fred McElroy, K1LOX, and Fran Legere who staffed the display table at all times. A new banner identifying IMRA was displayed for the first time. You will be seeing this banner more often at IMRA functions and hamfests.

Representing IMRA at the Swampscott Hamfest and discussing the merits of our association was a rewarding and enriching experience for us all.

IMRA Convention '67

Just another reminder and invitation to you to join the IMRA members at our annual Convention and Hamfest. It will be held in Asheville, North Carolina, this August 7th and 8th.

The Convention Committee has promised us a big surprise. They won't even tell me what it is. So come and see what they have in store for us. Write now to: IMRA Convention, 237 Victoria Road, Asheville, N.C. 28801.

IMRA Service

The question most often directed to the IMRA Staff at ARRL Convention in Swampscott, Mass., was this: "How is IMRA going to implement its goals and ideas?" In other words, how is IMRA going to put its ideas to work? How is it going to serve people (missionaries) and the "image" of amateur radio.

A few months ago, I told you what we mean by missionaries. Missionaries, in our context, are all those people who are working overseas to help better the lives of their fellow men. The term includes such people as clergymen of all faiths, doctors, Peace Corps Volunteers, and technicians.

IMRA will continue to serve these missionaries on an ever broader basis. We are providing them with communications. This means we are serving them with an international communications network. We are on the air to provide them with assistance, to patch them to their offices and families.

IMRA serves in another way. While providing communications it will often be necessary to provide communications equipment. If you have been reading these News Notes for the past few months, you know what I mean. An amateur radio station for many people overseas would mean more than a new car or a trip to Bermuda would mean to us at home. You say prove it? I say, read their letters. Look into your back issues of *CQ*. Since February you have had the opportunity to meet these IMRA members and to see their needs.

[*Continued on page 112*]

Members of the upcoming Asheville Convention Committee shown during a meeting are: l. to r. Bill Conrad, K4BE, Gretchen Burton, W4RTH, Murrill Burton, K4LGP, and Rev. Jesse Creel, W4YPR.

A 3-TRANSISTOR AUDIO COMPRESSOR

BY CAPTAIN PAUL H. LEE,* W3JHR

This simple compressor can be a boon to the s.s.b. operator since it will keep up the average level and talk power and prevent over-drive and splatter.

In the days of a.m., overmodulation caused splatter due to negative modulation peak chopping. In the modern days of s.s.b. too much audio also causes splatter, but due to overdriving of the linear amplifier stages in an s.s.b. transmitter, and the consequent generation of non-linearity products. Some s.s.b. transmitters have automatic level control (a.l.c.), but this may not always be effective in preventing overdriving. Here at W3JHR I decided to use an audio compressor amplifier to prevent overdriving, not only of the final amplifier but of all other stages in the transmitter as well. When I had the 1 kw a.m. transmitter, I used a compressor[1] employing vacuum tubes. This was sold, however, and so I decided to build one using transistors.

Circuit

The circuit of this simple unit is shown in fig. 1. Three type 2N467 transistors are used. Two of them are the audio amplifier which drives the transmitter. The third is the audio amplifier which drives the 1N34 diode to produce the d.c. bias for gain control of the first stage. The unit is powered from a 9 volt battery. The type of battery commonly used in transistor radios can be used, but I prefer to use six 1½ volt flashlight batteries in series, because they last longer.

*5209 Bangor Drive, Kensington, Maryland 20795.

[1]Lee, P. H. LCDR, "More Modulation per Dollar," *CQ*, August 1952, page 19.

Construction

The compressor can be built in many ways. It can be built into a beer can, for example, with an input jack on one end and the output jack on the other end. The microphone can be plugged into the input end, and a length of shielded cable can then be run from the output jack of the compressor to the input jack of the transmitter. I built my unit in a 6 × 6 × 6 inch aluminum box, which is in turn mounted on my audio control and phone patch panel in my station console. The batteries are contained in the box. Another way of building the unit would be to mount the components on a printed circuit board, and to find room for it inside the s.s.b. exciter, and to power it from 9 volts d.c. stolen from the exciter's plate supply. It could then be permanently wired in to the exciter, or connected to a front panel switch which could be labelled COMPRESSOR IN/OUT.

Components

The components are of course small. Half-watt resistors are used, and the small 6 and 10 volt electrolytic capacitors are employed. An r.f. choke is included in the input circuit for the obvious purpose of protecting the input transistor from stray r.f. which it will rectify very beautifully. The only large component is the 3 to 1 audio transformer which drives the diode rectifier, and that is a Stancor type A53 unit, which

[*Continued on page 116*]

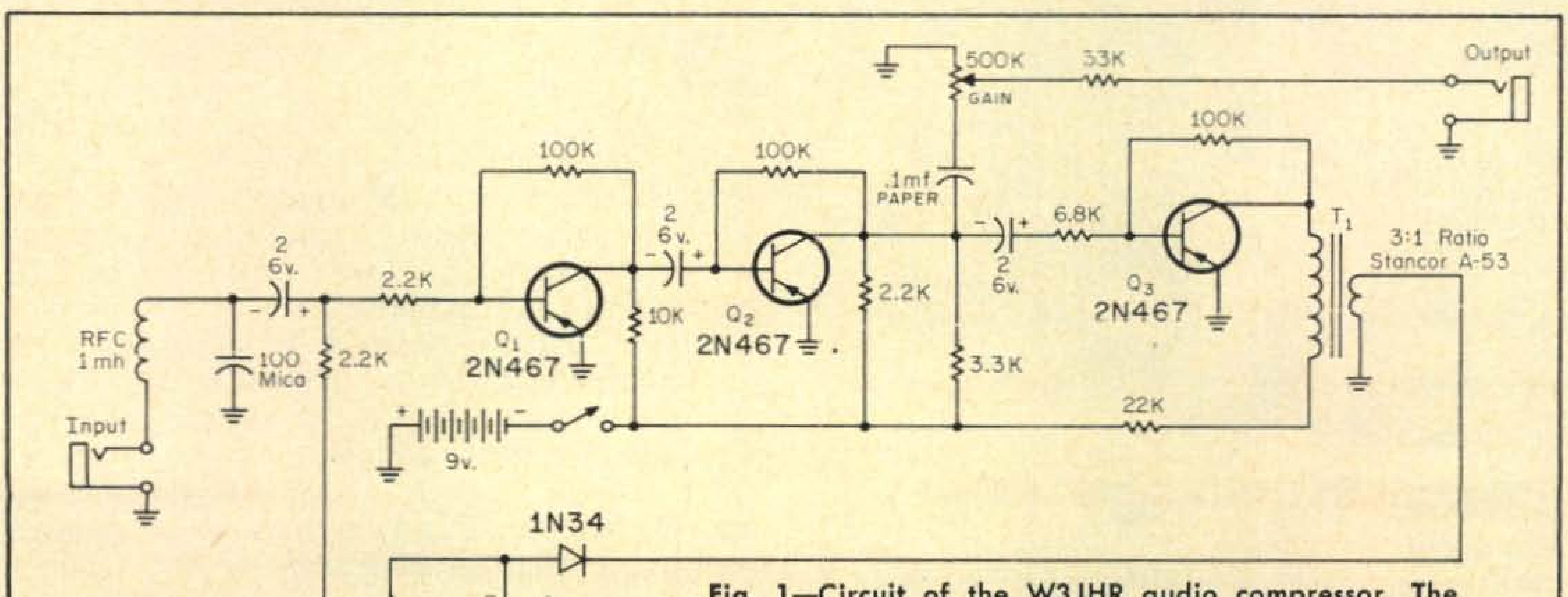


Fig. 1—Circuit of the W3JHR audio compressor. The transistors are all 2N467 and the compression pot is a log taper.

THE SHOEBOX II LINEAR

BY JOHN J. SCHULTZ,* W2EEY/1

THE original Shoebox Linear appeared in an earlier issue of *CQ* . Basically, it was designed as an easy-to-build project using only hand tools. The original linear used rather old-fashioned 837 tubes which the *CQ* staff suggested changing to 12 DQ7 tubes. After hearing from various amateurs who built a linear along the Shoebox lines, I decided to build another one incorporating some of their suggestions and some ideas of my own to improve the unit. The resulting Shoebox II is even easier to build than the original, uses modern low-cost tubes, lower plate voltage, has variable output loading and offers several drive and power level options to suit almost anyone's needs.

*40 Rossie Street, Mystic, Connecticut 06355.

Front view of the Shoebox II linear. Although similar in concept to the earlier Shoebox linear, the Mark II features more flexibility of operation and ease of construction. Inexpensive 6HF5 tubes are used in parallel to deliver as much power as the builder desires.

The unit uses 6HF5 tubes which have become probably the most popular TV-gone-linear tube judging from its wide use in homebrew and commercial designs. With 800 volts plate voltage, the recommended maximum, each tube can handle about 200 watts p.e.p. or 150 watts c.w. input. The linear can be built with anywhere from 1 to 10 of these tubes in parallel, depending upon the power level desired. This wide range of tube quantities can be accommodated with relatively minor changes in the basic design.

The power transformer must be capable of supplying the filament power of 6.3 volts at 2.25 amperes per tube and a high-voltage winding *VA* rating (taking the total secondary voltage) of about 50 watts per tube (60 ma for an 800 volt secondary. The p.i.v. rating of the diodes in the bridge rectifier remains the same and diodes of various current ratings differ very little in price. The size of the filter capacitors remain the same. This would not be the case if a doubler circuit were being used as with the original Shoebox since the capacitor size would then have to be increased with increased current drain. The other components that must be chosen for the number of tubes used are the plate choke (current rating) and the pi-network coil.

Linear Circuit

Figure 1 shows the schematic of the linear using four tubes as constructed by the author. A grounded cathode circuit is used and the grid input circuit can either be untuned or tuned. Most s.s.b. exciters will supply sufficient drive so an untuned input circuit can be used. Approximately 10 watts of drive per tube is required. The untuned circuit is preferred not only because it eliminates a tuning control but because of increased amplifier stability. The load resistor used in the grid circuit must be an r.f. non-inductive type. (It should *not* be a wire-wound power resistor labeled "non-inductive"). A suitable 50 ohm 30 watt unit can be constructed from 2 watt composition resistors as shown in the photograph.

If an exciter unit is used which will not supply

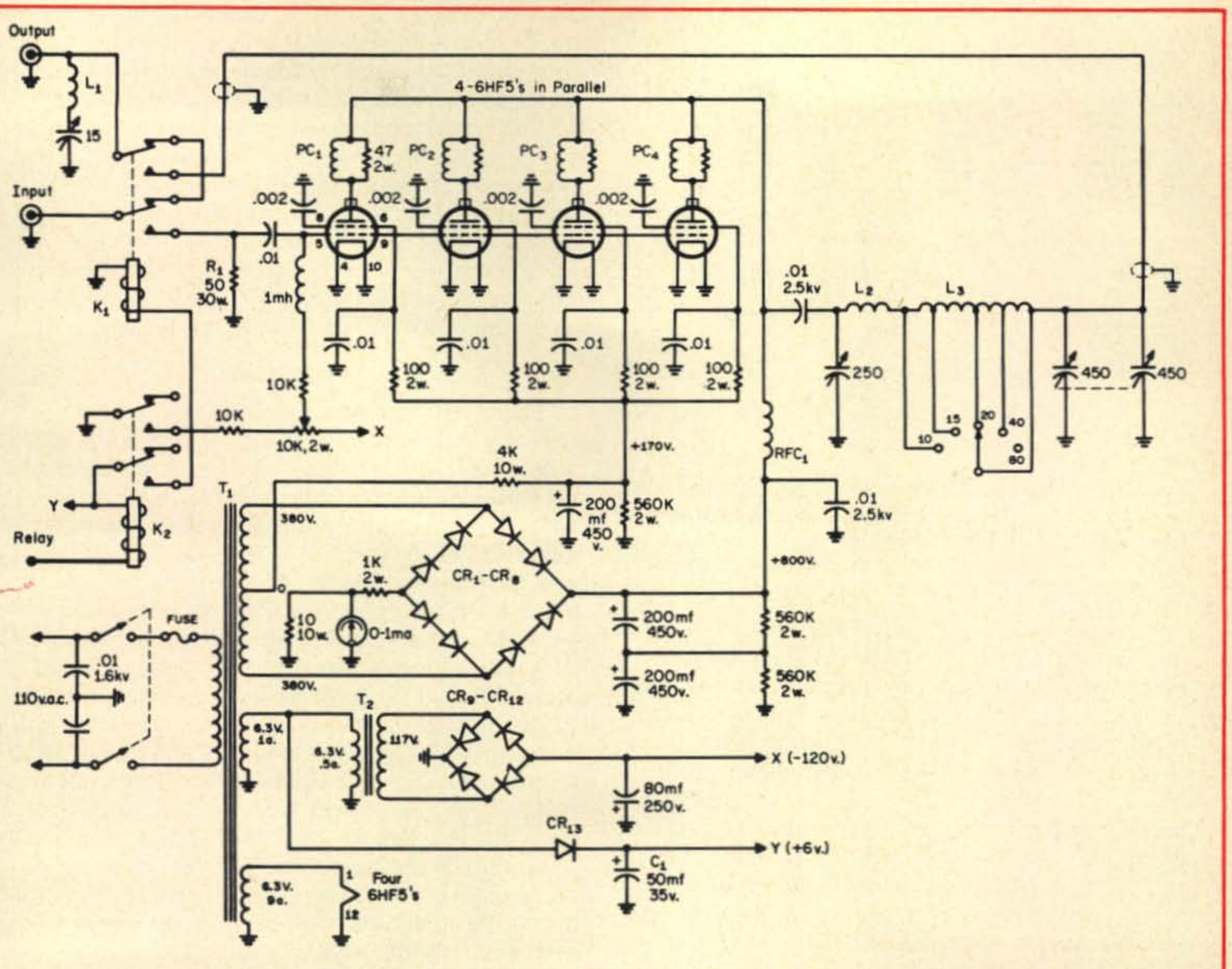


Fig. 1—Circuit of the Shoebox Linear II using four tubes in parallel. All resistors are ½ watt except where noted. All capacitors greater than one are in mmf; capacitors less than one are in mf except where noted. Control grids of each tube are paralleled directly with heavy wire or ¼" flat coppe rstrip. Relays K_1 and K_2 can be a.c. types and CR_{13} and C_1 eliminated. If d.c. types are used, however, the relay operation is quieter.

CR_1 to CR_8—750 ma, 800 p.i.v. diodes.
CR_9 to CR_{12}—200 ma, 400 p.i.v. diodes.
CR_{13}—1 amp, 100 p.i.v.
K_1, K_2—D.p.d.t. relay 6v a.c. or d.c. coil. or one 4 p.d.t. relay (See text).
L_1—7t #16 e., ½" dia., spaced 1/16" between turns for Channel 2. Reduce the number of turns for higher channels.
L_2—4t #8 tinned, 1" dia., 1" long.
L_3—36t #14 tinned, 2" dia., 8 t.p.i. 4½" long. Polycoil #1770 or Air Dux #1608T. 15 Meters tapped at 2t., 20 meters tapped at 4t., 40 meters tapped at 7t.
PC_1—10 t #18 e., closewound on 47 ohm 1 watt composition resistor.
RFC_1—1 mh, 600 ma. National R154U or equiv.
T_1—TV type power transformer, 380-0-380 v.a.c. at 250 ma, 6 v. at 9a., 6v. at 1 amp.
T_2—Filament transformer, 6 v.a.c. at ½ amp. connected backwards.

sufficient drive for an untuned input circuit (such as a 10A or 20A unit) the tuned input circuit shown in fig. 2 can be used. Only a watt or two of r.f. will be required for drive. However, care must be taken to properly isolate the input and output circuits. The input circuit should be enclosed in a Minibox inside the main enclosure. A neutralization voltage tap is available from the multi-band circuit shown in fig. 2. Normally, it should not be needed but, if it is, a metal tab of ½" × 3" placed near the plates of the tubes should suffice.

The pi-network coil shown in fig. 1 should be adequate for 5 or possibly 6 tubes. However, beyond this the output capacity of the tubes adds up to such a value that on 10 and 15 meters a coil of the required low inductance becomes touchy to build. Placing a variable capacitor in series with a larger inductance, as shown in fig. 3 (as is done in the Galaxy linear which uses ten 6HF5's) solves this problem nicely although care must be taken to isolate the capacitor from the chassis by mounting it on standoffs or on a small piece of plexiglass.

Biasing

Sufficient bias voltage is provided so the tubes can be biased to cut-off during standby periods.

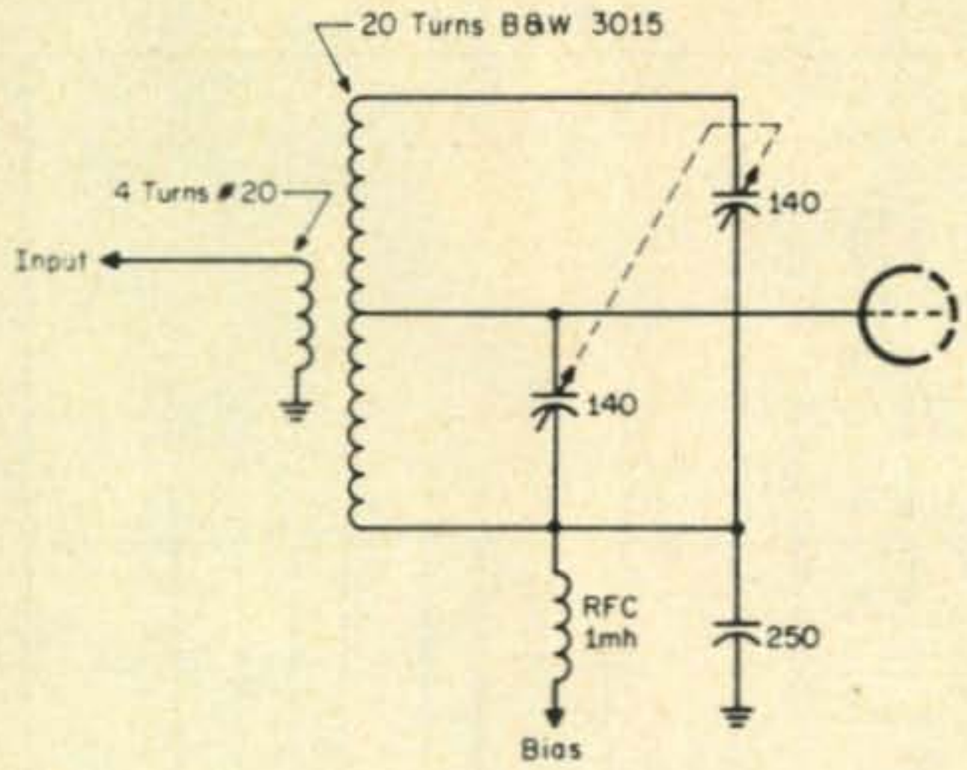


Fig. 2—Circuit of an 80-10 meter multiband tuned input circuit which can be used to replace the 50 ohm 30 watt untuned input resistor shown in fig. 1. The input coil is wound over the center of the center tapped secondary.

Such a provision not only contributes to keeping the heat down within the enclosure but also prevents tube noise from possibly causing difficulty during reception periods. The bias adjustment control is brought out as a front panel control to facilitate experimental adjustments but actually it can be left as a rear panel or internal control since it seldom requires adjustment unless the line voltage varies more than 10%.

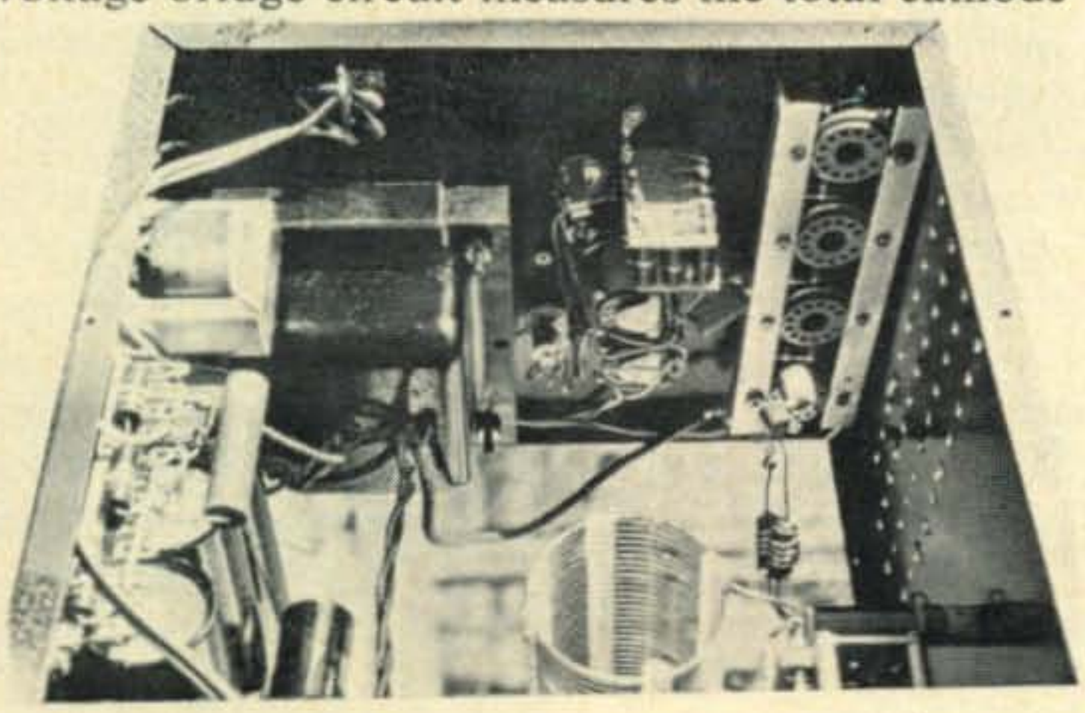
The relay switching circuit is shown using two relays only because the author did not have a suitable t.p.d.t. relay available.

TVI

To reduce or eliminate TVI a series tuned resonant trap can be placed across the output circuit as shown in fig. 1. It can, of course, be omitted if there is no TVI problem. In areas where the problem exists the tuned circuit will be found most useful since most linears for some reason concentrate their TVI in one channel.

Metering

The meter in the negative lead of the high-voltage bridge circuit measures the total cathode current. Although a 0-1 milliameter is shown in fig. 1, a less expensive 0-1 ampere meter could just as well be connected from the negative point to ground directly and eliminate the need for the 10 and 1,000 ohm resistors shown in the meter circuit. The meter is used to check the broad resonance of the output circuit and that the bias voltage is set correctly. Final tuning of the output circuit is best done with a meter indicating relative power output but since most amateurs have this feature available in s.w.r. bridges, no means to do this was provided within the linear.



Interior view of the Shoebox II gives some idea of the simple construction. At the left, foreground, is the power supply section, with most components mounted between two 12-terminal strips.

Construction

The construction of the linear follows that of the original Shoebox, utilizing a $8 \times 10 \times 10$ *steel,* metal utility cabinet. All of the components are mounted on the four joined sides of the cabinet. No components are mounted on the removable sides of the cabinet to facilitate construction and to allow complete access to the circuits for adjustment or repair. Since component sizes will vary, it is suggested that all components be carefully laid out against each side before any holes are drilled. The large holes necessary for the meter and transformer mounting are easily cut out with a nibbling tool, a handy and inexpensive tool to have around any shack for cutting out any form of chassis holes. The size of transformer used by the author for four tubes permitted mounting of the laminated portion inside the enclosure. With a larger transformer it may be necessary to mount this portion on the outside of the enclosure. Also, if more than 5 tubes are used without going to a larger enclosure, it probably will be necessary to relocate the antenna switching relay. Unfortunately, the only alternative location would seem to be on one of the removable sides.

The mounting of the tube sockets is done very simply on ½" aluminum angle stock as shown in the photograph. It is very desirable that compactron sockets with a metal grounding ring be used in order to insure a good ground path be-

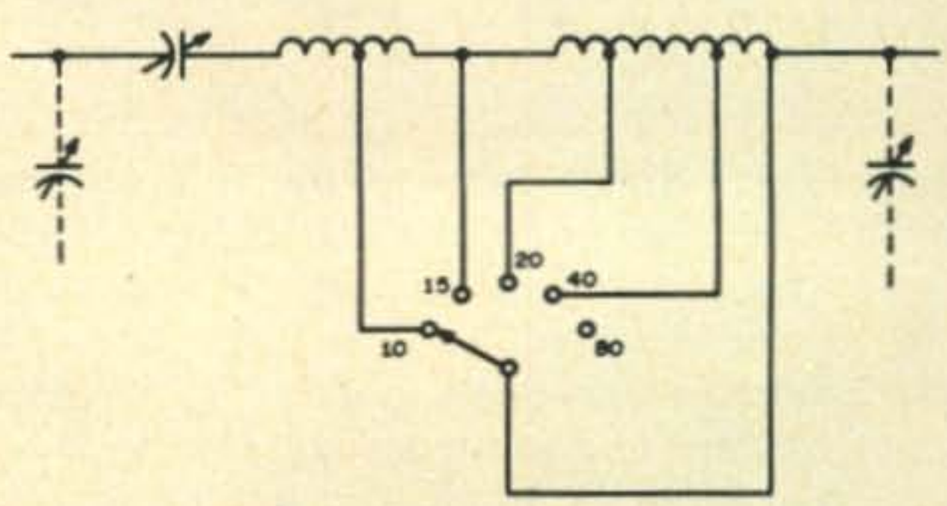


Fig. 3—If more than 5 or 6 tubes are used in the linear the normal pi-network coil used in fig. 1 will have to be replaced by that shown above. Some experimentation is necessary to find the best tap positions, depending upon the number of tubes used. The series capacitor should be approximately 500 mmf for ten 6HF5 tubes.

tween the two aluminum angle mountings. The molded sockets commonly available do not provide this feature as well as having no ground connection tabs.

There is nothing extremely critical about the tube circuit wiring except that the grid leads be kept as short as possible and that the bypass capacitors be connected from the socket pin to the nearest ground tab on the socket. As shown in the photograph, two feedthrough insulators are used; the one in the center for the grid circuit r.f. input and the one at the end for the filament lead since the heavy 9 ampere lead from the power transformer is too heavy to be connected to a socket pin. The hookup wires for the bias and screen voltages are wired directly to the appropriate socket pins. The 100 ohm screen parasitic suppressors and the r.f.c. in the grid bias circuit are connected between socket pins utilizing the No. 2 and 7 unused pins.

Power Supply

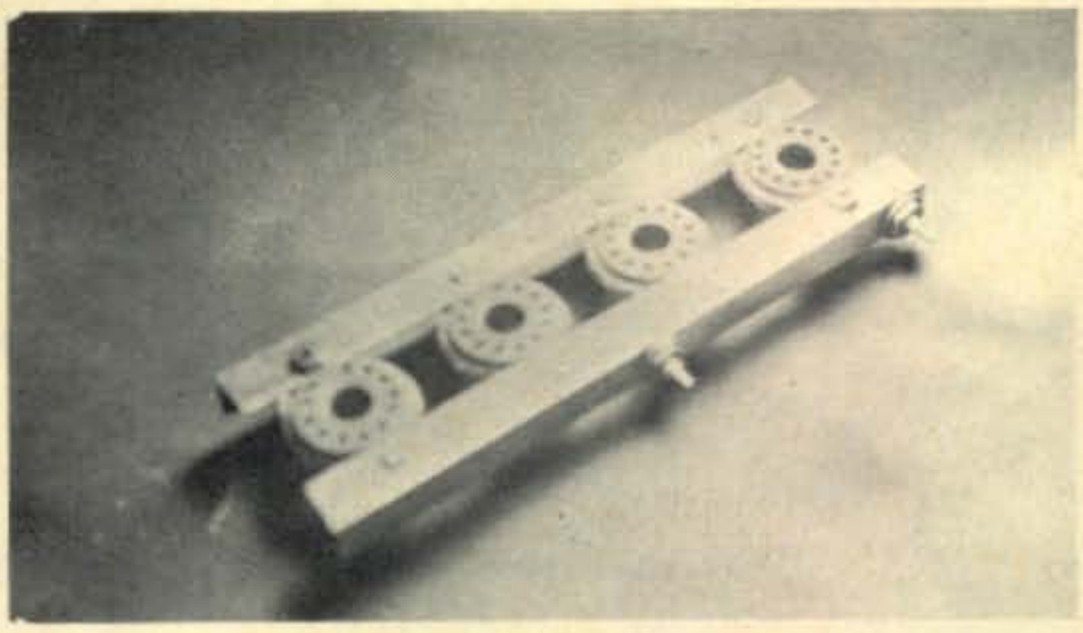
The power supply components are all mounted between two 12 unit terminal strips. The exact terminals used will depend upon the size and type of components used but they all should fit easily on the two terminal strips. A sketch to plan the wiring will quickly indicate which terminals to use. No equalizing resistors or capacitator voltage spike suppressors are used across the power supply diodes as suggested in the original Shoebox article. The cost of such components usually exceeds that of the diodes they protect and comcercial designs use 7 to 8 diodes in series without any difficulty. However, if desired 0.01/1 kv disc capicitors and 560K, 1 watt resistors can be connected across each diode.

Wiring

The wiring of the complete linear is extremely simple. The power supply terminal strips and the tube sockets are pre-wired. The relay and pi-network circuit components are mounted and wired in place. The power supply components (transformer and pre-wired terminal strips) are then mounted and wired to include the front panel controls. Finally, the tube socket mounting is installed and the remaining inter-wiring completed.

Testing

Testing of the linear should proceed by first disconnecting the filament lead from the tube socket mounting and with the power turned on checking that all voltages from the power supply are correct. With the tube filaments energized but with no drive applied the bias potentiometer is adjusted to produce a cathode current of approximately 25 to 30 ma per tube (about 100 ma for four tubes). If this value cannot be obtained, one of the power supply voltages is incorrect and should be corrected before proceeding further. Still without drive, the plate and



Four Compactron sockets are mounted together between to sections of ½" by ½" aluminum angle stock. Feedthrough insulating studs supply filament and screen voltage to the assembly. Sockets are prewired before installation.

loading variable capacitors should be turned through their entire range for each setting of the bandswitch to check for parasitics by noting any change in cathode current. If any are noted, the plate parasitic suppressor coil should be adjusted until they disappear.

With drive applied (c.w), a cathode current of about 175-200 ma per tube (approximately 750 ma for four tubes) should be obtained with the output circuit resonated. The cathode current meter swing with s.s.b. modulation depends upon the meter movement characterisitics, but will be about 100 ma per tube. The allowable meter swing for maximum output without distortion can only be checked properly by a two-tone test or careful on-the-air check using a receiver with a panoramic adapter.

Thanks are certainly in order for those who wrote about the original Shoebox article. Hopefully, this article has further clarified some of the construction procedures used and by use of improved design made the linear more appealing as a relatively simple construction project. ■

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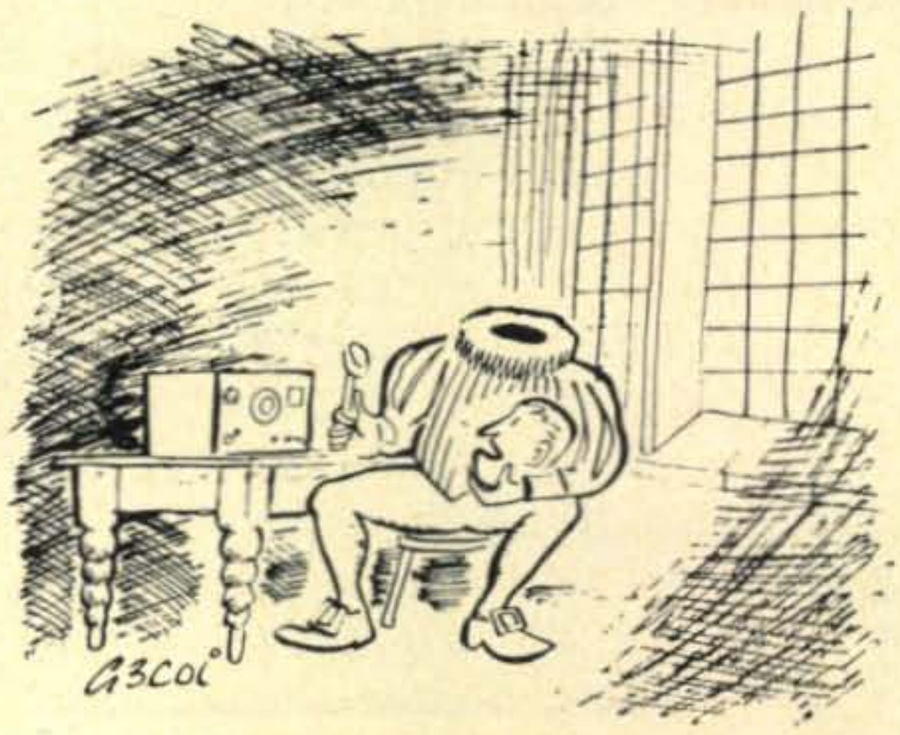
by... **G3COI**



". . . and the antenna here is a skeleton slot . . ."

Evaluating An Antenna

BY KEN JUDGE GLANZER,* K7GCO

The author outlines methods of evaluating an antenna with and without special equipment.

IN MOST cases evaluating an antenna is apt to be a difficult task for amateurs who do not have the proper equipment and/or antenna knowledge to properly interpret their findings. Trained engineers are often hesitant to make claims on certain antennas (unless they are in the advertising department) because they are well aware of the many variables that control their performance. In general, the simpler an antenna is, the easier it is to evaluate.

E and H Planes

To do a thorough job of research on an antenna, it is necessary to be able to measure an antenna's *E* plane and *H* plane patterns, graphically. The *E* plane is the same plane as the elements (horizontal pattern of a horizontal beam) and the *H* plane is the plane perpendicular to the elements (vertical pattern of a horizontal beam). If an antenna is mounted reasonably in the clear, the horizontal pattern is easily measured and a study of the pattern will reveal much information about the antenna.

Perhaps the most important pattern of a horizontal beam is the vertical or *H* plane. The sharpness of this pattern determines how little r.f. energy is directed in the higher angles of radiation and also the final angle of radiation for the main lobe for a given antenna height. It can be said that the higher the gain of a yagi antenna the sharper the pattern in the *E* and *H* planes and the less effect surrounding objects to the side and rear will have on the antenna's pattern.

*202 South 124th, Seattle, Washington 98168.

An effective way to measure the *H* plane of a yagi is to mount the antenna vertically polarized as illustrated in fig. 1. The *H* plane now is the horizontal pattern. A vertical pick up antenna must be used in plotting the pattern. The simplest method is to use a diode to rectify the r.f. voltage from the pick up antenna and a microammeter to register the current at different increments of rotation and plotting the pattern on polar graph paper. A graphic recorder is the most accurate and fastest way of plotting patterns. Varian Graphic Recorders are widely used in many antenna laboratories for this work.

Most of this is beyond the average amateur. Even if one could measure all the patterns, then what? Trying to improve them is another task that would require much antenna knowledge. The amateur has to accept the commercial antennas as the best available or if he builds his own he is limited by the design data that some one else has found. Unless this data is taken under ideal conditions there is no assurance it is valid. The antenna designs of many manufacturers often differ and even contradict each other. In some cases the antenna designs and performance of some amateurs is far in advance of the commercial field. Research and development is costly and although much research is being done, there is still a tendency for the manufacturer to stick to the tried and proven antennas. Hairpin matching for one band is not new but a two or three band device such as the "Beta" match was the result of much research.

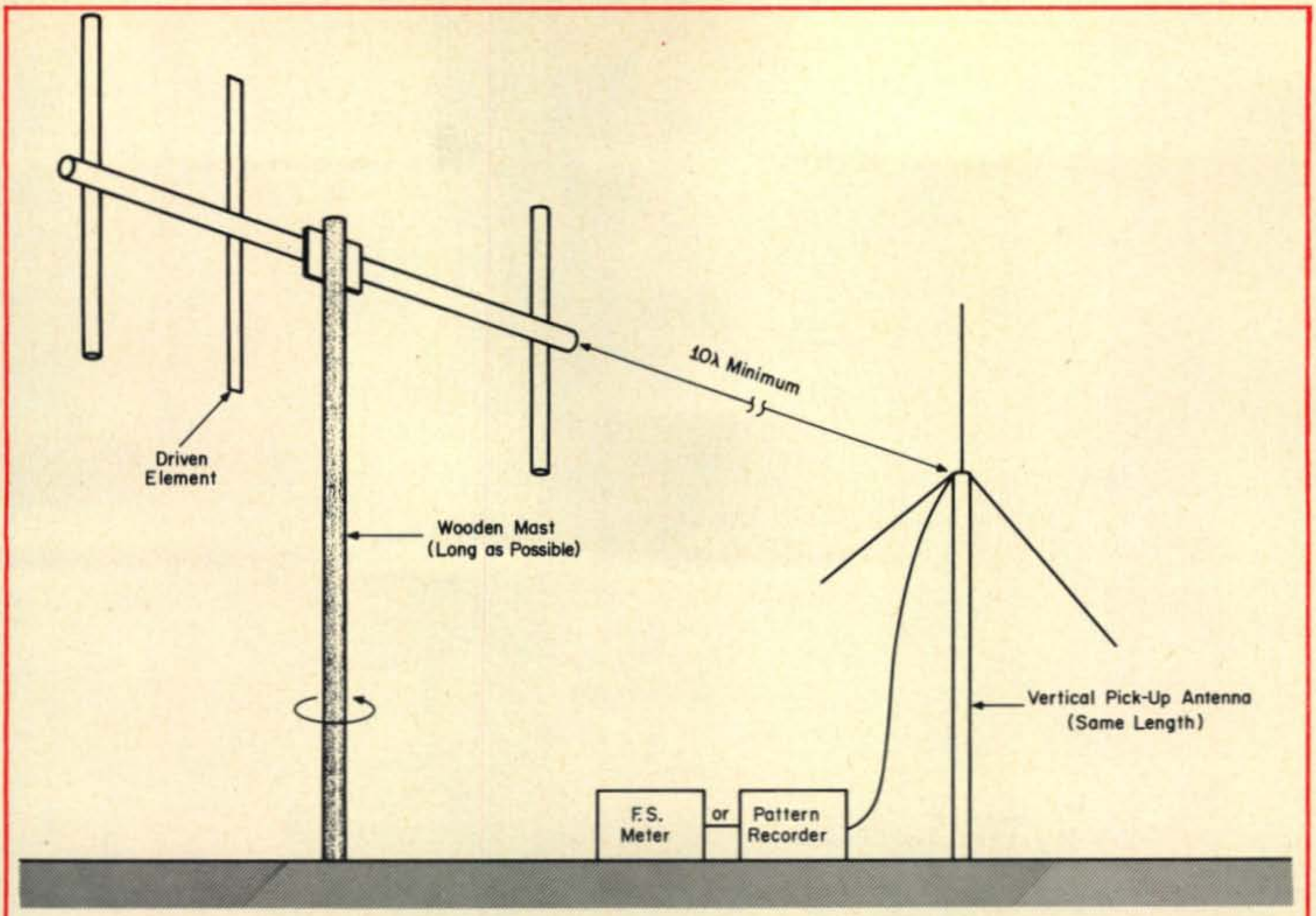


Fig. 1—Suggested method for measuring a Yagi H-plane radiation pattern. When the Yagi is placed vertically, as shown, the H-plane is horizontal. This procedure is best done with antenna models on two meters or higher. The Yagi is mounted on an unpainted wooden mast that is as long as possible (Do not use silver maple or iron wood for the mast.) The higher the gain the sharper the vertical pattern which is so important for low angle DX performance. The generator or transmitter should be transistorized and mounted at the feed point of the folded dipole driven element.

What can the amateur do to properly evaluate an antenna without elaborate equipment? A thorough understanding of the antenna's characteristics is the first step.

There are several characteristics to look for in a yagi. The maximum gain of a full sized, optimum spaced, 3 element is about 7 db according to several reputable authorities such as the two who invented it back in 1929, Yagi and Uda. This is shown in their Antenna Handbook and has been subject to much dispute by some but no evidence or legitimate data has even been produced by anyone to show otherwise, just talk. There are so many variables involved in the measurement that this will probably be in dispute for some time. There is *no* disputing, however, of the characteristics to be described.

Gains vs. F-B Ratio

One characteristic of a yagi antenna is that if the antenna is tuned for maximum gain, the front to back ratio is not maximum and visa versa. The front to back ratio can be as low as 15 db under maximum gain conditions. As a result many manufacturers tune their antennas for the best front to back ratio or some compromise inbetween, being fully aware of the gain loss.

When an antenna is rotated, the front to back ratio is much more apparent and dramatic than the forward gain of the array which is not easily measured. When tuned for maximum gain the beam width of the forward lobe is only a few degrees sharper than if it were tuned for the best front to back ratio and this small difference is often difficult to detect. If the antenna is tuned for the best front to back ratio, a 10 to 15 db improvement may result in only 1 db gain loss from the forward lobe.

Bandwidth

The bandwidth of a yagi tuned for maximum gain is very sharp. The s.w.r. will rise very fast on either side of resonance and limit operations to one section of the band

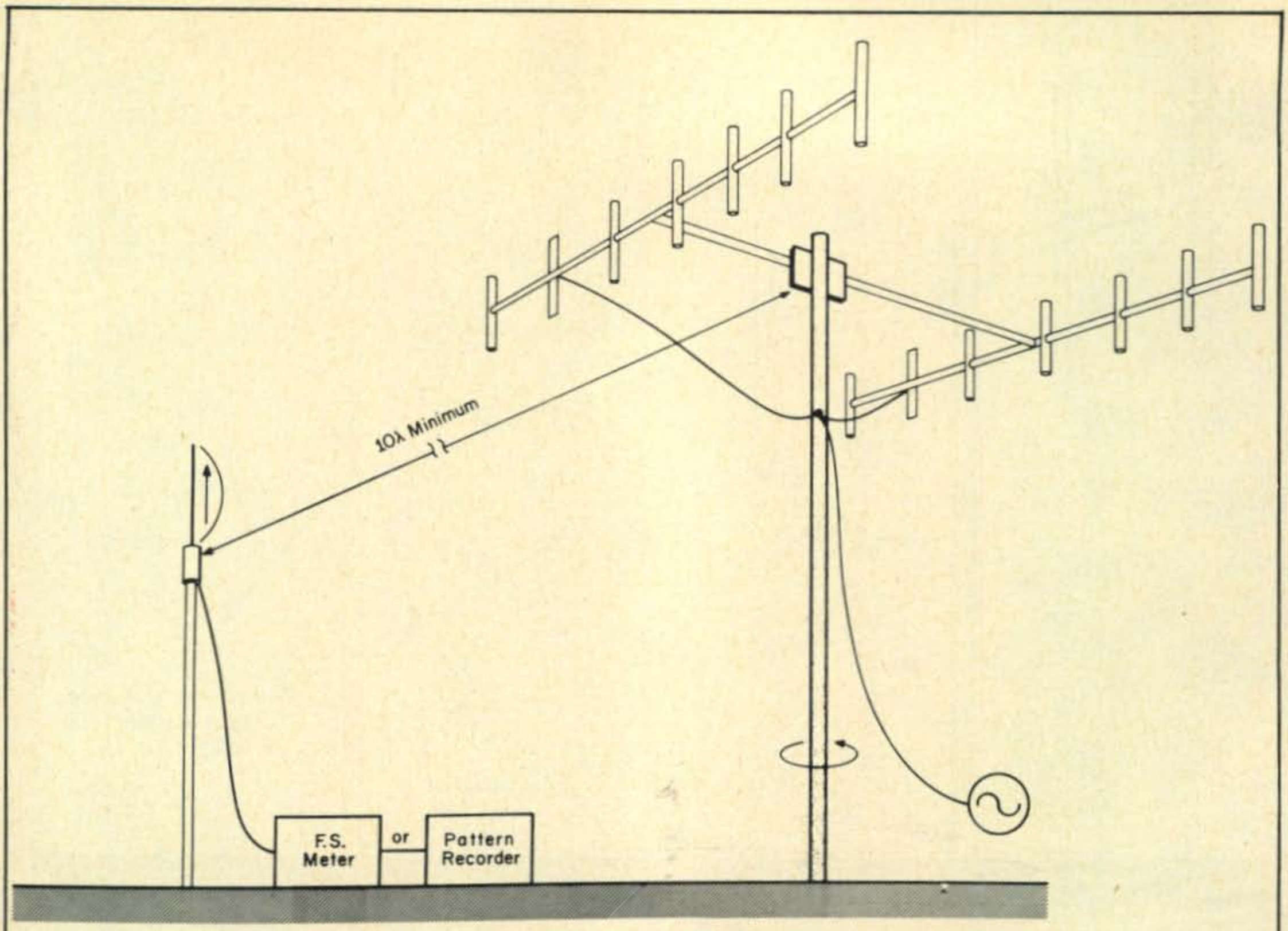


Fig. 2—Optimum spacing of stacked multi-element v.h.f. Yagis can be determined by this pattern measurement. Adjust the spacing for the cleanest horizontal (H) pattern. The optimum spacing is dependent on the gain of each beam.

such as the c.w. portion. As the beam is detuned for maximum front to back ratio the bandwidth improves substantially. The bandwidth is an indicator of how the antenna is tuned. If the antenna elements are detuned beyond the maximum front to back settings the bandwidth improves even more which in some cases is desirable such as on 10 meters. However, both the front to back ratio and gain settings suffer even more.

Impedance

The impedance at the center of a split driven element, when the antenna is detuned, approaches 50 ohms which will provide a direct match for coax which is another advantage. The early (and some of the present types too) tri-banders used this principle of matching.

The impedance at the center of the driven element of a 3 element beam properly tuned for maximum forward gain will average around 10 to 15 ohms. It will be 15 to 25 ohms for a beam tuned for maximum front to back ratio. The most popular matching techniques used for matching the feedline to the driven element are the gamma. T, folded dipole quarter wave matching stub, and hairpin match. Unless a beam has one of these matching systems it cannot be tuned for optimum performance for a particular boom length. A balanced feedpoint must be fed with a balanced feedline and an unbalanced feedpoint must be fed with an unbalanced feedline for top performance.

Boom Length

The boom length and/or the spacing of the elements has much to do with the gain and bandwidth of the antenna. Any boom length for a 3 element beam that is less than 0.25 wavelengths will place the antenna in the compromise category regardless of how it is tuned. Experiments have found that boom lengths of 0.34 to 0.37 wavelengths are necessary in order to develop maximum gain. Also, the greater the spacing between elements the wider the bandwidth.

Elements

The larger the number of elements the higher the gain and of course the larger the antenna becomes. Anything beyond three elements increases the support and rotation

problems substantially. The bandwidth decreases even more with the extra elements and some detuning is generally employed to maintain a reasonable bandwidth but this again defeats the purpose of the extra elements. If tower and rotator are available to support the antenna, the extra elements even in a slightly detuned state can perform exceptionally well and will often justify the installation.

General

Increased gain is not always the answer to maintaining a high communication percentage as compared to the distinct advantage of a flexible angle of radiation system such as obtained from stacked beams and the ability to switch between them individually or both together for a sharper vertical pattern and additional gain. This also gives three different angles of radiation for transmitting and receiving and has great advantage in DX operation. The switching harness that permits this is described in Chapter 3 of the author's Antenna Handbook 1.[1]

With the preceeding information the amateur can analyze any beam antenna to a high degree of accuracy without elaborate equipment. It should help to clear many misconceptions.

Other Antenna Types

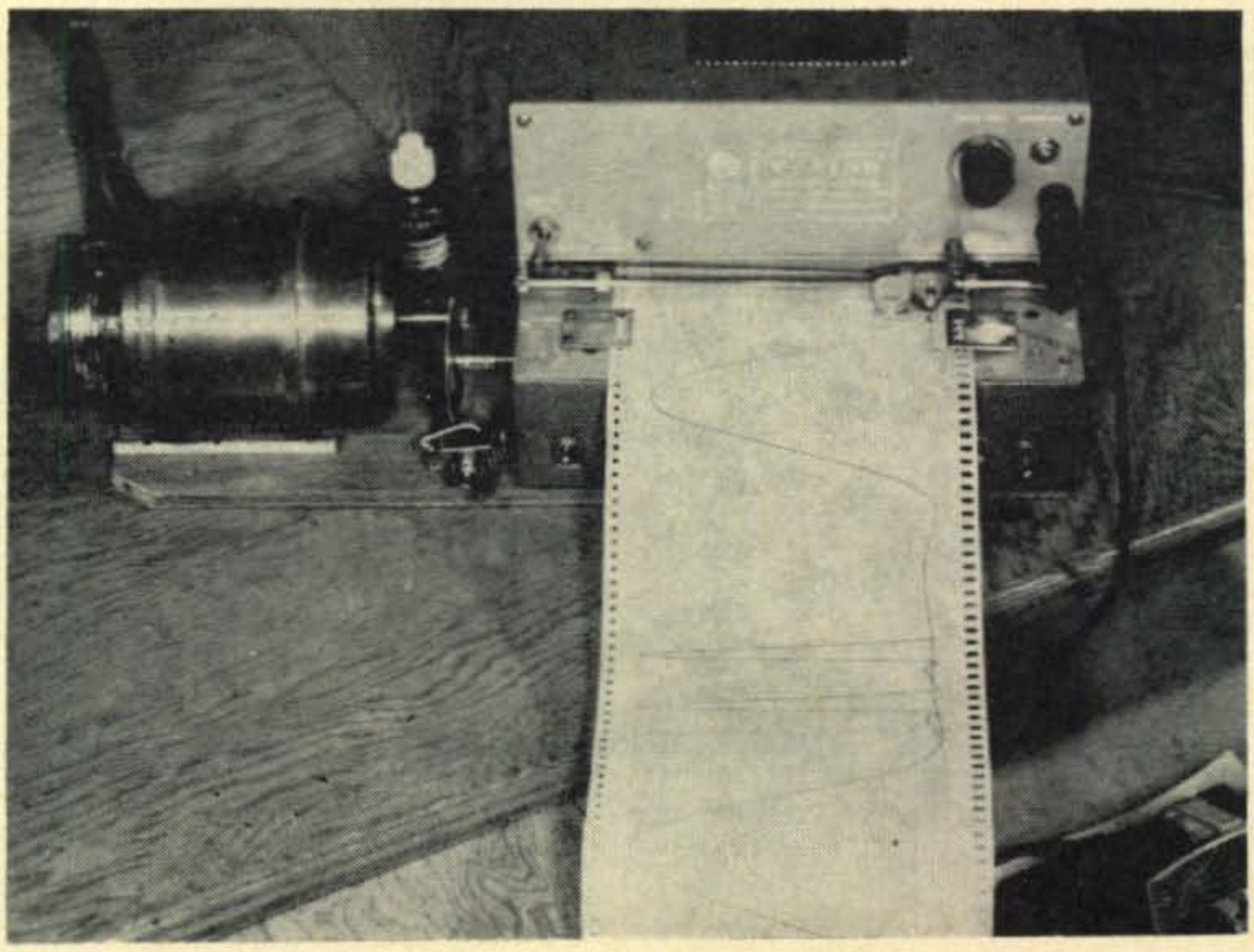
Dipoles and verticals are easy to evaluate relatively, for these are the often used references. There is nothing mysterious or unusual about them. The higher they are, the better they work in most cases.

Verticals are very effective antennas but are frequently installed improperly and unfairly compared to beam antennas on the higher frequencies. On the low frequencies a simple quarter wave vertical is very effective and particularly when two or more are phased together. See the Antenna Handbook Vol II, when released for extensive data on phased verticals.

In 1951 the author started research on the Inverted Vee dipole. The outstanding results a few users were having with it at the time were quite conclusive but hard to explain and the antenna was even harder to promote in many cases. Because of the ease of support and better performance and coverage it provided over the long standard horizontal dipole, it soon caught on, particularly after this author's article in *QST*.

Before any antenna is purchased or constructed for a particular electrical property it should be investigated thoroughly. One of the most interesting phases of amateur radio is trying out a new antenna and to have thoughtfully planned and constructed a well performing array is an accomplishment of no small size but of great satisfaction. It has been observed and experienced many times that the satisfaction one derives from amateur radio is directly proportional to the performance of one's equipment. The antenna is perhaps the most important link in the chain. ■

[1] Glanzer, K.J., *Antenna Handbook, Vol. I*, CQ, Port Washington, N.Y.



View of a Varian Associates graphic recorder that can be used to plot rectangular antenna patterns. The two graphs shown are identical except for the plot speed. The rectangular graphs can be plotted on polar coordinate paper. The selsyn on the left couples to a similar unit on the antenna mast to synchronize rotation.

1967 YL-OM Contest Results

LOUISA B. SANDO,* W5RZJ

HERE are the results of YLRL's 18th Annual YL-OM Contest, held Feb. 25-26 (phone) and March 11-12 (c.w.). Sincere congratulations to WA4HOM, Brenda, for winning both the phone and c.w. sections! (In the '66 contest Brenda placed second on c.w. and third on phone.) Congratulations also to W9LNQ who won first place on phone for the OMs (third place last year) and who placed second on c.w. Winner for the OMs on c.w. was WA9LHH.

YLRL V.P., Marte, KØEPE, who checked the logs, commented that it was a pleasure —so logs must have been in better shape than usual—hi! She adds that if claimed scores were changed, it was because of duplication either in contacts or multiplier. Also, a number of logs could not be counted because rules of the contest were not observed (such as mailing deadline). Marte adds, "PLEASE read the rules when you enter the 1968 YL-OM Contest!" And for this contest she has already provided the dates: Feb. 24-25, 1968—phone; March 9-10, 1968—c.w.

*4417 - 11th St., N.W., Albuquerque, New Mexico 87107.

WA4HOM, Brenda Garlough, made a clean sweep among the YLs by winning both the phone and c.w. sections of the '67 YL-OM Contest.

Top three scores in each category, and the high scores for each district or country follow:

YL CW

WA4HOM	38,625
PY2SO	36,100
VE3EZI	27,375

OM CW

WA9LHH	2,867
W9LNQ	2,544
W1PYM	2,356

YL PHONE

WA4HOM	81,696
WA5NVY	75,240
WAØEXX	65,450

OM PHONE

W9LNQ	3,690
W9LKI	2,430
W1BAB	2,351

Top District and Country Scores

YL CW

K1QFD	20,282
WB2JCE	18,290
W3SLS	10,120
WA4HOM	38,625
WB6CGA	12,555
K8ONV	18,954
W9MLE	11,685
KOZSQ	8,062
VE3EZI	27,375
PY2SO	36,100
VK3KS	8,731
SP6AZY/YL4	4,972
ON4QP	1,680
YU1JDE	1,080
G2YL	244
OK2BBI	101
JA4EHI/YL	45
OH2YL	31

YL PHONE

W1RLQ	41,856
W2OWL	11,752
K3WAJ	15,183
WA4HOM	81,696
WA5NVY	75,240
WB6CGA	40,170
K7MRX	2,362
K8ONV	45,962
K9LUI	46,500
WAØEXX	65,450
VE3EZI	38,497
PY2SO	9,660
DL3LS	9,435
VK3KS	3,187
ZS5OB	2,296

OM CW

W1PYM	2,356
W2AAU	2,223
W3HQU	2,146
W4LK	1,720
W5BUK	1,053
W6DDB	1,537
W7RGL	713
WA8KME	485
WA9LHH	2,867
KØOAL	570
VE1AE	1,744
IT1AGA	570
SP8MJ	285
YU1MV	211
OH3MF	192
OK2QX	150
GD3AIM	124
PAØVB	124
HA5KDQ	121
UP2AN	64
OZ1QW	61
OZ4H	61
DL4LA	61
JA2FCR	52
LA6U	50
UP5TQ	16
UH8DR	11
G3WP	5
SM5BDY	2

OM PHONE

W1BAB	2,351
K2RAR	1,125
W3BVL	2,137
WA4WAO	1,488
K5VTA	1,075
W6CLM	180
W7YEX	306
K8YBU	768
W9LNQ	3,690
KØETA	2,120
VE2BYJ	807
VP5RS	594
PY2DBU	56
CR6DX	56

WAØEXX, Betty Lindsay, and OM Jim, WØHTH, at their QTH at Castle Rock, Colo. Betty earned third high score for the YLs in the phone section of the '67 YL-OM Contest.

Brenda Garlough, WA4HOM, who earned top YL score in both the phone and c.w. sections of the YL-OM Contest, has been licensed since 1962. Her OM, Hess, WA4-GCS, is an electronics engineer and has been a ham since '49 (ex-W8ETG, K6YRZ, WØAYK). Their QTH is Huntsville, Ala.

Brenda likes working contests, chasing DX and earning awards. She holds DXCC (260 mixed; 240 phone), YLCC (250), DX-YL (35), WAS (7 mc. cw), 6X6, 8X8, TPA, and needs only JT1 confirmation to complete WAZ, and Georgia to complete WAS-YL. She has 900 counties toward USA-CA.

Besides hamming, Brenda enjoys their 3-year old son, Trey, and she loves to read, play the piano and enjoys expressionalistic art.

Brenda and her OM have been very active in the North Alabama DX Club they started last fall and in all the contests. During the phone section of the YL-OM Contest she used a TR-3 and Henry 2-K. In the c.w. section she used a 75S-1 and Navigator with final using 5763's. Antennas are 2-element Quad at 70 feet and verticals on 40 and 80 meters. Brenda lost an hour of prime contest time when the shield of the coax came loose and made intermittent contact with the Quad, but she still came out on top!

Betty Lindsay, WAØEXX, who placed 3rd among the YLs on phone in the YL-OM Contest, started hamming as a Novice in Jan. '63 and got her General that July. Her OM is Jim, WØHTH, and they chose their QTH for an antenna farm, on a ridge near Castle Rock, Colo., where they have a view of over a hundred miles of the Rocky Mountains. They have two towers 170 feet high with Quad antennas for 10, 15, 20 and 40 meters. (Betty adds she has often been Jim's sole ground crew—in rain, sleet, snow and wind—pulling up full-size elements for the Quads!) Their main interest is chasing DX and working the contests.

Betty is president of the Colorado YLs and is deep in plans with the club for the 1968 YLRL Convention to be held in Denver. She also is custodian for the SYLver DOLLar certificate.

Aside from ham radio, Betty and Jim have one daughter and four sons ranging in age from 8 to 18. She adds that when the bands go dead they work on their house, which was unfinished when they bought it.

Congrats to all who took part in the contest—and remember those dates for next year. ■

BY THE WAY...

Ever wonder where the "Coast Guard Net" originates from? Here's a glimpse of the Coast Guard amateur station, K4CG, located in Alexandria, Va. Manning the station are, l. to r. Frank Valliant, KL7EGA, V. C. Clark, W4KFC, Dallas Carter, K3-WUW, Commander Jack S. Thuma, Commanding Officer, U.S. Coast Guard Radio Station, Commander Charles Juechter, Executive Officer, and Robert Phillips, RM1C, WA4WJJ. If you are interested in participating in a Coast Guard MARS program contact them at: Coast Guard MARS Radio Station, 7323 Telegraph Rd., Alexandria, Va., 22310, *(U.S. Coast Guard Photo)*

Some Day We'll Build A Home on a Hilltop High, You and I....

BY SYLVIA MARGOLIS*

EXCEPT it won't be on the top of the hill, more on the side of the hill. On the top of the hill will be the antenna tower.

Christmas is a dismal season for radio amateurs. All kinds of social obligations get in the way of the proper pursuit of the things that matter. There are family gatherings, an enforced and unappreciated surfeit of togetherness, where they talk of trivia like birth and marriage and funerals, with not a word about Incentive Licensing or who's going to get to Rockall first. You can go sometimes a whole day without a QSO, because you are surrounded by relatives and you have to eat formally at the table, not at the rig, and Junior wants somebody to show him how to run his new electric train set. Money must be spent, not on sensible things like panadaptors, but on frivolities like extra food and gifts for Aunt Agatha and Cousin Willie. Suggest that Aunt Agatha might prefer an oscilloscope to that cashmere, and that both Cousin Willie's conversation and his blood pressure might be improved if you were to substitute a new Callbook for that bottle of Old Grandad, and you are marked down as antisocial, one-track-minded, obsessionist.

If you contribute something constructive to the festivities, like inviting a few of the local Boys and their wives to the family party, all the amateurs will congregate in one corner of the room, whilst the wives sit in inimical silence, like a QSO where the participants never get onto the same band, let alone the same spot frequency.

Christmas trudges over the niceties of life with convivial insensitivity.

Comes New Year and it's even worse. Everybody wishes you HAPPY NEW YEAR. Nobody wishes you top scoring in the *CQ*-DX Contest, or may you win the door prize at the London S.S.B. Dinner, or may the VR6 call you first. January is dark and cold and what you thought was a hangover turns out to be flu. The bills come marching in and you get to wondering how four people can have used all that electricity, unless they have been secretly arc-welding a tower capable of hoisting a monolithic 160 meter beam several wave-lengths above ground.

Life is real and life is earnest and it's weeks before the first contest is due and the night the ZM7 came up was the night you were running a temperature of 103°, 5/9!

Suddenly it's Spring—and your signal goes up two S-points. Spring does funny things to people, some of them rather rude, unless they are radio amateurs. Not that radio amateurs' hormones don't react to the rising of the sap, the chirping of the birds and the

*95 Collinwood Gardens, Clayhall, Ilford, Essex, England.

Rather extraordinary real estate agent's notice outside an early nineteenth century cottage for sale in the village of Buntingford, Hertfordshire.

buzzing of the bees. They react alright, like any other red-blooded characters', but they react kind of differently. Spring starts radio amateurs on the eternal quest for fulfillment that is bigger-than-either-of-us-darling. Every Spring radio amateurs get the urge to move house.

In itself this is a laudable reflex. Self-improvement is a basic instinct of the capitalist society and very nice too. It's only people who don't have things who condemn those things!

The radio amateur, being human (more or less), loves status symbols, as well as the next man. At least, he loves the status symbols of amateur radio—mobile before mink, sideband before swimming pool, DX before diamonds, third receiver before third automobile, linear before love life.

So every Spring he looks round and discovers that, whereas the little nest he built for his bride was good enough for *her*, it's not a satisfactory setting for a radio amateur. The kitchen might measure three yards by four and that should be sufficient for any woman. She only need spend four hours a day, 365 days a year, there. If it's a mite cramped, she can always diet. But what about the dimensions of the shack? Can the shack truly be said to be large enough for its purpose? Is it properly heated, air-conditioned? Does it face the sun? Is it sound-proofed, so that the noise of the family's activities and the clatter of the cat's hooves don't block out that 5:1 rare contact?

And is the house situated in a desirable neighborhood. How about the elevation? And the take-off? And the water table? Are there neighbors? Do they waste their time watching television or do they utilize it sensibly and constructively, not relying on piped entertainment, but making their own music (*pianissimo*), uncontaminated by the virus of mass communication? Do they properly appreciate the beauty of the tower and the beam and the dipole and the v.h.f. antenna and the rhombic, or are they unfeeling vandals, Yahoos who demand unbroken views of the mountains and lake?

Every Spring the radio amateur gets ants in his pants and goes to look for the perfect shack, with a home attached. This is what my radio amateurs do. Sometimes they are motivated by hints from the neighbors, like the time they lowered the tower one March Sunday morning, to check, clean and grease the motor. A neighbor, walking his poodle past the house, stopped in astonishment at the momentarily altered skyline.

"Are you going to move house? How sorry we'll be to lose you. It's been so nice having you. When will you be leaving? Oh, you're not leaving. . . . !" Or it may be the paintbrush syndrome, a serious condition which affects married couples. Spring shows up all the dingy paint and wallpaper and the husband's eagerness to decorate the house declines in proportion to the Spring-cleaning gleam in his wife's eye. It's preferable to move to a new house than to waste good transmitting time redecorating the old!

Years of research and yearning have produced the specification for our ideal home, for its location, construction, facilities, utilities, furnishing and DX propensities. In this we are inspired by the example of how G3BID, Edgar Wagner, discovered "Greenbanks."

He searched for years for a seaside cottage. It had to be on the beach, isolated, yet

"There's a lot to be said for an old house. . . ." (Tower of London)

"The location must be rare. . . ."

within reach of civilization. He advertised several times in the Personal Column of the *Times* and at last he drew up a short list of cottages to be viewed. Then only one cottage remained. He drove there with the owner. This was in the days when only portable operation was allowed in U.K., not mobile.

They bumped up to the cottage along a rutted shingle beach track, two miles from the village of Abbotsbury, in the county of Dorset on England's south coast. The place looked pretty enough and seemed to fill all the qualifications Edgar demanded, but the most important feature had to be ascertained. What was its DX potential? Edgar had the owner help erect a makeshift antenna, then he put out a CQ from the portable rig on the back seat of the Bentley. Back came a W, 5/9. As Edgar signed another W called. They were just signing when an SM broke in:—"Hello, Edgar, I didn't know they were allowing G's to use a kilowatt now!" "Kilowatt be blowed!" replied Edgar, "I'm running 25 watts with a portable rig on the back seat of the car to a piece of wire. The end of the wire is being held by the owner of a cottage which I'm thinking of buying. Before going inside the house I had to test its DX propensities. . ." "Don't hesitate any longer, Edgar!" yelled the Swede, "BUY at any price. . . !" and Edgar snatched the antenna plug out of its socket!

"Greenbanks" is the perfect QTH, not because of the beauty of the setting and the still unspoilt character of this remote English countryside, but because the nearest neighbor is far distant and there is enough room for V-beams in every relevant direction.

There was a legend that G2FUX, Frank Fletcher, had carried out similar investigations before having his home built in Ringwood, in Hampshire. It was rumored that the architect was instructed to design a house round a tower, which would go up and down through the roof. Despite my attitude to money, which is abjectly sentimental, I stinted nothing in my search for the truth on behalf of CQ readers and invested 25 cents in a long-distance call to Frank to ask him about it. A legend it is, but it makes a pretty story and one I'm going to stick to.

Once we thought we had found a place like Edgar's. I had some inside information about the sale of an old Church of England rectory in a rural area 20 miles from London. That weekend we had a houseguest, K2GYY, Philip Margulies, who had dropped in with a friend, en route to Europe. It was a beautiful day, the day that year we had our Summer. "Let's go for a picnic," they suggested, so we packed lots of food and Phil showed us how to make iced tea. British refrigerators are small and don't produce much ice, but, to humor him, we borrowed ice from all the neighbors (those that didn't get TVI) and let him play about distilling the nasty stuff, whilst secretly we packed some flasks of real tea, boiling hot, to be drunk with milk, the best refresher there is when the temperature tops 70.

The rectory was set in an acre of parkland. Maurice put out a CQ from the mobile and back came a VS6, so that was O.K. We had to get inside without disclosing that we knew about the sale. "You're history students and you are studying old houses!" I told my guests.

The Vicar was delighted to see some company, because he didn't get many callers, the location being *deliciously* isolated, and certainly not many American history students studying old houses. It was his pleasure to show us round his home.

It was built in 1714, but one wing dated back to the early 16th century. There were 23 rooms and 6 in the old part were no longer used. With their chilly, flagged floors, low ceilings, tiny windows and reluctance to concede anything to the principles of comfort, it's no wonder that people in the sixteenth century who had to live in houses like this set sail for North America, where they could expect central heating, regular plumbing and 110 volts.

The house offered possibilities beyond the dreams of any amateur. Each member of the family could have not only a bedroom, but a living room too. There could be whole suites of rooms for visting amateurs and now that we have reciprocal licensing the guests could enjoy the ultimate hospitality of a private rig, as well as a G5+3 callsign. They

could even choose from the V.H.F. Suite, the 10-15-20 Suite and the 75 m. Suite—Texas in rural Essex.

The Vicar's little daughter was thrilled with our visit. "I'ts a lovely house," she crooned, "you can paddle in the cellar in winter and there's ever such a lot of micies and Daddy and I don't tell Mummy because we don't want to frighten her, but there's a ghostie too!"

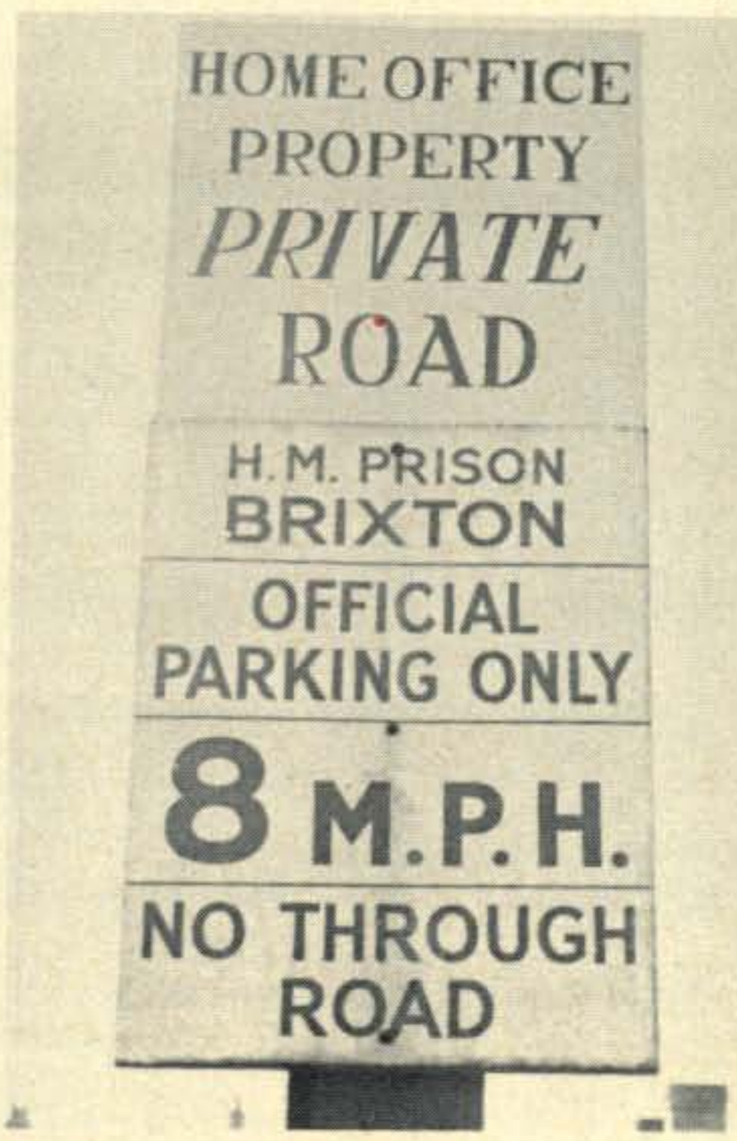
Yet there's a lot to be said for an old house. An old house is a soothing place to be. Within its walls you get to thinking objectively of all the generations it has sheltered, with their centuries of concern with the essentials problems of life—love, money, death and s.w.r.—and your own worries recede proportionately.

Britain abounds in old houses, because we never throw anything away until it falls down. But a good old house is rare, because the real peachey residences are bought up as soon as they come onto the market by Americans, either to use *in situ,* by misguided Anglophiles, or by people who need a permanent U.K. address to go with their G5+3 callsigns, or to ship, stone by stone, memory by memory, woodworm by woodworm, ghost by ghost, Stateside.

Our shack will be halfway up a hill, with the antennas on the top of the hill. The hill will rear up out of marshy ground, like the one that George Pearson, G3AWZ, lives on in Somerset, and we all know what kind of a signal he puts out. The marsh is important. It appears there is a vital factor in amateur radio real estate called the "water table." Far from being an alcoholic's nightmare, the water table—its presence or absence—contributes tremendously to the character of a radio signal. Edgar Wagner, who is one of the world's authorities on mobile operation, with a mobile score confirmed of over 160 countries as G3BID/M, recently had some of his best operation as ZD3F, parked in a mangrove swamp in The Gambia, than which you can't get a bigger (or would it be deeper, or perhaps wetter?) water table.

We proved this for ourselves when we took the trailer to Sussex, which county is a kind of back yard for London. It has, in miniature, delightful scenery, a wealth of quaint villages, inhabited by writers, artists, actors and tycoons, and, on its south coast, the glittering, glamorous, exciting, incomparable city of Brighton. Behind Brighton lie the South Downs. With true British logic, the *Downs* are *Ups,* a range of chalk hills, on one slope of which we parked the trailer. About 100 feet below was the marshy valley of the little River Adur. 100 feet above was a bare ridge, with windswept trees and cattle standing on the skyline like statues in the first scene of *Oklahoma.* We expected hordes of Indians to whoop over the rise in war bonnets, but it would have been quite alright because radio conditions there were so perfect that a MAYDAY would have fetched in the U.S. Cavalry in no time at all.

The takeoff was fantastic. Using the mobile rig, a Drake TR4, barefoot to a



Three ways of achieving the privacy that every radio amateur desires.

"The perfect home. . . ."

Mark Mobile HW-3 triband helical, 300 watts p.e.p., we worked every call area in the U.S. and most of Canada. The W1's, 2's and 3's on 15 and 20 came in like 2 meters. In the mornings JA's, VK's and ZL's on the long patch were calling us. We worked all Continents in 2 hours 40 minutes, which must constitute a world record from mobile installation. Exotic DX included TY, CR4, KL7, MP4, EL2, ZF1, HI8 and UA2. There was a mobile to mobile contact with a CT1 and several good 80 m. QSO's with W1, W2 and VE1 on 80.

The exact location of this QTH will remain a secret.

It really works, this water table thing. We were driving W3ASK, George Jacobs, around London one night and there didn't seem to be much around, so we drove half a mile away, into Hyde Park, where we stopped by the lake, which is called the Serpentine. Signals came up as we approached the water as steadily as if somebody were turning up the gain control. Once at the lakeside George was working the W's on 15 and 20 as fast as we could log them. George was very excited about this and about the other cars parked round us, in the dark. They were being used for activity other than amateur radio, but George can't be blamed for taking an interest in what they were doing. After all, he is *CQ*'s propagation expert.

Our Home on a Hill will be isolated, dissociated from overhead power lines, telephone wires, trolley cars, factories with r.f. welding plants, hospitals with X-ray apparatus and all other manner of evil and, of course, at least 500 yards from the nearest neighbor.

Not everybody can be as lucky with neighbors as G3KZI, Joe Steele. "I had three cases of TVI," Joe claims, "but one died and the other two moved house!"

K4BJO/G5AFA is bugged by this problem. He lives in a seaside village in England which is inhabited almost entirely by retired gentlefolk, with TV sets that should have retired with their owners. "Trouble is," says Bill Brady, "I feel sorry for them if I break through, so I never transmit, only receive."

Sometimes you can land a real lulu, like the man who called us:—"Are you voice-casting?"

"I beg your pardon."

"Are you voice-casting?"

"Sorry, I've no idea what you mean."

"My dear young lady," (at least the use of the word "young" spoke in his favor) "I've been in communications all my life and "voice-casting" is the correct term to use for radio transmission. Now, tell me, are you voice-casting on morse?"

Bedazzled by this display of know-how in communications I yet remembered the first ploy in the TVI-game. How long had we been voice-casting on morse into his television set?

"Eighteen-and-a-half minutes." was the relpy.

With this one I can see we're gonna have trouble—a TVI complainant who is a communications expert with a stop-watch yet!

Even radio amateur neighbors can be a nuisance. We live in densely packed suburbia. In one acre there are five amateurs, with three high-powered s.s.b. stations. The only solution is to hunt the DX in packs, liked by a 2 meter net to avoid chaos.

So now we have our isolated home halfway up a hill in the middle of a mangrove swamp. But the location must be rare, so that lands us in the middle of the Gobi Desert or in the one corner of Tristan da Cunha where nobody goes, not even sheep—or *anywhere* in Wyoming.

But desirable as isolation and rarity might be, we must be near enough to civilization for the boys to go to school until they have learnt enough math to work out permutations of Ohm's Law, if nothing else. And we must be on the admirable London Transport Underground system, so that overseas radio amateur guests can reach us easily (see "Not Over Our Transmitter You Don't Say Drop Dead"—March *CQ*.). This limits us to within ten miles of Piccadilly Circus. Besides, we couldn't bear to leave London, not because of any sentimentality, but because of GMT.

[*Continued on page 110*]

DX

BY JOHN A. ATTAWAY,* K4IIF

Awards

The following have qualified for *CQ* DX Awards during the preceding month:

WAZ-CW, Phone: DL8KJ, DL9NI, K4SHB, K7PJF, LA9CE, ON5DI, SM7IA, VE6IN, W4HOS, W8ACT.

WAZ-SSB: DL1EG, EL7FT, SM5LM, W5KUC.

SSB DX Award: W5KUC.

SSB DX Endorsements: W8EVZ (50-250), I1AMU (200-300), K3BNS (150), W5KUC (300).

WPX SSB: CT1KT, K4GXO, K4IIF.

WPX CW: SM7BHH.

WPX Phone: LU1DJU.

WPX Endorsements: CW—W4OPM (700), WB2FMK (500), W2IP (350). Mixed—W4OPM (750), G3HDA (600). 21 mc—G3HDA. 7 mc—G3HDA. Africa—WB2-FMK, I1AMU. Europe—I1AMU. Oceania—G3HDA. SSB—I1AMU (450), CT1KT (250). Special Contest Endorsement—WA2-SFP (280).

DX Editor Away—Please Hold Correspondence

Just a short reminder that K4IIF is away from the home QTH on business. He will return home on July 24 and will answer your letters as promptly as possible after his arrival.

The DX Hall of Fame

CQ will shortly be introducing a new award—membership in the DX Hall of Fame. This honor will not be readily available to a comparatively large number of individuals as are the WAZ and WPX Awards. To be a member of the Hall of Fame a DXer must have made some major contribution to the sport of DXing which has stood the *test of time*. Consequently, there will be only a small handful of members. The *CQ* DX Awards Advisory Committee, composed of dedicated DXers from coast to coast, is presently considering several outstanding individuals for membership, and the first man to be honored with this distinction will be announced in an upcoming issue. The DX world is invited to nominate individuals for the committee's consideration. Nominations must be signed by at least 10 DXers all of whom must hold either WAZ or WPX. The WAZ or WPX certificate number should be included with the signature.

*P.O. Box 205, Winter Haven, Fla. 33881.

VK2AVA/Lord Howe QSL Manager

In the May column we printed a letter from Arie, VK2AVA, in which he indicated that he might confirm the cards for his Lord Howe Island DX-pedition from his home QTH. This letter was dated January 10, and since that time plans have changed. *All* cards should go to WA2RAU *only!* Cards sent to Springwood, N.S.W. will *not* be answered, and if sent can be forgotten. The address for WA2RAU is Dr. Sam Rosen, 39 Old Orchard Road, New Rochelle, N.Y.

WA2RAU is the gentleman who fought successfully for the right to have a ham tower and beam as described in the November, 1965 issue of *CQ*.

Novices

Don't forget to send a self addressed stamped envelope to get your WPNX ap-

A DXer touring stateside, Hans Gabathuler, HB9TE, photographed during a recent visit to K9BPO. Hans' favorite band is 15 meters. (*Photo courtesy K9BPO*).

One of the most sought after DXers in the western hemisphere, Pierre Lameynardie, Jr., FM7WQ, of Fort-de-France, Martinique. Pierre's QSL manager is Joe Hiller, W4OPM, of the CQ DX Award's Advisory Committee. Joe will be happy to help you sked Pierre.

plication blank. WPNX is *CQ*'s new prefix award for Novices only. We are using the standard WPX application form so that the records can be continuous when you get your General ticket and start work toward WPX. We will know by your Novice call that you are applying for WPNX. Remember, if you plan to compete for certificate No. one you must send your 100 QSL cards when you apply, and all contacts for this award must be made after 0000 hours GMT on May 16, 1967. Cards and applications for WPNX should be sent directly to K4IIF, P.O. Box 205, Winter Haven, Fla. 33881.

De Extra

The soap box this month is occupied by a guest operator, Gay Milius, W4NJF, who has a proposal to make regarding usage of the 20 meter phone band. Gay's proposal makes a lot of sense. Here it is.

"The old order changeth! Several years ago someone set up what has been known as a gentlemen's agreement between a.m. and s.s.b. operators. In substance, the agreement limited s.s.b. to the high end of the 14 mc phone band. I don't know who entered into the deal, but while s.s.b. was an infant there was no doubt about its effectiveness as far as preventing the mixing of the two modes. However, s.s.b. has become a big boy—in fact it has become the giant—while a.m. has dwindled to the point where it is used only by a few diehards.

"As s.s.b. has gained in popularity both in the U.S. and around the world, the s.s.b. operators have slowly slid their operations down to the very edge of the 20 meter band. At the same time many foreign s.s.b. stations have climbed up to the high end of their phone band. Nevertheless, those few diehards who stick to a.m. continue to operate around 14200-210, and their 6 kc or broader signals are causing havoc to innumerable s.s.b. QSO's between DX stations and U.S. stations in that area. At the same time, to cause further complications, the VE's who continue to use a.m. are occupying the high portion of their phone band. (Incidentally, certain VE's refuse to move when courteously informed that they are interfering with rare DX stations.)

"Accordingly, I suggest that U.S. a.m. operation on 20 meters be confined to that portion of the phone band above 14300, thus abrogating the outworn gentlemen's agreement and instituting a new one."

Don Miller Crisis Ends

On May 4, 1967 Don Miller, W9WNV, got his hearing before the ARRL Board of Directors meeting in *informal* session. At the conclusion the ARRL Awards Committee issued its third position paper on the dispute. The highlights are as follows:

1. No DXCC credit will be given for the K1IMP/KC4 Navassa operation.
2. No DXCC credit will be given for the VU2WNV Laccadive's operation.
3. The suspension of credits for VQ9-AA/A, VQ9AA/D, FR7ZP, and 1M4A has been lifted.
4. Credit will be given for future DX-peditions by W9WNV providing that the committee is satisfied they have been properly conducted.

The CQ DX Awards Advisory Committee

In last month's column the beginnings of a *CQ* DX Awards Committee were announced. A workable committee has now been formed and has considered several sticky issues on it's first ballot. The membership of the committee is as follows: Bob Waters, W1PRI; Joe Hiller, W4OPM; Gay Milius, W4NJF; Bob Wagner, W5KUC; Bud Bane, W6WB; Ed Peck, W6LDD; Jim Ringland; Bob Thibert, W9ARV; and Dick Spenceley, KV4AA. This is a good committee with representatives coast to coast and in the Caribbean. Judging from the

response the committeemen gave to the first ballot they will do a good job for you.

Here are the issues considered on the ballot and the conclusions made by the committee. There was considerable discussion on each question, much too voluminous to print in full. Consequently, only the highlights of each decision are being given, with the DX Editor's position following in parentheses.

Item I: ITU Regulations make no provision for prefixes beginning with the figure one. Therefore, calls beginning with 1S9, 1M4, 1A6, etc. could not have been issued by any recognized licensing body. Should such prefixes be allowed for WPX?

DECISION: The committee voted *unanimously* that when no licensing agency exists the prefixes should be allowed providing the territory from which the operation originated is subsequently placed on a *recognized* country list. You will recall that 1S9 and 1M4 were placed on the ARRL DXCC Countries list and would therefore be qualified under this provision. (Prefixes will be allowed—*DX Ed.*)

Item II: Several prefixes recently submitted were of a peculiar type and were questioned. Examples are a KL7/1 claimed as KL1, a KH6/5 claimed as KH5, and a KP4/8 claimed as KP8. It seemed that these should be /W1, /W5, and /W8 as DL7KX/W2 is obviously W2. However, previous policy has allowed credit for KL1, etc. Should these prefixes be ruled invalid?

DECISION: The committee divided 4-4 with the 9th vote split. The split vote was from W4NJF who consulted the FCC and was told that "On a.m. or s.s.b. it is illegal to say KL7 portable 1. The correct procedure is to say KL7 portable in Boston, Mass., *nothing else!* However, on c.w. it is legal to sign KL7/1." From this it would appear to be legal on c.w. but not so on phone.

Dick Spenceley, KV4AA, the father of WPX, voted against the questioned prefixes on the basis that when the prefix doesn't actually exist it is illegitimate. However, among the 4 committee members in favor were convincing arguments for the "rare" prefixes.

(In case of a tie the DX Editor has the deciding vote, and although he is opposed to gerrymandered prefixes these will be allowed to stand because of the hundreds of precedents in the files. The job of going through all of the records to correct each individual listing is simply impractical.—*DX Ed.*)

Item III: The question was rather lengthy, but in effect it asked the committeemen whether the SSB DX Award should continue to follow the DXCC country list or have a separate list of it's own?

DECISION: The committee voted 5-3 with one undecided to retain the ARRL list. One member felt that since the purpose of this award was to promote the use of s.s.b. it was no longer needed. He suggested that it be dropped and all attention devoted to WPX and WAZ. (We will continue to use the DXCC list and the suggestion will be considered.—*DX Ed.*)

Item IV: Part one—Should we give WPX a fresh start in 1968? Should we give WAZ a fresh start in 1968? Should we give SSB DX Award a fresh start in 1968?

DECISION: The vote was 4-3 with 2 undecided for restarting WPX. Those in favor felt that since many prefixes no longer existed that a fresh start was the best solution. The dissenters felt that restarting placed too great a QSLing burden on rare stations.

For restarting WAZ the vote was 5-3 *against* with one undecided. The majority felt that since the same 40 zones existed, everyone had an equal opportunity to earn the award. The vote for restarting the SSB DX Award was also 5-3 *against* with the chief objection again being the heavy burden it would place on rare stations.

Part 2: If an Award is restarted, do you think that in the future it should be re-

Karl Fritsch, DL1EG, one of the latest recipients of the WAZ Award. Congratulations Karl.

started every 5 years, every 10 years, or every sunspot cycle?

DECISION: Three voted 10 years, 2 voted sunspot cycle, 1 voted 5 years, and 3 were emphatic that no new starts should be made. (The question of restarting WAZ and the SSB DX Award is closed. The question of restarting WPX is still under consideration. —*DX Ed.*)

Item V: As it is difficult to accurately locate some UAØ stations on Sakhalin Island which is now divided between Zones 19 and 25, it has been suggested that all Sakhalin Island be placed in Zone 25. What is your reaction to this suggestion?

DECISION: The majority of the committee felt that the zone should be redrawn with the boundary through the Soya Strait placing all of Sakhalin Island in Zone 19. (All of Sakhalin Island is now in Zone 19.—*DX Ed.*)

Longer Reciprocal Licenses in Germany

It has been announced that visitors to Germany may now obtain licenses for up to 3 months duration under the reciprocal licensing agreement. Applications should be sent at least 6 weeks in advance to DARC International Affairs, Muehlenberg 27, 5601 Doenberg, Germany. A fee of DM 14 must accompany the application.

New Italian Regulations

The new Italian Licensing Regulations effective Jan. 18, 1967 make no provision for a license to be issued to foreigners. However, foreign amateurs can obtain an operator's license permitting them to use the station of a licensed Italian amateur.

Miss Honorata Wojtowicz, SP6AYQ, of Warsaw, one of Poland's leading YL operators. (*Photo courtesy of DJ9NI*).

Here and There

BV2, Formosa—BV2A, Tim, has been reported on 14025 at 1300 GMT. He is said to be in Taipei. His signal has a T8 note.

CR8, Portuguese Timor—CR8AH has been worked on 21250 using a.m. phone. He is active between 1300 and 1500 GMT and answers s.s.b. calls. (*Tnx NEDXA*).

EA8, Canary Islands—EA8CB is frequently active on weekends around 14225. His favorite time is 0900 GMT. (*Tnx WGDXC*).

EA9, Rio de Oro—Justo, EA9EJ, is frequently heard on 20 meters with PY2PE as master of ceremonies. (*Tnx NEDXA*).

FB8, Kerguelen—FB8XX should be active on 10, 15, and 20 meter s.s.b. very shortly. (*Tnx LIDXA*).

FL8, French Somaliland—FL8RA has been reported on 21060 at 1730 GMT. (*Tnx DX-Mag*).

FR7, Reunion—Guy, FR7ZL, is very active on 14118 long path tuning above 14200. Unfortunately, his signals are fairly weak.

HBØ, Liechtenstein—HBØLL is the new call sign of Hugo, ex-HE9LAA, the only resident amateur in the country. (*Tnx DX-NS*).

K2AES—Tom reports that he has no knowledge of ZC2T, and is certainly not his QSL Manager. ZC2T is assumed to be a pirate. (*Tnx LIDXA*).

KH6, Kure—KH6EDY continues active. He has been worked on 14235 at 0600 GMT and 28575 at 0000 GMT. (*Tnx NEDXA*).

OHØ, Aland—OHØNM is QRV on 15 meters at 1300 GMT, on 10 meters at 1430 GMT, and on 20 meters at 2000 GMT beaming the USA. He prefers c.w. but will QSY to a.m. if a phone contact is desired. (*Tnx DX-Mag*).

SVØ, Rhodes—SVØWU frequently operates on 14232 transceive around 0500 GMT. (*Tnx DX-Mag*).

TA, Turkey—Activity has been reported from TA1LY on 14198 at 0400 GMT, TA2AC on 14050 at 0130 GMT, TA2BM on 7003 at 0730 GMT, TA2BK on 14059 at 0050 GMT, and TA1SK on 14074 at 2100 GMT. (*Tnx WGDXC*).

TR8, Gabon—George, TR8AG, is particularly active on Wednesdays at 0600 GMT. CR6GO usually acts as master of ceremonies. (*Tnx NEDXA*).

UZ9, Siberia—UZ9UA is a new station in Zone 18 and also a new prefix. There are now 33 separate prefixes within the USSR. (*Tnx DX-MB*).

VKØ, Antarctica—The following Australian stations are QRV from the south polar regions: VKØCS, VKØYO, and VKØGP. (*Tnx LIDXA*).

VP1, British Honduras—VP1VR operates on 14060, 21060, and 28060 c.w. His 20 meter operation is mostly after 2300 GMT, and his 10 meter operation mostly after 1700 GMT. (*Tnx DX-MB*).

VP2G, Grenada—VP2GLE is QRV on 14086, 21024, 21052, and 28040 c.w. with a KWM-1. He has also been heard on 28617 s.s.b. (*Tnx DX-MB*).

VP8, So. Georgia—VP8IE skeds CX3BBD on 14135 at 2030 GMT. (*Tnx WGDXC*).

VR4, Solomons—Art, VR4CR, is quite active on 20 meter c.w. Suggested frequencies are 14040 and 14088. His favorite time is 1200 GMT. (*Tnx LIDXA*).

VU2, Andaman—Hegde, VU2DIA, is QRV almost daily on 14060 from 0000 to 0200 GMT.

WAE—Remember to check Frank's column for rules of the 13th. European DX Contest. The c.w. weekend is Aug. 12-13, and the phone weekend is Sept. 9-10. The unique QTC provision will again be in effect. (*Tnx DX-MB*).

W4BPD—Rumor has it that Gus is restless. The ole

Edisto Valley swamp fox may be on the move by the time you read this. (*Tnx WGDXC*).

WA6SBO—C.w. frequencies for Bill's round the world DXpedition are 3501, 7001, 14005, 21005, and 28005. His s.s.b. frequencies are 3785, 7085, 14185, 21385, and 28485. His home address is 9418 Montamar Drive, Spring Valley, Calif. (*Tnx DX-NS*).

W9WNV—Don has issued a reply to the ARRL DXCC Committee containing over 80 pages. It has been widely circulated and a copy can probably be borrowed from your local DX club. If not, try writing to Box 310, Brooklyn, N.Y. 11206.

ZL1, Kermadec—ZL1AI skeds ZL2AFZ daily on 14260 at 0600 GMT. (*Tnx DX-NS*).

ZS9, Bechuanaland—ZS8L may soon operate from this rare location. (*Tnx DX-MB*).

3V8, Tunisia—3V8BZ operates around 14200 at 2230 GMT working USA stations by calling areas. (*Tnx DX-Mag*).

9M2, Malaysia—9M2NF, Dennis, in Kuala Lumpur is often QRV on 21330 s.s.b. from 1700 to 1830 GMT. (*Tnx DX-MB*).

Sheldon Weil, W2GQN, President of the Long Island DX Association, presents the 'DXer of the Year' trophy to Don Miller, W9WNV. The presentation was made at the Dayton Hamvention. (*Photo Courtesy WB2EPG*).

QSL Information

CR6IR	Box 194, Novo Redondo, Angola.
CR8AH	J. B. Santos Leite, SPM 225, Dili, Timor.
FO8BQ	Via WA6MWG for contacts after April 1, 1967.
FO8BU	Box 374, Papeete, Tahiti.
GD6UW	To W2GHK, Box 7388, Newark, N.J. 07107.
HBOAFM	Via HB9AFM.
HC8FN	To WA2WUV.
HKØAI	Via W9WHM.
HL9TQ	To WA8UVO.
HS4AK	Via Box 11/121, Bangkok, Thailand.
IS1ALX	To I1ALX.
JT1JT	Via 3C7ZM.
JY6GVM	To W6GVM.
KB6CZ	Via K4MQG.
KG6IF	To W6ANB.
KG6SM	Via W2CTN.
KG6SN	To W7PHO.
KH6GEL	W. D. Hurd, 978 Fugua St., Honolulu.
KL7EBK	For Europe QSOs send to DL7FT, *not* via Bureau.
KM6CE	Via WB6ITM.
KS4CC	P.O. Box 1148, Miami, Fla. 33148, or to WB6ITM.
KW6EJ	To W2CTN.
LU5XE	P. H. Masters, Ecia Cristina, Lago Argentino, SC, Argentina.
MP4QAL	Mohsan M. Ali, P.O. Box 56, Doha, Qatar, Arabian Gulf.
OA4AS	Antonia A. Leigh, Av Loreto 841, Piura, Peru.
OA4SA	B. Sterental, Box 4147, Lima, Peru.
PA9CN	To WA1GIA.
PJ5MG	Via W9IGW.
PX2AB	Box 22701, Paris, France.
PY3HT	Box 63, Panambi, Rio Grande de Sul, Brazil.
SU1AR	Via WB2UKP.
TA2AC	To K4AMC.
TA2BK	Via DJ2PJ.
TA2BM	To W5LTQ.
TR8AG	Via CR6GO.
TT8AQ	Via W4DQS.
TY3ATB	To VE2ANK.
VE8YL	Via WØQUU.
VK2AVA Lord Howe	WA2RAU.
VK2BRJ/VK9	Via W4ECI, Ack Radio Supply, 3101 4th Ave. So., Birmingham, Ala.
VKØCR	To VK7ZKJ.
VP1LB	Via VE3ACD.
VP1MW	P.O. Box 554, Belize, British Honduras.
VP1VR	To W4VPD.
VP8JD	Via British Antarctic Survey, Port Stanley, Falkland Islands.
VU2LE	To W6BCT.
WA6ZZD/KP6	Via K6UJW.
XW8AX	Via W6KTE.
XW8BZ	c/o U.S. Embassy, APO, San Francisco, Calif. 96352.
XW8CC	William B. Wright, American School, APO, San Francisco, Calif. 96352.
XW8CE	To WA1FCF.
ZD7IP	Via K2HVN.
ZP5JB	Box 512, Asuncion, Paraguay.
ZS2MI	To ZS4OI.
ZS9L	Via VE4OX.
1G1HKP	To JA1HKP.
3V8BZ	Reinhard Fierle, 6 Blvd. Habib Thameur, Fez Zahra, Tunis.
4M4A & 4M5A	Radio Club Venezolana, Box 2285, Caracas, Venezuela.
4W1G	Via HB9MQ.
5T5KG	To YASME, Box 2025, Castro Valley, Calif. 94546.
5W1AA	P.O. Box 498, Apia, Western Samoa.
8R1C	Via WA4NOE or P.O. Box 739, Georgetown, Guyana.
9U5ID	To W2GHK.
9V1LK	Dick Halls, Box 777, Singapore.
9X5GG	Via W2GHK.
9X5LH	To DL1ZK.

73, John, K4IIF

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

July	1-2	Venezuelan Contest
July	3-4	FEARL-M Contest
July	15-16	Minnesota QSO Party
July	22-23	Colombian Contest
July	29-30	County Hunters Party
August	5-6	Illinois QSO Party
August	5-6	Maryland/DC QSO Party
August	5-6	Boy Scout Jamboree
August	12-13	WAE C.W. DX Contest
August	19-20	QRP QSO Party
August	26-27	South Carolina QSO Party
August	26-27	All Asian DX Contest
September	1-30	British Columbia QSO Party
September	9-11	Zero District QSO Party
September	9-10	WAE Phone DX Contest
October	7-8	WADM C.W. Contest
October	14-15	RTTY Sweepstakes
October	**21-22**	**CQ WW DX Phone Contest**
November	11-12	OK DX C.W. Contest
November	**25-26**	**CQ WW DX C.W. Contest**

Venezuelan Contest

Starts: 0000 GMT Saturday, July 1
Ends: 2400 GMT Sunday, July 2

This contest is in commemoration of the 156th Anniversary of the Independence of Venezuela and was completely covered in last month's CALENDAR.

Entries must be postmarked no later than September 15th and they go to: Radio Club Venezolano, Independence Contest, P.O. Box 2285, Caracas, Venezuela.

FEARL-M Contest

Starts: 0900 GMT Monday, July 3
Ends: 1500 GMT Tuesday, July 4

See last month's CALENDAR for details.

Minnesota QSO Party

Contest Period: Sunday July 16 as follows:
Phone: 0000–0400 and 1600–2000 GMT
C.W.: 1200–1600 and 2000–2400 GMT

This is the second annual QSO Party sponsored this year by the Viking A.R.S. of Minnesota.

The same station may be worked both on phone and c.w. on each band.

Exchange: QSO number, RS/RST and county for Minnesota stations, section or country for others.

Scoring: For Minn. stations: Total QSO's multiplied by ARRL sections and countries worked on phone PLUS ARRL sections and countries worked on c.w. (Minn. stations can work each other.)

Outside stations: Total Minn. contacts multiplied by Minn. counties worked on phone PLUS Minn. counties worked on c.w. (A possible 87 on each mode)

Frequencies: Phone: 3880, 7280, 14280, 21380, 28680. c.w.—3580, 7080, 14080, 21080, 28080. (Avoid interfering with any net operation.)

Awards: Certificates to leading station in each section and country. (Min. of 5 QSO's) And each Minn. county. (Min. of 20 QSO's) Special certificate to the Top in state and out of state stations.

Mailing deadline is July 29th, and logs go to: Viking Amateur Radio Society, Box 3, Waseca, Minnesota 56093. Include a s.a.s.e. for copy of the results.

Colombian Contest

Starts: 0000 GMT Saturday, July 22
Ends: 2359 GMT Sunday, July 23

Complete details in last month's CALENDAR.

Logs must be received before Sept. 30th. Send to: L.C.R.A. Colombia Independence Contest, Box 584, Bogota, Colombia.

County Hunters Party

Starts: 0000 GMT Saturday, July 29
Ends: 2400 GMT Sunday, July 30

This is a party organized to stir up some activity for the County Hunters. Operation will be on c.w. only and a station may be worked once on each band.

Exchange: QSO number, RST, county, state and acknowledge you will answer all cards.

*14 Sherwood Road, Stamford, Conn. 06905.

Scoring: Total contacts multiplied by the number of counties and DX countries worked.

Frequencies: 3535, 7035, 14070, 21070, 28070. Novices. 3725, 7175, 21175.

Awards: To the Top 3 overall, Top 3 in each state and leading scorer in each country.

Mailing deadline is Aug. 30th and logs go to: John H. Shannon, K3WWP, 478 E. High Street, Kittanning, Penna. 16201. Include a s.a.s.e. if results are desired.

Illinois QSO Party

Starts: 1600 GMT Saturday, August 5
Ends: 2200 GMT Sunday, August 6

Rules for the fifth annual Illinois Party are the same as last year and will be given in details next month.

Maryland/DC QSO Party

Starts: 0000 GMT Sunday, August 6
Ends: 2400 GMT Sunday, August 6

The second Maryland/DC Party has been moved up from its October date but unfortunately it now conflicts with the established dates of the Illinois Party. Suggested frequencies however are different so perhaps the problem will not be too difficult. Rules are of the conventional state party type and will be covered in next month's CALENDAR.

DARC WAE DX

C.W.—August 12–13. **Phone** Sept. 9–10
Starts: 0000 GMT Saturday, Ends. 2400 GMT Sunday in each instance.

This is the 13th annual WAE contest sponsored by the DARC. The object of the contest is for non-Europeans to work as many European stations as possible. (Note the WAE country list)

Rules: 1. Use all bands 3.5 thru 28 mc.

2. The usual five and six digit serial number RST/RS report plus a progressive three figure QSO number starting with 001.

3. Each exchange will count 1 point, except on 3.5 mc where it will count 2 points.

4. The same station may be worked once per band.

5. The multiplier for non-European stations is determined by the number of European countries worked on each band. (WAE list.)

6. Europeans will use the latest ARRL country list for their multiplier. In addition each call area in the following countries will be considered a multiplier. JA, PY, VE/VO, VK, W/K, ZL, ZS, UA9, UAØ.

The final score is the total QSO points, plus the QTC points if any, multiplied by the sum total countries from all bands.

QTC Traffic: Additional point credit can be realized by making use of the QTC traffic feature.

A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to a European station.

It can only be sent from a non-European station to a European station. The general idea being that after a number of European stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 point credit can be claimed for each station reported.

1. A QTC contains the time, call and QSO number of the station being reported. ie: 1200/DLIFF/123. This means that at 1200 GMT you worked DLIFF and received number 123.

2. A QSO can be reported only once and not back to the originating station.

3. Only a maximum of 10 QTCs per station are permitted. You may work the same station several times to complete this quota. Only the original contact however has QSO point value.

4. Keep a uniform list of QTCs sent. ie: QTC 3/5 indicates that this is the 3rd series of QTCs sent and that 5 QSOs are being reported.

Classifications: 1. Scoring will be determined on all band operation only.

2. Both single and multi-operator divisions.

3. There is also a power classification. Class A up to 50 watts, B up to 150 watts and C over 150 watts. It's important you indicate your power in your log report.

Awards: Certificates to the highest scorer in each classification in each country and country/district in Rule #6. A minimum of at least 4 hours of operating is required for an award.

2. Continental leaders will be additionally honored and 2nd and 3rd place certificates will be given in areas of sufficient participation.

3. Contest contacts can be used for WAE certificate endorsement providing that the log of the requested station is also received.

[*Continued on page 113*]

THE awards PROGRAM

FEATURING USA-CA

BY ED HOPPER,* W2GT

THE "Story of the Month" is:

Harry R. McNutt, K8KOM

Harry waited until he had 2900 counties confirmed before he decided to give me any information on himself.

Back in 1958, Harry's son, Dick, got interested in ham radio through some friends, and got his Novice license. Harry started listening and got bitten by the radio bug and got his Novice license in 1958, then his Technician license and his General license in 1959.

Harry is 54 years old and married to Neva (not a ham). Their son Dick is now a Major in the Army and a flyer and his present call is W4NTG.

Harry says that radio and county hunting friends are the best you can find anywhere. He has been to the Dayton Hamvention twice to meet the county hunters and had a most wonderful time with that fine group.

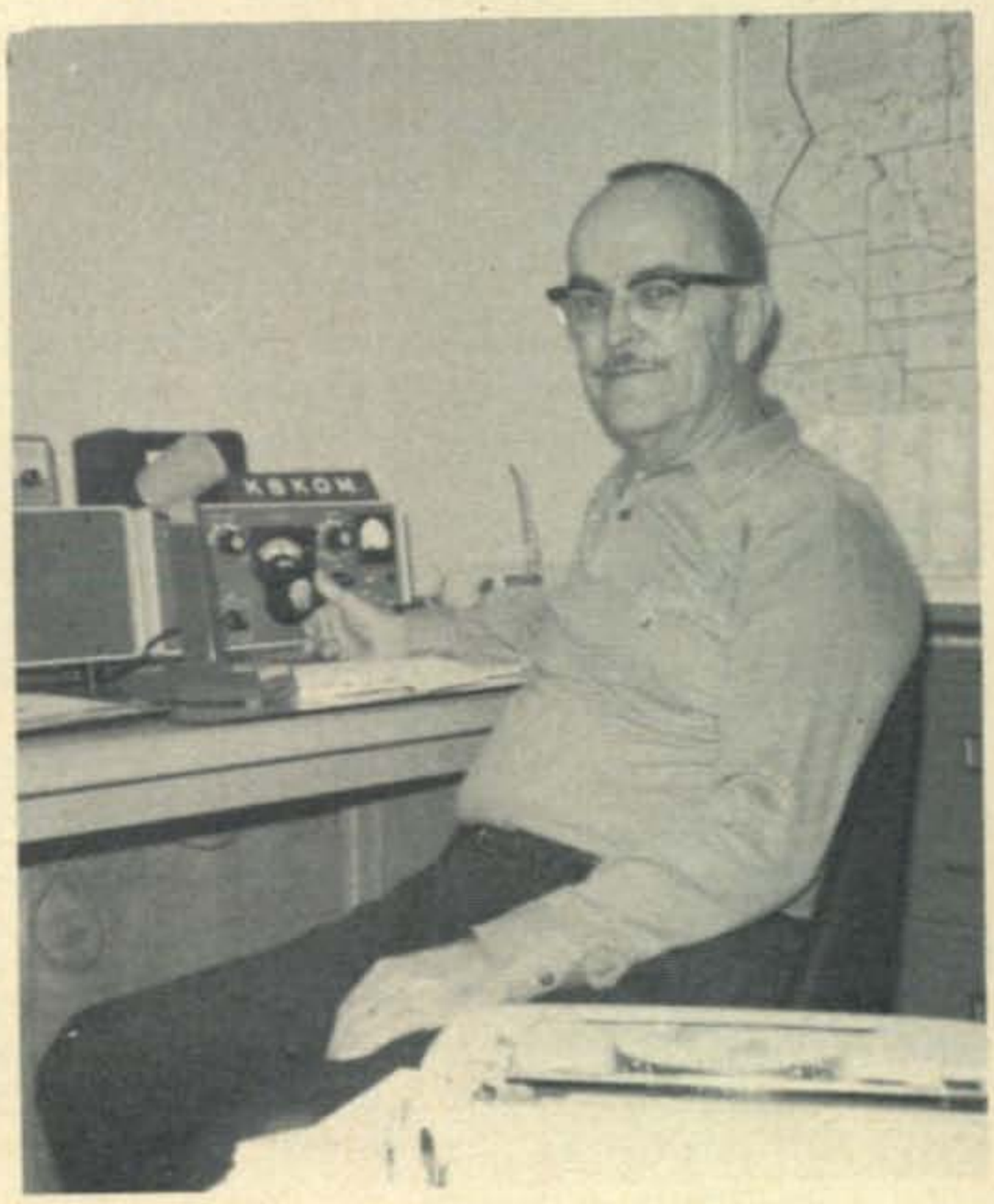
Harry started with a DX-20 and NC-88, then an Apache and Hammarlund receiver, next a GSB-100 and Drake 2B and he now uses a KWM-2 with a TA-33 Jr. and a 40-75 Mor-Gain antenna.

*103 Whittman St., Rochelle Park, N.J. 07662.

Harry received USA-CA-500 award #287 in October 1963; USA-CA-1000 award #32 in March 1964; USA-CA-1500 award #17 in August 1964; USA-CA-2000 award #11 in December 1964 and USA-CA-2500 award #11 in July 1965. His confirmed total is now over 2900 counties.

Awards

W A C O N Y S: The Work All Counties of New York State, award sponsored by the Binghamton Amateur Radio Association is at last back in business under the guidance of a new and energetic Award Custodian: Maurice Harvey, K2SVV, 138 N. Baldwin St., Johnson City, N.Y. 13790. Work all 62



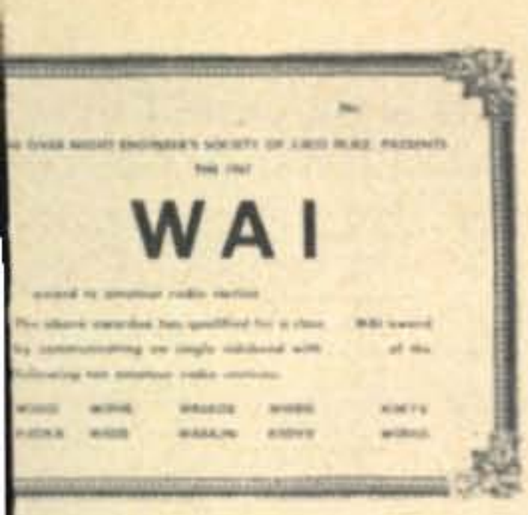
Harry R. McNutt, K8KOM

COUNTY HUNTER NETS

1300-1700 GMT 7225 s.s.b.
1800-2400 GMT 14336 s.s.b.
0100- GMT 3947 s.s.b.

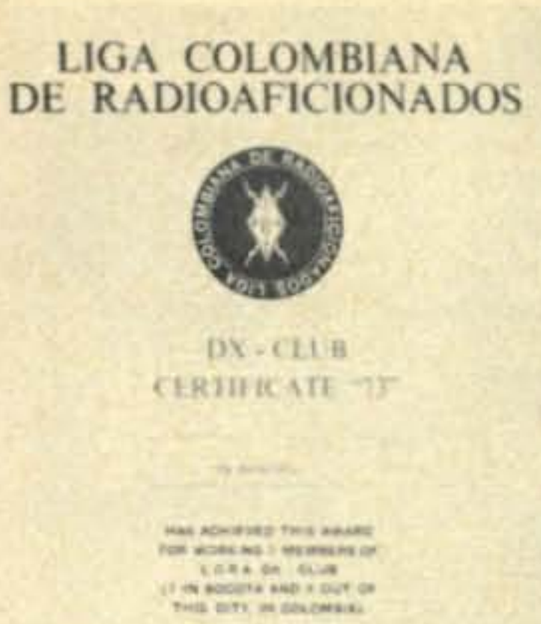
C.W.

Monday-Friday 1900-2200 GMT 7035
Saturday 1530-2130 GMT 7035
Sunday 1730-2130 GMT 7035
Monday-Friday—eves. 0000-0300 GMT 3523

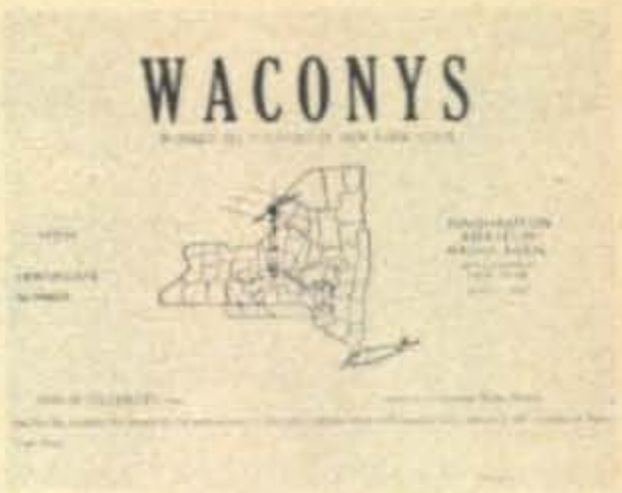


WAI Award

BARA Certificate



Certificate "73".



WACONYS Award

New York State counties, send GCR list and 50¢ to K2SVV. Maurice is also QSL manager for the club station W2OW.

BARA Award: This award also sponsored by the Binghamton Amateur Radio Association, Inc. of Binghamton, N.Y. (since 1928). The requirements are: work five members of the Binghamton Amateur Radio Club or work the club station W2OW and 4 club members. Send GCR list and $1.00 to Certificate Chairman, Maurice Harvey, K2SVV, 138 N. Baldwin St., Johnson City, N.Y. 13790.

W A I Award: This award is offered free by the Over Night Engineer's Society of 3.8032 mc. It is offered in 3 classes, C, B, or A for working 3, 6 or 10 of the following stations: W2GO, W3PHL, WB4AOE, W4EBG, K4KYV, K4OKA, W4SIB, WA8AJN, K8DVV, and WØRHA. QSOs must be on s.s.b. and before 1 January 1968. Send QSLs and s.a.s.e. to WA5FQC, 1509 14th Ave. North, Texas City, Texas 77590.

Certificate "73": This certificate is offered free and sent via air mail by the LCRA DX Club (Member of Liga Colombiana De Radio-Aficonados—President, "Bill", HK3RQ). Work ten members of the LCRA DX Club (7 in HK3 zone and 3 in other zones, or work 10 members in HK3 zone), any bands, any modes after January 1st, 1966. Send QSLs to each of the members you have worked, send log data and application to LCRA DX Club, Box 584, Bogota, Colombia, South America. Members of LCRA DX Club are: HK2AKG, HK3ABH, 3AFB, 3APC, 3APT, 3AJV, 3ASJ, 3AUE, 3AVK, 3BAE, 3HY, 3KN, 3LT, 3RQ, 3UA, HK4BQ, 4JC, HK5ACI, 5AOH, 5SL and HKØAI.

Other certificates issued (all free) by them are CHK, CZHK and 6Nl, and I will tell about them very soon.

Free Certificate: To help celebrate the 50th Anniversary of the city of Garfield, N.J., the 7-11 Amateur Radio Club of Northern New Jersey, which meets in Garfield, will issue this free certificate. I can not yet show a picture of the certificate as the Garfield High School students are having a contest to design the best certificate, the winner to win a U.S. Savings Bond. Contact at least one member of the 7-11 Club or a Garfield ham. Contacts must be between March 3, 1967 and September 30, 1967. Send your QSL or request to 7-11 Club, C/O City Hall, Garfield, N.J. 07026. A list of 7-11 members can be obtained for an s.a.s.e. sent to the same address, this membership includes about 25 active hams.

"CCC" Award: A note from C. L. Hardy, LU1DJU, QSL and Awards manager for Radio Club Argentino, Carlos Calvo 1420/24, Buenos Aires, Republica Argentina to the effect that after September 1st, 1967, application for this award should be presented in 2 bands. QSOs with the same station on different bands does not count. This award given for contacts with 5 continents (North and South America count as the same and one continent). The cost of this award and all R.C.A. awards, is 5 IRCs.

The West Virginia 55 County Club Award: Sponsored by the East River Radio Club of Bluefield, West Virginia as described and pictured in *CQ* of June 1965, is now just 25¢ to cover postage and handling. If your June copy of *CQ* is not handy, send a s.a.s.e. to Lee R. Brooks, K8BHG, Awards Chairman, P. O. Box 292 (ERRC), Bluefield, West Virginia, 24701.

Letters

Cliff, WAØKXJ & John, WAØNYK: write, "There will be another ZERO district QSO

Silvio A. Marini, Jr., WPE4IIO

Party this Sept. 8-11 and this time we will attempt to operate from 3 counties simultaneously—Polk, Boone and Story, in Iowa. The location will be just north of Des Moines in a town called Sheldahl.

"For interested hams, QSLs will be sent to all stations worked. Any station unable to be present for the contest, but who needs these counties, may write us directly for a sked between 1700 and 2000 GMT on Sept. 9. If time permits, we will try to enter the 7035 CHN".

Sil, WPE4IIO: writes, "Just a short note to let you know that the BEAUTIFUL USA-CA Award arrived today in FB shape!"

Of the 60 plus awards displayed on my shack wall, this one has undoubtedly got to be the MOST OUTSTANDING one of all!"

My sincere thanks to you and to *CQ* for making it possible for me to earn such a top-notch award; I am indeed proud."

Notes

A note from Vic, G6VC and one from Bill, G8VG both wanting to qualify for USA-CA but their two big difficulties are the many non-QSLers and many with no mention of county on the QSL. In general, English addresses *include* their country.

In May *CQ*, I thanked Mike, K1DGQ for sending a POD 26 to CO1AR—actually he sent one to VK9GN, OK1GT and the one to CO1AR was kindly sent by Dick, K9HSK, and Mike, K1DGQ sent one to GM3BCL.

I must again emphasize that my deadline is 60 days prior to publication. That is, material for September *CQ* should reach me by the 1st of July. I am constantly receiving important information (like the proposed operation from the rarest of all counties, Kalawao in Hawaii) only a few weeks before their scheduled operation. Try 60 days before, and even then I can not guarantee I will have space—so write early and often.

Wish I had a thousand readers like Bertha, WA4BMC. Her inspiring notes and letters are a pleasure to receive. How was your month? 73, Ed., W2GT.

BY THE WAY...

This group represents the Policy Committee of The New York State Phone Traffic and Emergency Net. The net operates on 3925 every night at 6:00 p.m. local time. Starting with the top row are left to right: W2PVI; K2AAS; WB2QAP, Net Manager; WB2-ASK; K2MPK (behind him); WA2TUI; and WB2NGZ, Assistant Net Manager. In the front row are: WB2AEK; WB2HLV, Policy Committee Chairman; WB2RHJ and VE3BEB. The only member not shown is the 2nd Assistant Manager, K2SJN, who took the picture.

Propagation

BY GEORGE JACOBS,* W3ASK

BOTH the 15 and 20 meter bands are expected to share honors for optimum DX propagation conditions during July.

Excellent world-wide openings are forecast for 15 meters during the daylight hours and through the early evening hours as well. Conditions are expected to peak on this band during the late afternoon hours, with optimum openings possible in almost all directions.

Twenty meters is expected to remain open for DX propagation around-the-clock. Although openings should be possible at all hours, optimum conditions are forecast during the early evening, the hours of darkness and the sunrise period.

Some good 10 meter DX openings are predicted for July, mainly on north-south paths during the afternoon hours.

During the hours of darkness, 40 meters is expected to open to several areas of the world, but seasonally high static levels may often make DX reception difficult. High static levels are also expected to result in somewhat poorer DX conditions on 80 meters, although some openings are forecast during the hours of darkness. Not many DX openings expected on 160 meters during July, because of seasonally high levels of static and solar absorption.

Short-Skip

This month's column contains Short-Skip Charts for July and August. Short-Skip conditions are expected to be optimum during July, mainly as a result of the seasonal peak expected for sporadic-E propagation. During the hours of daylight, considerable short-skip openings are forecast for 10 and 15 meters over distances ranging between approximately 500 and 1300 miles, with some openings on 20 meters, ranging between 250 and 2300 miles, are expected almost around-the-clock, with conditions peaking during the late morning hours and again during the late afternoon and early evening hours.

Good daytime short-skip openings are predicted for 40 meters between distances of approximately 100 and 600 miles, with excellent nighttime openings between 250

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for July

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: **3-4, 14, 16, 29**	A	A-B	B	B-C
Normal: **1-2, 5-6, 8-10, 12-13, 15, 17-18, 21-22, 25-26, 28, 30-31**	A-B	B	C	D
Below Normal: **7, 11, 19, 24, 27**	B-C	C-D	D	E
Disturbed: **20, 23**	C-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.

On the "Short-Skip" Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. Note the forecast rating for later use.

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 with considerable fading and noise; E—poor opening, or none at all.

4—This month's Propagation Charts are based upon a transmitter power of 75 watts c.w.; 150 watts s.s.b., or 300 watts d.s.b., into a dipole antenna one quarter-wave above ground on 160, 80 and 40 meters and a half-wave above ground on 20, 15 and 10 meters. For each 10 db increase 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—These Propagation Charts are valid through Aug. 31, 1967. These Charts are prepared from basic propagation, data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

and 2300 miles. Good 80 meter short-skip openings are forecast during the daylight hours for distances up to approximately 300 miles, with the range extending up to 2300 miles during the hours of darkness. While no 160 meter short-skip openings are expected during the daylight hours, some openings are forecast during the hours of darkness for distances up to 1300 miles. When static levels are low, 160 meter nighttime openings may extend out to approximately 2300 miles.

V.H.F. Ionospheric Openings

The big event expected during July are the numerous 6 meter short-skip openings, between distances of approximately 900 and 1300 miles, and occasionally as great as 2300 miles. The most likely times for these openings are a few hours before noon and again during the early evening hours, although they could take place at any time of the day or night. During many of these openings signal levels are expected to be exceptionally strong.

Be sure to check the 2 meter band during intense 6 meter sporadic-E openings, since 2 meters may occasionally open as well. Generally, 2 meter short-skip openings take place between distances of approximately 1100 to 1300 miles.

Some meteor-type v.h.f. ionospheric openings are likely to occur during the last week of July when the *Perseids* and the *Aquarids* meteor showers will take place. The *Perseids* is a major shower, and will extend into August.

Some v.h.f. short-skip openings resulting from auroral ionization are expected during the month. Check the "Last Minute Forecast" appearing at the beginning of this column for periods that are predicted to be disturbed; these are the dates during which auroral v.h.f. openings are most likely to occur during July.

Sunspot Cycle

The Zurich Solar Observatory reports a monthly sunspot number of 65 for April, 1967. This results in a 12-month running smoothed sunspot number, upon which the cycle is based, of 66 centered on October, 1966.

A smoothed sunspot number of 92 is forecast for July, 1967, as the present sunspot cycle continues to increase in activity.

Besides the Short-Skip Propagation Charts this month's column contains Propagation Charts centered on Alaska and Hawaii. World-wide DX Propagation Charts for July appeared in last month's column. ■

CQ Short-Skip Propagation Chart

JULY & AUGUST, 1967

LOCAL STANDARD TIME AT PATH MID-POINT

(24-HOUR TIME SYSTEM)

Band (Meters)	50-250 Miles	250-750 Miles	750-1300 Miles	1300-2300 Miles
10	Nil	07-09 (0-1)* 09-13 (0-3)* 13-17 (0-1)* 17-21 (0-2)* 21-23 (0-1)*	07-09 (1)* 09-13 (3)* 13-17 (1-2)* 17-21 (2-3)* 21-07 (1)*	07-09 (1-0)* 09-13 (3-1)* 13-17 (2-1)* 17-21 (3-1)* 21-07 (1-0)*
15	Nil	07-09 (0-2)* 09-13 (0-3)* 13-17 (0-2)* 17-19 (0-3)* 19-21 (0-2)* 21-07 (0-1)*	07-09 (2)* 09-13 (3)* 13-17 (2)* 17-19 (3)* 19-21 (2)* 21-23 (1-2)* 23-07 (1)*	07-09 (2) 09-13 (3) 13-17 (2-3) 17-19 (3-4) 19-21 (2-3) 21-23 (2) 23-07 (1)*
20	09-00 (0-1)*	06-09 (0-2)* 09-15 (1-4)* 15-20 (1-3)* 20-00 (1-2)* 00-06 (0-1)*	06-09 (2-3)* 09-16 (4)* 16-21 (3-4)* 21-00 (2-3)* 00-06 (1-2)*	06-09 (3) 09-15 (4-2) 15-16 (4-3) 16-21 (4) 21-23 (3-4) 23-00 (3) 00-06 (2)
40	07-11 (1-2)* 11-16 (2-4)* 16-20 (3-4) 20-22 (1-2) 22-07 (0-2)*	07-09 (2-4)* 09-11 (2) 11-16 (4-2) 16-17 (4-3) 17-20 (4) 20-22 (2-4) 22-04 (2-4) 04-07 (2-3)	07-09 (4-1) 09-16 (2-1) 16-17 (3-1) 17-20 (4-3) 20-04 (4) 04-05 (3-4) 05-07 (3)	07-17 (1-0) 17-20 (3-2) 20-05 (4) 05-07 (3-1)
80	06-11 (3-4) 11-15 (4-3) 15-21 (4) 21-04 (3-4) 04-06 (4)	07-09 (4-1) 09-11 (4-0) 11-15 (3-0) 15-17 (4-1) 17-19 (4-2) 19-21 (4-3) 21-06 (4) 06-07 (4-2)	07-09 (1-0) 09-15 (0) 15-17 (1-0) 17-19 (2-1) 19-21 (3-1) 21-04 (4) 04-06 (4-3) 06-07 (2-1)	07-17 (0) 17-19 (1-0) 19-21 (1) 21-03 (4-3) 03-04 (4-2) 04-05 (3-2) 05-06 (3-1) 06-07 (1)
160	17-18 (1-0) 18-19 (1) 19-21 (3-2) 21-23 (4-3) 23-05 (4) 05-07 (3-2) 07-08 (1) 08-09 (1-0)	18-19 (1-0) 19-20 (2-0) 20-21 (2-1) 21-23 (3-2) 23-03 (4-2) 03-05 (4-3) 05-07 (2-1) 07-08 (0-1)	20-21 (1) 21-00 (2-1) 00-03 (2) 03-05 (3-2) 05-06 (1) 06-07 (1-0)	20-22 (1-0) 22-00 (1) 00-05 (2-1) 05-06 (1-0)

HAWAII

Openings Given In Hawaiian Standard Time†

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	14-17 (1)	06-11 (1) 11-14 (2) 14-17 (3) 17-18 (2) 18-19 (1)	13-15 (1) 15-17 (2) 17-18 (3) 18-20 (4) 20-22 (3) 22-02 (2) 02-04 (3) 04-06 (2) 06-09 (1)	18-20 (1) 20-00 (2) 00-02 (1) 20-21 (1)** 21-23 (2)** 23-01 (1)**
Central USA	14-18 (1)	06-08 (1) 08-13 (2) 17-19 (2) 19-20 (1) 13-17 (3)	05-08 (2) 08-13 (1) 13-15 (2) 15-17 (3) 17-20 (4) 20-23 (3) 23-03 (2) 03-05 (3)	18-20 (1) 20-01 (3) 01-03 (2) 03-04 (1) 20-21 (1)** 21-01 (2)** 01-03 (1)**

Western USA	11-16 (1) 16-18 (2) 18-19 (1)	07-08 (1) 08-10 (2) 10-14 (3) 14-17 (4) 17-18 (2) 18-20 (1)	06-08 (4) 08-11 (3) 11-14 (2) 14-15 (3) 15-19 (4) 19-22 (3) 22-06 (2)	18-19 (1) 19-20 (2) 20-02 (4) 02-04 (2) 04-06 (1) 19-20 (1)** 20-21 (2)** 21-00 (3)** 00-01 (2)** 01-05 (1)**

ALASKA

Openings Given In GMT‡*

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	Nil	00-03 (1)	12-15 (1) 22-01 (1) 01-05 (2) 05-07 (1)	07-10 (1)
Central USA	Nil	22-01 (1) 01-03 (2) 03-05 (1)	13-16 (1) 22-00 (1) 00-04 (2) 04-06 (3) 06-07 (2) 07-09 (1)	08-12 (1)
Western USA	17-05 (1)	17-20 (1) 20-23 (2) 23-02 (1) 02-05 (2) 05-06 (1)	15-17 (3) 17-01 (2) 01-03 (3) 03-05 (4) 05-08 (3) 08-15 (2)	07-09 (1) 09-12 (2) 12-13 (1) 09-12 (1)**

†To use in other areas of the United States, *add* 5 hours to the times appearing in the Chart in the Eastern Standard Time Zone; 4 hours in the CST Zone; 3 hours in the MST Zone and 2 hours in the PST Zone. For example, when it is Noon or 12 hours in Honolulu, it is 5 P.M. or 17 hours, EST in N.Y.C.

‡To convert to Local Standard Time in Alaska, *subtract* 8 hours from the times appearing in the Chart in the Pacific Standard Time Zone; 9 hours in the Yukon Zone and 10 hours in the Alaskan Standard Time Zone. To use in other areas of the United States, *subtract* 5 hours in the EST Zone; 6 hours in the CST Zone; 7 hours in the MST Zone and 8 hours in the PST Zone.

*Predominantly sporadic-E openings.

**Indicates predicted 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a forecast rating of (2) or higher.

LICENSE EXPIRATION NOTICE SERVICE

Available To Anyone Anyplace In The World.

1. Address a postal card (no other form accepted) to yourself.
2. Write anything you wish to tell yourself on the card.
3. At the top of the correspondence side (when placed horizontally) write a date (month and year only) when you want the card mailed.
4. When this month arrives, the card will be mailed.

The Foundation for Amateur Radio, sponsor of the service, accepts no responsibility, if for any reason, the card is not mailed. The Foundation does agree, however, to maintain this service as long as volunteers are available. Mail your card today to:

Joan Machinchick, K3KBI
Lake Drive, Cape St. Clair
R.F.D., Annapolis, Md. 21401

Simon Says...

BY BERT SIMON,* W2UUN

Questions

Surface Area of Quad Antenna: "This may sound like a stupid question, but how do you find the area in square inches of a quad antenna consisting of 2 elements and 3 bands (10, 15, and 20 meters)? The tower I'm interested in is rated at a maximum of 7.2 square feet in 60 m.p.h. unguyed (40 foot tower) and the manufacturer gives the formula for computing wind area in square feet as:

$$\text{Wind Area (sq. ft.)} = \frac{\text{(El. Area in sq. in.) } (\frac{2}{3}) \text{ (.707)}}{144}$$

"What formula do you use to find out the area of all the elements in square inches?"

Neglecting the supporting mast there are four areas to consider in computing the total surface area of a quad antenna:

1. The boom surface area.
2. The cross arm surface area.
3. The wire surface area.
4. The cross arm gusset surface area (if you're using one, that is).

Figures 1 and 2 illustrate the various dimensions. It must be kept in mind that we are not concerned with volume but rather surface area. The surface area of a cylinder (isn't that what the boom, cross arms, and wire really are?) is defined as πdl.

*Holland Mountain Rd., Oak Ridge, N.J.

SIMON SAYS is a free technical question and answer service provided exclusively by *CQ*. Every attempt is made to answer each reader's question as promptly and accurately as possible. Occasionally, even Simon will be stumped, but this rarely happens. Readers are requested to enclose a stamped, self-addressed envelope with their questions to speed replies. Address inquiries to the author at his home address.

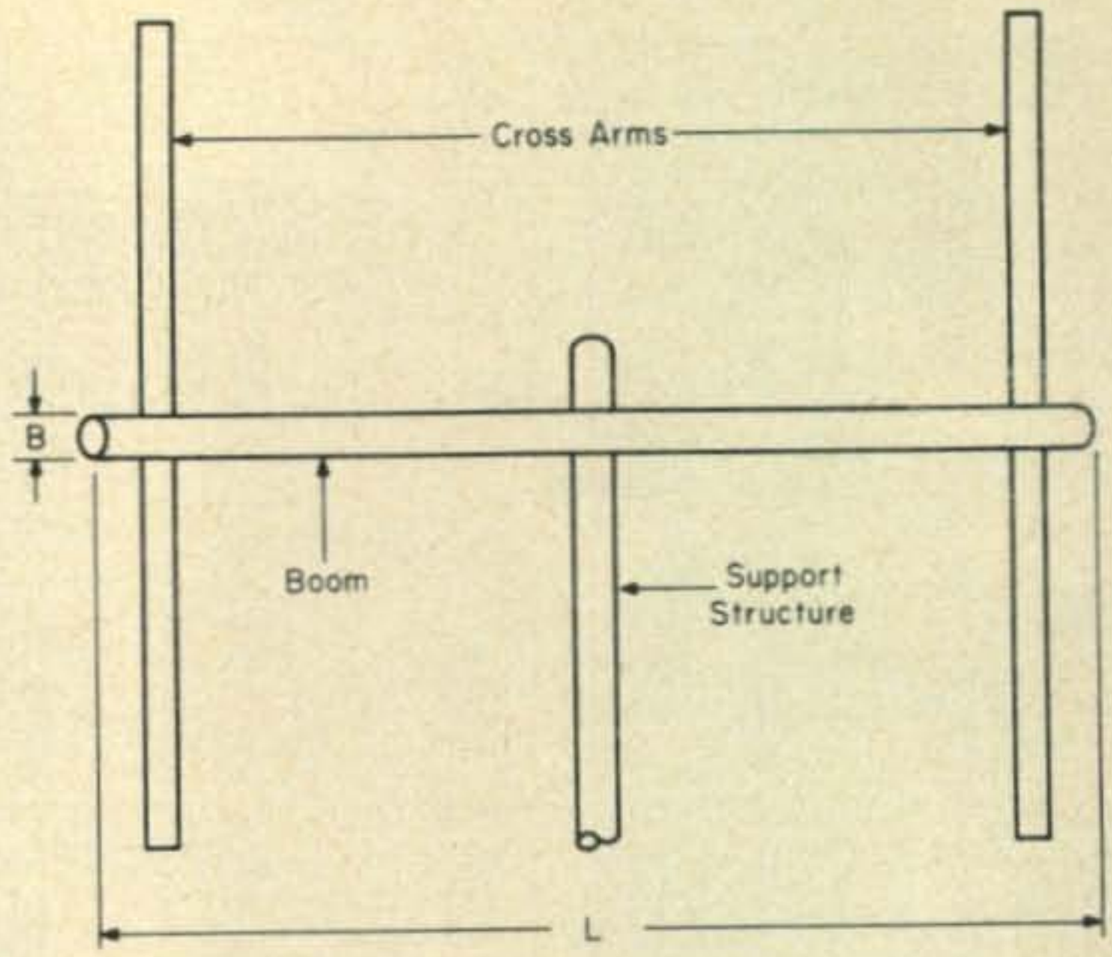


Fig. 1—Boom dimensions for calculating wind load of a quad antenna. See text.

where: d = the diameter of the cylinder
l = the length of the cylinder

Referring to the dimensions shown in fig. 1, the area of the boom can be calculated from:

$$A = \pi BL$$

Now figuring the cross arm area, one arm is πDl but there are 2 arms per element and since this is a 2 element quad, the area is:

$$A = (2)(2)\pi Dl = 4\pi Dl$$

There are four sides to each element and since we are speaking of a square where one of the sides is represented by $l/2$, X_1, or X_2, the length of wire per side is in general $\sqrt{2}\ X$. For the total length we have 2 elements with 4 side per element or a length of $(2)(4)(\sqrt{2})\ X = 8\sqrt{2}\ X$ where X can take on the dimensions:

$l/2$ for 20 meters
X_2 for 15 meters
X_1 for 10 meters

and since the wire is the same as a very long, thin cylinder it's surface area is:

$8\sqrt{2}\ \pi\ (l/2)$ for 20 meters
$8\sqrt{2}\ \pi X_2$ for 15 meters
$8\sqrt{2}\ \pi X_1$ for 10 meters

or a total of $8\sqrt{2}\ \pi(l/2 + X_1 + X_2)$ for three band operation.

The gusset plate we'll assume to be a square and hence it's area is simply y^2.

Now we can combine this entire mess together and obtain for the total area:

$$A_t = \pi BL + 4\pi DL + 8\sqrt{2}\pi d\ (l/2 + X_1 + X_2) + y^2$$

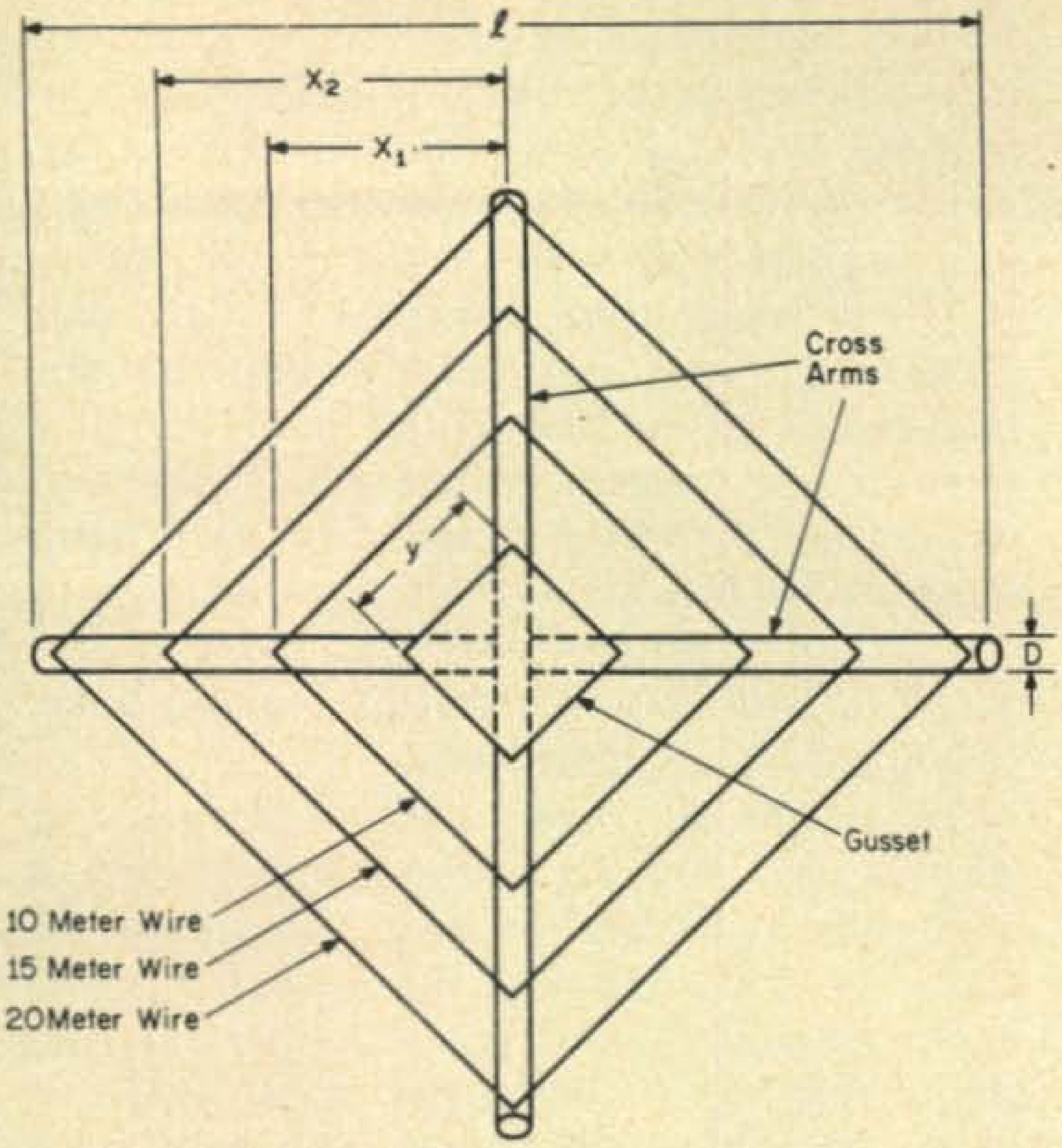


Fig. 2—Dimensions for calculating the element, cross-arm, and gusset-plate wind load of a typical 3-element quad antenna. The diameter of the wire is *d*. See text.

and to simplify (?):

$$A_t = \pi\,[BL + 4Dl + 8\sqrt{2}\,d\,(l/2 + X_1 + X_2)] + y^2$$

As a hideous example let's assume that the 2 element, tri-bander, quad has the following dimensions:

L = Boom length = 15 feet
B = Boom diameter = 2 inches
l = Length of cross arm = 24 feet
D = Cross arm diameter = 1 inch

We'll use No. 12 wire which has a diameter of 80.81 mils (or .081 inches) and let the distances $X_1 = 6$ feet and $X_2 = 9$ feet and assume the gusset plate (if we're using one) is 6 inches square. Ready to plug in numbers, all that remains is to convert all dimensions to inches. So:

$B = 2$ inches
$L = 15$ feet $= 180$ inches
$D = 1$ inch
$l = 24$ feet $= 288$ inches
$X_1 = 6$ feet $= 72$ inches
$X_2 = 9$ feet $= 108$ inches
$d = .081$ inches
$y = 6$ inches

$$A_t = \pi\,[2(180) + 4(1)(288) + 8\sqrt{2}\,(90 + 72 + 108)] + 6^2$$
$$= \pi\,[360 + 1152 + 257] + 36$$
$$= 5576 \text{ square inches}$$

and now plugging this into the magic formula provided by the tower manufacturer we obtain:

Wind Area =
$(5576)(2/3)(.707) \div 144 = 18.27$ square feet

Of course the 18.27 square feet is much greater than the 7.2 square feet specified by you which leaves two basic choices:

1. Increase the tower capability.
2. Reduce the size of the antenna.

The first choice can be met by guying the tower structure and you can expect about a two times increase by guying the tower at the apex. The second choice leads us down the ever popular controversy of Yagis vs. Quads. In the October 1966 issue of *QST*, W4RBZ reported on his findings of operating a 4-element quad against a 4-element yagi. His findings were slightly in favor of the quad but I don't believe it's a fair comparison. A yagi single element on 20 meters is about 33 feet long while the loop length of a single element quad is about 70 feet. That's 280 feet of antenna vs. 132 feet, now that ain't fair is it?

Would you believe a 3 element Tribander yagi? Let's consider the surface area of a popular manufactured 3 element Tribander yagi where:

$L = 14$ ft. $= 168$ inches
$B = 2$ inches
$l = 28$ ft. $= 336$ inches
$d = .75$ inches (I'm guessing here)

$$A_t = \pi LB + (3)\pi ld = \pi(168)(2) + (3)(\pi)(336)(3/4) = 3604\ \text{in}^2$$

which would represent:

$(18.27)(3604)/5576 = 11.8$ square feet

So if you guy the tower at the apex and use one of the popular 3 element beams available you should have a safe installation. Oh yes, let's not forget the mast, it's strength, moment arm, and stuff like that there . . . but that's another story.

MARS Operation with Tri-Band Beams: "The MARS station, Mather AFB, California, has a Tri-Bander beam which we would like to tune to MARS frequencies. Could you tell us how to tune it, if it is possible? I would also like to find some information on the proper operation of a grid-dip oscillator, especially in tuned circuits."

[*Continued on page 115*]

SURPLUS sidelights

BY GORDON ELIOT WHITE*

THIS column marks the 18th I have written for *CQ* on surplus electronics for the amateur, and in the year and a half since I have been Surplus Editor, I have gotten a pretty good picture of the surplus hound, ham style. My mail has run to over a thousand letters from readers who have gotten the surplus bug, and, usually, want to know just a little bit more about their bargain, now that they have it home on the bench. . .

For the majority of the readers who have written to me I have been able to offer at least part of the data they have been seeking, though to a few I have been a dead end, regretfully. To those who have written, sending self-addressed stamped envelopes but have not yet heard from me, please be patient. I will use the envelope to say I have no information, but if I think I can be of assistance within a reasonable period of time, possibly several weeks, I file them away for future review. Sometimes this becomes many weeks.

By far the most popular item in surplus interest since I took over this column has been the Command Set—SCR-274-N and AN/ARC-5. Close behind has been RTTY equipment including various converters, particularly Northern Radio, and the familiar AN/ARC-1 and AN/ARC-3 vhf sets. The old SCR-522 seems to have about faded away at last, and the Hammarlund Super Pro in all its military versions seems about to follow. The military and Taxi-type FM equipment is still in demand by surplusers, with data particularly hard to find.

There are, unfortunately, many people who still buy impressive-looking pieces of surplus, then find that they were either developmental items, for which no manuals were written, or commercial pieces in military dress, and the company is defunct, again virtually eliminating the possibility of finding schematics or other data. There are many pieces of sophisticated electronics now finding their way into amateur hands that are worthwhile chiefly as sources from which to cannibalize parts.

Much specialized test gear, radar, data processing, and particularly experimental material is of no use at all in its original form except to the most knowledgeable surplus expert. While a majority of such items seem to be handed out through MARS or the school donation program, some of the gang still will buy this sort of pig-in-a-poke. If you must, buy it cheaply.

There are of course a lot of bargains in surplus, and when the Viet Nam conflict is over there will be a lot more. An all-surplus shack is quite possible, at a cost running about a tenth that of new commercial ham gear, with a great deal of material available in surplus that can be found in no other way.

I thought that this month I would index the surplus articles that have appeared in *CQ* since Ken Grayson ended his three-year stint as Surplus Editor in March 1961. Since *CQ* can be found in many libraries, and in many amateurs' bookshelves, this review ought to help answer some of the queries that come in on every mail delivery to the Surplus Editor's QTH.

Command conversions lead the list. A description of a very neat method of putting the BC-458 transmitter on ten meters was printed in the January, 1962 issue of *CQ*, page 38. The November 1962 issue carried a description of four AN/ARC-5 transmitters set up as v.f.o.'s (p. 111). My own first effort in the Command Set line, a short history, appeared in the November, 1964 *CQ*. The following month Ed Marrinner published his ARC-5 Portable conversion, p. 26.

In the January, 1965 issue *CQ* printed a Test Set story to assist in tuning up the T-23/ARC-5 crystal-controlled v.h.f. transmitter (p. 42), followed in October, 1965, by my own further Command Set history, p. 34 and Crystal-Controlled Command Sets, p. 43. In the same October book appeared Marrinners' second ARC-5 portable story, p. 41.

In the January, 1967, issue *CQ* printed my Command Set Receiver specifications, with design data on the full range of receivers from 190 kc to 27 mc. In the March issue of SURPLUS SIDELIGHTS I covered the postwar v.h.f. Command receivers, R-13, R-

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15 and R-19 which cover from 108 to 148 mc in two bands. Another ARC-5 v.f.o. article appeared in the April, 1967 edition, p. 41.

Super-pro articles have appeared three times in the last six years of *CQ*, beginning with the "Ultimate Conversion of the Super-Pro" in the April, 1961, edition, and continuing more recently in the Surplus Column for June, 1966, with a "Product Detector for the Super Pro" in the July, 1965, *CQ*.

The old reliable AN/ARC-3 v.h.f. set has been covered: February 1962, p. 48; a general conversion; October, 1965, conversions to adapt it for two or six meters.

I dealt with low frequencies in the April, 1967 Surplus column, treating chiefly the Navy RBA receiver. I am informed by WA7GMI that amateurs—and anyone else who is interested—*can transmit in the 160-190 kc band* under Federal Communications Commission regulations, part 15.203, using unlicensed transmitters with a power of not more than one watt and an antenna not more than fifty feet long. This is the same regulation that permits 100 milliwatt transmitters to operate in the broadcast band (520-1,500 kc) or the citizens band at 27 mc, but at 160 kc a watt of output offers quite a bit of range. F.C.C. engineers also inform me that while there are government stations licensed in the l.f. band, much of the time they do not operate, leaving it relatively interference-free. Anyone for DX at 170 kc? Shades of the real old timers!

Another *CQ* article on l.f. and v.l.f. appeared in May, 1962.

Taxi and police f.m. gear has been covered several times, with the Motorola FMTU-30D heading the list. The Link Corporation 2365 and 2210 sets were written up in the November, 1961 issue with a Motorola story printed in the November, 1962 edition, offering conversion to two meters. Commercial v.h.f. f.m. gear was also treated in July, 1963. While not of Commercial design, the T-14-D/TRC-1, v.h.f. f.m. transmitter covered in April, 1964, is similar to the police sets and offers several ideas for surplus hounds interested in f.m. Two meter conversion of the FMTRU-80-D was offered in the February, 1966 *CQ*, with a follow-up in the March, 1966, issue.

The ever-valuable LM, LR and BC-221 frequency meters have been dealt with in August, 1962, October, 1965, and November, 1966.

The AN/APX-6 IFF and air traffic transponder has been the basis of several articles, notably December, 1962, October, 1965, and November, 1965, all with 1296 mc conversions.

Test gear in general has appeared in a number of surplus articles: an adapter for surplus tube testers was described in May, 1961. A second tube tester treatment appeared in May, 1967. Use of surplus v.h.f. and u.h.f. reflecto-meters was described in January, 1964.

Prop-pitch rotators, now virtually extinct as beam motors, but still of a little interest, were last described fully in *CQ* for November, 1962, page 128.

The AN/URC-4 search-and-rescue transceiver has been handled in *CQ* most recently in my June, 1967, surplus column, but also in October, 1965 (conversion to 2-6-10 meters).

RTTY converters have appeared in several issues, ranging from Byron Kretzman's two-part description of the huge AN/FGC-1 beginning in September, 1965, through the Surplus Column mentions of the Northern Radio 104, January, 1967; Boehme 5-C, July, 1966; converters generally, July, 1965, the TH-5/TG, in April, 1965, and a number of mentions in the RTTY column.

Here are some other interesting back references:

ART-13 speech amplifier: January, 1965

Modifications to the R-390/URR: January, 1965

Inverted double sideband with the SCR-522: February, 1965

Surplus ARA-26 keyer for automatic CW I.D.: May, 1965

R-19/TRC-1: July, 1965

BC-652-A: October, 1965

Collins 51M-2: May, 1966

Surplus AS-989/ML Log-periodic antenna (diagram) December, 1966

RBB-RBC receivers: November, 1966

RDZ receivers: December, 1966

TDQ transmitter: June, 1967

AN/TRC-8 for 220 mc: July, 1962

FL-8 roundup: July, 1962

ATK surplus TV camera: September, 1963

BC-669 transceiver: July, 1961

AN/APS-4 as a modulation monitor, March, 1961

Of course the current authority of surplus is the *CQ Surplus Conversion Handbook*,

by WB2AA1, which is a compilation of the best of *CQ*'s surplus articles since World War II, together with handy indexes and commentary by Tom Kneitel. Also very useful to any surplus library are the *CQ Surplus Schematics Handbook* and the *CQ Anthologies, I and II*. If you have all this material, you can save a lot of postage writing the Surplus Editor on most of the better-known units. ■

Scratchi [*from page 11*]

that is. He knowing how foolish it be to try to catching rabbit with car.

I being reel near home, so clever old Scratchi rushing back to Hon. Brother Itchi's ranch, getting what I needing, then coming back, taking reeding on reseever, and coming neer where jackrabbit are. Driving jeep in big circles, throwing out rabbit food and carrots and other food I getting from home, then driving to center of circle and sitting there. I figyouring jackrabbit sooner or later coming neer food, and stopping.

Sure enough, short time later jackrabbit hopping neer, smelling food, and starting to eat. I turning off engine, and ducking down out of sight. First thing you knowing, Hon. Jackrabbit jumping in back seat of jeep. and reel quick-like I reaching over seat and grabbing him. I taking xmitter off the rabbit, and, that's all there is to it, Hon. Ed., I winning the contest!!

I trying to get rid of jackrabbit, but he not leeving jeep on acct. he liking cupple lady rabbits I having in back seat that I bringing from ranch. Hee Hee, Hon. Ed., aren't that reel slicky! Love conquers all.

He so friendly he staying in jeep while Scratchi taking rabbits back to ranch. Hon. Ed., you thinking you or any of your reeders like to getting reel honest-to-gracious Western baby jackrabbits? If so, letting me know, on acct. are thinking maybe having lotsa them shortly.

Respectively yours.
Hashafisti Scratchi

Sylvia [*from page 90*]

I never fail to marvel at the throw-away casualness of radio amateurs who don't have this privilege of living on Longitude Zero. How do they work out what the time is Zulu? There they go, subtracting and adding hours to the clock, as if it were the natural thing to live perpetually five hours apart from their wives in the next room. This is one of the heartening things about being British. GMT is on our doorstep. They've taken away our Empire, they are draining away our brains, we're a Second Class Power (and what a relief that is!) but GMT remains, in Mini-Britain, irrevocably ours, long may it reign!

Our House must face south, so as to get as much sun as possible into the shack. Roy Stevens, G2BVN, suggested this and added that the ideal would be a revolving house on a turntable. This is important, because radio amateurs don't spend much time out of doors, except on N.F.D. and at mobile picnics. If they don't get the sun whilst they are operating, how would they keep healthy? Whoever heard of a Vitamin D exciter?

The other rooms, in which the family live, can quite decently face north, or even be underground, because wives and children can get out and enjoy the good fresh air, whilst they are digging the garden. As the garden will slope up a steep hill, it will require considerable heavy labor, which is very good for wives and children, but hell for radio amateurs, and the resultant terraced landscaping, culminating in the beam at the top, will be breath-taking.

OUR MOST POPULAR HANDBOOK!

The most popular handbook ever to be presented in the CQ Technical Series was the venerable old "Command Sets." Countless signals on the air today are there because of the information contained in "Command Sets," which went on to become the standard reference guide and definitive work on the topic. It went through 5 sellout printings, and when the last book of the final printing was stripped from our stock room we decided that the next printing would be an even bigger, newer, expanded, revitalized version of "Command Sets."

PRICE: $3.00

Our new book is called "Surplus Conversion Handbook," it's 192 pages BIG (that's 58 pages more than its predecessor). We kicked out all of the space-taking ads which cluttered up the old book and replaced them with more conversions — conversions of surplus gear other than just "command sets" alone. So the new book contains all of the best command set conversions of the original edition, plus complete conversion details on a whole slew of the most popular military surplus gear available today, including such winners as: SCR-522, ART-13, BC-603, BC-620, BC-624, BC-659, BC-779, ARC-1, ARC-3, ARC-4, and many more. Actually, it covers just about every piece of surplus gear which is worth the time and effort to convert for ham use.

"Surplus Conversion Handbook," Edited by Tom Kneitel, K3FLL/WB2AAI, is a book which every ham will find to be a valuable and interesting addition to the shack. It's available for immediate delivery.

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Privacy is the most important thing of all. Years ago I conceded that amateur radio and relatives can't be on the same frequency. There's one technical article none of the magazines has ever featured—devising a system whereby relatives are DF's as they approach a house. Automatically the windows would shut, the car slide into the garage and a robot neighbor would pop out, saying:

"They've all gone to Hawaii for six weeks!"

But if the stranger were a radio amateur, the doors would be flung open, the coffee percolator switched on and, if he were a foreigner, a reciprocal license arranged by remote control, his national flag hoisted and his national anthem played as he entered the house.

G3NUY plans to achieve this privacy with a shack at the top of the house, self-contained with its own kitchen and bathroom, so he need never be disturbed, accessible by an elevator which only he could control. There Sid Almond would be, a fair Prince in an Ivory Tower.

Lots of other amateurs I have consulted have definite ideas about the ideal shack. G5AAA/KØJBA, Glen Grazier, wants his at the top of the house too, so that the attic would have room for those extra ten kilowatts. G5ACY/WØHUC Bud Martin wants his at 45 Park Lane, London, which is the address of the London Playboy Club. VS9ARO, Roy Mewse, wants a garden big enough to contain his antennas, but entirely concreted over, to avoid the need for gardening, and painted green, for aesthetic reasons. The President of the Radio Society of Great Britain, GI3KYP, Barney Patterson, wants a beer barrel instead of a feeder over his rig.

As the first crocus peeps out from the frozen earth, so we start the search once more, hopes high, never downhearted despite the hours combing newspaper ads, the miles we drive with "orders-to-view," the wasted journeys, the irritable battles with occupants who can't understand why their offerings don't suit, the obtuseness of the real estate agents.

We've found only one home which fills our every need—big, old, with a private garden so large the nearest neighbor is more than 500 yards distant, with a lake to keep the soil damp. It is called Buckingham Palace and we can't see it becoming vacant for some time yet.

But radio amateurs are nothing, if not patient. ■

IMRA News [*from page 74*]

IMRA fulfills its goals by serving others with a communications network and with equipment to needy members overseas. By doing this job, IMRA is bringing the advantages of Amateur radio around the world teaching many the value of the radio art, and thus contribute to international good will and the "image" of amateur radio.

Support

Our work and effort has been receiving much response. We do, however, have a long way to go. We need the support of all dedicated Amateurs, as big or as small as this support may be.

I would like you to read this short note. It comes from a man I have never met. He is evidently one of those people who never stops doing his part for a good cause. He has done more than his share.

"Your IMRA news in *CQ* this month caught my attention. I am a totally disabled 'old goat,' a war casualty. I don't have much money, but I do have a complete a.m.-c.w. station which will work 80 through 10 meters. I will give it to you if you could use it in your work or give it to some person who could use it."

Needless to say this is the kind of fellow IMRA is happy to have in its ranks. We welcome him not because he is "giving" something, but because he wants to fulfill the goals of IMRA in any way he can.

IMRA Networks

Presently, IMRA operates two international communications networks. Both these networks are on the air at 1830 GMT every Wednesday. This service network is active on both the 20 meter (14.270mc.) and the 15 meter (21.393mc.) bands simultaneously. With these networks we have begun what we hope will grow into a daily communications service.

This network is designed to serve Latin America. It is only operational for two hours each week. If we could extend this service from 1830 GMT until 0200 GMT one day a week we will be well on our way to success.

IMRA also operates several national nets. These nets are designed to coordinate Statewide IMRA activities, while providing frequencies and times to meet IMRA members.

On the second Monday of each month IMRA members meet on 3.956 mc at 0300

GMT. On this network we discuss such things as the international service net, attendance at regional ham conventions, and the activities of IMRA.

Each Tuesday some IMRA members meet at 1900 GMT on 7.210 mc. Besides this net, there are other regional and local networks run by IMRA members. We hope to establish more of the latter in the near future. These local networks help to stimulate interest in IMRA while serving as a source of ideas for IMRA.

Plans for establishing a c.w. net are under way. If you are interested write to Bob Brine, WB6RYQ, 6128 Welty Way, Sacramento, Calif. 95824.

We realize it will take time to firmly establish good communications networks especially on an international level. We have to locate interested people who will be able to act as control. We must find those who can and will give time to participate in the IMRA services. We know such people are available. We will find them and show them that they can make IMRA work. By pitching in, you will be improving the "image" of amateur radio. At the same time, you will be serving these missionaries.

Until next month, 73 and 76. I hope to see you all in Asheville in August. ■

Contest Calendar [*from page 97*]

Endorsements cannot be considered before the publication of the results of the contest.

It is strongly recommended that you use the official DARC contest log form. A s.a.s.e. with 1 IRC (3 for Air Mail) will get you a supply from the DARC.

Address your request and your contest report to: Dr. H. G. Todt, DL7EN, Chlodwigstr. 5, 1 Berlin 42, Germany. Mailing deadline, September 15th for c.w. and October 15th for phone.

WAE Country List

CT 1 — CT 2 — DL/DJ/DK/DM — EA — EA 6 — EI — F — FC — G — GC — GD — GI — GM — GM Shetland Islands — GW — HA — HB/4 U 1 ITU — HBØ/ Liechtenstein — HV — I — IS — IT — LA — LA/Bear Island — JX Jan Mayen — JW Spitzbergen — LX — LZ — M1/9A — OE — OH — OHØ — OK — ON — OY — OZ — PA — PX — SM — SP — SV — SV Rhodos — SV Crete — TA/ European part — TF — UA/UW/UV 1 through 6 — UB/UT/UY — UC — UN

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QRP QSO Party

Starts: 0200 GMT Saturday, August 19
Ends: 2300 GMT Sunday, August 20

QRP Radio International a dedicated group of amateurs will hold their annual QSO party to promote the use of low power. Rules are same as last year (August 1966 issue) and will be given in details next month.

South Carolina QSO Party

Two periods
2000–0500 GMT Sat./Sun. August 26–27
1400–0500 GMT Sun./Mon. August 27–28

This is the second annual QSO party sponsored by the Low Country A.R.C. Rules are of the conventional state party type and will be covered next month.

All Asia DX

Starts: 1000 GMT Saturday, August 26
Ends: 1600 GMT Sunday, August 27

This is the 8th annual All Asia DX Contest sponsored by the JARL. Its the Asians working the non-Asians, c.w. only, 1.8 thru 28 mc.

Two classifications, single and all band. Operation is limited to single operator only.

Exchange: For OM stations, five figures, RST plus your age. For YL stations, RST plus OO.

Scoring: One point per contact. Asians will use non-Asian countries for their multiplier, and of course non-Asians will only count Asian countries. The DXCC country list will be used.

Final score, contact points multiplied by countries, for single band. Sum total of countries from each band for all band score.

Awards: Certificates to the top scorer on each band in each country. And the three highest scores in each country. There will be additional awards for the highest scoring single operator on all bands in each continent. (Wonder when the JARL is going to make awards in the USA by districts, or at least zones.)

Use a separate log for each band, include a summary sheet showing the scoring, your name and address in BLOCK LETTERS,

and the usual signed declaration that license and contest rules have been observed.

Entries must be in the hands of the committee no later than December 30th. Mail to: JARL Contest Committee, P.O. Box 377, Tokyo Central, Japan.

Editor's Notes

Results of most of the contests announced in this column are usually not received until a year or more later, much too late for publication. If we receive these results in reasonable time I will be happy to include them in this column.

Looking ahead to 1968, what is your opinion of holding our World Wide DX Contest the first full week-end in November and December respectively? We would like to have a greater separation from the ARRL SS and the Thanksgiving week-end that is somewhat of a handicap to the c.w. section of the contest over here. We have already received this suggestion from some of the W/K boys. What are your thoughts on this proposal?

Have a good summer,

73 for now, Frank, W1WY

Grumbles [*from page 45*]

who did continue the QSO with me during the experiment provided much worthwhile *information* which definitely expanded my horizons. One QSO resulted in my changing my views on a subject which I had long felt *very* strongly about.

Like, buddy, I don't need to talk to you from 3,000 miles away to hear your opinions on grid bias, I can check it out in an ARRL *Handbook*. Likewise I don't really care to know how you and Ezra put up the beam in a hailstorm, I've got enough troubles of my own. I *would* be interested in hearing your 3,000-miles-away type views on current events and what (in your opinion) this whole crazy business is all about. That's something I can't get anywhere except directly from you.

Which brings me around again to something I said a few paragraphs back, that the majority of hams are social outcasts. They are outcasts because they are shunned by non-ham people, who simply couldn't care less about their leaking grids and neutralized Nuvistors.

So there they are, apart from the world of reality, jawing their lives away in front of a box of electrons with some other guy who is equally hung up.

Sometimes I sit there with the receiver going full blast, listening to things like "Hi-Hi O.M., diddle-de-bump-be-bump, seventy-through and over to you, K."

Once in a while I even latch onto one of those, "I wuz jist a-tellin' paw" idiots.

I wonder if you and I have ever QSO'd. When was the last time you copped-out on a non-ham talk QSO? ■

Thin-Film [*from page 44*]

gests the revolution which will be caused when an economical method is found to deposit thin-film active components.

It is now evident how basic materials are made into thin-films, how these films are shaped into components and how these components are profitably incorporated into practical devices. With a little imagination it is possible to understand how thin-film techniques can be applied to virtually all electronic devices in order to reduce size and increase reliability. If this idea is carried still further, it is conceivable that Dick Tracy's ficticious, wristwatch television of today, may well be the indispensable reality of tomorrow. If this should occur, it will very likely be the result of advancements due to thin-film technology in microelectronic circuitry.

Conclusion

From the research connected with this article it became apparent that thin-film integrated circuits will completely revolutionize the electronic industry and will do so in the very near future. The basic reason for this is that seldom in the field of engineering does a development permit both increased reliability and at the same time result in a reduction of overall production costs. ■

Simon Says [*from page 105*]

I assume that you are referring to a tri-bander beam of the type employing parallel resonant traps as in Fig. 3.

In this type of construction the *L-C* parallel resonant traps are employed to iso-

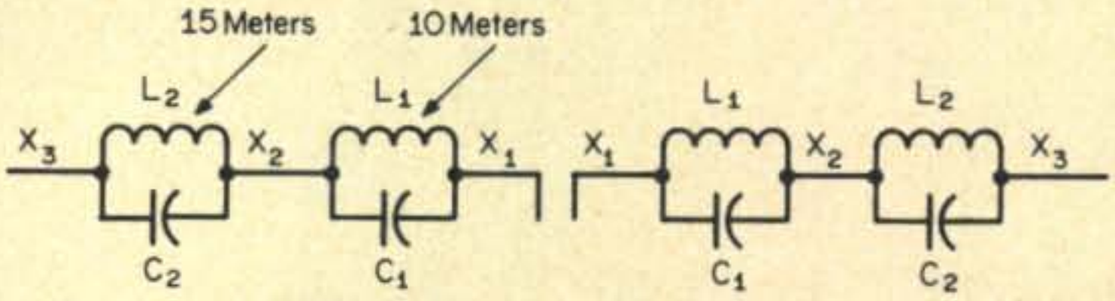

Fig. 3—Functional diagram of a tri-band trap antenna element.

Simon Says [*from page 115*]

late the rest of the antenna when operating on the next lower band. Putting it another way (since I'm confused by what I just said, myself), on ten meters, L_1 and C_1 form a very high impedance to a ten meter signal so that you are resonant, once again, in the antenna as, electrically, not being there. Now supposing you wanted to raise the frequency on 20 meters to operate in the MARS segment, fine, all you have to do is make section X_3 shorter and you will not affect operation on 15 meters or 10 meters. Not so if you wish to raise the frequency on 15 meters. In this case you will have to make section X_2 shorter and raise the resonant frequency of L_2C_2, and in doing so, while you haven't affected the operation on 10 meters you have electrically shortened the antenna for 20 meters. To compensate for this you will have to increase section X_3 so that you are resonant, once again, in the 20 meter band. Should you wish to operate on a higher frequency in the 10 meter band, you will have to reduce section X_1, resonate L_1C_1 to the new frequency add more inductance to L_1 to compensate for the shortened X_1, and then play around with X_2 and X_3 and maybe the L-C ratios of L_2C_2 to bring the rest of the antenna back on frequency. Pretty messy—would you believe a separate antenna for MARS (I'm just trying to be friendly).

As for grid-dip information. CQ *Anthology* (The Best of CQ 1945-1952) No. 102-1 contains several articles on GDO's.

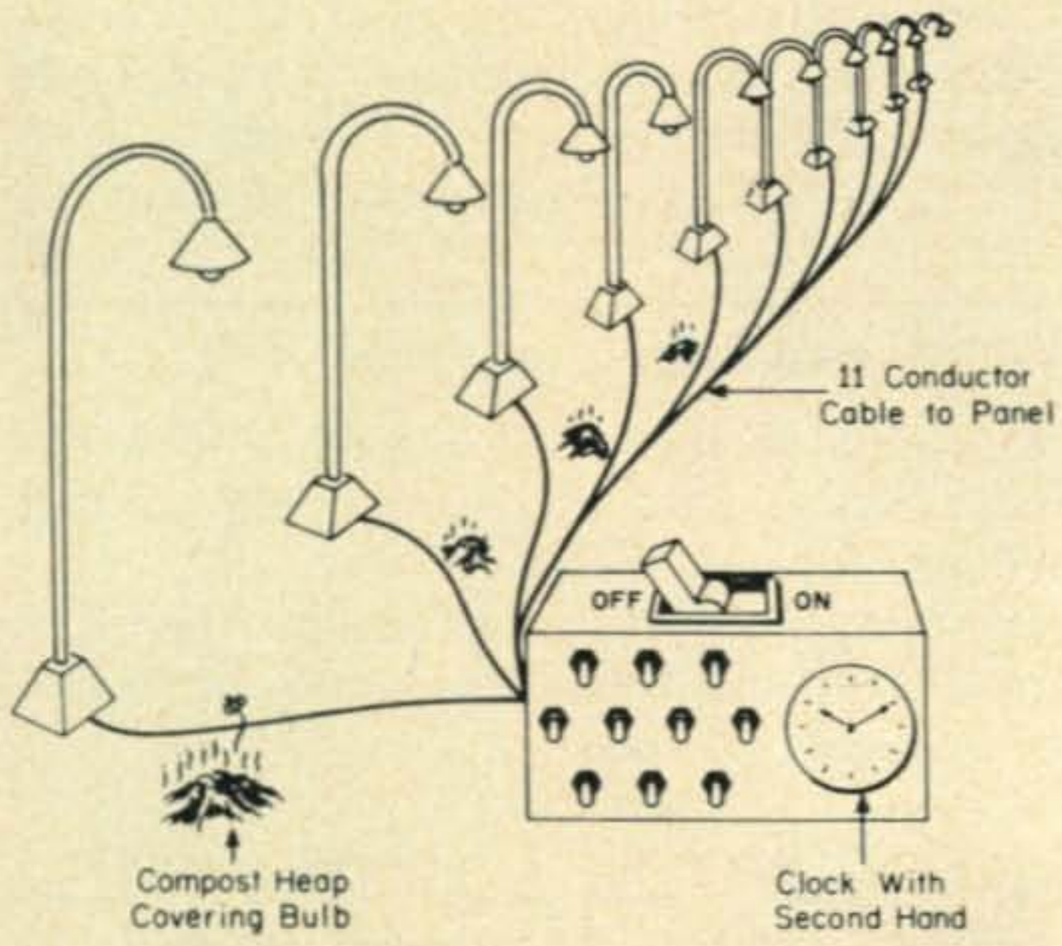

Fig. 4—Sure-fire, infallable switching system for sequentially controlling the illumination of the bulbs.

TS-239-UP Scope: Frank Kedl, W7CRP has a TS-239-UP Scope and would appreciate hearing from any other fellows who also have one or can supply him with an instruction book. Any takers?

Special Bulb Lighter: "Dear 'Simon Says': There are 10 bulbs in a row. We want to light all bulbs, and then progressively, starting at one end, put out one light at a time. Time to accomplish this should be adjustable from 1 second to 15 seconds. Input bulb voltage could be 110 v.a.c. or filtered d.c. from a power supply. If d.c. is necessary, what voltage is recommended?"

I'm delighted with this question. Please see fig. 4.

73, Burt W2UUN

Audio Compressor [*from page 75*]

I used merely because I happened to have it in my junk box. No doubt a miniature type of 3 to 1 ratio could also be found and used. The bias control potentiometer which controls the amount of compression is a logarithmic taper, which gives a smoother control of the compression than would a linear type.

General

There isn't much more that can be said about the unit itself because it is so simple. It has proven its worth many times, in providing a high average level of voice signal on s.s.b. with excellent "talk power," while at the same time preventing overdriving of the various stages in the exciter. It is particularly useful in this regard when running phone patches, because of the wide variations in audio level obtained from the party on the other end of the phone line. The unit has a fast attack time and a fairly slow release time, which is ideal for voice use. I heartily recommend its construction and use by those who desire to improve their s.s.b. signals. ■

C.W. Results [*from page 49*]

awarded to amateurs in 109 countries. (757 for both phone and c.w.)

Its the same overworked committee. Andy Bodony WB2CKS, Fred Capossela W2IWC, Ben Lazarus W2JB, Andy Malashuk W1GYE and yours truly. Our thanks too of course to the crew at *CQ*, Janis, Al and Dick. Bob Entwistle W1MDO gave a hand too, and let's not forget Ellen White who again forwarded those logs that still insist coming via 225 Main Street.

Forgive us if we have omitted any important factors in this report. Making the deadline was quite a chore this year.

73 for now, Frank, W1WY

FET [*from page 33*]

Detector Circuit

The unit constructed by the author uses an FET which is the equivalent of a tetrode and was meant to be an outboard accessory product detector with crystal-controlled b.f.o. for a receiver that had a rather poor product detector and a not-too-stable variable b.f.o. Aside from the symbol used for the FET, it is obvious that the circuit diagram of fig. 2 could be that of a regular 6BE6 product detector, except for the tetrode connection. The i.f. signal from the secondary of the last i.f. transformer in the receiver is coupled to one gate of the FET. The signal from the crystal controlled b.f.o. is introduced on the second gate. As in a tube-type product detector the output is the product of the two signal voltages. The 3.9K resistor in the plus 12 volt lead determines the bias on the second gate. If any distortion is noted, the value of this resistor may have to be adjusted slightly for the proper bias point.

Construction

Construction of the unit will be determined by the space available and mounting desired. Since space was not available within the receiver with which the unit was used, the components were mounted on terminal strips inside a Minibox. The only control used is a crystal switch for sideband selection. Three leads (shielded) are used to bring out the i.f. input, a.f. output and 12 volt a.c. If space is available within the receiver, the components can simply be connected together on an approximate 1½" square piece of vector board and mounted as close to the last i.f. transformer as possible. Shielded leads should be used for the crystal switch if the leads are more than a few inches long.

Other Applications

Although the unit constructed by the author was in response to a particular need, other amateurs may be interested in some other applications of FET's. For instance, fig. 3 shows two r.f. amplifier circuits which can be built as a preselector to boost the performance of a receiver. They might even be used to directly replace the r.f. tube stage in older receivers. Som realignment may be required for tracking purposes but no modifications to the tuned circuits should be necessary. Both circuits are usable down to 6 meters. As far as tube circuit equivalency is concerned, the circuit at (a) is similar to a triode grounded cathode stage and that at (b) to a cascade, direct-coupled driven grounded grid configuration. ■

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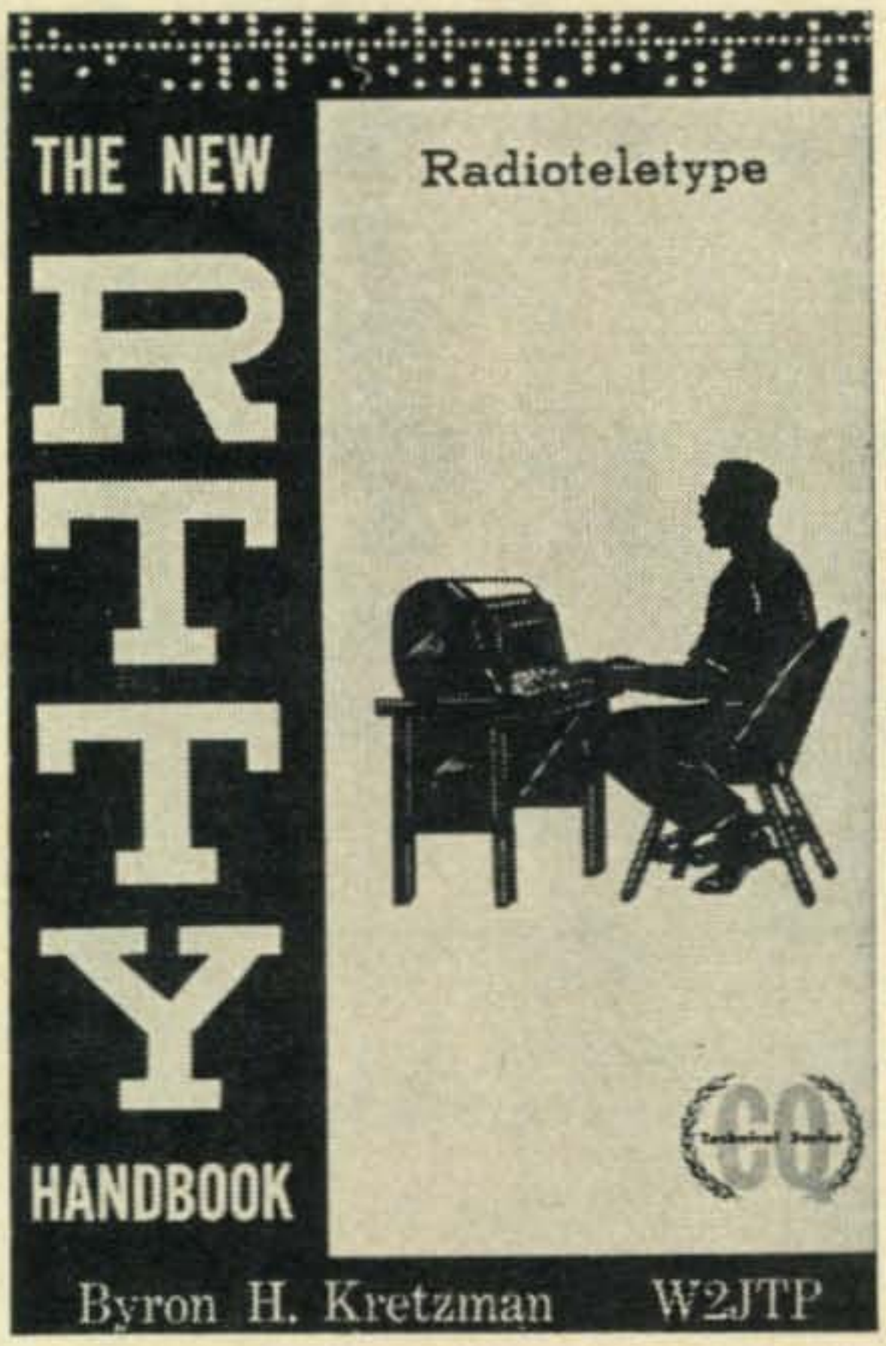

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HAMFESTERS Radio Club, Chicago, Illinois, proudly announces i 33rd Annual Midwestern Hamfest. Sunday, August 13, at San Fe Park, 91st and Wolf Road, Willow Springs, Illinois, near Ch cago. The Hamfest features manufacturer and distributor e hibits, swappers row, awards and a variety of activities for a This year Hamfesters salutes the "Armed Forces". Also di plays by the military. For complete details and map of the loc tion, write: Gregory Purtock, WA9MRE, 2916 West Marquet Road, Chicago, Illinois 60602.

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QCWA and W2JE, my apologies for inadvertently omitting you as a SAROC participant in our May and June adv. in **CQ, 73 & QST.** Join us in 1968 it won't happen again. Leonard M. Norman, W7PBV, 652 Utah St., Boulder City, Nev. 89005.

DRAKE 2B w/2BQ $275. Heath Marauder HX-10 $175. Excellent condx. Both for $425. M. K. Johnston Jr., K4NIJ, 5111 Governors Dr., Lot 45, Huntsville, Ala. 35805.

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RANGER I with PPT ex. condx. $85.00 R-100 A factory wired with S-Meter and calibrator $65.00. Both for $135.00 or best offer. Also want 20M 3 el Beam. Bill Gode, 1036 Hillside Rd., Northbrook, Ill. 60062.

NEED a pair of 4-64A tubes. What do you need? R. Senechal, W6PYR, 4028 China Ct., Hayward, Calif. 94542.

SWANTENNA Mod 45 $20., Master Mobile #75 all band coil $8.00. f.m. 100W/2M base station $125., f.m. GE 2M Mobile Xmtr $15., Clock timer for Hd 170. $5.00. QST's 46-59 25¢ ea. W. J. Davis, K6KZT, 4434 Josie Ave., Lakewood, Ca. 90713.

WANTED: SB-200 or warrior linear, good condition, cash. M. H. Kearns, K7WSW, 700 Savage Creek Rd., Grants Pass. Ore. 97526.

WANTED: WRL Globe Chief Transmitter—W1BB.

ASTATIC D-104 mike with G stand, excellent shape, $15; NCX-5 power supply, home built, works but needs work, good xfmr and diodes, speaker, $35. KX6FJ via KX6BU; S Fierston-W1BRJ, Box 1544, APO San Fran., Calif. 96555.

FOR SALE or Trade, 30 years accumulation of parts and gear. HQ-170, HRO-50, TCS, SB-10 and test equipment SASE for Mimiographed list., L. Harry-W7PT1, Box 387, Pinehurst, Idaho 83850.

GONSET GSB-101 Linear Amp. Mint $150 Hallicrafters SX-99 RCVR Mint $80, H. C. Sherrod Jr., 3636 Barcroft View Terr., Falls Church, Va.

SELL or Trade: G.R. 1208-B, R.F. GEN. $150. Simpson 269 V.O.M. $50. Both L/NEW W/Man. Want NC81-X, KWM1, L. Kulhay, W1MRR, 19 Topstone, Danbury, Conn. 06810.

HX-10 new $260, ARC-5 RCVR 6-9 mc w/ps $5, Johnson Modulator $8, CRTs-5DBP7 $20, 5CP1 $12, HV Cer Switch DP5T $8, 100 mmf 350 mmf HV Cap $10 ea. Dennis Burtick, 106 Fresh Ponds Rd., East Bruswick, N.J. 08816.

FOR SALE: Heath HG-10 VFO and Globe Chief Deluxe Xmtr. Make offer on either or Both. Wanted—Operating Manual for the RME VHF 152a Converter. G. J. Cotellis, Jr., 190-32nd St. W., Bradenton, Fla. 33505.

NO TIME to operate. Used 25 Hours. SB-300—$225. Northern Fadio Variable Master Oscillator $70. KSVYY., J. Beistle—3728 Wickie Way, Ft. Worth, Texas 76133.

HEATHKIT TS-2 T.V. Generator—$17. Heathkit IM-1 Distortion Analyzer—$17. Cadre Model 500 C.B. w/battery case—$79. Local pick-up or you pay shipping. L. A. Streng, 5229 N. 16th St. Phila. Pa. 19141.

WANTED: Western Fadio Amateur, YL Harmonics, Spark Gap Times, Ex-G Bulletin. Any or all copies acceptable. F. A. Herridge, 96 George St., Basingstoke, Hampshire, England.

75A4 mint 3.1 filter $375. 600L Excellent $150. Model 15 KSR excellent $50. Model 14 TD $30. Model 14 KSR typing reperf $45. AN/FGC-1 conv. like new $75. W8NLT, 209-55th St., S.E. Charleston, W. Va. 25304.

PANORAMIC Adaptor: in exc. condx. to ADO to I.F. of RCCVR 450-470KC. Hallicraftor, SP44, SN6255. $50 FOB. with manual. W2AS1. Monte Freedman, 15 Kensington Oval, New Rochelle, N.Y. 10805.

SELL—EICO 720 XMTR $40; 1800-0-1800, Fil XEMR, 4 866A $30. Phasemaster XMTR $35. W3CD, 2GF. Seyffert, 211 Sumner Ave. New Castle, Pa. 16101.

SHAWN 6 Meter Transceiver, Very Clean, unmodified 2 years old $115. Dr. Bernard Walkowiak—KILVO, 167 Hamilton St., Southbridge, Mass. 01550.

FOR SALE. Nationaly HRO 7 receiver. Includes 7 coil drawers. Excellent condition. Byron E. Fortner, W9FYM, RDF#10, Box 486 Indianapolis, Indiana 46239.

ASKING $50.00 for new prop pitch motor, two 2J1F3 selsyns and 24 volt power transformer. All in excellent condition. Fran Kedl, 55 East 8th St., Sheridan, Wyo. 82801.

OLD WIRELESS SETS, vacuum tubes type, UV199, UV200, UV 201, UV202, UV203, UV204, UV217, foreign types and others with brass bases. R. W. Schnedorg, W9LGH, 610 Monroe Avenue, River Forest, Illinois 60305.

SELLING 3 ele. Fiberglass Quad, incl. Boom, Wire and 60' RG8/U $70.00. Also TH-4 with s.s. hardware, $70.00. Sorry, pick-up only. A. H. Bott, 106 E. Highland Drive, McMurray, Pa. 15317.

WANTED: Bird wattmeter, 500 wattpolypedance Modulation-XFMR SX-42 Receiver. Jobson 6N2-Converter W/7MC or 14 MC out. Lab type oscilloscope. Sig. Gen. TS-497B/URR, 2-400MC. Pfalzer, 24 Beechwood, Granville, Ohio 43023.

WANTED: Latest model Collins KWM-2 or WKM-2A. Must be one with sealed relays and teflon wiring. W7BIF, 107 Wyoming, Boulder City, Nevada 89005.

COLLINS 75A3 3.1 Kc and 800 cycle filters, vernier knob, home brew calibrator and NBFM per Collins design, prod. det. per m article Oct. 66 CQ. Very clean, perfect operation. $250. W4HJ Carl Ebhardt, 22 Rowan St. Raleigh, N.C. 27609.

SBE 34—Demo $339—SB200—$200. Want KWM 1 or 2 F. L. Baker—W8QJR—W8FLT, Box 546, McComb, Ohio 45858.

RTTY—110 volt Ac synchronos motor for model 15 TTY $10 F.OB. W7MKB, 802 N. Rodney, Helena, Montana, F. J. Kamolsky

LOCOST Super-sens-selective 14 tube USAF surplus receiver, will tune 550 kc or 3mc slices of most HAM bands using simple front end converters, $15.00. Irving Megeff—W2LXK, 5015 Weeks La Flushing, N.Y.C.

SELL—15 TTY, Table, Power Supply You pick up. WØPHY, L. A. Stapp, 2903 Ash, Hays, Kansas 67601.

SELL—Hallicrafters HT-33-B $350.00; SX-101-A receiver $150.00 K6RTC, 470 Commercial Ave., South San Francisco, Calif. 98040 C. D. Bonino.

NEW IP69/ALA2-30mc. VHF Panadapter; New Zeiss Compact 35mm camera, f2.8 Tessar, Case, Flash; Petri Half Frame 35 mm f2.8 meter, strobe. Want Clemens SG83, Heath QM-1. Chester Benson, W91FB, 732 So. 14th, Richmond, Indiana 47374.

DX-401 VF-1 pair for $50.00, perfect operating condition 15 mtr 813 kilowatt linear or class cas in hardbook, $90.00 with pwr supply & mod. John Fulton, WB6nBO, 4977 Palo Dr., Tarzana, Ca. 93156.

MINT central electronics MM-2 s.s.b. a.m. analyzer with RX adapter $45.00. Hallicrafters Transverters HA-2, HA-6, P-26 $275.00. C. E. Spitz, W4API, 1420 S. Randolph St., Arlington, Va. 22204.

TRIEX HZR47IN deluxe rotating motorized crank-up tower. Galvanized, like new. $1095. Want HZ-588N. R. W. Ehrhorn, WA4NGO, 13315 108th Ave., No., Seminole, Fla. 33540.

FOR SALE: HX-32B and Heath GR-91 shortwave receivers. Both in excellent operating cond, HX-32B—$30, GR-91—$30.00. Ship C.O.D. V. Scott Galbraith, 1110 Wilson Ave., Cookeville, Tenn. 38501.

SALE G-76, w/a.c. and/or d.c. P.S.; 6M halo or squalo; HT-40 & SX-101, 6M conv. Best offer for part or all. J. J. Bock, K3PHC, 7605 Brookhaven Rd., Philadelphia, Pa. 19151.

FOR SALE: Motorola 2 mtr f.m., 80D 30W trans strip $20, 140D 60 W Trans Strip $30, Sensilicon rcrv 12 V $25, Alliance Ant Rotator $10. C. W. Copp, W2ZSD, 6 Northfield Lane, Westbury, N.Y. 11590.

$1.00 brings picture & guidance sheet for the new and unique barb wire antenna. C. L. Kerr, WA6CTK, P.O. 444, Montebello, Ca. 90640.

SELL ($49) or Swap: EICO 720 Transmitter. Tom Dornback, K9MKX, 19 W. 167 21st Pl., Lombard, Illinois 60148.

NEW Heath GW-14 C.B. transistor transceiver 48 crystals 12 & 110 V. Eico $135.00 430 scope; EICO $40.00 battery elim. $35. Wm. L. Ries, WA8HZO, 1712 Mohican S.E., Massillon, Ohio 44646.

HAMMARLUND Gen. Receiver HQ-100C, clock and xtal b.f.o. manual, orig, carton, very good condx. Cost $220. Yours for $100.00. Floyd Fellows, WA5RDI, 663 Washington Ave., Santa Fe, New Mexico 87501.

GALAXY c.w. monitor in outstanding condition. Easy connection. $18.00. Will ship. Phil Gluckman, WN6SSA, 19790 Merribrook Dr., Saratoga, Ca. 95070.

SELL: DX-40, $25.00; SX-99, $50.00, certified check or money-order. You pay shipping. N. A. Ginga, WA2MTI, 21 Napoleon St., Newark, N. J.

WANTED KWN-1 or KWM-2, with a.c. supply, located in S.E. Florida. Serial number, condition and lowest price. J. J. Moran, 4205 Arthur St., Hollywood, Fla. 33021.

WANTED: desperate for Telefunken, Valvo tubes circa WWII, ACH1, AD1, AC2 (sub. for ac2 is western electric #39). Tubes have lug "feet", not straight pin bases. Also buy WWII German, British transceiver, transmitters, receivers. Bob McGwier, Box 565, Grove Hill, Ala. 36451.

SELL or Swap Pierson KE93 w/2 Supplies NC88 SX71 LM HE50 Valiant Lampkin 105B and others. Write for list & prices. Robt. C. Gove, 7123 Cedar Lake Rda. St., Louis Park, Minn. 55426.

SB-34 WANTED: Must be in good shape and would prefer to inspect. P. B. Holmes, Jr., WB6KXI, 9733 Comanche Ave., Chatsworth, Calif. 91311.

COVER (LBPC) for model 28 ASR Teletype. With base, cradle, transformer, lites, and copy holder. $27.00. Excellent condition. J. Thomsen, W9YVP, 11001 S. Pulaski, Chicago 60655.

TUNING your antenna, need communications from rig to tower. First $10.00 takes prepaid two archer 27 mc walkie talkies. J. C. Mankus, KØAWM, 11431 Ortega Drive, St. Louis, Mo. 63138.

FOR SALE: National 200 & a.c.200 PS sealed cartons, warranty, $390.00 or best offer near that figure. A. S. Johnson, W6EPO, 594 Alderson St., El Cajon, Cal. 92021.

FOR SALE: Two pair syncero generators type 7 G Mk3 Mod A. 110V-60C $15.00 Pair—W3AH.

WANTED TO BUY: Code practice tapes for signal corps TG-34A Code Keyer. D. Testa, Jr., 390 Lincoln Ave., Newark, N. J. 07104.

SELL Knight KN-700 Stereo preamp $20; Homebrew general purpose scope $15; or trade for ?? Want Jan. 1961 **73** Magazine. John Becker, K9WEH, 2435 Birchwood Lane, Wilmette, Ill. 60091.

FOR SALE: Morrow Mb560A and RTS 600S. A.C.P's. Excel. Novice Ex. cond. $75. NC-300-Viking 500 both excel $350. for pr or best offer separate. T. C. Almgren, K6ZFO, 5112 Torida Way, Yorba, Linda, Cal. 92686.

SALE OR TRADE: HW-22 Transceiver with HP-23 & HP-13 supplies. Consider 2M gear or SB-34 plus cash. N. F. L'Heureux, WISCM, 13 Libby Ave., Lewiston, Maine 04240.

AMPEREX 6693 HV rectifiers new $25 ea., sell $10 ea. 6080 WA, $5—6080 tube, $2.50 Heath Ten'er $40. D. R. Etheredge, K6UMV, 12040 Redbank St., Sun Valley, Cal. 91352.

EICO 753 Tri-band XCVR, F/W exclnt condx, also 751 110 A.C. supply and spkr console. Both $260. Peter Ludwig, 34-15 Parsons Blvd., Flushing, L.I., N.Y. 11354.

ACCURATE model 161 utility tester. Tests tubes, appliances, motors, cars, 0-10K, 0-300VDC, 0-15ADC. R. E. Beatie, 1904 E. 114 Ave., Tampa, Fla. 33612.

SELL: Like new SX-100 $125. HT18 VFO $20.00. Gonset phone patch $20. HT9 100 Watt all band AM-CW Xmitter $50. Walt Rabe, W9AØL, 233 No. Taylor, Oak Park, Ill. 60302.

MITE TELEPRINTER $900, 5 & 8 level perforators, 14 channe magnetic tape recorder in 6 ft. rack, $100 6 ft. rack full of operating digital system $100. Multiplexer in 6' rack—new w/50+ tubes $40.00 Ampex 1250 stereo deck $300, Eico, McMurdo Silver RF generators $15 ea., Tektronix 310 $375, unimat $85, new broadcast quality impression amplifier $75. All above in perfect condition. Hi-Gain Roto-Brake rotator-needs adjustment $40. Tom Perera, 410 Riverside Drive, N.Y., N.Y.

TRADE Cleg 22er, 4 months old. For Clegg ZFuse and P/S Mod complete. or buy ZFuse. F. R. Harmon—K5TLB, 314 No. Birch, Owasso, Okla. 74055.

155 copies of CQ. Solid run '53 thru '65 with only Feb. 54 missing. Complete lot for $30 and you pay shipping. That's less than 20 cents per copy. E. M. Shook—W51T, 227 West Woodin Blvd., Dallas, Texas 75224.

FOR SALE: Johnson Pacemaker, 80-10, ssb, am, cw, $150, Hammarlund, HQ-110AC, $150, 1KW AMP, 80-10, $30, Power Supply for amp, $40, 6 meter squalo, $8, Stix Borok, 209-25 18 Ave., Bayside, N.Y.

FOR SALE: Operating manuals in perfect condition for the following equipment: 75A4, $3. Viking Thunderbolt, $2. Viking 6N2 Thunderbolt, $2. Al Brogdon—K3KMO, RD Box 390A, State College, Pa., 16801.

SELL: 75A4, KWS-1 plus accessories—Excellent Condition—Asking $900. K2SOX, 2217 Cornwall Ave., Northfield, N.J. 08225.

SWAN 350 and AC supply: Brand new in factory sealed cartons. Hamfest Price First $400. takes. R. G. Hanlon—3311 Garland—Midland, Michigan. W8HIZ.

NEW Heathkits—unopened kits. SB-101 $325, SB-200 $198. two of each available. Phone: (Day) 615-384-5573—(nites) 615-384-5643. Don Payne W4HKQ, Box 525, Springfield, Tenn. 37172.

FOR SALE: Transcom SBT 3 Transceiver, mic, AC & DC supplies mint 10 hrs use. $350.00. WA8GVK, 720 Oakmere, N. Muskegon, Mich. 49445.

WANTED: Teletype page printer set repairable condition. Hal Box 283, Saxonville, Massachusetts 01706.

QSL'S, SWL'S, CB 10¢. N & S Printery, Box 11184, Phoenix, Arizona 85017.

COMPLETE home or mobile station 160 thru 10, $250. Elmac AF67 PMR 7, M1070 pwr supply with Ptt mike bumper mount, speaker and ant. relay. WA2KOV, P.O. Box 321, Claverack, N.Y. 12513.

"SHAWNEE"—Heath HW-10, 6 mtr, 20W, Trans-Rcvr with Hal antenna, $140. Heath HW-19 "Phone Patch" $20.00. All Perfect. S. R. Samuels, 76-13 251st St. Bellerose, L.I., N.Y. 11426

QST, CQ, other misc. books; Sam Photofacts $1.00 write for list. Bill Hayward, WØPEM, 3408 Monterey, St. Joseph, Mo. 64507.

FOR SALE: Ham Scan 10-13. New condition. i.f. on 3395 kcs. Will change to other frequency. Manual. $45.00 Inquiries answered. John E. Probst, W8DCE, 5783 Oakridge Rd., Hamilton, Ohio 45011.

d.c. to d.c. convertor MOTOROLA. 12v to 105v @ 75 ma. $10.00. M. K. Gauthier, K6ICS, 10425 San Jose Ave., So. Gate, Ca. 90280.

GONSET TWINS G-66E Recvr a.c./d.c. supply G-77 Xmtr modulator d.c. supply connecting cables manuals originals ctns express collect exclnt condx $125.00. C. W. Chisholm, K6EKC, 1714 Tahoe Dr., Santa Rosa, Ca. 95405.

"TOROID" transformer for d.c. supply, $3.75. Crystal calibrator 100 kc. $9.50. IBM electric typewriter $75.00. Sell or trade for ham or test equipment even if not operative. J. Boer, K2OYN, 449 Hill St., Boonton, N. J. 07005.

WANT MORE POWER? I have SB-34 and linear $500. or will consider late Galaxy and appurtances. N. C. Hipp, K7AOA, 5750 Yukon Dr., Sun Valley, Sparks, Nev. 89431.

SELL 92121 manual for AN/SRT-14, 15, 16 $30; Millen 90905 monitor scope $55; Vanguard 6 meter converter with pre-amp & H.B. P.S. $18; R. Ireland, Pleasant Valley, N. Y. 12569.

WANT Model 15 Typing Unit. Will pay cash or will swap typing reperforator. W. H. Bauer, W4NZY, 119 No. Birchwood Ave., Louisville 6, Ky. 40206.

SELL: 3-6MC & 6-9MC command Rec'vrs. Genemotor 6V to 300V $6, PE101C 12V to 400V $8, All ex. FOB. J. M. Herrman, W8MKI, 894 Lincoln Drive, Conneaut, Ohio 44030.

WANTED: Early broadcast condenser mikes by WE, BTL etc. Also desk mounts for early carbon mikes, WE, Palmenberg, Universal. M. L. Gardner, WØJJD, 223 Welch, Ames, Iowa 50010.

HALLICRAFTERS SX-101 MKIII receiver excellent condition will deliver 200 miles. $160. Earle Gray, K7CEV, 18620 Occidental Ave. So., Seattle, Wash. 98148.

WOULD like to get in touch with radio amateurs who attended Dodgers Radio Institute, Valparaiso, Ind. Fall and Winter 1919. C. A. Sampson, WØGBF, 317 No. 9th Street, Montevideo, Minn. 56265.

FOR SALE: SX-101A. Latest prod. model. Mint cond. $190.00. R. Formica, WA2EBS, 1300 Greenbriar Lane, N. Bellmore, L.I., N.Y. 11710

SALE: Vibroplex lightning bug like new $12.00. Knight SWR Mode P-2 $12.00. C. E. Herr, W3LIE, RT. 1, BX 291, West Middlesex Pa. 16159.

HAVE new Collins 62S1, unused—will trade for used KWM-2—c other good rig plus cash—make an offer. J. Yeoman, W8VHY R#4, Washington C.H., Ohio 43160.

WANT: VT-2 Tube; Trade: Murdock Oscillation. Transformer fo atwater-Kent 10 or 12. Fred W. Chapman, 1367 Villa Rd., Oaklan Co., Birmingham, Mich. 48008.

FOR SALE: Heath Mohawk Rcvr, Excellent Condx, $139.00—W8SL —J. J. Kowalski, 4481 W. 139th St., Cleveland, Ohio 44135.

WANTED: Collins adapter #354A-1 for R-388 parts for tmc FRR 500 series rcvr D. M. Stahley, 166 Fairoaks Dr., Pleasant Hil California 94523.

WANTED: 2 KW linear amplifier; sell valiant w/manuals excelle condx. make offer or will trade towards linear. Dr. W. W. Fulche K4RTA, 1400 Harwood Dr., Nashville, Tenn. 37206.

QSL Service: Will send QSL cards to Japan or Russia at one cen each, elsewhere two for five cents. Tom Frenaye, WB6KIL, 61 Purdue Drive, Claremont, Calif. 91711.

WANTED: CW and SSB skeds on two meters, in any portion band. D. W. Blystone, K9ZNK, 812 Niles St., La Porte, Ind. 4635

WANTED TO BUY: old radio receivers and transmitters, book magazines, call books early radio and wireless parts for amate museum. Erv Rasmussen, W6YPM, 164 Lowell St., Redwood Cit California, 94062.

TOROIDS 44 or 88 mh, any 5/$2.00, 255A Polar, Relay $2.30, 18 Relay Socket 70¢, all p.p. USA. E. W. Evans, K4ØEN, 220 Mimos Lane, Paducah, Ky. 42001.

BARGAINS + SB-400, HQ-170C, 6 & 2 converter, mobile suppl much more—stamp for list. WANT—HX-50A or Ranger. J. R. Shan W3CNS, 21 Terrace Lane, Elizabethtown, Pa. 17022.

KW linear GSB-101—Mint Condition $125.00 SX 99 RCVR—Mint- $70.00. H. C. Sherrod, 3635 Barcroft View Terr., Falls Churc Va. 22041.

WE-275B/HG-1017 relays; 50 @ $2.00 ea. Potter-Brumfield K 1660-1; 25 @ $2.00 ea. UTC S-50 XFMR $25.00 4D32 Tubes use but O.K. $5.00 ea. your test want info on link 1905A, 1906 Schem. SASE for list. E. F. Lankford, W4HHY, 511 Purnell Dr Nashville, Tenn. 37211.

SELL: Johnson 500—$250.00 Johnson SSB Adapt. $135, SX 101 $175.00. Exc. Condit. Manuals. Lou Brummel, W6FZB, 262 Aragon Way, San Jose, Ca. 95125.

FOR SALE: Swan 350 with 117XC power supply, one year ol $375.00. Heath SB630, 4 months old, $70.00. Heath SB60 $12.00. All equipment in new condition. Reason for selling, g ing to Collins S-Line. J. Vugteveen, K8HNB, 415 Cochlin Stree Traverse City, Michigan 49684.

BEST OFFER: Heath Warrior HA-10 linear (no phony doubl supply!) $145 minimum. DRAKE R-4 in original carton $26 minimum. Manuals. Mint. Ship anywhere. G. V. Cordioli, WB6SB 18062 Norwood Park, Tustin, Calif. 94303.

SWAP Wide Range Transmatch for good SSB receiver. Tran match built according to Nov. 1961 QST. Article. W. Irving Coo W4HPF, RT. 2, Box 137, Marianna, Fla. 32446.

FOR SALE: Two R-44/ARR-5 Receivers. Military version. Hal crafter S36A. 27.8 to 143 mcs. $60.00 ea. R. Lee, W6EZ, 105 Crest Drive, Encinitas, Ca. 92024.

FOR SALE: Instructograph tape code machine. 9 rolls tape. Se contained code oscillator. $25.00. R. E. Lee, W6EZ, 1050 Cre Dr., Encitas, Ca. 92024.

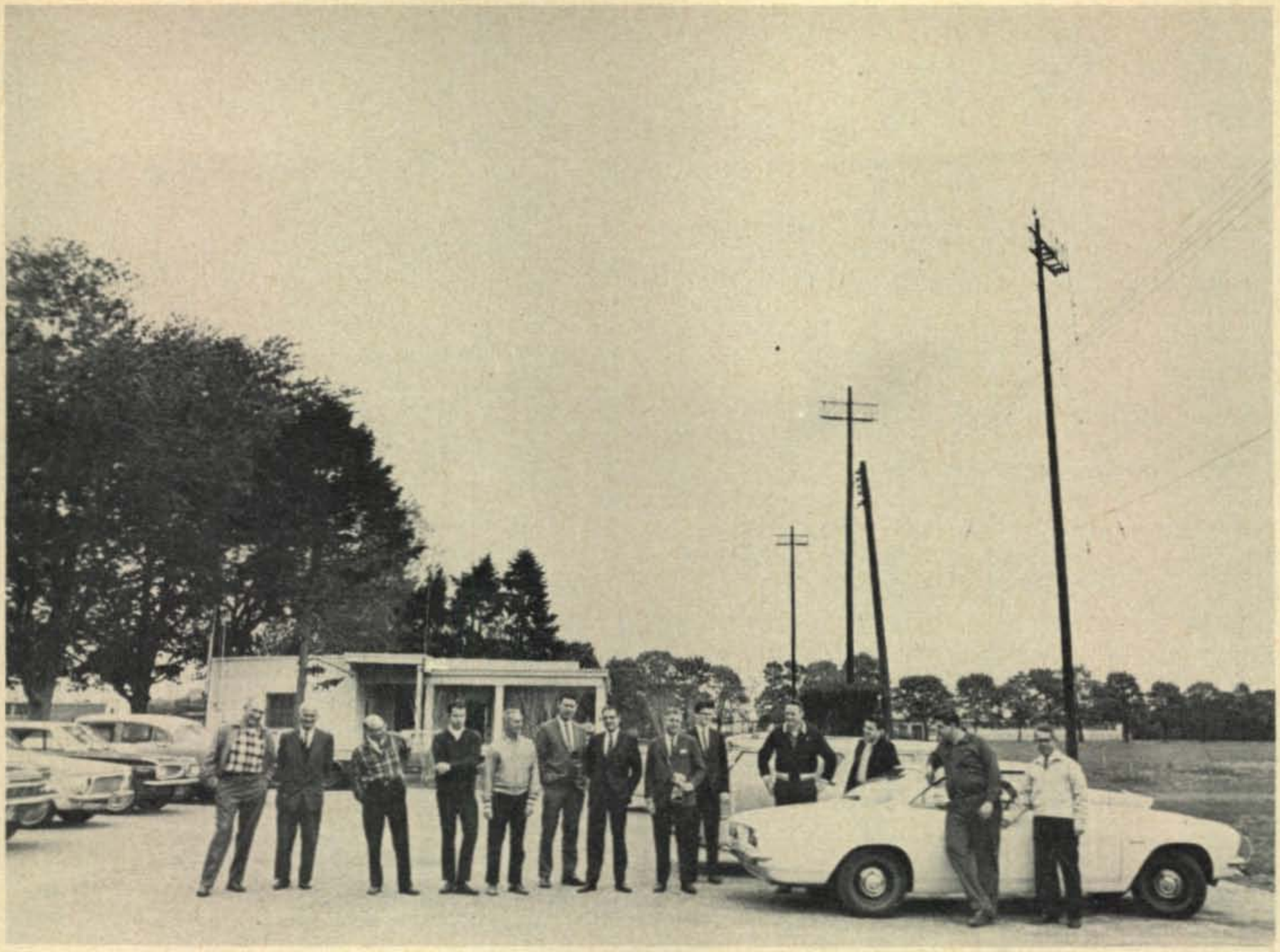
DX-40, VF-1, $50; 6'er, mike, 4 xtals, $35; Gonset Super conv. $25; home brew 25 W mod. $10. R. Hutchinson, W3WI 1705 Kaywin Ave., Bethlehem, Pa. 18018.

DESPERATELY NEEDED: 10 & 15 Meter plug-in coils for swingin link. B & W HOVL TYPE. Richard Filchock, K3LTY, Box 124, Hille Pa. 15444.

40' crankup tower—$55, HX30 6 meter SSB exciter $150, DB- preselector $40, SX-28A RCR $90. Swap any for Swan 512 supply, 75S3B rcr, or ham M rotator—J. Mayer, W8IYI, 194 Mendota, Detroit, Mich. 48221.

FOR SALE: 20 kc Collins Mechanical Filters. Perfect for SSB rig Also one 4.0kc WAØNIY, 706 Hyland, Storm Lake, Iowa 50588.

WANTED: CQ, April 1945; QST's prior August 1923; RADIO, Ju 1935; S. W. Craft, 1930 on. G31DG, 96 George Street, Basingstok Hampshire, England.



General view of NASTAR Headquarters shows some members with the shack and three of the 80 foot antenna poles behind.

Moonray [*from page 19*]

The group last year gave a 10-week course in satellite tracking which was the first ever offered at a Long Island college and, possibly, the first of its kind in the country.

When NASTAR was organized its first home was unique. Nassau Community College took over part of the de-activated Mitchell Air Force Base as its campus and the ham group's first shack was the field's glass-enclosed control tower. Last year, the college gave the group its own building, a former field house, which now houses kw rigs for the low bands and 2 meters as well as other transmitters for 6 and 432, plus associated receivers, converters and recording equipment. The building also provides quarters for NASTAR's astronomy section, formerly the Sperry Astronomy Club, a library alcove and a workshop.

An anonymous "angel" installed five 80-foot poles outside the NASTAR building this past fall. Already on them, or due for installation in the spring are: 40 meter wire beams aimed at OSCAR headquarters in California and 4U1ITU in Switzerland for relay work; wide-spaced 20 m. beam; 6m. Squalo stack and 2m. Big Wheel stack for QST work; a tribander to track OSCAR 5's 10m. transmissions; 44 cross-polarized 2m. elements and two 11-element 2m. Yagis for OSCAR tracking plus an assortment of long V antennas. A 40-foot steel tower that formerly held an Air Force siren is waiting erection to hold 432 and 1296 mc arrays.

The group recently acquired a completely operational SCR-584 radar unit for satellite tracking in a 24-foot trailer, which has not yet been towed to its location outside the NASTAR shack.

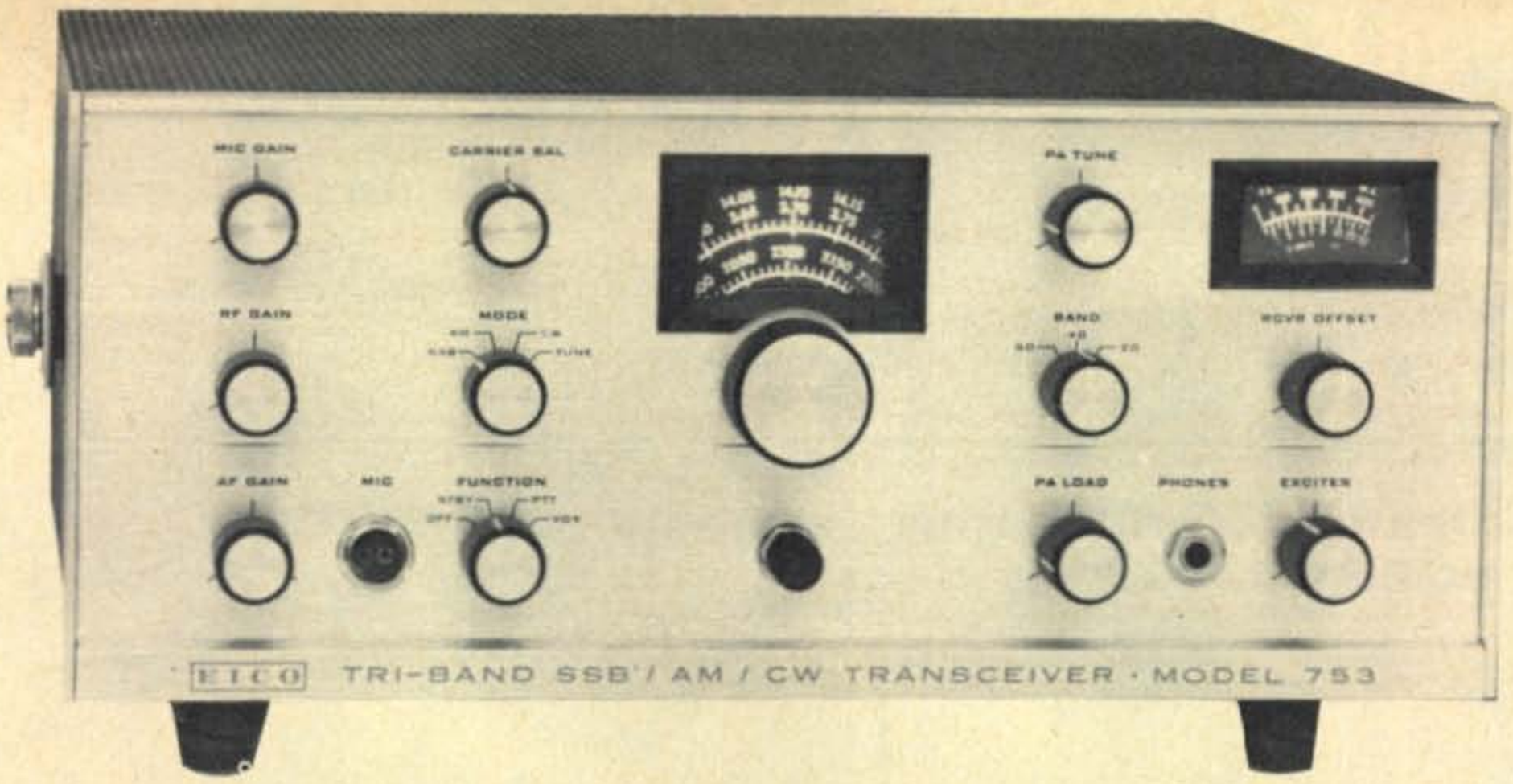
In addition to regular Sunday morning work sessions, NASTAR members meet weekly on Monday nights at 2000 hours E.S.T. on 2 meters. Net frequency is 145.85.

Membership is open to all licensed amateurs seriously interested in, and willing to work at, some phase of NASTAR's work which ranges from equipment and antenna construction to operating v.h.f and u.h.f. equipment and recording gear.

NASTAR's mailing address is P.O. Box T, Syossett, L.I., N.Y. 11791. ■

For further information, check number 21, on page 126

advertisers index



SPECIAL OFFER

For sale: Eico 753 SSB, AM, and CW, 20, 40, and 80 meter kits together with our famous "meat and potatoes" Power supply kit, only $189.95, FOB Harvard.

The regular price of the Eico 753 has been $189.95. The prevailing price for the "meat and potatoes" transceiver power supply kit has been and is $50.00. While our stocks last we will offer both the 753 latest version kit and our MP supply kit for the original price of the 753 itself, $189.95. By every measure of value this is the most that has ever been offered the American ham. Excepting for the antenna, microphone and key, this is a complete station. All that is needed is your perseverance in building the kits and with this particular combination you will have 300 watts PEP instead of 200 watts. Moreover when you decide at some subsequent time to go 5 bands instead of 3, you can continue to use the MP kit with any other transceiver that has so far been brought out.

Read closely the following specifications on the 753 and then see if you don't agree with me that this is a heck of a good value.

—The 753 includes a solid state silicon transister VFO strategically mounted for minimum drift.

—The 753 gives coverage between 3490 and 4010 kc on 80 meters with lower sideband output. It provides coverage for 6990 to 7310 kc on 40 meters with lower sideband output and it provides coverage for 13890 to 14410 kc on 20 meters with upper sideband output.

—You can inject carrier by upsetting the balance on the balanced modulator, a type 7360, so as to provide for AM modulation.

—SB generation is accomplished with a 5.2 mc crystal lattice filter having a band width of 2.7 kc at 6 db points.

—Unwanted carrier is down 50 db, unwanted sideband is down 40 db.

—The 753 provides for incremental tuning plus or minus 5 kc so that when tuning for other fellows your transmitted frequency will remain constant.

—The receiver has a tremendous dynamic range with sensitivity of 1 mv for 10 db signal-to-noise ratio.

—The 753 measures 5½" high, 14" wide and 11¼" deep.

The instructions are amazingly clear and can enable the average person to build this set with the minimum test equipment in only 40 hours.

If you are one of the few AM boys left who has not sampled sideband or if you are one of the beginners to our hobby, you should seriously consider this small investment, for I know of no means of breaking into sideband which is less expensive than this particular offer. The 753 kit and our MP supply kit, total price only $189.95, F.O.B. Harvard.

HERBERT W. GORDON COMPANY

"Helping Hams to Help Themselves"

Woodchuck Hill, Harvard, Mass. 01451

Tel. 617—456-3548

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"Duo-Bander 84"

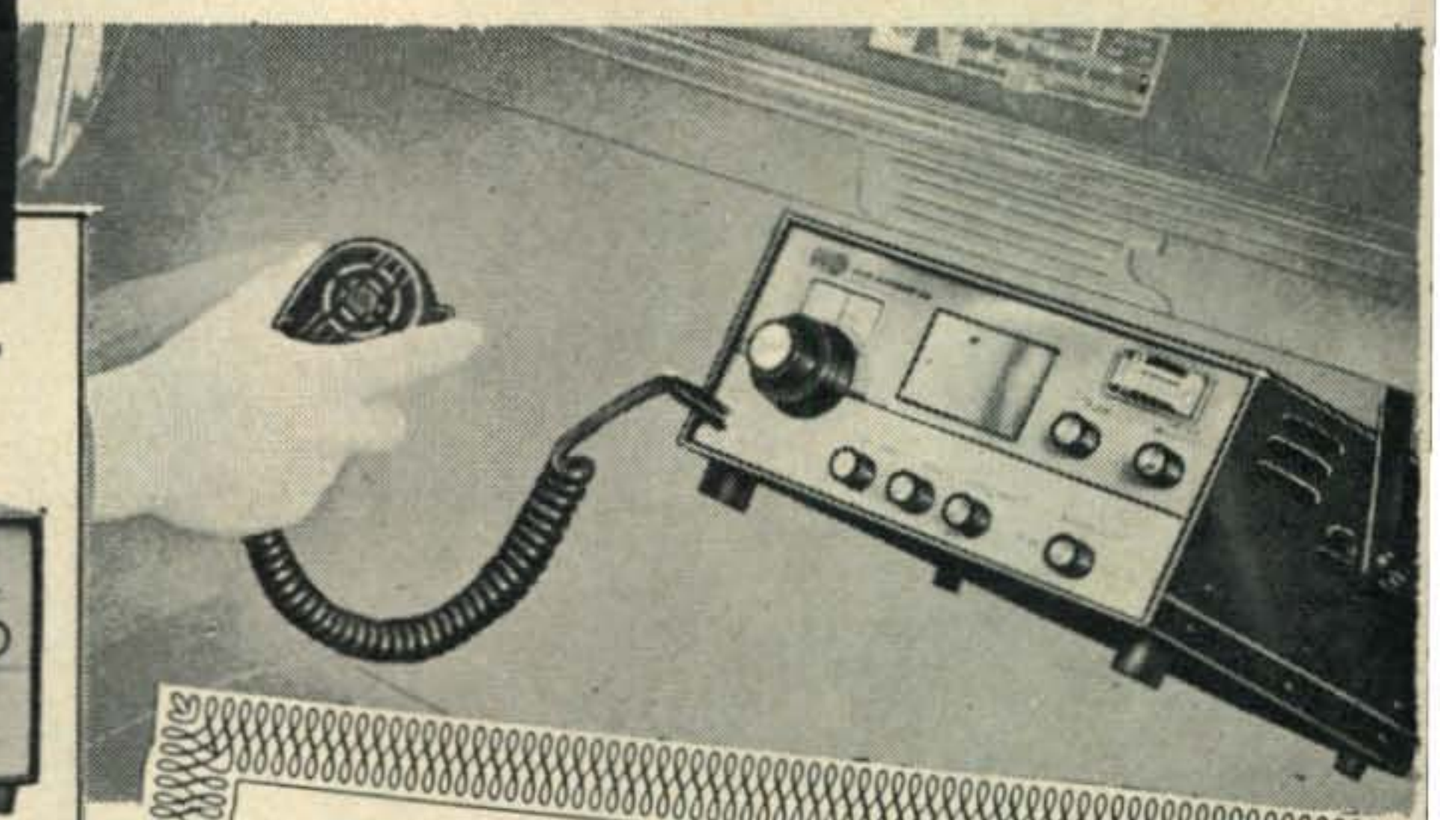
80-40 Meter SSB Transceiver

Ham Net $159.95

WRL CHARG•A•PLAN $8 Monthly

NOW —GO MOBILE 300 WATTS

AT AN AMAZING SAVINGS!



A Complete 80-40 Meter MOBILE PACKAGE!

Includes 1 ea.: Duo-Bander 84, DC384 Power Supply, one Bandspanner Antenna, BDYF Mount, 350C mic, Mic. Plug, PL 259 Plug, UG176/U Reducer and 25' RG58/U coax Cable. All supply cables are included.

ORDER: ZZA-103 package ($15 monthly)..Regularly $299.95 WITH BONUS COUPON...$279.95. ($14 monthly)

A Complete 80-40 Meter FIXED STATION PACKAGE!

Includes 1 ea.: Duo-Bander 84, AC48 250 watt supply, 80/40 Duo-Doublet Antenna kit, 350C mic., Mic. Plug, PL259 Plug, UG-176/U Reducer and 100 ft. RG58/U coax cable.

ORDER: ZZA-104 Package ($11 monthly)...Regularly $225.00 WITH BONUS COUPON...$205.00 ($10 monthly)

ORDER: ZZA-105 Package (same as above with 300 watt AC supply)...Regularly $255.00 WITH BONUS COUPON $235.00 ($12 monthly)

SAVE $20.00

WITH THIS BONUS COUPON!

This coupon may be applied against the package ZZA-103, ZZA-104 or ZZA-105 regular prices, provided there are no trade-ins involved, and will reduce the regular package cost by $20.00.

Only one coupon may be used. This Coupon invalid after August 30, 1967.

A GREAT RIG... AT AN AMAZING PRICE!

Designed for the Amateur whose interest is 80 and 40 meter SSB. Here's Power to make good contacts...a Selective Receiver...Stability...Compactness (only 5x11¼x10"). A GREAT value at the regular price ...NOW SAVE $20.00 on a package with the BONUS COUPON. Purchase yours NOW with our easy, monthly terms, too!

Look at these DUO-BANDER 84 FEATURES!

• 300 watts PEP-SSB • Rugged–Reliable Printed Circuitry • 2k-Hz Dial Calibration • Dual-Speed Vernier VFO tuning • E-Z One-Knob Tune-Up — "Just Peak Output" • Built-in Speaker • Mobile Bracket supplied • Combination "S" and Output meter • Crystal Lattice Filter.

Use this Handy, Quick Mail Order Form —

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Please ship me the following:

- ☐ Duo-Bander MOBILE Package ZZA-103 @ $299.95
- ☐ Duo-Bander Fixed Package ZZA-104 @ $225.00
- ☐ Duo-Bander Fixed Package ZZA-105 @ $255.00
- ☐ Your FREE 1967 HAM Catalog
- ☐ I am enclosing one BONUS COUPON as I have no trades. Deduct $20.00 from the regular package price above.
- ☐ My check or Money. Order for $_____ is attached.
- ☐ Charge it to my WRL charge Acct # _____

Name _____

Address _____

City _____ State _____ Zip _____

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RCA Transistors Rectifiers Integrated Circuits

For HAMS and EXPERIMENTERS

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Here displayed on the RCA Solid-State Center is the RCA SK-Series Transistors, Rectifiers, and Integrated Circuits; the new RCA 3N128 MOS Field-Effect Transistor; RCA's 40214 Silicon Stud Rectifier; and three RCA Experimenter's Kits. This new Solid-State Center, in addition to its host of devices, also includes technical literature to support the devices right on the rack. It's the "one-stop" answer to the solid-state needs of experimenter, hobbyist, ham, or the replacement requirements of the service technician.

All devices and kits are packaged in easily identifiable see-through packs for your convenience. Included with each device is broad performance data or specific ratings and characteristics where applicable.

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National's new 200 is fast becoming the most popular 5-bander on the market . . . and it's no wonder! Here's an ideal rig for mobile, portable, or home operation . . . the fastest way to move up from single band or triband. The price? . . . an amazingly low $359! Performance? . . . here's what Jim Fisk WIDTY said in a recent issue of a noted amateur radio publication: **"When National came out with their new model 200 transceiver a few months ago at a lower cost than any other five band transceiver on the market, I just couldn't believe that it would perform as well as the more expensive models. But — after using it for several weeks in chasing DX, I find that they have done a superb job and it performs right along with the best of them. The sensitivity is fine, the selectivity afforded by the steep-sided crystal filter is excellent, and the audio reports, if I am to believe the fellows on the other end, have all been good. Reports of, 'tremendous audio quality,' 'really sounds good,' and 'very clean and crisp,' have been normal reports during the time I have had the 200 on the air."**

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