CQ
ICD

June 1967
75¢

piezoelectric filters

See page 14.

Q REVIEWS:
The Drake 2C Receiver
See page 32.

World-Wide DX Contest:
Phone Results
See page 40.

Atmospheric Electricity-
Lightning!
See page 30.

The Radio Amateur's Journal

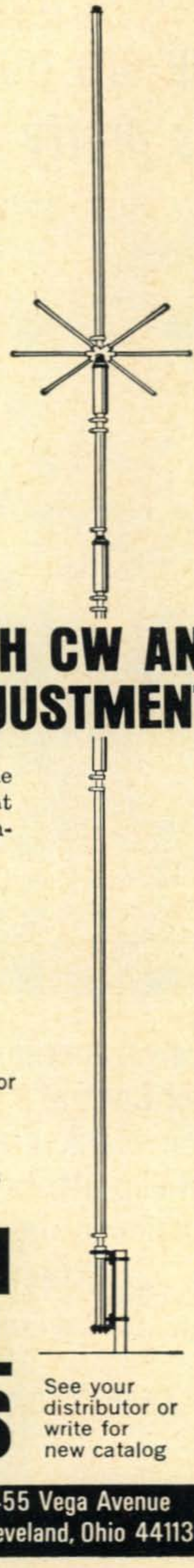
Traveling Companion

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 31, on page 110

COLLINS

WHY SETTLE FOR HALF?



GET THE ENTIRE BAND—BOTH CW AND PHONE WITH ONE TUNING ADJUSTMENT!

Only from HUSTLER will you receive the mechanical and electrical performance you want in a 4 Band Trap Vertical. Make the comparison and see for yourself.

Look what you get with Hustler!

- Individually and precisely tuned traps!
- Lowest SWR and Widest Band width!
- Outstanding mechanical construction!
- Heavy gauge heat treated aluminum!
- Stainless and cadimum plated steel parts!
- Base impedance nominal 52 ohms!
- 5 Band operation with 75 meter mobile resonator on top.
- WHOLE BAND OPERATION WITHOUT READJUSTMENT!
- Performance that defies comparison. Show us where any other is better!

FIXED STATION TRAP VERTICAL HUSTLER ANTENNAS

See your distributor or write for new catalog

NEW-TRONICS corp. / 3455 Vega Avenue Cleveland, Ohio 44113

For further information, check number 3, on page 110

Please do not write for this 25,000-word free book unless you are really interested. *It's pretty expensive.*

26 lbs. of pure "hurricane" —maximum legal input, in a box no bigger than an overnight bag.

Receiver Incremental Tuning... Amplified Automatic Level Control... and a tremendously effective new noise blanker are among the exclusive features of Hallicrafters' SR-2000 that you'll read about in voluminous detail.

SR-2000 "Hurricane"

5-BAND TRANSCEIVER WITH M.L.P.

(Maximum Legal Power)

hallicrafters

A Subsidiary of Northrop Corporation
5th & Kostner Aves., Chicago, Illinois 60624
Export: International Division. Canada, Gould Sales Co.

Specifications in brief . . . **Special Features:** Patented Receiver Offset Control (RIT) permits ±2 kc adjustment of receiver frequency, independent of transmitter, for round-table, net or CW operation. Hallicrafters exclusive Amplified Automatic Level Control. **Frequency Coverage:** Full coverage provided for 80, 40, 20, 15 and 10 meters. Upper, lower sideband and CW operation. All crystals provided for 28.0 to 30.0 mcs. **General:** Dial cal., 1 kc. Linear gear drive with less than 1 kc readout. Adjustable IF noise blanker. Provision for plug-in external VFO/DX adapter. Built-in VOX plus break-in CW and PTT. Built-in CW sidetone. Hi-Low power switch for SSB.* 2.1 kc 6-pole crystal lattice filter. S-meter-RFO-AALC and final screen metering.* Two-speed blower. 100 kc crystal cal. VFO covers 500 kc. **Transmitter Section:** Two 8122 output tubes. Variable Pi network. Power input, 2000 watts P.E.P. SSB; 1000 watts. CW. Carrier and unwanted SB suppression, 50db; distortion products, 30 db. Audio: 500-2600 cps @ 6 db. **Receiver Section:** Sensitivity less than 1 uv for 20 db S/N. Audio output, 2W.; overall gain, 1 uv for ½ W. output. **SR-2000 transceiver—$995** amateur net, **P-2000AC Power Supply—$395** amateur net.

*Meters for final plate current and voltage built into P-2000AC power supply. Also Hi-Low power switch, and loudspeaker.

For further information, check number 44, on page 110

CQ

JUNE 1967 VOL. 23, No. 6

The Radio Amateur's Journal

TABLE OF CONTENTS

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 Garden City, New York. Subscription Prices: U. S. A., Canada and Mexico, one year, $5.00; two years, $9.00; three years, $13.00. Pan-American and foreign add one dollar per year. CQ does not assume responsibility for unsolicited manuscripts. Please allow six weeks for change of address. Printed in the United States of America.

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

EIMAC

3-400Z's used in prototype 6-meter linear amplifier for 2 kW PEP at 50 MHz

The prototype Swan linear amplifier shown here uses two EIMAC 3-400Z triodes in grounded grid circuitry to achieve two kilowatts PEP input at 50 MHz. Drive power is less than 100 watts PEP. The prototype amplifier features a tuned cathode circuit for low intermodulation distortion, and uses a pi-network plate tank circuit. The new linear may be driven with modern six-meter SSB transceivers, and offers real operational economy at 50 MHz.

Swan chose EIMAC 3-400Z's because these compact, high-mu power triodes are ideal for grounded grid operation. They can provide a power gain as high as 20 in a cathode-driven circuit.

For more information on EIMAC's line of power tubes for advanced transmitters, write Amateur Services Department, or contact your nearest EIMAC distributor.

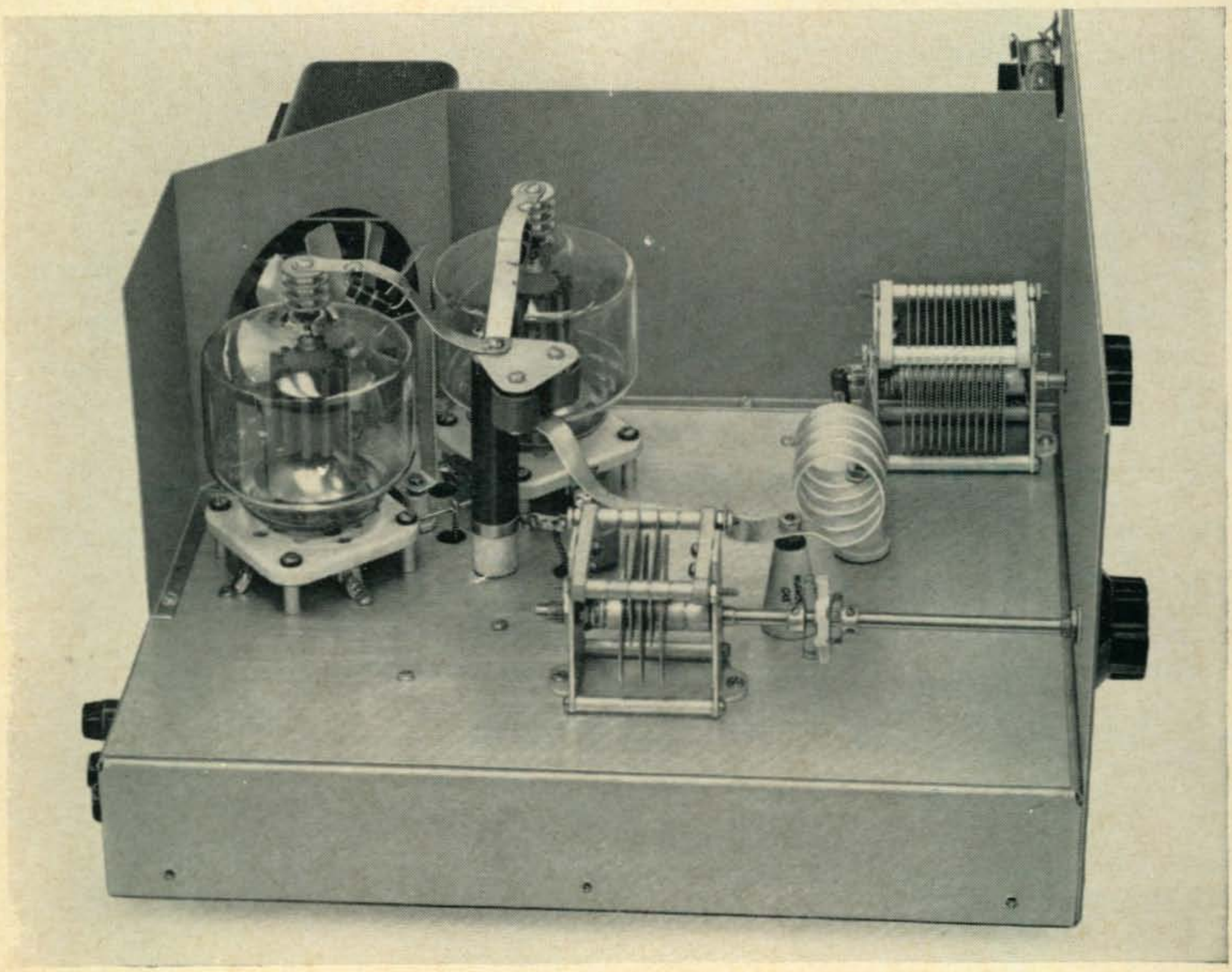
3-400Z TYPICAL OPERATION (Minimum IM Distortion Products at 1 kW PEP Input)	
DC-DC Plate Voltage	2500 V
Zero-Sig DC Plate Current*	73 mA
Single Tone DC Plate Current	400 mA
Single Tone DC Grid Current	142 mA
Two Tone DC Plate Current	274 mA
Two Tone DC Grid Current	82 mA
Peak Envelope Useful Output Power	560 W
Resonant Load Impedance	3450 ohms
IM Distortion Products	−35 db**

* Approximate

** −35 db or more below one tone of a two tone test signal.

We have a new brochure entitled "Linear Amplifier and Single Sideband Service." Write for your copy.

EIMAC
Division of Varian
San Carlos, California 94070

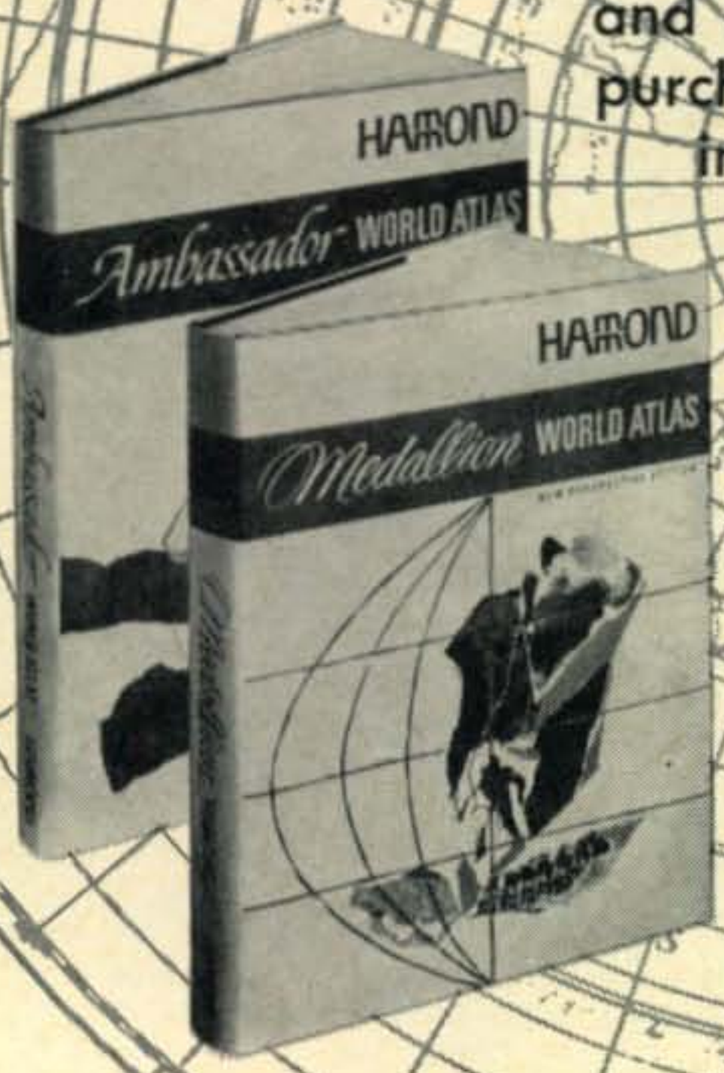


For further information, check number 13, on page 110

WHERE IN THE WORLD ARE YOU?

If you've been living anywhere but in a cave for the past ten years or so, you just may have noticed a change or two in the world around us . . . little things like new countries, new boundaries and enough name changes to tangle a Greek's tongue. In fact, things have been changing so fast recently that the old World Atlas you've been depending on as "the last word" is 43% WRONG if it's more than just a few years old!

Being the thoughtful, self-effacing folks we are (ahem!) we've arranged with Hammond, Inc. to offer either of two great "new perspective" revised and updated Atlases at a bargain price when purchased with a one or two year CQ sub (a bargain in its own right). Here's what you get:



Buy a one year sub to the oldest and largest independent magazine in amateur radio—CQ—at the regular rate of $5.00 and receive the 320 page Hammond AMBASSADOR *World Atlas at bonus price of $9.95 (Nationally advertised at $14.95).*

OR . . .

Buy a 2 year sub to CQ at the regular rate of $9.00 and receive the 464 page Hammond MEDALLION *World Atlas (120,000 indexed entries, full color, world statistics, gazeteer-index, 11¾" x 15¼") at the bonus rate of $10.95. (Nationally advertised at $19.95).*

rculation Dept.
Q Magazine
4 Vanderventer Avenue
ort Washington, N.Y. 11050

entlemen:
nclosed is my remittance of $_____ for the following:

One year subscription to CQ plus the Hammond AMBASSADOR World Atlas @ $14.95
Two year subscription to CQ plus the Hammond MEDALLION World Atlas @ $19.95
New Subscription. Start with _____ issue.
Renewal or Extension Subscription.

AME _____

DDRESS _____

TY _____ STATE _____ ZIP _____

PLEASE PRINT CLEARLY

NOTE: Atlas cannot be purchased separately at this bargain price.

OUR READERS SAY

Narrow Band

Editor, *CQ:*

I have received some comments that my article on "Narrow-Band" in the March and April issues of *CQ* contained some minor technical inaccuracies. Frankly, I don't doubt that it did. However, none of them are serious enough to distract from accomplishing the main purpose of the article: that is, to acquaint amateurs with a current technique for speech transmission bandwidth reduction that is bound to have a profound effect upon future communications systems.

Certainly, any amateur who wants to experiment with these techniques now will have to do a bit of reading up on the subject in detail in the professional technical literature which is available.

In a sense, we as amateurs, as well as those engaged in commercial communications activities, are fortunate that the FCC and international regulatory bodies do not receive the funding and authority they need to really evaluate modern communications techniques and to force their adaption in time to avoid intolerable h.f. spectrum space crowding. If requests for frequency channels were evaluated on the basis that the optimum frequency conservation transmission means was employed for the information to be transmitted, there probably would not be half the frequency crowding problem as exists today.

Because the FCC and other bodies do not or cannot take this approach in practice, all of us—both amateur and professional—take the easy way out and stick to outmoded modulation techniques. In recent years, I regret to say that amateurs in my opinion have been particularly guilty of this. When s.s.b. began to be widely used in earnest in the 1950's, amateurs did a great deal of experimentation with the techniques involved and generally were quicker to realize its potential than military communcations, for instance, which for tactical and medium distance voice circuits clung to a.m. Today, the situation is reversed; Amateurs are behind the times. Digital voice transmission is beng wdely used, especially by the military, and amateurs have done practically no experimentation in the field.

This letter has probably gotten a bit more critical that I really had intended it to become but, on the other hand, the question of how long amateurs will be able to justify their retention of their h.f. bands and well as some v.h.f. bands becomes a more critical one each year. I think every amateur should sometimes seriously reflect when he sees two children walking a hundred feet apart down the street and jabbering play-talk back and forth into $10 walkie-talkies, whether he honestly, aside from having more expensive equipment, really deserves any more spectrum space than those walkie-talkies are allowed.

John Schultz, W2EEY/1
Mystic, Connecticut

An Almost Ex-XYL

Editor, *CQ:*

Perhaps my experience with a ham husband will soften the hearts of the XYL's around the world who won't let their husbands operate their stations in their houses (Ref. Feb. '67 *CQ*, p. 69.)

Five years ago I married a ham who ran a home brew rig. On our first Christmas together, I worked in a department store and earned enough money to buy him a new tower and antenna. The next summer I went to work for the telephone company and subsequently was able to buy my OM a mobile rig. Next I increased his amateur radio library and improved his workshop. For our second Christmas, I found him a used Collins KWM-2 and by spring gave him a kw amplifier.

Meanwhile, since he was on the air so much, I had free time to learn code, thanks to the tape machine I had given him for his birthday.

I am thrilled to report that I have passed my Novice exam. When I receive my license in the mail, my lawyer will draw up my divorce papers, so that fabulous equipment will be ALL MINE, MINE, MINE!

Kristi Weinhardt, almost ex-XYL
Silver Spring, Maryland

Conversation With A Novice

Editor, *CQ:*

I'm not sure that I agree completely with K3QAX/W2QEX regarding his contention that 15-meter DX is not for the Novice (April *CQ*, p. 38.)

For the Novice who has learned to take signals over the air on other bands, and is well on the way to his General, the 15-meter band has its value.

My log shows 194 Novices worked on 15, and the pleasure and added confidence I know I have given these operators, convinces me I am doing good.

Through these DX QSO's the Novice realizes that all calls do not commence with W or K; that there are others throughout the world DXing with lower power and simpler antennae than themselves and that even the humble Novice QSL can be of value to the seeker after WPX and WAS.

Unfortunately, there are those beginner Novices whose lack of experience barely allows them to rcognize anything beyond RST and 'pse QSL.' These operators should never be on 15. Their QSO's are a frustration to all concerned and a blow to a Novices' self-confidence. QRM and QSB can be bad and it requires a deal of experience to follow DX signals under such conditions.

To those Novices who now decide that their operating ability will allow them to try DXing on 15, a few words of advice.

To the knowledgeable DX man a WN call automatically brings a QRS. There is no need to tell him you are a Novice.

Most DX stations QSL via the various Bureaux. Be certain you know about these Bureaux, and the address of your own QSL Bureau manager. A SASE to him may bring you a packet of long overdue cards. Many of the Novices I tell "QSL via Bureau; I will do same" are obviously at a loss to know what I mean, and, after giving "R R OK," send their full postal address and a card direct!

Do not waste time, when in QSO, telling your DX contact the obvious. He is an intelligent fellow and will *know* that a W or K call originates in the U.S. So don't offend him by adding "U.S.A." to your QTH when you pass it.

And don't panic if you don't get his name. Call him "OM." It's every bit as respectful, and actually preferred by some.

I doubt, too, if many operators, thousands of miles away, are interested to know that the temperature with you is "about 57 degrees." Tell him "sunny and warm," "windy," "snow" or what-have-you. It will convey more, anyway.

Much of what to send, and what not to, comes with experience so, while you are getting that experience, confine yourself to getting the basic information through the QRM and QSB. Rag-chewing with the DX can come later. If you're sixteen now, you'll have fifty or sixty years to chew the rag all you want—provided you pass your General.

Always bear in mind that's the sole aim of your time as a Novice—gaining experience and *not* chasing DX, unless you feel certain you can combine the two successfully.

F. Allan Herridge, G3IDG
Hamshire, England

That Old Ham Fellowship

Editor, *CQ:*

Had I been in church, where I belonged at that hour on Sunday, it wouldn't have happened. The band was wide open, and the signals from the Far East sounded almost like local. I got involved in a long and extremely interesting chat with VK6RG, after a round table with ZS6CN and ZS1KG via the long path. We were working

NOW

A low cost Crystal for the Experimenter

International

type "EX"

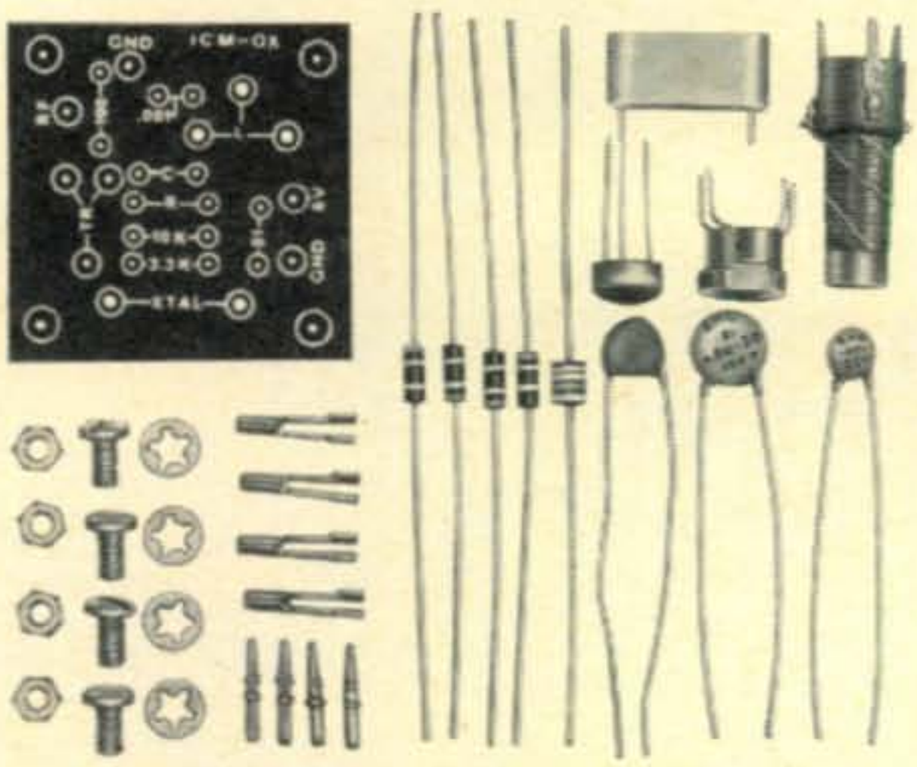
- LOW COST
- MINIMUM DELIVERY TIME

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.

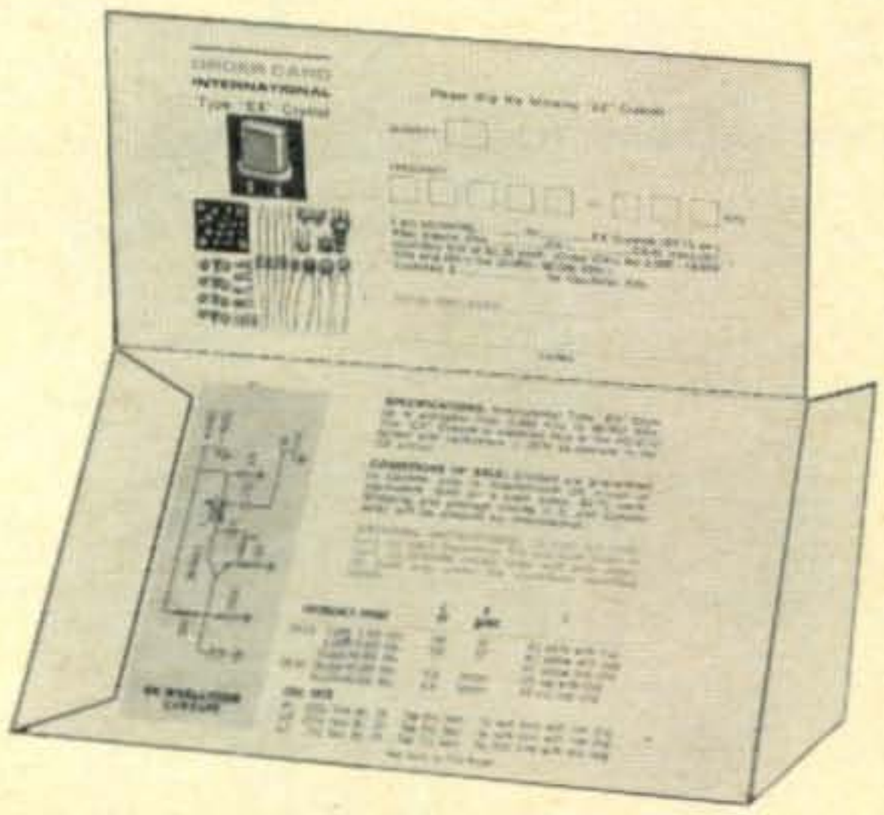
CONDITIONS OF SALE: All "EX" Crystals are sold on a cash basis, $3.75 each. Shipping and postage (inside U.S. and Canada only) will be prepaid by International. Crystals are guaranteed to operate only in the OX circuit or its equivalent.



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

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.

INTERNATIONAL

CRYSTAL MFG. CO., INC.

10 NO. LEE • OKLA. CITY, OKLA. 73102

For further information, check number 7, on page 110

cross band s.s.b. with me about ten kc's into the 14.2 section of the band and Bob a like number below. At the end of a particularly gratifying exchange of pleasantries, an old buddy, W6LN, who heard Bob signing off to me broke in on c.w. to call me. I quickly shifted to c.w. and that frequency to arrange a schedule and to pick a frequency removed from the DX phone band, but before I could even get an R from Thor (W6LN) a voice dripping with venom snarled, "DID YOU HAVE TO USE THIS FREQUENCY, YOU LUNKHEAD?" Startled . . . then mad . . . I broke an important commandment . . . lost my temper . . . lost W6LN . . . lost interest in hamming for an hour or two . . .

Then, at about 2200 GMT, I decided that fewer members of the bright new generation have brains enough to build an RTTY set, so I shifted up to 14.090 to look for a little bit of old time fraternal spirit of hamdom. This I found quickly in the person of Jack (K6EQV) out in Fullerton. We banged away at the green keys with great satisfaction for a while, then suddenly there came a self-appointed jammer on frequency. He ran his keyer constantly on the dot side and rocked his v.f.o. back and forth across the frequency alternately knocking out both the mark and space signals from K6EQV. Again, after a fit of near apoplexy, the simple thing was to get out of the shack and think about something else. There was scant benefit in the knowledge that in each case my tormentors were operating illegally (the first used phone outside the band).

There is a happy ending, though. I have been gone for several months and I had a lot of reading to catch up with. I found Ethel R. Johnson's moving article in the February issue, "My Quarter of a Million Friends." This not only enabled me to forget the punks who were trying to annoy me, but it restored my faith in the hobby which has meant so much to me since March of 1921 . . . a lifetime of enjoyment, punctuated by only a few minutes of exasperation. I stopped to count my blessings (somewhat belatedly) and it was a good Sunday after all!

Rex G. Howell, WØRX
Grand Junction, Colorado

$5000 For The Future

Editor, *CQ:*

Just a note about the results of W5YM's incentive licensing poll (April p. 60). I feel care should be taken in analyzing the responses to the last three questions. If you will accept the fact that humans are basically lazy, like the status quo and are always seeking security, then the results to these questions could have been predicted in advance and should consequently be reviewed in that light.

If the questions were asked the same way but included a second sentence, such as: "In answering, assume *you* would not be affected, *your* license was automatically renewable and it only affected the other guy," and he believed it, I'll bet a cup of coffee your responses would have been just the opposite.

Also, with a little imagination one can see parallels to question six in some of our government spending programs.

J. Bradley Flippin, K6HPR/4
Falls Church, Virginia

Don Miller

Editor, *CQ:*

I just read your editorial (Zero Bias) in the April issue of *CQ* regarding Don Miller, W9WNV. On the stand you're taking re: Don's problems, please accept my subscription for another year starting with the April issue.

The one and only reason I dropped *CQ*, I wasn't sure what your stand was at the present time. I remember well your original accusations against Don and later your apology, eating crow, I think you said.

I'm well acquainted with all the proceedings that are taking place at the moment and it wouldn't surprise me a bit, if Ole' John Huntoon and his staff of "Yes" people, better known as the Awards Committee back there at Headquarters, might have to eat a whole flock of crows, including the feathers.

Remember, it always pays to look how deep the water is before you jump into it.

C. R. Schrotke, W6UJ
Bakersfield, California

NOW FACTORY ASSEMBLED
THE WORLD'S MOST POPULAR RIG

The HEATHKIT® SB-101 Transceiver and SB-200 KW Linear Plus Accessories

In Answer To Your Requests . . . now those of you who just can't spare the time for "do-it-yourself", can purchase the SB-101 Transceiver and SB-200 KW Linear factory assembled and tested ready for operating the moment you unpack them. For those who want to save the most, these units also will continue to be available in kit form. Either way, you get the renowned SSB performance and features that have made the Heath SB line the fastest selling rigs on the air.

The following related accessories also will be available factory assembled or in kit form: HP-13 DC Power Supply (for mobile operation of the SB-101), HP-23 AC Power Supply (for fixed station operation of the SB-101), and SB-600 Communications Speaker (matches appearance of SB line and has space for installing the HP-23 AC power supply).

SB-101 80-10 Meter SSB Transceiver

• 180 watts PEP, 170 watts CW • Switch select Upper or Lower sideband or CW • CW sidetone • PTT or VOX • Linear Master Oscillator with 1 kHz dial calibration (resettable to 200 Hz) • Provision for switch selection of optional SBA-300-2 CW filter • Provision for external LMO • Separate CW offset carrier crystal • 100 kHz calibrator

Assembled SBW-101, 23 lbs., write for terms..... **$540.00**
Kit SB-101, 23 lbs..... **$360.00**

SB-200 80-10 Meter KW Linear Amplifier

• 1200 watts PEP, 1000 watts CW • Drives with 100 watts • Built-in SWR meter, antenna relay, solid-state power supply • ALC • Shielded, fan-cooled amplifier compartment • Pre-tuned cathode input • Circuit breaker • 120/240 v.

Assembled SBW-200, 41 lbs..... **$320.00**
Kit SB-200, 41 lbs..... **$220.00**

SB-600 Communications Speaker

• Styled to match SB series • For fixed station use • 8 ohm speaker with shaped 300-3000 Hz response • Has space for HP-23 power supply

Assembled SBW-600, 5 lbs..... **$24.95**
Kit SB-600, 5 lbs..... **$17.95**

HP-13 Solid-State Mobile Power Supply

• Supplies voltages for SB-101 • Provisions for remote operation (can be located in engine compartment) • Circuit breaker protection • 12 to 14.5 VDC input (neg. ground only)

Assembled HPW-13, 7 lbs..... **$89.95**
Kit HP-13, 7 lbs..... **$64.95**

HP-23 Solid-State Fixed Station Power Supply

• Supplies voltages for SB-101 • Excellent dynamic regulation • Fused primary • Can be installed inside SB-600 speaker cab.

Assembled HPW-23, 19 lbs..... **$64.95**
Kit HP-23, 19 lbs..... **$49.95**

FREE 1967 CATALOG

Describes these and over 250 kits for stereo/hi-fi, color TV, amateur radio, shortwave, test, CB, marine, educational, home and hobby. Save up to 50% by doing the easy assembly yourself. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

HEATHKIT®

HEATH COMPANY, Dept. 12-6
Benton Harbor, Michigan 49022

☐ Enclosed is $_____, plus shipping.
Please send model (s)_____
☐ Please send FREE Heathkit Catalog.

Name_____
(Please Print)
Address_____
City_____ State_____ Zip_____

Prices & specifications subject to change without notice. AM-182

For further information, check number 5, on page 110

Announcements

Corpus Christi, Texas

The South Texas Emergency Net is holding its annual convention on June 16-18, 1967 at Kerrville, Texas. Those interested in information should contact W5LVC, 638 Collingswood, Corpus Christi, Texas.

Ursina, Pa.

The 3rd annual Somerset County Amateur Radio Club's Hamfest will be held Sunday, June 18th, from 9:00 A.M. to 6:00 P.M. near Green Gables and The Mountain Playhouse, located on Route 219, one mile North of U.S. Route 30, at Jennerstown, Pa. Unlimited parking, Green Gables Restaurant, swapshop, and prizes. Donation of $2.00 at the door or $1.50 in advance from club secretary, K3PQK, Box 17, Ursina, Pa.

Paducah, Ky.

The Paducah Amateur Radio Club and the MOARKY Radio Association will hold their annual Ham Picnic at the Noble Park Community Center, Paducah, Ky. It will be an all day affair on July 9. Lunch will be served on the grounds, and bring along your swap material and equipment. Further information can be furnished by H. G. Dunning, W4NBS, 3716 Alameda Drive, Paducah, Ky., 42001.

Amarillo, Texas

The annual Hamfest conducted by the Panhandle Amateur Radio Club will be held the 24th and 25th of June this year. Location at the National Guard Armory at T Anchor Blvd. right off route 40. Talk in on 3940. Direct further inquiries to the Panhandle Amateur Radio Club, Box 5453, Amarillo, Texas, 79107.

Correction

RE: "A Product Detector For Military Receivers," *CQ*, March, 1967, p. 67. (1) The diodes used in the circuit *must* be the germanium type as silicons have no leakage and will not work; (2) a.m. detection is adequate with this detector with the b.f.o. turned off, however, if a sharp filter is used the audio will suffer some in quality; (3) in doing step #1 of the SP-600 modification, be sure to clip C_{139} at pin 7 of V_{14} and not at the other end. Also make sure that the other small ceramic capacitor, C_{138} is still connected between the plate of V_{11} and pin 2 of V_{14} or the a.v.c. and S meter action will be affected.; (4) in the filter adapter wiring diagram, the lead labled K_{63} should be labled K_{G3} for cathode grid 3.

Atlanta, Ga.

The Atlanta Amateur Radio Club, Inc., will hold its 39th annual Hamfest on June 3rd and 4th. A Saturday banquet and dance will begin at 7:30 P.M. Registration and breakfast at 8:00 A.M. on Sunday. Manufacturers displays and special interest meeting will be held at Lenox Square Mall and Auditorium through the noon hour. For further information contact: John Granberry, W4YPM, 2389 Bynum Rd. N.E., Atlanta, Ga., 30319.

Huntington, W. Va.

The Tri-State Amateur Radio Club announces it's fifth annual Ham Picnic which will be held on June 4, 1967. The picnic will be at Camden Park in Huntington, W. Va. For complete details contact Fred Yost, 2937 Auburn Road, Huntington, W. Va.

Salamanca, N.Y.

The Southwestern New York Very High Frequency Association will hold it's annual field days and picnic July 15 and 16 at Wades Sign Shop on route 242, Ellicotville, N.Y. Family style picnic and six and two meter transmitter hunt will be held on Sunday; as well as an auction. So bring that surplus gear along. For more information contact D. M. Baker, 149 South Main St., Salamanca, N.Y.

Seattle, Washington

The International Teen-Age Net (ITAN) is looking for new members. If you are a teenager, we want you! Inquiries should go to: Net Control Station (ITAN), WA7FDF, 17728 22nd N.E., Seattle, Wash., 98155.

◀ For further information, check number 21, on page 110

R.S.G.B., England

Overseas visitors to London who wish to meet British radio amateurs are invited to telephone any of the numbers on the following list, so that suitable arrangements for their reception can be made. It would be of assistance if a preliminary letter, giving the dates of their trip and details of any special interests or needs, could be sent to the Publicity Officer, R.S.G.B., 95 Collinwood Gardens, Clayhall, Ilford, Essex, England. We regret we are unable to undertake accommodation bookings, although we are able to advise visitors who have difficulty in finding hotel rooms. We strongly advise visitors not to come to London unless they have made definite accommodation arrangements. Direct inquiries from visitors to R.S.G.B. Headquarters will be re-routed to one of these numbers: 550.0882, Colindale 1443, Laburnum 5733, Colindale 4770, Wordsworth 5723, SM8.5866.

Medical Amateur Radio Council

The first annual conference and meeting of the Medical Amateur Radio Council will be held at Chalfonte-Haddon Hall in Atlantic City, New Jersey on Thursday, June 22, 1967. This corresponds to the last day of the A.M.A. Meeting. Noted medical and technical personnel will speak. All professional and interested people are urged to attend. For complete information write to William L. Sprague, M.D., WA6CRN, 433 North 4th Street, Montebello, California, 90640.

Montreal, Canada

The Ladies Committee is putting out the welcome mat for YL and XYL of the ARRL—June 30th, July 1st and 2nd Convention at EXPO 67 in Montreal, Canada. By registering with Doug Shaw—VE2BSX, 7401 Mount Ave., Montreal 16, before June 1st, it will cost you only $4.00, ($6.00 after this date). This ticket will enable you to see a beautiful fashion show where you will have a chance to win one of many prizes, to join the HAMS for the evening of entertainment and dancing to an 18-piece orchestra. They have a special hospitality room and at lunch time, the hotel has set aside tables in the dining room or the roof garden where you can gather and get better acquainted. On Sunday, tours of the Ciy and trips to Expo can be arranged for those interested. In the evening is the big banquet at $10.00 per person, well worth attending.

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

Feenix, Ariz.

Deer Hon. Ed:

Well, good old Scratchi are doing it again, yes indeedy. Are solving problem that are bothering amchoors ever since they having problems finding oatmeal box on which to winding coils. No need to running out and ordering statchew of me, though, as this are the month for Scratchi to be modest.

The problem I'm speeking of? Well, it's the problem that amchoors are not reely wanting to talk to a lot of other amchoors, but they talking to them anyway, just so they can find out how there rig is doing.

Most QSO's are same old stuff. You know what I meening, Hon. Ed. Like: "ur sigs here 599x mi handle are Joe wats urs? diddlely bump-de-bump." Same old words, and all amchoor wanting are signal report.

Scratchi are convinced that all anybuddies wanting to know is how his modulayshun is, or how far over the S-meter is bending when his signal hitting reseever at some rare dee-x locayshun.

So, I sitting around, trying to figure out how amchoors can doing this easily. After a lot of head scratching, I coming up with reel beauty of an idea. I calling it Scratchi's Worldwide International Measurement Service—or SWIMS for short. Even having peechy slogan: Getting in the swim of things with SWIMS!

Here is how SWIMS working. Scratchi will finding at least one amchoor in lotsa different foreign countries who willing to act as Official Measurer in SWIMS. On acct. he not in this country, we calling him Foreign Official Measurer—FOM for short.

Then, also needing peeples in good old Yewnited States, so getting a feller in each state, and calling him Local Official Measurer—LOM for short.

Each FOM and LOM must be able to listening and xmitting on several bands, and be able to making skeds when needing to, whenever having amchoor who wanting to have his signals listened to.

After getting everything all organized, then Scratchi launching big advertising program about SWIMS, telling all amchoors that now they can arranging to have amchoors all over world listening to their sigs and sending in re-

ports on signal strength, mudulayshun and QRM. All this without having to have boring QSO with each other amchoor.

(Incidently, Hon. Ed., you thinking maybe I can getting speshul advertising rates on acct. you and me being old buddys?)

To joining SWIMS, each person sending two bux so he being officially registered in program. For this two bux he not only gets in SWIMS program, but he gets one free one-way worldwide measurement. Others measurements he having to pay extra for, depending on what kind check he wanting.

Most expensive is worldwide two-way measurement. In this case he is listened to by everybuddy overseas and in Yewnited States, and, in addition, he can QSO'ing any five FOMS or LOMS he wanting to. Even getting QSL cards from these five if he needing them.

Next most expensive is one-way worldwide measurement. He getting reports from everybuddies, but not being able to QSO'ing anybuddy. Least expensive is local Yewnited States measurement—Alaska and Hawaii being thrown in at no extra charge.

Hon. Ed., aren't this grate idea? All amchoor having to do is getting on air for few minutes, and he getting reports from all over the world. Think how easy it being to checking out different antennas!

Now, while I relizing this are 1/c idea, Scratchi having cupple problems. In fact, problems so big it sinking hole idea unless you can helping out. That's why are riting you.

My problem are that everybuddy reelizing what big job it being to be a FOM or LOM, what will all reports have to making out, postage have to using, etc. So, how I getting anybuddy to be a LOM or FOM? I not having enough bux to paying them to do this.

That's when I thinking of you and Hon. Seek-You Magazine. Hon. Ed., here are your chance to being big hero to amchoors and boosting prestige of your Hon. Rag. I not being selfish, so I giving you the hoel idea, so that all amchoors can benefit.

You see, you can appointing the FOMS and LOMS and listing names and call letters in Hon. Mag. Lotsa amchoors jumping at chance to being big local measurers for Seek-You. And, in case you not getting as many volunteers as you needing, you can always calling them Associate Editors and paying them a few bux a month.

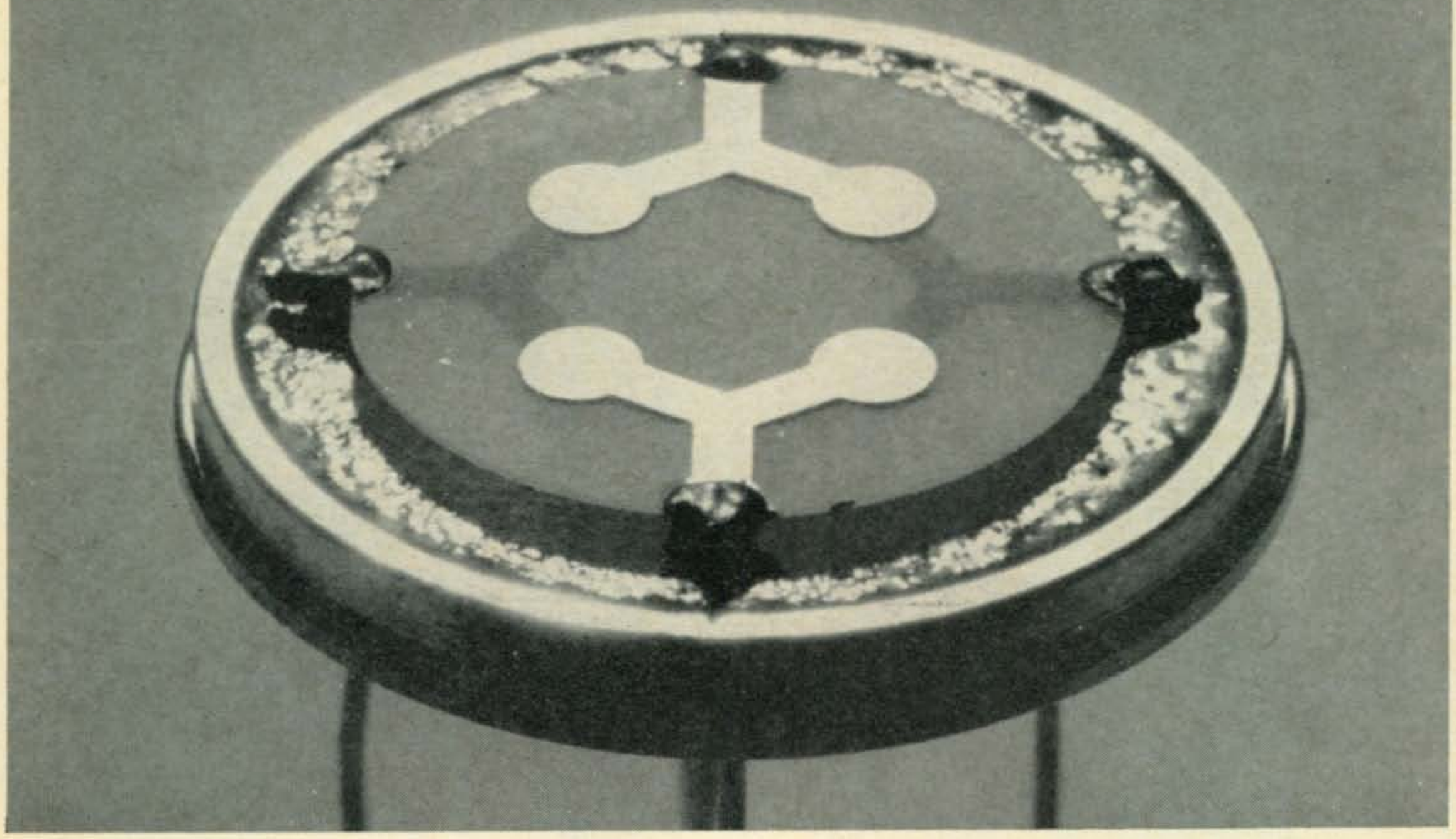
I reelize you having to be careful with some peeples on acct. amchoors shouldn't taking money for being amchoors, but I thinking maybe calling them Associate Editors putting everything on ups and ups.

Now, when you getting all FOMS and LOMS, Scratchi being happy to taking care of coordinating all reports. You can calling me Head Amchoor Measurer—HAM for short.

Of course you will be charging amchoors for measurements they wanting made, so Hon. Seek-

[*Continued on page 100*]

PIEZOELECTRIC FILTERS



A typical Uni-wafer filter measuring approximately one inch in diameter.

BY JOSEPH TARTAS,* W2YKT

THE recent trend towards circuit simplification, lower weight, and miniaturization of electronic equipment has required the development of many new and unusual components. Some of these, although not very new, are still being used to this end, and are being further improved to obtain the utmost in the packaging of such equipment.

One of these components is the piezoelectric filter, which, depending upon the frequency in

*1204 Ringwood Ave., Haskell, N. J.

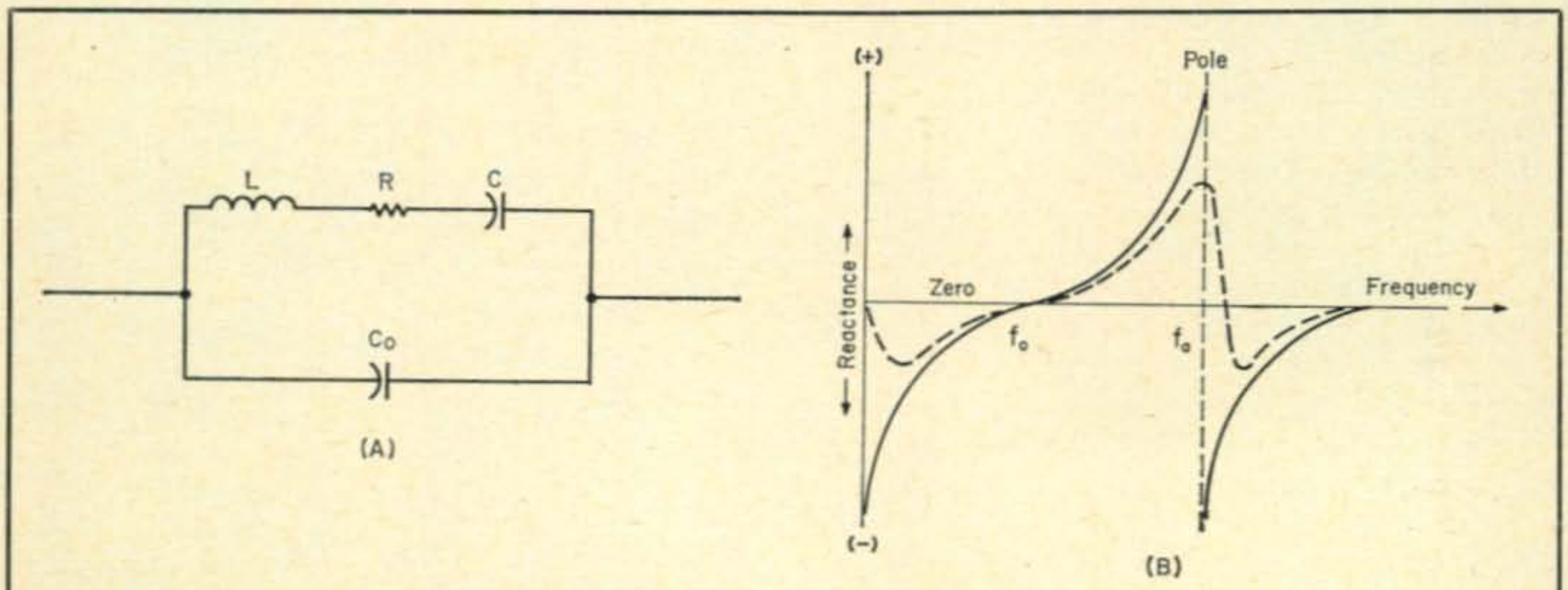


Fig. 1—(A) The equivalent circuit of a piezoelectric resonator near its resonant frequency. The inductance, *L*, represents the mass of the plate (quartz or ceramic) and C the stiffness. *R* is the loss due to friction when it is vibrating. C_0 is the holder and wiring capacity. As in any resonant circuit, the Q is the ratio of reactance to resistance: $X \div R$.; (B) The reactance curve for a lossless equivalent circuit approximated by a quartz crystal (solid curve) compared to that of a ceramic resonator with a Q of about 500 (dotted curve).

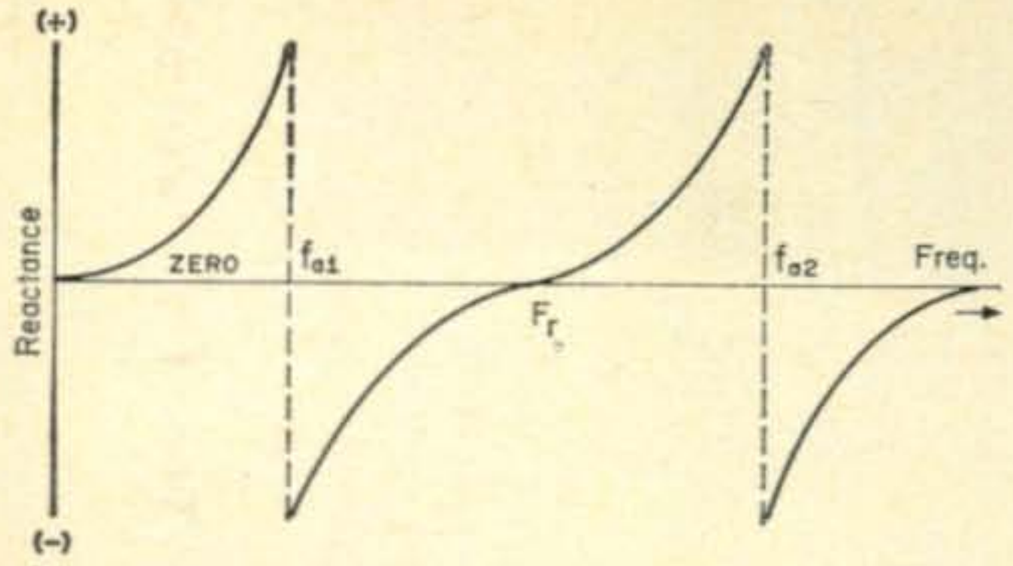


Fig. 2—The reactance of a single crystal [fig. 1, (A), (B)] shunted by an inductance to produce an additional pole f_{a2}.

use, can be made of piezoelectric ceramic material first developed more than twenty-five years ago. The more familiar material for such filters is quartz. Each, of course, has its own distinct advantages. The ceramic material is formed from a powder, much like an aspirin tablet, by means of pressure. The quartz crystal, on the other hand, must be mined (although they are being grown experimentally) cut into slabs, then into smaller blanks, and then meticulously ground and polished to the correct dimensions and frequencies.

Advantages of Piezoelectric Filters

As will subsequently be shown, several crystals (henceforth the word crystal will also refer to ceramic filters) can be combined to form a bandpass circuit of highly desirable characteristics. These include: excellent frequency stability over wide temperature ranges; never need adjusting; small shape factor (ratio of 6db to 60db bandwidth); high attenuation of image frequencies because of shape factors attainable; long term stability (less than 0.3% frequency change over 10 year period), filter Q's of 10,000 to 20,000 (with individual crystals of Q's as high as 1,000,000); physically small (size depending upon the filter requirements); shock and vibration resistant; reproducible to extremely good accuracy; and lower in production line costs, since they need no adjustment, complicated wiring is eliminated, and they replace many components.

Characteristics of Crystal Filters

A single crystal, near resonance, is essentially a high-Q series resonant circuit, shunted by some small capacitance due to its wire leads and holder. The equivalent circuit of fig. 1(A) has a resonant characteristic shown in fig. 1(B). The resonant impedance at f_o is known as a "zero" and the anti-resonant impedance f_a (at which the impedance is extremely high) is known as a "pole."

Quartz crystals are available for center frequencies from 100 kc to well over 100 mc, and ceramic resonators are available for center frequencies of 100 kc to 6 mc.

The pole and zero for a crystal usually occur within a narrow frequency range, from a few hundred cycles for the lowest frequency crystal to a maximum of 0.2% for the highest (or 80 kc at 40 mc). It is this small difference that limits the final bandwidth of these filters. The addition of parallel or series inductance can cause additional poles to appear (fig. 2), and with proper addition of series and parallel elements (crystals, inductances, and capacitances) we can create filter networks of varied characteristics. The inductances can be part of input and output transformers and still be considered as in shunt with the crystals.

To produce a circuit (fig. 3) having a passband with steep skirts (and therefore a small shape factor) with high attenuation at frequencies just outside this passband, crystals Y_1 and Y_2 are different by a small frequency from Y_3 and Y_4. The series crystals (Y_1 and Y_2) are tuned to make their series resonant frequency the same as the parallel frequency of the other crys-

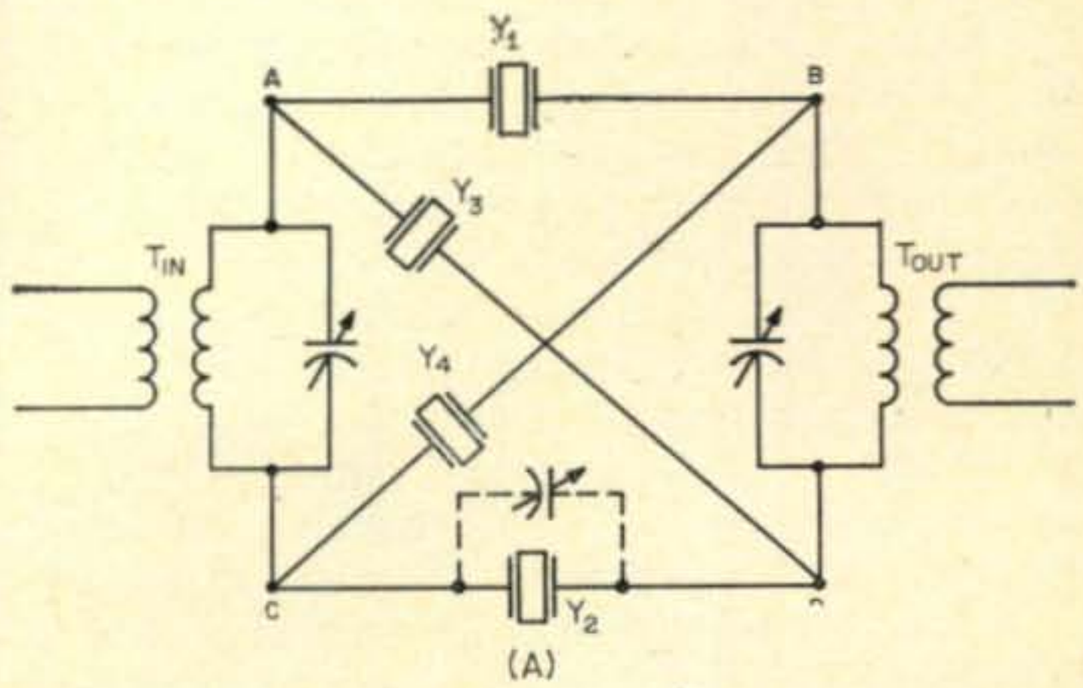


Fig. 3—(A) A two section lattice filter using the transformer windings as shunt inductances. The reactances (B) of the series and parallel branches of the lattice filter add up to produce the passband shown here (C).

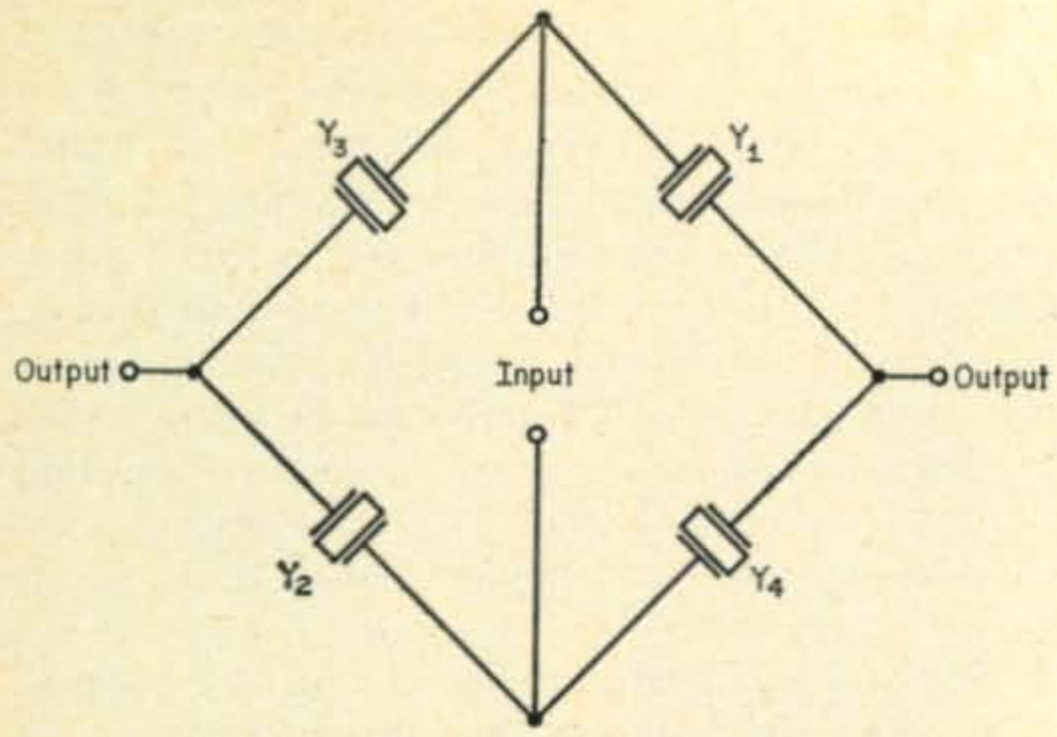


Fig. 4—Redrawing the two-section lattice filter circuit of fig. 3 clearly shows the bridge circuit configuration. Unbalancing any one reactance arm substantially changes the overall circuit impedance.

tals (Y_3 and Y_4) which are parallel connected. This results in the characteristics shown in fig. 3(B), as the passband response of fig. 3(C).

The reactances add up in such a way that within the desired passband the rejection (or attenuation) is minimum, and beyond the passband the rejection is greatest. This is better understood by referring to the bridge circuit of (fig. 4). If any of the reactance arms are unbalanced, the net impedance of the entire bridge is drastically changed. If the reactance arms are fixed and the frequency changed, the same results are obtained, due to the impedance versus frequency characteristics in figs. 2 and 3(B).

It is recommended that the basic operation of a bridge circuit be throughly understood by the reader, since this type of circuit occurs continuously throughout electronic circuitry. There are many basic texts which contain this information.

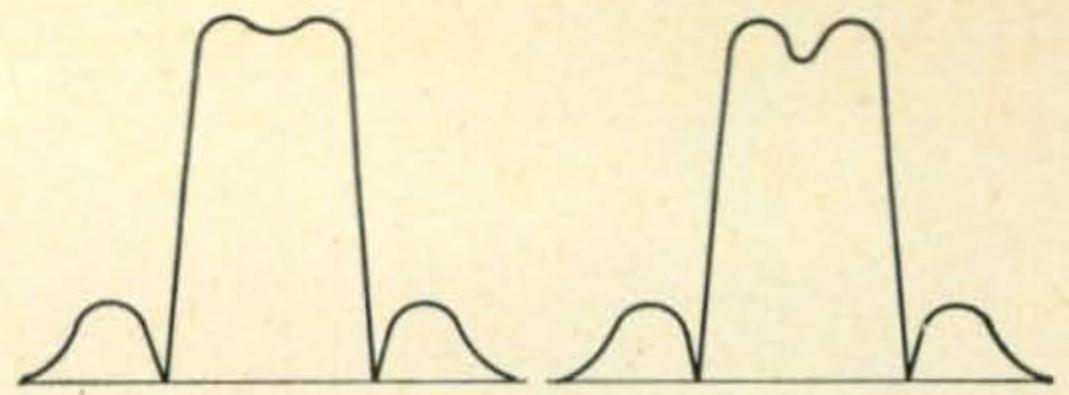
Basic Filter Circuits

Keeping in mind that single crystal is the equivalent of a very high Q tuned circuit with a resonance and anti-resonance, let us see how the additive effects of more than one crystal acts as a filter.

In fig. 5(A) the single-crystal filter acts as a narrow bandpass similar to that of any high-Q single-tuned circuit. Two crystals in series (since they are series resonant at f_r) produce a bandpass equivalent to a double-tuned circuit (fig. 5B).

Further attenuation of the sides of the response may be obtained by the addition of crystals at discrete frequency intervals to produce the response curves of fig. 6. A direct comparison of the advantage gained in selectivity with two and four crystals is shown in fig. 7(A), and the comparison of four and eight-crystal filters in fig. 7(B).

Ceramic filters are used in low frequency i.f.'s at the present time to reduce the size and weight



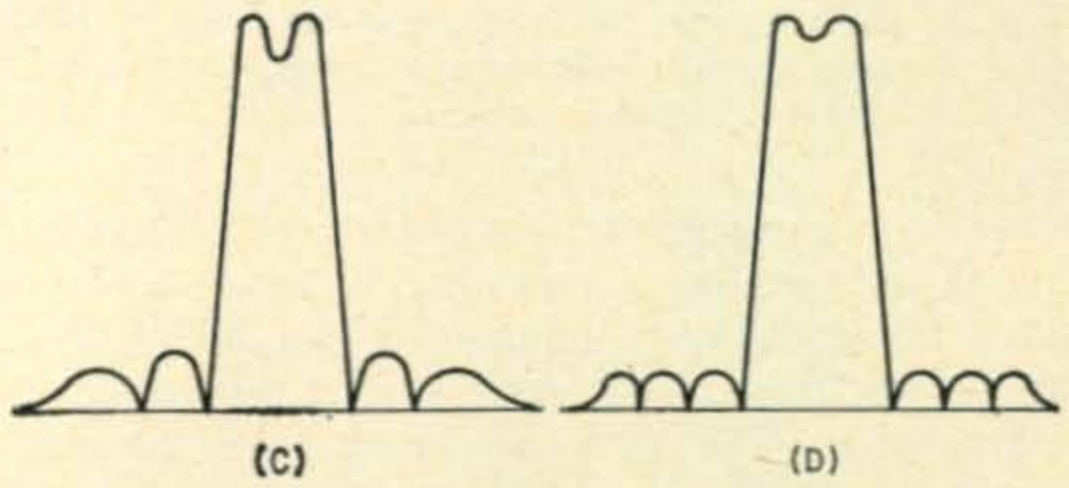


Fig. 6—(A) Response curve of two series crystals with a C on the higher frequency crystal to vary the position of the notches. (B) Response curve for two series and two shunt crystals. The shape is essentially the same as (A) but the notches are fixed. (C) response curve for the circuit in (B) with a variable C on the high frequency series crystal. The skirts are steeper and the extra notches reduce the size of the side lobes. (D) Response curve obtained with four shunt and two series crystals with a variable C. More crystals produce even smaller lobes and sharper skirts which result in greater selectivity in the passband and greater rejection outside the passband.

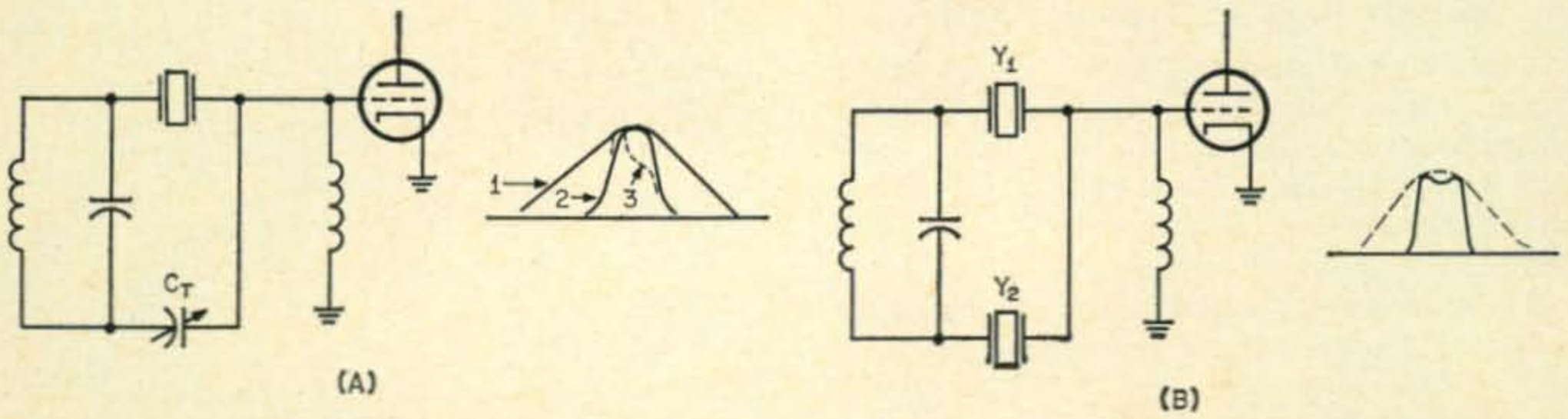
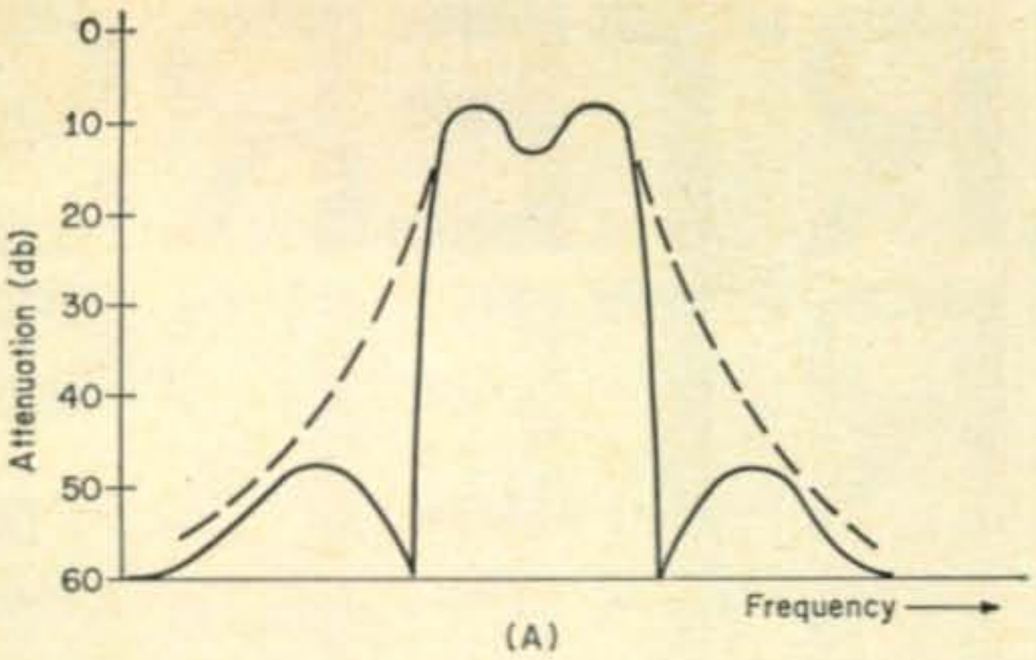


Fig. 5—(A) A crystal filter used in the grid of an i.f. amplifier. Capacitor C_t adjusts the position of the rejection notch which is absent when C_t equals C_o, the holder and wiring capacity. Curve (1)—Bandpass without filter; (2) Bandpass where $C_t = C_o$; (3) rejection notch when C_t is less than C_o. (B) The response obtained with two crystals. Crystal Y_2 is resonant at a slightly higher frequency than Y_1. For this configuration C_t is replaced by the C_o of Y_2.



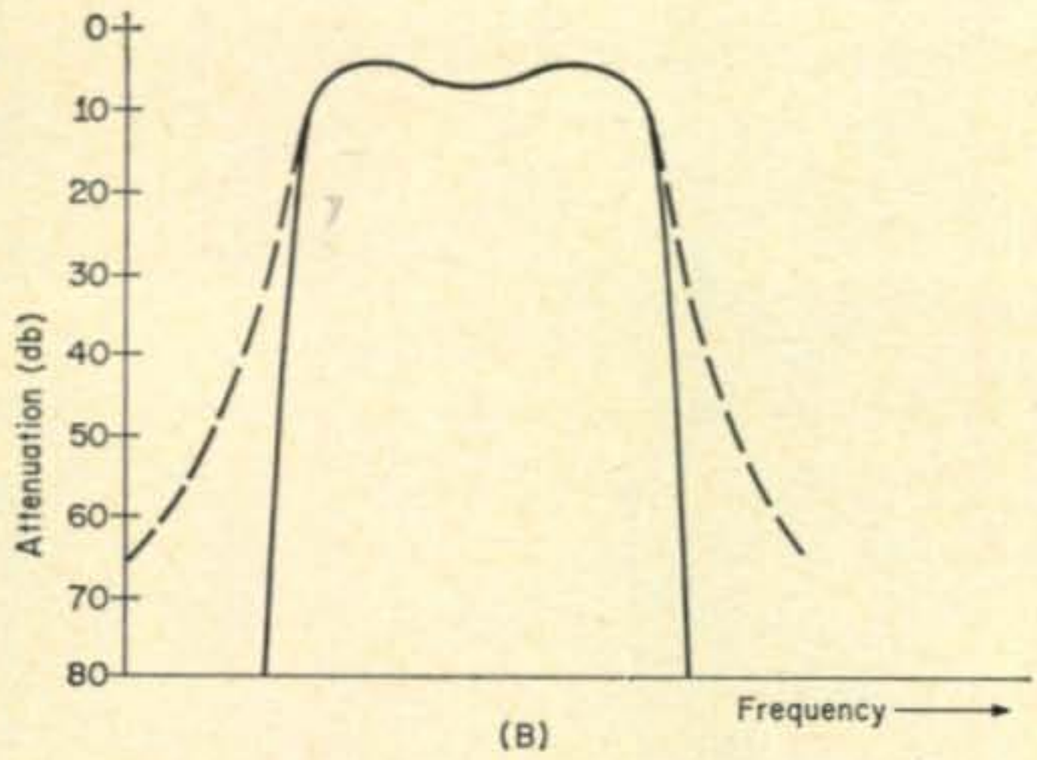


Fig. 7—(A) Curves showing the increase in skirt selectivity of a four crystal filter (solid line) over that of a two crystal filter (broken line). (B) Increase in rejection of an eight crystal filter (solid line) over the four crystal filter (broken line). This is the same four crystal filter as shown in (A) but drawn to a different scale.

of transistorized communication receivers. A typical circuit of such an i.f. section is shown in fig. 8. Such a filter eliminates all i.f. transformers, capacitors, and associated components, and what is more important, produces a better and more reproducible response.

Filters as Traps

Due to the crystal's ability to be made either series or parallel resonant, such a crystal or crystal filter may be adapted as a resonant bypass, as a trap, or both, as shown in fig. 9. If the element is regarded as equivalent to a series resonant *LC* circuit, the applications are the same as those for tuned traps using lumped circuits.

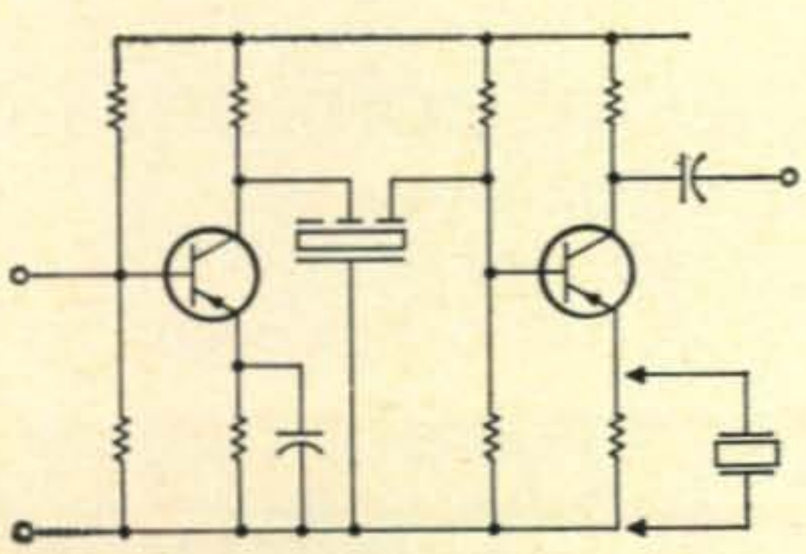
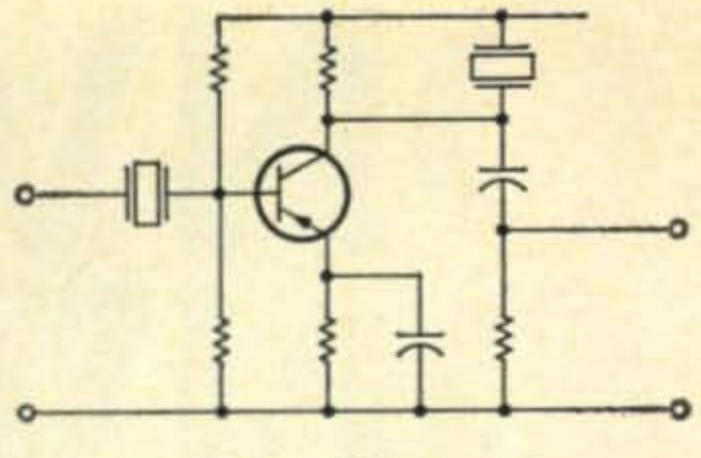
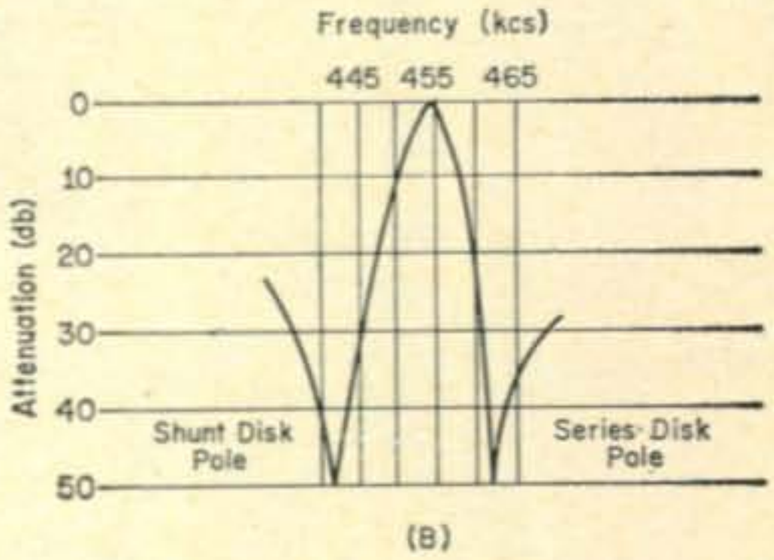


Fig. 8—Circuit of an i.f. amplifier using a ceramic coupler.



(A)



(B)

Fig. 9—(A) Circuit of an i.f. amplifier using a series resonant coupler on the input and a shunt resonant coupler in the collector circuit. The resulting curve is shown at (B). Note particularly the steep slope and narrow bandpass at the 3 db points.

A summary of the various uses of such filters is given in fig. 10. At (A), the *bandpass* filter will pass signals in a given band of frequencies with little or no rejection, at the same time attenuating greatly, signals at all frequencies above and below the design, or specified frequency limits. The *band rejection* (or elemination) filter (B), is the opposite of the bandpass filter. It will pass signals at all frequencies above and below the specified limits, and greatly attenuate (reject) all signals between these frequencies. It is the combination of these two that normally form the passband of the television receiver.

The filters at (C) and (D) are designed to pass all signals *below* a certain frequency and reject all those above, and conversely to pass all

[*Continued on page 102*]

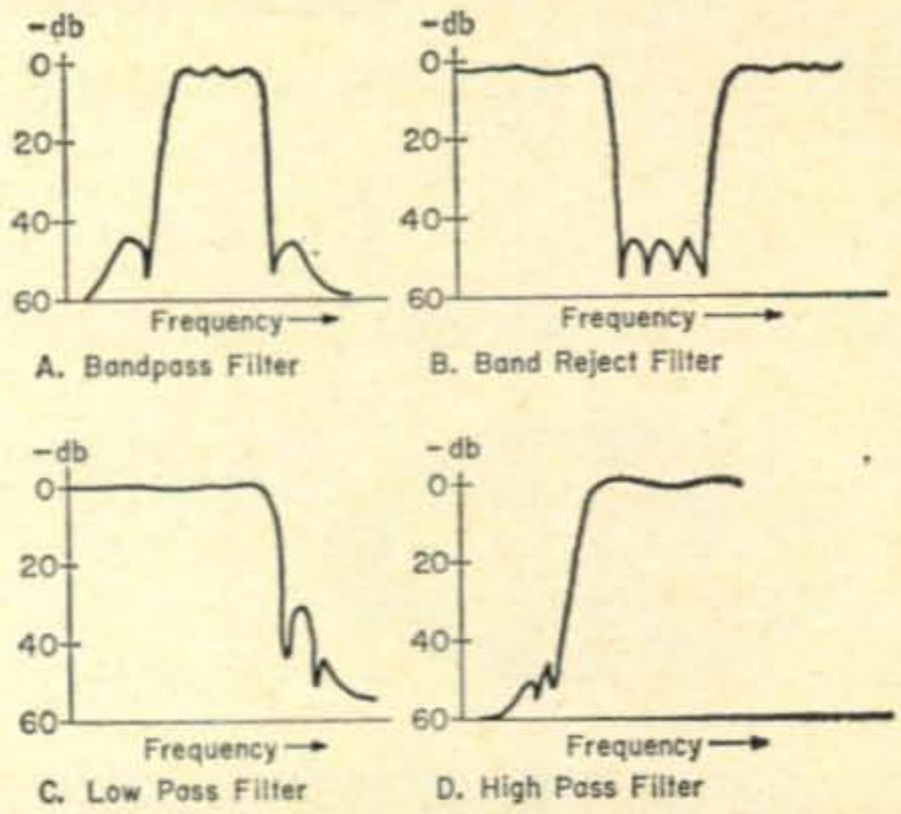


Fig. 10—A summary of filter responses possible with various combinations of resonant elements covered in the text. Other types of specialized filters are also possible.

CONVERTERS
CONVERTERS
CONVERTERS
CONVERTERS
CONVERTERS

HF & VHF ▪ UHF ▪ HAM ▪ POLICE
FIRE ▪ MARINE ▪ ETC., ETC.

WE HAVE THEM ALL

TUBES ▪ NUVISTORS ▪ TRANSISTORS

THE LEADER IN THE FIELD

AVAILABLE AT LEADING DISTRIBUTORS WRITE FOR FREE CATALOG

AMECO

AMECO EQUIPMENT CORPORATION

A SUBSIDIARY OF AEROTRON, INC.

P. O. BOX 6527

RALEIGH, NORTH CAROLINA 27608

MANUFACTURER OF FM AND AM TWO-WAY RADIO, SSB AND ISB COMMUNICATIONS, CONTROLATOR FUEL CONTROL & DATA EQUIPMENT, AMECO* HAM, CB AND SHORT WAVE LISTENING EQUIPMENT.

For further information, check number 4, on page 110

Fig. 1—Front view of the weather receiver.

A FIXED FREQUENCY WEATHER BROADCAST RECEIVER

BY RONALD L. IVES*

CONTINUOUS broadcasts of weather information on the long wave aeronautical band have been generally available to the public for more than five years. Extensions and improvements of the service have increased the areal coverage so that two or more broadcasts can be received consistently in almost every part of the United States and in many adjacent parts of Canada and Mexico.

Locations and frequencies of stations broadcasting weather information are given on the Sectional Aeronautical Chart for your area. These charts are published by the U. S. Coast and Geodetic Survey, Washington, D.C. Index and current prices are available free on request. A complete listing of these same stations is also given in the Airman's Guide, available from the Government Printing Office, Washington, D.C.

Although a very few modern receivers will cover the low frequency aeronautical band, most popular weather receivers seem to be converted surplus, such as the BC-453, the ARB, the R24/ARC-5, the RAL, and the RAK-7. All of these can be successfully converted for use with a.c. power, and all, despite their age, are satisfactory performers.

Another possibility is the use of a crystal converter and a receiver covering some other frequency range. For most areas, a converter will work well only if it incorporates filters to prevent "blast through" of powerful local broadcast stations and enough tuned circuits to eliminate image troubles.

Because most listening to weather broadcasts is from a single station, use of a fixed-frequency receiver, designed only for weather broadcast reception, provides great operational convenience, and frees the tunable receiver for other uses.

*2075 Harvard Street, Palo Alto, California 94306.

Fundamental Requirements

Weather broadcasts on the long wave aeronautical band are continuous tape recordings, with

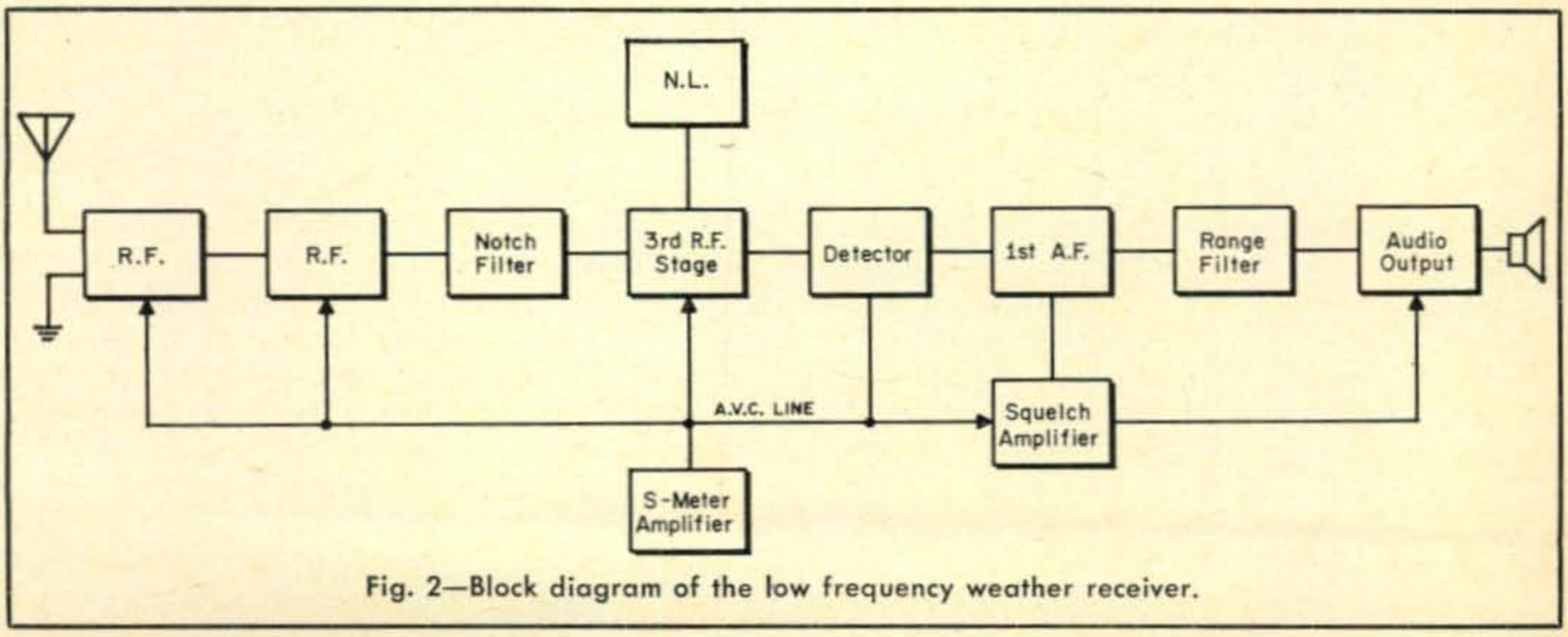


Fig. 2—Block diagram of the low frequency weather receiver.

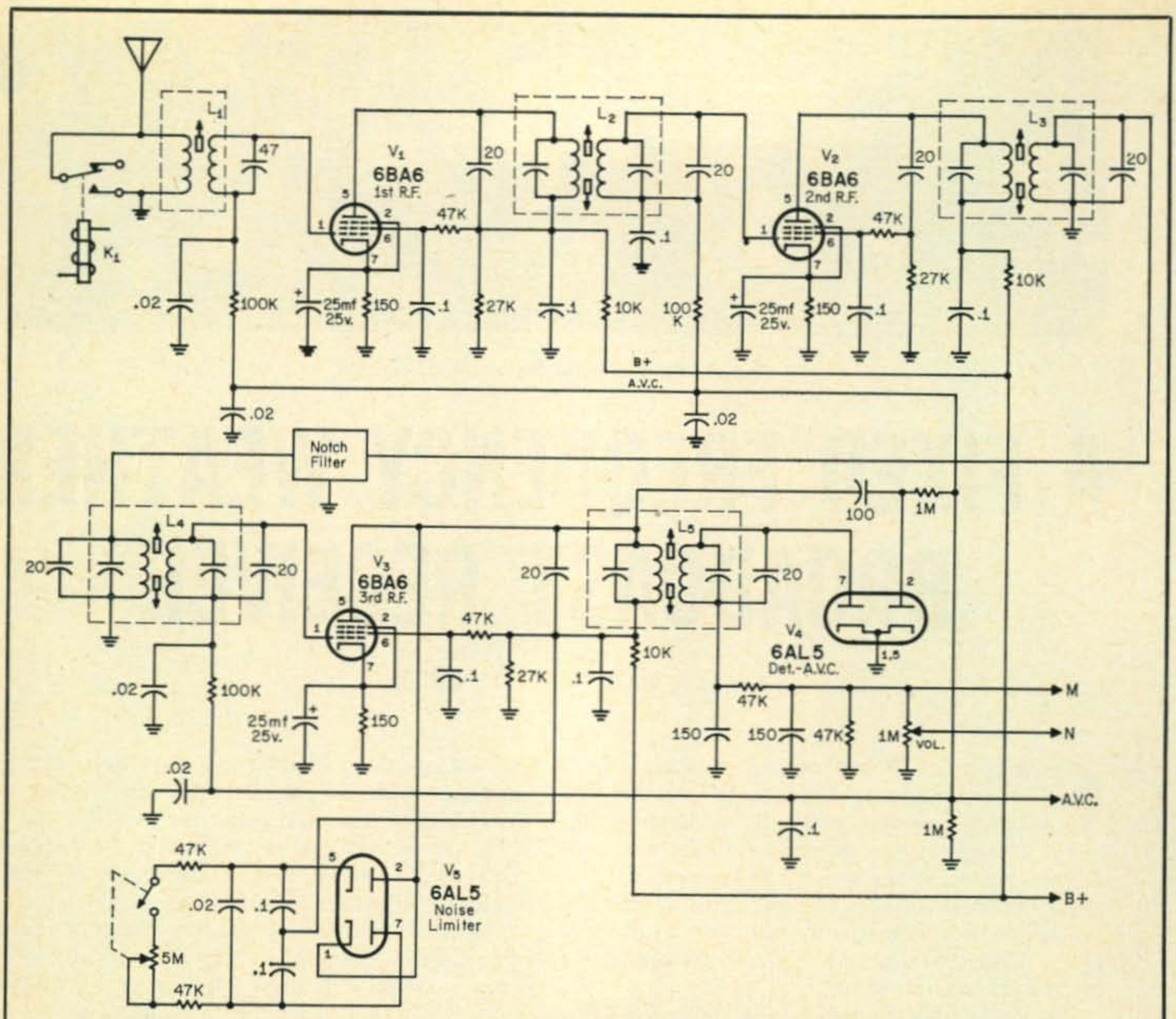


Fig. 3—Circuit of the r.f., detector and noise silencer portion of the low frequency weather receiver. The tuned circuit components are selected for an operating frequency of 362 kc as explained in the text. The notch filter circuit is shown in fig. 4. The noise limited control actuates the noise limiter switch turning it off fully counter clockwise. All Resistors are ½ watt unless otherwise noted. All capacitors one or greater in value are in mmf. Capacitors less than one in value are in mf. Electrolytics are polarized and are in mf.

L_1—Antenna coil—Miller X-5495-A with a shield can added.

L_2, L_3, L_4—455 kc i.f.—Miller 913-C1 or equiv.
L_5—455 kc i.f.—Miller 913-C4 or equiv.

a limited audio range, and relatively low transmitter power. The audio quality depends upon the speaker, and is not enhanced by somewhat obsolete tape equipment. A 1020 c.p.s. identification signal is included in the broadcast, giving the station call letters in Morse at regular intervals. Some stations also transmit the A and N range identifications in Morse. This range signal is being eliminated at most stations.

At the relatively low frequencies used for weather broadcasts, atmospheric and industrial noise are serious problems, particularly near mountain areas where afternoon thunderstorms tend to drown out the desired signals. Industrial electrical noise is quite severe in this frequency range especially in urban areas where the power distribution system is overloaded.

Although reception of weather signals is largely by ground wave, signal strength is quite variable due to such weather conditions as ice fogs and strong atmospheric inversions. The actual effect of weather conditions on signal strength seems to be very much greater in the San Francisco Bay area and adacent to the Gulf of California than is indicated by current theories. Ionized smog layers may be the culprit here.

Interference in the long wave band is also quite severe, due to overcrowded channels and obsolete equipment, particularly in "terminal areas" like Oakland, California. Efforts are being made by the FAA and the FCC to reduce this interference.

Elimination of background noise during carrier interruptions, and during the long "no audio" periods between weather sequences, is most desirable from the standpoint of operator convenience. Tape growl, and similar background noises during "no audio" periods are most fatiguing to the operator.

frequency weather receiver, to be a useful com-

In consequence of these conditions, a fixed

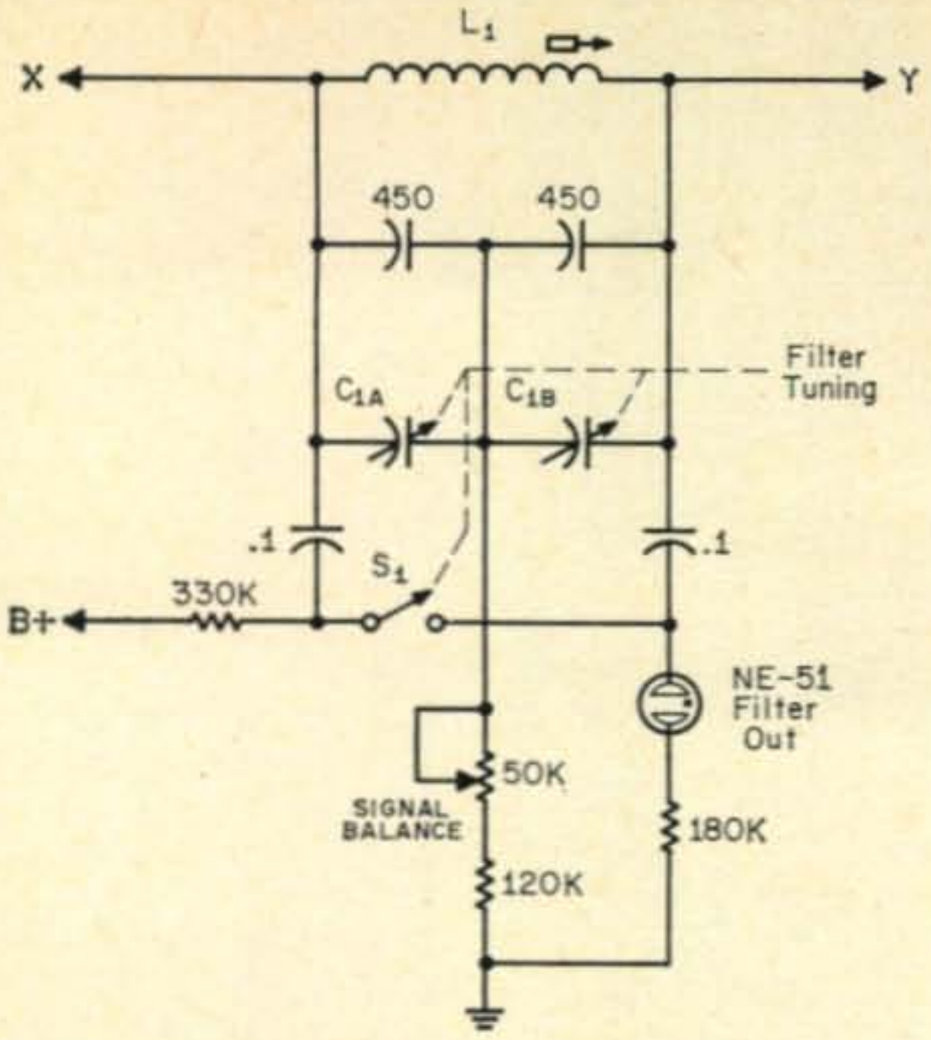


Fig. 4—Circuit of the notch filter used in the receiver r.f. section shown in fig. 3. The values shown are for an operating frequency of 362 kc. The formulas shown may be used to determine the component values for other operating frequencies. The coil and tuning capacitor are enclosed in the shield can as shown in the view of fig. 5. Switch S_1 is driven by a cam on the shaft of C_1.

C_1—2 gang variable, 51 mmf per section. Johnson 167-52.

L_1—0.6-1.25 mh, 8 ohms d.c. resistance, Miller 43A-103CB1.

munications device, must have as narrow a passband as practicable, a tunable filter, a good noise limiter, an effective a.v.c., and some means of eliminating range and station identification signals. Optional, but most desirable, is a squelch to silence the audio output whenever the carrier or the audio signal fails.

Component Lineup

With the foregoing requisites in mind, several fixed frequency receiver designs were tried out, emphasis being on consistent performance, operator convenience, and use of as many standard parts as possible. Compactness, power economy, and "modern design" were minor considerations here.

A block diagram showing component lineup finally chosen is shown in fig. 2. Considerable experimentation showed that more stages, more amplification per stage, or more audio did not improve the quality of the received signal. Additionally, in the frequency range concerned, use of superheterodyne techniques added components without improving receiver performance. Panel view of the completed receiver is shown in fig. 1. As should be obvious, exact physical format of the receiver is not critical, although too much crowding will lead to stability and heat-disposal problems.

R.F. And Detector Circuitry

The "front end" circuitry of this receiver consists of three stages of fixed-tuned r.f., a tunable notch filter, a Bishop-type noise limiter and a diode detector-a.v.c. These circuits comprise fig. 3. Although this receiver was designed specifically for reception of signals from OAK (Oakland, California), which transmits on 362 kc, all constants other than those of the tuned circuits are good throughout the long wave aeronautical band. Despite the "unusual" frequency involved, satisfactory coils are available as standard items. The antenna coil is a Miller X-5495-A, shunted by a 47 mmf ceramic capacitor. Shunt capacitor for any other frequency can be computed by standard formulas.

All intermediate coils, except the notch filter inductor, are standard i.f. transformers (designed for operation at 455 kc.) padded to the desired lower frequency with ceramic capacitors. For the frequency used here, the transformers were Miller 913-C1 (between r.f. stages) and Miller 913-C4 (output to detector), padded to 362 kc, with 20 mmf ceramic capacitors. If the station frequency is less than 260 kc, similar transformers, nominally rated at 262 kc can be used effectively. Preliminary tuning is conveniently done with a signal generator and oscilloscope, circuits being adjusted for maximum output in a shunt connection.

Because of the great amplification in this receiver, special care must be taken with circuit isolation to prevent unwanted feedback. Filament bypass capacitors were found desirable on

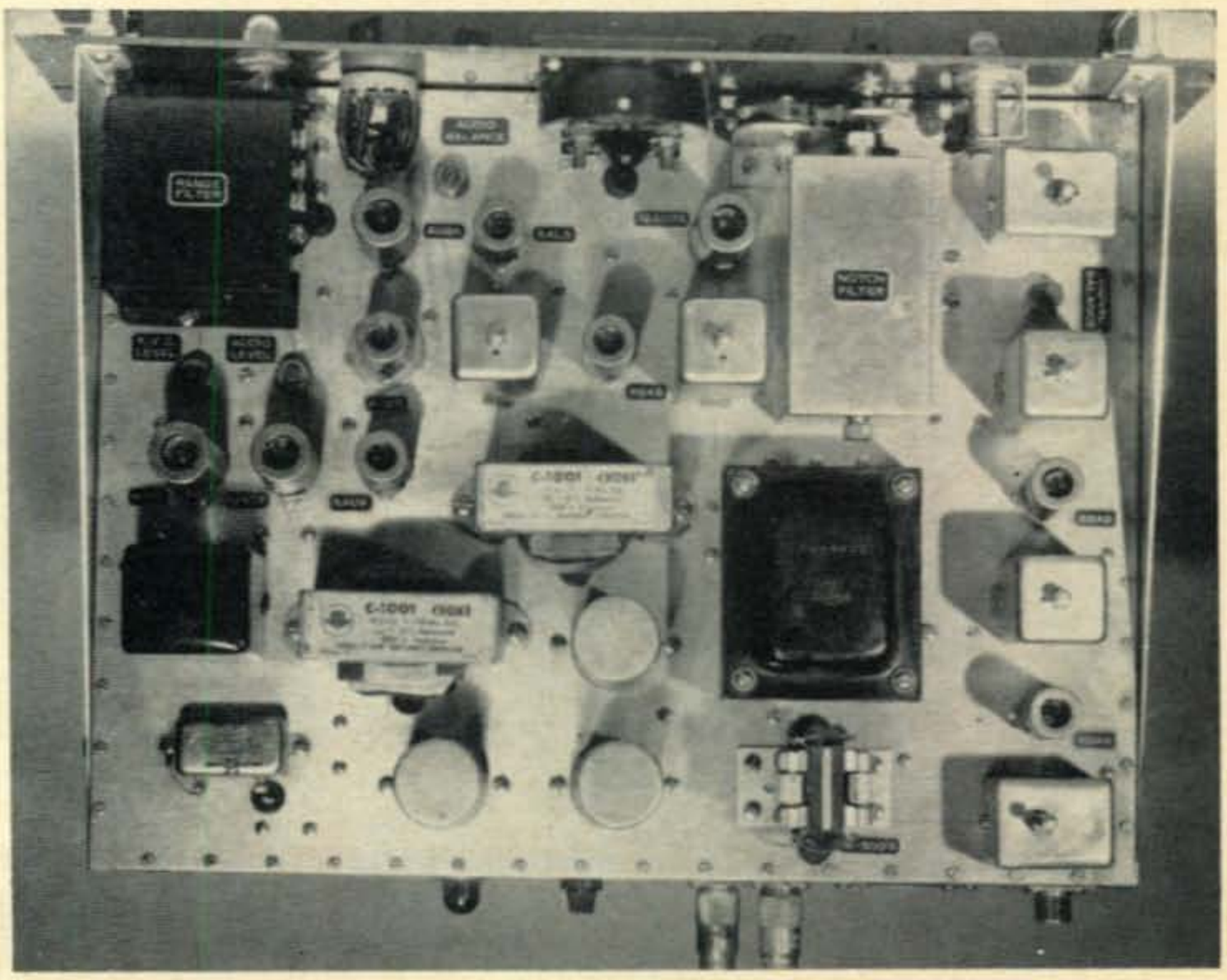


Fig. 5—Top view of the weather receiver.

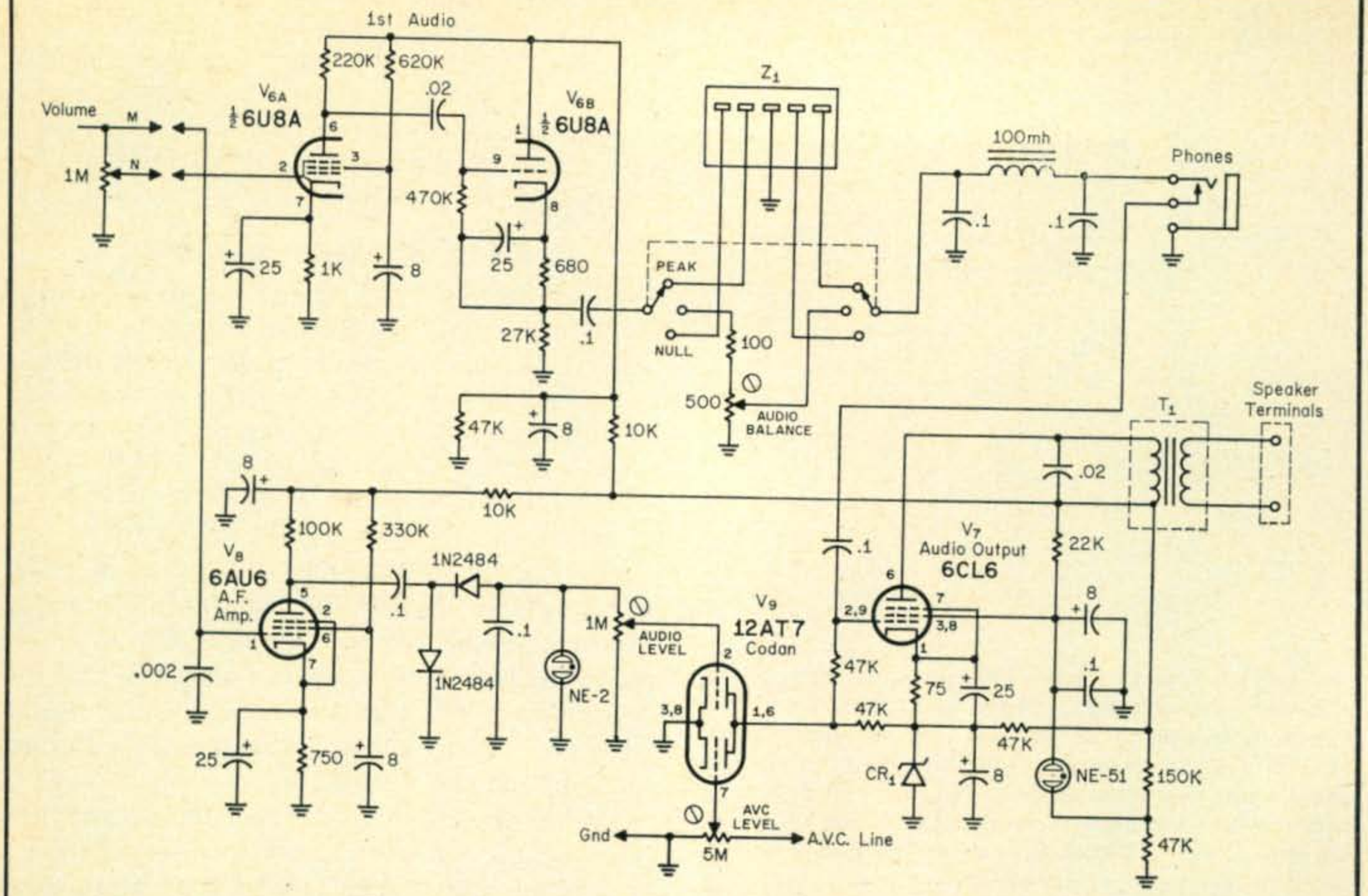


Fig. 6—Audio circuits of the low frequency weather receiver. All resistors are ½ watt unless otherwise noted and all capacitors are in mf.

CR_1—Zener diode, 100 volts, International Rectifier HZ-100 or equiv.

T_1—Output transformer, 7K ohms to 4 ohm secondary. Stancor A3878 or equiv.

Z_1—Range filter, NAF 68304. Surplus.

the three r.f. stages, and a voltage divider type screen supply was found essential to prevent undesired stage intercoupling.

Interference reduction with a receiver in this frequency range, is somewhat of a problem as both a crystal filter and a Q multiplier are too sharp to be of much use at frequencies below about 400 kc and conventional bridged-T notch filters are too broad at frequencies much above 200 kc. Happily, the art advances, and coils are now commercially available with a *Q* considerably above 120. This extends the usable range of the bridged-T notch filter upward toward 400 kc. The circuit of the notch filter for this receiver is shown in fig. 4, with specific constants for 362 kc. Calculations for other frequencies are explained at the end of the article. Do not, for reasons of economy, substitute an inexpensive low *Q* coil for the Miller 43A103CB1 here specified or the rejection notch will be so broad as to be unusable.

As should be obvious from the circuit, the tuning capacitor frame and shaft must be insulated from the chassis. The capacitor and coil must be shielded, and the coil shield, for the coil specified, must not be smaller than 1¼" square, or coil *Q* will be degraded seriously.

The notch filter is cut out of circuit by a microswitch, operated by a cam on the capacitor shaft so arranged that the OUT position is 180° from the NULL position. The same switch also operates the FILTER OUT lamp in the OFF position.

Noise limiting, in the long wave aeronautical band, is quite important as atmospheric and industrial noise is intense, particularly during the summer thunderstorm season. Because rectified noise raises the a.v.c. voltage in most detector-noise limiter circuits, degrading the receiver sensitivity, an r.f. noise limiter of the Bishop type is used here. This type of noise limiter is an envelope rider, which clips all r.f. peaks that exceed a preset fraction of the average r.f. envelope by more than the contact potential of the diodes. The operating level is adjustable from the front panel, and the noise limiter can be removed from the circuit by means of a switch on the 5 megohm pot which determines the level.

Detector and a.v.c. circuits are entirely standard in construction and operation.

The general layout of components is shown in Fig. 5, an above chassis interior view. R.f. circuits are at right and center; a.f. circuits are at left; power supply is in lower center. Although this layout need not be followed religiously, the arrangement shown places all panel controls close to their respective circuit functions. Panel and chassis labels here are compatible with those in the circuit diagrams.

A.F. Circuitry

The audio frequency portion of this receiver consists of the main signal channel, containing

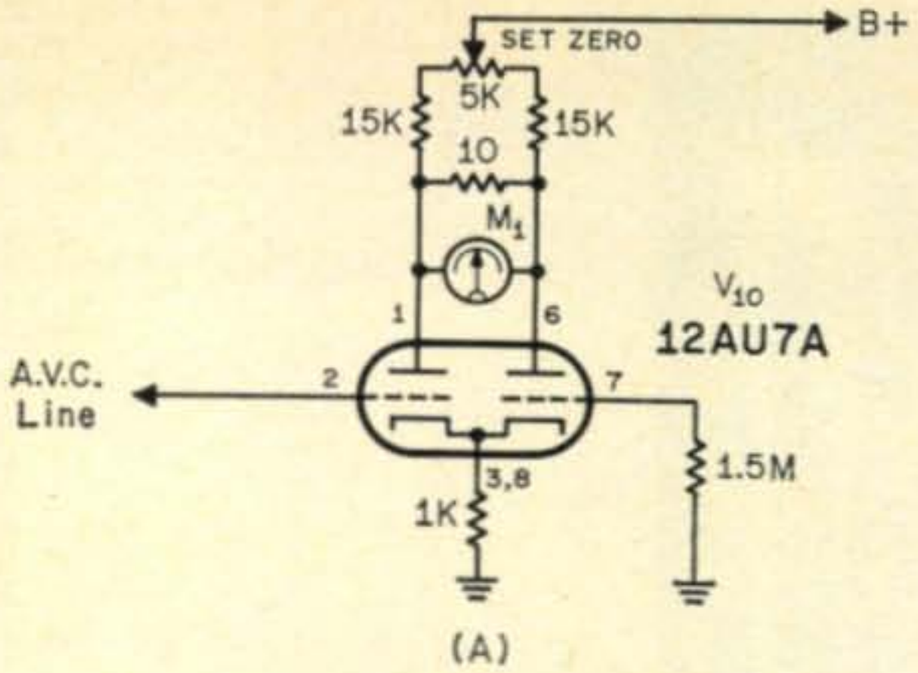


Fig. 7 (A)—Circuit of the signal strength meter amplifier. (B)—Circuit of the "Zero Check Relay."
K_1—S.p.s.t. relay, 6 v.a.c. coil, Potter Brumfield RS5D or equiv.
M_1—O-1 ma meter. Triplett 327-T or equiv.

a range filter and a high killer; and a branch channel, which operates a squelch circuit, so that the audio output is silent whenever either the audio signal or the carrier fails. Audio circuits are shown in fig. 6.

Audio signals to the main channel come from the arm of the volume control (*N* in fig. 3), and go first to a pentode, the pentode portion of a 6U8A. Thence they go to a cathode follower, the triode portion of the 6U8A, which gives a low impedance output. This is fed to the range filter, which can be switched to either suppress or peak the Morse station identifier and/or the range signal.

The range filter can be switched completely out of circuit by a third switch position, through the AUDIO BALANCE potentiometer, which is so adjusted that the audio volume with the filter out is the same as that when the filter is at NULL position.

Immediately following the range filter is the "high killer," an L-C filter which attenuates the higher audio frequencies. This is most helpful in attenuating not only the banshee heterodynes so common in the aeronautical band, but also in reducing "denture hiss" and other annoying audio imperfections. A phone jack is provided after the "high killer" to permit headset listening and/or tape recording of the signals.

The output tube is a 6CL6, operated with the cathode held 90 volts above ground by a zener diode. When the Codan tube, to be described later, draws no current, the 6CL6 functions as an audio output tube. When the Codan tube draws current, the voltage drop across R_Z (fig. 6) produces enough negative grid bias to cut the tube off, silencing the audio output. It was found desirable to pot the output transformer to prevent "talking" at the higher signal levels.

The squelch circuit, which silences the output tube whenever either the carrier or the audio fails, acquires its audio control component from

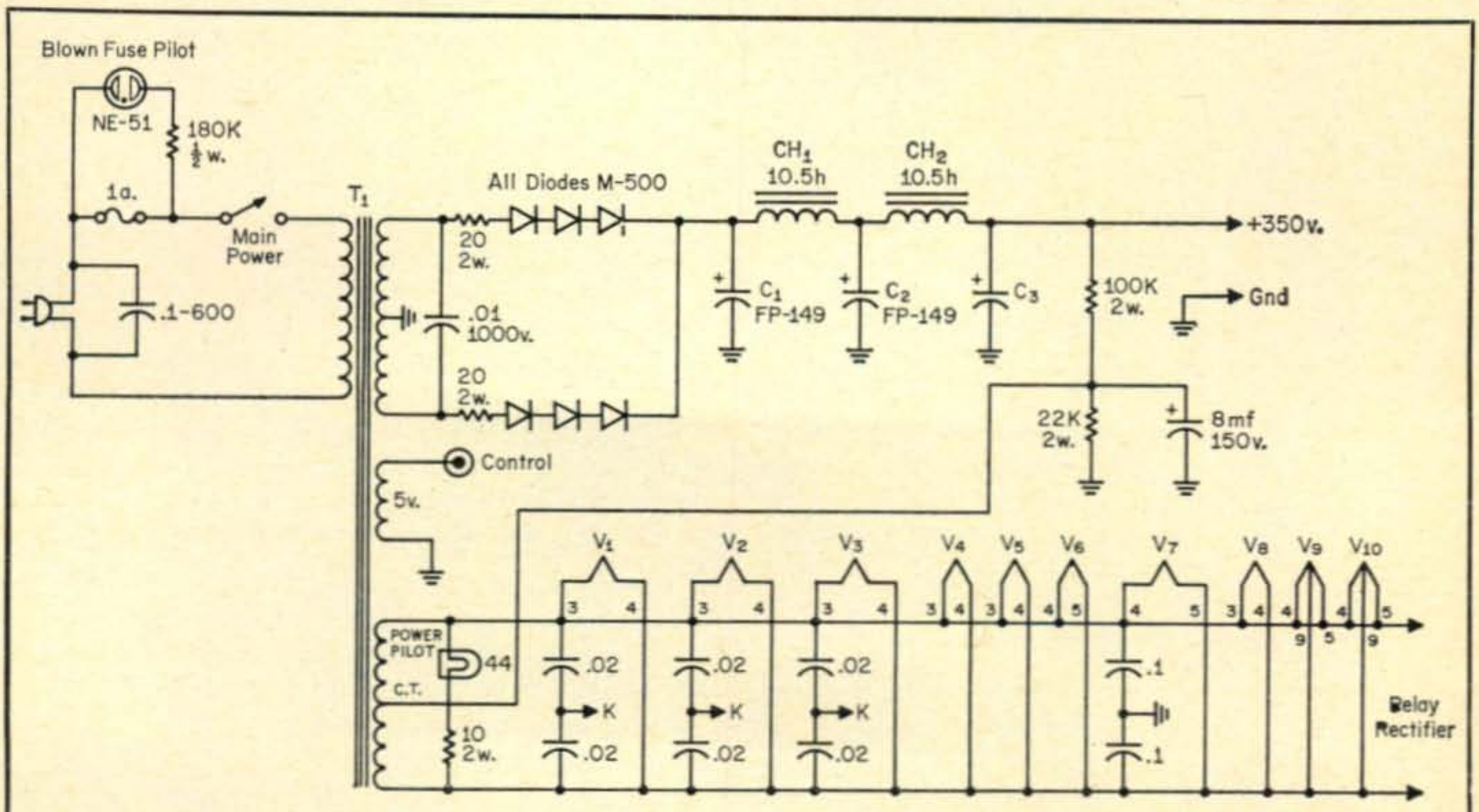


Fig. 8—Circuit of the power supply for the weather receiver. All capacitors are rated in mf. Those capacitors used in the filament circuit must be connected at the specified tube sockets. The junction of the capacitors across the filaments of V_1, V_2 and V_3 return to the cathodes of the respective tubes.

CH_1, CH_2—10.5 henries at 110 ma. Stancor C1001.
C_1, C_2, C_3—80 mf 450 v. Mallory FP-149 or equiv.
T_1—Power Transformer 720 v c.t. @ 120 ma, 5 v @ 3a., 6.3 v @ 3.5a. Stancor PM8410 or equiv.

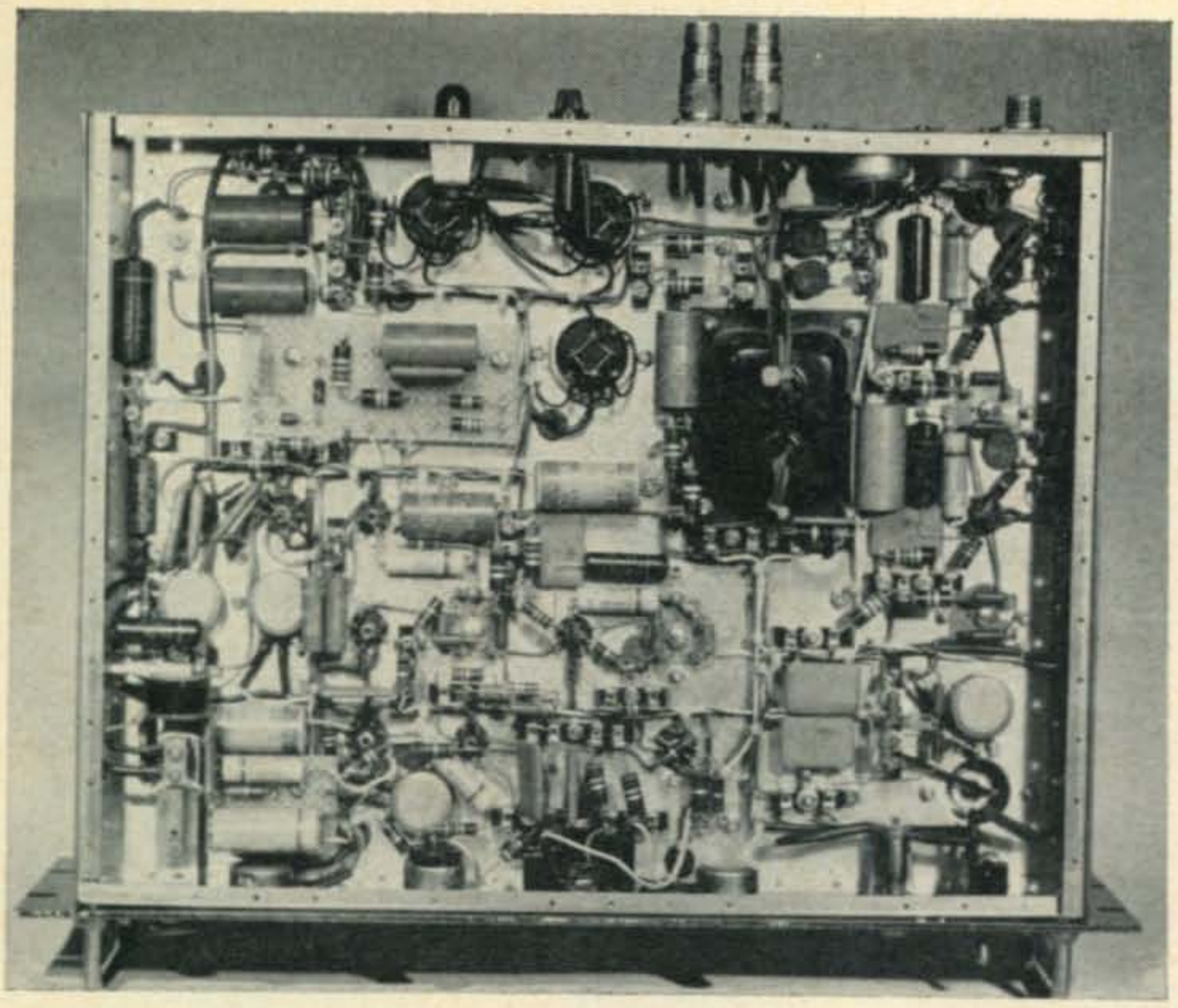


Fig. 9—Under chassis view of weather receiver. R.f. components are along right edge and in center. A.f. components are at left. Power supply is in upper center.

a branch amplifier, coupled to the top of the volume control (M in fig. 3). This is a conventional 6AU6 amplifier (V_8, fig. 6). Output of this tube is rectified in a voltage doubler circuit, the rectifier output filtered, and the resultant d.c. fed to one half of the Codan tube (V_9, fig. 6), via the AUDIO LEVEL potentiometer. The NE-2 shunted across the audio rectifier output is a voltage limiter so that the time constant of the circuit is substantially constant through a wide range of signal strengths.

The other half of the Codan tube is connected to the receiver a.v.c. line through the AVC LEVEL potentiometer. When both halves of this tube are cut off, it draws no current. If either the audio signal or the a.v.c. voltage falls below the preset limits, the Codan tube draws current, and silences the receiver by producing a voltage drop across R_Z, which cuts off the 6CL6 output tube, as previously outlined. "Codan Off" is indicated by a neon lamp, connected between the screen of the 6CL6 and a plate supply voltage divider. When the tube is operating, it draws screen current, and voltage across the lamp is insufficient to fire it. When the 6CL6 is cut off, it draws no screen current, and the voltage across the neon lamp rises above the firing voltage. The Codan circuit is a modernization of one developed by the Bell Telephone Laboratories more than forty years ago.

Signal Strength Meter

Strength of the received signal, as determined by the a.v.c. voltage, is indicated on a panel meter, driven by a vacuum tube voltmeter. Zero of the meter is checked by shorting antenna and ground by means of a relay (K_1, fig. 3). This is a simple and dependable circuit, detailed in fig. 7. Once zeroed, it needs minor readjustment only about every 1,000 hours, due to tube ageing. Meter indication, in this circuit, varies substantially as the logarithm of the carrier level. If, in your location, the meter goes off scale, it may be shunted down into the desired range.

Power Supply Circuit

The power supply of this receiver is conventional as to plate voltage, but somewhat non-standard in the filament circuits. Plate supply filter is somewhat larger than is theoretically needed, so that it will not pass switching transients and other "line riders." Capacitors are shunted across the a.c. input and the high voltage secondary to attenuate intense microsecond spikes that come in over the supply line. The power supply circuit is shown in fig. 8. To facilitate testing and eventual replacement, the electrolytic filter capacitors (FP-194) are mounted in sockets (Cinch 2-C-7).

By means of a voltage divider across the high voltage supply, the filament center tap is operated at about 85 volts (not critical) above ground. This effectively prevents hum due to diode action between cathodes and filaments, even in the cathode follower and output tubes, where the cathodes are operated far above ground potential. Filament bypass capacitors shown must be connected directly at the socket, or they will be ineffective. Those in the r.f. circuits are for r.f. bypassing. The two 0.1 mf capacitors in the power output tube (V_7) suppress a swept oscillation occurring as the tube is cut off by the Codan. This is heard on adjacent equipment, but not on the receiver. The two .02 capacitors in the rectifier circuit of the tuning meter relary (fig. 7), suppress rectifier noise occurring when the circuit is energized.

Constructional Features

Construction of a receiver of this general type is both simple and exacting. The prime requisite is consistent and dependable operation. This calls for conservative design and rugged construction. The receiver illustrated uses a 5¼" × 19" aluminum rack panel, with a 17" × 13" × 2" aluminum chassis held to it by brackets. General above-chassis parts arrangement is shown in fig. 5 and the under-chassis view is shown in fig. 9. Exact component arrangement here is not sacred, but any crowding of r.f. components, and any skimping of circuit isolation will lead to oscillation.

Fig. 10—Rear connections of the low frequency weather receiver.

Component mounting is facilitated by liberal use of tie terminals. Complicated subassemblies, like the cathode follower components of V_6 and the audio rectifier and filter of the Codan circuit, are mounted on Vectorboard. All a.c. wiring is done in twisted pair, all signal circuits are run as nearly point to point as practicable; power circuits are cabled and held in place with cable ties.

Antenna and a.c. inputs are at the rear of the chassis, as is the speaker terminal, and the 5 volt a.c. control output (which here operates relays to connect antenna and speaker to the receiver). Rear connections are shown in fig. 10.

Initial Alignment And Adjustment

When wiring is completed and checked, the receiver must be aligned and adjusted before it is ready for use. First, being sure that there is a fuse in the fuse holder, connect power, turn the receiver on, and give it a "smoke test."

Set RANGE FILTER and NOTCH FILTER controls to OFF. Press the CHECK ZERO push button, and with the button down, set the SIGNAL STRENGTH meter to zero. Pull out V_9, the 12AT7 Codan tube, to disable the squelch. Set the signal generator to the desired frequency, and align each tuned circuit in turn, starting at the detector, and working toward the antenna. The desired adjustment is for maximum signal strength at each position.

When alignment with the signal generator is completed, remove the signal generator, and connect the antenna. Touch up the alignment, using the actual station as the test transmission.

While receiving the station, turn on the notch filter, set it to "null" position, and adjust the coil for minimum signal strength. When this is reached, adjust the SIGNAL BALANCE control for minimum signal. The filter should drop the meter reading by 60 to 70 percent.

Next, adjust the noise limiter for maximum signal intelligibility. This will usually be a trifle counter clockwise of the "no noise" point. Too much noise limiting results in a "mushy" signal which is hard to read.

Set the range filter to NULL, adjust the audio volume to a convenient point. Then switch the filter to OFF, and adjust the AUDIO BALANCE control until the volume is the same as before.

Replace V_9, the 12AT7 Codan tube. Set both AUDIO LEVEL and A.V.C. LEVEL controls to maximum. With a signal incoming, back off on the AUDIO LEVEL until the audio silences during pauses in the audio transmission. Then, null the NOTCH FILTER and back off on the A.V.C. CONTROL until the audio silences. With these settings, the speaker will silence whenever either the audio signal or the carrier fails.

Put the bottom plate on the chassis, and the receiver is ready for standard operation.

Notch Filter Component Values

The component values indicated in the notch filter are for an operating frequency of 362 kc as explained earlier. If this receiver is used to receive a different station at another frequency different values of L, C and R will be needed to achieve resonance. Set forth below are the formulas and procedures necessary to determine these values. A frequency of 262 kc has been chosen for this example.

The design is based on the resonance formula:

$$f = \frac{1}{2\pi \sqrt{L\,C}}$$

Since this circuit, shown in fig. 11, has two identical value capacitors in series, C total will be equal to $C/2$. Therefore:

$$f = \frac{1}{2\pi \sqrt{L\,\frac{C}{2}}}$$

Simplifying, we have:

$$f = \frac{1}{\sqrt{2\pi^2\,L\,C}}$$

For a frequency of 262 kc, then:

$$262 \times 10^3 = \frac{1}{4.45 \sqrt{L\,C}}$$

$$1{,}165 \times 10^3 = \frac{1}{\sqrt{L\,C}}$$

$$\sqrt{L\,C} = \frac{1}{1{,}165 \times 10^{3}}$$

$$\sqrt{L\,C} = 0.857 \times 10^{-6}$$

$$L\,C = 0.730 \times 10^{-12} \text{ or } 730 \times 10^{-15}$$

Set L at a reasonable value determined by an available high Q coil. Try a Miller 43A223CB1, 1.3-2.2 mh with a Q of 156 at 250 kc and a resistance of 11.8 ohms. Assume that L is set for a value of 2 mh or 2 x 10_{-3}h. Then:

$$2 \times 10^{-3}\,C = 730 \times 10^{-15}$$

$$C = \frac{730 \times 10^{-15}}{2 \times 10^{-3}}$$

$$C = 365 \times 10^{-12} \text{ or } 365 \text{ mmf.}$$

Fixed values of 340 mmf in parallel with a dual 51 mmf variable capacitor could be used.

The next step is to determine if the 51 mmf dual variable will tune an adequate range. The 340 mmf plus the 51 mmf variable gives a range of approximately 340-390 mmf with slight error due to the minimum capacitance of the variable and the distributed circuit capacitance.

$$f_1 = \frac{1}{4.45\sqrt{2 \times 10^{-3} \times 340 \times 10^{-12}}}$$

$$f_1 = 274 \text{ kc or } + 12 \text{ kc}$$

$$f_2 = \frac{1}{4.45\sqrt{2 \times 10^{-3} \times 390 \times 10^{-12}}}$$

$$f_2 = 254 \text{ kc or } - 8 \text{ kc}$$

Thus the 51 mmf will tune the notch filter over an adequate range but will be a trifle assymetrical. However, this will be inconsequential through the normal voice range (300 to 3500 c.p.s.). Adjustment of the coil, L, will compenstate for arithmetical slack due to slide rule error and component variations.

Resistance Calculations: The value of the resistor, R, is determined from the formula:

$$R = \frac{L}{2R_L\,C}$$

where R_L is the d.c. resistance of L.

$$R = \frac{2 \times 10^{-3}}{2 \times 11.8 \times 365 \times 10^{-12}}$$

$$R = 232\,K$$

A 220K fixed resistor with a 25K variable in series would do fine here.

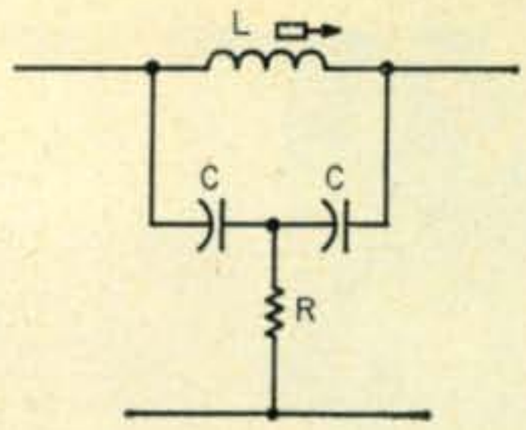


Fig. 11—Basic circuit of the notch filter used in the circuit of fig. 4.

Performance

This receiver was put into operation in February, 1964, and used three or more hours daily until September, 1966, when the chassis was pulled for photography. At that time, all components were checked and found good. Only years of operation was two replacements of the maintenance needed during the more than two power pilot lamp. These are not "down time" failures.

From experience with similar equipment, it appears that a receiver of this general type has a service life considerably exceeding 20,000 hours of operation, and that maintenance needs will not exceed pilot lamp replacements, retubing every 5,000 hours or so and replacement of the electrolytic filter capacitors if and when they dry out (after four or more calendar years, regardless of use).

Useful range of this receiver, with present FAA transmitter power and conditions, is somewhat in excess of 60 miles in most areas. In general, if the desired station can be heard on an ARC-5 or equivalent receiver, a better signal will be secured with one of this type.

With the present rapid advances in the electronic art, it appears that a carefully-built receiver of this general type will become obsolete considerably before it wears out beyond economical repair. ■

". . . I have always preferred center loading . . ."

KNOW... your rig is running right!

(keep it in constant check)

Waters

DUMMY LOAD • DUMMY LOAD/WATTMETERS

DUMMY LOAD/WATTMETERS

MODEL 334A . . . Reads power output to 1000 RF watts over 2 to 230 MHz. 4 calibrated scales for accurate readings. THE wattmeter if you operate through VHF!

MODEL 374 . . . Indicates RF power to 1500 RF watts from 2 to 30 MHz. Has 4 calibrated scales. Specifically designed for the 2KW PEP Linears to 30 MHz.

DUMMY LOAD

MODEL 384 . . . Handles up to 1500 RF watts from DC to 230 MHz. Combined with Waters Reflectometer operates as a Dummy Load/Wattmeter — and a VSWR Meter.

CANADIAN HAMS: Order direct from M. J. Howard & Co., Ltd., 1300 Carling Ave., Ottawa, Canada.

You'll transmit a consistently better signal with your rig kept under constant operating surveillance. And a Waters Dummy Load/Wattmeter will help you do just that! Even more . . . you'll know with every transmission your precise power output measured directly in RF watts. Dummy Load/Wattmeters are available in two models to handle either 1000 or 1500 RF watts.

Send for your copy of Waters new Catalog.

WATERS
MANUFACTURING INC.
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 9, on page 110

ATMOSPHERIC ELECTRICITY
LIGHTNING

BY JEROLD SIMONS,* WB6LAS

The possibility of lightning destroying an amateur station is ever present and protection techniques have been discussed in many previous magazine articles. Presented below is a thorough discussion of the origin and behavior of lightning that will serve as a background to provide a better understanding of how to protect your station.

LIGHTNING is a form of the flow of atmospheric electricity; this flow may occur between parts of a single cloud, between separate clouds, or between cloud and ground. In order to understand the nature of the flow, let us first examine briefly the nature of the electric charges.

Sources

Atmospheric electricity originates from many sources, some of which are much more important than others. Radioactive emanations from the ground are a relatively unimportant source. Of greater importance is the electric charging of particles of air and pollutants that result from combustion processes, both natural and man-made. Still another source is the breaking up of water drops, as in waterfalls and in rainfall; the fracturing of snowflakes also is quite similar. However, the most important cause of atmospheric electricity is the action of high-speed, high-energy particles that originate both in the sun and in intergalactic space. For want of an all-inclusive general term, we can call this "cosmic radiation," even though some of it is definitely of solar origin.

*11 - Southside, College Station, Texas 77840.

Ionization

Cosmic radiation electrifies the earth's atmosphere by knocking electrons from their normal orbits around nuclei of atmospheric gases. When an electron, which is the basic charge of negative electricity, is removed from the atom of molecule, the nucleus is left with a net positive charge. If there are sufficient such collisions, great amounts of electricity may collect at various levels in the earth's atmosphere.

One such level is known as the "ionosphere" because it contains large concentrations of free electrons (negative ions). The ionosphere exists in a fluctuating state at heights above the earth's surface above about 50 miles; we do not know

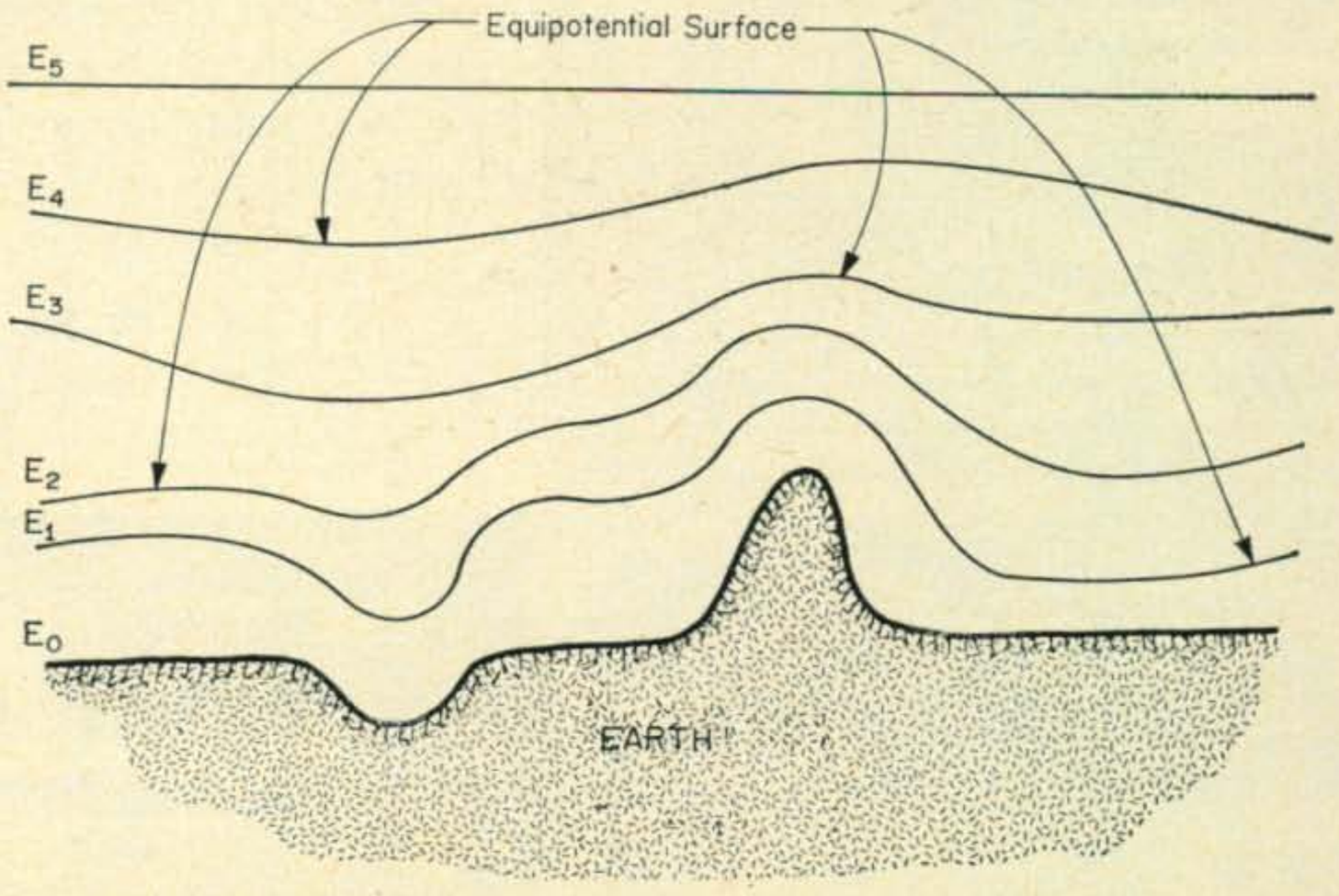


Fig. 1—A cross section of the earth and atmosphere near the ground illustrating the equipotential surfaces. The minus signs in the earth indicate the concentration of charges.

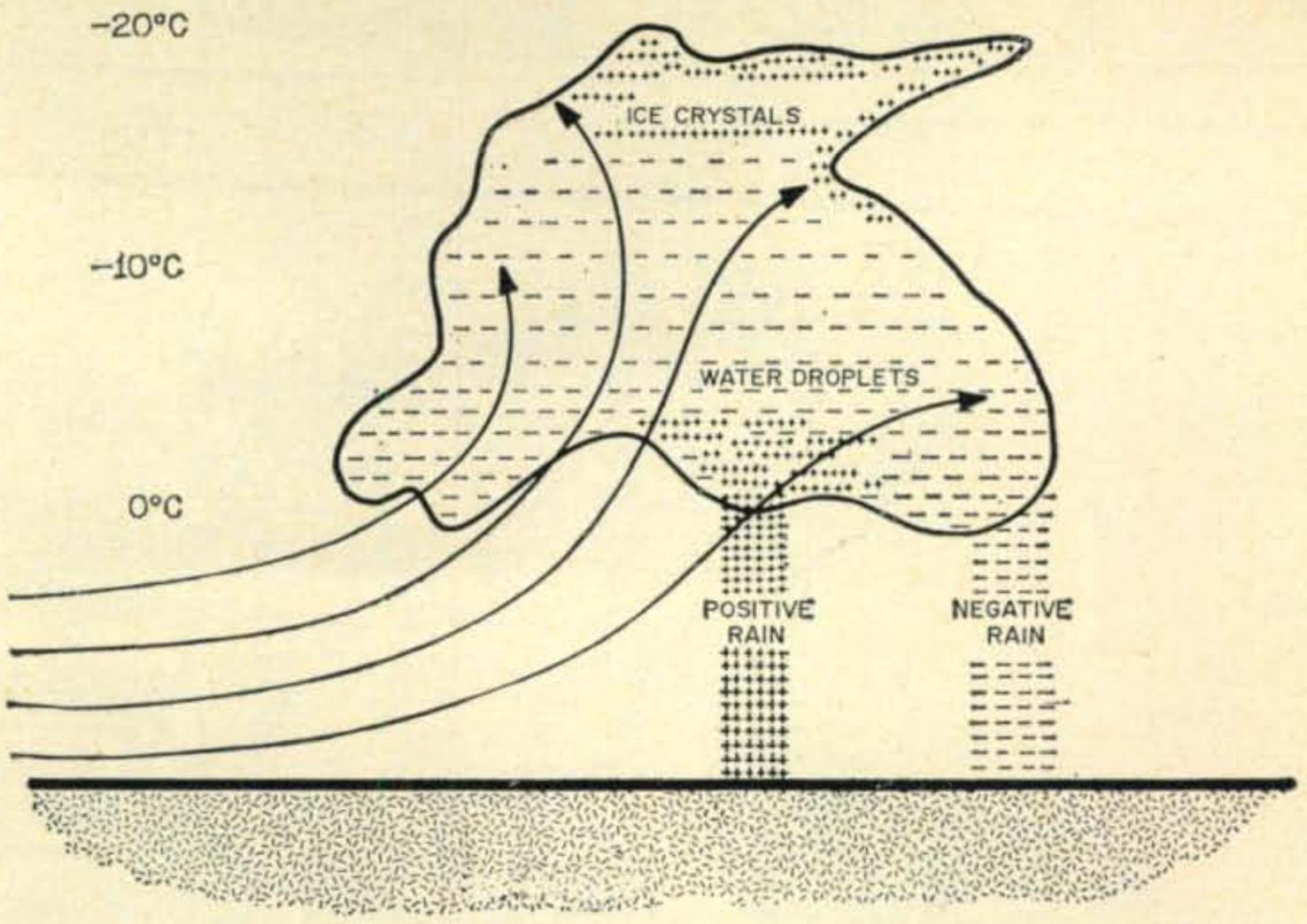


Fig. 2—Illustration of the charge separation that exists in a cloud. Some of the charges, both negative and positive, are bled off by precipitation that reaches the ground.

yet how far out it extends, but have measured large electron concentrations as high as 150 miles. There probably are decreasing concentrations even farther toward the edge of the atmosphere.

Potential Gradient

On a normal day in fair weather, the magnitude of the electric charge in the earth's atmosphere is about 125 volts per meter. This is called the "potential gradient," and means that there is a voltage difference of 125 volts between a point one meter above the ground and the ground itself. Ordinarily we are unaware of this electric potential, or potential gradient, as it is called, because we are grounded.

The diagram of fig. 1 intends to represent a cross section taken through the earth's atmosphere near the ground. The lines labeled "Equipotential Surface" are, then, the edges of plane surfaces everywhere on which the potential is equal. That is, every point on the surface E_4, for example, has the same electrical potential; every point on surface E_2 has the same potential —but the points on E_4 do not have the same potential as those on E_2.

The small minus signs indicate the concentration of the charges in the surface of the earth. The closer together these signs, the greater the total potential that is gathered here; the farther apart the signs, the weaker the potential. Notice that the signs are farthest apart at the bottom of the depression on the left side of the figure and that they are concentrated near the peak of the protrusion on the right side. This ability to concentrate has an important effect on the mechanism of lightning discharge.

Capacitor Action

The earth and its atmosphere are generally considered as a spherical capacitor; the earth is a negatively charged conductor separated from

[*Continued on page 96*]

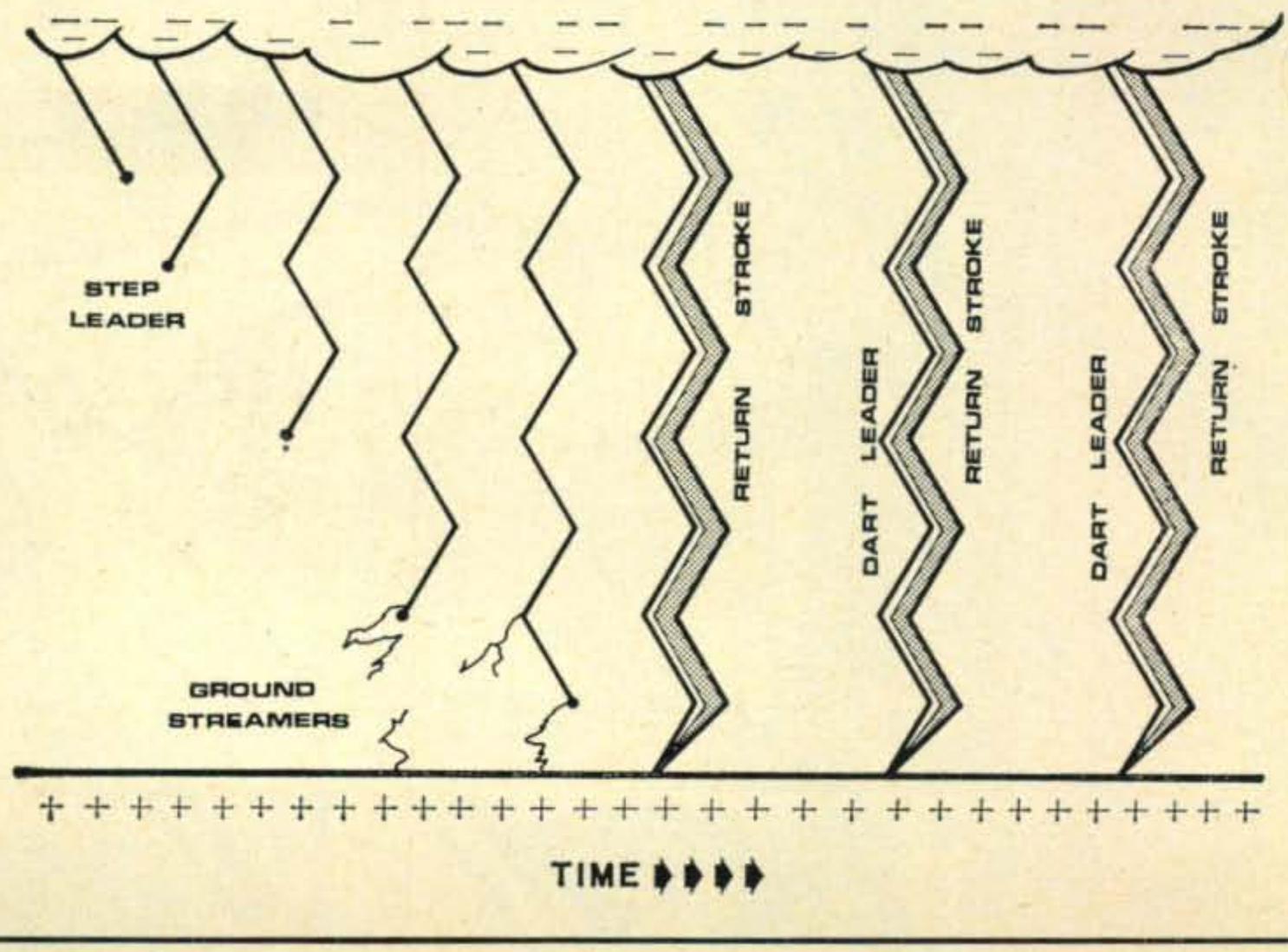
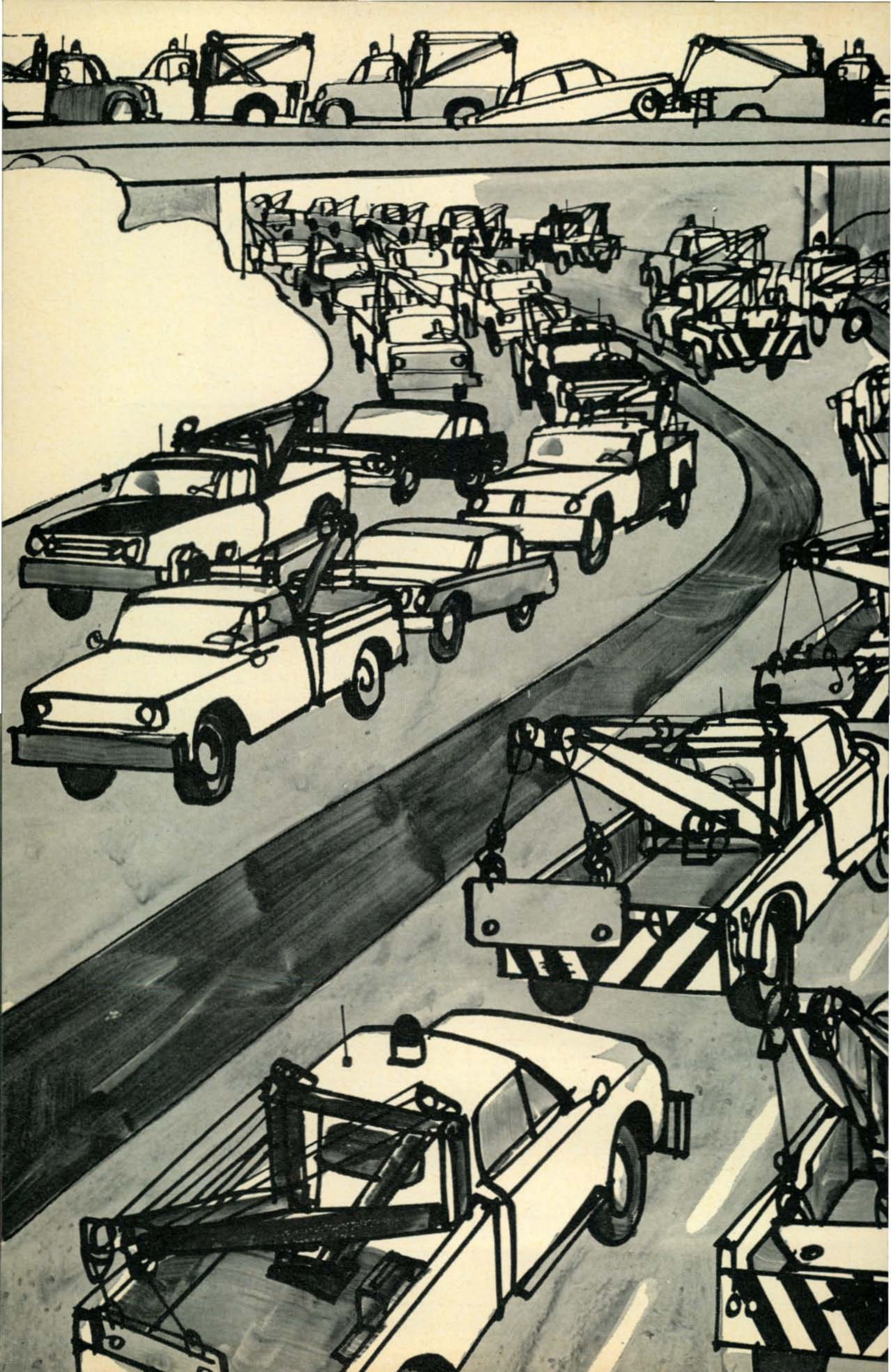
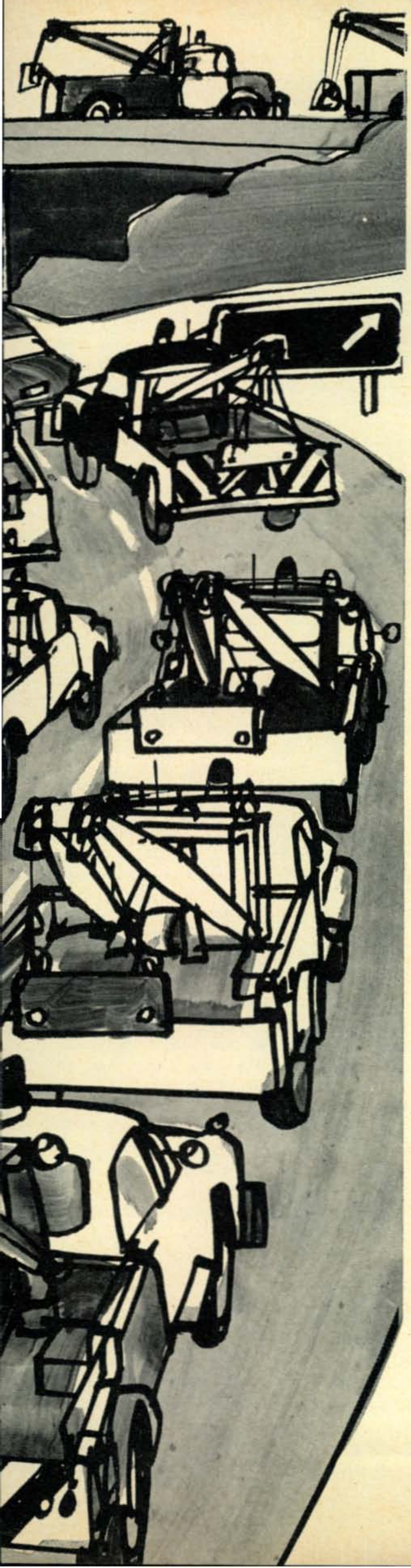


Fig. 3—A time sequence drawing (from left to right) shows the order of the lightning discharge development starting with the step leader and ending finally with the return stroke.





14,187 radio-dispatched tow-cars and only one tetrode rated for PTTS*

The tow-car driver is rarely on the air with his dispatcher for as long as 60 seconds and he drives at least 5 minutes between calls. The same goes for most radio-dispatched vehicles.

PTTS* (Push-To-Talk-Service), with its duty cycle of ONE MINUTE ON and FOUR MINUTES OFF has been shown to be the most realistic, economical and practical rating system for vehicular communications systems.

For this reason, Amperex developed the 8637, the only twin tetrode ever designed and rated for PTTS. Featuring high thermal inertia anodes and incorporating a wealth of twin-tetrode manufacturing experience, the 8637 offers the designer a new approach in creating a better vehicular radio. Fewer, and less costly components may be used. Some typical operating conditions which bear this out are shown on the chart at right . . . lower plate voltage, lower drive and higher efficiency at the VHF frequencies.

The 8637 is a 'small tube', (only 3⅛" seated height), perfectly suited for today's low-profile designs. Its cost is lower than ICAS and CCS rated tube types of the same power.

For data, applications reports and engineering assistance, write: Amperex Electronic Corporation, Tube Division, Hicksville, L. I., N. Y. 11802.

ALL THIS—and AMPEREX QUALITY, TOO!
ONE 8637—PUSH-PULL
Internally Neutralized Throughout Entire Freq. Range

50 MHz	PLATE	OUTPUT	DRIVE
CCS	375v.	25w.	0.67w.
ICAS	450v.	34w.	0.82w.
PTTS	**600v.**	**84w.**	**0.86w.**
175 MHz			
CCS	300v.	18w.	1.4w.
ICAS	350v.	26w.	1.6w.
PTTS	**560v.**	**63w.**	**2.2w.**

Amperex®

TOMORROW'S THINKING IN TODAY'S PRODUCTS

For further information, check number 10, on page 110

The Drake 2-C receiver. The S-meter window is at the right, the v.f.o. dial window is near the left. The panel has a charcoal-gray and silver-colered finish with red striping. The case is black. Dimensions are 6¼" × 11⅞" × 9 1/16" (H.W.D.).

CQ Reviews:

The Drake 2-C Receiver

BY WILFRED M. SCHERER,* W2AEF

THE Drake 2-C receiver is a moderately-priced job, yet one that delivers high-priced performance. It is basically a 3.5-30 mc ham-band-only affair with 500 kc tuning ranges and with the essential facilities needed for use on a.m., c.w., RTTY or s.s.b. with upper or lower sideband on any range. Coverage on any other 500 kc band-segment between 3 and 30 mc also is available with auxiliary crystals that can be plugged in externally. There are three degrees of selectivity, 0.4, 2.4 and 4.8 kc, that can be chosen with any mode of operation for which there also are separate envelope and product deterctors. An h.f. crystal-controlled oscillator is used at the front end along with pre-selector tuning. The set includes an S-meter.

An amplified a.g.c. system with selectable slow or fast release times has a very wide dynamic range. Other performance features are: excellent frequency stability, high sensitivity and signal-to-noise ratio, high image and i.f. signal rejection, good sideband suppression and clean-sounding audio quality.

Available as optional accessories are a 100 kc crystal calibrator, *Q*-multiplier/notch filter with built-in matching loudspeaker, and a noise blanker.

Technical Details

Although the detailed circuit arrangements shown here as employed in the 2-C are not really new or may have previously been described elsewhere, they are discussed at this time for the newcomer to s.s.b. or for those who may not already be acquainted with the particular schemes.

The Drake 2-C is a hybrid affair which employs both vacuum tubes and transistors. Refer to the block diagram at fig. 1. Except on the 3.5 mc band, the receiver functions as a triple-conversion job with a first conversion to a variable i.f. of 3.5-4 mc, a second conversion to 455 kc and a third to 50 kc. A choice of selectivity is obtained at the 50 kc i.f.

Dual conversion is used for the 3.5 mc band, in which case the h.f. oscillator is disabled and the 1st mixer operates as a straight-through 3.5-4 mc amplifier.

"Pre-selector" tuning is used at the input and output of the r.f. amplifier, while the output of the first mixer is gang-tuned along with the v.f.o. to provide the 3.5-4 mc variable i.f.

Selectable Passband Filter

The 50 kc selectable-passband filter is similar to that used in other Drake receivers. It consists of four tuned circuits of very high *Q* that are capacitively coupled in cascade as shown at fig. 2. A characteristic of such coupled circuits is that the selectivity is largely dependent on the degree of coupling, being greatest with light coupling. Thus, by switching in different value coupling capacitors, the overall selectivity can be accordingly varied. As the coupling is increased, however, a dip in the passband tends to appear. R_1 is then inserted or varied as needed to provide a flatter response in the passband at the broader selectivity positions.

Also, as the coupling is increased, the response curve spreads out from both sides of the initial resonant frequency. The setup is therefore also arranged so that resonating capacitances are altered for the various selectivity positions in order that the low-frequency side of the response curve in each case remains at a fixed point. As the passband increases, it then extends out only on the high-frequency side, as indicated by the selectivity curves at fig. 3.

One advantage of this is that the frequency of the b.f.o. may be left set at the same point on the filter skirt for operation with any degree of selectivity, eliminating the need for retuning in each case. In addition, since the 50 kc i.f. is preceded by a fix-tuned mixer at 455 kc, sideband switch-

*Technical Director, *CQ*.

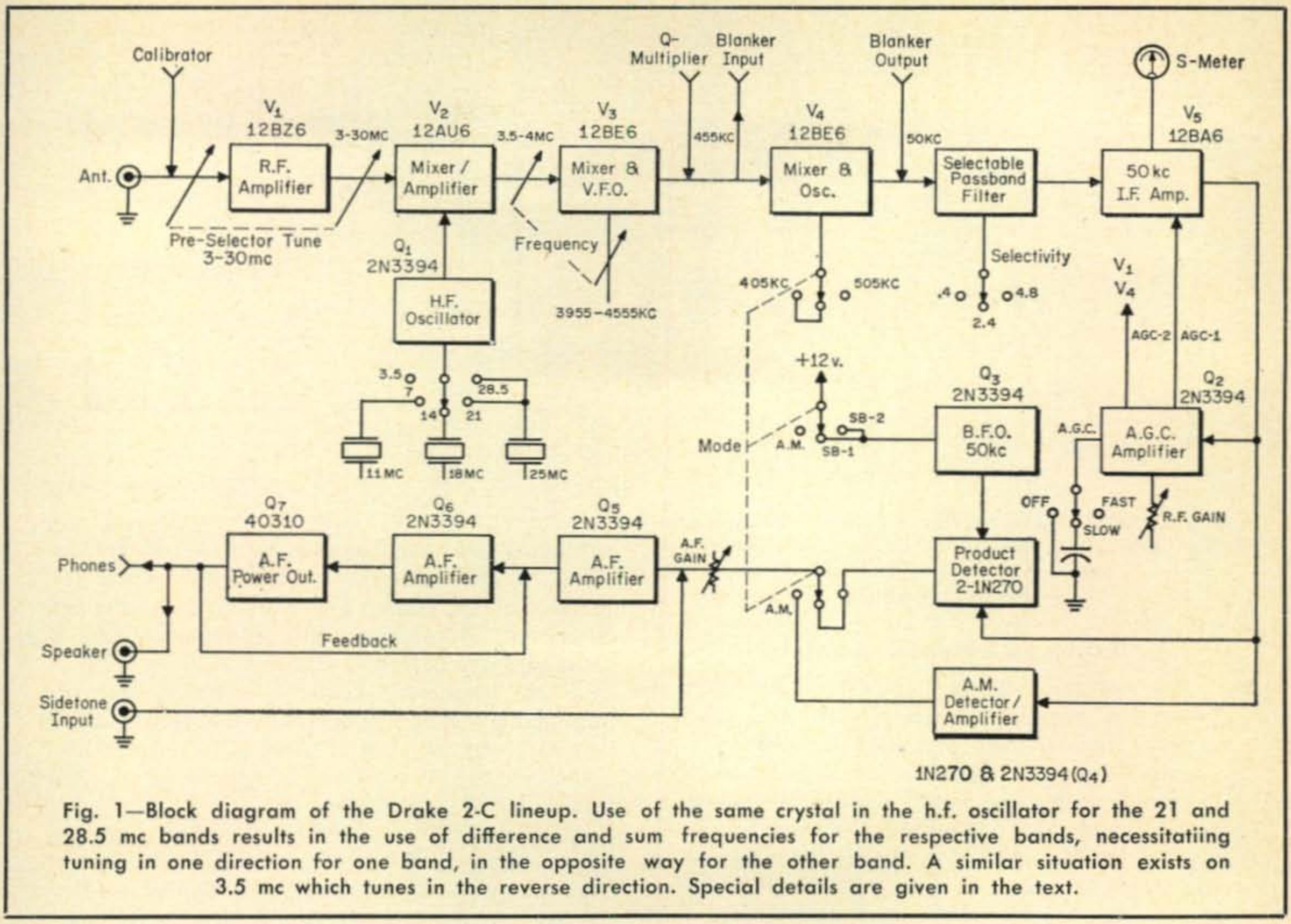


Fig. 1—Block diagram of the Drake 2-C lineup. Use of the same crystal in the h.f. oscillator for the 21 and 28.5 mc bands results in the use of difference and sum frequencies for the respective bands, necessitatiing tuning in one direction for one band, in the opposite way for the other band. A similar situation exists on 3.5 mc which tunes in the reverse direction. Special details are given in the text.

ing can be had by changing only the oscillator frequency at this mixer without necessitating retuning of the v.f.o. at the second mixer as otherwise would be the case.

This is how it works out: With a 50 kc signal the filter will reject the lower sideband, but will pass the upper sideband (50-52.5 kc) as shown at fig. 3.

If an s.s.b. signal at the 455 kc i.f. (2nd mixer output) is an upper sideband one with 1 kc modulation, the i.f. signal will be 456 kc (455 kc + 1 kc). When heterodyned at the 3rd mixer with a 405 kc oscillator, the mixer output will be 51 kc (456 kc — 405 kc) and it will be a u.s.b. signal at the filter output (50 kc + 1 kc).

On the other hand, a 455 kc l.s.b. signal with 1 kc modulation will produce a 2nd-mixer output of 454 kc (455 kc — 1 kc) which, when heterodyned with 405 kc, will produce a l.s.b. signal of 49 kc (454 kc — 405 kc) that will be rejected by the sideband filter; however, if the 454 kc l.s.b. signal is heterodyned with a 505 kc signal instead, it will be inverted to a u.s.b. signal of 51 kc (505 kc — 454 kc) at the 3rd-mixer output as needed to pass through the filter. Sideband switching of an incoming signal is thus simply obtained by altering only the heterodyning frequency at the 3rd mixer.

H.F. Oscillator

The h.f. oscillator at the first mixer is crystal-controlled using a transistor that functions in a grounded-base circuit as shown at fig. 4. Operation is designed for use with series-resonant crystals connected between the emitter and a feedback winding that is coupled to the tuned circuit at the collector. The feedback winding also is in series with the ground return at the input inductor to the first mixer to thereby provide oscillator-signal injection to the mixer.

The collector circuit is broadbanded both by a shunt resistor across the inductor and a resistor in series with the circuit-resonating capacitor which, together with switching in or out of appropriate tank capacitors, permits operation over a wide frequency range for use with 7-26 mc crystals.

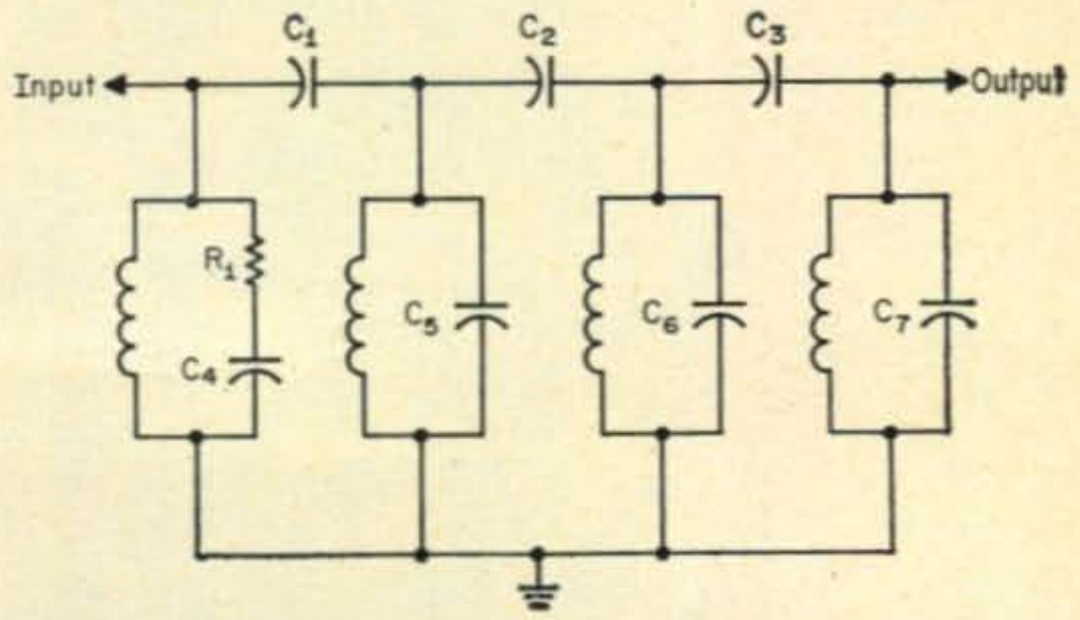


Fig. 2—Basic circuitry used for the selectable bandpass filter in the Drake 2-C. Various size coupling capacitors, C_{1-3}, and resistor, R_1, are switched in or out to obtain the desired bandpass characteristics. Resonating capacitances, at C_{4-7}, also are altered at the same time to maintain the low-frequency side of the filter at one point, as described in the text.

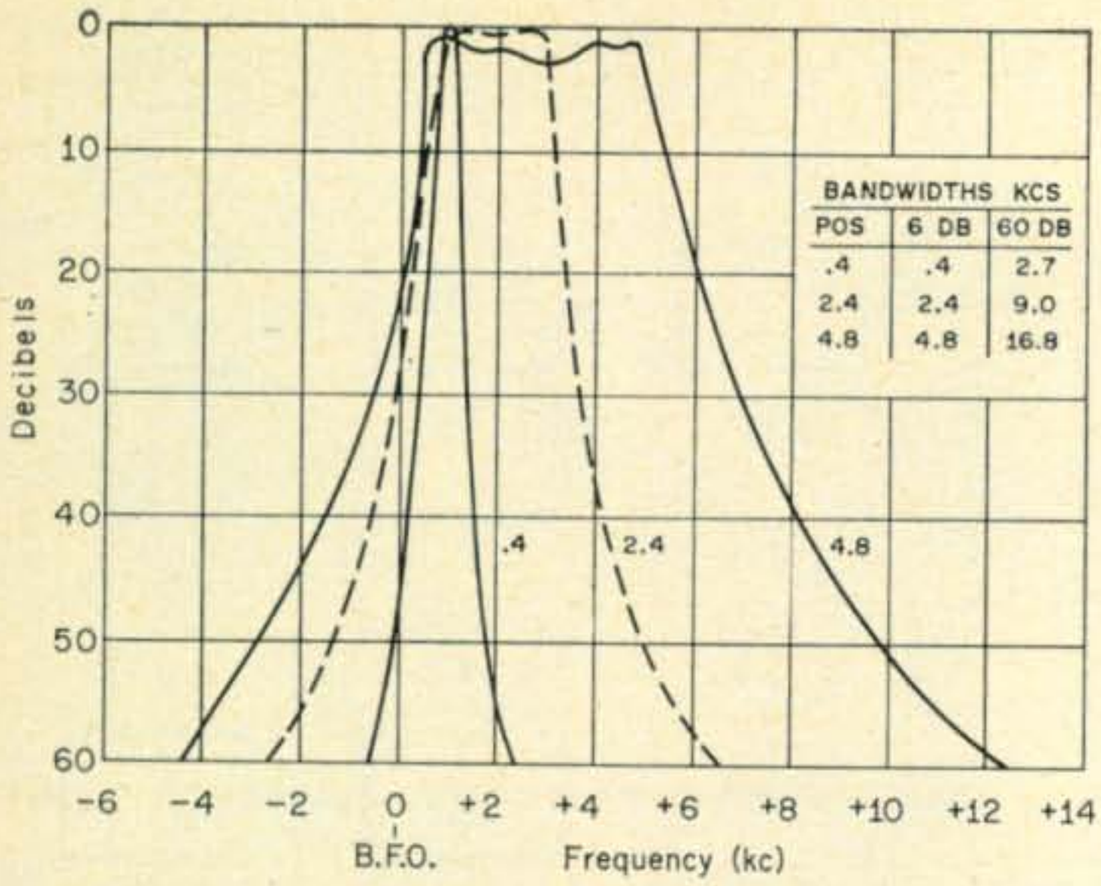


Fig. 3—Selectivity curves for the three passband positions provided in the Drake 2-C. The low-frequency end of the passband remains at a fixed point as the bandwidth widens.

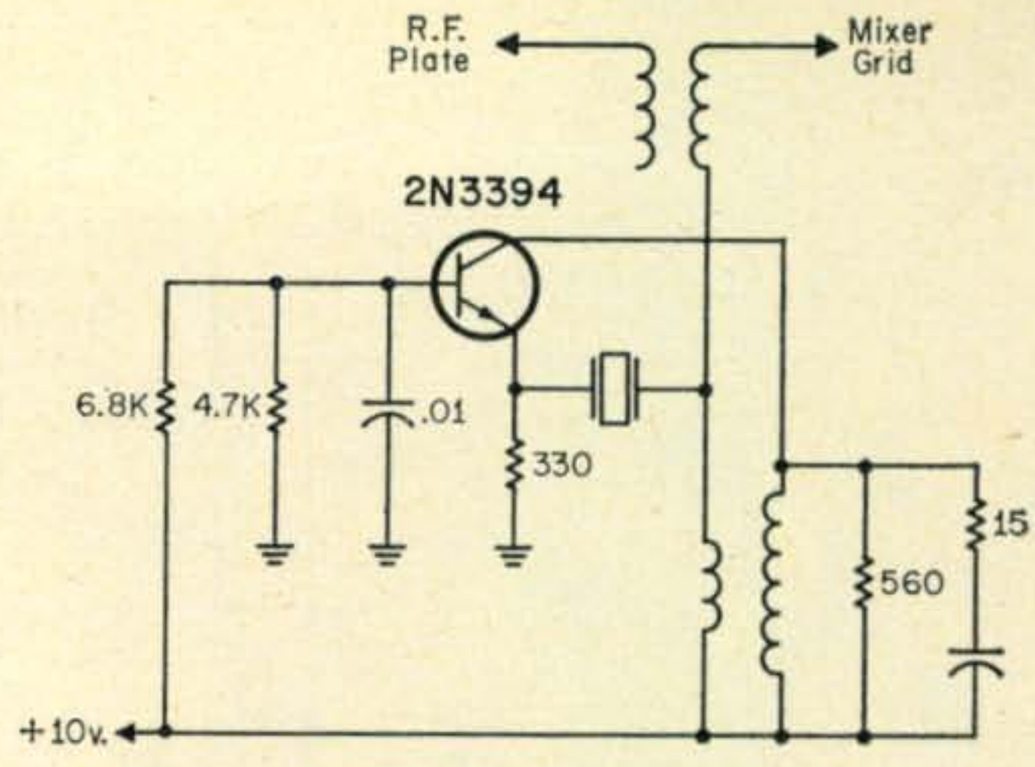


Fig. 4—Circuitry for the h.f. crystal oscillator used in the Drake 2-C receiver.

Extended Frequency Coverage

An external auxiliary-crystal socket is provided for plugging in additional heterodyning crystals for receiver operation on any 500 kc segment between 3 and 30 mc for which wide-range r.f. tuning also is provided by the preselector according to the band position used.

The required crystal frequency in each case is the low-frequency end of the desired-band segment *plus* 4 mc for frequencies up to 24 mc. For 24-39 mc, the crystals must be *minus* 4 mc.

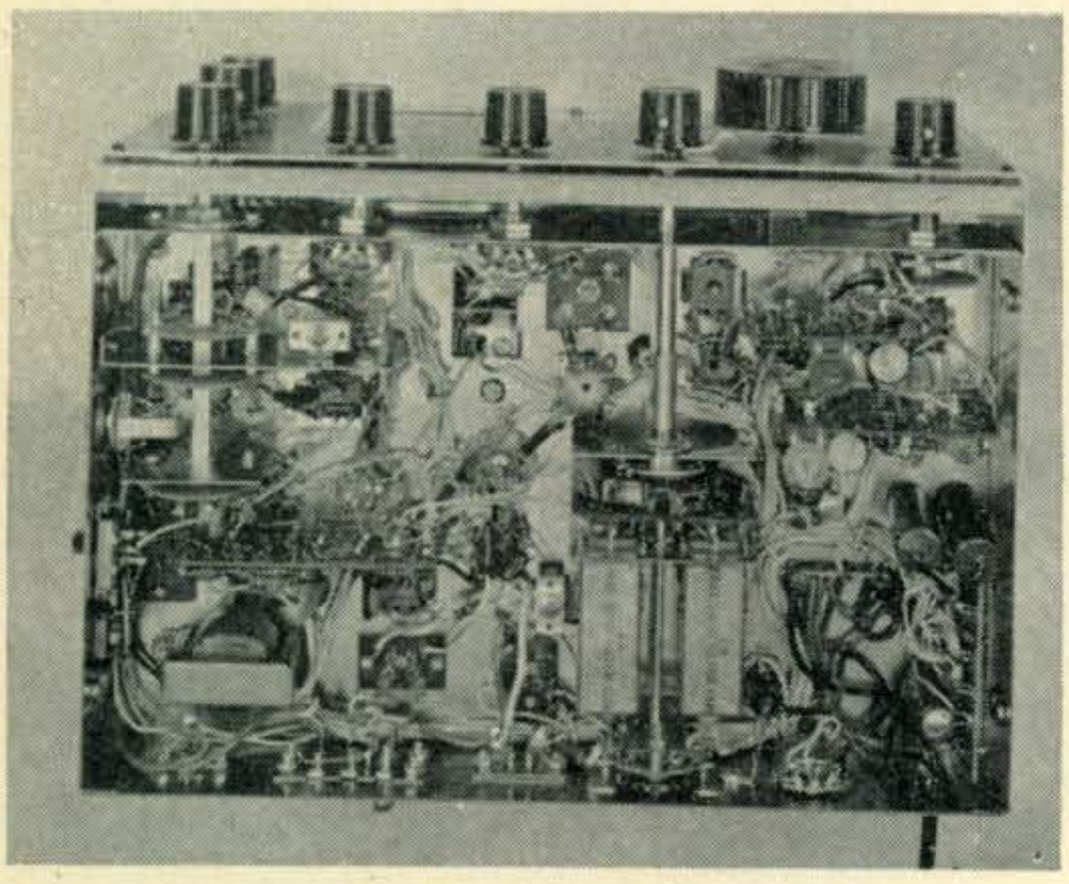
A table in the operating manual indicates the required crystal frequency for each 500 kc band segment, the bandswitch position to be used and the approximate setting for the preselector tuning control.

Self-Excited Oscillators

In order to provide good isolation and frequency stability, particularly as needed for s.s.b., present-day receivers usually employ a separate tube for the v.f.o.; however, in the 2-C a 12BE6 pentagrid converter is used both as mixer and v.f.o. in conventional converter-tube circuitry with a cathode-tapped oscillator inductor. Proper choice of circuit constants, voltages, feedback ratio and temperature compensation results in excellent frequency stability, even without voltage regulation as evidenced by the performance results given later. A 12BE6 with similar circuitry for the 405/505 kc oscillator at the 3rd mixer also is employed.

A self-excited transistor oscillator provides the b.f.o. signal for the product detector which utilizes two solid-state diodes in a configuration similar to that used in series-balanced modulators for s.s.b. exciters which, as we've mentioned at other times, is among the better type product detectors.

A. m. detection is obtained with a diode directly coupled to a transistor amplifier. The a.f. chain consists of three stages using transistors, the last of which is a power type that provides 1.8 watts of output to a 4-ohm speaker. Feedback circuitry ensures a clean and pleasant sounding signal. Headphone operation also may be had.



Bottom view of the Drake 2-C. The switch with the shield cans near rear center make up the assembly for the selectable passband filter. Transistor stages are built on printed-circuit boards that may be seen mounted vertically.

A.G.C. System

An amplified a.g.c. system, with delay, provides a very flat characteristic rated at 6 db a.f. output change with 100 db r.f. input change. The attack time is extremely fast (rated at 100 microseconds) with slow and fast release times rated at 0.75 and .025 seconds respectively. A switch permits selection of either time constant. It also allows the a.g.c. to be turned off. The basic a.g.c. circuitry is shown in simplified form at fig. 5.

Power Supply

Besides furnishing tube-heater power, a built-in power supply, using silicon rectifiers, provides +135 and 110 v.d.c. for operating the tubes, +12 v.d.c. for the transistors and —70 v.d.c. for muting and other operating bias. Potentials for the 1st a.f. transistor stage are obtained through dropping resistors from the h.v. supply, evidently to avoid the possibility of unwanted coupling through a common power source due to the high gain of the a.f. system.

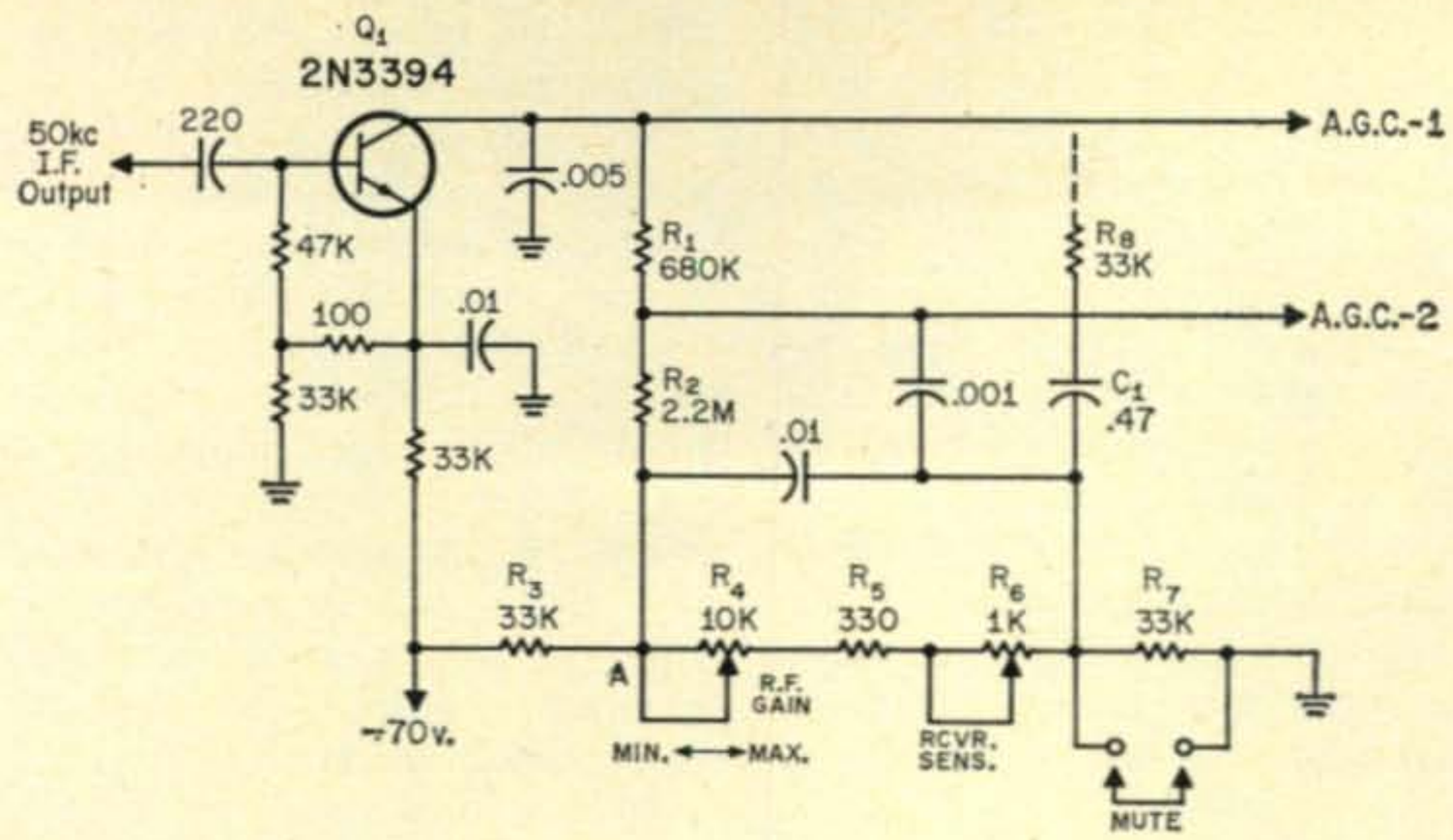


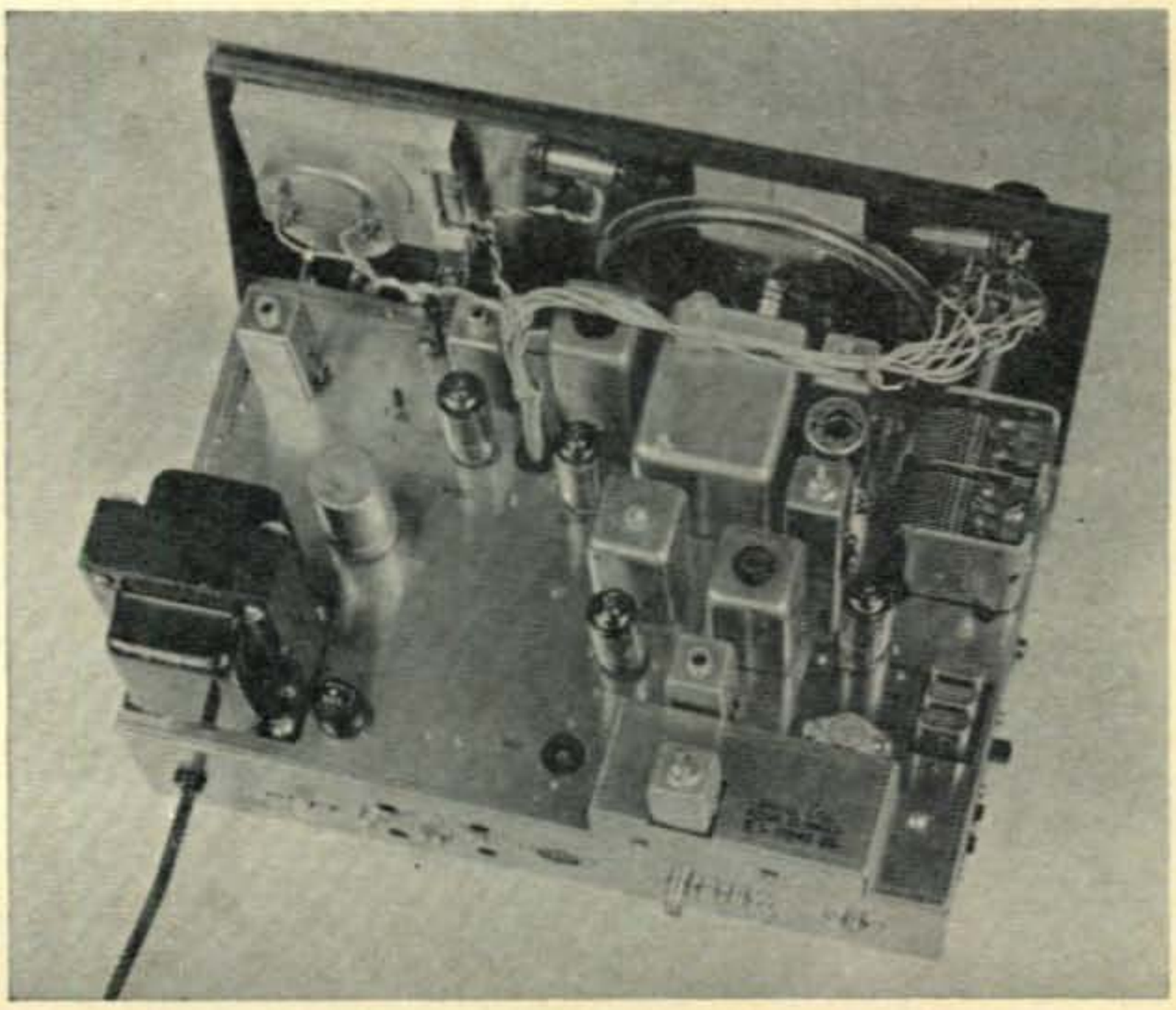
Fig. 5—Basic circuitry for a.g.c. amplifier used in the 2-C. With the muting switch closed and the r.f. gain set at maximum, the voltage at *A* is a very low value (about 1.5 v.) due to the voltage division by R_3, R_5, R_6. Q_1 is normally biased to cutoff, so there is no significant collector current. The voltage at AGC 1-2 then is the same as that at *A* and is the normal operating bias for the a.g.c. controlled tubes. A signal from the i.f. causes Q_1 to conduct and draw collector current, resulting in a voltage drop across R_1-R_2 that produces a negative-going voltage at AGC 1-2, that is larger at AGC 1. The initial bias on Q_1 is a bit beyond cutoff to prevent conduction with weak signals, thus providing delayed a.g.c. Slow-release time is obtained by adding R_8-C_1. R_1 is reduced in value at the same time. The r.f. gain is controlled with R_1 which, as its resistance is increased, raises the negative voltage at *A* and consequently that on the a.g.c. lines. When S_1 is opened, the voltage at *A* rises sufficiently to cut off the a.g.c. controlled tubes and mute the receiver.

Construction

The 2-C is neatly built on a copper-plated chassis. A sub-panel, made of the same material, has its sides folded back to form supporting brackets which are welded to the sides of the chassis. The top and bottom edges of the sub-panel also are folded back to form a ¼" lip, making the entire assembly exceptionally sturdy. An aluminum panel, mounted to the sub-panel on small spacers, serves as an escutcheon to dress up the set.

The v.f.o. tuning capacitor is a two-gang unit. One section is double-spaced for the v.f.o., the other section with single spacing tunes the variable i.f. It is operated by a high-ratio string drive by which the 500 kc range is covered with 11½ turns of the tuning knob. Frequency calibration is somewhat non-linear on a circular dial marked off in 10 kc steps spaced an average of a little less than ⅛". The tuning knob has a dial attached to it that had 40 linear-spaced divisions, each representing about 0.8-1.2 kc, depending on which section of the range is in use. The hairline fiducial for the main dial can be mechanically adjusted for calibration purposes, as can be the dial on the tuning knob. The latter is accomplished by holding the knob stationary with one hand, while using the other hand to slip the dial plate to the desired position on the control shaft.

Tuning and calibration are in the normal forward direction on the 7, 14 and 21 mc bands. On 3.5 and 28.5 mc they are in reverse. Sideband position also are reversed. The dial calibrations, the bandswitch settings and the sideband-switch positions are marked in red for 3.5 and 28.5 mc operation. For the other bands the panel markings are white and those on the dial are black.



Top view of the Drake 2-C. The preselector-tuning capacitor is at the right. The large square shield-can near the center encloses the v.f.o. and variable i.f. tuning capacitors. At the right foreground is the noise blanker, accessory at the left of which is a socket for similarly installing the crystal calibrator module.

Besides the usual tuning and gain controls, there is a mode switch to select a.m., l.s.b. or u.s.b. operation. It also has a concentric control to switch in any one of the selectivity steps. A function switch selects normal receiver operation, external muting, noise blanker or crystal calibrator.

On the rear of the set are phono jacks for antenna, loudspeaker, external muting and sidetone. The latter permits external aural-monitoring facilities, such as may be obtained from a keyer or transmitter, to be fed directly through the a.f. section of the receiver. There also is the S-meter zero-set and a connector for an external *Q*-multiplier accessory. The crystal-calibrator and a noise-blanker accessory can be plugged in and mounted on the chassis deck.

The phone jack is on the left side of the set along with the auxiliary-crystal socket and a slide switch for changing over between ham-band or auxiliary-band operation.

Performance

When mention is made of a moderately priced piece of gear, an eyebrow-raising thought that comes to mind concerns its performance. In this respect, the 2-C need not take a back seat to more expensive receivers.

On-the-air operation has indicated that its high sensitivity and low noise provide excellent capabilities for pulling in weak signals, while its signal-handling capabilities enable it to hold its own with strong signals. Sideband suppression using the 2.4 kc selectivity is excellent and is well maintained, even with the 4.8 kc selectivity the use of which nicely rounds out the a.f. quality of s.s.b. signals; as a matter of fact, we prefer use of this position, except when the QRM gets rough. Even though the 0.4 kc selectivity has a very narrow bandwidth, s.s.b. signals are quite readable with it and its use is of particular advantage in cases of extreme QRM. Using either the 2.4 or 4.8 kc selectivity, the a.m. quality and readability is among the best we've experienced. The 0.4 kc filter is extremely effective with c.w. as was significantly evidenced by its ability to satisfactorily separate signals only a few hundred cycles apart. No signs of ringing were experienced, even on strong signals.

As will be noted from the performance measurements, the thermal frequency stability was found to be fine and in addition, dropping the set an inch or so to the table did not produce even a whimper of frequency shimmy. The unusually small frequency variation with line-voltage changes was quite surprising in view of the fact that three self-excited oscillators are involved and that there is no voltage regulation in the set.

The a.g.c. characteristic is the flattest we've encountered so far, resulting in a smooth and uniform a.f. output level; however, one thing that can occur due to this characteristic is that adjacent-channel crud from strong signals may have a tendency to desensitize the receiver when a weak desired-signal is being received;[1] nevertheless, the effect can be eliminated by reducing the r.f. gain to minimize the a.g.c. action.

While the slow a.g.c. is in use, the level change when the r.f. gain is varied is somewhat sluggish, since this control is tied in with the a.g.c. system. Also, the use of the slow a.g.c. was found better, inasmuch as the fast a.g.c. works so quickly that where repetitious noise and adjacent-channel-signal pulses are present, annoying chattering is experienced.

The 2-C has internal provisions for operation on only the 28.5-29 mc portion of the ten-meter band, but if another section is desired, it may be obtained by plugging an appropriate crystal into the auxiliary-crystal socket.

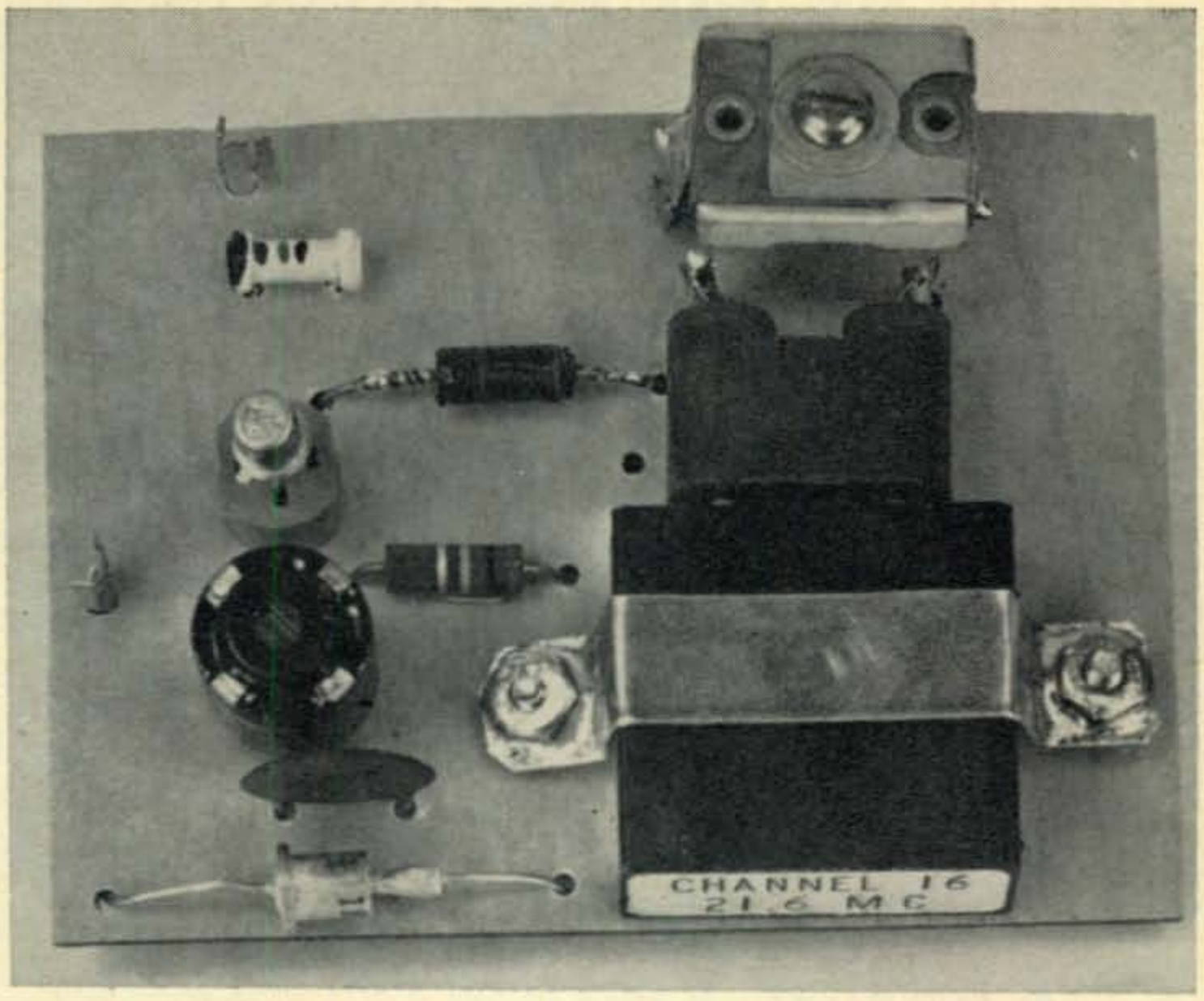
We did not have crystals on hand for checking operation on the auxiliary ranges outside the ham bands; nevertheless we were able to do so by employing a signal generator instead, in which case good performance was realized over the 3-30 mc spectrum. This added feature can be especially handy for receiving WWV signals which we found possible to copy on all WWV channels between 5 and 25 mc.

From an operating standpoint the receiver handles very nicely and the tuning is smooth without apparent backlash. By way of criticism it would be more desirable to find the headphone jack on the panel, instead of at the side of the set. Another convenience would be 50 divisions, instead of 40, marked off on the tuning-knob dial along with reference numerals.

Results of measurements made on the 2-C are as follows:

SENSITIVITY (rated at 0.5 μv for 10 db S/N): with 2.4 kc selectivity on s.s.b. and c.w., 0.1 μv for 10 db S/N on all bands except 28.5 mc, 0.16 μv; with 4.8 kc selectivity on a.m., 0.65 and 0.8 μv on same respective ranges (30% modulation with 400 c.p.s.); in-band gain variations (not rated): within 1 db; band-to-band gain variations (not rated): none, except 28.5 mc, —4 db (measured at 0.25 μv); image rejection (rated at more than 60 db): 90 db on 3.5 mc, progressively decreasing to 58 db on 28.5 mc; i.f. signal rejection (3.5-4 mc-rated at more than 60 db on ham bands): 60 db on 7 mc to 85 db on 28.5 mc; internal spurious (rated at 1 μv equivalent in ham bands): one each of 0.3 μv in 3.5, 21 and 28.5 mc bands, any others 0.1 μv or less; selectivity: within 10% of rated values shown at fig. 3; sideband suppression (not rated): 42 db at 1 kc with 2.4 kc selectivity, slightly less with 4.8 kc selectivity; a.g.c. characteristic (rated at 6 db a.f. output change with 100 db r.f. input change): 3 db a.f. with 100 db r.f. (1-100,000 μv); a.g.c. time;[2] 4 seconds slow release from 100 μv signal back to threshold (other constants not checked); frequency stability (rated at less than 100 c.p.s. after warmup and less than 100 c.p.s. for 10% line-voltage variation): average of several test runs on all bands with u.s.b. and l.s.b., 200 c.p.s. during first hour from cold start

[*Continued on page 101*]



Top view of the 100 kc subharmonic oscillator built on a fibre board. The pot, to the left of the crystal sets the unijunction oscillator built on a fibre board. The pot, to the left of the crystal sets the unijunction oscillator frequency and the trimmer across the crystal sets the crystal frequency.

SUB-HARMONIC CRYSTAL OSCILLATORS

BY FREDERICK W. BROWN,* W6HPH

A novel 100 kc calibrator circuits using inexpensive surplus crystals.

It is fairly common knowledge that a synchronized oscillator can be used as a frequency divider. What is not so well known is that a divider and crystal controlled oscillator can be made to share the same active element (tube or transistor), thereby forming a "subharmonic oscillator."

Circuits

Figure 1 shows a vacuum tube version of such a circuit which is probably easier for most of us to understand than the solid-state form of fig. 2. The tube version is simply a 100 kc multivibrator intimately coupled to a 300, 400, or 500 kc crystal. Harmonics from the multivibrator excite the crystal which, of course, can oscillate only very close to its resonant frequency. The crystal in turn supplies a fixed-frequency sine wave which synchronizes the multivibrator at the appropriate subharmonic. In this way a stable 100 kc waveform is derived from, say, a 400 kc crystal. The inexpensive surplus crystals marked CHANNEL 16-21.6 MC have a 400 kc fundamental and work well in the circuits of fig. 1 or 2. The crystals marked CHANNEL 70-27.0 MC are 500 kc and can also be used in these circuits. A third

*Pine Cove, Idyllwild, California 92349.

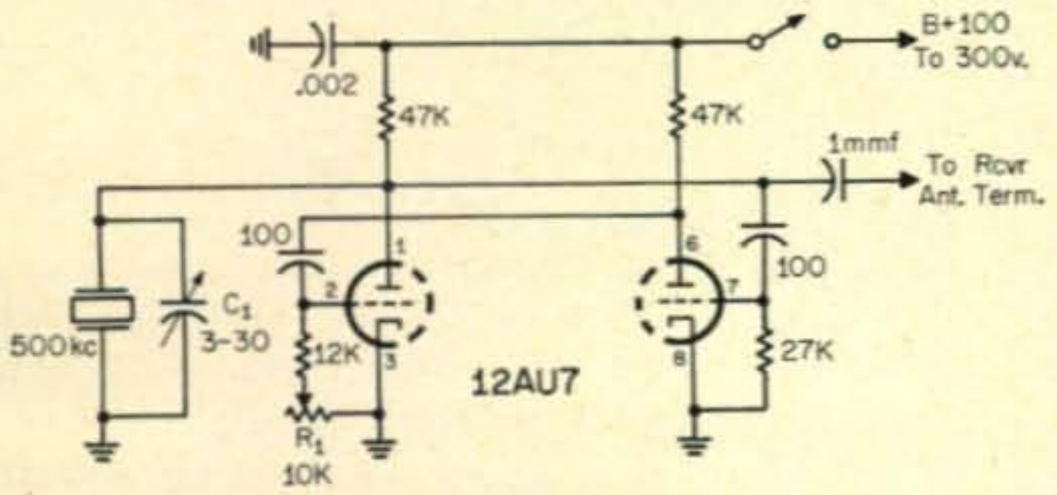


Fig. 1—Circuit of a vacuum tube type 100 kc crystal calibrator that works on a subharmonic of a higher frequency crystal. The resistors are ½ watt and the capacitors are in mmf.

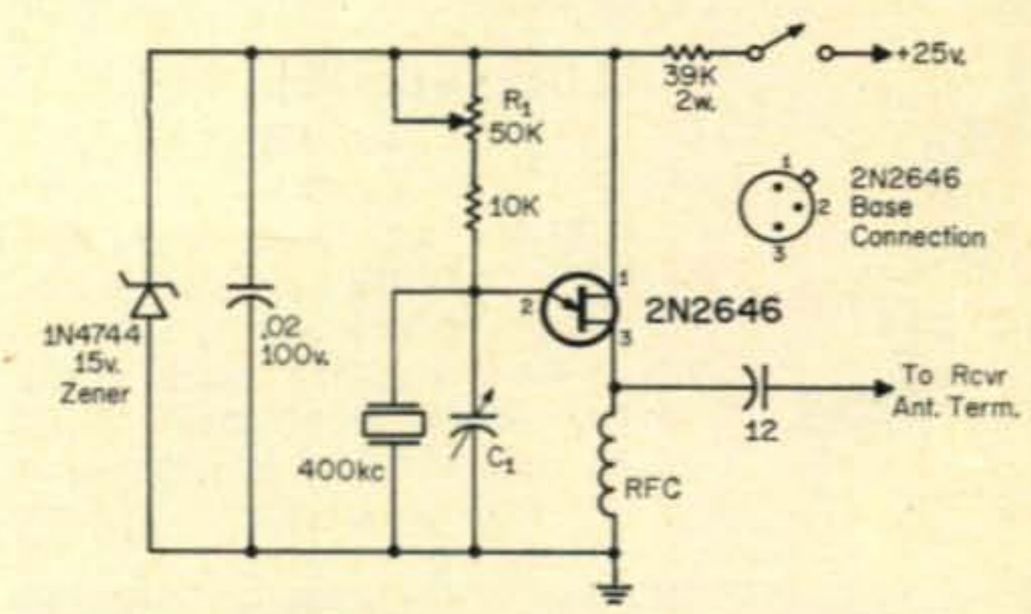


Fig. 2—Circuit of a solid state version of the subharmonic oscillator using an inexpensive unijunction transistor. Capacitor C1 is a 25-250 mmf compression type mica trimmer. The r.f.c. is made from 45 turns of #34 c. wire wound on a half-watt high value resistor.

possibility is the 200 kc crystal from the ART-13 transmitter.

My attempts to translate fig. 1 into a solid-state multivibrator using ordinary bipolar transistors were not very successful probably because of the bad impedance mismatch between the low impedance transistors and the high impedance parallel-mode crystal. The circuit of fig. 2, however, is even simpler than a multivibrator. It uses only one inexpensive unijunction transistor, a 2N2646, made by G.E., and available from Allied Radio for $1.05.

The zener regulator is not an absolute necessity but is recommended since the oscillator frequency is slightly voltage sensitive. If the zener is not used an appropriate value resistor should be substituted to insure 15 volts across the unijunction when connected to the receiver's B supply.

The circuit of fig. 2 will supply 100 kc markers from the broadcast band up through at least 30 mc. But judging by the fall-off in signal strength at ten meters, the harmonics probably do not extend very far into the v.h.f. range. Some kind of efficient harmonic generator such as a tunnel diode switch would be needed to extend the harmonics higher.

Adjustment

Adjustment procedure for either of these circuits is as follows:

(1) Connect the calibrator to the receiver antenna terminal and tune in WWV.

(2) Apply voltage to the calibrator and slowly adjust R_1. As the pot is adjusted many birdies will be heard going past WWV's signal. Eventually one will be found that is stable in frequency over a small range of adjustment of R_1 as indicated by a fairly steady beat note.

(3) When this steady birdie is found, indicating the oscillator is "locked on the crystal," tune exactly 100 kc away from WWV to make sure the circuit is dividing the crystal frequency by the correct integer. (A 400 kc crystal must be divided by 4, not 3 or 5.) If dividing by the wrong integer, adjust R_1 until the correct one is found.

(4) When the calibrator is locked on the crystal at 100 kc, adjust C_1 to zero beat with WWV. Control R_1 may then need some readjustment. The pot should be set to a point where the oscillator will start easily and remain locked on the crystal over the largest possible range of supply voltage and temperature.

Crystal Shifts

The surplus FT-241 crystals are evidently designed to work into a fairly high capacitance circuit. If you find it impossible to zero beat WWV by adjusting C_1, the crystal frequency may be lowered slightly by the following procedure: Apply a tiny drop of India ink to a corner of the crystal. After the ink is dry reassemble the crystal and check the frequency. If still too high, repeat, but usually only a tiny amount of ink is required. ■

Results of the

1966 CQ World Wide DX (Phone) Contest

BY FRANK ANZALONE,* W1WY

THE 1966 World Wide DX Phone Contest will long be remembered, not only for the record participation but also for the opening of the 10 meter band and the fine conditions which resulted in record breaking scores in practically all categories.

No object will be served in quoting figures, the various charts in this report gives all this information in details. A comparison of these figures with last year's results and with the all time records (page 32, Oct. 1966) will prove most interesting. You will find that the 1966 Champions have exceeded all past figures in all categories, both for single operator and multi-operator divisions (except 1.8 mc).

The charts of the break-down by bands of the top groups should prove most useful to the involved stations. It will show their weak bands and suggest improvements that will result in a better score next year. Single band operators can see how their score stacks up against some of the all band "hot shots."

A few of last year's champs were able to break their old record and retain their World Champion title, DL6EN on 21 mc and YV9AA in the multi-multi group. While others, even though they exceed their record scores of previous years, still lost their crowns to new Champions.

You will note two additional awards in the Trophy listings. Since both WA2SFP and YV9AA were winners last year, they are not eligible for an award this year. (Three year ruling). However *CQ* is making a special award of two full sized Plaques to these two Champions. (Not the small cup base plate that has been given in the past.)

It goes without saying that Don Miller's performance from VQ9AA/D is in a class by itself. Those who heard Don's signal pounding in on all bands at all hours of the day and night, should have no reason to question this fantastic score. Let us assure any "doubting Thomas" who might jump to his own conclusion because of the controversy brought about by the Des Roches operation, the Committee is fully aware of its obligations. This was a legal operation, and the submitted log passed the close scrutiny of the Committee. We are not concerned with the country status of this location or personal accusations that have been brought to our attention.

*Chairman, Contest Committee.

TROPHY WINNERS

Single Operator, All Band, U.S.A.
Potomac Valley Radio Club Trophy
won by Robert M. Knowles, K1DIR

Single Operator, All Band, Europe
W4BVV operators Trophy
won by Walter Skudlarek, DJ6QT

Single Operator, Single Band, (14 mc)
W2GHK, Stuart Meyer Trophy
won by Raul Eiris, V., YV5BIG

Single Operator, All Band, World
W2SKE, Bill Leonard Trophy
won by Don Miller, VQ9AA/D

Multi-Operator, Single Transmitter
W6YY, John Knight Trophy
won by Station CX2CO
(Oprs: CX2CO, 1BY, 3BBD, 7CO)

Multi-Operator, Multi Transmitter
K2GL, "Buz" Reeves Trophy
won by OH2AM, OH DX Ring.
(Oprs: OH2BC, 2BH, 2BQ, 2BS, 2KH, 2QV, 2SB, 2BBM, 2BBR)

SPECIAL CQ PLAQUES

U.S.A. All Band Champion
James Lawson, WA2SFP

World Champion
Multi-Operator Multi Transmitter
Station YV9AA, Radio Club Venezolano
(Oprs: YV5AGD, 5AIP, 5ANF, 5BOA, 5BNW, 5BPJ, 5BPU, 5CIY)

KL7WAH—Top score for North America in the Multi-operator, Single transmitter division. Crew at Fort Wainwright discussing the results. L. to R. K8INX, K7MQY, WB6HFX, K2YFE, W5IDA. *(Photo by U.S. Army).*

Without slighting any of the other fine scores, we feel that the performance of WØGTA/8F4, WA2SFP, OH2AM, LU1DAB and YV5BIG were outstanding. Each of these stations was in a class by itself in their respective divisions and areas. It's unfortunate that all were not Trophy winners.

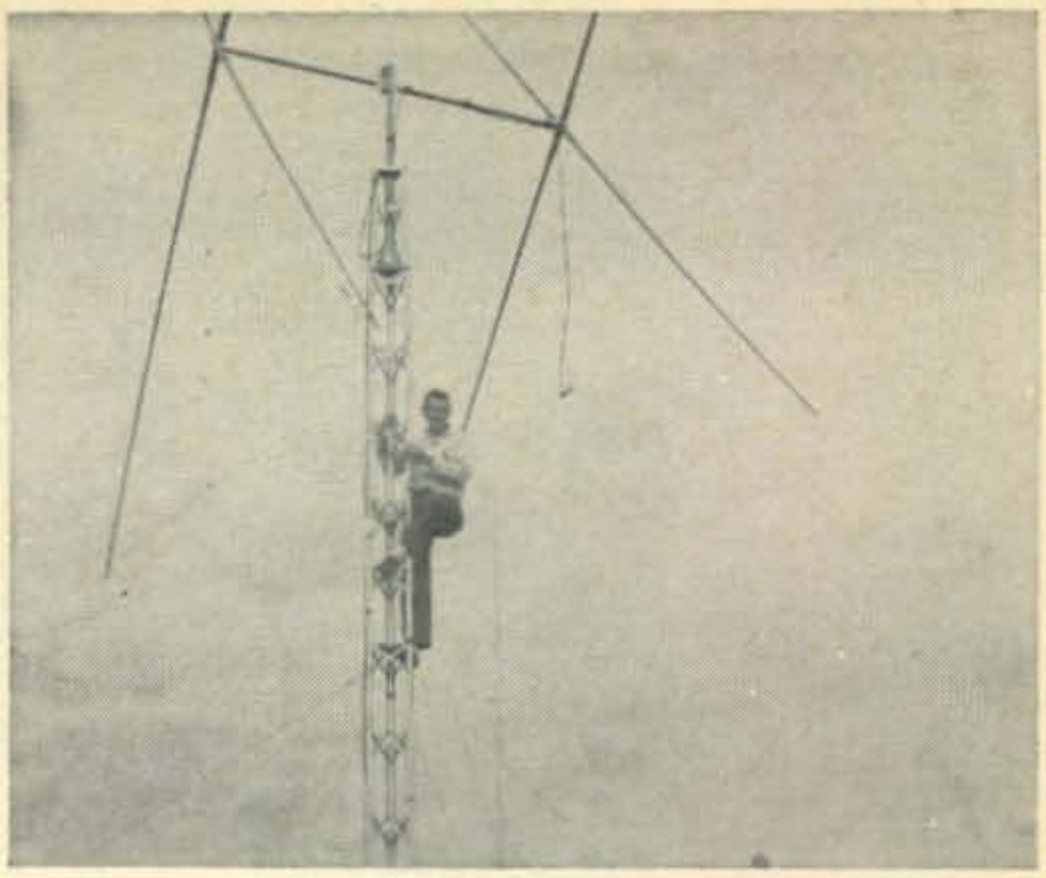
However all this ballyhoo should in no way leave the "also ran" and little QRP fellow out of the picture. Their standings in the score list tells its own story. There is always the satisfaction of having bettered one's own score of previous years, or beating out a friendly rival in your area.

Another pleasant surprise in the returns this year was the tremendous gain in the returns from the 2nd district, almost three times that of previous years. This was brought about by the sudden revival of the North Jersey DX Club. If they do equally well in the c.w. section they should be high in the Club standings.

Many of you will find that your claimed score has been shaved down a bit. You probably overlooked a few duplicate contacts or your addition was faulty. IØRB/4U is *not* a separate country, Newfoundland is *not* in Zone 2, nor is it an additional multiplier from Canada.

One of the most common errors is usually made in the summary of the score of an all band entry. A few still multiply the zones by the countries and again by the QSO points, which results in an astronomical figure. While some short-change themselves by adding the score from each band for their final score. The correct method of course is the total zones from each band *plus* the total countries from each band *multiplied* by the total QSO points.

Some of the fellows feel that an all band entry should also be eligible for a single band award, or that awards should be made on the basis of his best score. Our answer is definitely NO. It is up to the contestant to decide what division he wants to enter. In a track meet, a mile runner does not win a prize for running a record quarter mile. There is a separate race in the meet for quarter milers.



WA4WFQ—High scorer for the 4th District in the Multi Single transmitter division. Buck, WA4WJH making final adjustments to the Quad.

However we will permit a station to submit his all band score for club credit and he can designate a single band for his own entry.

Some of the VE boys want us to give awards for each call district, like we did a few years ago. With only 27 entries from the whole of Canada and none from Zone 2 or 3, we feel that the present system is adequate.

We are still disappointed with the poor returns from the boys "Down Under." But Australia being a whole continent in itself with only 2 Zones, and all the activity in one Zone, there is not much we can do but use the call district division. But we would certainly like to see the

[*continued on page 46*]

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
VQ9AA/D 3,624,942	3.8	29	11	22	79
	7.0	96	20	40	271
	14.0	1075	37	125	3122
	21.0	620	33	92	1768
	28.0	678	32	90	1981
	TOTAL	2518	133	369	7221
DJ6QT 1,519,823	3.8	139	13	42	187
	7.0	134	17	46	248
	14.0	633	31	91	1730
	21.0	271	28	56	750
	28.0	344	27	38	992
	TOTAL	1521	116	273	3907
SM2BJI 1,492,836	3.8	61	13	36	88
	7.0	129	23	49	267
	14.0	673	34	75	1848
	21.0	540	29	49	1428
	28.0	142	23	41	389
	TOTAL	1545	122	250	4010
WØGTA /8F4 1,306,842	3.8	12	9	9	30
	7.0	68	19	32	196
	14.0	464	33	79	1256
	21.0	503	29	66	1428
	28.0	304	22	48	867
	TOTAL	1351	112	234	3777
HK2KL 1,182,864	1.8	2	1	2	1
	3.8	45	9	22	82
	7.0	58	12	27	167
	14.0	383	32	84	1104
	21.0	648	22	57	1911
	28.0	217	16	20	626
	TOTAL	1353	92	212	3891

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
DJ2QZ 915,287	3.8	64	6	32	72
	7.0	70	8	30	84
	14.0	269	29	67	592
	21.0	438	28	47	1231
	28.0	290	28	54	803
	TOTAL	1131	99	230	2782
WA2SFP 908,628	3.8	23	9	14	47
	7.0	81	21	40	214
	14.0	248	28	75	702
	21.0	250	26	66	713
	28.0	269	27	67	760
	TOTAL	871	111	262	2436
ZL1KG 906,182	1.8	1	1	1	0
	3.8	5	4	3	6
	7.0	36	12	11	91
	14.0	631	35	95	1771
	21.0	384	24	41	1105
	28.0	192	13	17	553
	TOTAL	1249	89	168	3526
YV5AXT 890,766	3.8	21	8	15	54
	7.0	21	11	15	56
	14.0	488	30	66	1374
	21.0	399	19	37	1149
	28.0	395	17	28	988
	TOTAL	1324	85	161	3621
I1BAF 857,472	3.8	33	10	27	52
	7.0	102	12	33	211
	14.0	426	33	79	1145
	21.0	419	26	55	1204
	28.0	31	17	27	76
	TOTAL	1011	98	221	2688

Breakdown of the Top Ten Single-Operator, All Band scores.

Top Ten
ALL BAND
SINGLE OPERATOR

	VQ9AA/D	**3,624,942**	
DJ6QT	**1,519,823**	DJ2QZ	915,287
SM2BJI	1,492,836	**WA2SFP**	**908,628**
WØGTA/8F4	1,306,842	ZL1KG	906,182
HK2KL	1,182,864	YV5AXT	890,766
		I1BAF	857,422

Top Six
MULTI-OPERATOR
SINGLE TRANSMITTER

CX2CO	**2,600,923**	DL1KB	1,896,156
IØRB/4U	2,141,150	SM6VR	1,364,967
ET3WH	2,139,696	PAØGMU	1,114,785

Top Six
MULTI-OPERATOR
MULTI-TRANSMITTER

YV9AA	**6,195,211**	K2GL	4,128,215
OH2AM	**5,465,610**	W3MSK	3,811,934
YV5AKP	4,782,505	W3WJD	1,904,826

U.S.A. Runners-Up

All Band	**K1DIR**	**778,816**
28 mc	W8NBK	100,800
21 mc	WA4PXP	195,615
14 mc	W3JNN	272,857
7 mc	W4BYB	10,078
3.8 mc	W1AQH	11,826

Continental Leaders—Single Band

28 mc		9L1HX	479,460
LU1DAB	314,056	KW6EJ	375,193
G3HDA	171,567	UR2AR	341,250
W2OKM	123,072	KP4CL	337,792
JA1RJO	118,109	PAØEEM	256,680
5N2AAF	113,181		
VK2FU	17,605	**7 mc**	
21 mc		DJ5BV	53,664
DL6EN	410,256	W3PHL	37,825
ZD8WZ	378,200	JA2BTV	26,585
JA3JXJ	248,045	PY7APS	12,298
CX8CZ	231,462		
WA8CZH	199,320	**3.8 mc**	
ZL1AGO	95,680	YV5BTS	69,471
14 mc		ON4UN	61,523
YV5BIG	**840,252**	K8YWG	26,492
		KH6EPW	5,040

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.**

Phone Results

SINGLE OPERATOR

North America

United States

K1DIR	**A**	**778,816**	**838**	**103**	**241**
K1OBT	A	188,564	351	60	128
K1NWE	A	108,655	257	56	99
W1PLJ	A	8,084	60	15	32
W1BFA	**28**	**56,672**	**226**	**25**	**63**
K1LWI	28	45,864	203	23	55
K1YRO	28	33,048	144	25	56
W1BPW	28	32,844	169	22	47
W1DEP	28	25,821	167	20	37
K1WJL	28	18,848	109	19	43
W1WY	28	13,090	91	19	36
K1FNP	28	7,980	75	14	28
W1HQV	**21**	**125,660**	**417**	**29**	**74**
W1UOP	21	87,516	295	27	75
W9MIJ/1	21	24,255	134	19	44
K1OWM	21	13,254	99	15	32
K1KNQ	21	5,540	60	12	21
W1ZFV	**14**	**150,144**	**419**	**34**	**94**
WA1ANR	14	38,610	152	31	59
W1AQH	**3.8**	**11,826**	**87**	**15**	**39**
WA2SFP	**A**	**908,628**	**871**	**111**	**262**
W2JAE	**A**	**418,230**	**548**	**90**	**180**
K2ISP	**A**	**407,550**	**579**	**85**	**162**
W2DNG	A	319,566	469	75	166
W2RGV	A	314,987	463	80	161
W2MJ	A	278,208	386	74	178
K2ZWI	A	250,638	401	77	145
K2SUX	A	236,352	439	60	132
WA2FQG	A	193,431	368	55	128
W2QDY	A	149,301	320	52	107
K2BZT	A	147,327	303	52	115
WA2ELS	A	142,400	278	57	121
W2HZY	A	127,140	284	51	105
W2PXR	A	119,112	248	59	109
W2GKZ	A	102,720	203	74	118
W2IUV	A	98,280	221	51	105
W2JVU	A	96,926	256	45	86
K2QOU	A	79,254	178	54	99
W2ZTV	A	77,586	203	39	95
WA2PXI	A	71,240	191	42	88
WA2WQG	A	70,560	159	58	110
W2JLH	A	70,213	165	51	92
W2AGM	A	61,659	182	38	79
W2TP	A	56,350	184	40	75
W2GHK	A	54,756	164	43	74
W2SHC	A	53,136	152	48	75
WA2IZS	A	45,770	142	42	73
W2SNI	A	42,900	152	38	62
WA2JGL	A	39,962	131	38	68
W2QKJ	A	39,647	99	42	99
W2LV	A	31,110	109	36	66
K2CPR	A	27,295	109	43	60
WA2MEX	A	25,032	106	28	56
W2FZJ	A	19,520	86	31	49
WA2BEX	A	12,870	62	33	45
W2DEW	A	11,730	61	28	41
W2JKH	A	10,030	59	24	40
W2MG	A	9,856	56	24	40
WA2EOQ	A	4,455	34	19	26
K2ITM	A	4,240	36	16	24
WB2PCF	A	3,784	33	17	26
W2LEJ	A	3,535	35	15	20
W2GT	A	1,800	24	13	17
W2JB	A	1,410	18	14	16
W2YTH	A	1,152	19	11	13
W2BHM	A	625	10	5	5
W20KM	**28**	**123,072**	**442**	**28**	**68**
WB2MDH	28	52,113	211	24	63
WB2CON	28	33,060	154	24	52
K1YRB/2	28	18,780	113	22	38
W2CBA	28	1,357	20	7	16
W2BXA	**21**	**170,178**	**514**	**28**	**85**
WA2CYQ	21	103,114	327	31	78
WB2NXL	21	75,516	285	26	67
WA2EFN	21	64,992	251	29	67
WA2JMW	21	57,290	244	25	60
WA2UJM	21	56,693	219	25	66
WB2PWU	21	48,032	210	24	55
K2CHS	21	47,345	193	26	59
W2IIY	21	35,189	161	23	54
WB2MFX	21	22,492	130	18	38
WB2QXX	21	4,120	39	16	24
W2TQR	**14**	**172,499**	**430**	**38**	**101**
WA2WVL	14	134,640	345	37	99
WA2HUV	14	85,905	260	35	80
W2FZY	14	72,625	206	33	92
W2BOK	14	69,185	236	30	71
K2BQO	14	64,491	214	34	77
W2LAX	14	25,347	122	24	47
WA2DIG	14	16,758	105	19	38
WB2EPG	14	11,115	59	27	38
K2DGI	14	4,992	42	21	27
W2LNB	14	2,190	26	12	18
K2GXI	7	4,440	42	11	26
W2ZPO	**3.8**	**7,280**	**52**	**11**	**31**
W3BES	**A**	**651,717**	**717**	**96**	**223**
K3NHL	**A**	**554,591**	**671**	**105**	**218**
W3AZD	**A**	**541,178**	**584**	**111**	**220**
K3TPL	A	380,824	491	86	177
W3MWC	A	242,858	318	72	137
W3DBF	A	198,198	346	67	131
W3GRF	A	194,220	340	65	130
W3PZW	A	177,800	310	68	132
W3NOH	A	175,352	336	61	123
W3MCG	A	139,490	260	63	122
W3DHM	A	126,225	231	60	127
W3GRS	A	124,344	223	68	130
W3CGS	A	115,292	271	47	101
W3EQA	A	113,588	275	52	94
W3BYX	A	110,842	249	54	103
K3BNS	A	108,569	255	54	97
K3JH	A	102,887	261	51	86
W3GHM	A	73,457	186	56	93
W3AXW	A	63,210	168	55	92
K3VWQ	A	44,850	147	44	71
W3DRD	A	36,059	120	40	67
W3ZNB	A	32,946	105	40	74
W3LNE	A	19,783	101	25	48
K3JLI	A	16,043	92	21	40
W3EVW	A	6,519	46	24	29
W3CBF	A	5,360	45	13	27
W3EAN	A	5,184	51	14	22
W3LOE	**28**	**78,578**	**275**	**28**	**73**
W3ZPO	28	71,038	272	27	65
W3QQL	28	18,221	115	18	41
W3TLN	**21**	**130,180**	**395**	**31**	**84**
K3NTK	21	47,547	204	23	58
K3PDC	21	36,800	160	28	52
W3HCW	21	20,280	111	19	46
W3YUW	21	10,388	70	20	33
W3JNN	**14**	**272,857**	**624**	**38**	**113**
W3BGN	14	237,392	545	37	111
W3PHL	**7**	**37,825**	**174**	**24**	**61**
W4BVV	**A**	**698,544**	**735**	**107**	**229**
K4CG	**A**	**331,890**	**507**	**72**	**158**
W4NBV	A	272,843	420	76	157
K4SHB	A	242,672	373	75	157
K4EZ	A	194,064	342	66	142
W4YDD	A	116,369	286	76	149
W4AZK	A	112,665	220	67	118
W4MMD	A	74,906	203	47	87
W4PTR	A	58,688	168	47	84
K9KBW/4	A	50,820	131	38	72
K4BAI	A	35,712	142	33	60
W4BJ	A	32,046	115	40	58
W4MVB	A	28,304	104	56	60
WA4UFW	A	10,976	67	23	33
W4LVV	A	10,010	56	22	43
W4KFC	A	7,020	49	23	31
W4HVU	A	6,000	43	22	28
W4KJL	A	2,590	27	15	20
K4RLO	**28**	**92,200**	**311**	**30**	**70**
K4VYN	28	64,844	264	25	61
K4QWX	28	55,814	231	26	60
WA4VAI	28	31,040	137	24	56
W4DII	28	22,800	108	24	51
WA4DDG	28	17,612	83	23	51
WA4IKU	28	9,540	66	18	35
W4ZM	28	4,522	45	13	25
W4HOS	28	1,350	19	12	15
W4WSF	28	1,056	17	9	13
WA4PXP	**21**	**195,615**	**511**	**31**	**104**
WA4GCS	21	106,392	303	30	94
WA4LMD	21	84,164	283	26	80
W4FRO	21	53,142	187	26	76
W4NML	21	51,022	190	27	70
W4DRW	21	48,048	197	25	63
W4NQM	21	44,384	210	19	54
K4RZK	21	30,966	142	20	58
W4DS	21	3,960	44	11	19
WB4ACJ	21	2,088	29	12	17
K8RJP/4	**14**	**55,517**	**195**	**31**	**72**
WA4WAO	14	50,784	171	34	75
WA4ICB	14	21,830	109	23	51
W4HA	14	12,870	74	22	43
WA4KGJ	14	2,912	35	12	20
K4TWJ	14	1,536	27	10	14
W4BYB	**7**	**10,078**	**75**	**17**	**41**
W4RLS	7	4,875	48	16	23
W4IHK	**3.8**	**6,636**	**63**	**13**	**29**
WA5ALB	**A**	**301,224**	**424**	**91**	**173**
WA5DAJ	A	155,216	264	78	140
W5BRB	A	127,448	268	64	114
W50DJ	A	105,350	233	65	110
W5NXF	A	104,747	255	53	96
W5LZZ	A	82,524	189	54	100
W5LDH	A	46,948	138	42	79
W5RO	A	18,592	98	33	50
K5EXW	A	10,478	65	22	40
W50RH	**28**	**88,400**	**309**	**27**	**77**
K5IIN	28	44,462	184	26	60
W5FPN	28	13,268	77	22	40
WA5LLX	28	8,150	67	15	35
WA5MUE	28	6,384	55	17	31
WA5NVY	28	5,499	43	19	28
W5KC	**21**	**43,092**	**189**	**24**	**60**
K5VTA	21	25,500	124	22	53
W5NOP	**14**	**68,376**	**223**	**32**	**79**
W5CCP	14	42,406	166	32	59
W5QKZ	14	11,700	63	23	42

W6ITA	**A**	**771,316**	**851**	**106**	**220**
K6SEN	**A**	**615,680**	**684**	**106**	**214**
W6NJU	**A**	**428,100**	**512**	**105**	**195**
W6WX	A	327,918	463	88	158
K6HZP	A	316,756	455	91	162
W6SRF	A	198,983	360	66	127
W6VUW	A	195,201	301	72	135
K6DXM	A	161,816	311	63	116
W6YMV	A	108,405	241	62	103
W6ERS	A	101,460	211	72	106
WB6LCS	A	93,670	248	70	100
W6ZKM	A	92,073	233	53	88
W6LDD	A	91,341	211	55	98
WB6IQI	A	76,150	209	50	75
K6ALH	A	69,639	180	55	84
W6JKJ	A	46,004	138	55	69
W6VVR	A	39,058	121	46	72
K6PIH	A	36,105	169	30	53
WA6HAE	A	31,752	128	33	53
W6PLS	A	20,856	93	38	50
WA6IVN	A	18,292	100	29	39
WB6KOS	A	16,849	86	35	48
W6EWN	A	13,824	77	27	37
W6BJH	A	11,592	65	25	38
W6BSY	A	9,639	60	29	34
W6DZZ	A	9,576	61	22	34
K6HOR	A	7,964	43	24	32
W6CUF	A	7,290	52	26	28
W6RGG	A	4,214	38	20	23
WA6AUD	A	3,690	31	17	24
W6GHM	**28**	**67,001**	**281**	**26**	**63**
WA6SBO	28	50,580	167	28	62
K6CT	28	31,595	168	23	48
W6ESI	28	30,192	149	24	50
WB6BBT	28	9,010	62	21	32
WA6EYP	28	6,578	54	17	29
W6QMC	28	5,460	48	19	23
WB6IEX	28	1,344	20	12	16
K6UJW	**21**	**110,526**	**363**	**34**	**75**
WA6EKL	21	78,185	297	26	69
W6PQW	21	77,697	310	27	70
W6LCX	21	60,720	232	27	65
WA6ZQU	21	56,248	223	26	63
W6ISQ	21	53,592	215	28	59
K6OHJ	21	48,790	205	26	56
W6SIA	21	46,197	191	29	58
W6HVZ	21	37,444	179	23	51
WA6ISP	21	17,226	104	19	39
WB6LMN	21	7,344	72	14	22
K6EVR	**14**	**175,427**	**478**	**35**	**98**
K6BCE	14	117,552	339	36	88
K6YRA	14	86,250	273	36	79
K6BPR	**3.8**	**2,100**	**32**	**11**	**17**
W6ITY	3.8	1,742	28	10	16
K7NEQ	**A**	**108,584**	**210**	**78**	**118**
W7MX	A	101,920	255	52	88
W7AYY	A	70,301	211	46	75
W7HRH	A	48,930	168	41	64
W7WLL	A	45,505	169	42	53
W7BTH	A	42,119	127	46	72
WA7BYF	A	3,348	44	15	16
WA7CGR	28	540	18	5	7
W7PHO	**21**	**118,902**	**362**	**33**	**81**
W7THX	21	17,543	119	18	35
W7EKM	21	13,988	97	19	33
W7JRG	21	12,096	74	18	38
W7EVU	21	8,471	70	17	26
W7TDK	**14**	**132,990**	**352**	**37**	**93**
W7RQN	14	121,210	372	35	80
K7STK	14	15,561	89	27	36
W7SGN	14	9,558	56	21	38
W7LBN	14	7,425	53	21	34
W8DWJ	**A**	**250,465**	**399**	**74**	**151**
W8TWA/8	A	199,584	330	68	148
W8LXU	A	142,692	290	66	122
W8KYY	A	63,176	228	48	101
W8FRJ	A	32,578	128	32	59
W8YGR	A	10,385	54	22	45
W8NBK	**28**	**100,800**	**352**	**27**	**73**
WA8LEO	28	50,048	257	20	48
K8WIJ	28	25,764	123	24	52
WA8GUF	28	24,780	148	19	41
WA8CZH	**21**	**199,320**	**516**	**33**	**99**
WA8AJI	21	136,539	409	30	87
W8WT	21	60,264	225	28	65
W8ECA	21	57,009	212	27	66
W8QID	21	29,760	137	23	57
WA8IMX	21	14,787	103	16	37
W8KC	21	10,492	83	14	29
WA8SKV	21	3,552	43	12	20
W8HUD	**14**	**103,092**	**299**	**38**	**83**
WA8RSL	14	88,992	294	32	76
K8YBU	14	73,764	239	32	75
W8NZD	14	19,108	103	22	46
K8OVK	14	18,157	99	26	41
K8YWG	**3.8**	**26,492**	**149**	**24**	**50**
W9EWC	**A**	**477,694**	**584**	**98**	**200**
W9LKI	A	237,864	426	68	136
W9LKB	A	149,688	314	56	112
WA9HJM	A	109,228	265	69	119
K9NBH	A	91,560	232	51	89
W9AQW	A	50,568	142	48	81
K9IDQ	A	43,354	151	38	68
K9ZJV	A	36,828	146	31	62
WA9NKN	A	31,304	111	35	69
W9MUR	A	1,458	20	13	14
WA9QJW	**28**	**15,301**	**94**	**20**	**41**
WA9MFY	28	14,950	108	17	33
W9TKD	28	2,996	38	14	14
K9CSW	**21**	**152,217**	**472**	**31**	**86**
K9PPX	21	138,320	435	28	84
W9IRH	21	135,700	410	32	86
K9QFR	21	42,406	178	26	65
W9CRN	21	11,016	68	17	37
WØVXO	**A**	**676,750**	**833**	**102**	**216**
WØBAA	A	220,150	339	77	161
WAØKDI	A	160,360	305	65	125
WØTYK	A	45,510	164	44	79
WAØHWZ	A	28,665	114	33	58
KØGSV	A	8,791	55	24	35
WØKZZ	A	8,316	58	22	32
WØLBB	**28**	**25,014**	**138**	**19**	**47**
WØEZO	28	20,345	110	23	42
WAØMSD	28	15,960	94	19	41
WØLQN	28	11,284	75	21	31
WAØGCP	28	11,025	81	16	33
WØCGM	28	2,079	28	11	16
WØCUC	**21**	**61,180**	**238**	**28**	**67**
WØIEM	21	14,278	86	18	41
WAØMOJ	21	8,775	79	17	28
WØUCK	21	1,917	25	11	16
WØIYH	**14**	**90,120**	**266**	**34**	**86**
KØUKN	14	74,360	249	34	76
WAØEMS	14	42,097	180	27	62
WØSEA	14	27,229	138	22	51

Alaska

KL7FRY	**A**	**234,264**	**789**	**58**	**71**
KL7FCH	A	49,010	217	28	37
KL7FPU	**14**	**42,408**	**338**	**20**	**37**

Antigua

VP2AC	**14**	**61,028**	**375**	**21**	**50**

Bermuda

W2HTI/VP9	**A**	**196,988**	**604**	**55**	**93**
W3GHD/VP9	**14**	**19,512**	**245**	**16**	**20**

Canada—Zone 5

VE1UA	**A**	**25,474**	**260**	**19**	**28**
VE2NV	**28**	**44,936**	**204**	**24**	**58**
VE1ASL	28	741	22	5	8
VE2AFC	**21**	**36,991**	**191**	**21**	**50**
VE1TG	**14**	**188,190**	**633**	**32**	**91**
VE1AFY	14	130,820	391	32	92
VE2WY	14	82,110	248	32	83
VO1IB/VE1	14	57,057	254	24	67
VE2WA	14	53,965	193	31	74
VE1ACE	**3.8**	**4,368**	**84**	**7**	**21**
VE2AZQ	3.8	2,001	37	8	15

Canada—Zone 4

VE3LZ	**A**	**622,252**	**803**	**89**	**203**
VE3ELA	A	48,396	158	36	73
VE4SD	A	37,669	129	29	62
VE4RP	A	17,941	82	29	48
VE3EFX	A	1,617	22	15	18
VE3BMB	**21**	**37,130**	**171**	**24**	**55**
VE6SF	**14**	**116,130**	**453**	**31**	**74**
VE3ES	14	78,177	274	31	72
VE4OX	14	72,186	247	31	75
VE6XJ	14	47,437	206	29	60
VE3DYB	14	41,769	163	28	63
VE4SK	14	24,696	138	22	50
VE3BSJ	14	21,888	132	24	52
VE3EOE	14	17,328	96	21	45

Canada—Zone 1

VE8BB	**A**	**161,764**	**468**	**49**	**99**
VE8RX	**14**	**241,257**	**690**	**35**	**102**

Canal Zone

KZ5TW	**A**	**640,574**	**1224**	**86**	**156**

Dominican Rep.

HI8LC	**14**	**46,970**	**240**	**23**	**54**

Grand Turk Is.

VP5BP	**A**	**172,288**	**631**	**49**	**79**
VP5RS	**28**	**113,029**	**824**	**23**	**44**

Greenland

OX5AR	**14**	**69,020**	**397**	**22**	**46**

Guatemala

TG8IA	**28**	**3,312**	**101**	**7**	**9**
TG8RH	**14**	**1,625**	**61**	**7**	**6**

Honduras

HR2GK	**A**	**244,608**	**796**	**55**	**92**
HR1CP	A	79,076	333	37	69

WØGTA/8F4—Bob Snyder's beautiful location at Pekanbaru, Sumatra. The 10/15 beams on left tower, 75 ft. up and the 20/40 job at right on a 90 ft. tower. All were 2 el. yagis. Bob had a 144 ft. vertical for 80.

Mexico

XE1FN	A	1,682	21	13	16
XE2YP	**14**	**84,412**	**410**	**32**	**62**
XE1IX	14	37,185	255	23	44

Nicaragua

YN6BF	**A**	**17,812**	**171**	**31**	**30**

Panama

HP1JC	**A**	**144,213**	**396**	**57**	**102**

Puerto Rico

KP4AST	**A**	**757,391**	**1445**	**85**	**154**
KP4RK	A	122,815	385	54	91
KP4YT	A	28,483	131	36	55
KP4CQZ	**28**	**95,360**	**708**	**21**	**43**
KP4CQW	28	63,000	459	21	42
KP4BJM	**21**	**41,965**	**237**	**24**	**53**
KP4CL	**14**	**337,792**	**1147**	**35**	**93**
W1FZJ/KP4	**28**	**26,270**	**152**	**18**	**53**

Salvador

YS1SRD	**14**	**10,088**	**188**	**13**	**13**

Virgin Island

KV4AA	**A**	**245,651**	**875**	**46**	**87**

Africa

Angola

CR6HF	**A**	**147,168**	**410**	**43**	**83**
CR6GM	A	81,250	232	48	77
CR6EW	A	26,460	108	33	57
CR6IV	**14**	**198,334**	**525**	**36**	**95**

Ascension Island

ZD8SKI	**28**	**80,625**	**379**	**24**	**51**
ZD8WZ	**21**	**378,200**	**1076**	**31**	**91**

Congo Republic

TN8AA	**A**	**77,499**	**281**	**36**	**73**

Des Roches Island

VQ9AA/D	**A**	**3,624,942**	**2518**	**133**	**369**

Lesotho

ZS8L	**28**	**40,002**	**232**	**19**	**40**

Libya

5A1TY	**A**	**36,560**	**190**	**25**	**55**

Morocco

CN8AW	**A**	**104,412**	**313**	**27**	**86**
CN8BV	**14**	**291,755**	**867**	**30**	**85**
CN8BB	14	7,596	72	10	26

Nigeria

5N2AAW	**A**	**212,480**	**561**	**50**	**78**
5N2ABF	A	100,080	294	47	73
5N2AAF	**28**	**113,181**	**423**	**26**	**67**

Rhodesia

ZE1JE	**A**	**606,608**	**864**	**84**	**164**
ZE2JE	**14**	**203,616**	**634**	**33**	**79**

Rep. of Congo

9Q5HD	**A**	**189,800**	**423**	**59**	**100**

Sierra Leone

9L1HX	**14**	**479,460**	**1216**	**33**	**98**

Somalia

606BW	**A**	**207,711**	**469**	**59**	**98**

South Africa

ZS6RM	**A**	**90,906**	**273**	**43**	**66**
ZS2HI	A	43,044	154	41	61
ZS6NM	**28**	**62,530**	**438**	**21**	**44**
ZS6VX	**14**	**215,794**	**547**	**36**	**102**
ZS4JB	14	145,530	490	31	75

Zambia

9J2FK	**A**	**612,066**	**876**	**76**	**171**
9J2WR	**28**	**28,998**	**179**	**20**	**34**

Asia

Aden

VS9AJC	**A**	**290,220**	**491**	**72**	**138**

Afghanistan

YA1DAN	**14**	**35,585**	**197**	**25**	**14**

Hong Kong

VS6DS	**14**	**24,156**	**162**	**24**	**42**

India

VU2CK	**14**	**16,578**	**117**	**20**	**34**

Israel

4X4FV	**14**	**178,420**	**563**	**33**	**77**

Japan

JA1JAN	**A**	**350,360**	**736**	**66**	**102**
JA3RQ	**A**	**177,625**	**422**	**50**	**95**
JA1DFQ	**A**	**176,329**	**449**	**56**	**80**
JA1CG	A	132,496	375	48	64
JA8EL	A	96,202	328	41	63
JA1JDP	A	60,152	217	43	60
JA1NEC	A	56,546	200	37	61
JA1NDO	A	52,290	148	56	70
JA1RJU	A	26,937	133	33	40
JA1EZT	A	26,372	123	33	43
JA1ITE	A	17,230	149	30	40
JA7FC	A	13,380	90	28	32
JA8QA	A	4,775	66	12	13
JA1OCA	A	4,416	38	20	26
JA3BB/2	A	3,655	32	18	25
JA6AFL	A	1,026	18	8	11
JA1RJO	**28**	**118,109**	**488**	**30**	**53**
JA2DDN	28	82,026	371	32	44
JA1BYT	28	32,130	246	19	26
JA4OK	28	26,865	201	18	27
JA1EZL	28	26,280	196	20	25
JA8CDE	28	9,694	90	18	19
JA8GY	28	5,355	106	8	9
JA1QBG	28	4,564	56	13	15
JA1JUQ	28	3,456	49	12	12
JA3HZT	28	1,950	30	11	15
JA1NEZ	A	1,800	31	10	10
JA3JXJ	**21**	**248,045**	**880**	**30**	**65**
JA3COX	**21**	**230,412**	**854**	**29**	**62**
JA2CWX	**21**	**229,617**	**836**	**30**	**63**
JA7UJ	21	218,970	820	29	61
JA1MIN	21	185,389	675	29	64
JA7BSD	21	103,589	488	26	45
JA6BZI	21	102,138	400	30	57
JA1SYK	21	87,394	395	25	49
JA1DQL	21	78,144	401	22	44
JA7MA	21	73,664	390	24	40
JA4FK	21	52,806	232	25	53
JA6ATL	21	41,976	222	24	42
JA6DFD	21	40,500	187	27	48
JA1ULW	21	27,820	182	19	33
JA8CKC	21	25,141	273	10	21
JA3BOY	21	21,855	155	17	30
JA2GSW	21	17,289	115	18	34
JA6GT	21	16,614	143	15	24
JA1UVR	21	15,504	106	21	30
JA1EHA	21	8,694	109	13	14
JA1WUN	21	7,790	75	15	26
JA1VZM	21	7,611	62	18	25
JA8BHV	21	3,990	45	13	30
JAØBBW/1	21	3,936	41	14	18
JA2AXG	21	2,697	29	14	17
JA1XCZ	21	855	17	10	9
JA3KEA	21	54	3	3	3
JA3UI	**14**	**173,232**	**561**	**34**	**74**
JA6AD	**14**	**76,200**	**268**	**34**	**66**
JA8AA	14	65,025	302	27	48
JA3AA	14	41,850	207	28	47
JA8NU	14	33,902	172	27	40

HM1AJ—Cho Dong-in and Im Jung-Hyuk and their two chubby harmonics. The XYL is HM1AM but is too busy with the harmonics to get on the air.

JA3LGG	14	16,072	104	23	33
JA1KFQ	14	14,322	79	24	38
JA8BB	14	12,836	68	22	32
JA1ALX	14	6,816	52	20	28
JA2BDR	14	5,031	47	20	23
JA8GR	14	4,617	64	11	16
JA4AQR	14	3,528	36	16	20
JA1ISC	14	2,240	35	12	16
JA3ADW	14	117	5	4	5
JA2AIR	14	42	3	3	3
JA2BTV	**7**	**26,585**	**146**	**26**	**39**
JA2BAY	7	14,256	114	20	28
JA1ADD	7	8,136	79	18	18
KA8HC	A	4,968	44	21	25
KA2RJ	**28**	**81,380**	**433**	**27**	**38**
Korea					
HL9KB	**28**	**1,638**	**35**	**9**	**12**
HM1AJ	**14**	**9,589**	**125**	**17**	**26**
Lebanon					
OD5CA	**A**	**26,286**	**121**	**26**	**52**
OD5EJ	**28**	**28,914**	**164**	**21**	**40**
Macau					
CR9AH	A	3,600	48	11	14
Malaysia, West					
9M2LO	**A**	**10,640**	**58**	**31**	**39**
Marshall Is.					
KX6FB	**A**	**14,784**	**87**	**26**	**30**
Ryukyu Is.					
KR6TAB	28	1,150	19	6	19
KR6CO	**14**	**108,058**	**433**	**31**	**66**

U.S.S.R.

Asiatic					
UA9EU	**A**	**182,900**	**525**	**36**	**88**
UA9VH	A	47,168	301	23	44
UA9FV	**28**	**3,146**	**51**	**6**	**16**
UA9WS	**21**	**6,702**	**70**	**9**	**24**
UA9DT	**14**	**74,686**	**268**	**35**	**72**
UA0AI	14	56,192	332	21	43
UA9HW	14	4,551	43	16	25
Kazakh					
UL7JA	**A**	**252,068**	**570**	**52**	**112**
Turkoman					
UH8BO	**14**	**34,168**	**170**	**22**	**52**

EUROPE

Alands Island					
OHØNI	**A**	**186,729**	**550**	**60**	**141**
Austria					
OE2AL	**A**	**31,464**	**191**	**28**	**48**
OEIRZ	**28**	**47,724**	**207**	**28**	**54**
OEIWO	**7**	**7,102**	**101**	**12**	**41**
Belgium					
ON4SZ	**A**	**423,800**	**677**	**92**	**196**
ON4XG	A	15,410	127	23	44
ON4QJ	**28**	**75,475**	**295**	**30**	**45**
ON5KY	**21**	**343,395**	**1058**	**34**	**83**
ON4IZ	**14**	**252,144**	**721**	**33**	**103**
ON5GA	14	95,312	389	30	82
ON5AZ	14	51,175	302	25	64
ON4UN	**3.8**	**61,523**	**616**	**19**	**58**
Bulgaria					
LZIWD	**A**	**127,448**	**433**	**56**	**122**
LZ2KLC	A	960	36	9	15
LZIDV	**7**	**5,781**	**123**	**11**	**30**
Crete					
SVØWL	**A**	**53,160**	**357**	**37**	**83**
Czechoslovakia					
OK1AHZ	**A**	**97,744**	**255**	**53**	**101**
OK1ADM	A	72,962	194	64	127
OK1AHV	A	68,686	326	43	79
OK3EA	A	18,612	153	28	66
OK1MP	**28**	**14,790**	**98**	**22**	**36**
OK2ABU	28	198	10	4	5
OK1AKL	**21**	**2,072**	**36**	**12**	**16**
OK1ADP	**14**	**102,609**	**345**	**34**	**83**
OK1GT	14	86,640	383	33	81
OK3CAD	14	19,812	164	24	54
OK2RO	**3.8**	**13,530**	**326**	**9**	**32**
OK1WGW	3.8	6,816	205	6	26
OK3KNO	3.8	2,400	100	4	20
OK1GO	3.8	1,600	88	4	16
OK1AAE	3.8	630	37	3	15
Denmark					
OZ4FA	**A**	**753,489**	**1017**	**98**	**199**
OZ3SK	**A**	**625,918**	**970**	**84**	**178**
OZ6OX	A	182,591	444	58	99
OZ3KE	A	120,078	386	41	85
OZ7DX	A	39,093	247	26	57
OZ8PK	A	18,054	128	22	37
OZ7BG	A	14,018	96	29	57
OZ2BI	A	5,328	86	10	38
OZ1RH	A	3,536	51	18	34
OZ7SS	A	496	18	10	16
OZ5DX	28	144	12	2	2
OZ3Y	**21**	**36,685**	**230**	**18**	**37**
OZ9CR	**14**	**8,342**	**109**	**15**	**28**
OZ7OMR	14	7,019	106	12	31
OZ3FU	14	4,795	88	11	24
OZ4QQ	14	3,640	67	10	30
OZ1IF	14	1,750	64	5	20
OZ5GT	**3.8**	**14,406**	**252**	**13**	**36**
OZ8BZ	3.8	2,392	82	5	21
England					
G3TWV	**A**	**496,982**	**1006**	**68**	**123**
G3KZQ	A	367,640	711	54	128
G4JZ	A	258,279	638	55	92
G3LNO	A	220,364	523	55	123
G3RHM	A	216,631	493	68	135
G2AJB	A	66,350	250	45	85
G8DI	A	50,427	273	33	84
G3MWZ	A	30,358	189	29	57
G3HDA	**28**	**171,567**	**631**	**30**	**69**
G3UML	28	83,498	256	29	53
G3LZQ	28	33,390	215	19	34
G3OHP	28	21,460	135	22	36
G3PEU	**21**	**97,650**	**396**	**29**	**61**
G3LSF	**14**	**238,392**	**726**	**37**	**92**
G3OIE	14	192,038	897	31	55
G3RJH	14	37,600	193	25	55
G5HZ	**7**	**21,970**	**197**	**17**	**48**
G3ESF	3.8	600	41	3	12
Finland					
OH400	**A**	**238,199**	**509**	**78**	**173**
OH1OE	A	60,750	238	47	78
OH6VE	A	14,700	100	24	36
OH2XK	A	7,979	55	29	50
OH6AF	A	4,752	84	13	31
OH2TE	A	1,369	35	11	26
OH3XZ	A	1,290	23	13	17
OH2SJ	A	882	19	10	11
OH2FT	**28**	**12,291**	**107**	**16**	**35**
OH2XA	28	8,313	72	18	33
OH1SM	28	1,218	25	8	13
OH1UR	28	104	5	4	4
OH7PI	**14**	**118,441**	**583**	**29**	**54**
OH5TN	14	81,613	364	28	61
OH2CP	14	17,080	210	15	25
OH3NY	14	6,501	92	10	23
OH3TT	14	5,040	53	16	20
OH8OS	14	4,920	75	11	13
OH2DW	14	3,686	73	11	27
OH3YI	14	3,570	89	8	27
OH3QA	14	2,345	25	17	18
OH5UQ	7	672	33	5	11
France					
F3KC	**A**	**350,424**	**713**	**67**	**119**
F3KW	A	106,408	395	42	52
F9RM	A	53,074	189	44	75
F5ED	A	13,039	95	23	36
F8RU	A	10,720	85	27	53
F8TM	A	1,597	30	14	23
F2AD	A	336	10	7	7
F9OE	**14**	**8,208**	**79**	**17**	**37**
F5SJ	14	1,728	24	12	24
F5JA	14	657	15	8	13
F7DO	**A**	**410,112**	**751**	**73**	**119**
F7BE	**14**	**30,816**	**183**	**24**	**48**
Germany					
DJ6QT	**A**	**1,519,823**	**1521**	**116**	**273**
DJ2QZ	**A**	**915,287**	**1131**	**99**	**230**
DJ8FC	**A**	**612,715**	**775**	**101**	**194**
DL7AA	A	559,632	767	100	162
DJ4AX	A	548,733	723	101	202
DJ2HH/P	A	536,389	796	86	173
DJØLDA	A	272,052	659	64	134
DL7BQ	A	241,362	462	75	132
DL7EN	A	154,956	323	78	144
DJ2GG	A	152,148	345	65	121
DJ8IF	A	139,944	426	51	96
DL8BS	A	129,420	297	61	119
DL9HC	A	106,080	309	51	119
DJ1FC	A	104,904	402	37	56
DJ1XP	A	83,640	247	53	109
DJ1OJ	A	79,170	264	61	113
DL8KS	A	75,720	264	44	76
DJ3KQ	A	75,153	302	38	85
DJ8OT	A	50,180	199	45	85
DJ2RT	A	48,410	231	35	59
DJ3YU	A	44,896	182	45	77
DJ6QP	A	41,510	209	33	37
DL1TA	A	38,676	148	48	84
DJ5HN	A	33,592	131	40	64
DLØSM	A	26,574	134	36	67
DL8JO	A	20,503	128	32	69
DJ2UU	A	20,200	177	24	76
DJØJG	A	19,240	133	34	70
DL1AM	A	15,416	126	32	50
DJ3BB	A	14,823	99	26	55
DJ8RR	A	14,750	102	24	35
DJ7PB	A	9,928	93	21	52
DJ2YA	A	8,775	93	18	47
DJ8UM	A	6,960	118	10	48
DJ2XO	A	2,688	34	19	29
DJ1UE	A	1,505	31	13	22
DJ5ZE	A	594	15	8	10
DL7BA	**28**	**143,034**	**529**	**28**	**65**
DL9KRA	28	128,516	505	30	59
DJ7ZG	28	112,608	406	33	63
DJ8OD	28	80,376	402	27	41
DJ4PT	28	50,256	242	25	47
DJ4IZA	28	20,350	134	21	34
DL7DI	28	9,150	64	20	30
DL2JO	28	1,100	20	9	11
DL6EN	**21**	**410,256**	**1254**	**35**	**77**
DJ2BW	**21**	**406,681**	**1161**	**34**	**87**
DJ1LP	21	351,317	1061	35	78
DJ2DR	21	100,530	403	28	62
DL8PC	21	64,459	318	24	49
DJ8FF	21	36,783	207	24	43
DJ4UB	21	35,997	196	24	47
DJ9LI	21	34,776	185	27	45
DL9FV	21	29,700	238	17	27
DJ4PU	21	27,552	177	21	35
DJ7ST	21	6,528	59	19	29
DJ2DW	21	3,759	179	4	3
DL8YD	21	1,152	22	11	13
DJ7VY	**14**	**112,224**	**479**	**32**	**80**
DJ1SX	14	84,660	388	29	73
DJ4OX	14	61,596	214	35	81
DJ6TK	14	1,426	30	6	11
DL9VS	14	765	25	5	12
DJ5BV	**7**	**53,664**	**337**	**23**	**63**
DJ3BW	7	23,940	208	15	45
DL8UI	**3.8**	**28,969**	**324**	**16**	**55**
DL4AN	**A**	**205,326**	**446**	**61**	**122**
DL5HH	**14**	**154,450**	**618**	**32**	**78**
DL4SK	14	80,920	355	31	88
DL5LR	14	50,016	256	26	70
DL4RO	**3.8**	**6,027**	**161**	**8**	**33**
DM2BTO	**A**	**16,450**	**120**	**30**	**64**
DM2BKG	A	4,488	59	19	32
DM4UJJ	A	1,044	29	11	18
DM2ATL	A	18	3	3	3
DM3LOG	21	286	10	6	7
DM4QG	3.8	81	12	2	7
Greece					
SVØWV	**14**	**17,388**	**222**	**16**	**38**
Hungary					
HA5DU	**A**	**18,761**	**137**	**25**	**48**
HA5DG	21	988	42	5	14
HA5FE	**14**	**41,280**	**338**	**26**	**60**
Iceland					
TF3EA	**14**	**96,758**	**382**	**30**	**71**
Ireland					
EI3S	**A**	**113,998**	**360**	**45**	**78**
Isle of Man					
GD3TIU	**A**	**72,704**	**246**	**51**	**91**
Italy					
IIBAF	**A**	**857,472**	**1011**	**98**	**221**
IØKDB	**A**	**509,970**	**1016**	**80**	**187**
IICBZ	A	7,350	58	31	39
IILCF	**28**	**4,636**	**83**	**9**	**10**
IINU	**21**	**256,742**	**894**	**31**	**70**
IIGAD	21	98,784	436	28	56
IIKE	21	76,770	330	24	66
IIZLW	21	15,660	165	13	35
IILCK	**14**	**198,909**	**645**	**37**	**102**
IICNE	14	182,780	609	34	96
IIEVK	14	82,225	355	33	82
IIBOB	14	62,916	169	27	71
IIMOL	14	27,671	187	20	47
IIAHO	14	23,375	181	23	62
IIZSQ	**7**	**10,290**	**126**	**12**	**37**
Jan Mayen Is.					
JX6XF	**A**	**44,080**	**339**	**27**	**68**
Netherlands					
PAØXPQ	**A**	**296,484**	**631**	**67**	**119**
PAØDEC	A	77,744	328	33	53
PAØLV	A	11,520	163	12	48
PAØQT	A	7,611	76	20	39
PAØYN	A	759	29	7	16
PAØFM	**21**	**222,271**	**701**	**34**	**79**
PAØEEM	**14**	**256,680**	**787**	**35**	**103**
PAØKSB	14	17,496	150	22	32
Norway					
LA7HH	**A**	**29,304**	**169**	**35**	**64**
LA4ZB	A	19,600	118	32	66
LA8RI	A	8,410	73	23	35
LA4UH	A	3,524	40	19	19
LA7QI	A	1,677	29	15	24
LA4LE	**28**	**11,872**	**129**	**14**	**18**
LA4KE	28	3,201	37	14	19
LA5YZ	21	2,591	48	7	11
LA7JF	**14**	**27,840**	**223**	**20**	**38**
LA4DJ	14	18,560	116	24	56
LA9UI	14	6,201	76	13	26
Poland					
SP8AJK	**A**	**304,414**	**648**	**82**	**192**
SP6AAT	A	106,140	443	55	128
SP5HS	A	14,820	119	21	55
SP5AKG	**14**	**164,608**	**688**	**35**	**93**
Portugal					
CT1PK	**A**	**303,050**	**670**	**61**	**129**
CT1IW	A	283,038	685	53	108
CT1LN	**28**	**18,512**	**176**	**14**	**38**
CT1KT	**14**	**53,448**	**296**	**26**	**42**
Romania					
YO9HH	21	1,113	39	7	14
Scotland					
GM3BCL	**A**	**80,181**	**284**	**44**	**107**
GM3KGT	**21**	**19,600**	**284**	**10**	**15**
GM3JDR	**14**	**67,956**	**473**	**26**	**58**
GM3SFH/A	14	36,075	332	20	45
GM5ABN/KP4BRY	**A**	**204,594**	**612**	**46**	**83**
Shetland Is.					
GM3RFR	**A**	**154,020**	**497**	**48**	**103**
Sicily					
IT1ZGY	**A**	**214,200**	**480**	**69**	**141**
IT1GAI	**21**	**84,976**	**461**	**27**	**67**
Spain					
EA2EL	**A**	**181,350**	**553**	**48**	**82**
Sweden					
SM2BJI	**A**	**1,492,836**	**1545**	**122**	**250**
SM3BIZ	**A**	**580,206**	**826**	**87**	**211**
SM4CMG	A	506,688	902	71	153
SM5CEU	A	217,536	550	68	138
SM3AF	A	198,432	636	46	98
SMØRK	A	182,328	629	36	71
SM5WT	A	176,610	425	71	132
SM7CSN	A	44,940	300	23	84
SM5DZG	A	24,900	146	29	46

SM5BOE	A	24,323	132	33	64
SMØBPZ	A	14,060	127	21	53
SMØBNX	A	10,192	100	19	37
SM6AMD	**28**	**37,800**	**240**	**19**	**35**
SM4ARQ	28	6,624	55	18	30
SM3CNN	**21**	**185,706**	**650**	**33**	**81**
SMØBUT	21	165,870	663	31	66
SM7DBD	21	57,376	243	29	59
SM7SX	21	42,120	191	28	50
SM7CRW	**14**	**160,792**	**727**	**29**	**72**
SM5API	14	70,343	330	31	60
SM6DLL	14	56,880	318	27	63
SM2CTY	14	40,495	222	29	62
SMØAIO	14	4,983	60	16	17
SM3AZV	14	4,820	87	9	11
SM5CAK	**7**	**17,628**	**241**	**13**	**39**
SMØFE	**3.8**	**19,840**	**257**	**17**	**47**
SM3DKO	3.8	1,120	53	4	16
SMØBAD	3.8	80	8	2	5

Switzerland

HB9ZY	**A**	**804,616**	**937**	**102**	**242**
HB9AAZ	A	296,496	619	74	139
HB9AER	A	48,919	273	28	43
HB9RX	A	22,311	136	26	41
HB9UD/P	A	9,144	86	26	46
HB9IX	**28**	**14,490**	**112**	**18**	**28**
HB9DX	28	7,215	70	16	23
HB9PQ	28	2,190	33	11	19

Wales

GW3NWV	**A**	**422,400**	**892**	**58**	**118**

Yugoslavia

YU1PCF	**14**	**1,881**	**41**	**9**	**24**

U.S.S.R.

Estonia

UR2IV	28	1,767	23	13	18
UR2CW	**21**	**184,842**	**896**	**26**	**55**
UR2AR	**14**	**341,250**	**999**	**37**	**93**
UR2DL	14	12,985	190	15	34

European

UA1DZ	**A**	**809,676**	**1250**	**95**	**211**
UA3DR	A	219,188	633	50	98
UA6XG	A	126,582	429	50	96
UA6KOE	A	53,277	289	34	95
UA4NZ	A	4,378	109	10	12
UW3CX	A	3,196	43	18	29
UA3AJT	**28**	**6,528**	**71**	**17**	**31**
UA1KBB	28	4,080	65	10	24
UA3APT	28	2,747	40	15	25
UA1LL	**21**	**7,588**	**183**	**10**	**22**
UW3IN	21	3,146	89	7	19
UA1MU	**14**	**54,675**	**257**	**27**	**54**
UA3KOB	14	2,280	54	10	30
UA3YR	14	1,430	39	9	17
UA3KBO	**7**	**15,281**	**198**	**16**	**43**

Latvia

UQ2KBI	**A**	**9,850**	**151**	**14**	**36**

Lithuania

UP2OM	**A**	**47,988**	**330**	**27**	**66**
UP2CV	A	3,870	66	15	28

Moldavia

UO5AR	**14**	**2,116**	**64**	**6**	**22**

Ukraine

UB5FG	**28**	**10,830**	**112**	**17**	**40**
UB5KUT	28	375	19	5	10
UB5KGZ	**21**	**52,745**	**402**	**21**	**56**
UB5SR	**14**	**8,225**	**103**	**15**	**32**
UB5SJ	14	7,467	88	15	42
UB5ND	**7**	**4,251**	**91**	**11**	**28**

White Russia

UC2BF	**A**	**8,736**	**120**	**15**	**41**

Oceania

Australia

VK2WD	**A**	**35,088**	**138**	**35**	**51**
VK2FU	**28**	**17,605**	**172**	**14**	**21**
VK2APK	**14**	**147,864**	**432**	**33**	**89**
VK3ZR	**A**	**61,722**	**195**	**50**	**77**
VK3XB	A	7,728	49	25	31
VK3ABA	**21**	**22,001**	**162**	**20**	**29**
VK3LW	14	2,940	29	12	23
VK4CK	**A**	**17,145**	**129**	**17**	**28**
VK4SD	**14**	**70,560**	**219**	**34**	**78**
VK4DO	14	4,114	51	12	22
VK5LC/VK5	**14**	**3,157**	**31**	**17**	**24**
VK6RU	**A**	**660,393**	**902**	**88**	**175**
VK6XX	**28**	**12,384**	**90**	**16**	**32**
VK7SM	**A**	**31,341**	**140**	**41**	**52**

Canton Island

KB6CZ	**A**	**231,720**	**711**	**55**	**65**

Christmas Is.

VK9DR	**A**	**8,460**	**63**	**22**	**55**

Guam

KG6AQA	**A**	**284,610**	**564**	**68**	**111**

W7ALE/KG6	**14**	**100,416**	**378**	**35**	**61**

Hawaii

KH6IJ	**A**	**770,430**	**1423**	**73**	**110**
WØPAN/KH6	**A**	**428,705**	**849**	**73**	**106**
K6CAA/KH6	**21**	**2,376**	**34**	**14**	**13**
KH6EPW	**3.8**	**5,040**	**82**	**10**	**11**

Indonesia

WØGTA/8F4	**A**	**1,306,842**	**1351**	**112**	**234**

Marshall Is.

KX6DC	**A**	**163,170**	**637**	**40**	**80**

New Zealand

ZL1KG	**A**	**906,182**	**1249**	**89**	**168**
ZL1AGO	**21**	**95,680**	**514**	**25**	**41**
ZL1HW	**14**	**103,469**	**348**	**34**	**73**
ZL4LM	**3.8**	**2,492**	**32**	**11**	**17**

South America

Argentina

LU1DGM	**A**	**399,510**	**737**	**70**	**123**
LU1BB	A	46,788	221	34	50
LU9AW	A	33,733	150	39	40
LU8FP	A	21,330	103	33	46
LU4DMG	A	980	18	12	15
LU1DAB	**28**	**314,056**	**1051**	**26**	**76**
LU3EQ	**14**	**124,836**	**428**	**36**	**67**
LU8FAO	14	42,225	205	25	50
LU2FAO	14	17,395	136	21	28

Brazil

PY7ACQ	**A**	**504,138**	**825**	**67**	**152**
PY1NBF	A	291,137	502	73	136
PY1CK	A	168,606	392	58	95
PY7EC	A	106,704	317	38	76
PY2DYI	A	17,562	67	41	50
PY2DKG	A	16,182	66	39	48
PY2AQQ	A	10,855	64	28	37
PY2ASO	A	2,108	23	15	19
PY3BAD	**28**	**71,544**	**388**	**21**	**45**
PY4BEX	**21**	**33,453**	**152**	**26**	**55**
PY7AKW	21	26,015	167	20	35
PY3OJ	21	15,096	110	20	31
PY7LAK	21	12,852	91	18	33
PY4OD	**14**	**287,028**	**729**	**36**	**98**
PY3AHJ	14	227,148	565	38	100
PY6NX	14	63,180	265	28	53
PY7GV	14	49,218	220	27	51
PY6OQ	14	43,011	166	28	53
PY7APS	**7**	**12,298**	**101**	**12**	**31**

Colombia

HK2KL	**A**	**1,182,864**	**1353**	**92**	**212**
HK3AJV	**21**	**52,535**	**301**	**14**	**21**
HK3RQ	**14**	**96,483**	**386**	**27**	**60**

Ecuador

HC1TH	**A**	**577,690**	**987**	**72**	**133**
HC6GM	**21**	**64,192**	**354**	**21**	**43**

Paraguay

ZP5KT	**A**	**347,360**	**649**	**76**	**126**

Peru

OA8V	**A**	**754,956**	**990**	**98**	**170**

Uruguay

CX3BH	**A**	**652,955**	**1078**	**80**	**135**
CX9CO	A	620,940	959	77	160
CX8CZ	**21**	**231,462**	**847**	**30**	**69**

Venezuela

YV5AXT	**A**	**890,766**	**1324**	**85**	**161**
YV1LA	A	441,640	841	61	120
YV5AST	**21**	**170,520**	**831**	**22**	**48**
YV1SA	21	28,750	228	15	31
YV5BIG	**14**	**840,252**	**1929**	**36**	**111**
YV5BQF	14	389,035	936	37	108
YV2IF	14	119,496	396	30	74
YV2CJ	14	115,697	311	30	97
YV7AV	14	54,054	297	20	43
YV4GD	**7**	**11,480**	**95**	**12**	**29**
YV5BTS	**3.8**	**69,471**	**296**	**21**	**62**

MULTI-OPERATOR
Single Transmitter

Top scores in each US district, and in each country are certificate winners.

North America

United States

K1DFC		51,324	221	24	60
(K1DFC, WA1FEH)					
W2JT		441,351	570	87	180
(W2JT, DEW, SHC)					
WA2OJD		398,764	540	83	179
(WA2OJD, WIRAN)					
WB2FON		341,362	465	83	176
(WB2FON, FOV, WA2UBC)					
W2NOD		183,210	326	65	132
(K2VVV, WB2OIV, RHM, TNY)					
W2YNM		122,616	273	55	101
(WB2UHF, VJA)					
W3IYE		230,671	372	71	146
(W3IYE, TGF)					
W3MVB		215,688	347	76	152
(W3MVB, W1ARR)					
W3OK		171,150	363	59	104
(W3IZI, K3MAZ, QDV)					
WA3DHV		121	11	6	5
(WA3DHV, DVH)					
WA4WFQ		200,791	357	68	131
(WA4WFQ, WJH, ZMH)					
W4PGK		34,068	120	40	62
(W4PGK, WLBU)					
WA6EPQ		506,752	608	101	195
W6UMI		228,960	388	73	143
(W6UMI, WA6SII, WB6KIG)					
K7UDV/7		400,830	483	105	205
(K7UDV, W7BSW)					
W8EDU		133,525	272	59	116
(K3UFV, W8AZA, WA8MGI, NQC)					
WA8HPJ		111,696	259	50	106
(WA8HPJ, GLY)					
WA9ISM		176,866	319	60	131
(WA9ISM, QXH)					
WA9IBT		131,726	253	65	129
(WA9IBT, NXH)					
K9KWL		89,100	200	50	100
(K9KWL, NCS, W9JWD)					
K9MRC		71,820	190	48	92
WAØHVR		268,862	404	85	157
(WAØHVR, KEQ)					
WAØKXZ		192,172	320	70	144
(WAØKXZ, AHL, KDT)					
WAØNLP		155,817	307	73	126
(K6IYF, WB6RNF, WØCHT, GYH, KWK, VSA, QIN, TLX, KØEOK, MPH, VLC, WAØBHD, PTJ)					
WAØCPX		96,338	240	54	97
(WAØCPX, KØBLT, WØLPY)					

Alaska

KL7WAH		785,180	1972	62	110
(KL7EDV, K2YFE, W5IEA, WB6HFX, K7MQY, K8INX)					
KL7EDY		445,512	1382	68	84
(KL7EDY, JDO)					
KL7FSU		97,026	371	44	59
(KL7FSU, FMM, KØMXX/KL7)					
W4FAY/KL7		61,460	367	29	41
KL7FKL		60,310	313	27	47
(KL7FKL, WA7BVQ/KL7)					

Canada

VE3FHO		396,344	726	67	139
(VE3FHO, VE3GCO)					
VE5US		273,856	705	65	111
VE5UF, DK, A. Leganchuk)					

Mexico

XE1CE		248,270	598	64	121
(XE1CE, GV)					

Africa

Angola

CR6DX		1,094,268	1300	93	201
(CR6DX, DA, DB, FY, HL)					

Egypt

VE3FJZ/SU		341,220	1055	33	77

Ethiopia

ET3WH		2,139,696	2306	98	226
(WA3ELH, Jerry)					

Lybia

5A5TJ		217,400	740	29	71
(5A5TJ, TN)					

Asiatic U.S.S.R.

UA9KWA		84,184	229	41	95
(UA9WL, WHT, UA9-9224, UA9-9232)					
UA9KQA		66,804	213	39	75
(UA9RR, RQ, RU, RY)					

Georgia

UF6KAF		2,376	31	12	21
(UF6AAN, ACR)					

Asia

Hong Kong

VS6AJ		1,049,436	1261	106	218
(VS6AJ, FS, W5UHK, K6IHO)					

Japan

KA9MF		498,542	912	70	117
(KA9MF, K3GPH, K4UTK, K6KGX, WA5QNI, WB2HMF, K3NDC)					
KA2JR		130,161	351	53	76
(KA2JR, DJ)					
JA6YFL		19,380	105	36	40
JA1YDE		1,560	22	11	15
(JA1BNW, OJH)					

Europe

Azores

CT2YA		338,880	1062	40	80
(Lloyd & Iris Colvin)					

Czechoslovakia

OK3KAS		60,360	381	33	87
(OK2-15037, OK2-12600)					

England

GB2USA		375,920	923	52	96
(G5AAB, ACP, G3KVF)					
G3IAR		177,184	416	75	149
(G3IAR,RYV)					
GB3GJ		64,676	291	32	60
(G3KVG, VDV					

Finland

OH2AA		157,586	474	50	93
(OH2BEF, BEM, BFF, LP)					
OH3AH		76,329	313	33	66
(OH2UQ, OH3QA, OH4QG, OH5VS)					
OH2BR		26,826	135	37	65
(OH2BK, BR, BDP)					
OH5AA		10,584	108	21	42
(OH5OD, PN, RZ)					

Germany

DL1KB		1,896,156	1892	113	249
(DL1KB, JW)					

YV5BTS—World high score on 3.8 mc Phone. Bill reading his favorite magazine at the operating position of his modest lay-out.

DJ3YL 943,425 1107 98 217
(DJ3YL, DJ2YA)
DKØAA 770,448 1020 99 237
(DJ6TS, TT, DJ7IK)
DLØWW 746,650 1020 96 178
(DJ6WI, DL6NK, DJ4XN, DK1HC, DL3ZA, DL4OT, DJ3GR DJ6DU, DL2LW, Faustle Muller)
DJ8EQ 662,472 1154 75 141
(DJ8EQ, DJ7DJ)
DLØAA 627,578 774 100 222
(DL3AA, BK, OH, DJ4XG)
DL8RL 624,990 925 86 165
(DL8RL, RM, DL1KN, DL3LU, DJ6WO)
DJØPH 500,745 750 93 158
DLØJD 409,968 724 74 134
(DJ1CY, XI, DJ4HO)
DLØFK 373,896 1061 60 102
(DJ3AS, DK1DN, DU, DV, HA)
DLØPH 182,043 452 59 120
(DJ1DB, DJ8AY)
DL8KJ 124,875 374 52 83
(DL8KJ, DJ6WD)
DL6OA 171,798 407 71 138
(DL6OA, DJ4ZN)
DM3ML 155,348 509 45 97
(Club Station)

Italy

IØRB/4U.. 2,141,150 2053 126 332
(I1RB, RBJ)
I1PGL 415,461 775 77 160
I1ZYF 196,350 511 60 110

Netherlands

PAØGMU.. 1,114,785 1513 90 225
(PAØGMU, HBO, SNG)

Norway

LA1H 562,324 920 79 187
(LA5FG, LA9OI)
LA1K 459,130 943 75 170
(LA1EE, LA3JJ, LJ)

Sweden

SM6VR 1,364,967 1582 108 225
(SM6VR, CAS, CKV)
SM4AD 212,212 424 69 143
SMØAZU 173,745 387 65 130
(SMØAZU, ATN, MC)
SL3ZV 121,392 523 42 102
(SM3APU, AXV, DGE, DGU, DKO, DMU, DYU, DDZ)
SLØDF 115,992 508 35 73
SMØXAC 702 19 10 16

European U.S.S.R.

UA4KED 309,765 747 58 135
(Juri, Valentin, Vlad)
UA1KBW 306,904 710 55 114
(Alex, Yurie, Valerie)
UA3KAO 238,707 738 56 133
(UW3AO, UA3-27282, UA3-27216)
UA3KUB 225,096 516 73 176
(UA3VB, UJ, ULX, ULU, UN, UW3UJ)
UA3RDO 171,303 589 50 129
(UA3FG, AZA, UW3HR, UA3-27320, UA3-27214)
UA3KYA 12,350 142 17 33
(Club Station)
UA3KND 7,172 98 14 30
(Club Station)

Latvia

UQ2KFG 315,456 938 47 112
(George, Vic, Alex)

Lithuania

UP2KNP 366,540 826 69 177
(Club Station)

Ukraine

U5ARTEK 169,467 516 49 124
(Boris Anatoliy)
UB5KAW 81,026 447 32 95

Oceania

American Samoa

KS6BT 1,003,820 1704 80 132
(KS6BT, BV)

Christmas Island

VK9XI 149,640 440 45 75
(Club Station)

Guam

KG6AAY.. 1,042,245 1378 89 176
(K6KII, W7IIZ, K5IOH, WØQQG, Simeon, Ron, Orion)

South America

Brazil

PY7BDX 332,280 693 61 119
PY1CPE 206,924 424 65 114
(PY1CPE, ATG, CBS)
PY7GAI 39,528 250 17 37
(PY7GAI, KI)

Ecuador

HC1EY 1,111,800 1916 74 126
(HC1EY, EL, LE, MF)

Peru

OA4PQ 821,907 1327 89 130
(OA4PQ, RQ, BQ, ML, CV)

Uruguay

CX2CO 2,600,923 2413 114 263
(CX2CO, CX1BY, CX3BBD, CX7CO)

Venezuela

YV1AJ 915,561 1579 70 137
(YV5BQL, YV1QF, PP, DH, BP, EC)

MULTI-OPERATOR
Multi-Transmitter
North America

United States

K1JGD 1,180,025 1072 109 276
(W3WPG, K1JGD)
K2GL 4,128,215 2587 144 415
(K2GL, W2SKE, IWC, W6KFV, W1GYE, K2UYG, DGT, TXC, W2VCZ, W7ESK, W2BIU, K2KUR, WA2RAU)
W3MSK .. 3,811,934 2322 145 429
(W3MSK, K6ZA, K3EST, W3ZKH, K1ANV, W3TMZ, KMV, W6HOH, K3NPV, WA3FUM)
W3WJD .. 1,904,826 1449 127 335
(W3WJD, K3MCO, JJG, JCT, W3HHK)
K6ERV 891,062 884 115 243
(K6ERV, W6BHY)
W8NGO 549,552 606 100 221
(W8NGO, CLR, ONA)
WØPKH 273,120 405 77 163
(WØPKH, KHZ, KØBSZ, WØKBG)

Bermuda

VP9BDA ..1,547,225 2166 92 219
(VP9AK, DL, BO, BY, FU, FX, BU, CP, FJ, BP, WB, G, L, FO)

Cayman Island

ZF1EP 1,569,780 2962 88 167
(W4PJG, K4CAH, W4KET, WA4WIP)

Europe

Finland

OH2AM .. 5,465,610 3972 153 405
(OH2BS, KH, BQ, QV, SB, BC, BH, BBR, BBM)
OH1AA .. 1,168,116 1646 94 217
(Club Station)

Germany

DL4AK 380,808 614 84 174
(DL4AK, DL3BA, DL2NO, VQ)

Lithuania

UP2OK 888,900 1493 89 211
(UP2OK, NV, ON)

Netherlands

PE2EVO 468,992 897 73 156
(PAØIB, PAZ, PFW, PWA, RE, VO, WJG)

Norway

LA3T 146,160 569 34 82
(LA6JI, LA9FJ, LA5II, LA1CI, WK, LA2CI, LA5VK, LA2NI)

South America

Chile

CE6CA 1,738,143 2073 92 199
(CE6CC, EW, EZ, EF)

Ecuador

HC5CRC .. 1,287,510 1708 95 174
(HC5EJ, NW, MP, BZ, HC)

Venezuela

YV9AA 6,195,211 4232 136 381
(YV5AGD, AIP, ANF, BOA, BNW, BPJ, BPU, CIY)
YV5AKP .4,782,505 3678 122 333

Our thanks to the following stations who sent us their check logs: W1RIL, WB2QZD, WA4LSK, WB6SQP, W8HMO, WØIKD, DJØPN, DL6CO, DM4WNL, DM4UG, HB9IX, LA2MA/mm, LA9TI/mm, LU9DAH, LZ2-L93, OD5FC, OH2YV, OK1NH, OX3WX, PAØZGD, SM2-3706, SM3GJD, SM7ACB, SM7DML, SM7TQ, SMØBDS, SMØDZL, SMØGA, SMØIC, UA1CS, UP2NBG, UW9CE, VE3CEA, VK5WC, VP5RS, YV5BPG, ZL-149, ZL4LM, ZS6AJO.

[*Continued from page 41*]

VKs justify our generous by district awards.

It seems we erred in having our contest on the same dates as the Boy Scouts Jamboree. At least that is what the Scout Headquarters would have us believe. However as we all know, the *CQ* World Wide Phone Contest has been held on this same October week-end for many, many years. All I can say is, that the Scouts who operated in the 1966 Jamboree really earned their Merit Badge.

And now for a few individual observations. The only two single operator entries from Bermuda were made by outsiders. W2HTI was there to pick up his award for winning the 1966 Bermuda Contest, W3GHD was just there on a vacation. All the natives were over at VP9BDA's in a multi-multi operation.

GM5ABN/KP4BRY is probably the longest call ever used in a contest. Sandy thinks we should give him a bonus for working under this handicap.

Another Scot, GM3RFR was also operating under a handicap. He had to keep explaining that he was not really in Scotland but in the Shetland Islands. Which under the WAE country list counts as an additional country multiplier.

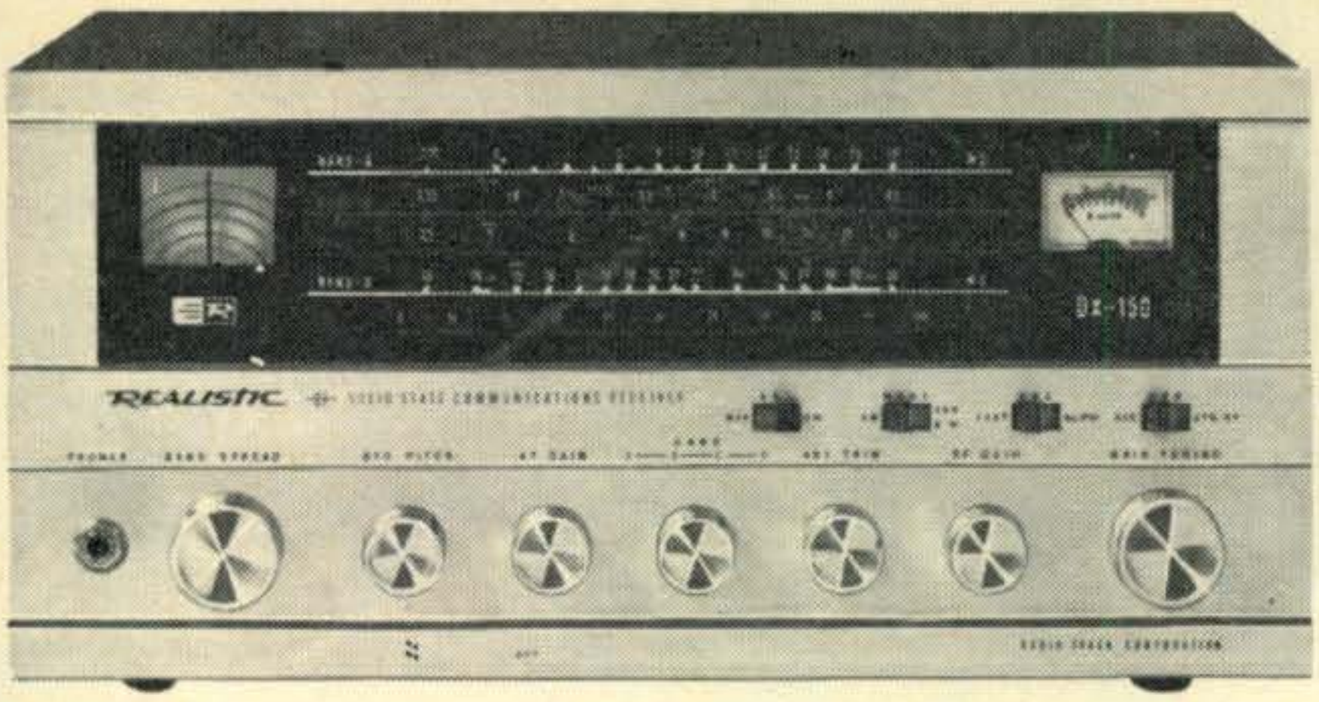
G3UML was critical of some of our W/Ks who don't know what zone they are in. Nothing much we can do about it Laurie, some of the fellows still only read "that other magazine."

You can't hold down a good contest man. Over at DL1TA's, contest operation was vetoed by the XYL, but Doc managed to sneak away from time to time and got in a few licks. (Just like you and I. Hi!) While VK5LC had to go away on a trip during the contest week-end, so Les packed his transciever and a whip antenna and also managed to put in some time.

CT1IW was on for only one day, Norberto was celebrating his birthday on October 22nd,

[*Continued on page 111*]

YV1AJ—YV5BQL and YV1QF at the operating position.



RADIO SHACK

BREAK THRU!!

ALL SOLID STATE

The World's First 117V/12V All-Transistor Communications Receiver Is Available Now In 150 Radio Shack Stores Coast to Coast!

THE REALISTIC® DX-150

- *Over 30 semiconductors — no tubes, no nuvistors — the DX-150 is 100% solid state!*
- *SSB/CW/AM reception, covering 535KC through 30MC in 4 slide-rule bands!*
- *Product detector for SSB/CW, plus fast and slow AVC; variable-pitch BFO!*
- *Illuminated electrical bandspread fully calibrated for the Amateur and CB bands!*
- *Cascade RF stage; ANL for RF and AF; zener-stabilized; OTL audio; illuminated "S" meter!*
- *Built-in monitor speaker plus front-panel jack for external (optional) matching speaker!*

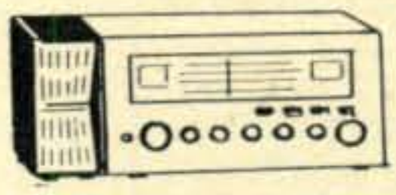
ONLY 119.95

New, big, exciting, professional — the Realistic DX-150 obsoletes tube receivers and warm up, banishes forever your dependence on house current to stay in operation. For example: **the DX-150 will run 100 hours on 8 D-cells** if current fails, or isn't available, or on field day. Additionally, it will operate from a car's cigarette lighter or any other mobile or base 12VDC source! Of course a 117VAC power supply is built in. DX-150 is a husky brute: 14⅛ x 9¼ x 6½", with a massive silver extruded front panel, solid metal knobs, grey metal cabinet, 14 pounds of quality.

A NEW STANDARD OF RECEIVER VALUE!

Priced Radio Shack's way (factory-to-you) the DX-150 saves you about $100 off traditional pricing methods. Yet it offers 11 front controls; dual power supply; 12¼" slide-rule dial in 5 colors; **continuous coverage** from 535KC through 30MC, including 160 through 10 meters; separate detector circuits for AM (diode) and SSB/CW (4-diode bridge); sensitivity good to 0.5μv at 30MC. Nobody **but nobody** but 44-year-old Radio Shack could have created this unique product for $119.95. You better believe it!

REALISTIC DX-150 CUSTOM ACCESSORIES



Exact-match external Voice-Frequency speaker cuts out built-in monitor, includes lead and plug. 20-1500: $7.95 (4 lbs.)

12VDC portable pack with all cables, plugs, 8-long-life batteries; includes plug-to-plug and plug-to-lighter cord sets. 20-1501: Only $7.95 (wt. 4 lbs. w/batteries)

THERE'S A STORE NEAR YOU!

ARIZONA — Phoenix
ARKANSAS — Little Rock
CALIFORNIA — Anaheim, Bakersfield, Covina, Downey, Garden Grove, Inglewood, La Habra, Long Beach, Los Angeles, Mission Hills, Mountain View, Oakland, Pasadena, Pomona, Reseda, Sacramento, San Bruno, San Diego, San Francisco, Santa Ana, Santa Monica, Torrance, West Covina
COLORADO — Denver
CONNECTICUT — Hamden, Manchester, New Haven, New London, Orange, Stamford, West Hartford
FLORIDA — Jacksonville, Orlando
GEORGIA — Atlanta
ILLINOIS — Chicago
KANSAS — Wichita
LOUISIANA — New Orleans
MAINE — Portland
MARYLAND — Langley Park
MASSACHUSETTS — Boston, Braintree, Brockton, Brookline, Cambridge, Framingham, Lowell, Medford, Natick, Quincy, Saugus, Springfield, Waltham, West Springfield, Worcester
MICHIGAN — Detroit
MINNESOTA — Minneapolis, St. Paul
MISSOURI — Kansas City, St. Joseph, St. Louis
NEBRASKA — Omaha
NEW HAMPSHIRE — Manchester
NEW JERSEY — Pennsauken
NEW MEXICO — Albuquerque
NEW YORK — Albany, Binghamton, Buffalo, New York, Schenectady, Syracuse
OHIO — Cincinnati, Cleveland
OKLAHOMA — Oklahoma City, Tulsa
OREGON — Portland
PENNSYLVANIA — Philadelphia, Pittsburgh
RHODE ISLAND — Providence, East Providence
TENNESSEE — Memphis, Nashville
TEXAS — Abilene, Arlington, Austin, Brownsville, Corpus Christi, Dallas, Fort Worth, Houston, Lubbock, Midland, San Antonio, Sherman, Waco
UTAH — Salt Lake City
VIRGINIA — Arlington, Virginia Beach
WASHINGTON — Seattle

ORDER BY MAIL! IN PERSON! FREE FOLDER!

RADIO SHACK
East: 730 Commonwealth Ave., Boston, Mass. 02215
West: 1515 So. University Dr., Ft. Worth, Tex. 76107
Dept. CQ

Please rush me the item I've checked below.
I enclose $_____, plus 50¢ for postage and handling:

- ☐ FREE 1968 Catalog
- ☐ FREE DX-150 Folder
- ☐ Receiver, 20-150, $119.95*
- ☐ Matching Speaker, 20-1500, $7.95*
- ☐ 12 VDC Power Set, 20-1501, $7.95*

** Plus Shipping Cost: 14 lbs., 4 lbs., 4 lbs.*

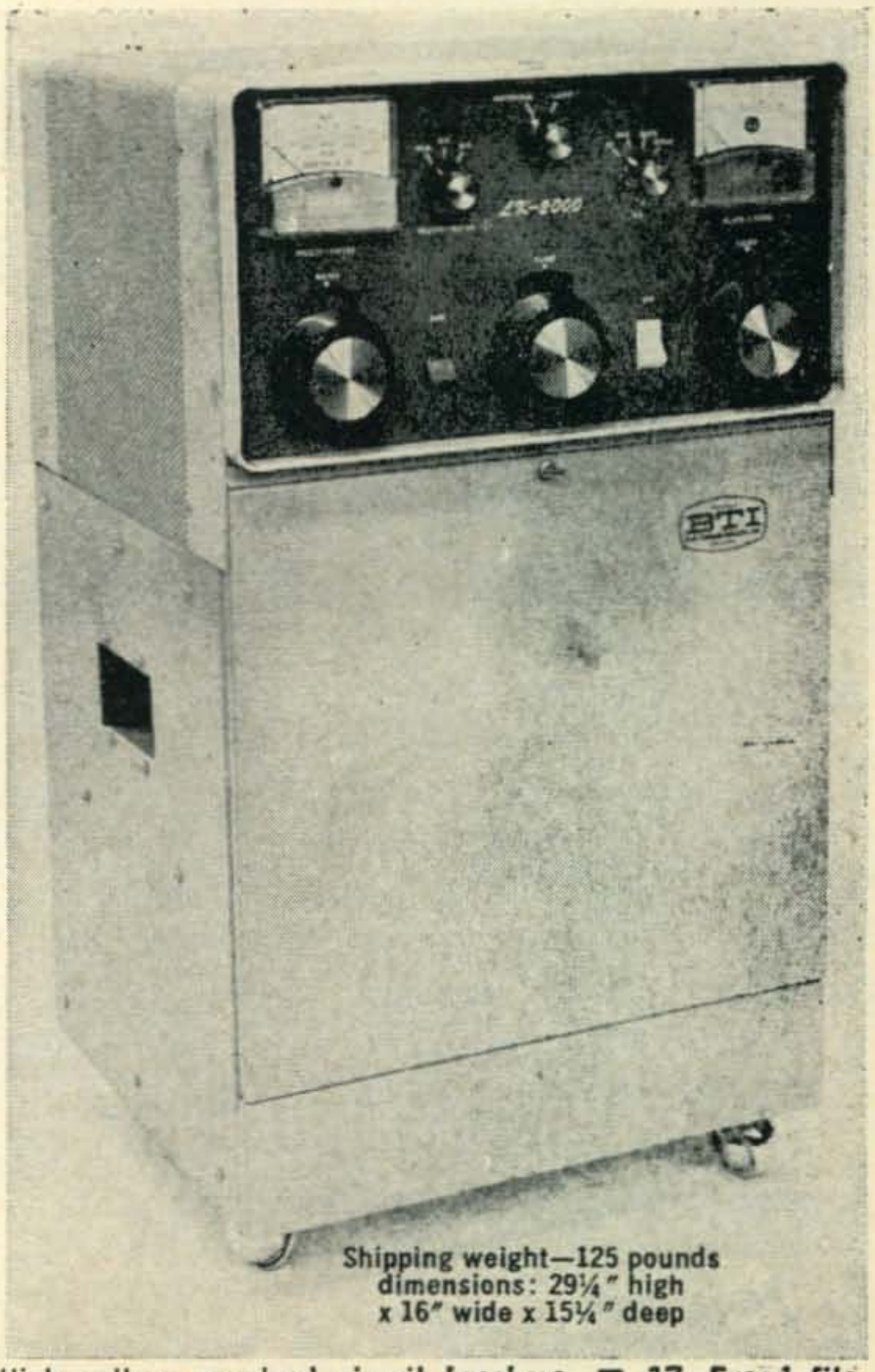
Name (print)_____
Street_____
City_____ State_____ Zip_____

For further information, check number 11, on page 110

NEW B. T. I. LINEAR STOPS THE SHOW

At Ham Conventions Everywhere

Thousands marveled at important and advanced features built-in the brand new



Shipping weight—125 pounds
dimensions: 29¼" high
x 16" wide x 15¼" deep

BTI LINEAR AMPLIFIER
MODEL LK-2000

YOU'RE THE EXPERT—CHECK FOR YOURSELF

■ 1. Designed for maximum legal input all modes. 2000 watts PEP SSB—1000 watts CW-AM-RTTY. ■ 2. Full 1000 watts plate dissipation using Eimac 3-1000Z. ■ 3. New tank circuit design provides greater output on higher freuencies including 10 meters. ■ 4. High Reliability Solid State Power Supply using Computer Grade capacitors for continuous duty. ■ 5. Instant transmit—no warm up—accomplished by BTI Solid State Supply and use of thoriated tungsten filament in 3-1000Z. ■ 6. Longer tube life because of exclusive after off cooling. ■ 7. A.L.C. output provides higher audio level without flat topping. ■ 8. Tuned cathode input for minimum distortion and higher efficiency (50 ohm inp.). ■ 9. Choice of Line Voltages—220V AC @ 10 amps or 115V AC @ 20 amps (Solid State Supply permits efficient 115 VAC operation). ■ 10. Metered relative R. F. watts output to antenna. ■ 11. Built in metering and switching for Dummy Load accessory which when attached provides dummy load for linear or exciter. ■ 12. Meter overload protection. ■ 13. Changeover relay feeds exciter direct to antenna when linear is off. ■ 14. All relays have D.C. coils for hum free operation. ■ 15. Safety switch and shorting bars for personal safety and component protection. ■ 16. High voltage overload circuit breakers. ■ 17. Fused filament and control supplies using lighted fuse indicators. ■ 18. Distinguished console (TVI preventive) design (29" H x 16" W x 14¾" D.) ■ 19. No exposed high voltage in lower console. ■ 20. Precision console casters for easy mobility. ■ 21. Grounded grid, zero-bias linear operation.

BRAD THOMPSON INDUSTRIES, long recognized for innovation in the electronics field, realized the need for a quality linear amplifier which would offer more features with reliable and rugged construction, at a price within practical limits.

Well-engineered, foolproof, simple operation, reasonably priced, fully guaranteed, the B. T. I Linear Amplifier provides the signal impact you've been wanting.

B. T. I. (Amateur Division)
83-810 Tamarisk Street—P.O. Box CCCC
Indio, California 92201

Write immediately for free 4 page illustrated specifications brochure or Contact your local distributor NOW.

$795

COMPLETE READY TO GO!

For further information, check number 37, on page 110

PRE-TUNING THE LINEAR AMPLIFIER

BY WALTER L. COSS,* W4RND

The author describes a method of making sure the homebrew linear will load out. The correct impedance transformation in the pi-network can be set beforehand using an antenna impedance meter (the "Antennascope") and a grid dip oscillator.

HOME constructed linear amplifiers frequently begin life with an obstinate refusal to load properly. The plate tank circuit should convert the load impedance of the antenna system into the specific load impedance required by the amplifier tube. If the plate tank cannot be adjusted so that this impedance transformation takes place, the amplifier will not load.

Fortunately, if the antenna load impedance is known, it is possible to pre-tune the tank circuit to provide the exact plate load required by the amplifier tube. The word "pre-tune" is used because the job can be done before any voltages are applied to the new amplifier. If desired, in a multiband amplifier, the variable loading control can be calibrated in terms of frequency to simplify the band changing problem.

Test equipment required is a minimum—a grid dip meter and an antenna impedance meter, two pieces of equipment which should be in every practicing amateur's workshop. Neither need be expensive. Kit equipment will do a very nice job.

Preliminary Considerations

Let's say the new amplifier is completed and ready for pre-tuning of the pi-network tank circuit. Three circuit values must be known before beginning: (1) the plate load impedance required by the amplifier tube (2) the capacity needed at the input end of the pi-network for the particular plate load impedance, Q and frequency, and (3) the impedance of the antenna system.

The required load impedance can be obtained from manufacturer's literature on the tube. If the figure is not published for the r.f. application it may be derived from data on a.f. usage. Note that, in the audio case, the manufacturer usually gives figures for the plate-to-plate load required in a push-pull circuit, while the r.f. circuit in which we're interested is usually single ended. For example, the plate-to-plate load for two type 811A tubes in a Class B push-pull audio application at 1500 volts is 12,400 ohms. In the Class B single ended r.f. circuit using one 811A at 1500 volts the load would be 6200 ohms. If four 811A tubes are used in parallel the load is 1550 ohms.

The plate tuning capacity required at the input end of the pi-network can be determined from the formula

$$C = \frac{159{,}000\ Q}{R\ f}$$

Where C = The plate tuning capacity in mmf.

Q = The desired operating circuit Q, usually 12 or 15.

R = The load impedance for the tube in ohms.

f = The frequency in mc.

It would be wise also to have handy the values of inductance and output capacitance needed for the tank circuit. Many excellent articles have been published describing methods for calculating these values.[1] Having them available is not necessary to perform the pre-tuning, but they can serve as a starting point and as a check on the results.

In most amateur stations the antenna system impedance is either 52 ohms or 72 ohms at the point where it is being fed by the final amplifier. More on this later.

Equipment Setup

Figure 1 shows the test setup for performing the pre-tuning operation. The antenna impedance

*3311 Parkside Terrace, Fairfax, Virginia 22030.

[1]Marriner, E. H., W6BLZ, "Practical Pi-Network Design Data," *CQ*, Aug. 1962, page 44.

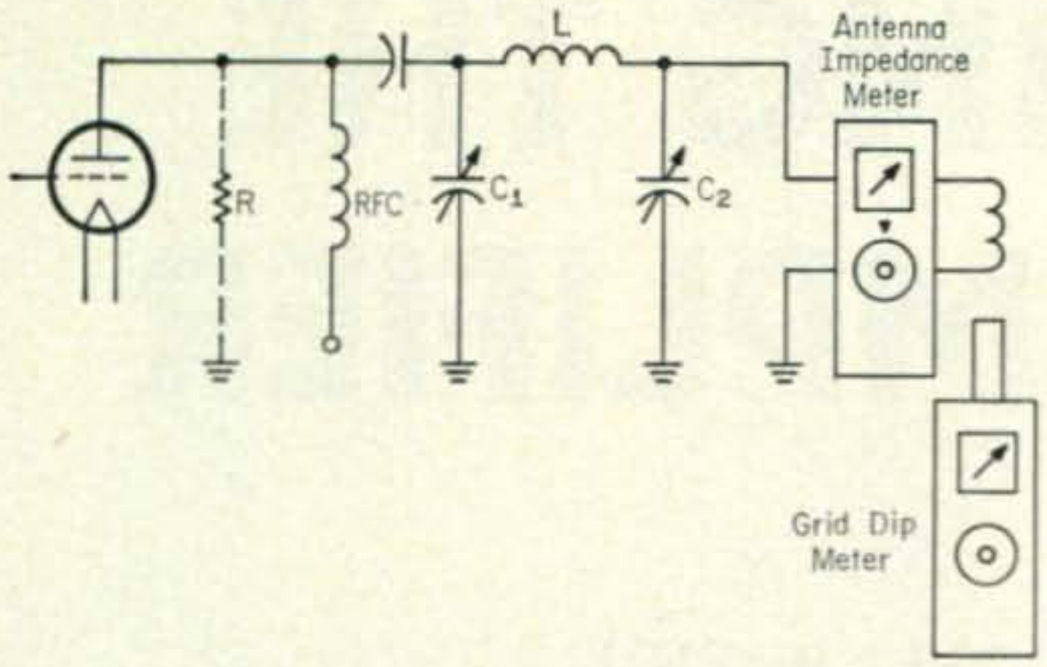


Fig. 1—Circuit and equipment setup for the pre-tuning operation.

meter is connected to the output terminals of the amplifier and is fed by the grid dip meter through a two or three turn link. The antenna impedance meter is set to the value of the antenna system impedance, presumably 52 ohms or 72 ohms.

Resistor R is temporarily connected between plate and ground of the amplifier tube. The value of this resistor should be within a few percent of the load impedance required by the amplifier tube. One watt dissipation rating is sufficient but the resistor must be non-inductive and the leads must be as short as possible.

Since part of the input capacitance of the tank circuit is provided by the plate to ground capacity of the amplifier tube, the tube should be in the socket but without any voltages applied.

Capacitor C_1 should be set for the value of input capacity previously calculated less the plate to ground capacity of the amplifier tube and the estimated stray circuit capacity. Admittedly, an element of guesswork enters here, but it is not difficult to estimate an intermediate value for a variable capacitor with acceptable accuracy. In any event, an error made here will affect only the Q at which the circuit will operate. So, if in doubt, err in the direction of a little too much capacity rather than not enough. A little extra capacity means that the tank circuit will operate at a slightly higher Q than originally planned.

The grid dip meter should be set for the frequency at which the tank circuit is to be pretuned. Monitor with the station receiver. Don't rely on the dipper dial calibration or resistance to frequency pulling.

Pre-Tuning

The object now is to adjust the values of inductance L and output capacitance C_2 to obtain a null on the antenna impedance meter. When the null is obtained, the impedance at the output terminals of the amplifier will be exactly the same as that of the antenna system.

There will be only one combination of L and C_2 which will give a complete null. The setting of C_1 should remain essentially fixed during adjustment of L and C_2. However, due to the practical difficulties of adjusting the inductance exactly on the nose, it may be necessary to fudge a bit by changing the setting of C_1 slightly to obtain a complete null. This will, of course, result in a slight change in operating Q of the circuit but not in its impedance transformation characteristics.

When suitable values of L and C_2 have been determined, the test equipment and temporary resistor can be removed. At this point the tank circuit, when terminated by the antenna system load, will present the correct load impedance to the amplifier tube and the tube will therefore be loaded.

Let's take a concrete example. Suppose the antenna system is fed through an antenna coupler equipped with an s.w.r. meter and that the coupler can be adjusted to maintain a 1:1 s.w.r. on the 52 ohm coax line from the amplifier. Suppose the amplifier uses four 811A tubes in parallel grounded grid at 1500 volts thus requiring a plate load of 1550 ohms. Operation will be on 14.3 mc and with a tank Q of 15.

Using the formula previously given, the pi-network input capacitance works out to be 108 mmf. The output capacity of four 811A tubes in grounded grid is 22.4 mmf (four times the plate-to-grid capacity of 5.6 mmf). Estimate approximately 20 mmf for stray capacity. Then for the pre-tuning operation C_1 should be set at about 66 mmf ($108 - 22.4 - 20 = 65.6$)

The antenna impedance meter will be adjusted to measure 52 ohms. The temporary resistor will be 1550 ohms.

Of course we don't want to stop with a calibration good for only one frequency. If this is a multiband amplifier, the pre-tuning method can be used to simultaneously set up the band-switching taps on the tank inductor and to calibrate the variable loading capacitor for each band. The inductance should be established for the band center frequency, but the loading capacitor calibrated for both the band edge and center frequencies so that interpolations can be made. If the loading capacity is provided by switching in fixed capacitors, the required values will have

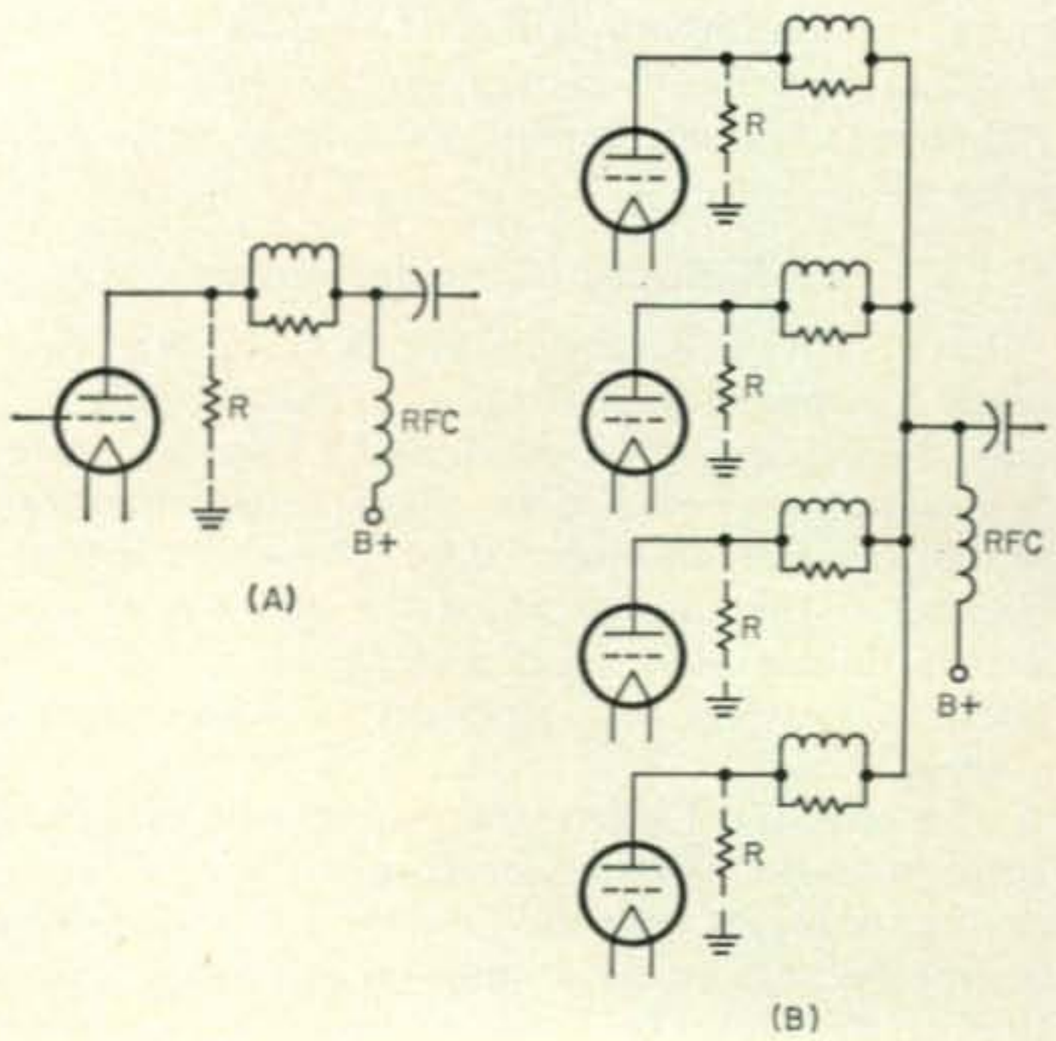


Fig. 2—Temporary resistor connections for (A) single tube amplifier and (B) multi-tube amplifier.

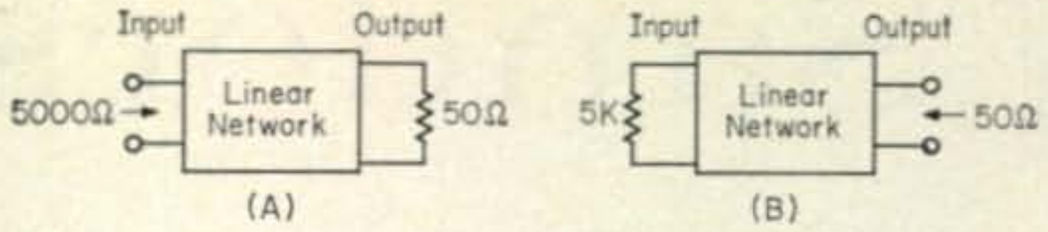


Fig. 3—Diagram illustrating network theory on which pre-tuning technique is based.

previously been calculated and installed for the band center frequencies. The pre-tuning method can then be used to determine the tank inductance at the band center frequency.

When calibrating a variable loading capacitor on 80 meters, note the surprisingly wide variation in loading capacity needed to cover the band. The variation decreases, of course, on the higher frequency bands.

Precautions

Here are several precautions to observe when pre-tuning tank circuits.

First and foremost, when the pre-tuning is completed *remove the temporary resistor before applying plate voltage*. A low value one watt resistor explodes with considerable violence when hit with 1500 volts or so.

If there is a parasitic suppressor in the plate lead of a single tube amplifier, the temporary resistor should be connected at the plate side of the suppressor as shown in fig. 2(A). If the amplifier uses several tubes in parallel with a parasitic suppressor in the plate lead to each tube, it is usually physically easier to connect the temporary resistor at the junction of the suppressors and the hot end of the RF choke. This connection will be satisfactory when pre-tuning on the lower frequencies, say 14 mc and below. However, at the higher frequencies the reactance of the suppressors may become great enough to cause inaccuracies. Therefore, if the tank circuit is to be pre-tuned at the higher frequencies it may be necessary to use an individual temporary resistor for each tube connected directly from the plate to ground as in fig. 2(B). In this case each temporary resistor should be equal to the required load impedance for one tube used alone. For example, in an amplifier using four 811A tubes in parallel with a parasitic suppressor in each plate lead a temporary resistor of 6200 ohms would be connected from plate to ground of each tube.

Once the tank circuit has been pre-tuned and the loading control calibrated for a specific output impedance, it is necessary to insure the antenna system always presents that specific impedance to the amplifier. Otherwise, the calibration of the loading control will not be correct and the load presented to the amplifier plate will be something other than that set up during pre-tuning. The easiest way to be certain of the antenna system impedance at all times is to use an antenna coupler with an SWR meter in the coax feed line between amplifier and coupler.

To tune the amplifier with power applied, connect the proper load impedance, set the loading control to calibrated position and tune the plate tuning capacitor for maximum output. However, with a new amplifier, don't stop here. Check for linearity using the standard two tone test. While the loading problem has been solved there may be other problems to be dealt with before that amplifier merits a place in the station rack.

Theory

This adjustment technique is based on the reversible properties of linear networks. Let's take an example. Assume a linear network (the plate tank circuit qualifies) which, when terminated at its output terminals by a 50 ohm load, presents a 5000 ohm impedance across its input terminals. See fig. 3(A). We know from network theory that if a 5000 ohm impedance is placed across the input terminals of this same network, the impedance across the output terminals will measure 50 ohms. See fig. 3(B).

In the pre-tuning method just described we have placed the required plate load (in the form of the temporary resistor) across the input terminals and then adjusted the network so that the output terminals show an impedance equal to the antenna system impedance. Now, when the network is terminated by the antenna system and the temporary resistor is removed, we know that the tube will be looking into the proper load impedance—in other words, the amplifier will be loaded.

Other Applications

This pre-tuning technique can be used to adjust any tuned circuit connecting two fixed non-reactive impedances which are known beforehand. The only requirement is that one of the impedances be within the operating range of the antenna impedance meter, usually 10 to about 600 ohms.

Pre-tuning a linear amplifier tank circuit is an easy job. It is so easy that you can now cross off "fear of loading problems" from the list of reasons for not building your own linear. ■

New Amateur Product

Jensen

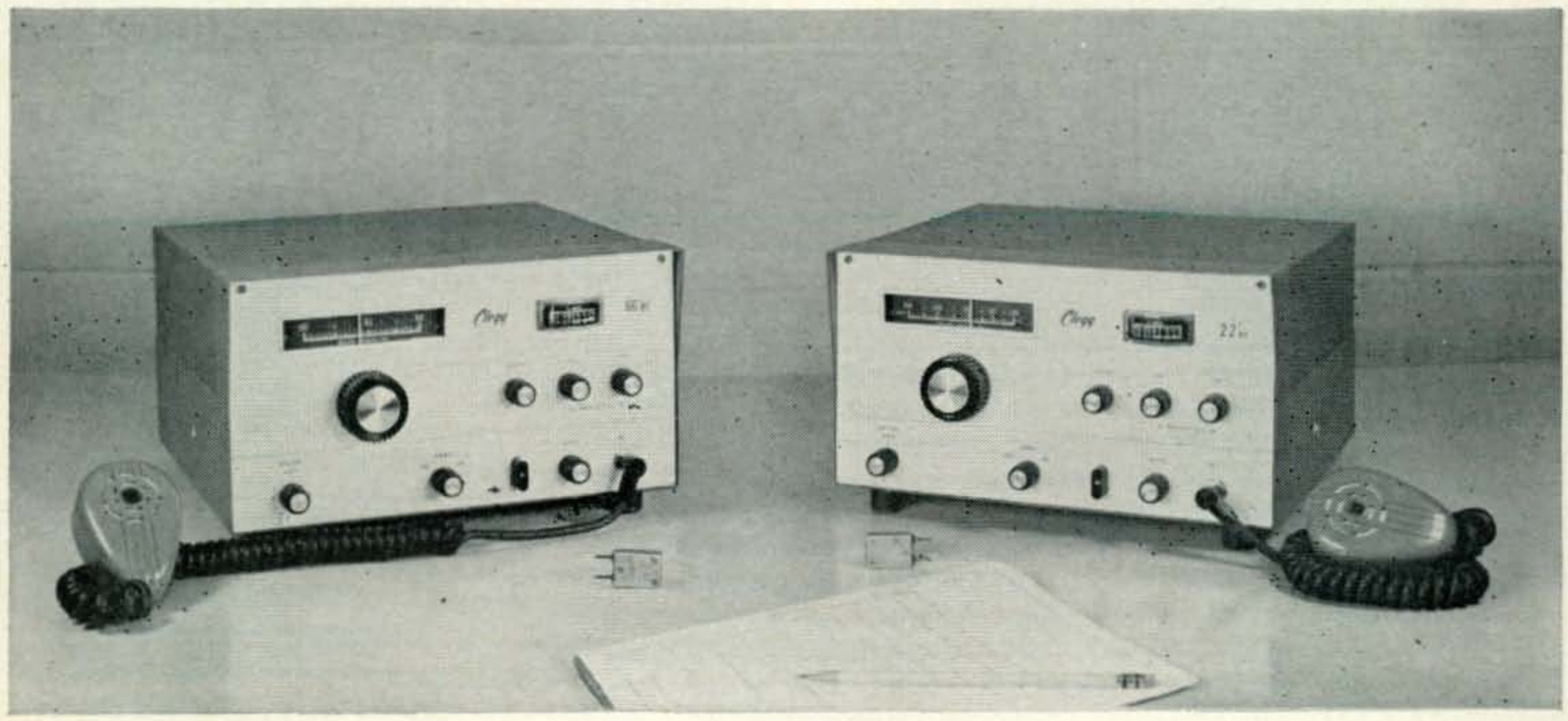
JENSEN Tools and Alloys announces their new catalog (No. 266) featuring 58 pages of tools useful to the amateur. Over 1500 different tools are offered and described in the new catalog. Also notes on proper tool selection and use are featured. For a free copy write either directly at 3630 E. Indian School Road, Phoenix, Arizona, 85018, or circle 67 on page 110.

Squires Sanders

VHF

is a specialty at Squires-Sanders. Effective designs for receiving and transmitting equipment for these frequencies demand a unique engineering and production approach – different circuit arrangements, experienced selection of active components, critical production procedures and unusual test equipment and alignment routines. Success cannot be achieved by alteration of designs originally intended for lower frequencies. In amateur products, the 22'er* two meter transceiver and the 66'er** six meter transceiver are examples of these unique talents working to produce top performance VHF equipment at modest cost. They are an attractive and effective pair for a complete VHF installation.

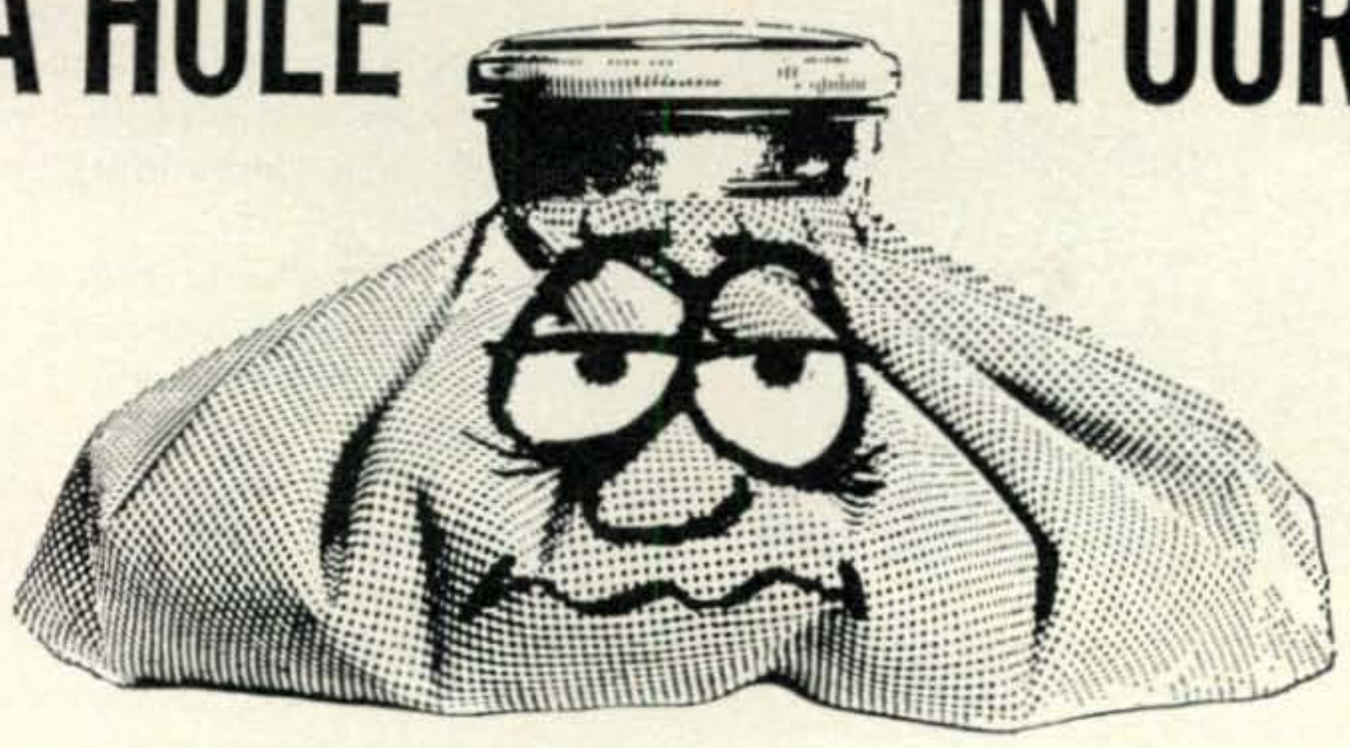
*QST — APRIL 1967, PAGE 48 **QST — APRIL 1965, PAGE 38



See your dealer for details or write today to SQUIRES-SANDERS, INC., Box 319, Millington, N. J. 07946

For further information, check number 8, on page 110

LIKE A HOLE IN OUR HEAD



BY SYLVIA MARGOLIS*

IT's not true that a good Editor should have tasted his mother's wedding cake. I know, because my husband and I are an Editor and we were born in wedlock.

You can be an Editor for money. What you earn helps pay the surgeon's bill when you pop your ulcer. Or you can do it for love, love of humanity, or love of the gospel you preach or just love of seeing your name in print, unassailable, impregnable, right up there, month after month. It's a great feeling and you get to enjoy it like a hole in your head.

I walked straight into it, like a young girl into an apartment full of etchings, and I came out roughly in the same condition.

In 1959 Maurice gave up being a responsible husband, citizen and businessman and became G3NMR. Nothing more was to matter except the state of being G3NMR. There was the station to be set up and TVI complaints to be answered. They came as fast and enthusiastically as replies to a Don Miller CQ and lost us the affection of those few neighbours who still spoke to us after the erection of the antenna tower.

There came the radio magazines. We had a pile in each room, including the smallest room, to which one of the newer U.S. publications was always elevated, because its Editorials made such suitable reading there. When I said either the magazines are tidied, or I go, he offered to carry my bag to the station, but I made him see it my way and we collected all the journals together and counted them. There were 223. We sorted out those that were tattered beyond use, duplicated, irrelevant or obsolete and counted the remainder. There were 235.

And of course there was mobile operation, which seemed to take masochism to the point of the ridiculous. Added to normal problems of building, installing and activating a station, it presented a fresh set of obstacles—suppression, power supplies, space limitation, antenna design and mounting, safety. To solve these problems, just for the doubtful privilege and pleasure of carrying the noise about with you in your car, seemed the ultimate in nuttiness.

But ours is a home where my husband is never wrong, so mobile we went and he joined the Amateur Radio Mobile Society, which had been formed that year to cater for the new and blossoming mobile interest in Europe.

All societies grow to a defined pattern, whether they exist to rebuild a church, to protest or to preach a new and dotty philosophy—like mobile operation. The club starts modestly, with high hopes. Should it flop, it retreats into Limbo. If the road to Hell is paved with good intentions, then the road to Limbo must be littered with the Minutes and Articles of Constitution of societies that never got beyond the first A.G.M.

But let a club succeed and it soon seeks to reaffirm its existence, to make its mark. Inevit-

"Mobile Madness"—mobile antenna array spotted at one of the European mobile rallies covered by *Mobile News*. This one was in Brussels.

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

What the well-dressed woman wears for a mobile picnic —typical scene at a British mobile hamfest. This one took place at Langleat House, Wiltshire, ancestral home of the Marquis of Bath.

ably it chooses to immortalize itself in the printed word. That's where we came in, to a drive-in movie that had no exit.

Maurice had an ancient duplicator, which he had bought at a government surplus auction. It was rusting in decent retirement, behind the War Department book press, the lathe and a do-it-yourself obstetric kit, all of which he had to buy outright, as one lot, to get hold of a power supply and terminal unit for a teleprinter, which he never used.

He returned from a night with the Boys, at the home of Joe Steele, G3KZI (See "Not Over Our Transmitter . . ."—March *CQ*) where, between arguments about whether it would be possible to get an expedition onto Rockall (they were at it already, in 1959!) a momentous decision had been taken, to go into print! Hallelujah!

Maurice stumbled round the dark bedroom, pretending he had been home and in bed for hours and had just gone downstairs for a sandwich. "So what's new?" I muttered.

"Remember you said you don't have enough to do and you'd like to get back into the word business? They've made me Honorary Editor of the *A.R.M.S. Newsletter* and you're going to do the typing!"

Me, who didn't believe Ohm's Law.

Me, the blood of all those magazines I had thrown out still on my hands, that Night of the Long Knives, was going to produce another magazine.

The first *Newsletter* was a single, mimeographed, foolscap sheet. I had to copy a list of mobile DX worked by the people who had been at Joe's. It looked pretty dull stuff to me, just letters and numbers. So next month I added a couple of home-brew limericks, faintly rude and not very clever, real undergraduate stuff, but they took a lot of thought. The young men from Peru and Berlin and St. Louis came out fine, but try rhyming upper sideband suppression. They made their impact, though, and five of the Society's fifty members resigned at once, sending long plaintive, or long furious, letters about making a mockery of amateur radio.

Seven year later *MOBILE NEWS* is a bulky, prestigious, authoritative magazine, with readers in every continent and in over thirty countries. Like the new-hatched amateur who put out his first CQ and Don Miller came back to *him*, we wonder how we got to be this way.

It's hard work, demanding and rarely rewarding, except for the occasional letter from a satisfied customer, or the several times when *Mobile News* has been complimented, and even quoted, in commercial publications. Like all communal work it makes you vulnerable to insult. We have been accused of frivolity, incitement, irrelevance, blasphemy, obscenity, communism, fascism, perversion, corruption and misappropriation of public moneys.

Misappropriation? Such profits they should all misappropriate, every one of our critics!

They should see my dining room carpet, for instance. For years we handled the collating, assembly and despatch, as well as editing and production. So one dining room carpet was completely worn out with the trampling of the assembly party, who must circle the table, like demented folk dancers, to pick up a set of pages.

Sometimes, to get this task completed, I would invite guests. By now all our friends were radio amateurs. The others had drifted off, hurt and bewildered, years before. I never told the guests what was planned, just fed and wined them well, then suggested we play a lovely, new and very fashionable game, called "ASSEMBLY." Thinking, perhaps, that it was a version of "KEYS," they usually complied, although we even lost a couple of radio amateur friends, this way. They lacked "ham spirit."

We no longer handle assembly and despatch, but the editing and production remain irrevocably ours.

Over the editing we squabble with vicious consistency, me and my Two Bosses.

A firm non-believer in Ohm's Law, I prefer non-technical articles. I admit I'm wrong as wrong can be. My husband tells me this and so does his ally, our collaborator in *Mobile News*, Norman Fitch, G3FPK. He has been Honorary Secretary of the Society for as long as we have been Honorary Editors, which proves he is as deranged as we are.

I am wrong to suggest that, although amateur radio is a tremendously serious business, and it

At least the cover is finished—see it there on the desk—but what about the rest of this month's "copy?"

would be sacrilege to laugh at it, might we laugh a little *with* it? Even doctors make doctor jokes sometimes. My entirely misguided opinions are supported only by the many readers who say that their wives read *Mobile News* right through, before they themselves ever get to see it.

We British women are still treated as inferior, and very nice, too. That's the proper way of things, so I don't mind being told it's a lot of silly female nonsense to assume that radio amateurs are human, too, despite the impact made by this series of non-technical, frivolous articles in *CQ* magazine.

Nevertheless, according to my Two Bosses, *Mobile News* must be a serious, technical journal. My flights into irrelevance, bawdiness and querulousness, which the wives seem to enjoy, must be severly curbed.

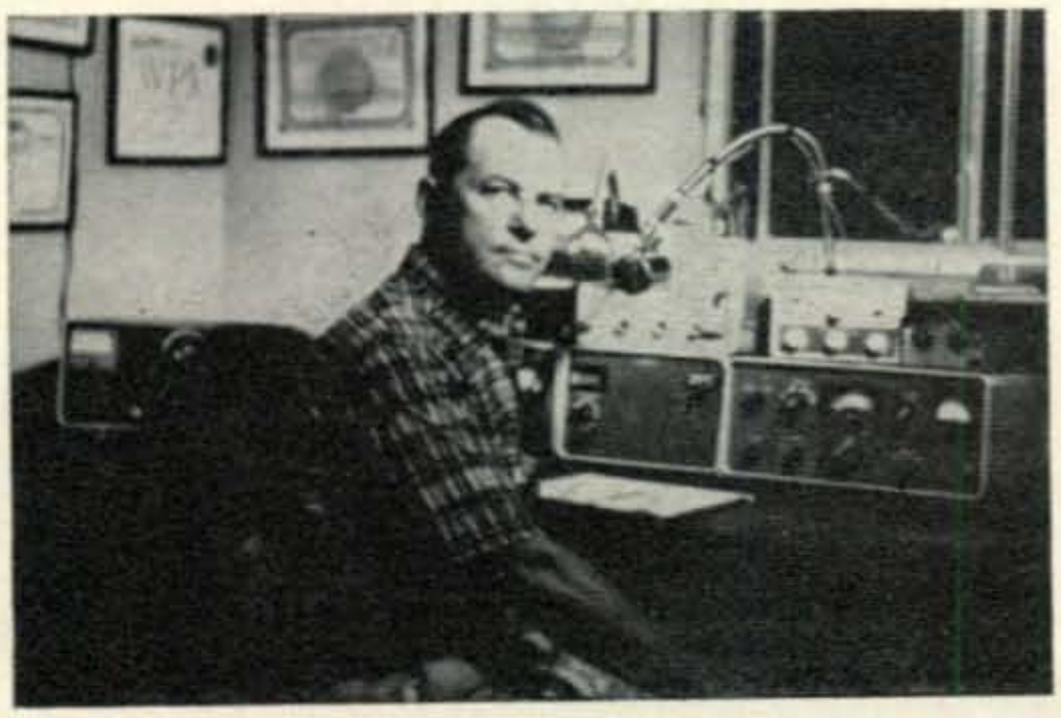
Technical they want and technical they must have. Just like that—like tuning the band and expecting the VR6 to be there, waiting for you! Good technical material is rare enough when you pay for it. When you want it for free, or for the small fee we pay, you attempt something that makes this Rockall Dxpedition they keep blathering about seem as easy as a day trip to Coney Island.

We solicit, blackmail and extort our copy, stopping at nothing to find it, battening without mercy, ethics or principles on friendships and favors.

"Remember that time I helped you clear up all your TVI complaints, when your neighbors were threatening to chop down your beam? Then do me a thousand words on F.E.T.'s?"

It's a dirty game and we play it dirty. It's a double-edged game, too. I get requests from somebody who saved us once, galloping in like the U.S. Cavalry, just in time, with an article on suppression or s.w.r. Could I do a short article for his magazine? Could I hell! I have to, don't I? Then I can put the black on him next time I desperately need an article on suppression or s.w.r.

Being an Editor means that you can reject material, although we rarely reject feasible technical contributions, unless the process suggested would result in the disintegration of the reader's transmitter, or his car or the reader. My Two Bosses



W4NJF, Gay Milius, who writes the North American Column.

. . . gift-wrappd, with built-in demons. The author and her husband, G3NMR, Maurice Margolis, coping with an off-set emergency.

like to make like Editors, flinging articles out scornfully.

I'd love to do this, to wear an eye shade and shirt-sleeves and be surrounded by phones and beer bottles and bismuth tablets and to yell "BOY" or "COPY" and to do all the things Editors do in movies. But I remember that Dead Line Day is here and all we have so far is the Secretary's notice of subscriptions due, which by itself, is hardly enough to hold the readers' interest for another month. So I point out the clause we always publish about not accepting responsibility etcetera and they turn back to the article, to try to make some sense of it.

With limited space available, it's difficult to hold everybody's interest all the time. Mobile operation is only one section of amateur radio, but already it has divided into several sub-sections, v.h.f., s.s.b. DX, Top Band, into which 95% of British mobiles come, even mobile c.w. and mobile on a bicycle. Then there is the Great Schism—the Builders versus the Buyers. This pinpoints the very basis of modern amateur radio thought—what do you understand by amateur radio? Is it a means of communication or is it a science to devise the means of communication?

Our readership calls for editing of a very special kind. *Mobile News* is possibly the only truly international amateur radio journal, trying hard to understand and satisfy readers all over the world. One difficulty is the English language which, for lack of any better substitute, is still used in North America. If we say:—

> *". . . the bonnet, silencer, exhaust pipe and boot lid must be effectively bonded to the chassis to provide good earthing and H. T. leads should be adequately screened . . . . . "*

an American member will remember that the British are effete, decadent, reactionary, snobbish stuffed shirts—and he will resign!

But if we say:—

> *". . . . the hood, muffler, tail pipe and trunk lid must be . . . . to provide good grounding and the B-plus leads . . . . . "*

bet your life in irate British member will point out that all Americans are blasted foreigners, and damn' colonial rebels into the bargain—and resign!

Nationalism is just fine with 3,000 miles of

Pond in between. But amateur radio reduces that pond to a piddle of a puddle and, in a magazine that must reduce the gap still further, a hair-line balance must be drawn. To do this we get real crazy mixed up, talking of "tubes" one month and "valves" the next, of "colour programmes" and "color programs," "10 to 80" and "10 thru 80," of "windscreens" and "windshields."

Once we've got the material, it has to be edited, compiled, composed, translated, bowdlerised, plagiarised and wangled into some semblance of sense and continuity.

It must be turned into English, whether it comes from Benares, Basle, Birmingham, Ala. or Birmingham, England. Because a man is clever enough to write an erudite technical article, he isn't necessarily literate, or even articulate. Sometimes he is offended when you alter his words. Useless to explain that, great as his grasp might be of integrated circuitry technique, he still leaves dependent clauses dangling in outer space, like unanswered CQ's, that his soldered joints might be just dandy, but his participles remain obstinately unattached.

Blood, sweat and tears later the baby is ready for print. At this stage my participation theoretically ceases. I am still needed, though, during the printing process, to keep my hands over the children's ears, so they shouldn't hear all the naughty words their Daddy knows, to make sure the transmitter is switched off, for the same reason, to produce strong coffee, commiseration and alka seltzer.

Back of our house is a patio which, we imagined, when it was built, in the happy time before amateur radio, would be a sun lounge, play room, orchid house, our little bit of gracious living. Now it is a print shop, dominated by the resident off-set litho.

These machines, and their equally bloody-minded cousins, the duplicators, arrive gift-wrapped with built-in demons, who play pranks on Christmas Eve, Yom Kippur, at the start of a 4-day smog or when all the repairmen are down with flu. No matter how new, expensive and cossetted, it will choose the most laugh-making moment. Sometimes it throws sheets of paper around with reckless abandon. Or it squirts ink all over the paper and operator. Or it tears the paper and the irreplaceable stencil, the one with the intricate technical drawings that you had to mortgage your very honor to get drawn up, into interesting shapes. Or, with simple, folksy humor, it explodes. Or implodes.

The A.R.M.S. litho dominates our home like an ancient relative, peevish, cantankerous and good for trouble when we can least afford it. Will it blow its top this month or did the exasperated repairman's last visit exorcise the evil spirit? Then, when you think you've got the s.o.b. tame at last, surprise, surprise!

There are times when we decide we've had enough, that this will be the last ever edition, that we'll resign. Then we see the new issue, stacked in lovely piles, ready to carry our ideas wherever in the world people are daft enough to install radio gear in a car.

What drives people like us is a kind of conceit. If you stop, then you have failed. If you don't progress forwards, you have taken a step backwards. Your project becomes an extension of you and its success is your personal success. Only this can explain the phenomenon of *Mobile News* and of those scores of other voluntary publications that amateur radio inspires.

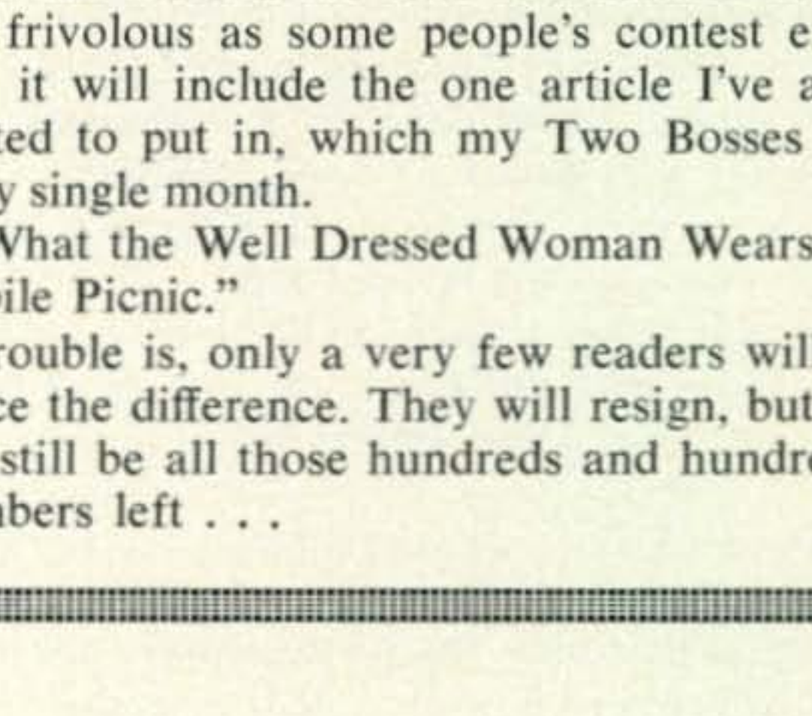
On some good friends we know we can rely —on Edgar Wagner, G3BID, our International Relations Adviser, who contributes useful copy each month; on Gay Milius, W4NJF, who writes our North American Column; and on the readers, the radio amateurs who come back year after year with their subscription, which, I suppose, is their way of saying "thanks!"

Mobile News is brash, upstart, undignified, regrettably impetuous in its attacks on smug Establishment or pompous self-importance, but it welcomes new ideas and truly tries hard to help solve some of the problems that beset and imperil amateur radio.

Occasionally, when the Offset Demon, temperamental authors, my Two Bosses, Lord North's ghost and the whims and caprices of radio amateurs get to be too much even for my tolerance, I do plan that last issue. Sensational, it will be. I'll use the title by which we always refer to it in our intimate moments—"NUBILE NUDES." Obscene it will be, so that it makes "Last Exit to Brooklyn" read like Yogi Bear, and irrelevant without an ohm or a resistor in sight, and frivolous as some people's contest entries. And it will include the one article I've always wanted to put in, which my Two Bosses reject every single month.

"What the Well Dressed Woman Wears for a Mobile Picnic."

Trouble is, only a very few readers will even notice the difference. They will resign, but there will still be all those hundreds and hundreds of members left . . . ■



". . . Well OM I don't want to keep you from your lunch . . ."

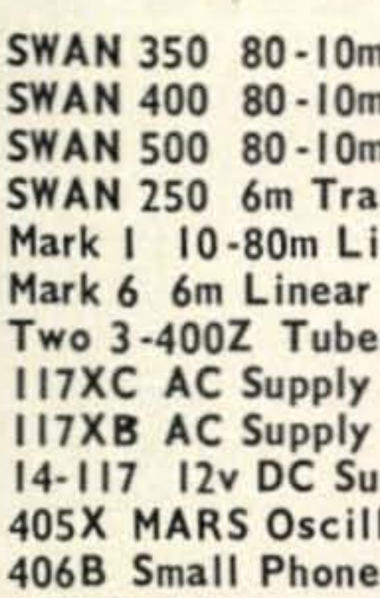
SWAN SWAN

LOOK at your low Monthly Payment
AFTER JUST $5.00 DOWN

SWAN 350	80-10m Transceiver	(14.98)	$420.00
SWAN 400	80-10m – No VFO	(14.98)	420.00
SWAN 500	80-10m – Deluxe	(17.69)	495.00
SWAN 250	6m Transceiver	(11.55)	325.00
Mark I	10-80m Linear - less tubes	(16.79)	475.00
Mark 6	6m Linear - less tubes	(16.97)	475.00
Two 3-400Z Tubes for Mark I or 6			68.00
117XC	AC Supply for 350/250		95.00
117XB	AC Supply for 400		75.00
14-117	12v DC Supply w/cable		130.00
405X	MARS Oscillator - less crystals		45.00
406B	Small Phone Band VFO		75.00
410	Full-Coverage VFO		95.00
210	6 Meter VFO		120.00
VX-1	Plug-in VOX for 350 & 400		35.00
SSB-2	Selectable Sideband kit for 350		18.00
22	Dual VFO Adaptor for 350 & 400		25.00
100kc	Calibrator kit for 350		19.50
500kc	Calibrator kit for 250		19.50
RC-2	Remote Control kit for 400		25.00
45	Swantenna – Manual		65.00
55	Swantenna – Remote Control		95.00
Custom Contour Bumper Mount			24.95
Kwik-On	Antenna Connector		3.25

NOTE: Avove are listed the "Standard - Everyday" Swan products – Below are listed some Special Purpose items:

14X	12v DC Module w/cable	$ 65.00
14XP	As above, but Positive Ground	70.00
117X	Basic 117v AC Supply ONLY	65.00
230X	Basic 230v AC Supply ONLY	75.00
	117 or 230vac Line Cord (specify)	5.00
	8' Cable w/plug (Supply to Transceiver)	3.00
	Cabinet w/Speaker & AC Line Cord	30.00
230XC	230v AC Supply for 350/250	105.00
14-230	12v DC Supply w/230v Basic	140.00
230XB	230v AC Supply for 400	85.00



AMATEUR ELECTRONIC SUPPLY

4828 West Fond du Lac Avenue
Milwaukee, Wisconsin 53216
Phone (414) 442-4200

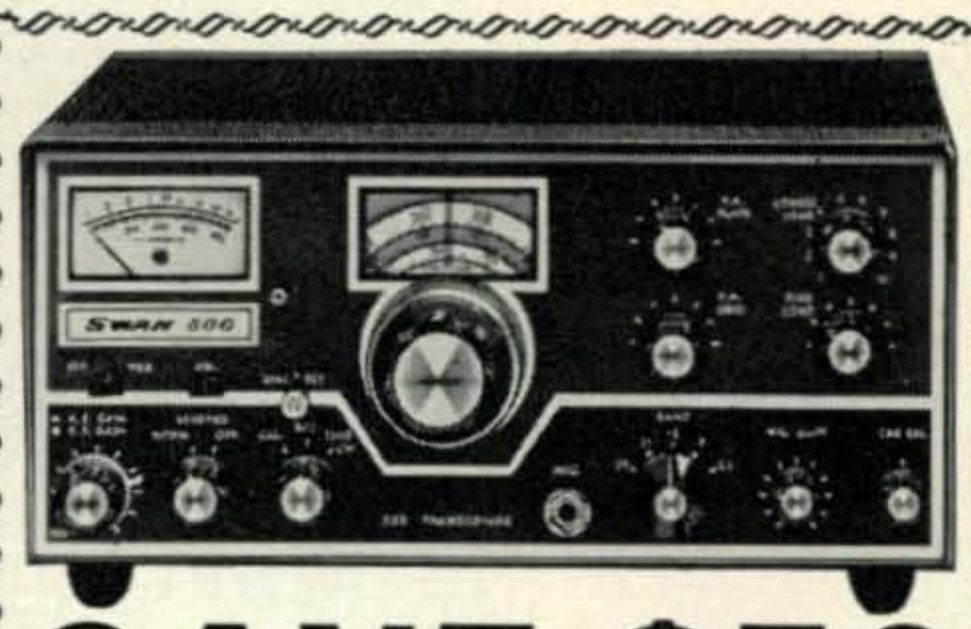
MILWAUKEE STORE HOURS: Mon & Fri - 9 am to 9 pm; Tues, Wed, Thurs - 9 am to 5:30 pm; Sat - 9 am to 3 pm

IMPORTANT! – Be sure to send all Mail Orders and Inquiries to our Milwaukee store, whose address is shown above. VISIT – Please do not write the following Branch stores – they are set up to handle walk-in trade only.

CHICAGO, ILLINOIS
6450 Milwaukee Avenue
Phone (312) 763-1030

ORLANDO, FLORIDA
19 Azalea Pk. Shpg. Ctr.
Phone (305) 277-8231

CHICAGO & ORLANDO STORE HOURS: Mon, Wed, Thurs - 12 to 9 pm; Tues & Fri - 12 to 5:30 pm; Sat - 10 am to 4 pm



SAVE $50

Purchase any new Swan transceiver or linear at the regular price with no trade-in and you may take a $50.00 Credit toward the purchase of any other merchandise.

Order Today direct from this ad !

Terry Sterman, W9DIA
Proprietor

TRADES ??
GET OUR DEAL TODAY!
Use Handy Coupon Below

Ray Grenier, K9KHW
Mgr. Mail Order Sales

To: **AMATEUR ELECTRONIC SUPPLY**
4828 West Fond du Lac Avenue
Milwaukee, Wisconsin 53216 C

I am interested in the following new equipment:

I have the following to trade: (what's your deal?)

Ship me the following New Equipment.

I enclose $_____, I will pay balance (if any)

☐ COD ☐ 1 year ☐ 2 years ☐ 3 years

Name _____

Address _____

City _____

State _____ Zip _____

☐ SEND YOUR NEW 1967 CATALOG.

For further information, check number 6, on page 110

THE SELF RESONANT TWO ELEMENT BEAM

BY HENRY G. ELWELL JR.,* W2JKH

How to get better performance from the station is of great interest to most amateurs. If money is a small consideration, no problem exists. Most of us, however, must consider finances, and therefore strive for improvements at minimum cost.

The antenna system of a station is a rich source for improving performance, and pays off handsomely when a good design is available. Since 1936, W2JKH has gone through long wires, Vee beams, rhombics, 8JK beams, Sterba Curtains, and two and three element Yagi's. When trading off size and complexity *vs.* performance, the Yagi antenna is my favorite. This article presents, for the newer amateur, the fact that antennas can be simple yet very effective.

Experience with two element Yagi beams has been with the self resonant quarter wave spaced elements. The self resonant antenna is so called because both elements, the driven and reflector, are both cut to the same length and are electrical half wave lengths. If separated by one-quarter wave length and when one element is excited from a transmission line, the other element acts as a reflector. The impedance at the drive point is approximately 60 ohms, which may be reasonably matched by using "Twin Lead" 75 ohm cable; the s.w.r. is about 1.25:1. There is no tuning to be accomplished, and the quarter wave spacing permits a wide frequency response, hence a low s.w.r. across a given hand. Its gain is approximately 5 db. Figure 1 shows the dimensions for this simple antenna.

If self resonant elements are used at 0.1 wavelength spacing, the parasitic element acts as a director and produces higher gain (5½ db) than the 0.25 wavelength spacing. However, the 0.25 spacing has always seemed more attractive because of its greater generosity in overlooking less than ideal heights, wide frequency coverage and in supplying higher input impedances.

Actually any spacing can be used with self resonant elements. If 0.14 spacing is used, the antenna will be bidirectional with a gain of 4 db.

Background Experience

In the fall of 1939, an antenna was needed in a hurry to put a respectable signal on the 10 meter band for the Sweepstakes Contest. The easiest thing to put up was a 2 element beam. Since fussing with element tuning was undesirable, the 0.25 wavelength spacing, cut to formula was put up and used.

The element lengths were designed by the formula, Length (in ft.) $= 468/f(mc)$ which considers a 5% end effect. The spacing was determined from the formula for a quarter wave spacing of Length (in ft.) $= 246/f(mc)$.

The antenna had two wire elements each 16.4 feet long and were spaced 8.6 feet for an operating frequency of 28.6 mc. Two nine foot poles connecting the elements were tied between the chimneys of the house. A tuned feeder was connected between the antenna and the transmitter, and a beautiful signal was put across the country from New Jersey.

Then in the fall of 1963 a 40 meter beam was needed for the same purpose. (Seems like poor planning, doesn't it?) A 2 element, 0.25 wavelength spaced Yagi was again felt to be the

*392 Lafayette Avenue, Westwood, New Jersey 07675.

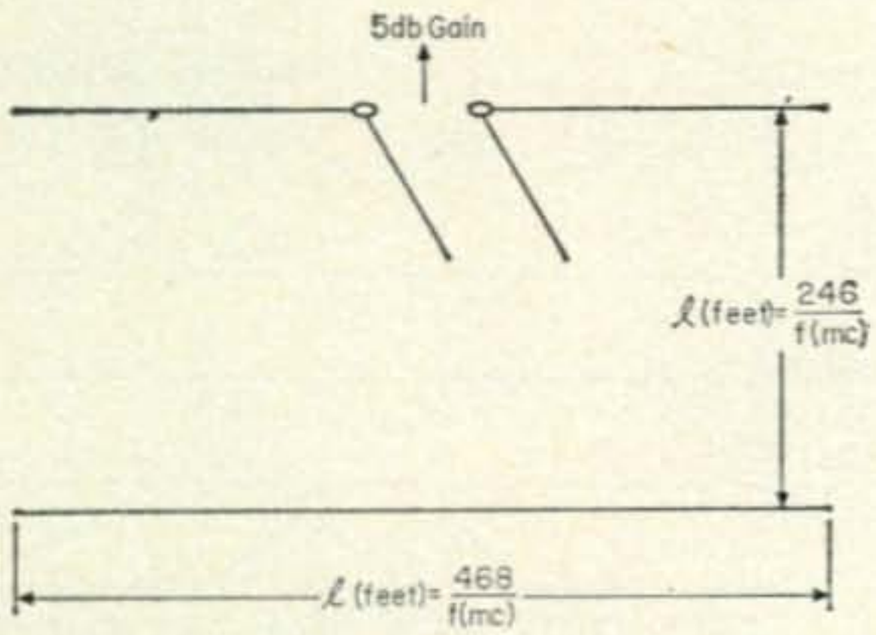


Fig. 1—Dimension data for a two element quarter wavelength spaced Yagi antenna.

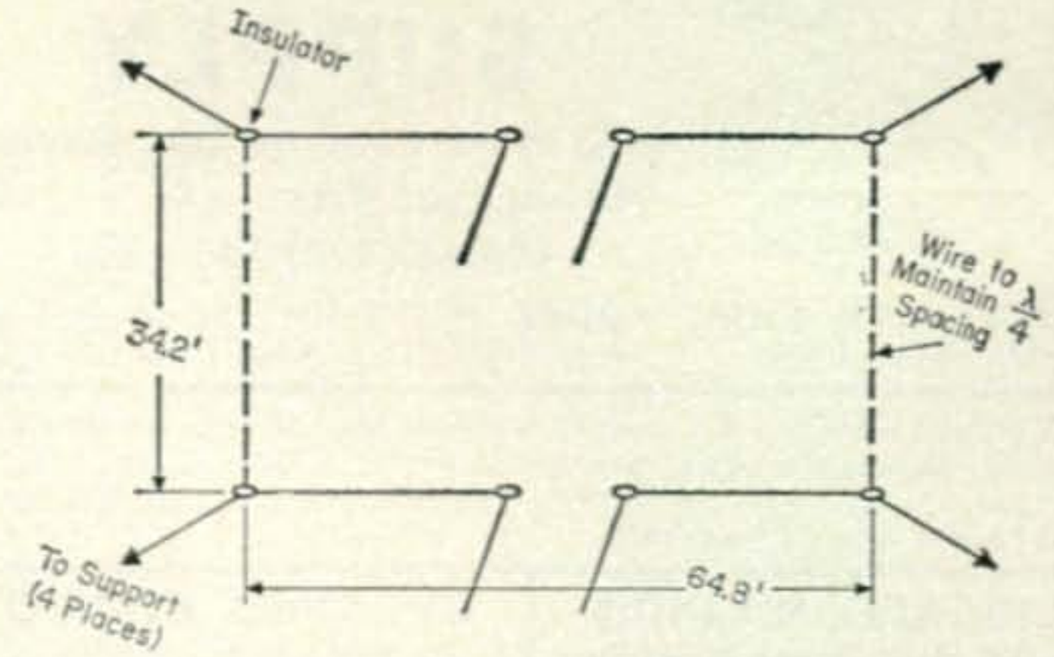


Fig. 2—Two element 40 meter Yagi beam that can work in either direction as described in the text. Each feed line is a half wavelength or a multiple of a half wavelength.

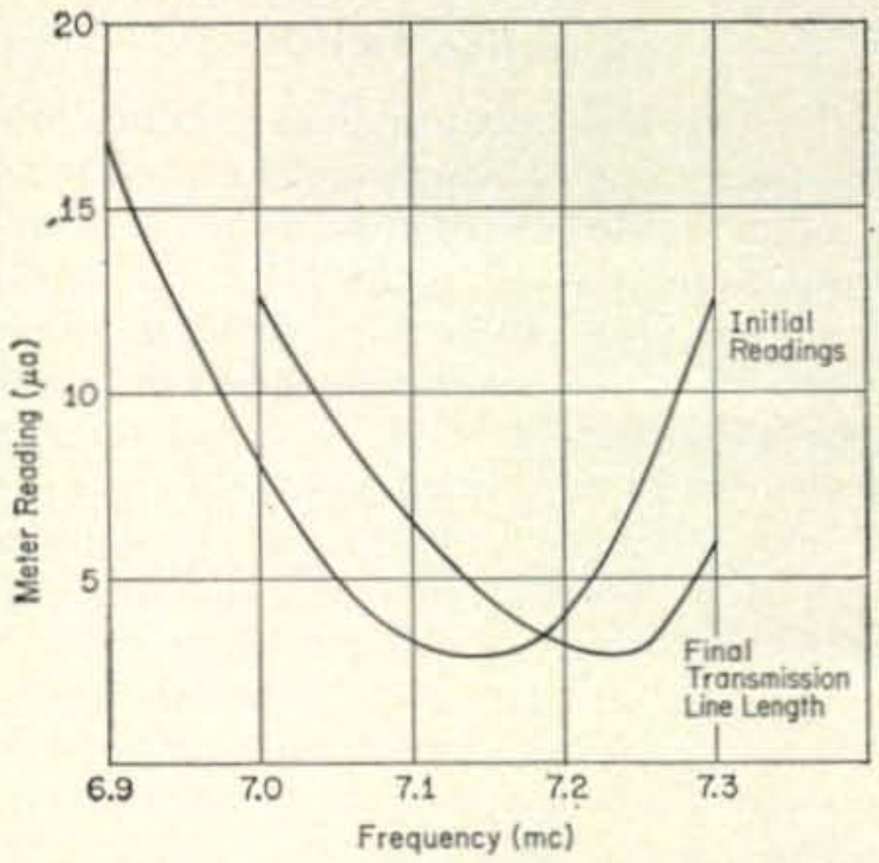


Fig. 3—Plot of null variation versus frequency for a given transmission line length.

simplest, and element length and spacing was computed from the above formulas to be 64.6 feet in length, spaced 34 feet. This antenna was strung up between four trees. In this case the spacing was maintained by connecting the antenna ends by wire. Again this antenna put out an exceptional signal on the 40 meter phone band.

The antenna was so successful, that the following year a three element antenna was strung up at the same height, about 40 feet. This was a miserable failure and leads me to believe that a three element antenna is much more critical to height than a two element antenna. This is born out somewhat by raising and lowering my three element 20 meter rotatable beam from 25 feet to 40 feet. At 25 feet it's a dud, and at 40 feet it provides world-wide phone operation.

A Two-Way Two-Element Antenna

To provide good operation on 40 meters, for my new SB100 s.s.b. transmitter in 1966, it was decided to revive the 2 element antenna, but with an added attraction which would permit a selection of east or west directivity. Although the front to back ratio is only approximately 6 db, it is some assistance in minimizing unwanted direction signals.

The peculiar characteristic of the self resonant two element Yagi (elements are of equal length) permits either element to be the driven element if some means is provided to make the other element think it's a continuous piece of wire and thus act as a reflector.

This can be accomplished by using two transmission lines, one to each element. If the transmission lines are a multiple of a 0.5 wavelength, they will look like a short at the element end when shorted at the far end. Thus for a westerly direction of fire, in my case, the west element is excited through the transmission line, and the transmission line to the east element is shorted presenting a short at the east element feed point. The east element then becomes an electrical continuous piece of wire and acts as a reflector. To fire east, the above is reversed. See fig. 2.

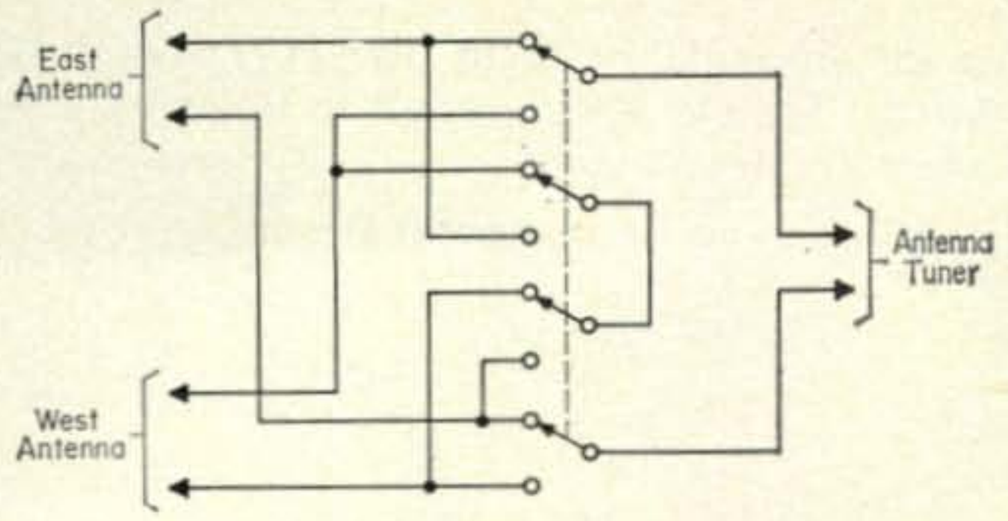


Fig. 4—Switching arrangement for a two element two direction beam antenna.

Additionally, since a 0.5 wavelength transmission line is used, its impedance is immaterial since whatever is fed to the input appears at the antenna end. A transmitting type 300 ohm transmission line is used at W2JKH.

Determination of Half Wave Transmission Line

How do you know you have a 0.5 wavelength length of transmission line? Very simple if you have a resistance bridge[1] and a variable frequency voltage source. The interesting thing about a 0.5 wavelength transmission line is that it will "see" looking into it whatever is hung across the output end just as if there were a zero length of line between the bridge and the output. Thus, take any length of transmission line and connect it to your variable frequency source through your bridge. At the other end of the line connect a *carbon composition* resistor whose d.c. resistance will balance the bridge. Then as you vary the frequency source, a point of minimum current will be reached on your indicator; a 100 microammeter in my case. The frequency at which this occurs is the electrical 0.5 wavelength or multiple of the transmission line.

If an s.w.r. Bridge such as the Heathkit is used, a variable frequency output device sufficient to give full scale deflection in the forward direction must be used and a load correspondingly rated is required as a dummy load.

In the case of the resistance bridge, maximum sensitivity was assured by first setting the driving voltage to give a full scale reading on the microammeter with the transmission line open. When the load is connected, the meter will read a lower value. It is necessary to do this for any frequency change to give proper data.

I have to have at least an 80 foot transmission line to reach from the far driven element to the radio room, thus a length of transmission line greater than 0.5 wavelength was required. Due to the velocity factor, approximately 80% for twin-lead, its physical length is less than the computed length for an antenna.

A 50 ohm bridge was excited from a grid dip meter and connected to 300 ohm transmitting type twin-lead. The length of approximately 130 feet was terminated in a 50 ohm, ½ watt resistor. The null reading on the meter occurred around 6050 kc. A calculation was made using the free

[1]The ARRL Antenna Handbook, Chapt. 3, Transmission Lines.

space formula; Length (feet) = 492/f(mc) for 0.5 wavelength modified to consider a full wave length and the 80% velocity factor, or:

Self Resonant Two Element Beam

$$Length\ (feet) = \frac{492 \times 2 \times 0.8}{f(mc)}$$

$$= \frac{788}{f(mc)}$$

The length should be 109 feet for a frequency of 7250 kc. Therefore the difference between 130 feet and 109 feet, or 21 feet had to be chopped off. Knowing that its better to have too great a length rather than too short, only 19 feet was cut off. The frequency which produced a null reading for this length was found to be 7100 kc.

Before proceeding with any further cutting, it was desired to see if the length was really cut correctly. This determination was done by taking null readings at 6.9, 7.0, 7.1, 7.2, and 7.3 mc to see how the null varied. A plot as shown in figure 3 was obtained. It showed that the null was at about 7.1 mc. Further cuttings were made of three inch lengths, taking frequency plots each time, until a length was reached where the null was near 7.25 mc; the best performance was desired in the middle of the phone band.

The second piece of transmission line used was the twin lead type 214-022 which is a flat copperweld type. There is no reason for using two different types, they just happened to be available. Interestingly enough, the flat type produced a higher null than the tubular type.

Direction Switching

With two transmission lines coming into the radio room, one of which had to be shorted and the other go to an antenna tuner, a switching arrangement was necessary.

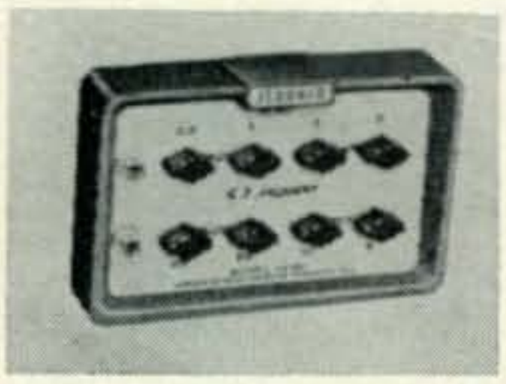
Figure 4 is the switching schematic necessary to permit instant reversal of the direction of fire of the two element beam. The switch connects the element to be excited to the antenna coupler and shorts the transmission line to the element which is to be the reflector. The short at the switch shorts the transmission line at the element making it behave as a continuous length of wire.

Switching to the opposite set of contacts reverses the direction of fire. When the antenna coupler is tuned for a given direction, no further tuning is required when reversing direction since the antenna is symmetrical.

Results

The antenna was ready in time for the RSGB 7 mc contest. Although it was rather difficult to listen on 7.09 mc and call the English stations on 7.29 with an SB-100 tranceiver, I was able to work all the G stations I heard with 57 signal reports. Switching the beam to a westerly direction produced good signals in that direction. Now when I call CQ, stations come back and good contacts result, even though the power is only 150 watts. For the small investment, the two element, quarter wave spaced antenna produced improvement in station performance many times over. ■

New Amateur Products



Jerrold

A 50 ohm variable attenuator from d.c. to 500 mc and covering a range of 0 to 62.5 db in 0.5 db steps has been announced by Jerrold. For complete specs write to: Jerrold Electronics, Industrial Division, Philadelphia, Pa., 19105 or circle 68 on page 110.

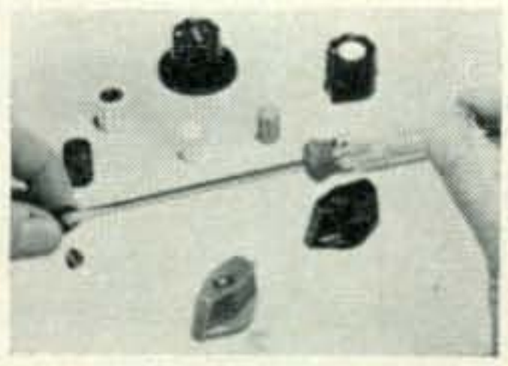
Alcoswitch

A new miniature 4p d.t. push button switch is now available from Alcoswitch. The switch has turret type terminals and is rated at 6 amps @ 115 v.a.c. It is priced at $5.95. For further details write direct to Alcoswitch, Lawrence, Massachusetts, or circle 69 on page 110.

Montedoro

Montedoro announces their model TFA-1 r.f. balun which operates from 2 to 30 mc with an input power of 1500 watts average and 6000 watts peak. It will couple a 50 ohm unbalanced input to either a 300 ohm or 600 ohm balanced load with an insertion loss of less than 0.15 db. The unit sells for $125.00. For more details write them direct at 2740 Orcutt Ave., P.O. Box 1401, San Luis Obispo, Calif., 93401 or circle 70 on page 110.

Amperex



Amperex announces a precision line of clamping collet knobs. The series F112 is shown. For further information write to Amperex, Component Division, Hicksville, L.I., N.Y., 11802 or circle 71 on page 110.

International Mission Radio Association News

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

For the past few months now, I have been introducing you to overseas members of IMRA. Often I have mentioned Peace Corps members, and now finally I am able to tell you about a few of them. These men and women, like the clergymen and teachers you have met in the past, are people with deep concern for their needy fellow men. They, as you know, are working all over the world to do their part to help the cause of mankind and of peace.

Needless to say most of the areas in which the Peace Corps volunteers are working are depressed and underdeveloped. Communications problems are real and many. Amateur radio has a real potential for serving them and facilitating their work. If this potential is used, these people will continue to be goodwill ambassadors of amateur radio as well as ambassadors of Peace from the USA.

Last month I was able to get a brief article in the Peace Corps international magazine, *Volunteer*. This notice appeared in the March issue of *Volunteer*, and before the end of the month I had received over thirty letters from PCV's (Peace Corps Volunteers) from all over the world. For many of them it was the first time they had heard about IMRA, and their enthusiasm about our organization is very high. They are seeking the aid of IMRA to begin to fulfill the potential amateur radio holds for them and their work.

But there's a problem. The day before this article was to be submitted to the editors of *CQ*, a prospective PCV informed me that transmitters were on their "not allowed" list. In other words, PCV's cannot take advantage of the benefits of ham radio.

From the tone of other letters received from PCV's, I gather that many of them are unaware of this restriction. Consequently I had to make a prudential decision on my own, without the opportunity of consulting the board of directors of IMRA or the PC itself. I had the choice either of scrapping this entire article or of reflecting on the implications of the Peace Corps regulation of amateur radio. Peace Corps volunteers themselves recognize the value of amateur radio in their work, as their letters demonstrate. But because of the PC administrative decision regard ham radio, I think it best to withhold the names of the Volunteers whose letters I have used in this article.

*Mary Immaculate Friary, Garrison, New York.

IMRA & PCV's?

In South America there is a number of PCV's already active on IMRA networks. Cicero I, HC??, Cicero II HC?? are on the 15 and 20 meter bands from Ecuador. When they have the opportunity they like to talk with stations Stateside. They have many interesting stories about their work in Ecuador, and they enjoy telling the folks home about them. An occasional contact with their families, through the IMRA network or otherwise, are very much appreciated by themselves and the many Corpsmen with them.

In Brazil, Cicero III and the thirty other PCV's make use of the advantages of Amateur radio through PY? They are often on 15 meters between 20 and 24 GMT. It is quite a job to try to keep all the Volunteers in contact with the folks, but in their spare moments they do their best. The station operator is however due for a transfer. This will leave Cicero III and the others out of touch for a while, but I am sure they will find someone else to keep them on the air.

In Uruguay, Cicero IV CX? is active both in the name of the Peace Corps and amateur radio. He is working with IMRA to show his fellow corpsmen the advantages of radio. Cicero IV was on the air for some time before entering the Corps, and his knowledge of the skills of amateur radio is serving him well in Uruguay. This skill has also served his community on many occasions

Tom A. Cox, W2CBX

Cicero IV has great ideas for amateur radio in the Corps and is cooperating with IMRA to implement them. Besides international communications, Cicero feels amateur radio should play an important role for PCV's. It will enable them to share experiences, solve urgent problems and provide all the advantages that a good communications system can produce. Cicero IV writes that in many areas phone connections are nonexistent to the PCV, and amateur radio would surely fill the gap. The ability of the PCV to assist in handling emergency traffic for hospitals and in disaster situations, as in the quakes of Peru and Colombia, would serve men and the cause of the Peace Corps itself. The other more obvious advantage of keeping in contact with one's family is important to Cicero IV and to all his fellow Corpsmen.

Cicero IV realizes that there are many countries where third party traffic is restricted, but he feels this would not detract from the overall advantages amateur radio could bring to the Peace Corps. Cicero IV is doing his best to prove this to the Peace Corps. He has asked our help.

Here is another request.

"I am a Peace Corps volunteer in Botswan. I will be getting my ZS9 call letters soon, but am having difficulty trying to finance the equipment. State-side I hold a K call and I have been licensed for 12 years. I hope to be able to get s.s.b. equipment on 10, 15, and 20 meters. Maybe you could connect me with some source of funds toward this end."

This letter comes from Cicero V. If any one would like to help him out please notify me. If too, any of you would like to hear a few more ZS9's on the air, lets hear from you.

I hope you will excuse me for all this Cicero business. I am not trying to question the motives of anyone here. Most good citizens both endorse the Peace Corps as an organization and encourage its volunteers. I have had the good fortune to meet many of the latter. They, I think, are the reason I am pusuing the present line of thought. Let me explain.

I realize that any organization or community has to have rules. In our own amateur radio community the F.C.C. has imposed, and rightly so, regulations for radio operation. You could just imagine the absolute havoc if there were no rules. The Peace Corps too must have regulations for its volunteers. However, I am curious about the reasons for the apparent policy of the PC, If it is no amateur radio.

As a person convinced of the advantages of amateur radio, I wonder whether or not this restriction of amateur privileges, especially in areas where the host Government will give them, is good. I admit I am no authority, but it would seem amateur radio should be an advantage for the PCV as well as to the Peace Corps itself.

The "Cicero" letters demonstrate that amateur radio can bring real good to the Peace Corps. It will not only serve the members, but maybe even more importantly in their case, the community in which they live. PCV's are in areas that need them, that is quite evident. Wouldn't the PCV's ability as an amateur radio operator be of assistance to his work?

It is possible, on the other hand, to understand there could be some danger to a nation's security if amateur radio were to fall into the wrong hands. This consideration is in my estimation overcome by the idealism and intelligence of the PCV's themselves. Again I admit I am no expert on the question. I am sure there are good and not so good personnel in all organizations. However, my understanding of the requirements for admission to the PC and the volunteers themselves would warrant my saying that a policy seems to be over-restrictive which prohibits amateur privileges. The PCV is a highly motivated U.S. citizen. He is not out to overthrow Governments nor to colonize countries. He is respectable, intelligent, and has a moral fibre that is quite outstanding.

With all this in mind, I can not help but wonder—and tell you about my thoughts. I wish I had had more time to investigate the question, but I don't. I hope you will hold me excused if I appear to speak against PC policy. These remarks indicate curiosity rather than criticism. Perhaps if this question of amateur radio and the PCV is raised, some good might result both for the Peace Corps and amateur radio. In any event I would be happy to hear from anyone who could demonstrate to me the opposite of what I have said regarding the advantages of amateur radio and the Peace Corps? I would be glad to hear what you have to say.

In Less Troubled Waters

The men and women of the Peace Corps and/or others in similar situations and endeavors could use the help and the support of IMRA.

How does IMRA plan to serve? Really it is quite simple. IMRA is now on the air providing an international communications service for Latin America. (Wednesday, 1830 GMT 21.393 mc & 14.270) In order that this service progress and develop IMRA needs your help as well as your verbal support. We need action. IMRA is also thinking of ways to supply equipment to the more needy areas and stations. This task will be discussed at length at IMRA's annual convention and business meeting to be held in Asheville, N.C., this July 7th and 8th. Join us if you can, and share your ideas with us.

The IMRA has a big job to do, and we need your assistance. This is more than in invitation for you to join IMRA. We not only would like to have you with us, we NEED you.

This letter is from Padre Rupert Dawson, VK4ID.

"I have been a ham in Australia for some years. My superior recently has told me that I will be moving on to Palm Island. Palm Island is small, 5 miles long and 2 miles wide at its widest point. Delinquent aborigines from the main-land, youths and adults, are sent there. I shall be with them on my own. To overcome

the loneliness I hope to have the assistance of amateur radio.

"At the moment I have a home brew transmitter and receiver on a.m. The Xmeter is low powered and cumbersome. It would cost a packet to send it to Palm Island, and even if I did get it there, I doubt if I would be able to make any contacts with it. I can pick up what would be suitable in Australia for about $600. I have no one who could help me with this money problem so I was wondering if you could help me through IMRA? With a hope and a prayer, I send this letter. Rupert Dawson, VK4ID, c/o Franciscan Friary, Turner Road, Kedron, Brisbane, Queensland, Australia."

'67 Convention—Asheville, N.C.

The annual IMRA convention will be held in Asheville, N.C. on August 7th and 8th. Committee chairman for the convention is Mr. Murrill Burton, K4LGP, 1008 Mendenhall St., Thomasville, N. C.

We are planning to have a profitable as well as an enjoyable meeting this summer. I hope you will be able to join us. Working on the convention plans under the chairmanship of Most Reverend Vincent S. Waters, Bishop of Raleigh are Rev. Jesse Creel, W4YPR; Mr. William Conrad, K4BE; Mr. Bob Moren, W4INL; Mr. James Cosgrove, W4EKO; Mr. John Berner, W4ALB; Mr. Harold Gannon, WA4KVA; and Dr. Robert Lade, WA4UFQ.

These folks are working hard on the convention plans and have promised a good time. Plans are still tentative but here is some of what we can hope for. Rev. Daniel Lenihan, S.J., W1HWK will be on hand with an enjoyable lecture. Mr. Bob Waters, W1PRI is preparing an equipment setup. We have also received an invitation from Hammerlund to visit their plant not far from Asheville. There will be technical talks, lectures on international network procedures etc. We hope to have representatives of Project MED-AID from Duke University, Durham, N.C. and representatives of the Peace Corps and other organizations.

I hope you can all take advantage of IMRA hospitality in Asheville. Be sure to write Murrill now. I'll see you next month with some information on IMRA networks. ■

YLRL International Convention

BY LOUISA B. SANDO,* W5RZJ

FROM now on you'll be seeing this slogan: "Don't Forget Our BIG DATE—YLRL—'68!" The Colorado YLs, hostess club for YLRL's 5th International Convention, have adopted it to publicize the convention, which is set for June 13-16, 1968, at Denver.

The Colorado YLs are already in "high gear" with plans and preparations. All committees have been set up and the gals are fairly bursting with enthusiasm and activity.

Working with chairman Marte, KØEPE, will be KØBTV, Kay, as co-chairman. Registration will be handled by WØHEM, Elaine. Treasurer is WAØECG, Marge. Serving as publicity chairman is WØESD, Estelle, and working on her committee are KØGAS, Connie, K7WVT, Phyllis; KØYWE, Dorothy, and KØLCZ, Hazel. Prizes will be handled by WAØEXX, Betty, chairman, and committee members WØESD, Estelle; WAØPYZ, Linda; WØKEK, June and WAØLDU, Charlene. Decorations and souvenirs will be handled by KØWZN, Ann, chairman, with WØUTO, Ollie; WAØKRB, Sue, and KØZUW, Janyce. Chairman for the badge project is WAØECG, Marge. KØZSQ, Val, and OM KØDCW, are in charge of the convention station.

Says Marte, "Hold your hats! The main 'donation' prize for a ham winner will be a 1968 Mustang complete with mobile rig!!" For a non-ham it will be a 1968 Mustang, plus $200 (in place of the rig). Donation tickets are 25¢ each, or 5 for $1. All YL clubs will participate in this, and if there isn't one near you, contact WAØEXX, Betty.

There are many other prizes in the works.

[*Continued on page 100*]

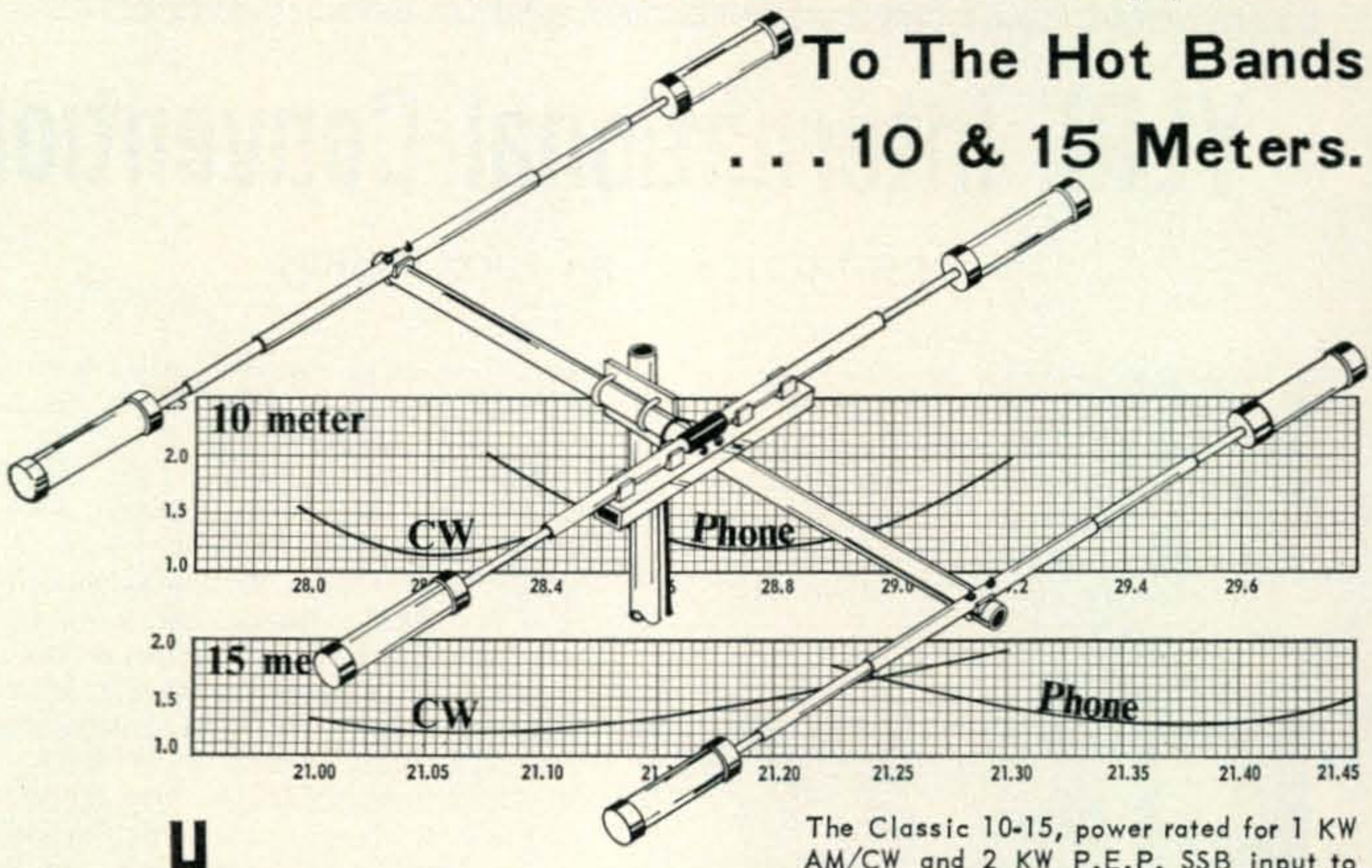
*4417-11th St., N.W., Albuquerque, N. M.

Pictured are some of the Colorado YLs who met in April at Palmer Lake, QTH of KØWZN, for an all-day work session on the up-coming YLRL Convention. L. to r., WAØECG, Marge; KØYJG, Claire; WØHEM, Elaine, before the club members accomplish their ambitious plans for "OUR BIG DATE—YLRL '68"!

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.

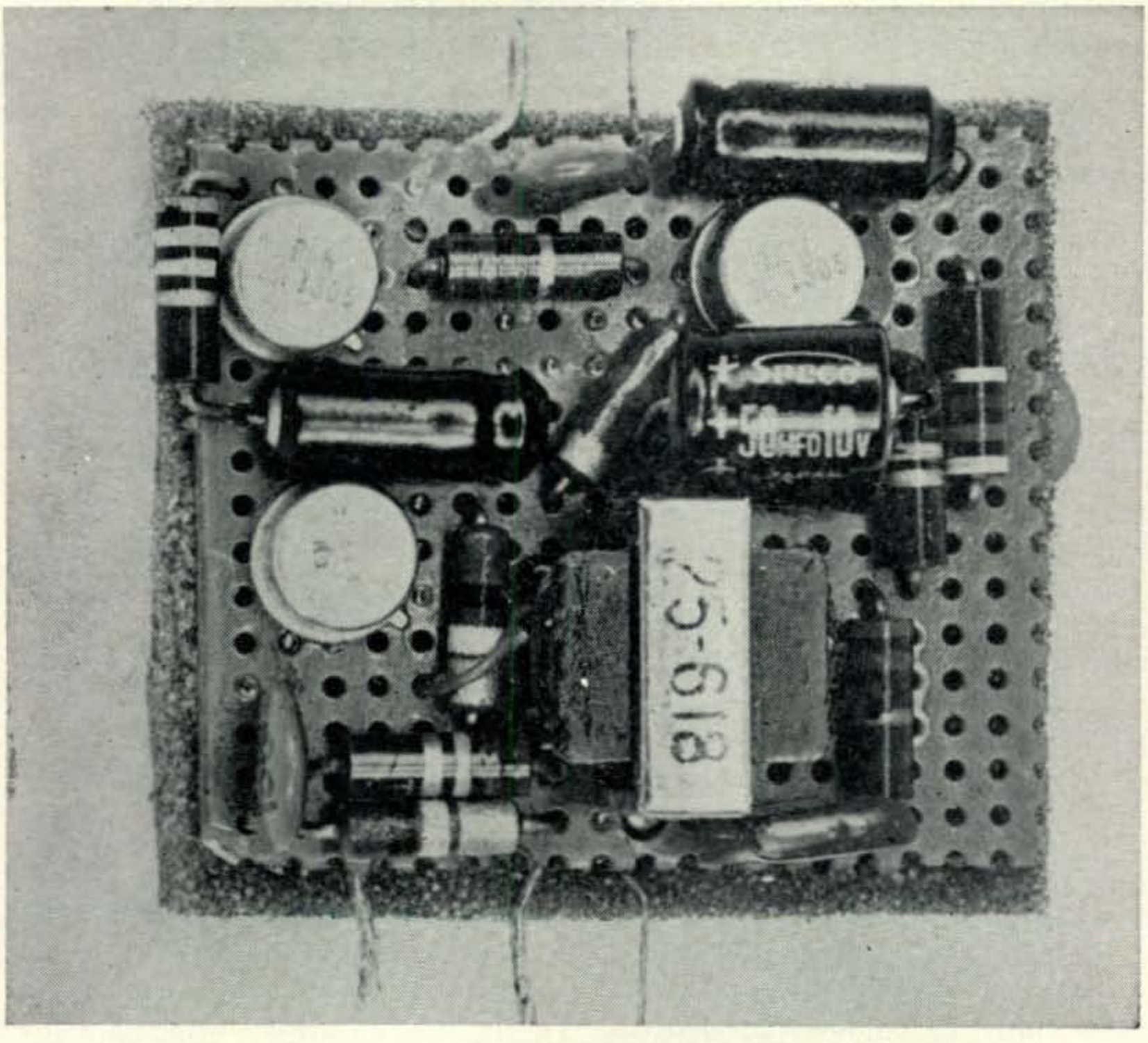
The Classic 10-15 . . . another reason why you select quality when you specify Mosley. Write for more information.

Write Dept. No. 131

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

For further information, check number 1, on page 110

THE COMPRESSATOR



Construction of the Compressator is shown above. The layout of the components on the vector board, while not critical, is described in the text.

BY JOHN J. SCHULTZ,* W2EEY/1

The author describes an inexpensive but very effective speech compressor which can be easily built into an s.s.b. or a.m. transmitter. It also can be used as an audio oscillator for test adjustments.

SPEECH compressors have been developed in a number of forms for use with s.s.b. and a.m. transmitters. Their effectiveness has been the subject of many QSO's and on-the-air tests have yielded conflicting results. The author has experimented with several types of audio compressors with varying results. All the variables involved: transmitter characteristics, propagation conditions, receiver a.g.c. characteristics and the circuitry of the compressor itself, make it difficult to arrive at too many definitive conclusions. However, one result does seem clear; used with a transmitter which has no automatic gain control circuit or a circuit with relatively poor control range (10 db or less) a compressor will produce an apparent signal improvement of several "S" units under poor signal conditions (below S6 level or so).

Under moderate to strong signal conditions and with transmitters which have built-in a.g.c. circuitry with a wide control range, the effect of an auxiliary audio compressor is much less apparent. Relatively few commercial and home-design transmitters do have a.g.c. circuits with a wide control range, however, so probably no easier way can be found to increase the effectiveness of the average transmitter than by the addition of a compressor.

*40 Rossie Street, Mystic, Connecticut 06355

Advantages

Most audio compressor designs have been too large to easily incorporate in an existing transmitter. The little unit described in this article measures only 1½ × 1½ × ⅝" using all

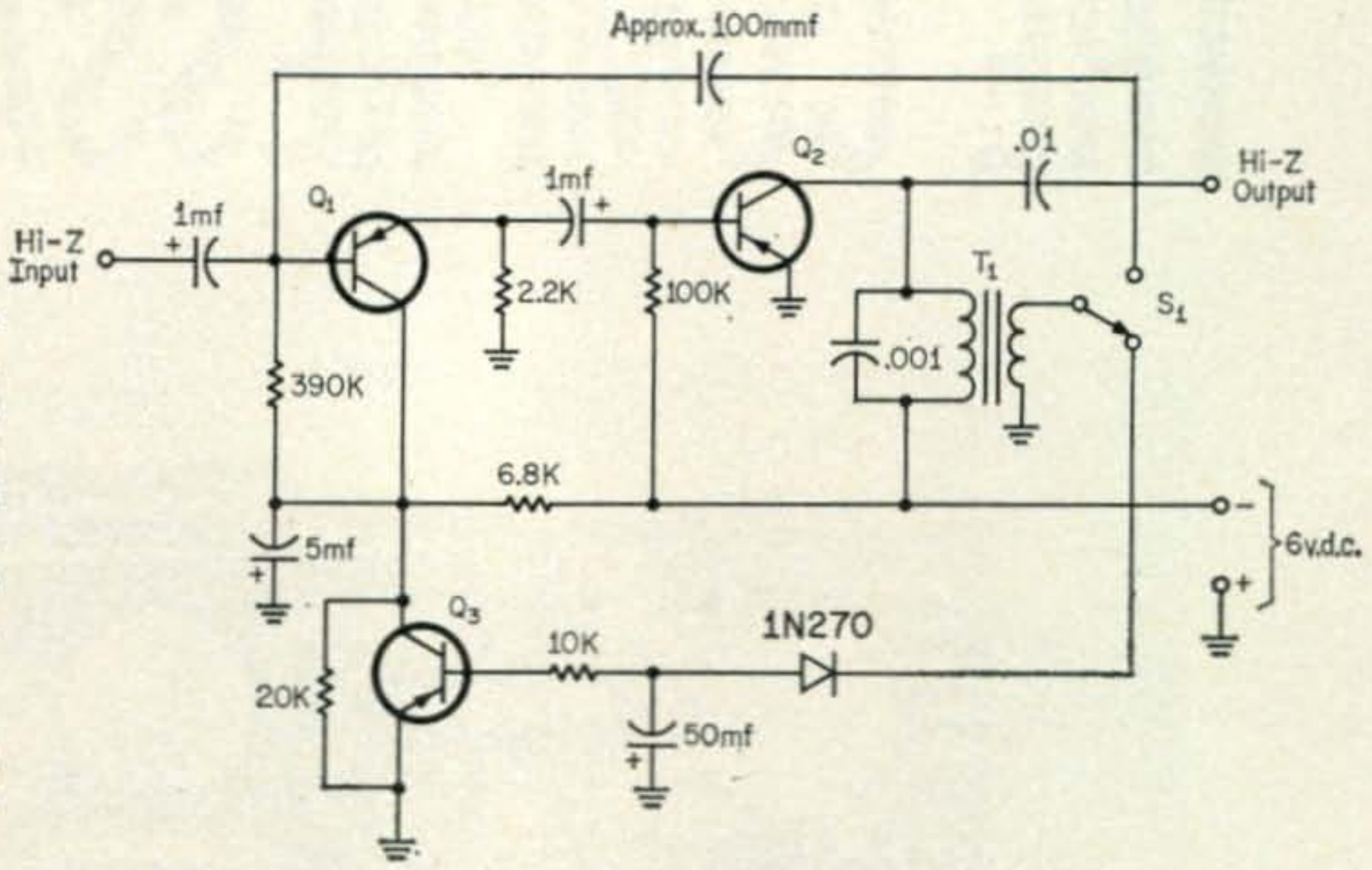


Fig. 1—Circuit of the Compressator, a compressor preamp that can also serve as an audio oscillator for test purposes. All resistors are rated for ⅛ or ¼ watts. The electrolytic capacitors are rated a 6 volts w.v.d.c.
Q_1, Q_2—2N1305.
Q_3—2N1370 or 2N1379.
T_1—10K primary to 2K secondary, miniature audio transformer.

readily available and inexpensive components. In fact, with care in the purchasing of miniature parts, it could probably be built even 20 to 30% smaller in discrete component form. Thus, it can easily fit into almost any existing transmitter or even the base of many home station microphones.

Besides small size, the circuit used has several advantages over many others previously presented for communications applications. The control range is almost 30 db, meaning that for a 30 db change in the input signal, the output voltage will not change more than approximately 3 db. Although this is not as great a control range as that possible with more elaborate circuits it does seem to be completely adequate for amateur applications. Another advantage of the unit is that by careful choice of the time constants used, a fast attack time is achieved in conjunction with a relatively long recovery time. The fast attack time means that sudden increases in input level are responded to in a fraction of a second to prevent overmodulation. The use of a long recovery time of several seconds avoids the "noise buildup" which occurs with most audio compressors when a pause between words takes place.

Circuit

The circuit of the unit, as shown in fig. 1, is relatively simple. Looking at the circuit without Q_3, it is seen to be a simple resistance coupled two stage audio amplifier of conventional design. The input transistor, Q_1, is a common emitter stage for a high impedance input suitable for a crystal or dynamic type of microphone input. The primary of the transformer T_1 acts as an audio choke.

Considering now the action of Q_3, it will be seen that it acts to regulate the collector voltage on Q_1 in accordance with the output voltage level of Q_2. Transistor Q_2 itself is not regulated. Increasing output voltage produces a negative control voltage (after rectification by the 1N270 diode) which in turn biases Q_3 so that it is switched into conduction and decreases the resistance of the lower leg of the voltage divider formed by the 6.8K and 20K resistors. Thus, the gain of the input stage is reduced in proportion to the input signal level. The 10K resistor and 50 mf capacitor between the base of Q_3 and the 1N270 diode as well as the characteristics of the transformer T_1, determine the circuit's response time. The 0.001 mf capacitor across the primary of T_1 is used to "build-out" the transformer in order to peak the response in the voice frequency range. It is generally not necessary, however. No gain control is provided nor generally necessary since the output level is within a range which can be accommodated by the audio input circuit of most transmitters. If needed the pad shown in fig. 2 can be used to lower the compressator output.

The unit is assembled very simply on a piece of vector board. There is nothing critical about the construction nor is any particular layout necessary. The circuit components should be grouped around the transistor with which they are used as compactly as possible. The number of components used is small enough so that they should all be test mounted for the best arrangement before they are soldered in place. The photograph shows the general layout used by the author in constructing the unit. Transistors Q_1 and Q_2 are in line above the transformer T_1 and Q_3 is below Q_1 (to the left of the transformer).

Mounting

Mounting of the unit, if done within a transmitter should ideally be done between the microphone input jack and the first audio stage so that the pigtail leads from the vector board can be used directly. Otherwise, shielded cable will have to be used to the input and output connections. The power required can be supplied by a battery or a simple rectifier circuit from the transmitter filament line. In any case, the d.c. must be well filtered with at least a 500 mf output capacitor on the supply source being desirable. One easy way to mount the unit without any hole drilling is to glue a quarter-inch thick-

ness of foam plastic material on the underside of the unit (making sure none of the connections puncture the material) and then glue the entire unit on a flat chassis surface. The unit is light enough so that such mounting, using Duco or similar cement, will be stable enough for all but the most rough mobile service.

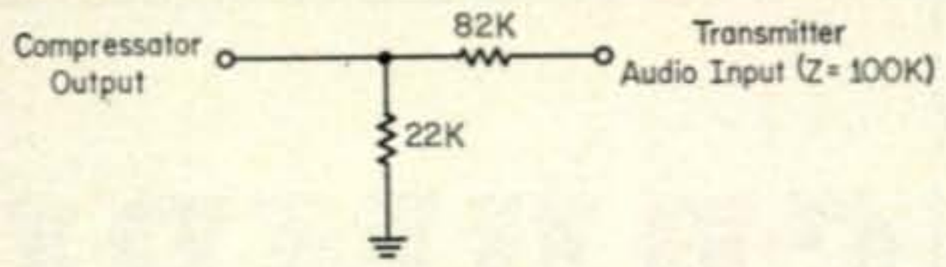


Fig. 2—This simple pad can be inserted between the Compressator and transmitter audio input to reduce the level if necessary.

Adjustment

The unit should work well, using the values shown, with almost all high impedance microphones and transmitter audio circuits. Optimum performance, however, can only be obtained by some experimentation with the circuit components that determine the time constant and the basic gain of the input stage. This is necessary because of the gain characteristics of different transistors, different microphone output levels and varying transmitter audio circuit input ranges. The simplest way to make these adjustments is to temporarily replace both the 20K resistor between the emitter and base of Q_3 and the 10K resistor between the base of Q_3 and the 1N270 diode by 100K potentiometers. Both potentiometers should initially be set at maximum value and then reduced for best sounding compressor action while conducting a test with another local station. The receiver used at the other station should be run with its a.v.c. switched off and the r.f. gain control reduced to the point where the signal is just audible, in order to simulate weak signal reception conditions.

Another less subjective way to determine the proper circuit operating conditions is to feed an audio tone into the microphone being used, increase the level gradually and then record the output voltage. The plot of output versus input voltages will illustrate the dynamic or control range and should be as flat as possible. Feeding a square wave into the microphone and noting the time it takes for the amplifier output to stabilize after the start of the wave and then again after the end of the wave will demonstrate the attack and recovery times. The former should be a fraction of a second and the latter several seconds minimum. Since a fairly long pulse of 10 seconds or so is needed, it can be produced simply by increasing the level suddenly of the audio tone to the microphone from a level which just gives an output reading to a 20 or 30 db greater level. The output level changes can be monitored on a v.t.v.m. or an oscilloscope.

A simple feedback arrangement via the switch S_1 allows the unit to be used as an audio oscillator for test purposes. The value of the coupling capacitor must be determined by trial and error for the most stable feedback conditions.

For someone who would like to really try packing multiple functions into one unit, the possibility of using the unit in its audio oscillator position as an r.f. actuated c.w. monitor might be appealing. At least the name that such functions builds into—Compressmonitor—is properly confusing. ■

"Some days it doesn't pay to get out of bed"

BY ED GRIBI,* WB6IZF

A pleasant spring afternoon drive from the Los Angeles area to San Bernardino turned into a snowbound adventure for Al Lewison, W6KAO, and his wife Ruth, K6KLN, and several other motorists recently. The La Crescenta amateur chose to take the scenic Angeles Crest route near 8000′ peaks when an April Fool blizzard hit the southern California area. Al called in on 7255 Kc., the West Coast Amateur Radio Service monitored frequency, at 3:13 P.M. PST to report that his easterly progress was blocked by a snow slide and that a snow plow was needed at the site. K6KZI, Bill Schwarz, acting Net Control, Daly City, picked up the call and with the help of several stations got a message into the Division of Highways in Los Angeles requesting help. W6JCU, Stan Horsley, Hollywood, maintained contact with the DOH operations officer for the next 3½ hours while plows and other rescue vehicles worked toward the site from either end. At 3:40 P.M. PST the mobile reported that while attempting to turn around and head back they became stuck in the snow. K6KZI, W6JCU, and others monitored the frequency and relayed reports on the progress

[*Continued on page 100*]

*Publicity Chairman, West Coast Amateur Radio Service, 229 Vivian Street, King City, California, 93930.

GRUMBLES

by Sam

MY old man was a real radio fan, I guess he got interested in it way back when it started. When I got interested in radio he was delighted and his big joy would be to bring visitors into my shack and show off the gear.

To my dad, radio equipment consisted of *aerials, bulbs,* and a *horn.* Sometimes he would throw the word *galena* if he really wanted to impress someone; in fact he once insisted on my opening my receiver's *box* so that he could point out the *galena.* Failing to locate it, he covered up his obvious embarrassment by stammering around and giving out with words like *ballast bulbs, rheostats, honeycomb coils,* and (as an almost desperate last resort) *leyden jar.*

I was aghast! Rheostats? Galena? Honeycomb coils? The old guy had flipped-out for sure. All I could say was, "Those little square things are in the *i.f. stages,* and that the screw-on connector is for *coaxial cable.*" It was the wrong thing to say, it really put him down.

He just stood there and looked at me with a disbelieving expression on his face. Eventually he headed towards the living room with a slow shuffle. Pausing at the door, he turned and mumbled something about if I bought some *spreaders* he would help me hoist a *cage* and lay some *counterpoise.* That was the end of my dad's interest in electronics, he never again mentioned the subject. I had given him a jolt of "one-upmanship."

I tell you all of this because it was only a few years ago that I went to a hamfest and some teenager with a Novice QSL pinned to his lapel came over to me and asked my opinion on a new development—the transistor? What?

Yup, by golly; and he had one with him. It was a little thing like a metal aspirin with three long whiskers. Smiling, I told him that he should stick to regular carbon resistors. Don't you think the little snot wouldn't get off my back, he insisted that it wasn't so much a resistor as a kind of replacement for a tube. Tube? HAH! I then put on my smuggest ham-type sneer and asked him to show me the grid cap.

I now know how my old man felt with his damned galenas, the look on the kid's face was one of stark horror and disbelief! At the mention of *grid cap* I felt all eyes turn on me. "Well, heh, the ol' B-plus sure ain't gonna do much good for this thing, and it don't even have a loctal base to keep it from falling into one of the tuning condensers," I announced to all around in an effort to show that I was really "one of them."

As you can imagine, I shut my eyes and wished that I could evaporate right there on the spot and be magically transported back to my house where I could sit with dad in front of his Victrola and blot out the whole stinking world with a good loud Shep Fields record. I had been "one-upped" by a kid—my radio knowledge had bogged down in a silt of *dynamotors, BC-348's, 6K7's,* and (gasp) *bleeder resistors.*

Vowing revenge, I determined to update myself. Selecting a choice circuit using one of the new gadgets I then started construction on some little nonsense project using a CK-722. My fingers were just too numbed from years behind a soldering iron to be able to work with it. It still sits on a shelf in the shack (right next to a supply of type 80 tubes) as a monument to how I *might* have been washed up in modern day ham radio.

Yes, *might* have been, because I've discovered *the* secret of success in ham radio. If you're interested, just bear with me. The nicest thing about it all is that you don't really have to know anything at all about the subject. In fact, the less you know the better off you'll be because facts are very confusing.

In the initial stages I merely memorized a few great stock "safe" phrases to respond to almost any inquiry. For instance, any mention of transistors would trigger me to state that "transistors are OK, but they sure are prone to noise pickup." That would satisfy most operators.

If modulation was the topic I would say that the "carrier envelope shows up nice on the scope."

Any time I got stuck in a QSO with a guy pressing me for an analysis of his signal, I simply gave him an S-meter reading and said that I

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

Radio One-Up-Manship Chart

Column 1	Column 2	Column 3
0. Integrated	0. Sinosidal	0. Options
1. Pulsed	1. Envelope	1. Flexibility
2. High Level	2. Monitored	2. Capability
3. Parallel	3. Reciprocal	3. Parameter
4. Functional	4. Digital	4. Transmission
5. Responsive	5. Logistical	5. Concept
6. Optimal	6. Transitional	6. Phase-lock
7. Synchronized	7. Incremental	7. Projection
8. Compatible	8. Third Generation	8. Mode
9. Balanced	9. Steady state	9. Modulation

Note: Select any three digit number at random, then match up with the words above for a super snob-squelcher. For difficult cases, use two in a sentence. Guaranteed to work if used per instructions in text.

think he had a little "carrier shift." That threw enough panic into the clown to end the contact in short order and keep him away from me for a few days while he pulled apart the rig.

As you can see, I had all aspects worked out well and had a full listing of replies posted at the operating position (the list fit neatly under the base of the Harvey Wells).

This has all been superseded by a far superior system since I found that radio today is teeming with obnoxious creeps who take great delight in seeing you squirm when pressed about a subject upon which you seem even slightly foggy. There is now one great and ultimate way of one-upping the whole rotten bunch of them. I warn you now, it's potent dynamite; cleverly engineered to wither even the most knowledgeable soul. I once had the head equipment designer for a major ham gear manufacturer alternately begging for mercy and offering me a job at any salary I could name.

The idea was supplied by a newsletter I received from the Special Industrial Radio Service Association (SIRSA). Using their basic idea, I worked up my plan—an evil little chart which makes possible 1000 different super-colossal highly technical terms. The formula is to pick any three digit number, select those words on the chart which correspond with the numbers, and lay it on the guy at the first sign of his trying to give you the business.

Here's a typical application. You're at the IEEE show. Some finky type with a tweed jacket, button down collar, and black knit tie is standing there watching you. He's got a slide rule sticking out of the handkerchief pocket of the jacket—that's the secret identification of the type. You just know that this guy is waiting for the right moment.

Walking over to one of the many ridiculous looking pieces of junk which they peddle at these affairs (thermoresisticons, or whatever), you pick it up and study it. Aha! He moves in on you.

"Bet you didn't know that this device offers automatic display of MIS capacitance versus bias characteristics," says he.

Without batting an eyelash you throw him an 803—"Yeah, I was wondering about that. What about its *compatible sinosidal parameters?*"

End of conversation.

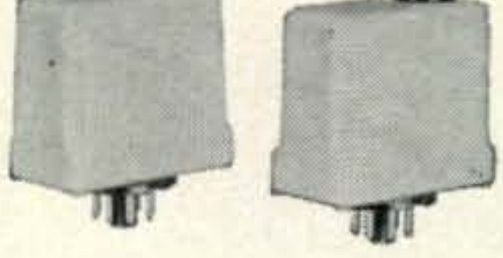
If you get a particularly difficult type (a 2 slide rule man), fling him a double, like a 587 coupled with an 095. "Can you tell me if these devices with *responsive third-generation projection* are superior to those having an *integrated steady-state concept?*"

End of conversation.

The possibilities are utterly fantastic. I have now taken to writing letters to manufacturers, technical authors, editors, and others who have bugged me for years. Ah, sweet revenge.

In the mean time, I've got a great circuit you might like to use, it's this really swell 117N7GT tube running on 80 meters. The condenser can be clipped from an old table radio . . .

New Amateur Products



Ohmite

NEW solid state time delay relays by Ohmite are designed to achieve delays in the closing or opening of the output contacts of an electromechanical relay. A variable delay model and a fixed delay model are available. Delays or intervals up to 180 seconds are possible. For a complete range of specs, request Bulletin 709 from Ohmite Manufacturing Company, 3678 Howard Street, Skokie, Illinois, 60076, or circle 72 on page 110.

EICO

EICO is offering copies of their 1967 catalog. The 36 page catalog features pictures and descriptions of all their products including prices on both kit and wired units. There is also a listing of 2500 authorized dealers and 200 authorized service centers. For a free copy of the catalog write EICO Electronic Instrument Co., Inc., 131-01 39th Ave., Flushing, N.Y., 11352 or circle 73 on page 110.

DX

BY JOHN A. ATTAWAY,* K4IIF

Awards

It doesn't seem possible that another month has gone by, but the calendar never lies and here we are again.

Unfortunately we still haven't completed the complex transfer of records from the outgoing editor, to Port Washington, to Winter Haven, so I am still unable to assign certificate numbers to the new winners. However, the following have qualified for *CQ* DX Awards during the past month and their certificates will be processed as soon as humanly possible:

WAZ: W9ALI, DL2AB, WB6EFA, W1FTX, OH2BH, DJ10J, K7PJF.

WPX Mixed: K4ZCP, VE3UR, WA4PXP. **WPX SSB:** WA4PXP (end. to 400), PAØXPQ, VE6IN, CT1KT (end. to 250). **WPX CW 14Mc:** K4TUA (end. to 400), LA5QC. **WPX Europe:** LA5QC.

SSB DX Award: WA8AJI.

Endorsements: W4NJF (SSB WPX to 600).

Novices

The WPNX Award chase has been underway for two weeks now. Who will be the first novice to earn 100 prefixes and qualify for the award? Let us know how you're coming and as soon as you have your 100 cards get them in the mail with a *clear postmark*. If you still haven't sent for an application blank, send a self-addressed stamped envelope to K4IIF posthaste and I will get one to you at once. My address is at the head of the column.

Special Contest WPX Award

Special thanks to the DX-MB, Geoff Watts DX News-Sheet, Gus Browning's DXer's Magazine, and the Long Island DX Association Bulletin who printed *full and complete* information on this award prior to the *CQ* WW SSB DX Contest in April.

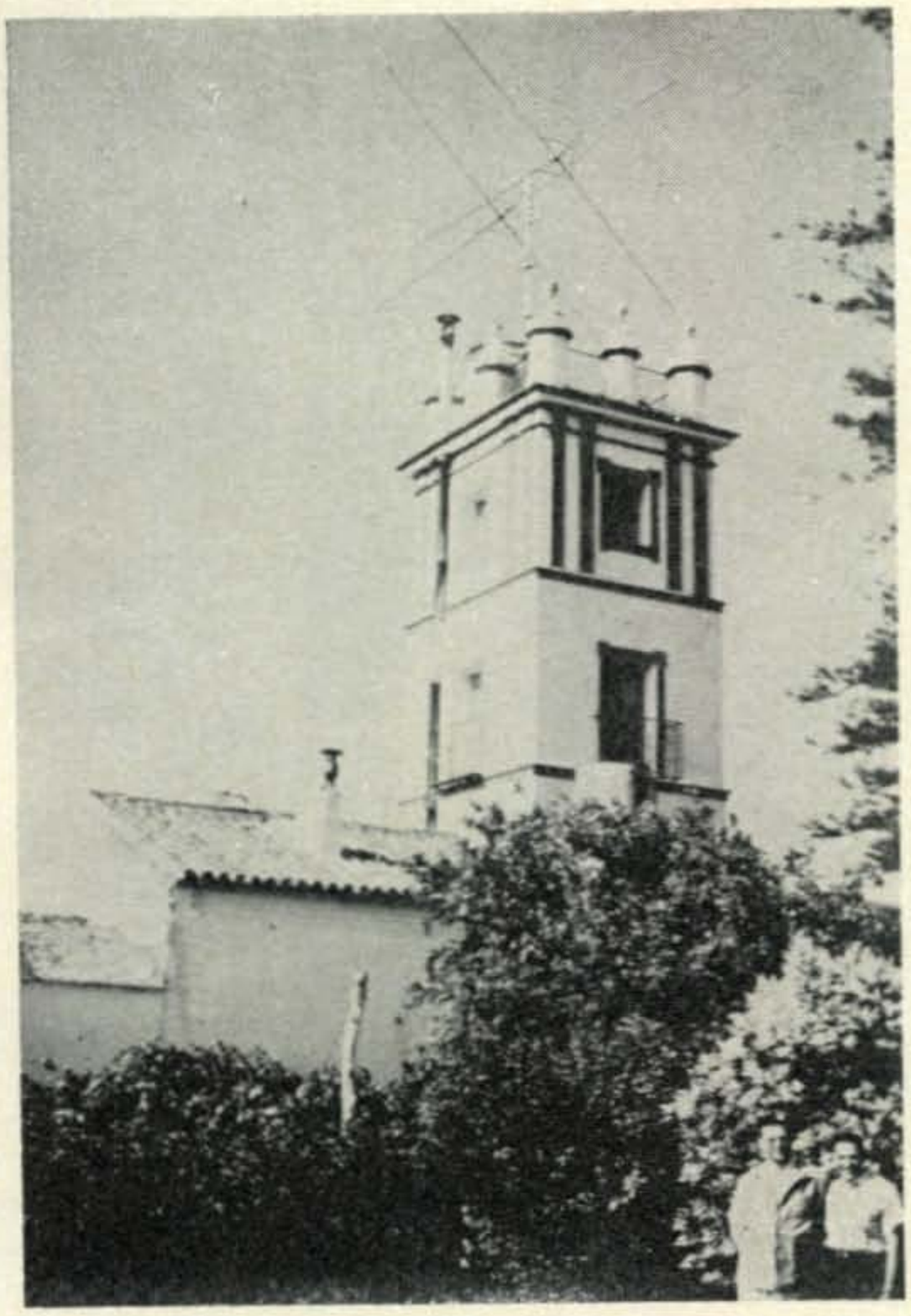
Looking Ahead in the CQ DX Awards Program

There are a few things under consideration which will interest you. You are already familiar with our new WPNX Award and our special WPX Award during the DX Contest. Let us know if you like the WPX Contest Award because we are tentatively planning to offer it again in the *CQ* WW DX Contests this fall.

With regard to the administration of the awards, the DX Editor is pretty much the chief referee of any disputes which may arise regarding prefixes, zones, and countries. I don't object to this responsibility, but it isn't an ideal situation. I think it would be more desirable to have an advisory committee composed of top DXers from different areas of the country to resolve the more controversial questions, and I am working on the formation of such a committee at the present time. The committee will initially be composed of 5 to 7 members with myself as chairman. There will be representatives of the east coast, the midwest, and the west coast, with one or more representatives at large. At a later date we may add some associate committeemen from DX areas to advise us on problems pertaining to their particular countries or zones. Already in the committee lineup are Gay Milius, W4NJF, of the Virginia Century Club as an east coast representative and Dick Spenceley, KV4AA, as a

*P.O. Box 205, Winterhaven, Fla., 33881.

Takae Tokushima, JA6DCE, of Fukuoka, Japan. Takae is 33 years old and works in a bank. At the right, the rig of JA6DCE with which Takae earned his WAZ certificate. *(Photos courtesy W4NJF)*



Joaquin, EA7ID, of Seville, Spain tuning up the rig. Right, the 2 element, triband quad of EA7ID atop the 100 ft. "tower." *(Photos courtesy W2PCJ).*

representative at large. Dick is a former DX Editor of *CQ* Magazine and has been one of the world's most prominent DXers for many years. He is the father of the WPX Award and has a paternal interest in its welfare. I am highly pleased that both these outstanding DXers and gentlemen have agreed to serve.

What would you think of starting the DX Awards program over again with a new series of certificate numbers for each sunspot cycle? We are thinking of starting a Cycle 20 chase next year with hopes of providing some nice prizes for the winners of the first certificates in each category. (Manufacturers please take note.) There would be a nice prize for the first WPX, the first WAZ, and the first SSB DX Award of the new series. How does this sound? We would like to hear from you.

Also under consideration are some further changes in the monthly column. As the column isn't in your hands until 6 or 8 weeks after it is written, it is almost impossible for me to provide you with really useful, up-to-date information on rare stations and DXpeditions. This is the province of the weekly bulletins. Therefore, in the future I plan to de-emphasize this activity somewhat and concentrate on the award's program, the reporting of past events, and the dissimilation of QSL information. You will find an expanded QSL Info list this month and it will probably be increased even more in the future. I hope to use a lot of photographs of DXers both abroad and in the USA in future columns, and I would appreciate your help in obtaining them. Snapshots of operators, rigs, and antennas are appropriate, and will be returned to you after use.

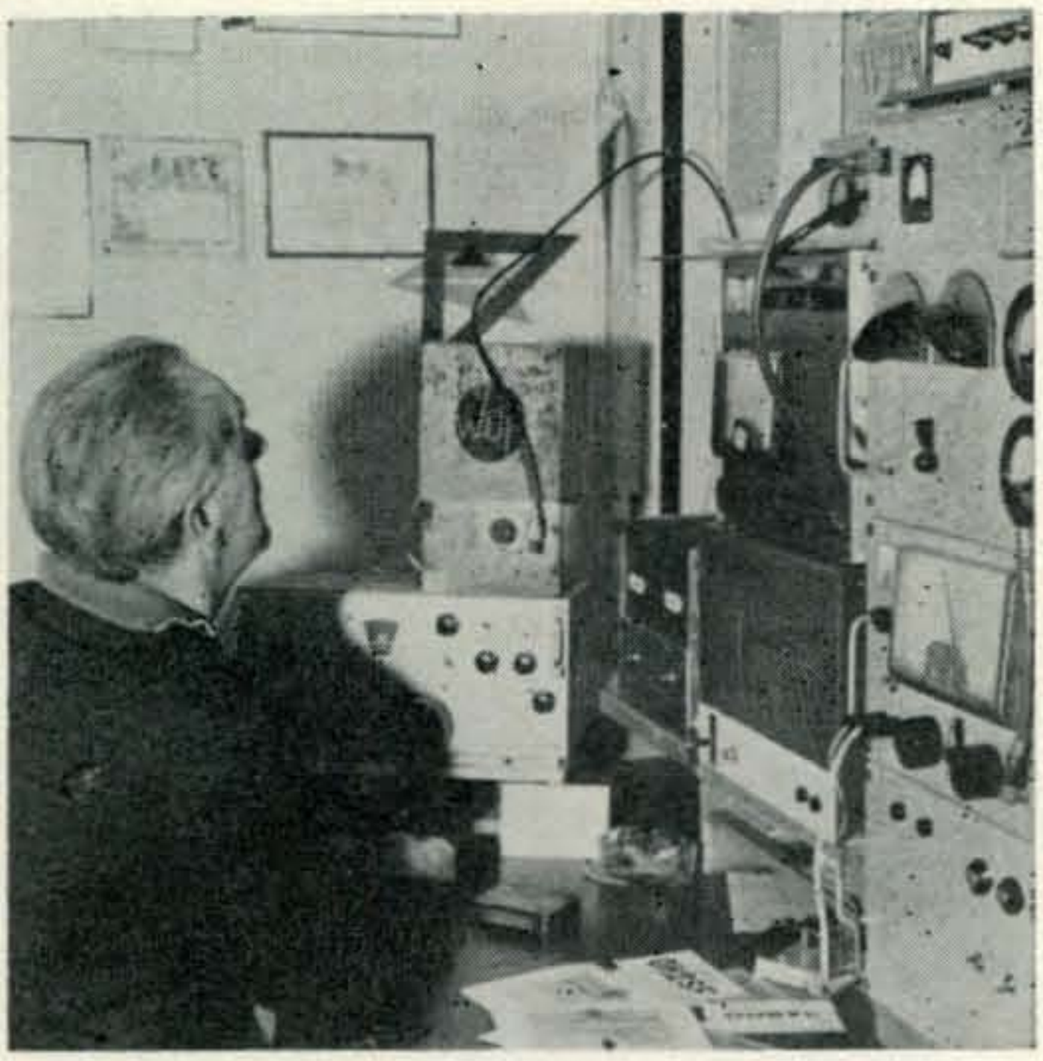
De Extra

To the Newcomer to DX: Maybe you just got your ticket,—maybe you're an ole timer who is tired of ragchewing and handling traffic,—maybe you just plain got bit by the DX-bug,—anyway it happened and you're joining in this DX game. Fine, we're glad to have you. Now lets talk a little bit about the rules.

WHAT RULES you say? All you do is listen around a minute and call CQ DX. What more is there to it? Well, if you're going to DX a month or two and work maybe 50 countries or 70 prefixes that approach might be all right. You can work most of the countries in Europe and So. American that way, countries with large populations of active hams which are known to DX men as "garden variety" countries. However, if you're going to shoot for WPX, WAZ, or the SSB DX Award you're going to need to contact a lot of rare to very rare countries. Sometimes you will only be able to do this by listening for a DXpedition scheduled to operate from the country you need, or there may be an active ham or two in the country who get on the air at sporadic intervals. Whichever it is, the old "CQ DX" technique is not good enough. You won't work rare countries that way. There is no substitute for less talk and more listen. Lots and lots of quiet mornings and evenings just LISTENING.

Now that you begin to see the picture let's go into the details. First of all, what mode do you plan to operate? S.s.b. of course. OK, I'll give you 2 points for that answer, particularly if you're

Larry, W9ALI. The happy smile is the result of a bright, new WAZ certificate after 35 years of hamming.



PAØWOR tuning up his transmitter. This well-liked Dutch operator has compiled an outstanding DX record despite the handicap of total blindness. His WPX certificate can be seen in the upper right hand corner of the picture. *(Photo courtesy PAØLOU).*

going for the SSB DX Award because there is no other way, but if you said a.m. deduct 5 points because you're living in the past. However, the best answer for plus 5 points is c.w., that's right, ole "Charley Whiskey." It's still the best mode for the guy with average equipment to use in running up a good prefix score or working all zones. This isn't to say that you can't do it on s.s.b. because you can. However it takes a lot bigger investment in gear and a lot more know how. The reasons are simple: First, hams in a lot of the "less developed" areas of the world use pretty primitive gear and consider themselves lucky to have it. Surplus World War II equipment is very popular, and c.w. rigs with low power to a dipole or longwire antenna are common. Stations with sideband gear are very rare in many of these countries, and frequently appear only when a DXpedition hits the scene. This is why it takes only 200 prefixes to make WPX on s.s.b while it takes 300 on c.w., but the 300 will be easier to get.

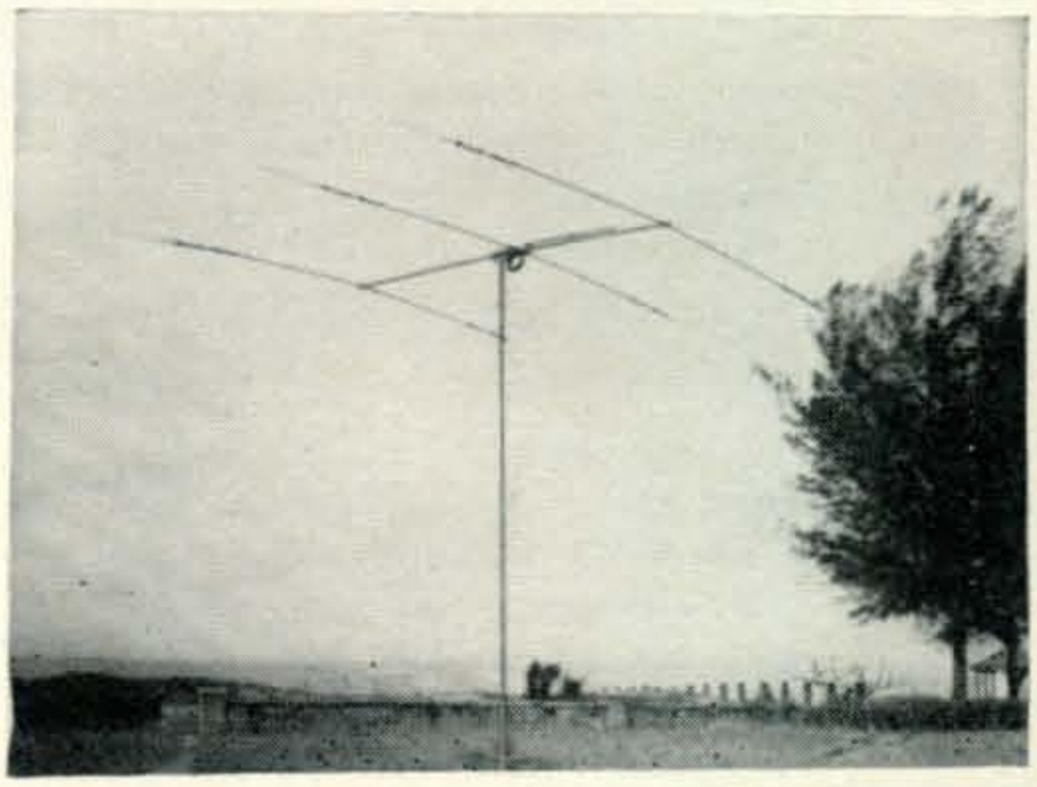
A second reason for starting your DXing on c.w. is that unless you've got beaucoup kilobucks for an extra good receiver, a linear amplifier, and beams on a high tower you're going to have a hard time competing on s.s.b. Now you can work a lot of countries with your 150 watts p.e.p to a 3-element tribander at 35 feet. However, when the rare stations come on you're going to be sitting down on the 10th level and it will be a long time before they hear you. You will miss a lot of the short DXpeditions. However, on c.w. your chances of getting through on low power are not only better, but you may work the local man with 20 watts to a dipole and not have to depend on the DXpedition.

If you're dubious about all this listen down on 20 meter c.w. some evening from 0000 to 0300 GMT and count the number of UA9s, UAØs, UL7s, UH8s, VU2s, etc. that you hear, and then tune up in the fone band and count the number you hear on s.s.b. It should be a revelation to you, but if you still need convincing listen for DX in the 7000 to 7010 kc band segment for a while and then tune into the 40 meter fone band, nuff said, huh?

Now that I've established myself as a reactionary old hypocrite lets proceed to the rules. When a rare station or a DXpedition come on things change, and your style of operation has to change too or else you'll be way out of step. The rare station will have several to several hundred stations calling him at once, and unless you follow his instructions things will become impossible for everyone. Therefore, **Rule 1** is **Follow Orders.** Unless the rare station is operating transceive this means that you will transmit on some designated frequency other than the one he is using, and if he is working them by areas you will transmit only when your area is called. If the "pileup" gets on the DX station's frequency nobody will be able to hear him through the bedlam and nobody will work him. Usually on c.w. the DX station will tune 3-5 kc above or below his own frequency, while on 20 meter s.s.b. he will usually be out of the US fone band, but tuning some designated band of frequencies above 14200. On 10 and 15 meter sideband there is no "DX reservation" corresponding to 14100-14199 on 20 meters and you just have to play it by ear.

Rule 2 is **Keep Your Logs In GMT, (Greenwich Mean Time).** This is a must, for otherwise QSL Managers and rare stations won't be able to locate you in their logs without a lot of trouble. A QSL showing only your local time will frequently be bounced back to you or worse yet end up in the waste basket. Remember, for a DX Award working him is not enough. You've got to have the QSL to prove it.

Rule 3—When you send your card via a QSL Manager send a **Self-Addressed Stamped Envelope, (s.a.s.e.),** for the return of your confirmation. This is a very fundamental rule, yet some QSL Managers tell me that up to 40% of the cards they receive are not accompanied by an



The Hy-Gain TH-3 beam used by ZD3G since Jan. 30, 1967. It puts out a very good signal even though only 20 feet above the ground. *(Tnx K6ENX).*

s.a.s.e. If the card is going directly to the DX-station, or to a QSL Manager in another country, enclose a self-addressed envelope, SAE, with an appropriate number of International Reply Coupons (IRCs), or stamps of the country where the return envelope will be mailed. IRCs may be obtained from most local postoffices, and stamps of many countries can be bought from W2SAW who operates a DX Stamp Service for the Ham fraternity. More on this subject in a later column because getting the QSL is a complex topic in itself.

Rule 4—Pick Your Time Of Operation Intelligently. The magic hours for many DX contacts are just before and after sunrise and sunset, or when it is near sunrise or sunset in the country you want to work. This is why 1100-1400 and 0000-0300 are such popular hours for working into many Asian areas from the east coast. The best times for Africa are usually in the mid to late afternoon hours when you can usually work into Oceania by the long path as well. Short path openings to Oceania are best in the very late evening or early morning hours.

Rule 5—Keep Up To Date On The Latest DX Information. Unfortunately this column is usually written 7-8 weeks before it gets to you so I can't really keep you up on the latest dope. However, there are several good DX bulletins which come out at weekly intervals. If you are serious about DXing you should subscribe to one of them. I will consider the bulletins in detail next month as this is also a vast subject.

Well this doesn't cover everything, but I think it is enough for now. Whether you're a casual DXer or a rabid DXer get in there and enjoy it, but please don't call CQ DX just as a rare one is starting to come through.

Those Rare Russian Zones

The Zones of many of the UA9 and UAØ stations can frequently be determined by the combination of letters which follow the prefix. The first letter following either the numeral 9 or Ø, or following the K as in UA9K—or UAØK—indicates the Zone as shown in the following table:

Zone	*Prefix*	*First letter after numeral or K*
16	UA9, UW9	S, T, U, V, or X
17	UA9, UW9	A, B, C, D, E, F, J, M, or N
18	UA9, UW9	H, or Q
	UAØ, UWØ	A, B, O, P, S, T, U, V, W, & some with Q & R
19	UAØ, UWØ	Some with Q & R, plus C, D, G, I, J, L, M, or Z
23	UAØ, UWØ	Y
25	UAØ, UWØ	Parts of E & F

Judging from the number of inquirys, many people are not aware that a portion of UAØ is in Zone 23. This is the Tanna Tuva region along the Mongolian border. A UAØ station currently active there is UAØKYA. You can see that the table is correct for this station as the Y after the K corresponds to Zone 23. UWØIA, reported by W9EU to be active around 14200 kc at 0500 GMT, is seen to be in Zone 19, while UW9CC is shown by the table to be in Zone 17.

Stuart, VK5MS, at the rig. (Photo courtesy VE3CFG).

Kwajalein Atoll

Sylvania Electric Products has announced the opening of a field office on Kwajalein to direct installation of a long-range tracking system. More than 50 members of its Product Support Organization will be stationed on Kwajalein or Roi Namur to aid in the installation. Any hams aboard??????

Viet-Nam

The following interesting bit of information comes to us via Geoff Watt's DX-News Sheet: "Official info from Australian Military Forces to ZL1HW states that VK2AIF is allocated to 1st Sig. Regt. ARC., but that they have been inactive for 18 months. The Australian PMG. Dept have traced VK2AIF/XV5 calls as made from XV5 by an unauthorized operator. K8NHW/XV5 is now QRV, but awaiting word from FCC whether he will be allowed to work W-stations. If so, his QSLs will be handled by W6FAY."

You Handle Mine and I'll Handle Yours

Klaus Gueldenpfenning, DL7KX/W2, writes that Frieder A. Kluge, DJ8UC, will handle all European QSLs for DL7KX/W2 and WB2FNT. In return, Ernest Juhn, WB2FNT, will handle QSLs for DJ8UC to North America and Central America. The direct U.S. address of DL7KX/W2 is 42-20 192nd St., Flushing, New York, N. Y.

From the Carolines

KG6AHW writes that at 0030 on the morning of March 2, 1967 a small but highly destructive tropical typhoon struck the Palau group of the Western Caroline Islands. The hardest hit was the tiny island of Koror. The head of the Catholic Mission, Father Richard Hoar, KC6AQ, along with 85% of the other islanders, found himself with no roof over his head. The heavy rain and 100 m.p.h. winds had thoroughly soaked his rig and divided his beam into small pieces. Thelma McKinsey, KC6CK, was in the same predicament, and the island power distribution system was all but comletely destroyed.

Ray Benny, ZD3G, and the Swan Transceiver he has used to make so many contacts from the once very rare country of Gambia. Ray is in the Peace Corps and has been on the air from The Gambia since Dec. 10, 1966. He expects to remain active until approximately October, 1967. He was very active during the s.s.b. portion of the ARRL DX Contest making over 2000 contacts. *(Photos and information courtesy Otto, K6ENX, QSL Manager).*

By the next morning news of the disaster had gotten to Guam and Saipan and the Marianas Amateur Radio Club went into action. Lou Garrido, KG6AIG, began a continuous watch on 20 meters for some contact with Koror, and on Friday, March 3 when the U.S. Coast Guard sent a plane load of relief supplies a transceiver contributed by Tommy Tudor, WA5GDQ/KG6 was included. John Hogan, KG6AHW, also sent a 1 kw, Mighty Mite generator. KC6AQ rigged part of the tattered beam belonging to KC6CK, and by using the transceiver he was able to get on 20 meters by Saturday, March 4. His signal was poor but readable.

On Tuesday, March 7, a well equipped Tommy Tudor and Bill Wehrung, WA4YOK/KG6 boarded the Coast Guard plane determined to get a 5/9 signal out of Koror within 24 hours. After considerable pipe bending and straightening they finally raised Thelma's beam and were pleased to find that the s.w.r. only varied from 1.0 to 1.5-1 across the entire 20 meter band, and by the cool of Wednesday evening March 8 a solid 5 by 9 was again radiating from the QTH of KC6CK.

K2MGE—New Call and QTH

Dorothy, K2MGE, is now active as W4MYE. Her new address is 10 Carjen Ave., Asheville, North Carolina 28804. She is very busy these days with FB8WW QSLs, and judging from Henri's activities on 20 meters things will become even more hectic in the future

New West Gulf DX Bulletin Editor

The new editor of the West Gulf DX Club Bulletin is Tom, WA5LES. His address is 3819 S. Shepherd, Houston, Texas 77006. Everyone sends a vote of thanks for a job well done to retiring editor, Frank Campbell, W5IGJ, who has rendered four years of excellent service.

QSO Assistance Needed

UA900 writes via WA4IKU that he needs help on WAS. He will be on 14 mc c.w. daily between 0100 and 0500 GMT listening for Nevada, Maine, Wyoming, Louisiana, Montana, Delaware, and Rhode Island.

JA3CWV writes that he is QRX for the West Indies every evening around 2300-0100 GMT on 28515 kc.

DX Editor Away

DX Editor K4IIF will be away on special assignment from approximately June 20 to July 25. Mail directed to the DX Department will be answered as promptly as possible after he returns.

Correction in QSL Manager Listing

Chuck, VP5RS/VP7CC writes that his QSL Manager is K7UXN, not K7UNX as incorrectly listed in a recent issue.

VK7TR

Ray Conrad, VK7TR, of Hobart, Tasmania was completely burned out in the great fire which recently swept the South Australian island. His home and all contents including his radio gear, QSLs, and logs were completely destroyed. Ray and his XYL escaped with their lives by racing away in the night in their car from the fire which descended on their home at 75 m.p.h. If those to whom Ray owes VK7TR cards will send QSLs to his old QTH or to VK7CK, he will attempt to QSL from memory. Ray and Mrs. Conrad were to leave April 22 for England and the USA. They hope to be in New England by August 20 to visit W1BCR. Afterward they will visit W3CES in Pennsylvania and then travel across the USA to the west coast and thence homeward. Don't be surprised to hear Ray's melodious accent from G3LSF, W1BCR, W3CES, and others as he will be applying for reciprocal privileges. (*Tnx W3CES*).

On The Bands

As mentioned above, this section of the column is being de-emphasized due to the difficulty in forecasting DX events two months before they take place. However, information which seems to have lasting value will still be presented.

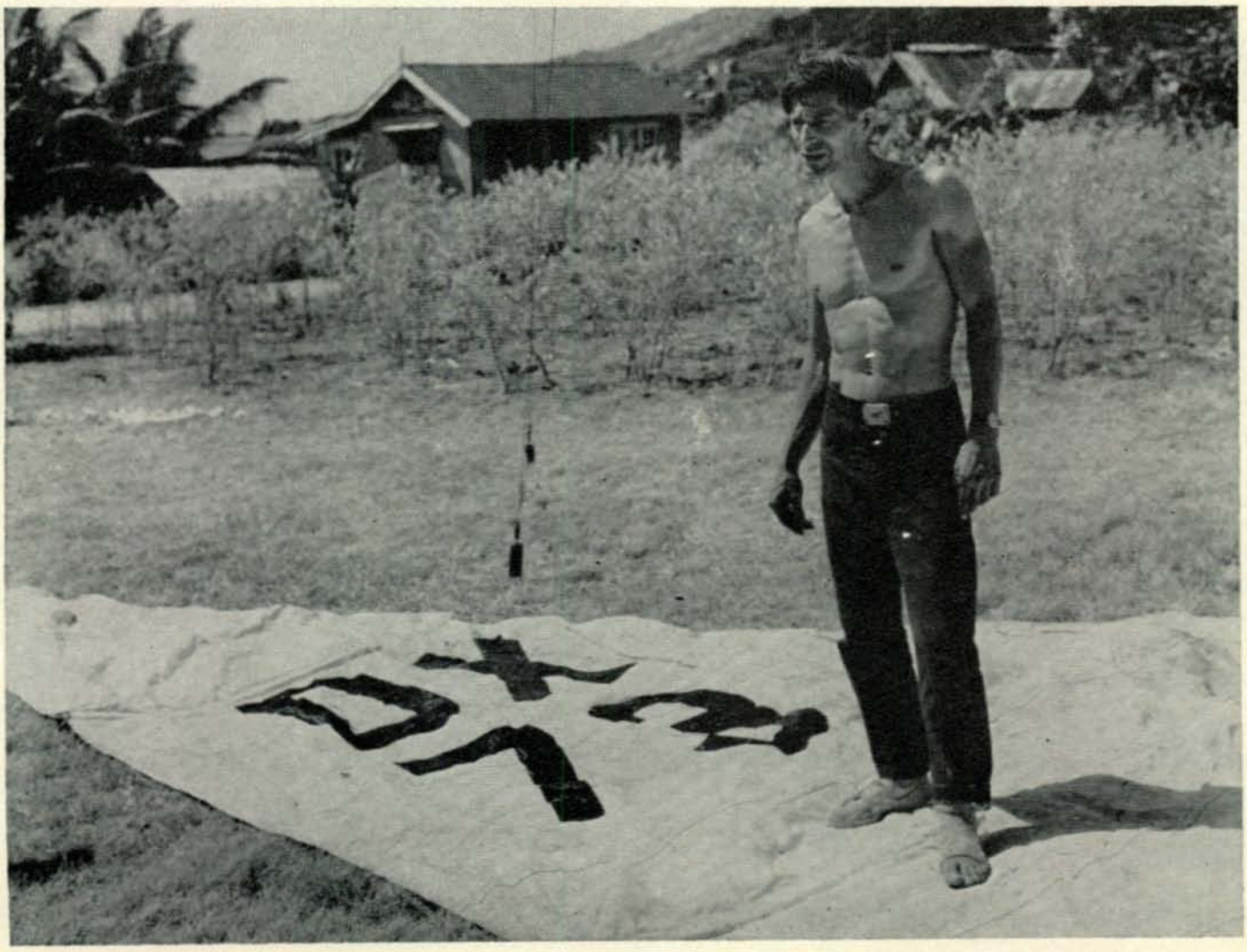
AP2, Pakistan—AP2NMK is reported to be legitimate, active, and to QSL promptly (*Tnx DXers Magazine*).

FB8, Crozet—Henri, FB8WW has been quite active on s.s.b. around 14250 kc. 1230Z has been a good time to work him from the east coast.

EL9, Liberia—EL9A will be active at this rare prefix for over a year. (*Tnx DXers Magazine*).

K6KA DXpedition—By June 1 the meat of the trip will be over, but the remainder of the itinerary will be as follows: May 30—5X5AU, June 4—SV1, June 7—SVØWL Crete, and June 8—Rhodes, SVØWU. The c.w. frequencies are 7004, 14044, and 21044. The s.s.b. frequencies are 7194, 14104, 14194, 21404, and 28544. (*Tnx Florida DX Report).*

Above, Newcomers and old timers alike will agree that these shots from the May, 1959 CQ showing the incomparable Danny Weil, VP2VB/MM, are some of the most expressive DX photographs ever taken. The scene was the sinking of the YASME III on the rocks of the Grenadines during Danny's trip through the VP2s. Danny subsequently recovered, of course, and made a very successful DXpedition to the Pacific before going QRT in 1963.



KG6, Mariannas (Saipan)–KG6SL is active daily on ten meters around 28600 kc. The usual times are 2100-0100 GMT. Early risers can find him on 14270-275 kc around 1000 GMT. *(Tnx W4FRO).*

KH6, Kure Island–KH6EDY is active on several bands. He has been worked on 14235 at 0605 GMT, 21395 kc at 0330 GMT, and 28575 kc at 0040 GMT. *(Tnx K4THA).*

PYØ, St. Peter and Paul's Rocks–PYØXA DX-pedition was definitely legitimate. *(Tnx K1IMP).*

Twenty Meters–The No. 1 DX Band is frequently open 24 hours per day. Happy days are here again. *(Tnx Todo el Mundo y Alle Menchen).*

QRT–VS9ARV and 6O6BW are now QRT and have returned home. Ray is now G3VIY while Bee is back in Florida and can be reached through his QSL Manager W4HKJ.

WAE Contest–A good time to pick up any countries you may need in Europe is during the Worked All Europe (WAE) Contest. The c.w. section is during the 2nd week of August, while fone is the second weekend of September. Details will be given in Frank's Contest Column and longsheets may be obtained from DL7EN. *(Tnx DX-MB).*

YK1, Syria–YK1AA and his son YK1AM will not lose their licenses as had been rumored earlier. *(Tnx DXers Magazine).*

3V8, Tunisia–3V8BZ, Reinhardt, has been reported around 14100 using an HX-20 to a ground plane antenna *(Tnx DX News-Sheet).*

4W1, Yemen–4W1G has been reported on 14115-14125 kc between 1500 and 1800 GMT. The length of his stay is unknown at this time. *(Tnx West Gulf Bulletin).*

9G1, Ghana–Earl, W7KTL, is now active as 9G1KT. Listen for him on 10, 15, and 20 meters between 1700 and 2100 GMT.

Some semi-rare to rare stations recently reported on the bands include the following: **7 mc c.w.**–CO7HC, 7020 kc, 2313 GMT; CR6GO, 7007 kc, 0422 GMT; VP1MW, 7006 kc, 0520 GMT; VP2KR, 7026 kc, 0432 GMT; ZD3G, 7006 kc, 2322 GMT; 9L1TL, 7016 kc, 0503 GMT.

14 mc c.w.–HV1CN, 14042 kc, 1833 GMT; JT1AG, 14029 kc, 1300 GMT; OHØNM,14024 kc, 1833 GMT; SU1IM, 14038 kc, 2215 GMT; TJ8QQ, 14002 kc, 0642 GMT; UJ8AV, 14030 kc, 1430 GMT; 9M8RS, 14050 kc, 1635 GMT.

14 mc s.s.b.–EA8CB, 14212 kc, 0858 GMT; ET3USA, 14198 kc, 2142 GMT; FK8AV, 14303 kc, 0730 GMT; FR7ZN, 14105 kc, 1730 GMT; FY7YM, 14170 kc, 2315 GMT; KC6AA, 14315 kc, 1357 GMT; KS6CL, 14225 kc, 0850 GMT; PJ4AC, 14115 kc, 2347 GMT; VKØCR, 14175 kc, 0745 GMT; ZB2AM, 14115 kc, 0823 GMT; ZD7IP, 14225 kc, 2000 GMT; ZS3BP, 14125 kc, 2100 GMT; 3W8D, 14120 kc, 1730 GMT; 5R4AS, 14114 kc, 1520 GMT; 5U7AK, 14230 kc, 1955 GMT; 5W1AA, 14148 kc, 0651 GMT; 5X5FS, 14290 kc, 1925 GMT; 9M2BO, 14118 kc, 1514 GMT; and 9M6MG, 14168 kc, 1624 GMT.

28 mc–CR4BC, 28242, 1144 GMT; CR9AH, 28640 GMT, 1025 GMT; EP2GI, 28675 kc, 1006 GMT; FG7XX, 28085 GMT, 1318 GMT; HI7JMP, 28035 kc, 1755 GMT; MP4BGM, 28680 kc, 0928 GMT; UI8KNA, 28072 kc, 1313 GMT; VK8NO, 28050 kc, 1116 GMT; ZD8BUD, 28518 kc, 1843 GMT; 5R8AX, 28650 kc, 1622 GMT; 9L1TL, 28457 kc, 1150 GMT; 9V1NV, 28015 kc, 1819 GMT; and 9Y4VS, 28430 kc, 1330 GMT.

This report is courtesy *Geoff Watts DX-News Sheet*. Many of the observations were made at European locations, and consequently the times reported do not coincide with the time the station would be heard in the USA. However, the frequencies should be of value, and it shows a representative sampling of the wide variety of DX being heard on the bands.

QSL Information

CT2BO–Via W6NJU
CT3AS–Via G2MI
CR6AI–To W7VRO
CX3BBD–To U.S. Embassy, Montevideo, Uruguay
EA8AH–Via W4CCB
EL2D–Via K3JXO
EL9A–To P.O. Box 548, Monrovia, Liberia
EP2BQ–Via Box 1065, Tehran, Iran
ET3KWD–To K4KWD
ET3USA–Via W7TDK
FB8WW–Via W4MYE (ex-K2MGE)
FM7WQ–To W4OPM
FO8BS – Via P.O. Box 374, Papeete, Tahiti
FR7ZL/T–To Guy Petit de la Rhodiers, 7 Eme Km., St. Francis, Reunion Island
GC8HT–Via W6UNP
GD3PXO–To G3ULF
HC8FN–Via WA2WUV
HH9EH–To P.O. Box 70B, Port-au-Prince, Haiti
HI8XAL–To W9SZR
HR4ET–Via P.O. Box 3, Amapala, Honduras
HZ1AT–To G3DYY
I4LCK (SSB DX Contest Operation)–Via I1LCK
I6ESV–To P.O. Box 26, Varese, Italy
JT1CK–Via Box 639, Ulan Bator, Mongolia
K6KA DXpedition–To K6KA, Box 1, La Canada, Calif. 91011
K3FOY/OX5–Via VE7BMS
KØOXV/CEØA–Via K8EHU
KB6CZ–Via K4MQG
KG6CD–To W5VWU
KG6IG–Via K6ZDL
KG6SL–To W4FRO, P.O. Box 714, Eau Gallie, Fla. 32935
KH6CH/KW6 – Via Box 365, Wake Island, 96930
KJ6JA–To WA6OET
KL7FRY–To E. Cunningham, c/o G.E.C., APO, Seattle, Wash. 98736
KR6JZ–Via W2CTN
KS4CC–To WB6ITM, John F. Morrice, Rt. 3, Box 171, Carmel, Calif. 93921
KS6BO–Via K4TWE
UA6KAF/UF6–Cards for Nov. 25-27, 1966 operation go to Larry Loper, W4WHF, 255 Suntan Ave., Sarasota, Fla. 33577
VE3FJZ/SU–Via VE3AWU
VE8YL–To WØQUU, 686 Arbogast Rd., St. Paul, Minn. 55112
VK8OX–Via G5UG (Use large SAE as card is 8&½ by 6 inches).
VP1PV–To G3UML
VP1RC–Via WA6BFA
VP2AA–To VE3ACD
VP2AC–Via WA4AYX
VP2GSM–To W9YSM
VP2KY–Via WØVXO
VP5AB–To W1WQC
VP6KL–Via VE40X
VQ9BC/D–To Box 191, Mahe, Seychelles
VQ9HB/D–To Box 191, Mahe, Seychelles
VR1C–Via ZL2NS
VR5PK–To Box 46, Tonga Island
VR6TC–Via W4TAJ
VS9ARV–Via G3VIY, Ray Vasper, 15 The Street, Godmersham, Canterbury, Kent
WA6ZZD/KP6–To K6UJW
ZK1AR–Via K4SHB
ZD7KH–C/O Cable & Wireless Ltd., The Briars, St. Helena, or via K2HVN
ZF1EP–To W4PJG
ZF1RD–Via K8LSG
ZL1AI–Via K6UJW
ZS2MI–To ZS4OI
ZS8L–Via W4BRE
ZS9D–To W4BRE
3B2HA–Via Goose Bay Amateur Radio Club, P.O. Box 232, Goose Bay, Labrador
3V8BZ–To DARC Bureau, P.O. Box 99, 8 Munich 27, Germany
3V8SW–Via W1BPM
4S7NE–To W5NOP
4U1SU–Via Iinternational Amateur Radio Club, Geneva 20, Switzerland
4W1G–To HB9MQ
4X4RD–Via W3HNK
5R8AS–To W6ZPX

[*Continued on page 101*]

Propagation

BY GEORGE JACOBS,* W3ASK

SPACE FLASH

June 25 has been designated as "World Television Day". To mark the event, a special 2-hour television program is planned which will be seen live in at least 28 countries in Europe, Africa, Australia, Asia and the Western Hemisphere. Four communication satellites will provide an unprecedented link-up between the widely separated points on the globe participating in the program. The four satellites will include the Earty Bird satellite in a stationary orbit over the Atlantic, the Lani Bird satellite over the Pacific, a third INTELSAT satellite over the Atlantic and the Russian Molniya-1 satellite.

For the world television program, the world will be divided into four television zones, with a control center for each zone. The control center for the Western Hemisphere will be located at the EXPO-67 city of Montreal, with other centers at Moscow, Prague, London and Brussels. Coordination of all centers will take place from London. Commentaries will be given in English, French, German, Russian and Spanish.

It is expected that hundreds of millions of persons in at least 28 different countries will be able to watch on their television sets the first television program being beamed to the entire world. Among the television stations participating in the program are those of Czechoslovakia, Australia, Germany, Hungary, Italy, Japan, Mexico, Spain, Canada, the United Kingdom, Russia, France, the United States, Cuba, UAR, and many others.

The world television program is scheduled to begin at 1900 GMT on June 25 2 P.M. EST). Late reports indicate that it will be carried in the United States only over the facilities of the National Educational Network (NET). Check the television program listing in your local newspapers for more information concerning the stations that will be carrying the world television program in your area.

THE present sunspot cycle is rising at a faster rate than earlier, and it is expected to reach a smoothed suspot number of 90 by this month. This is a relatively high level of sunspot activity and should result in a pattern of propagation conditions on the amateur h.f. bands which has not occurred since the summer of 1960.

Excellent world-wide DX propagation conditions are forecast for 15 meters, with conditions peaking during the late afternoon and early evening hours. To some tropical and southern areas of the world, the band is expected to remain open well into the hours of darkness. Fifteen meters is expected to be the optimum band for DX openings during most of the daylight hours.

While DX openings to most areas of the world are forecast almost around-the-clock on 20 meters, propagation conditions are expected to peak on this band during the early evening

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for June

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: **2-3, 7, 15, 24, 29**	A	A-B	B-C	C
Normal: **1, 4, 6, 8-10, 12, 14, 16, 19-21, 23, 25-28, 30**	A-B	B-C	C-D	D-E
Below Normal: **5, 11, 13, 17, 22**	C	C-D	D	E
Disturbed: **18**	D	D-E	E	E

How To Use These Charts

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

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

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

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

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

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

6—The Eastern USA chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9 and Ø areas, and the Western USA Chart in the 6 and 7 areas. The Charts are valid through July 31, 1967, and 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 the hours of darkness. During June, 20 meters is expected to be the optimum band for DX propagation conditions during the hours of darkness.

A sharp seasonal decrease is expected in DX propagation conditions on 10 meters during June and the summer months. While fewer openings are predicted, some fairly good ones however, may take place to some areas of the world during the daylight hours.

With a greater number of daylight hours and a sharp seasonal increase in static levels, DX propagation conditions are expected to be poorer on the 40, 80 and 160 meter bands during June than they were during the previous winter and early spring months.

Despite the poorer conditions, some fairly good DX openings are forecast for 40 meters, a few for 80 meters, and hardly any at all for 160 meters. The optimum times for DX openings on these bands are during the hours of darkness and the sunrise period.

This month's *CQ* Propagation Charts contain DX predictions to all areas of the world for *June* and *July*. Short-skip predictions for June, for distances between 50 and 2300 miles, and from Hawaii and Alaska, appeared in last month's column. Instructions for the correct use of this month's DX Propagation Charts appear directly below the "Last Minute Forecast" at the beginning of this column.

V.h.f. Ionospheric Openings

Sporadic-E short-skip propagation reaches a seasonal peak during June, and this is expected to result in very frequent openings on 10 meters, numerous openings on 6 meters, and an occasional openings on 2 meters. Six meter short-skip openings are expected to occur almost daily during the month, between distances of approximately 750 and 1300 miles. When intense sporadic-E ionization takes place, "two-hop" openings up to distances of about 2400 miles may also be possible on 10 and 6 meters. During periods of intense sporadic-E propagation, two meter openings may occur between distances of approximately 1200 and 1400 miles.

While sporadic-E openings may occur at any time, they are more likely to take place between 9 A.M. and 1 P.M., local time, and between 5 P.M. and 9 P.M. For some tips on self-predicting v.h.f. sporadic-E openings see "Some Notes on Sporadic-E Propagation", which appeared on page 60 of the June, 1962 issue of *CQ*.

No major meteor showers are expected during the month, and very little auroral activity is forecast for June. Check the "Last Minute Forecast" appearing at the beginning of this column, since v.h.f. auroral openings are likely to occur during periods of ionospheric storminess or below normal h.f. conditions.

Sunspot Cycle

A monthly sunspot number of 108 was reported by the Swiss Federal Solar Observatory for March 1967. This results in a smoothed sunspot number of 64 centered on September, 1966, as the present sunspot cycle begins to climb at a more rapid rate than previously. This month's propagation forecast is based upon a predicted smoothed sunspot number of 90, centered on June, 1967.

CQ DX Propagation Charts

JUNE & JULY, 1967

Time Zone: EST (24-Hour Time)

Eastern USA To:

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

*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.

Southern Brazil, Argentina, Chile & Uruguay	13-16 (1) 16-18 (2) 18-21 (1)	07-08 (1) 08-14 (2) 14-16 (3) 16-19 (4) 19-23 (3) 23-00 (2) 00-01 (1)	14-16 (1) 16-18 (2) 18-19 (3) 19-00 (4) 00-02 (3) 02-05 (2) 05-07 (3) 07-08 (2) 08-10 (1)	20-23 (1) 23-04 (2) 04-06 (1) 00-05 (1)*
McMurdo Sound, Antarctica	15-18 (1)	08-10 (1) 14-16 (1) 16-17 (2) 17-18 (3) 18-19 (2) 19-21 (1)	16-18 (1) 18-21 (2) 21-00 (3) 00-02 (2) 02-07 (1) 07-09 (2) 09-10 (1)	23-06 (1)

Time Zones: CST & MST (24-Hour Time)
CENTRAL USA To:

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

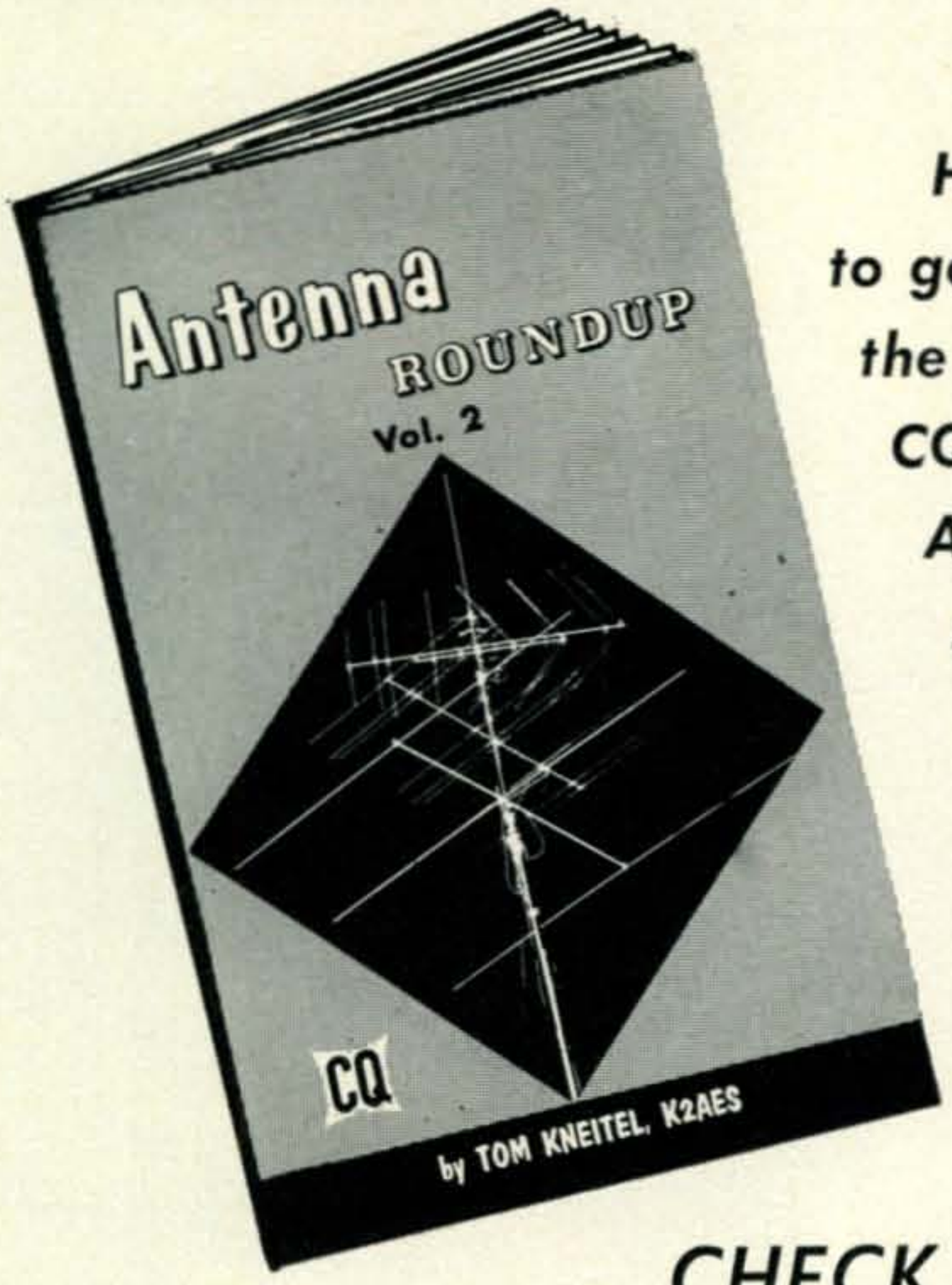
Southern Brazil, Argentina, Chile & Uruguay	08-12 (1) 12-14 (2) 14-18 (3) 18-19 (2) 19-21 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	02-04 (1) 04-08 (2) 08-14 (1) 14-16 (2) 16-22 (4) 22-00 (3) 00-02 (2)	20-22 (1) 22-01 (2) 01-04 (1) 22-04 (1)*
McMurdo Sound, Antarctica	14-19 (1)	11-14 (1) 14-16 (2) 16-18 (3) 18-20 (2) 20-21 (1)	16-18 (2) 18-22 (3) 22-00 (2) 00-04 (1) 04-07 (2) 07-16 (1)	23-05 (1)

Time Zone: PST (24-Hour Time)
WESTERN USA To:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western Europe & North Africa	08-10 (1)	21-22 (1) 22-00 (2) 00-01 (1) 06-07 (1) 07-08 (2) 08-11 (3) 11-13 (2) 13-15 (1)	03 05 (1) 05-07 (2) 07-14 (1) 14-16 (2) 16-18 (3) 18-21 (2) 21-00 (3) 00-03 (2)	19-22 (1)
Central & Northern Europe & European USSR	*Nil*	21-22 (1) 22-00 (2) 00-02 (1) 05-07 (1) 07-09 (2) 09-11 (1)	06-08 (2) 08-14 (1) 14-18 (2) 18-21 (3) 21-23 (2) 23-06 (1)	20-22 (1)
Eastern Mediterranean & East Africa	08-11 (1)	07-11 (1) 11-13 (2) 13-14 (1) 19-20 (1) 20-22 (2) 22-01 (1)	12-15 (1) 15-19 (2) 19-22 (3) 22-00 (2) 00-02 (1) 05-07 (1)	*Nil*
West & Central Africa	07-10 (1)	06-10 (1) 10-12 (2) 12-16 (1) 16-18 (2) 18-19 (1) 22-01 (1)	11-14 (1) 14-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-03 (2) 03-07 (1)	20-23 (1)
South Africa	*Nil*	08-11 (1) 23-02 (1)	01-05 (1) 05-07 (2) 07-10 (1) 10-12 (2) 12-18 (1) 20-21 (1) 21-01 (2)	19-20 (1) 20-21 (2) 21-22 (1) 19-21 (1)*
Central & South Asia	08-11 (1)	07-08 (1) 08-10 (2) 10-12 (1) 17-22 (1)	22-04 (1) 04-07 (2) 07-12 (1)	*Nil*
Southeast Asia	08-10 (1) 14-16 (1)	07-08 (1) 08-10 (2) 10-12 (1) 16-18 (1) 18-21 (2) 21-22 (1)	06-07 (1) 08-10 (3) 10-11 (2) 15-18 (1) 18-20 (2) 20-00 (1)	02-06 (1)
Far East	13-15 (1)	07-08 (1) 08-10 (2) 10-13 (1) 13-16 (3) 16-22 (2) 22-00 (3) 00-02 (1)	18-20 (1) 20-22 (2) 22-00 (4) 00-03 (3) 03-07 (2) 07-09 (3) 09-12 (2) 12-14 (1)	01-02 (1) 02-05 (2) 05-06 (1) 02-04 (1)*
Guam & Pacific Islands	13-15 (1)	07-09 (1) 11-12 (1) 12-14 (2) 14-16 (1) 16-20 (2) 20-23 (3) 23-00 (2) 00-02 (1)	06-07 (2) 07-09 (4) 09-10 (3) 10-12 (2) 12-16 (1) 16-18 (2) 18-20 (3) 20-01 (4) 01-06 (3)	23-01 (1) 01-04 (3) 04-06 (2) 06-07 (1) 23-01 (1)* 01-04 (2)* 04-06 (1)*
Australia & New Zealand	13-14 (1) 14-17 (2) 17-19 (1)	11-12 (1) 12-16 (2) 16-18 (3) 18-20 (4) 20-21 (3) 21-22 (2) 22-00 (1)	06-11 (1) 11-13 (2) 13-18 (1) 18-20 (2) 20-22 (3) 22-00 (4) 00-05 (3) 05-06 (2)	23-01 (1) 01-04 (2) 04-07 (1) 00-02 (1)* 02-04 (2)* 04-06 (1)*

[*Continued on page 101*]

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 supergiants 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!

SPRING BONANZA
CQ's Giant Subscription Giveaway

100 UNIVERSAL QSL CARDS
Handsomely Printed in 2 Colors on fine quality stock
$2.00 VALUE
FREE WITH BONANZA SUBSCRIPTION

1

W9IOP's FAMOUS "Second Op"
$1.00 VALUE
DX Operating Aid
FREE WITH BONANZA SUBSCRIPTION

2

CALL LETTER BADGE
K2MGA 1" x 3"
Handsomely Engraved With Your Call
$1.50 VALUE
FREE
WITH BONANZA SUBSCRIPTION

3

SHURE REACTANCE SLIDE RULE

$1.00 VALUE
FREE
With A Bonanza Subscription

4

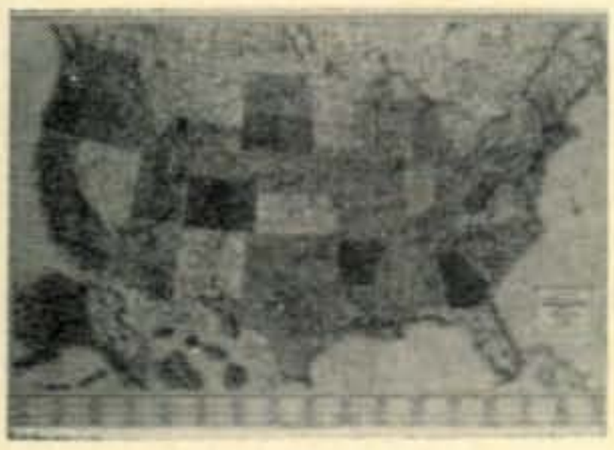
TEPABCO *package of*
3 *plastic* **QSL** *Holders*
Each Holds 20 cards
Fine for WAZ or WAS displays.
$1.00 VALUE
FREE
WITH BONANZA SUBSCRIPTION

5

W1DBM's FAMOUS "TVI" HANDBOOK
$1.50 VALUE
FREE
WITH BONANZA SUBSCRIPTION

6

GIANT 38" x 52" FOUR-COLOR MAPS OF THE U.S. AND THE WORLD!
$2.00 VALUE FREE WITH A BONANZA SUBSCRIPTION



7

9

8

CQ MAGAZINE,
14 Vanderventer Ave.
Port Washington, L. I., N. Y. 11050

Rates: 1 Year... $5 ☐ 2 Years....$9 ☐ 3 Years....$13 ☐
Pan-American and Foreign Add $1.00 Per Year Postage.

Please enter my subscription to CQ for_____year(s). Enclosed is $_____. Please start with the _____ issue.

☐ New ☐ Renewal

Please Print

NAME_____

ADDRESS_____

CITY_____

STATE_____ ZIP_____

CALL_____

CHECK ONE BONANZA BONUS ITEM FOR EACH YEAR OF SUBSCRIPTION

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
6 ☐ 7 ☐ 8 ☐ 9 ☐

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

June	2-5	CHC/FHC/HTH QSO Party
June	3-4	National Field Day
June	10-11	ARRL VHF QSO Party
June	10-11	New York State QSO Party
June	24-25	ARRL Field Day
July	1-2	Venezuelan Contest
July	3-4	FEARL-M Contest
July	22-23	Colombian Contest
August	12-13	WAE C.W. DX Contest
August	19-20	QRP QSO Party
August	26-27	All Asian Contest
September	9-10	WAE Phone DX Contest

CHC/FHC/HTH QSO Party

Starts: 2300 GMT Friday, June 2
Ends: 0600 GMT Monday, June 5

The contact exchange is more involved than the average contest and the scoring is a bit complicated. A review of the rules in last month's CALENDAR is highly recommended.

Mailing deadline is July 5th and logs go to: Clif Evans, K6BX, Box 385, Bonita, Calif. 92002.

National Field Day

Starts: 1700 GMT Saturday, June 3
Ends: 1700 GMT Sunday, June 4

This is primarily a European activity but overseas stations are invited to participate.

There is an award to the overseas station that has the most contacts with these portables.

Send your report no later than June 19th to: RSGB H. F. Contest Committee, 28 Little Russell Street, London WC1, England.

New York State QSO Party

Starts: 1800 GMT Saturday, June 10
Ends: 0200 GMT Monday, June 12

The South Shore Amateur Wireless Association invites all to join in its annual QSO party.

There are no time or power restrictions, you use both c.w. and phone and the same station can be worked once per band and mode.

Exchange: QSO number, RS/RST, ARRL section, country or New York county.

Scoring: One point per QSO, multiplied by number of N.Y. counties. In state stations use ARRL sections and countries for their multiplier.

Frequencies: 3565, 3900, 7065, 7250, 14065. 1420, 21065, 21350, 28065, 29000.

Awards: Certificates to the high scorer in each ARRL section, N.Y. county and country. (A minimum score of 100 points required)

Include a s.a.s.e. with your entry which must be received by July 15th. They go to: SSAWA, P.O. Box 465, Valley Stream, New York 11582.

ARRL Field Day

Starts: 2100 GMT Saturday, June 25
Ends: 2400 GMT Sunday, June 26

This is the week-end that half the ham population in this country takes to the hills. The boys really stir up the pea patch. The June issue of *QST* will give the details.

Venezuelan Contest

Starts: 0000 GMT Saturday, July 1
Ends: 2400 GMT Sunday, July 2

The Radio Club Venezolano invites all amateurs to participate in their annual contest. This one commemorates the 156th Anniversary of the Independence of Venezuela.

Bands: This is a phone *only* contest, a.m. or s.s.b., all bands 10 thru 80.

Exchange: The RS report plus a 3 figure contact number starting with 001.

Categories: Single operator, single band and all band. Multi-operator, all band only, both single and multi transmitter.

Contacts: *Stations in the Americas:* With YV's, other American countries and the rest of the world. *Stations in other continents:* With YV's and other American countries only.

Scoring: One point per contact, 2 points if its with a YV. (Except on 40, where its 1 point for stations in the Americas, 2 points for all other continents.)

Multiplier: A multiplier of 1 for each country, YV call area and USA call area.

Final Score: For a single band, total QSO points multiplied by the multiplier. All band, total QSO points multiplied by the sum of the multipliers from all bands.

Logs: Date/time in GMT, station worked, number sent, received, multiplier (only first time worked) and QSO points. Use separate sheet for each band. Also include separate summary sheet with your computed score and your name and address in BLOCK LETTERS.

Awards: A certificate to each station with the following number of contacts. *Americas:* With

*14 Sherwood Road, Stamford, Conn. 06905.

20 YV's and 10 other countries. *Other Continents:* With 5 YV's and 5 other American countries. (s.w.l.'s with 50 different confirmed contact.)

There are also 8 Trophies for the highest scorer in each category, both for the YV's and foreign stations. And a silver medal for each continental winner. There is a special Trophy to the single operator station with the highest score outside the American continent. There will also be special awards, this year being the 400th anniversary of the founding of Caracas.

You will note that you do not have to be a winner to qualify for a certificate. Those of you who have received a certificate for last year's contest will verify that this is probably the most beautiful certificate in your possession. It is requested that a remittance of $1.00 or its equivalent in IRC's be included with your log if you are eligible for an award.

Entries must be postmarked no later than Sept. 15th and they go to: Radio Club Venezolano, Independence Contest, P.O. Box 2285, Caracas, Venezuela.

Last year's Trophy winners were: Single Operator, single band, HK4KL YV5BQF; all band, WA4PXP & YV1LA. Multi-operator, single transmitter, CX2CO & YV5BPJ; multi transmitter, K2GL & YV5BNR.

The silver medal continental winners were: WB2FON, HR1CP, PY4KL, EA8EZ, 4X4JU, DJ6QT, VK2APK, HP1JC and HI8LC.

FEARL-M Contest

Starts: 0900 GMT Monday, July 3
Ends: 1500 GMT Tuesday, July 4

This is an annual affair held over the 4th of July. There is no number exchange or scoring system involved. Just try to contact as many KA's as possible. Operation is on all bands except 80, which is not permitted by KA's.

There are certificates for 5 KA confirmations, 25 KA confirmations and for working 5 KA districts.

Send your confirmations to Far East Auxiliary Radio League, Att: Dirk A. Johnson, KA2DJ, APO 96525, San Francisco, Calif.

Colombian Contest

Starts: 0000 GMT Saturday, July 22
Ends: 2359 GMT Sunday, July 23

This is an annual affair held to celebrate the independence of Colombia. The Colombians will contact DX stations, other countries will work HK's as well as other DX.

Use all bands, 10 thru 80 and both c.w. and phone. Cross band or mode contacts not allowed.

Exchange: The conventional RS/RST report plus a progressive 3 figure contact number starting with 001. HK's will include their district in their number.

Scoring: *Stations in the Americas*, 3 points for each HK contact, 1 point for non-HK. *Stations on other continents:* 5 points for each HK, 1 point for non-HK. The multiplier will consist of the sum of HK districts from all bands plus the number of different countries worked.

Final Score: Sum of QSO points from all bands multiplied by the number of HK districts, plus the different countries worked.

Categories: Single operator, Multi-operator both single transmitter and multi transmitter.

Awards: Certificates for the top scorer in each category in each country and also for each continent. There is also a Silver Cup for the overall non-HK winner. The HK's have many awards for their own contestants.

You are expected to compute your own score and include a summary sheet with all the details.

Logs must be in the hands of the committee before September 30th. They go to: The L.C.R.A. Colombia Independence Contest, Box 584, Bogota, Colombia.

In last year's contest the continental winners were: UP2OK, YV5FT, VK2APK, UA9WL, W2GRD, VE2BVJ/SU in that order. The top scorers in the single operator division were: UP2OK, YV5FT, PY2SO, YV1CS, YV5BJC/1, VK2APK, PJ2AQ, PJ3CJ. Multi-operator: UA3KAO, UA2KAP, UA2KAT, UA6KAF, LZ1KKZ. The top Colombian was HKØAI with 232,375 points, followed by HK3RQ and HK3BAE.

Editor's Note

At this writing we are in the midst of completing the results of the C.W. Contest. The Phone results which broke all previous contests both in scores and number of entries, will be found in this issue.

A final reminder, don't forget to send in your log for the recent WW SSB Contest, some fantastic scores are expected. This year we are giving additional awards to stations whose scores show a prefix multiplier of over 200, 300 and 400, the last two are quite a challenge.

Another reminder, all you secretaries of organizations that plan to have activities this coming Fall, now is the time to get this information to me. Three months before the date you pick is not too soon. Consult last year's lists of activities for possible conflicts.

Have a good summer.

73 for now, Frank, W1WY

"... and of course everything here is home brew ..."

ESSCO *Presents* THE NEW APPROACH

SOPHISTICATED...
SPACE-AGE DESIGN...
THE ULTIMATE FOR SENDING AND RECEIVING RTTY SIGNALS

We at ESSCO are proud to note that aspiring competitors try to imitate the under-the-surface qualities that come only through years of RTTY experience and know how.....
That's why ESSCO will continue to be the leader in radio-teletype components.

NOW ESSCO BRINGS YOU THE CONVENIENCE OF SPACE-AGE MODULAR CONSTRUCTION PLUS THE INGENUITY AND SKILLS FROM YEARS OF RTTY ENGINEERING ALL COMPACTED INTO A SLEEK DESK-TOP PACKAGE.

★ Simple Plug-In Operation

No external odds-n-ends required. Directly couples your receiver, transmitter and teleprinter.

★ Ready to Run

Standard factory wired unit is complete with TU-1M Demodulator, FS-1 AFSK, PS-3 Power Supply, BP-1 Band Pass Filter and SM-1 Dual Channel Selector Magnet Driver..... **$163.00**

★ Unique Build-On System

BASIC CABINET AND INDIVIDUAL PLUG-IN UNITS MAY BE PURCHASED SEPARATELY

Cabinet, fully wired, with loop supply, connectors, tracks, tuning indicator, reversing switch, jacks and function switch..... **$39.95**

ESSCO MAKES A COMPLETE LINE OF SOLID STATE DEVICES FOR RADIO TELETYPE SYSTEMS

IF YOU ALREADY OWN THE ESSCO LINE, JUST PLUG YOUR EXISTING BOARDS INTO THE PRE-WIRED CABINET.

✔ *CHECK THESE FEATURES*

- BUILT-IN 50μa ZERO CENTER METER
- INDICATOR LAMP
- AFSK OUTPUT FOR VHF MODULATOR OR SSB TRANSMITTER
- NORMAL/REVERSE SWITCH
- OPERATES TWO TELEPRINTERS SIMULTANEOUSLY*
- SELF CONTAINED LOOP SUPPLY
- BUD 'GRAND PRIX' CABINET
- FAMOUS ESSCO SOLID STATE PLUG-IN CIRCUIT BOARDS
- SCOPE OUTPUTS
- GUARANTEED FOR 90 DAYS

*WITH DUAL CHANNEL SEL MAG DRIVER

WRITE FOR FREE BROCHURE ON COMPLETE ESSCO LINE

DEALER INQUIRIES INVITED

ESSCO *"Teletype Specialists"*
324 ARCH STREET CAMDEN, N. J. 08102
Phone: (609) 365-6171

For further information, check number 15, on page 110

Simon Says...

BY BERT SIMON,* W2UUN

Questions

High-Pass Filters: "Figure 1 pictures a typical high-pass filter apparently in common use in modern TV sets. What is the actual cutoff frequency? Attenuation in db's? How good is it on 6 meters front end overload and does color TV take a wider pass band?"

Can't really say what the actual cutoff frequency is, you didn't include the value of inductances, but if I were designing a high-pass filter I would choose the cutoff frequency as 54 mc. You have a 2-section filter which should provide about 45 db attenuation of frequencies 12 percent lower than 54 mc. I happen to have some response curves for 2, 3, and 4 section filters designed for a cutoff frequency of 36 mc. These originally appeared in the March-April 1954 issue of RCA's *Ham Tips*. (See figure 2). Color, shmolor, it doesn't make any difference with respect to the pass band, however, since color sets are more susceptible to interference than black and white, a 3 or 4 section filter would be a good choice.

*Holland Mountain Rd., Oak Ridge, N.J.

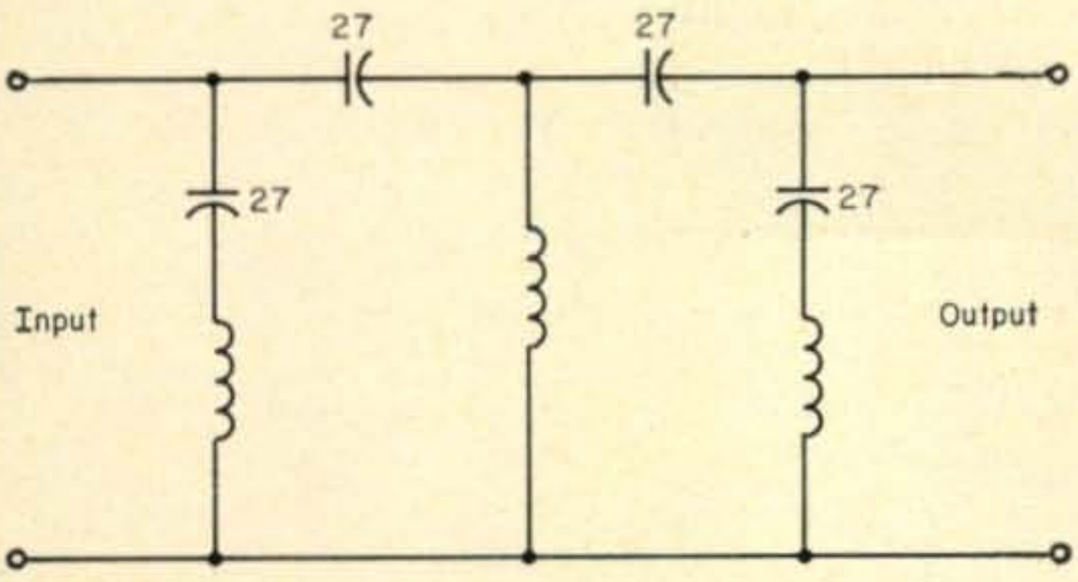


Fig. 1—Circuit of a typical 2-section hi-pass filter for minimizing TVI. Response curves for this type filter as well as larger 3- and 4-section filters are shown in fig. 2.

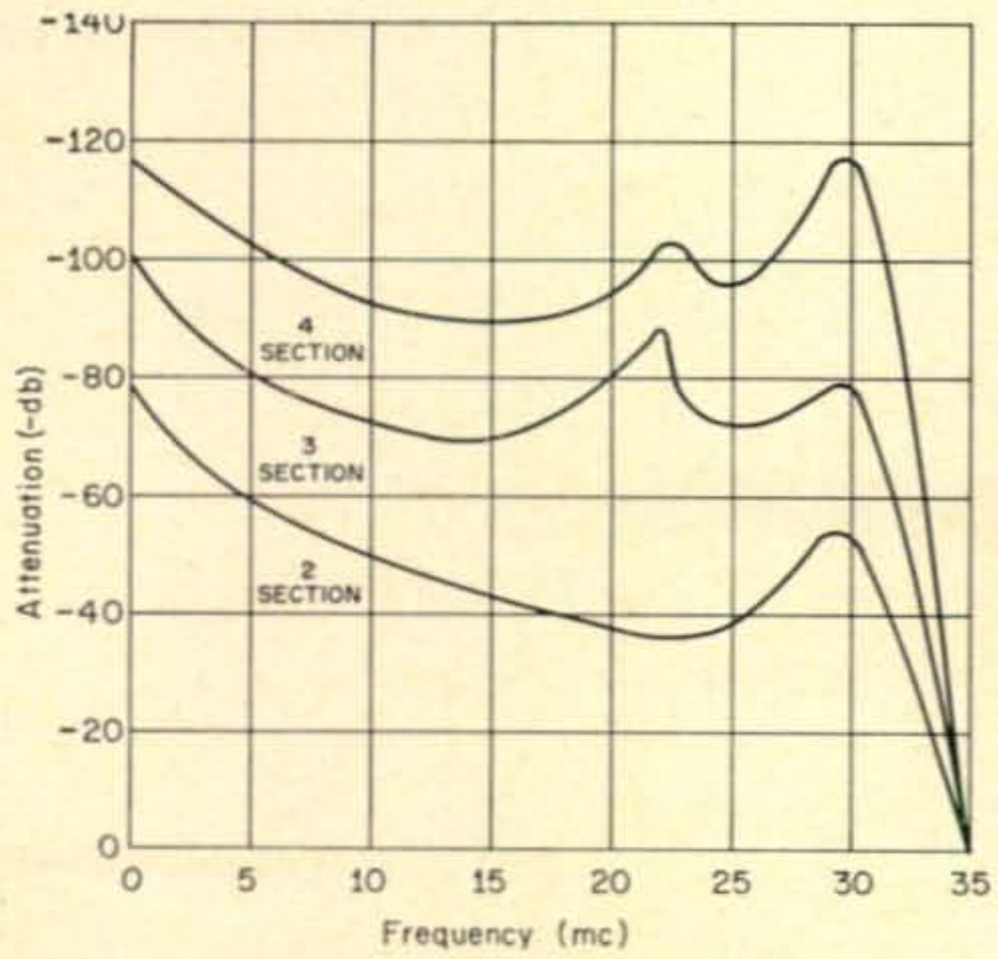


Fig. 2—Response curves for 2-, 3-, and 4-section low-pass filters designed for a cut-off frequency of 36 mc. Where interference is with a color TV set, a 3- or 4-section filter is suggested.

Voltage Reduction With a Capacitor: "I recently acquired some older issues of *CQ* and looking through the Nov. 1959 issue notice in HAM CLINIC (page 119) about voltage reduction with a capacitor. Would you please tell me how the value of 4 mf was arrived at? I would like to be able to find the correct values of capacitors for obtaining desired voltages in different applications."

The formula for the day is:

$$(1) \qquad C = \frac{I_{fil}}{2\pi F (E_T - V_{fil})}$$

Where: C = capacity in farads
F = frequency in cycles
E_T = line voltage (hopefully 60 cps)
V_{fil} = voltage drop of filaments
I_{fil} = filament current

So as an example, for a 12AD6, which has a voltage drop of 12.6 volts and a current drain of .15 amps we have:

$$(2) \qquad C = \frac{.15}{2\pi .60 (117 - 12.6)}$$

$$C = \frac{.15}{39338}$$

$$C = .00000381 \text{ farads or } 3.81 \text{ mf}$$

This is pretty close to 4 mf. Before you go hog wild and decide to put transformer manufacturers out of business, let me caution you about the hideous facts of life. Firstly, electrolytics are out because you have a.c. flowing through the capacitor and secondly capacitors are not perfect (unfortunately) and we become concerned with the equivalent series resistance of the capacitor which can be expressed in terms of power factor or Q. A typical dipped mylar-paper capacitor might have a power factor of 1 percent and since power factor is the same as $\text{Cos}\beta$, $\text{Cos}\beta = R \div Z$. Then $R = .01\ (700) =$ 7 ohms and for a current of .15 amps, the power that the capacitor must dissipate is $I^2R =$ $(.15^2)\ (7) = 2.28$ watts. You must make sure that the capacitor you choose can handle this power dissipation. I personally think this idea of a capacitor voltage dropping technique is great if you were marooned on a desert island

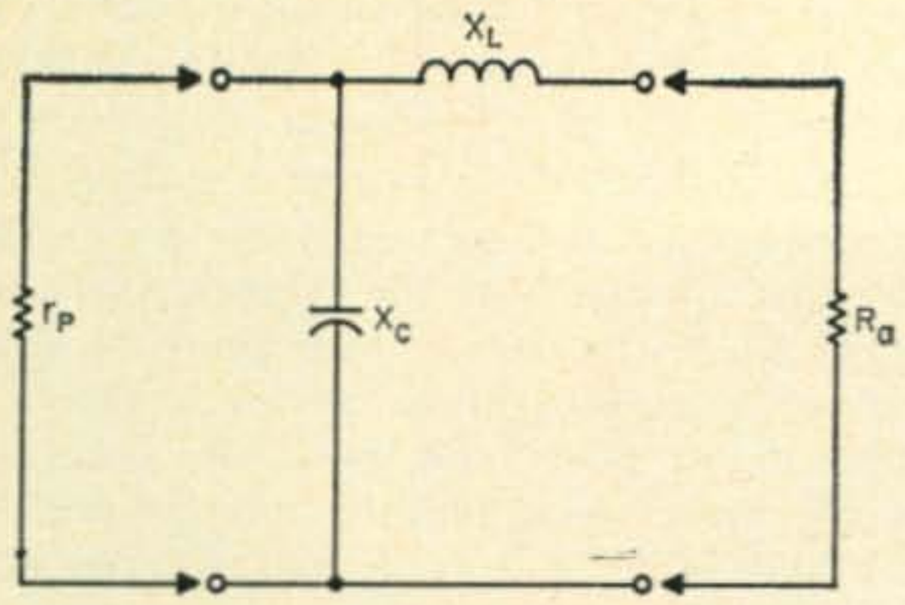


Fig. 3—An L-network forms the basis of the pi-network shown in fig. 4.

and your filament transformer burnt up, but as for me I'll use a transformer when ever I can.

Pi-Networks: "How would you go about designing a Pi-network so that I can use a 4CX1000A as a linear amplifier and be able to match to a 50 to 72 ohm transmission line? I plan operation 80 through 10 meters."

The first steps are to determine the operating requirements particular to your own requirements. Here you are concerned with the class of operation (for a 4CX1000A it would be AB_1 where you'll draw no grid current). You would have to obtain the constant current curves from the tube manufacturer and with the aid of a plastic transparent calculator (supplied by Eimac) you would calculate where to place your tube operating parameters and from this information you would also know what your tube load impedance is. For purposes of these calculations we can say the value is 1000 ohms.

For the benefit of any purists, the *L*-network is shown in figure 4 from which I'll proceed to show the derivation of the Pi filter design equations. The design equations for an L-network are:

(1) $X_L = Q\,R_a$
(2) $r_p = R_a\,(Q^2 + 1)$
(3) $X_c = \dfrac{r_p}{Q}$

Where r_p must be greater than R_a:

r_p = input impedance (like that of the tube).
Q = the operating or loaded Q of the network.
X_L = the inductive reactance.

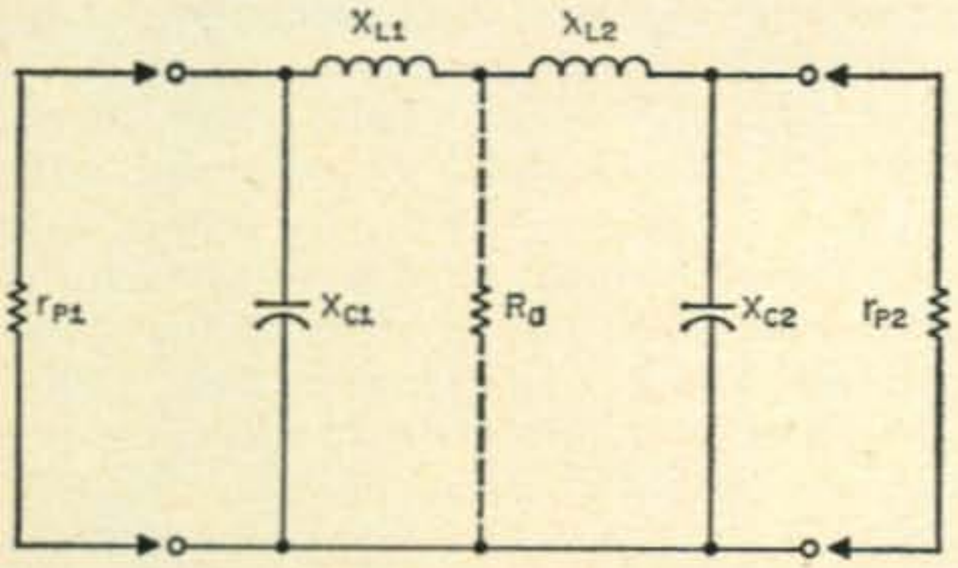


Fig. 4—The common pi-network impedance matching circuit may be visualized as two L-networks back-to-back with a common mutual reactance R_a. In practice R_a is non-existent and L_1 and L_2 are a signal inductance.

X_c = the capacitive reactance.
R_a = the output impedance (like that of the transmission line).

A Pi-network is actually two L-networks back to back (pardon the expression).

The design equations for the pi is derived by combining the following *L*-equations:

(4) $X_{L1} = Q_1 R_a$
(5) $X_{C1} = r_{p1} \div Q_1$
(6) $r_{p1} = R_a\,(Q_1^2 + 1)$
(7) $X_{L2} = Q_2\,R_a$
(8) $X_{C2} = r_{p2} \div Q_2$
(9) $r_{p2} = R_a\,(Q_2^2 + 1)$

Rearranging (9) we have $Q_2^2 + 1 = r_{p2} \div R_a$ or $Q_2^2 = (r_{p2} \div R_a) - 1$ and substituting in (8) we get:

$$(10) \qquad X_{c2} = \frac{r_{p2}}{\sqrt{\dfrac{r_{p2}}{R_a} - 1}}$$

Rearranging (6) to:

$$R_a = \frac{r_{p1}}{Q_1^{\,2} + 1}$$

and substituting in (10) we get:

$$(11) \qquad X_{c2} = \frac{r_{p2}}{\sqrt{\dfrac{r_{p2}}{r_{p1} \div (Q_1^{\,2} + 1)} - 1}} = \frac{r_{p2}}{\sqrt{\dfrac{r_{p2}\,(Q_1^{\,2} - 1)}{r_{p1}} - 1}}$$

which can be cleverly rearranged to:

$$(12) \qquad X_{c2} = r_{p2} \sqrt{\frac{r_{p1} \div r_{p2}}{(Q_1^{\,2} + 1) - r_{p1} \div r_{p2}}}$$

and by definition:

$$(13) \qquad X_{L\,(Total)} = X_{L1} + X_{L2}$$

Substituting (4) and (7) we get

$$(14) \qquad X_{LT} = Q_1\,R_a + Q_2\,R_a$$

Rearranging (6) for R_a we get

$$R_a = \left(\frac{r_{p1}}{Q_1^{\,2} + 1}\right)$$

and rearranging (8) for Q_2 we get

$$Q_2 = \frac{r_{p2}}{X_{c2}}$$

Dumping these into (14) we arrive at:

$$(15) \qquad X_{LT} = Q_1 \left(\frac{r_{p1}}{Q_1^2 + 1} \right) + \left(\frac{r_{p2}}{X_{c2}} \right) \cdot \left(\frac{r_{p1}}{Q_1^2 + 1} \right)$$

which can be simplified (?) to:

$$(16) \qquad X_{LT} = \frac{r_{p1} \, (r_{p2} + X_{c2} \, Q_1)}{X_{c2} \, (Q_1^2 + 1)}$$

Equations (5), (12) and (16) are the design equations needed for the pi network design, but what value do you pick for Q_1, the loaded or operating Q? Here we are torn between two desires: one to have a large operating Q that would provide a very selective network very useful in suppressing 2nd harmonics and stuff like that there. The other desire is to use a low value of Q so that the circulating circuits are kept to a reasonable value. Circulating current is proportional to the operating Q. If the 4CX1000 tube was providing let's say 1000 watts output into a 50 ohm load the d.c. plate current might be about 1 amp, but the circulating current through C_1 would be Q (1) = 10 amps which is a very respectable amount of current. For a Q of 100 the current would be 100 amps which would necessitate very large and costly components. In practice a Q of 10 is a good compromise between selectivity and circulating current, so having decided upon that we can begin the calculations. I should add at this point that in my travels I encountered a so called single side band expert at one company who didn't know what Q and circulating currents were . . . it only cost about 14 kilobucks to correct that goof.

From (5) $X_{c1} = 1000 \div 10 = 100$

From (12) we mustn't forget that r_{p2} varies between 50 to 72 ohms so:

$$X_{c2} = (50 \rightarrow 72) \sqrt{\frac{1000 \div (50 \rightarrow 72)}{101 - 1000 \div (50 \rightarrow 72)}}$$

For C_2 minimum, $X_{c2\,min} = 24.9$ ohms and likewise for C_2 maximum, $X_{c2\,max} = 28.8$ ohms. Therefore $X_{c2} = 24.9$ to 28.8 ohms.

From (16) then:

$$X_{LT} = \frac{1000 \, ([50 \rightarrow 72] + [24.9 \rightarrow 28.8] \, 10)}{(24.9 \rightarrow 28.8) \, (10^2 + 1)}$$

$$X_{LT} = 119 \text{ ohms} \rightarrow 124 \text{ ohms}$$

So here's our circuit:

$$C_2 = \frac{1}{2\pi \, F X_{c2}} = \frac{1}{2\pi \, (3.5)(24.9)} = 1826 \text{ mmf}$$

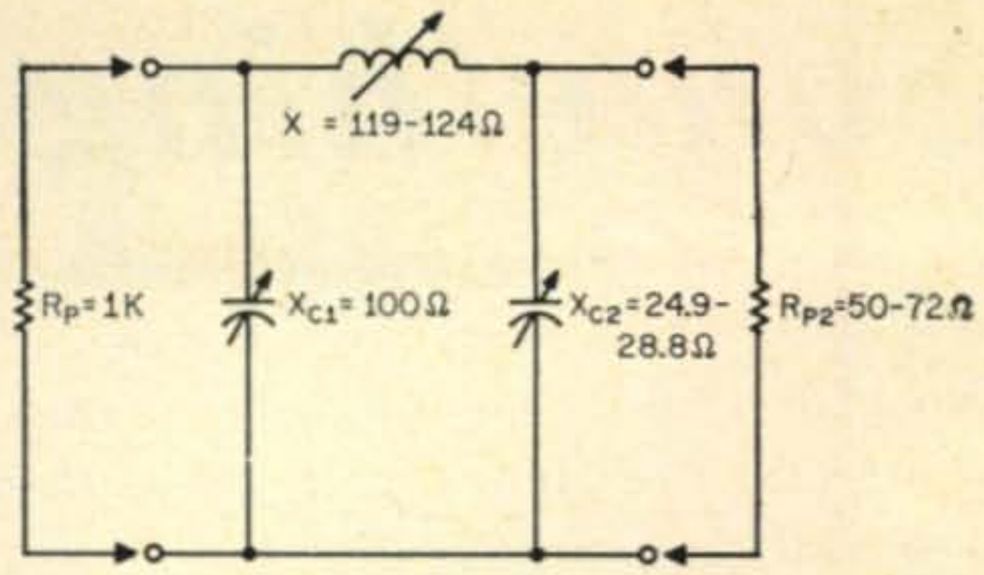


Fig. 5—Pi-network designed from the text discussion showing the range of reactances for the 50-72 ohm range of output impedances.

For operation on 3.5 mc:

$$C_1 = \frac{1}{2\pi \, F X_{c1}} = \frac{1}{2\pi \, 3.5 \, (100)} = 456 \text{ mmf.}$$

The 4CX1000A has an output capacitance of 13 mmf, so C_1 becomes 456 − 13 = 443 mmf.

$$L_T = \frac{X_{LT}}{2\pi \, F} = \frac{119 \rightarrow 124}{2\pi \, (3.5)} = 5.65 \text{ uh}$$ (picking $X_{LT} = 124$ ohms to obtain the largest value needed).

For operation on 29.7 mc:

$$C_1 = \frac{1}{2\pi \, (29.7) \, 100} = 53.6 \text{ mmf,}$$ and subtracting 13 mmf for tube output capacity, the required $C_1 = 40.6$ mmf minimum capacity.

$$L_T = \frac{119 \rightarrow 124}{2\pi \, (29.7)} = .638 \text{ uh}$$ (picking $X_{LT} =$ 119 ohms to obtain the minimum requirement).

$$C_2 = \frac{1}{2\pi \, (29.7) \, 28.8} = 186.5 \text{ mmf minimum.}$$

Is this the end? Nope, there's still voltage and current ratings to be arrived at. C_1 may be specified as operating at whatever the unloaded voltage the power supply provides, whereas the current rating must be at least equal to whatever the circulating current may be. As we said

[*Continued on page 98*]

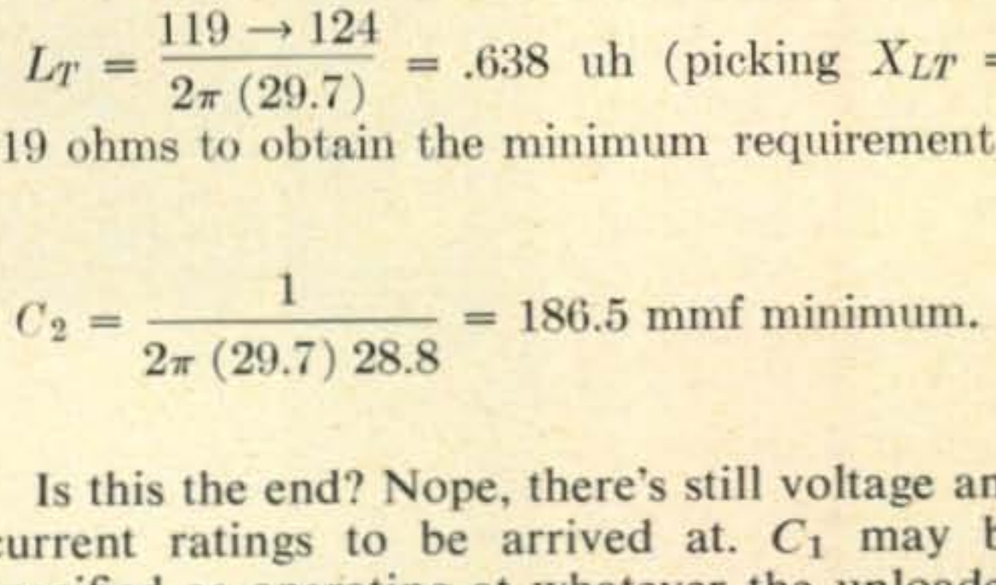


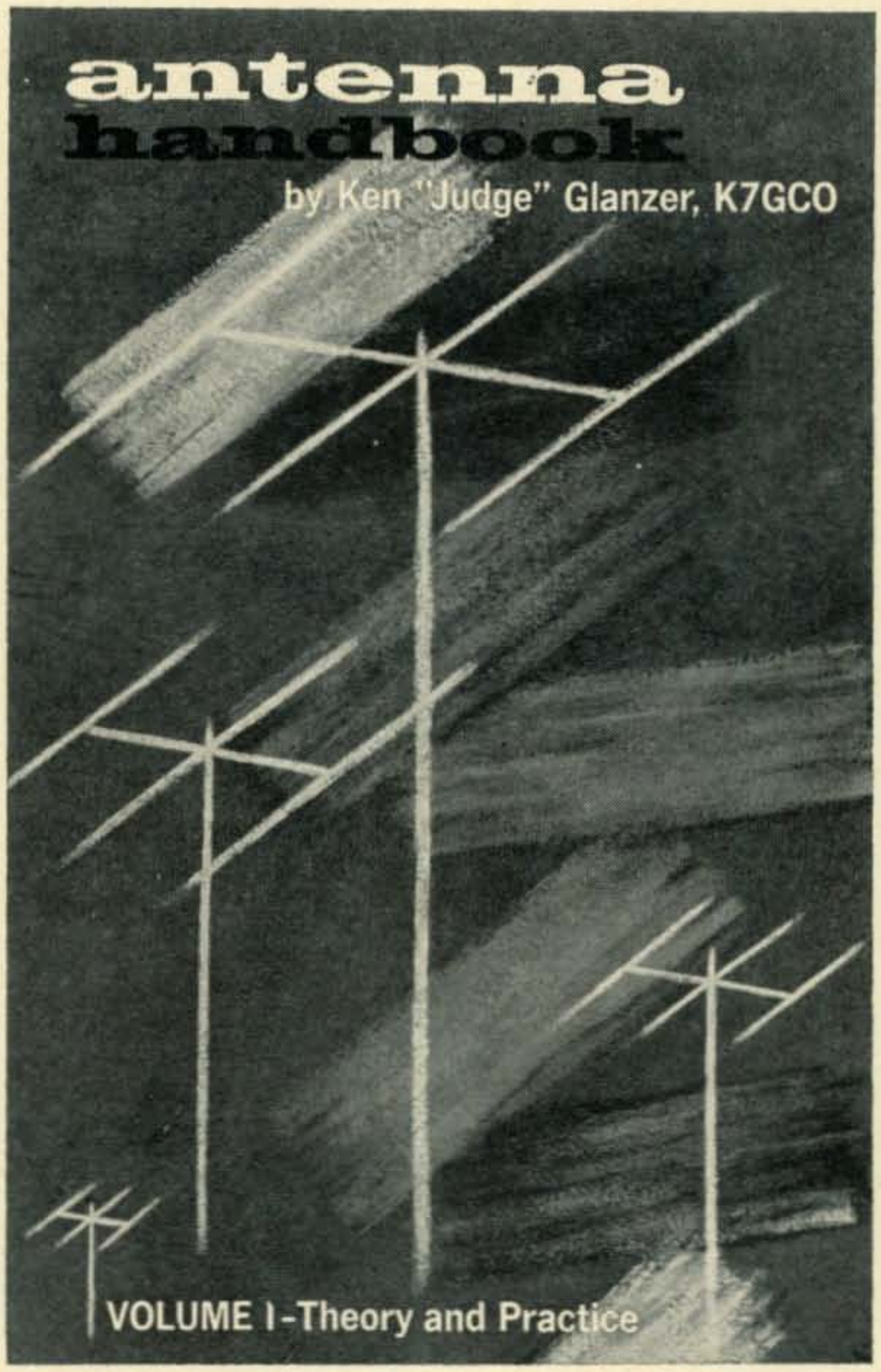
Fig. 6—For the 3.5 to 29.7 mc range, with output impedances between 50 and 72 ohms, the actual pi-network values fall within the ranges shown.

Something Really New!

The result of 15 years of exhaustive research—of trying to find the best antenna for every possible situation. Not a re-hash of old material, but a completely new and exciting book describing techniques and concepts as never before seen in the antenna field.

So big and complete that it takes *three* volumes to tell the whole story. Now, after six years of preparation, the *CQ* Technical library is proud to present Volume I of this soon-to-be-classic trilogy. Volumes II and III will follow in quick succession.

Here's just a sample of what Volume I covers: Transmission line theory, Attenuation, Impedance, Standing waves, resonant and non-resonant lines, stub matching, single and parallel coaxial lines, radiation fundamentals, current distribution, induction field, radiated field, gain, reciprocity, radiation resistance, dipoles, tripoles, depth of electrical ground, relative ground conductivity from s.w.r., reactive variations, free space **3 dimensional** patterns of long wires of all practical lengths, effect of center and end feed on antennas, tilted antennas, terminated long wires and vee beams,



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.

Cowan Publishing Corp., Book Division
14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050

Enclosed is $_____ for _____ copy(ies) of the Antenna Handbook, Volume I, by K7GCO.

Name ..... Call .....

Street .....

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

New York City and State residents add applicable sales tax.

Volume I of three volumes. Price:

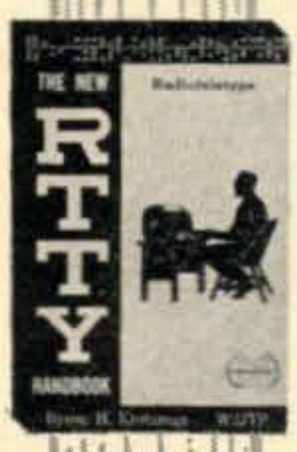
$4.00

CQ BOOK MART

ANTENNA ROUNDUP Vol. II

Cat. #119-2. Here's your chance to get a copy of one of the most comphensive books on antennas ever offered to the Amateur. Ten big theory articles backed up by 82 detailed and illustrated construction projects for VHF on into microwave, from longwires to 17 element beams and Sterba Curtain arrays.

THE NEW RTTY HANDBOOK



Cat. #116. A treasury of vital and "hard to get" information. Loaded with equipment schematics, adjustment procedures, etc. A valuable asset to both the beginning and the experienced RTTY'er. Special section on getting started, written by Byron Kretzman, a well known authority in the field.

CQ ANTHOLOGY I

Cat. #102-1. We've looked back through the years 1945-1952 and assembled all in one place the articles that have made a lasting stir. The issues containing most of these articles have long ago been sold out and are unavailable.

SURPLUS SCHEMATICS

Cat. #117. This is a book literally loaded with schematics for all the currently popular pieces of surplus gear. Most amateurs are well aware of the problems encountered in purchasing seemingly inexpensive surplus units, only to find that no schematic diagram is available.

VHF FOR THE RADIO AMATEUR

Cat. #115. If you are, or are planning to be a VHF operator you can't afford to be without this dynamic new handbook written especially for you. Filled from cover to cover with all new and original construction material presented so you can understand it.

ANTENNA ROUNDUP Vol. I

Cat. #119. A common denominator for all ham stations is the antenna. Here at last is the cream of antenna information packed into a 160 page book. Forty-seven information-packed articles that will dispel much of the mystery surrounding antennas.

SIDEBAND HANDBOOK

Cat. #103. One full year in the preparation of this terrific volume. This is *not a technical* book. It explains sideband, showing you how to get along with it . . . how to keep your rig working right . . . how to know when it isn't . . . and lots of how to build-it stuff, gadgets, receiving adaptors, exciters, amplifiers.

SURPLUS CONVERSION HANDBOOK

Cat. #122. Contains 192 pages of conversion articles including the famous Command Set's plus a whole slew of the most popular military surplus gear including such gems as: SCR-522, ART-13, BC603, BC659, ARC 1, ARC 3, etc. Actually, it covers almost every piece of surplus gear worth the effort to convert for ham use.

ELECTRONIC CIRCUITS HANDBOOK

Cat. #121. Describes and discusses in detail 150 of the most often needed circuits around the shack. Novices and old-timers alike will find many valuable circuits here ideal for construction projects. Eleven great chapters cover a multitude of circuits for all.

SHOP & SHACK SHORTCUTS

Cat. #120. Here is a collection of hundreds of hints, kinks and short cuts which should be part of the library of every experimenter ham and CB'er. A veritable gold mine that will help save time, improve their shop techniques, dress up their shacks, and increase the efficiency of their equipment.

CQ ANTHOLOGY II

Cat. #102-2. Top favorite CQ articles from 1952 to 1959 . . . including some you may have missed . . . compiled into one new information-packed book! No more need to try to locate sold out back copies of CQ. This Anthology includes past articles of lasting interest to every amateur radio enthusiast. Over 250 pages of text.

ELECTRONIC CIRCUITS HANDBOOK VOL. II

Cat. #121-2. Tom Kneitel, K2AES, does it again with this sequel to his best selling Volume I. This time it's 159 additional circuits which will appeal to all Every shack will have a spot for this book. All circuits fully described in text with complete detailed construction steps plus schematics.

NAME _____

ADDRESS _____

CITY _____

STATE _____

Zip Code _____

Cat. No.	Name	Price	Order	Cat. No.	Name	Price	Order
99	TVI Handbook	1.75		115	VHF for the Radio Amateur	3.50	
102-1	CQ Anthology vol. 1	2.00		116	The New RTTY Handbook	3.95	
102-2	CQ Anthology vol. 2	3.00		117	Surplus Schematics	2.50	
103	New Sideband Handbook	3.00		119-1	Antenna Roundup vol. 1	3.00	
105	New Mobile Handbook	2.95		119-2	Antenna Roundup vol. 2	4.00	
109	Ham's Interpreter	1.50		120	Shop & Shack Shortcuts	3.95	
112-A	Reg. Ham Log Sheets, per C	1.00		121-1	Electronic Circuits Handbook vol. 1	3.00	
112-B	SSB Ham Log Sheets, per C	1.00		121-2	Electronic Circuits Handbook vol. 2	3.00	
113	CQ Binders (Indicate year)	4.00		122	Surplus Conversion Handbook	3.00	

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

COWAN PUBLISHING CORP. Book Div. • 14 Vanderventer Avenue • Port Washington, L.I., N.Y. 11050

the USA-CA PROGRAM

BY ED HOPPER,* W2GT

THE June "Story of The Month" about Lou, K8IWI, after this information on awards issued. Lou, K8IWI received #10 USA-CA-3000 award. Mixed USA-CA-2000 awards went to Leo, W4KA; Earl, W7KOI; and Walter, W8NXN. Earl, W7KOI received the first USA-CA-2000 issued to the 7th district and he also received ALL A3 endorsement for his USA-CA-1000 award and ALL A3A and ALL 14 mc endorsement for his USA-CA-500 award. David, W4SKI/5 received a Mixed USA-CA-1500 and John, W5OYG received a USA-CA-1500 award endorsed ALL A3A, as well as a USA-CA-1000 endorsed ALL 75 M and ALL 2x S.S.B. Mixed USA-CA-1000 awards went to Alfred K1WQU and Jim, K1QZV. Zdenek, OK1ZL received a USA-CA-500 award endorsed ALL A-1 as did Mitch, VO1AW and his was the first award to a VO station. Bill, WA8QND earned a USA-CA-500 award endorsed ALL 2x Phone; and Frank, WAØILV received one endorsed ALL 75 M A3A. Mixed USA-CA-500 awards went to Gerald, W4KUF; WB6CPE (Loyola High School ARC); Leonard, W8BSR; and to John, ZL1AH.

USA-CA HONOR ROLL

3000

K8IWI 10

2000

W8NXN 32
W7KOI 33
W4KA 34

1500

W4SKI/5 57
W5OYG 58

1000

K1WQU 109
W5OYG 110
K1QZV 111

500

OK1ZL 607
W4KUF 608
WAØILV 609
W8BSR 610
ZL1AH 611
VO1AW 612
WA8QND 613
WB6CPE 614

SPECIAL USA-CA HONOR ROLL

Top Twenty-Five County Hunters

K9EAB	3079	K8IWI	3003	W9CMC	2501
WØMCX	3079	K4VOF	3001	WØGYM	2500
K8CIR	3079	K5SGK	2970	W8UPH	2414
W2QHH	3078	K8KOM	2900	K3LXN	2331
WØJWD	3051	W5EHY	2779	K8VSL	2180
W9ICF	3050	WØKZZ	2708	K8EUX	2154
WA9AJF	3012	VE3-9301	2679	W5NXF	2153
K5SGJ	3005	WØVFE	2527	WA5AEB	2062
				W2JWK	2050

Louis Van Duyn, K8IWI
USA-CA-3000 #10

Lou was born 47 years ago in a small town in the state of Iowa. In 1940 he moved to Michigan and in 1943 entered the army and served 14 months overseas as a radio operator. He had been graduated from the communications school in Fort Benning, Ga., having passed with a code speed of 22 w.p.m.

His family includes Marie, his wife; daughters Norma and Mary; and sons Larry and Ken. Larry is a senior at Western Michigan University working towards a degree in technical studies. Norma also attends this university as an art major.

After leaving the army, Lou had no contact or interest in radio until about 10 years ago when his son Larry became interested in radio and wanted help in learning the code. This revived Dad's interest and in 1957, Lou obtained K8IWI and Larry got K8JBL. Another ham in the family is Lou's older brother, Van, W9WRW.

In April 1964, USA-CA-500 award #363 was obtained, followed by USA-CA-1000 award #52 in July 1964; closely followed by USA-CA-1500 award #22 in November 1964 and USA-CA-2000 #12 in December 1964. Then in March 1965, #9 USA-CA-2500 award was issued to Lou and in March 1967 #10 USA-CA-3000 award was obtained.

The present equipment includes a Heath Marauder transmitter and a National NC 270 receiver along with sundry pieces of surplus gear used on the v.h.f. bands. He also has a model 19 printer for RTTY. The workhorse rig is a Hallicrafters SR-160 transceiver which is kept in the car. As K8IWI/M, Lou has given out over 4000 county contacts and has worked over 2000 of his own total while mobile.

Lou regularly travels through 27 counties during his work as a dog food (Rival) salesman and makes many side trips to bordering counties on request.

Lou began county hunting in earnest some 3 years ago when he discovered the net on 40 meters. Most of his operating is now done on the 20 meter Independent County Hunter Net on 14.336 daily. The earning of #10 USA-CA-3000 award in some 3 years is proof that his hard work has not been in vain.

*103 Whittman St., Rochelle Park, N.J. 07662.

Lou Van Duyn, K8IWI.

Zone 3 Award

Welfare Award

Maplewood ARA Award

The Lucky 7

Letters

Edwin, W5ZBC/W5NZY, writes: The Bossier High School who manages the WAPUS award program is no longer in the business. Any other school that would like to take over, please write to Bossier High School ARC, Coleman Drive, Bossier City, La. 71010."

Awards

Zone 3 Award: The Boeing Employees' Amateur Radio Society (BEARS) of Seattle, Washington, is now issuing this new certificate. Zone 3 includes the states of Arizona, California, Idaho, Oregon, Utah, Washington, and the Province of British Columbia, in Canada.

Basic Award requires confirmed 2-way radio contact with an amateur radio station in each state and Prov. of B.C. located in Zone 3. Any amateur band, any type of radio transmission count and the contacts must be on or after January 1, 1946. **Master Award** requires contacts as per Basic award, but contacts must be with stations in the capitol city of his state and B.C. **Special Award** requires contacts per Basic award but the last letter of the call letters of any five Zone 3 area confirmations must spell the word BEARS. **Extra Award** requires the confirmations to combine the rules of the *three* above listed awards. To apply: Make list of your confirmed contacts which will comply with the rules of the award you desire and include your call letters, call letters of stations worked, city and state of each station, date, band and mode. Sign this list and have it verified by two other amateur operators (Not Novices)—GCR rule. Send this list and money order for 50¢ to BEARS, K7NWS, P. O. Box 3707, Seattle, Washington, Mail Stop 11—59.

Maplewood (N.J.) ARA Award: The Maplewood Amateur Radio Association, members of the local C.D. radio unit, for over ten years have offered this certificate for any outsider who works ten of their two meter stations—there are 14 active. Special on-the-air drills are held each Monday 7 to 7:30 P.M. on 146.894. Send list of stations worked and date and s.a.s.e. to F. Bruce Parsons, W2COT, 12 Washington Park, Maplewood, N.J. 07040.

World Institute of Home Brewers: Here is a new award to help promote home built equipment and encourage new comers. To qualify, send foto of your station with *ALL* home brew transmitter and receiver (NO kits) and s.a.s.e. for W/K or 1 IRC for DX, to Al Bry, W2MEL, R. D. 6, Wappingers Falls, N.Y. 12590.

The Lucky 7 Certificate: Issued for working 7 of the 9 members of the 2 meter group who have a net each Thursday evening at 8 P.M. EST (0100 GMT) on 146.39. Upon completion of the net, all members QRZ the band looking for contacts. The members of "The Lucky 7" are: WA2YIB, WB2HVV, WB2LOP, WB2MMC, WB2MMV, WB2NCE, WB2NCG, WB2NCV, and WB2RTD. There is no charge, send list of stations worked with time and date to the custodian. Betty L. Boyd, WB2NCG, 27 Park Place, Bloomfield, N.J. 07003.

Welfare Net Award: Work net members for points. Members 1 point, charter members 2 points, or K3YMK, while operating marine mobile for 3 bonus points. Stations east of Mississippi need 20 points, rest of US/VE (except KH/KL) need 10 points, all others need 7 points. Net meets on about 3920 kc nightly at 0200 GMT. Net will allow 2 contacts per night during net time. Available to s.w.ls, no endorsements or starting date. Fee—$1.00 for US/VE; DX 50¢ or 5 IRCs. Send list stating time and dates and calls, signed by 2 licensed amateurs stating they have seen the confirmations (GCR rule) to Walt Stolenburg, WA3BON, R. D. #3, Box 185, Erie, Pennsylvania 16509.

Notes

The new custodian for the awards of the Binghamton Amateur Radio Association of Binghamton, N.Y. is Maurice Harvey, K2SVV, 138 N. Baldwin Street, Johnson City, N.Y. 13790. They issue the Worked All Counties of New York State award and the B.A.R.A. certificates and Maurice is also QSL manager for the club station, W2OW. They are sorry for all the delays, but have had a hard job locating the awards since the custodian became a silent key.

I am in receipt of the third edition of the *Florida Ham Directory*. There have been 1800 changes since the 1965 issue and Florida now has over 9000 hams. They are listed alphabetically by call *and* by name, plus other interesting data on Florida nets and clubs. For sale by the Amateur Radio Club of Florida, Box 7326 Euclid Station, St. Petersburg, Florida 33734 for $3.00 ($2.00 to club members).

Again thanks for all your help and interest, I had hoped to get more mail regarding awards *not* now obtainable. How was your month? 73., Ed., W2GT.

WIHB Award

SURPLUS sidelights

BY GORDON ELIOT WHITE*

THIS month I am devoting much of the column to a pair of contributions from two readers, Billy L. Nielsen, DL5KS, and Norman Chipps, Deputy Chief of Staff of the National Capitol Wing of the Civil Air Patrol. These well-qualified radio engineers have looked into the TDQ v.h.f. transmitter, and the AN/URC-4 v.h.f. transceiver, two of the postwar crop of surplus. Let's hear first from Billy:

"For some time now, the TDQ transmitter has been available on the Surplus market, but not too many of these sets seem to find their way into the amateur shack, probably due to their large size.

"To remedy some of the TDQ's lack of popularity, let us mention first off that the transmitter as it comes is ready for amateur operation with the proper crystal plugged in. Let's take a look at what the TDQ has to offer:

"It is a complete self-contained v.h.f. transmitter covering the frequency range of 115 mc to 156 mc, using 16 megacycle crystals, with provisions for selecting four preset channels.

"The tube lineup starts out with a single 807 crystal oscillator, in a temperature-controlled oven, which drives an 829B first multiplier, which drives a second 829B multiplier which in turn drives the 829B final amplifier straight through.

"The crystal frequency is tripled in the first multiplier and tripled again in the second to give direct drive to the final. For example, 16.00 mc $\times$ 3 $\times$ 3 equals 144 mc to the grid of the final 829B.

"All of the circuits are direct coupled, and the final is plate modulated by a pair of 807's, and the plate tank output impedance is 50 ohms.

"The modulator speech amplifier is designed for a carbon mike input, and fig. 1 shows a suitable preamplifier for a crystal microphone. The preamplifier may be built on a small L—shaped chassis and put in any convenient location close to the terminal board marked "Terminal Board A". Connection is made to pins 9 and 10 of the t.b.

"It is possible to use the TDQ with the more common 8 mc crystals, but the 8 mc rocks are not recommended. With 8 mc crystals multiplying 18 times to a 144 mc signal frequency, the 7th harmonic is at 136 mc and the 9th falls at 152 mc, some 40 to 50 db below the output channel power, enough spurious signal to cause serious trouble in some areas, particularly in the aircraft, government, and space bands which surround 136 mc!

"Using 16 mc crystals, the 8th harmonic is 128 mc and the 10th is 160 mc, both at least 60 to 70 db below the output frequency, weak enough that it is improbable that they will cause trouble.

"The TDQ has a power output of between 45 and 50 watts, and may be keyed at up to 40 w.p.m. c.w.

"Outlets for the TDQ include Columbia Electronics, 4365 West Pico Blvd., Los Angeles 19, California, and Selectronics, 1206 S. Napa Street, Philadelphia. These dealers also stock the crystals.

Here is Norman Chipps' treatment of the URC-4 handi-talkie:

"This is a battery-powered u.h.f.-v.h.f. transceiver which is normally used on the 121.5 mc and 234.0 mc aircraft emergency channels. The only items needed to use this unit on the 148.14 Civil Air Patrol frequency are a crystal and a battery. The crystal is a series resonant type cut for a third overtone frequency of 37.035 mc (fundamental 12.345 mc). A CR-19 crystal can usually be bought for around $4, and will work as well as the exotic CR-24 barrel type crystal which was originally used. (other frequencies can of course be substituted)

"Along with the crystal, a battery is needed. A battery-pack can be put together to give 1.5 volts filament power, and 90-135 volts plate power, or a RCA type V5-064 dual battery can be bought for about what it would cost to assemble the battery pack.

"Before making the conversion, try to determine whether the set is working in its unconverted condition. Now remove the rear cover. You will find several screws with red circles around them. Remove all of these, and very carefully lift the unit from the case.

"Identify the wire running from L_5 and the TRANSMIT-RECEIVE switch, S_2. Unsolder the wire at the switch, pull it back to the coil, and unwind one turn from the coil, leaving 1 1/16 turns on the link. Reroute the lead back to the switch,

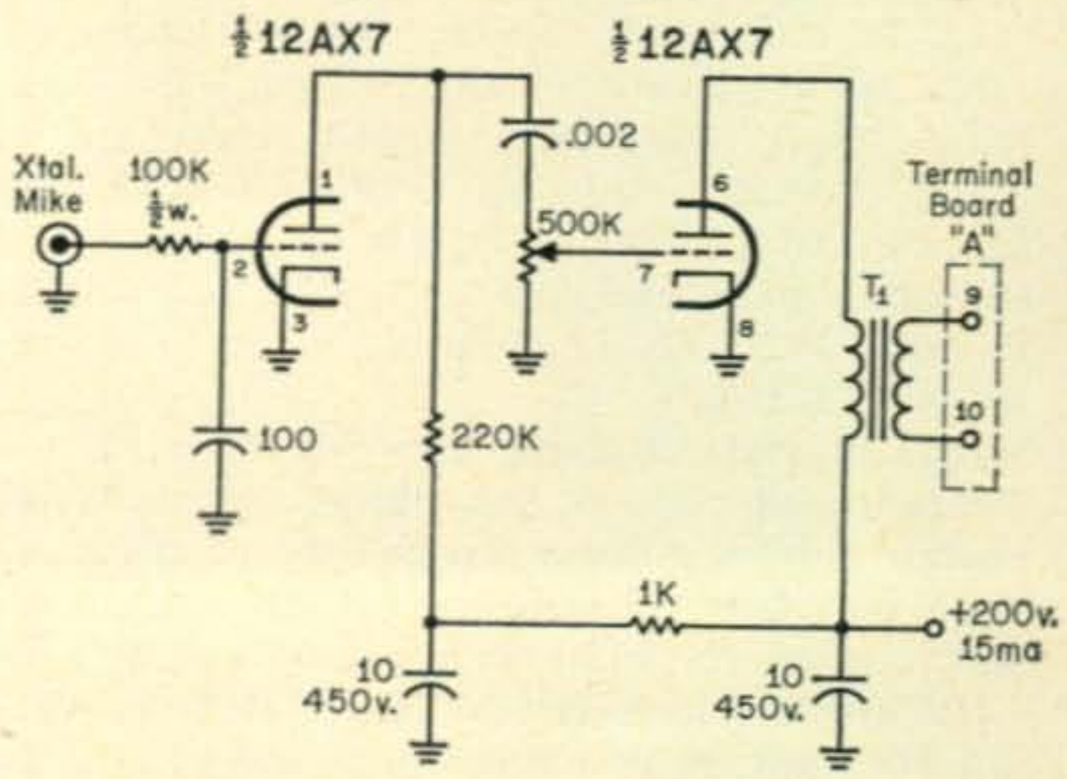


Fig. 1—A crystal mike preamplifier for the TDQ transmitter.

*5716 N. King's Highway, Alexandria, Virginia 22303.

SURPLUS CORNER

TCS EQUIPMENT

NAVY TCS RECEIVER AM—1.5 MC to 12 MC in two (2) bands. Variable freq. oscillator & crystal control on four (4) preset channels in the entire freq. range. Audio output 1.5 watts into 500 ohm load; uses tubes 12SK7 RF A., 12SA7 converter, 2/12SK7 IF A., 12SQ7 detector BFO, 12A6 oscillator, 12A6 audio Amp. 456 KC IF Freq. Large vernier & spin dial, audio gain, AVC, BFO and all controls on the front panel. Voltages required: 12 VDC & approx. 220 VDC 100 MA. Size: 11¾ x 11¾ x 13¾". Wt.: 37 lbs. USED: **$44.95**

NAVY TCS TRANSMITTER AM—1.5 MC to 12 MC in three (3) bands, CW 40 watts, voice modulation 20 watts, master oscillator variable and crystal control on 4 preset channels in the entire freq. range. Uses 3/12A6 in oscillator & buffer-doubler, 4/1625 in modulator & power amplifier stages, 2½" meters for PA Plate 0-200 DC RF meter 0-3, all tuning and operating controls on front panel. Voltages required: 12 VDC & 400-440 VDC 200 MA. W/tubes. Size: 11¾ x 11¾ x 13¾". Wt.: 41 lbs. USED: **$34.50**

Antenna Loading Coil #47205	Used:	$ 6.95
Remote Control Box w/Speaker #23270	Re-New:	9.95
Dual Dynamotor Power Supply—12 V. #21881	Re-New:	14.95
D-401 TRANSMITTER Dynamotor—12 V.	New:	6.95
D-402 RECEIVER Dynamotor—12 V.	New:	4.95
CABLE—Receiver to Power Supply	New:	2.75
CABLE—Transmitter to Power Supply	New:	2.75
Connector Plugs for Remote Control Box	New:	1.50
AC POWER SUPPLY—115 V. 60 Cycle (Not Government Surplus) Receiver: $20.00 — Transmitter: $35.00		
Shock Mounting for Receiver or Transmitter	Used:	2.95
Noise Limiter Conversion Kit—W/6H6 tubes		2.00

PARTS available for Rec. and Trans. Advise us of your needs!

Prices F.O.B. Lima, O. — 25% Deposit on COD's — For BIG CATALOG, send 25¢ (stamps or coins) & receive 50¢ Credit on your order. Dept. CQ

FAIR RADIO SALES
P.O. Box 1105 • LIMA, OHIO • 45802

CASH PAID . . . FAST!

For your unused TUBES, Semiconductors, RECEIVERS, VAC. VARIABLES, Test EQUIPM'T, ETC. Fair Dealing since '38. Write or Call now! Barry, W2LNI.

BARRY ELECTRONICS, 512 Broadway, NY, NY 10012 (212-WA 5-7000) (We Buy Factory Terminations & from Individuals).

WE PAY CASH FOR TUBES

LEWIS PAUL ELECTRONICS INC.
303 W. Crescent Avenue
Allendale, New Jersey 07401

MAKE MONEY BY PHONE!!

YES! You can make BIG MONEY by calling us collect —today!—if you have any of the following equipment. **We urgently need** and must buy the following: TED Radio Transmitters, RT-67 and RT-68/GRC Transceivers, PP-109/GR Power Supply. R-110/GRC Recvr., C-433 and C-434/GRC Controls, AN/URR-13 and -35 Radio Recvrs., AN/ARC-27, -34, -52 Transceivers, PLUS any hi quality military or commercial TEST EQUIPMENT. We pay the most—fastest!—with a smile! **CALL TODAY!**

COLUMBIA ELECTRONICS, Dept. C
4365 West Pico Blvd., Los Angeles, Calif. 90019
Phone: (213) 938-3731

For further information, check number 30, on page 110

WANTED
ALIVE
all your surplus VACUUM TUBES & SEMI-CONDUCTORS

cash in on your left over stock, production over runs & design obsolescence.

REWARD-CASH

WRITE, WIRE or PHONE for our TOP DOLLAR quotation

(201) 351-4200

UNITY *Electronics*

107 Trumbull St.,
Elizabeth, N.J. 07206

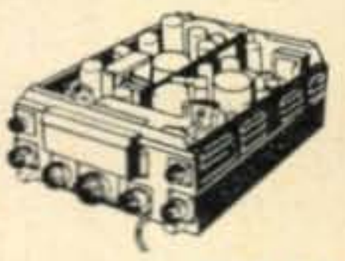
For further information, check number 28, on page 110

G&G CATALOG!

NEW 24 Pages - the BEST in Military Electronic Gear. SEND NOW FOR YOUR COPY!
Please include 25¢ Refunded with first order

FAMOUS BC-645 TRANSCEIVER

15 Tubes 435 to 500 MC



Easily adapted for 2-way communication, voice or code, on ham band 420-450 mc. citizens radio 460-470 mc. fixed and mobile 450-460 mc. television experimental 470-500 mc. Now covers 460 to 490 mc. With tubes, less power supply in factory carton. Shipping weight 25 lbs.
BRAND NEW—OUR LOW PRICE **$16.95**
Dynameter, Antenna, Plugs, All Accessories Available

TG-34A CODE KEYER

BRAND NEW in Original Carton..... **$24.50**
Exc. Used $18.95
Practice Tapes available, with Keyer ..... P.U.R.

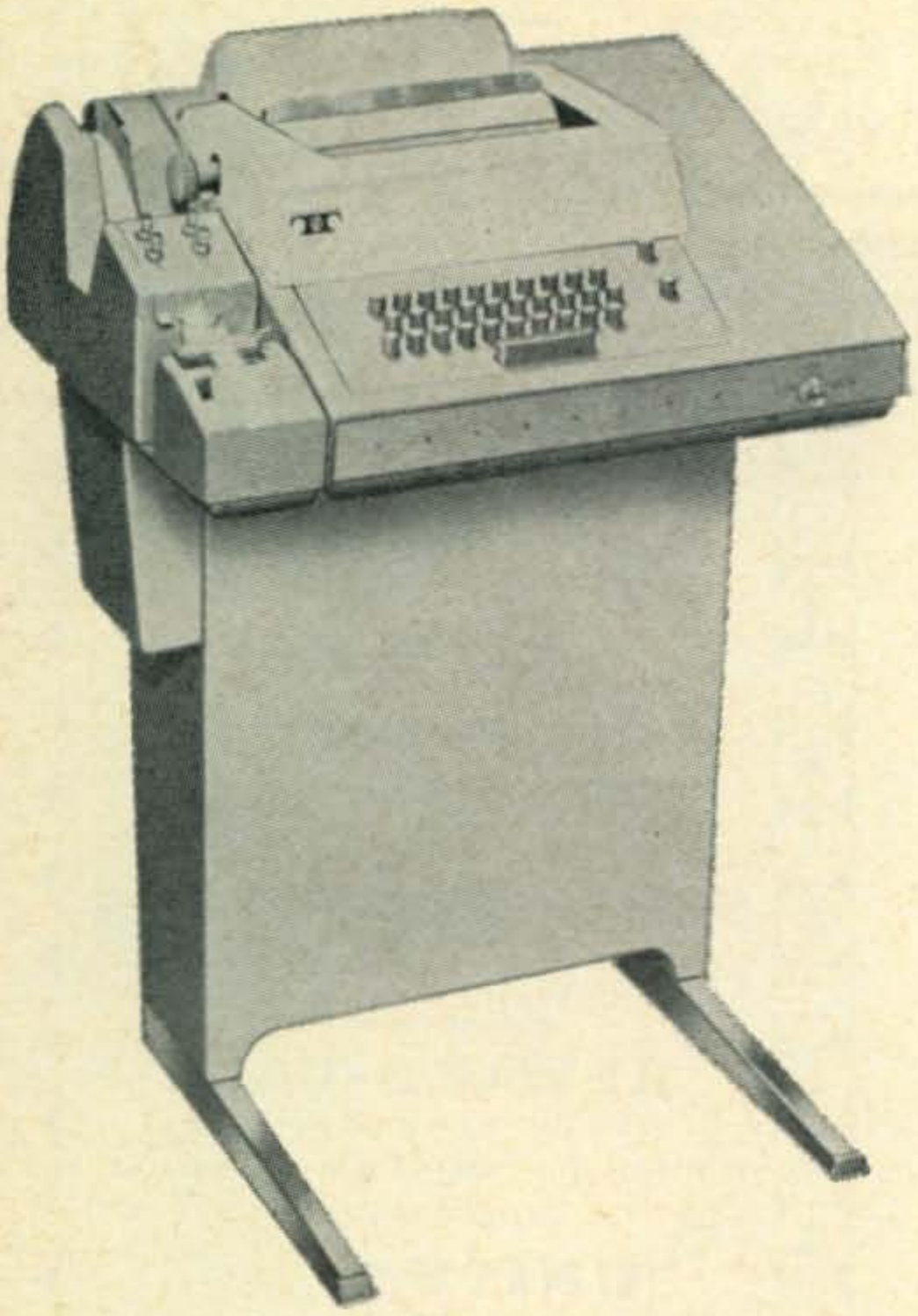
SCR-274-N, ARC-5 COMMAND SET HQ!

Freq. Range	Type	Exc. Used	BRAND NEW
RECEIVERS, Complete with Tubes			
190-550 Kc.	BC-453	$18.95	$23.50
3-6 Mc.	BC-454	$16.50	$21.50
6-9.1 Mc.	BC-455	$14.95	$19.95
1.5-3 Mc.	R-25	—	$21.50
TRANSMITTERS, Complete with Tubes			
4-5.3 Mc.	BC-457	$ 6.95	$11.95
5.3-7 Mc.	BC-458	$ 6.95	$12.95
7-9.1 Mc.	BC-459	$17.95	$22.50
2.1-3 Mc.	T-18	—	$10.95
3-4 Mc.	T-19	$10.50	$14.95
MODULATOR, Complete with 3 Tubes			
Voice	BC-456	$ 2.75	$ 4.95

All Command Set Accessories in Stock

Please include 25% Deposit with order — Balance C.O.D., or Remittance in Full. 50¢ Handling Charges on all orders under $5.00. All shipments F.O.B. Our Warehouse, N.Y.C. All Merchandise subject to Prior Sale and Price Change.

G & G RADIO SUPPLY COMPANY
Telephone: (212) CO 7-4605
75-Q Leonard St., New York, N.Y. 10013



Teletype Corporation's Model 32 KSR.

slip a piece of insulating tubing on the wire, and resolder it to the switch terminal.

"Next find the lead running between coil L_5 and pin 1 of detector socket V_5. Disconnect this wire, and as before, unwind one turn from the coil and reconnect to V_5.

"This completes the change of receiving frequency from 121.5 mc to approximately 148 mc. All that remains is a tuneup of the receiver. This is done by first adjusting the slug in L_5 until signals are found at precisely 148.14, or whatever frequency is chosen in the C.A.P. or 2-meter amateur band. (The cover may detune the set when it is replaced, so it may be helpful to drill an access hole to allow slug tuning when the cover is on.)

"For the transmitter conversion, remove V_6, a 6050 tube, and V_4, a 5851, putting them aside as spares. Locate the end of coil winding L_1 that is attached to pin 1 of the socket of V_1, the 6050 oscillator tube. Unsolder this lead at the tube socket, pull it through the coil eyelet, and unwind three turns. Take this wire back to V_6 and reconnect it, trimming off the excess.

"Now locate coil L_2. Find the lead that goes to pin 1 of V_2 (6050, doubler) and disconnect as before, removing two turns from L_2.

"Coil L_3 is left as-is. L_4 is not used here, and may be removed.

"Solder two wires to the original crystal holder terminals and to the new crystal pins, and secure the crystal holder with masking tape.

"To tune the transmitter, press the transmit button and listen for the r.f. carrier on a nearby receiver. If no signal is heard, slowly tune L_1 until the oscillator starts, then peak L_1, L_2 and L_3 for maximum received signal.

"To tune the antenna, unscrew the vertical rods near the cap with a small wrench noting which is connected to ground. Solder a one-inch loop of wire across the two contacts near the center of the antenna cap. Lift out the two loading coils, and remove all but two turns on the ungrounded side and replace the coils.

"Now resonate the antenna to 148.14 mc, (or whatever frequency is chosen) by tuning the two turn coil with a grid dip meter inserted in the one inch loop of wire. Replace the antenna assembly, drill access holes in the cover and retune the transmitter and receiver coils, and the unit is ready for operation."

For reference, the manual on the AN/URC-4 is *NavShips 93245*, and the TDQ book is *NavShips 0967-120-6031*.

I wonder if any readers of the SURPLUS COLUMN can help your Editor and some other readers with data, hopefully a technical manual, on the Collins MBF, a 60-80 mc Navy transceiver?

Another item for the RTTY gang that has appeared in surplus (chiefly Western Electric scrap) channels recently, is the 314-A polar relay. This is a direct replacement for the old, often troublesome, 255-A telephone company relay. (The 314-B is identical except that it lacks the contact-protecting suppression networks on the 314-A.)

The 314 relay, shown in fig. 2, is 4⅞ inches high and 2⅝ inches square, about an inch lower than the 255-A. They contain mercury-wetted contacts in a sealed pressure tube. No adjustments are possible, but the contacts can handle

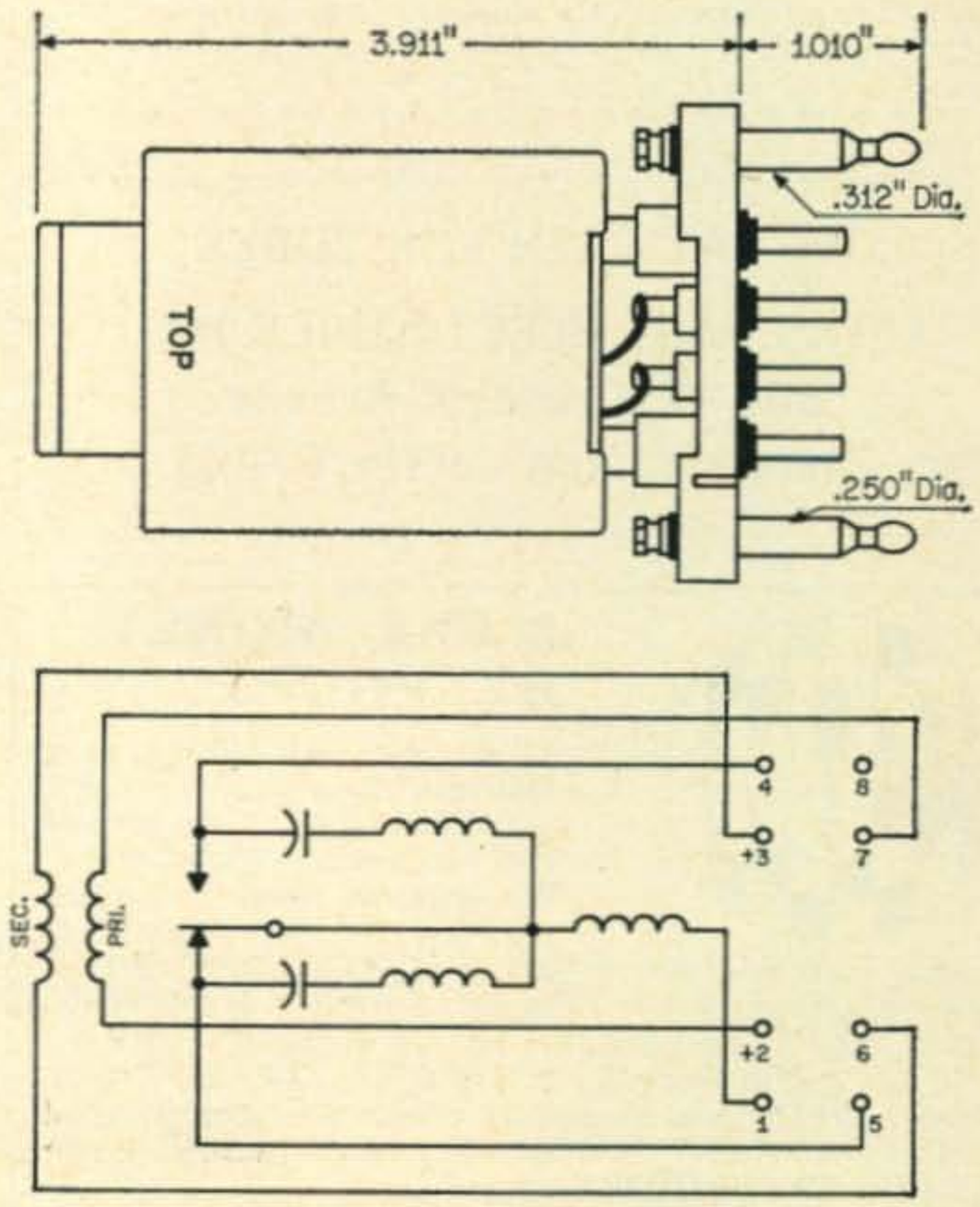


Fig. 2—Mechanical and schematic diagram for the 314-A relay.

up to 600 c.p.s. reversals, and have exceedingly long life. They generate much less hash than their predecessors.

Although the connections are identical to the 255-A, fig. 2 also shows a schematic of the 314-A relay.

In the February column I discussed modern Teletype Corporation equipment in the #32 line, which is an inexpensive equipment, available to amateurs at reasonable prices. I said that the 32 KSR listed at $475, which Teletype now informs me is inaccurate.

According to the latest list prices, the 32 KSR can be bought for $404. This set includes keyboard and printer with the "here-is" 20-character identification feature, a sheet metal stand, chad box, 115 volt a.c. synchronous motor, communications type arrangement, and geared for five-level, 7.50 unit code, 66 words per minute. The gear required to adapt the #32 for standard amateur RTTY 7.42 unit, 60 w.p.m. communication code, is part number 181417 and lists at $2.05.

Teletype Corp. tells me that 66wpm (50 baud) gears are provided in stock production because that is the most popular version of the set, which is widely used in Telex and international communications networks, thus they standardized on the 66 w.p.m. gear for production line efficiency. Since the gear change is cheap and simple, amateur purchasers should find this no real problem.

Slightly more trouble is the stock provision of signal bell on upper case "J" rather than the standard Upper Case "S" bell on most amateur machines. The bell can be switched to the "S" by replacing a keylever and a function bar, at nominal cost.

The 32 ASR, which comes with a tape perforator and transmitter-distributor, lists at $578.00 with the same other features as the KSR. This is a small, streamlined, slightly less flexible version of the famous model 28 Automatic Send Receive Teletype set. ■

the conducting ionosphere by a poorly conducting dielectric provided by the air in the troposphere and stratosphere, that is, the air nearest the ground. This low-level air is a relatively good insulator, but its highly variable electric conductivity plays a primary role in the path taken by the lightning discharge.

The air's conductivity depends partly on the distribution and partly on the properties of the ions that happen to be present at any given moment. The properties of the ions depend upon the manner in which they originated; their distribution depends partly on where and how they were formed and partly on the turbulence of the air, in which they are supported. I think that we can see that the ionic distribution at any given instant must be a tremendously complicated thing. Yet this complicated distribution determines to a great extent the path that a stroke of lightning will follow.

Breakdown

Lightning will not occur until the potential gradient between the beginning point of the stroke and end point builds up to so high a value that the air's insulating effect is broken down. This means that there must be a very high concentration of electrons somewhere above the ground, but such concentrations occur quite readily in thunderclouds.

The magnitude of the potential gradient at a given place depends to a great extent on the conductivity of the air near the ground. The greater the number of free ions the greater the conductivity and the smaller the potential gradient. This is just as with a wire through which an electric current is flowing; the voltage drop over a given length of wire will be small when the resistance of the metal is small or when its conductivity is large. Thus we can expect that under certain atmospheric conditions when the air is full of large, *immobile* ions, the potential gradient will be large. In clean air that contains few ions, the potential gradient will be large; in clean air that contains very few ions, the potential gradient will be still larger, while if the relatively clean air contains enough small and *mobile* ions, the potential gradient will be small.

Meteorological Conditions

The influence of meteorological conditions rest chiefly on the properties of the air masses. In unstable air, such as thunderstorm air, convective currents will remove ions from the layers near the ground and thus lower the potential gradient. Nevertheless, it has been found that even during fair, undisturbed weather the earth always carries an electric charge.

Our main interest rests, however, on the disturbed electric field. During such a time, all the forces that tend to produce and concentrate ionic charges are all working in the same direction. We know that lightning discharges result from only the most spectacular of nature's clouds, the cumulonimbus or thunderhead, in which the most severe turbulence is encountered. There is no doubt that the prime source of thunderstorm energy is the convective activity set up by thermal instability. The conversion of this energy into electricity is still not completely understood, but we can isolate several factors and combine them to satisfy our purposes.

One way in which the large electric field in a thunderstorm can occur is through the capture of ions in the air by falling raindrops. Moreover, falling raindrops of the large sizes common in thunderstorms tend to break up, the fragments becoming charged in the process and leaving the air ionized with the opposite charge. Since the air in a thunder storm rises while the droplets fall, a change separation is thereby effected. Additional charge is contributed by the shattering of snowflakes in the very cold upper portions of the cumulonimbus cloud. Finally, we know that a large potential exists between the solid and liquid phases of water, the magnitude of the potential depending upon the type and concentration of the contaminants in the water. This process requires the coexistence of liquid water and ice in a cloud, but this is also a prerequisite for rain formation and occurs quite commonly. Each or any combination of these factors may be chiefly responsible for the charge separation, which is pictured in fig. 2.

Notice that fig. 2 shows a high concentration of plus signs near the top of the cloud and similar positive concentrations near the base, with an intermediate region of negative electricity. Notice, too, that some of these charges are bled off by the precipitation reaching the ground.

Lightning

When a cloud of this description moves over the ground, it induces a charge into the surface of the earth. This enhances the build-up of the potential gradient between cloud and earth. When the potential gradient builds up so high that the resistance of the air is broken down, a spark discharge that we know as lightning takes place. The magnitude of the potential gradient necessary for spark discharge varies between about one billion volts per meter (that is, about 300 million volts per foot) in clear air to as little as about 100 thousand volts per meter (that is, about 30,000 volts per foot) in air filled with precipitation elements.

The mechanism of the lightning discharge is fairly well understood, mainly through the expedient of using cameras with rotating lenses to photograph lightning strokes. The main point to be made is that the old adage "seeing is believing" is utterly *untrue*. The human eye is a very inefficient observational tool. A good demonstration of this is had by observing the nature of the illumination cast by an incandescent light bulb. To our eye, the bulb seems to cast even, steady illumination; yet we know that it is activated by an electrical current that is alternating at a rate of about 60 cycles per second. This means that the eye cannot resolve things that take place at rates quicker than in one-sixtieth

of a second. It is not at all odd then, that the average layman is very much surprised to hear that what he sees as a single stroke of lightning, may in reality have been caused by as many as 42 strokes flowing along the same path in a period of less than one half a second.

Most lightning discharges, as indicated by moving-lens photography, consists of these multiple discharges. The diagram in fig. 3 illustrates the mechanism.

In about 95% of all thunderclouds, the portion of the base of the cloud from which the lightning issues is negatively charged. The ground beneath the clouds is consequently positively charged by induction. When the electric potential between cloud and ground reaches a critical value of about 100 million volts, corresponding to a localized potential gradient of roughly 40 thousand volts per ..eter (or 12 thousand volts per foot), a stream of electricity begins to surge from the base of the cloud toward the ground, at a speed of about one-sixth that of light. By collision with air molecules, this stream of electrons causes further ionization of the air in its path. When this streamer, the first *step-leader* in our picture, reaches a distance of about 150 feet from its source, recombination of ions in its upper portions produces a high enough resistance to stop the downward flow of ions, and the advance of the streamer is stopped. However, the potential at the source is restored quickly to breakdown value, and a second streamer lowered resistance due to residual ionization permits this second stroke to plough ahead farther than the first, and so on, at intervals of about one ten-thousandth of a second. (No wonder the human eye cannot detect this.)

Ground Streamers

As this so-called step-leader stroke approaches the earth's surface, the positive charges crowd into the area of approach and create a particularly high potential; this increase in intensity of the electric field may be sufficient to start positively charged streamers to surge upward from slightly elevated or pointed positions of the ground. Actually, other factors, such as a source of quite local conductivity, may even overcome the absence of the favored pointed feature with the result that the welcoming committee of ground streamers may originate from featureless terrain. This is shown in the fig. 3, in which we have converted the time scale into a space separation progressing from left to right in order to show the proper sequence of events. It may be remarked that *ground streamers* have in many cases proved fatal to persons in the vicinity of a lightning stroke without these persons being struck directly by the main discharge from the cloud.

The whole step-leader mechanism travels at a speed of about one kilometer in five thousandths of a second, that is, about 450 thousand miles per hour! When it makes contact with the earth's surface, a violent potential wave, called the return stroke, flashes upward with a speed of about 100,000 kilometers per second, (224 million miles per hour!) or about one-third the speed of light (670 million m.p.h.) along the channel ionized by the step-leader. This return stroke is the brightest phase of the lightning.

Dart Leaders

The return stroke to the cloud is often followed by a number of *dart-leader* strokes from the cloud, each traveling in the original channel and each immediately followed by another return stroke. The dart-leader moves at speeds less than half those of the step-leader.

So far in our discussion we have neglected an effect which may be of some importance at times; this is the branching that very often takes place at some phase of the progress of the step-leader. It is quite possible that several branches of the step-leader may reach the ground simultaneously, with the result that part of the charge is drained off along one branch, part along the other. Either of these branches may prove lethal to man.

In about half of all cases, the lightning stroke lasts about four-tenths of a second; the longest lightning discharge ever observed instrumentally lasted one and one-half seconds—but this would seem to a visual observer to last much longer, because the retina of the human eye retains the image of the stroke for much longer periods. Ordinarily, the width of a lightning stroke is from about one to about five inches; this is also the diameter of holes made when lightning strikes airplanes. Here again the human eye plays tricks on us, because one's impression of the width of a stroke is much larger, but diffraction in the retina causes this apparent enlargement.

Current

The electric current of a lightning stroke varies between wide limits. About half of all strokes are composed of currents of more than 25,000 amperes and 10% of all lightning strokes more than 60,000 amperes. The maximum current ever recorded was 220,000 amperes. Needless to say, the effect of this high current on objects struck by lightning is varied; nonconductors, such as trees, utility poles, and chimneys, are frequently shattered or splintered, and a repetition of discharge in multiple strokes may set combustible material afire. The explosive effect of lightning on trees, for example, is probably the result of the electrolytic dissociation of the water in the trees into hydrogen and oxygen gas, a highly explosive mixture that is set off immediately by the spark itself.

Conductors, such as metal wires, are usually heated to their melting or even vaporization points, depending on the resistance of the conductor; hollow conductors, such as high-tension cables or pipes, may be crushed by the thermal and magnetic effects of the stroke.

Lightning Forms

We have made no mention of the various

forms that observers attribute to lightning. In brief, it can be said that all lightning, except for some questionable after effects of the electric flow, have but one form, *streak lightning*, which is the irregular, often forked path of discharge. *Beaded lightning* results simply from the three-dimensio al geometry of the part of a stroke of streak lightning. Sheet or heat lightning is simply the aerial illumination of distant thunderstorm by streak lightning.

Finally, let us dispense with the familiar adage that "lightning never strikes twice in the same place"—nothing could be further from the truth. ■

Bibliography

Chalmers, J. A., *"Atmospheric Electricity,"* Pergamon Press, New York, 1957.

Humphreys, W. J., *"Physics of the Air,"* McGraw-Hill, New York, 1940.

Johnson, C., *"Physical Meteorology,"* M.I.T. Press—Wiley, New York, 1954.

Malone, T. C. (ed.) *"Compendium of Meteorology,"* American Meteorological Society, Boston, 1951.

Mason, B. J., *"The Physics of Clouds,"* Oxford University Press, London, 1957.

Massey, H.S.W., and Boyd, R.L.F., *"The Upper Atmosphere,"* Philosophical Library, New York, 1959.

Neuberger, H., *"Introduction to Physical Meteorology,"* Mineral Industries Extension Service, The Pennsylvania State University, State College, Pennsylvania, 1951.

Rawer, K., *"The Ionosphere,"* Ungar, New York, 1956.

Simon Says [*from page 87*]

earlier, for a Q of 10 and 1000 watts output, the current is about 10 amps. C_1 must be able to handle this. The requirement for C_2 is not as severe and may be easily computed by figuring that 1000 watts output across R_L develops 223 volts RMS across R_L and C_2 and hence $I_{c2} = 223/24.9 = 9$ amps.

Thus in actual practice it might be advisable to specify the components as so:

C_1: 30 to 450 mmf
3500 v.d.c.
$I = 15$ amps

C_2: 160 to 2000 mmf
500 v.d.c.
$I = 10$ amps

L_1: .5 to 6μh
$I = 15$ amps

Let's not forget the voltage rating of the inductance also, the entire inductance must be insulated sufficiently above ground so that the r.f. voltage (also a function of Q and where you operate the tube) doesn't arc to ground and in addition you would like the inductance to be spaced sufficiently so that the r.f. doesn't arc between coil turns.

Now aren't you sorry you started this whole mess?

Seven Tea Trees, Bert, W2UUN

You work where the action is when you're in 2-Way Mobile Radio Servicing–with police, airline crews, fire fighters, and other mobile radio users. Many, like CIE-graduate Ed Dulaney (above), own their own mobile radio businesses. Says Dulaney, "My CIE electronics course was the best investment I ever made. CIE deserves full credit for greatly expanding my technical background. I am much better off financially and really enjoy my work."

You earn a man's pay as a Broadcast Engineer, putting glamorous radio and TV entertainers on the air, covering sports events and big news developments. "Now I am a Broadcast Engineer," wrote Don Fosco after taking a CIE course, "and earn $150 more a month." Once you get your FCC License and some broadcast experience under your belt, you can earn $185 to $215 a week at big city stations. (Photo above posed by models.)

Want a real man's job and pay? Your best bet today is Electronics!

Electronics is a great life for a man!
And breaking in is easier than you think.
Here's how you can prepare right at home.

What does a real man want from his job?

A man's pay, for one thing. Money enough to raise a family comfortably... take some exciting vacation trips... send the kids to college.

But you want a man's satisfaction on the job, too. You don't want to be just a workhorse harnessed to routine chores. Nor do you want to sit behind a desk and push a pencil all day. You want the feeling of doing something important–of being needed. Of having dozens, maybe even thousands, of people depend on *you* and how well you do your job.

Offers High Pay and Excitement

For that kind of satisfaction–a real man's job and a man-sized pay check to go with it–your best bet today is ELECTRONICS. This booming field really separates the men from the boys. Every year more good jobs open up, and there just aren't enough good men to fill them. The unprepared don't stand a chance. But the fellow who takes the trouble to learn what it's all about can write his own ticket.

For instance, how would you like to meet with top political leaders and sports celebrities–put glamorous radio and TV stars on the air? As a Broadcast Engineer you'll be an "insider" in the exciting worlds of show business, sports and news reporting.

Or how about getting out "where the action is"–working with your local police, firemen, airline crews, etc.? You can, by getting into 2-Way Mobile Radio Servicing. It pays considerably better than fixing television sets because you hold a Government FCC (Federal Communications Commission) License. You can even become your own boss–start your own service shop–come and go as you please.

How to Become "The Man in Demand"

And these are just a few of the many golden opportunities in the great wide world of electronics today. Computers... electronic automation... electronically guided spacecraft... the whole world is going electronic. And the man needed to keep it all running, the electronics expert, will be "king."

Breaking into electronics does call for some training. But you needn't quit your job or turn your life upside down to get it. You won't even have to set foot in a classroom. CIE can teach you electronics right at home... in your spare time.

Over the past 30 years we have developed special home study methods that take the mystery out of electronics...even for men who've had trouble with other studies. Your instructor, an expert in electronics, will give you all the personal help you need.

Send for 2 Free Books

We offer two free books that tell all about career opportunities in Electronics, and how to prepare for them without previous training. Just fill out and mail the coupon below. No obligation. And the books may open the door to an exciting and rewarding life in electronics...doing a man's job and earning a man's pay. If coupon is missing, write to address below.

ENROLL UNDER NEW G.I. BILL

All CIE courses are available under the new G.I. Bill. If you served on active duty since January 31, 1955, or are in service now, check box in coupon for G.I. Bill information.

CIE **Cleveland Institute of Electronics**
1776 E.17th St., Dept. CQ-29, Cleveland, Ohio 44114

Cleveland Institute of Electronics
1776 E.17th St., Cleveland, Ohio 44114

Please send me without cost or obligation:

1. Your 40-page book "How To Succeed In Electronics" describing the job opportunities in Electronics today, and how your courses can prepare me for them.
2. Your book on "How To Get A Commercial FCC License."

Name_____ Age_____
(Please Print)

Address_____

City_____ State_____ Zip_____

☐ **Check here for G.I. Bill information**

Accredited Member National Home Study Council CQ-29

For further information, check number 2, on page 110

Somedays . . . [*from page 67*]

of rescue vehicles and conditions at the site. At 6:31 p.m., with the 40 meter band remaining unusually open, W6KAO reported the arrival of the first snow plow. At 8:04 p.m. he reported that he was clear and following the convoys out, but it was nearly midnight before they got out of the mountains. At the time of rescue Al reported that the snow was up to window level on his Mustang. Other stations that helped at various stages included WB6JXQ, W6HVA, W6HBP, WA6AVN, WB6LYX, W6MLZ, K6EXL, WA6LML, and WB6IZF. W6MLZ relayed a message on 2 meters to KAO's anticipated host in San Bernardino. WA6LML relayed a message to the wife of one of the sheriff's officers when he arrived on the scene. ■

Scratchi [*from page 13*]

You will be raking in the bux from reeders and others who wanting to know how there kilowhat plus rigs are sounding in Okinawa or some such place.

Scratchi are having the reel hard job. All FOM and LOM reports are having to come to me, and I having to get them sorted and written up, then having to send composite report to amchoor who wanting measurement.

I knowing that you not letting me down, and knowing that you willing to paving me for my efforts. Scratchi not wanting any fancy title or being listed on masthead—Scratchi just wanting the money.

By the way, you not having to worry about me accepting money as an amchoor. I finding out I not having legal license at the moment anyway.

You thinking maybe thousand bux a month about right?

Respectively yours,
Hashafisti Scratchi

YLRL Convention [*from page 63*]

WØESD is working on a coffee table to be made of blocks engraved with YL club certificates and calls. (This will continue the theme used for the 1960 and 1964 conventions when embroidered squares, replicas of YL certificates, etc. were made into souvenir bed covers.)

WAØPYZ, Linda, is making a YLRL tablecloth, to be autographed by the YLs attending the convention. K9QGR, Hazel, is making an afgan which will be a "donation" prize.

Prizes are wide open and everyone can contribute toward this convention activity by donating stamp books or prizes. The club is collecting prizes for three categories: Around the world (from all DX countries); special YL prizes, and non-radio prizes. (The convention committee requests that all prizes donated be at least $3 in value.) KØYJG, Claire, is collecting the stamp books.

The decorations and souvenir committee is hard at work with many lovely and interesting projects, to name a few—tote-bags, decorated "YLRL 1968" cups, matchbox souvenirs, ash trays, YLRL girl on the globe, special new YLRL

badges, and many others.

And don't forget to make some "swaps" to bring to the convention. These were a real hit at the '64 convention, and the Colorado YLs are already working on theirs.

In addition to the convention activities of forum, luncheon, banquet, amateur station, hospitality room, etc., the gals are planning an all-day sightseeing tour on Friday, with a coffee stop at Palmer Lake, tour of the Air Force Academy, Garden of the Gods, and returning via Colorado Springs. On Saturday a tour for the OMs is planned to Central City, Blackhawk and Golden (including Coor's Brewery!).

This is just the beginning. As the year rolls along the Colorado YLs will be coming up with even more plans. We can hardly wait for—"OUR BIG DATE—YLRL '68!"—how about you?

DX [*from page 76*]

KS6BZ–To Dept. of Education, Pago Pago, American Samoa 96920
KX6DC–Via K1AZA
LZ2KKZ–To Box 18, Varna, Bulgaria
MP4BDF–Via W3KVQ
MP4TBO–To VE1AKZ
OY7ML–Via W2GHK
PA9CN–All W, K, & VE cards to WA1GIA
PJ3CC–Cards for March 25-28, 1967 QSOs to WA2OJD, RFD Box 494, Woodstock, NY 12498
PZ1CQ–Via Box 2222, Paramaribo, Surinaam
SP7GH–To T. Jokiel, Przytycka 2/1, RADOM, Poland
SVØWA–To W3MSK
SVØWFF–Via K4FUV
TA2AC–To K4AMC
TT8AQ–Via W4DQS
TU2AY–Via Box 20194, Abidjan, Ivory Coast
5T5KG–Via Yasme, PO Box 2025, Castro Valley, Calif. 94546
5U7AL–To PO Box 201, Niamey, Niger Republic
606BW–Via W4HKJ
601PF–To WØOMM
6W8BL–Via Box 5256, Dakar, Senegal
6W8CD–To YASME, PO Box 2025, Castro Valley, Calif. 94546
6Y5JMA–Via 6Y5RA
6Y5MJ–Direct to Dr. Manley. KØTYO is **no longer** QSL Manager.
7Q7LC–Via W4NJF
7Z3AB–To W4HEG, 1606 May Ave. SE, Atlanta, Ga. 30316
9G1KT–Via PO Box 625, Tema, Ghana
9M2NF–To Dennis A. Bowden, 1st Regt. Malaysian Signals, GPO, Kuala Lumpur, Malaysia
9N1BG–Via VE4OX
9X5GG–To W2GHK
73, John, K4IIF

CQ Reviews Drake 2C [*from page 36*]

at 72° F. ambient, 100 c.p.s. next hour and 50 c.p.s. per hour thereafter; ±10 c.p.s. on 3.5 mc and ±4 c.p.s. on other bands with ±10% line-voltage variation with *momentary* jumps of ±30 c.p.s. and ±10 c.p.s. on the same respective bands only at instant of line-voltage shift.

Noise Blanker

The noise blanker is a solid-state affair using 5 transistors and 4 diodes. The principle of operation is that of sampling the noise pulses at the 455 kc i.f. output from the 2nd mixer and processing them through an amplifier, rectifier and pulse-shaper/amplifier to provide positive-going pulses that gate a diode shunted across the input to the 50 kc filter. The diode is normally biased to non-conduction (during the absence of noise pulses) and thus effectively is an open switch.

When noise pulses appear at the receiver input, those processed by the blanker chain cause the diode to conduct during each pulse. Thus, each time, the diode acts as a closed switch which short-circuits the filter input and thereby interrupts the receiver continuity only for the duration of each pulse. This prevents pulses from being heard at the receiver output or from increasing a.g.c. action that might decrease the receiver sensitivity. The desired signal also is interrupted, but the pulse time is so short, that the effect on the signal is not observed by ear. An advantage of the system is that noise suppression takes place before the noise pulses can be lengthened by the selective i.f., thus ensuring more effective results.

Performance-wise the blanker does an excellent job of suppressing impulse-type noise. Noise pulses up to several hundred microvolts at various repetitive rates simply disappear when the blanker is switched on.

As with most noise-suppressing systems, performance is best on short pulses at slow rates with effectiveness diminishing as the rate becomes very fast. Power-line noises usually fall in the latter class and have somewhat longer pulses. Results in such cases may be good or poor, depending on the exact character of the noise.

With s.s.b. and a.m. signals above 50 μv or so, noticeable distortion was experienced with the blanker on. As is pointed out in the instruction manual, this should cause no detrimental effects, since signals of this strength should far exceed noise conditions in which case the blanker would not be needed anyway.

The Drake 2-C receiver is priced at $229.00. Accessories are priced as follows: Model 2-CS Matching Loudspeaker, $19.95; Model 2-AC 100 kc Crystal Calibrator, $16.95; Model 2-CQ Matching Loudspeaker with Q-Multiplier/Notch Filter, $39.95; Model 2-NB Noise Blanker, $24.50. These are products of R.L. Drake Company, Miamisburg, Ohio 45342. —*W2AEF*

[1]Not related to overload or cross modulation.
[2]The a.g.c. release times given earlier are based on a.g.c. voltage recovery time to 36.8% of maximum value.

Propagation [*from page 79*]

Northern & Central South America	08-10 (1) 10-14 (2) 14-15 (3) 15-16 (2) 16-17 (1)	07-08 (1) 08-12 (2) 12-14 (3) 14-17 (4) 17-18 (3) 18-20 (2) 20-21 (1)	05-08 (3) 08-10 (2) 10-13 (1) 13-15 (2) 15-17 (3) 17-22 (4) 22-02 (3) 02-05 (2)	19-21 (1) 21-23 (2) 23-01 (3) 01-03 (2) 03-04 (1) 20-22 (1) 22-00 (2) 00-03 (1)
Southern Brazil, Argentina, Chile & Uruguay	08-12 (1) 12-14 (2) 14-18 (3) 18-19 (2) 19-21 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	02-04 (1) 04-08 (2) 08-14 (1) 14-16 (2) 16-22 (4) 22-00 (3) 00-02 (2)	20-22 (1) 22-01 (2) 01-04 (1) 22-04 (1)
McMurdo Sound, Antarctica	14-19 (1)	11-14 (1) 14-16 (2) 16-18 (3) 18-20 (2) 20-21 (1)	16-18 (2) 18-22 (3) 22-00 (2) 00-04 (1) 04-07 (2) 07-16 (1)	23-05 (1)

Filters [*from page 17*]

above a specified frequency and reject all those below. It is for these reasons that they are simply called *low pass* and *high pass* filters.

Design Requirements of Filters

Without discussing the complicated mathematics involved in filter design (some filters require a ream of paper in the mathematical design) the following data are necessary when specifying one:

1—Input and output impedances.

2—3 db bandwidth.

3—Bandwidth at some greater attenuation (or the shape factor) such as the ratio of 3 to 30 db, or 6 to 60 db bandwidths.

4—Frequency at the center of the band.

5—Insertion loss allowable (the loss in output due to the filter's insertion in the circuit).

6—The flatness of the response through the passband (usually required only when the bandwidth is very wide, and the top of the band-pass is essentially flat).

7—The cutoff frequency, if a high or low pass filter.

8—The desired amount of attenuation outside of the pass-band (either higher or lower in frequency).

It must be remembered that the design of crystal filters, as in any other type of circuitry is limited by certain capabilities of the crystals and the constants of lumped components. Extreme bandwidths can only be obtained at the sacrifice of shape factor and insertion loss, or physical size. Narrow bandwidths may be obtained, but at a limit of frequency.

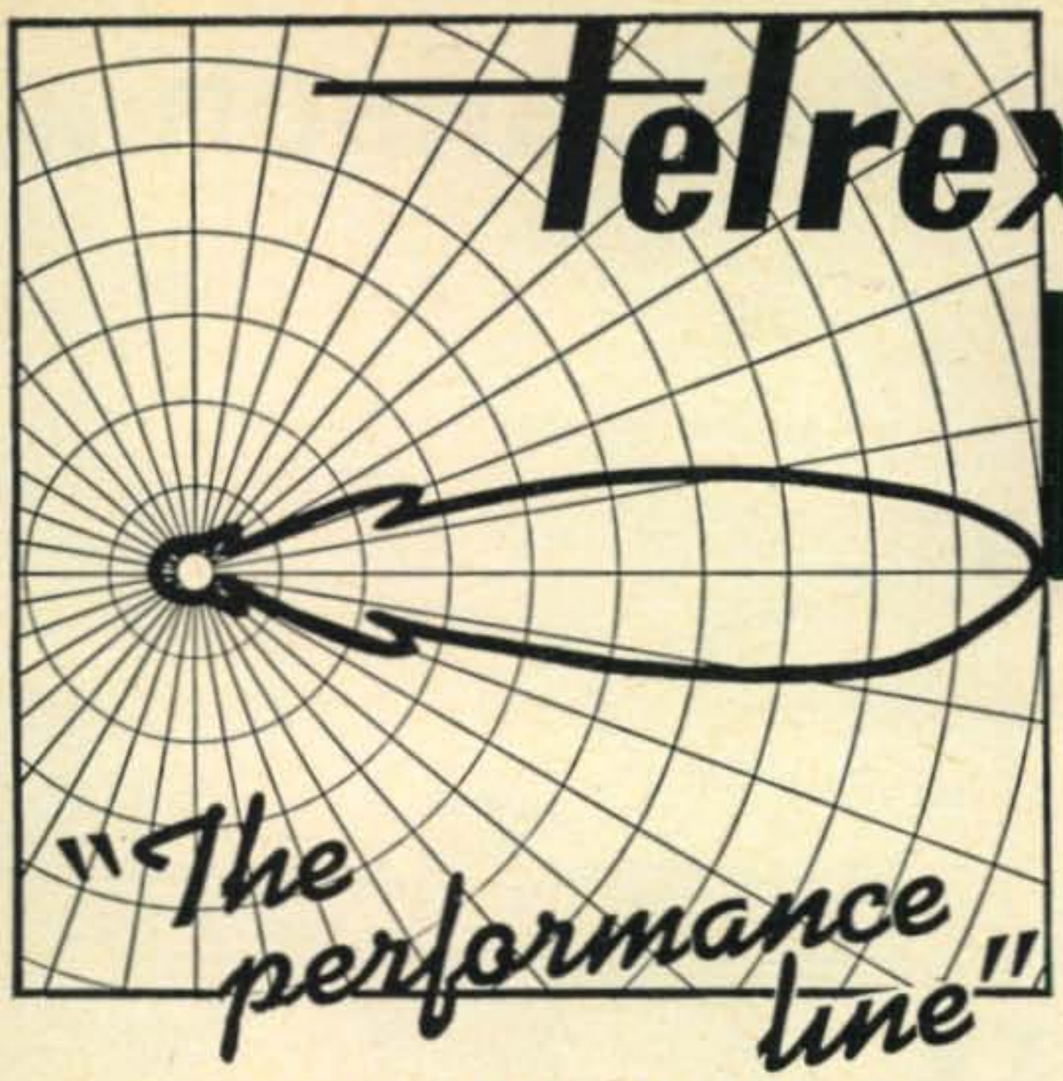
New Promises for the Future

The newest in crystal filters has recently been announced by the U.S. Army Electronics Lab. at Fort Monmouth. In conjunction with two manufacturers, Clevite Corp. and Bell Labs, two types of crystal filters have been developed, one ceramic, and the other quartz.

The amazing features of these filters is that the equivalent of as much as 9 sections have been reproduced *on a single crystal* wafer. The ceramic filter is usable from 50 kc to 5 mc and the quartz filter from low frequencies to as high as 150 mc. So far, bandwidths have been limited, but show promise of radically changing the package size of presently manufactured filters.

The photograph shows a typical Uni-wafer Clevite filter measuring approximately one inch in diameter, and only a few thousandths of an inch thick. ■

[*Continued on page 100*]



"Beamed-Power" ANTENNAS, "BALUNS" I. V. KITS and ROTATOR SYSTEMS!

Most Technically-Perfected, Finest Communication Arrays in the World! Precision-Tuned-Matched and "Balun" Fed for "Balanced-Pattern" to assure "TOP-MAN-ON-THE-FREQUENCY" Results

Enjoy, World renown TELREX performance, value and durability! Send for PL67 tech. data and pricing catalog, describing professionally engineered communication antenna systems, rotator-selsyn-indicator-systems, "Baluns", I.V. Kits, Towers, "Mono-Pole", "Big-Berthas", accessories, etc., etc.

— with a MATERIAL DIFFERENCE!

Use, is one of the most dependable testimonials of endorsement, and Telrex products are in use in 139 Lands

COMMUNICATION SYSTEMS SINCE 1921

Communication Engineering **telrex** Laboratories

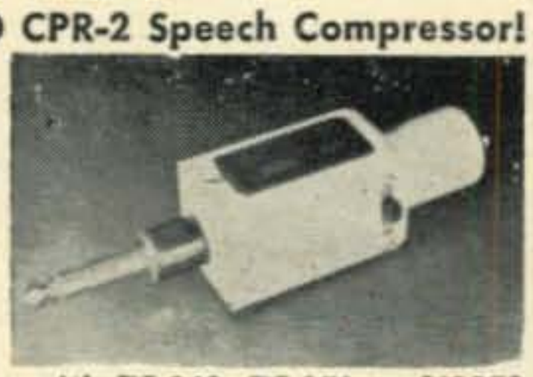
ASBURY PARK, NEW JERSEY 07712, U.S.A.

For further information, check number 19, on page 110

Boost Talk Power!

With our NEW, IMPROVED CPR-2 Speech Compressor!

- TRIPLES SSB output power or AM modulation!
- NEW adjustable compression control!
- For ALL transceivers, transmitters, and P.A. systems!
- For ALL microphones!
- Internal battery



With single button connectors, or with PLO68, PLO51 or 80MC2 connectors for Push-to-talk (effective Nov. 1, 1966).....$19.95

FULLY WARRANTED . . . . . MONEY BACK GUARANTEE

Send for full description of our product line.

COMMUNICATION COMPONENTS CO.

P. O. Box 8721 • Dept. B • Orlando, Florida 32806

The NEW TYMETER©

"Time at a Glance"

24 HOUR CLOCK

#100-24H¼

$15

Walnut or ebony plastic case. H4", W7¾", D4". 3 lbs. 110V 60 cy. A.C. Guaranteed 1 year.

At Your Dealer, or WRITE TO

TYMETER ELECTRONICS

PENNWOOD NUMECHRON CO.

7249 FRANKSTOWN AVE., PITTSBURGH 8, PA.

For further information, check number 27, on page 110

"HOW TO MAKE MONEY IN Mobile Radio Maintenance"

AUTHORITATIVE GUIDEBOOK

ABOUT THE BOOM IN TWO-WAY MOBILE-RADIO: GIVES FACTS, FIGURES, PAY RATES.

WRITE TODAY! FREE

LAMPKIN LABORATORIES, INC. Electronic Div. BRADENTON, FLA.

TELETYPE TERMINAL EQUIPMENT

Receiving Converter
Model RTY-2

A new completely solid state RTTY receiving converter. Provides three common shift frequencies: 850, 425 and 175. Panel switch selects desired shift.

Audio filter type converter gives good discrimination between signals and noise or interference. Circuit is made up of limiter, amplifier/filter driver, detector, pulse shaper, and keyer. May be used for either FSK or AFSK.

Integral a.c. power supply uses zener diode regulation for dependable operation independent of line voltage variations.

RTY-2 $139.95
Postpaid in USA

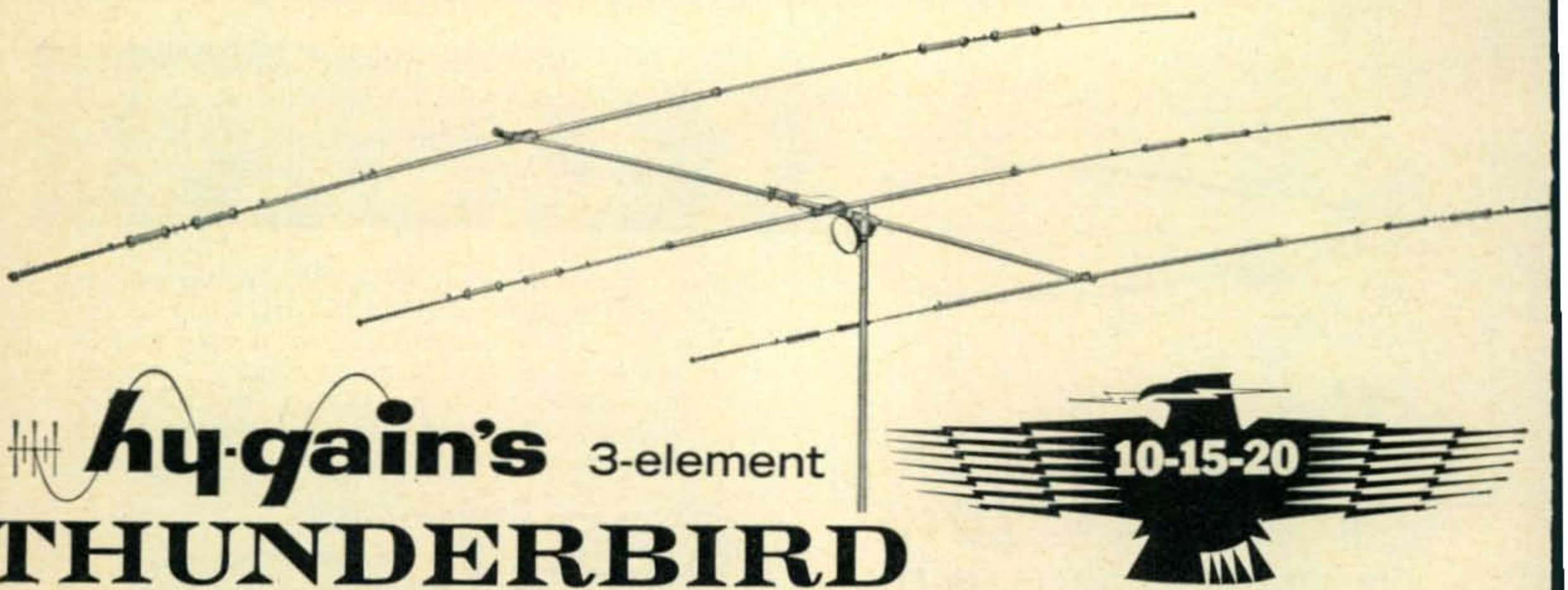
NEW! IMPROVED!

Now includes 100 volt 60 ma. loop supply. Uses high voltage output transistor for better selector magnet current waveform.

AQUADYNE, INC. • BOX 175 • E. FALMOUTH, MASS. 02536

For further information, check number 24, on page 110

So good it defies comparison...



hy-gain's 3-element

THUNDERBIRD

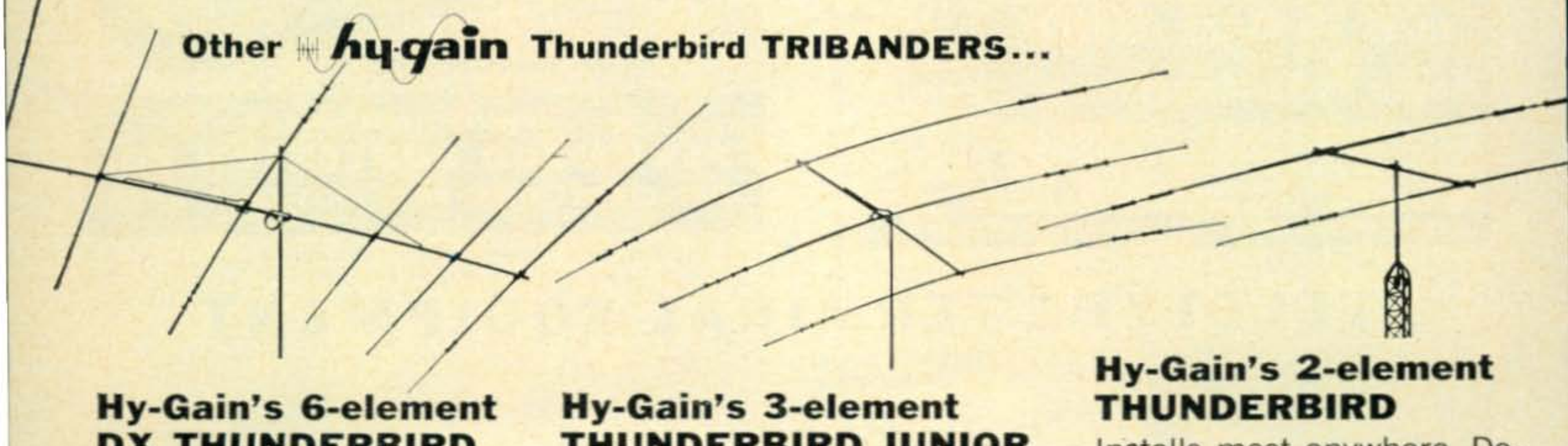
TRIBANDER MODEL TH3Mk2

- **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.

Model TH3Jr. . . . . **$74.50** Net

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...

hy-gain ELECTRONICS CORPORATION

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

For further information, check number 26, on page 110

Ham Shop

ADVERTISING RATES: Commercial and organization ads, **35¢** per word. Non-commercial ads for other than subscribers **10¢** per word, including abbreviations and addresses. **Minimum Charge $1.00.** No ad will be printed unless accompanied by full remittance. Current CQ subscribers must send mailing label from CQ wrapper in lieu of cash payment.

Closing Date: The **5th** day of the second month preceding date of publication.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of **CQ** cannot vouch for the merchandise listed therein. We reserve the right to reject advertising which we feel is objectionable.

Direct all correspondence and copy to: **CQ HAM SHOP, 14 Vanderventer Avenue, Port Washington, L.I.N.Y. 11050.**

RADARS Wanted: Radar equipment of all kinds bought. Write: M. Cemprola, 550 Fifth Avenue, New York, New York 10036.

GOVERNMENT surplus picture catalog 25¢. Meshna, Nahant, Mass. 01908.

FREE CATALOG: Electronic parts, tubes, wholesale. Thousands of items. Unbeatable prices. Areturus Electronics Corp., 502 22nd Street, Union City, New Jersey 07087.

QSL's by RUTGERS VARI-TYPING SERVICE, Thomas Street, Milford, N.J. 08848. Free Samples.

YOU NEED IT, we got it! Unheard of bargains in Coaxial Cable, Switching Equipment, Meters, Relays, Connectors, Capacitors, Transformers, etc. Phone or visit! Open Monday-Saturday till 5 P.M. Windsor Distributors, 46 Fulton Street, Brooklyn, New York 11201, Phone 212 MA4-7038.

QUADS: Proven sensational! All metal (except spacing insulator dowels); full size; two element; absolutely complete with boom, all hardware, wire and fittings; terrific gain and directivity; no bamboo or fibreglass; uses single 52 ohm coaxial feedline. 10-15-20 quad, $35; 15-20 quad, $32; 10-15 quad, $30; 20 meter quad, $25; 15 meter quad, $24; 10 meter quad, $23. Remit with order, shipped charges collect same day. Gotham, 1807 Purdy Ave., Miami Beach, Fla. 33139.

HOBBYISTS, EXPERIMENTERS, AMATEUR SCIENTISTS, STUDENTS. . . . Construction plans-all complete including drawings, schematics, parts lists, prices, parts sources . . . LASER-build your own coherent light optical laser. Operates in the pulsed mode, in the visible light range—$6.00 . . . DIODE LASER-Invisible light (infrared) can be continuously modulated—$3.00 . . . REVERBERATOR (Echo) Unit-build your own. Use with your automobile radio, home radio or hi-fi, electric guitar, etc. $3.00 . . . RADAR-build your own ultrasonic doppler radar. Detect motion of people, automobiles, even falling rain drops. Transistorized, uses standard small 9-volt battery—$4.00 . . . LONG RANGE "Sound Telescope"—this amazing device can enable you to hear conversations, birds and animals, other sounds hundreds of feet away. Very directional. Transistorized. Uses 9 V. battery—$3.00, or send 25¢ coin or stamps for complete catalog . . . TECHNICAL WRITERS GROUP, Box 5501, State College Station,, Raleigh, N.C. 27607.

HOT-SHOT CARD. Designed for clubs and individuals engaged in emergency communication, this 4" by 5" red card with black printing may be placed in your mobile unit's window to identify you as an "Emergency Radio Unit." Card is on a heavy Bristol board stock and is almost identical to those issued to regular emergency vehicles by many agencies. 50¢ each, ppd, or available in bulk amounts of 25 cards for $6.25. Order now from HOT SHOT CARD, c/o CQ's Ham Shop, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

RED or WHITE, die cut Scotchlite letters. Day-Night Visibility. Postpaid/letter, 2"-15¢, 2½"-20¢, 3"-25¢. Portage Industries Inc., Dept. B, Box 188, Portage, Ind. 46368.

POLICE—fire—aircraft—amateur calls on your broadcast radio! Tune the band with TUNAVERTER. Free catalog. Salch Company, Dept. CC, Woodsboro, Texas 78393.

RUBBER ADDRESS STAMP including call letters. Three or four line text $1.50. Signature stamp $2.88. Free catalog. Jackson Stamps, 1433 Winnemac, Chicago, Illinois 60640.

SHIELDING Systems, Kits, accessories. Eliminate mobile interference. Estes Engineering, 1639 West 135th, Gardena, Calif. 90249.

FREE CATALOG—Loads of Electronic Bargains. R. W. Electronics, Inc., 2244 South Michigan Ave., Chicago, Illinois 60616.

CREATIVE QSL cards. 25¢ for catalog, samples 50¢ coupon. Personal attention. Imaginative new designs. Wilkins Printing, Box 787-3, Atascadero, Calif. 93422.

FCC Commercial operator License preparation by correspondence. Grantham, 1507 N. Western, Hollywood, California 90027.

QSLs—BROWNIE—W3CJI—3111 Lehigh, Allentown, Pa. 18103. Samples 10¢ with catalog 25¢.

NEW!!! 1,000 Glossy Q.S.L. cards by the Rabling Redskin, only $4.75. Samples and details 10¢, refundable. Post Office Box 564Q, North Bergen, New Jersey 07047.

"HOSS-Trader," Ed Moory; Offers Limited supply of equipment opened, displayed and demonstrated at various Ham-Fest's. SB-34, $319.00; NCX-5, $449.00; NCL-2000, $495.00; Galaxie 5 MK-2, $339.00; TR-4, $495.00; T4-X, $349.00; R4-A, $345.00. Package Deal: New Mosley Classic 33 Beam & Demo Ham-M Rotor, $209.00; Special 'Rohn 50 ft. foldover tower prepaid; $189.00. "The Hoss needs Hay for his Ponies' Cash talks at our Stable." Write us for special quotes. "Recent Special Quantity purchase on new Collins gear allows us to pass this saving on to the amateur: New KWM-2, $950.00; New 32S-3, $649.00; 75S-3-B, $559.00; 30L-1, $459.00; One to a customer: New 516F-2, $102.00; Used Swan 500, $389.00; Ham-M Rotor, $89.95; Ed Moory Wholesale Radio Co., Box 56, DeWitt, Arkansas. Phone Area code 501-946-2820.

WANTED: Full time sales representative needed to sell a quality line of nationally known two-way radio equipment in the North Central and Mid-Western areas of the country. Salary, commission, plus expenses; liberal company benefits. Ideal opportunity for Ham or CB'er with a knack for selling. Must be willing to travel. REPLY: Mr. Warren Whittel, P.O. Box 536, Baltimore, Md. 21203.

SOUTHERN NEVADA Amateur Radio Club thanks participants and exhibitors who made "SAROC", the "FUN-CONVENTION", such a success in 1967. Stellar Industries, E G & G, Southern California Edison Company, Brad Thompson Industries, Mission Ham Supplies, California Highway Patrol, Henry Radio, Tistao Towers, Weatherbie Electronics Center, Swan, Tri-Ex Towers, Collins, Hallicrafters, Hy-Gain, Radio Products, Linear Systems, Hotel Sahara, MARS, Raytheon, Superior Engraving, United States Air Force, WCARS-7255, W6SAI. "SAROC" 1968 "FUN-CONVENTION" will be centered in the heart of the entertainment capital of the world at Hotel Sahara, Las Vegas, Nevada, January 4-7. QSP, QSL-card, ZIP and telephone number for details to Southern Nevada Amateur Radio Club, Box 73, Boulder City, Nevada 89005.

PHONE PATCH LOG. Must for ur shack. $2.00 incl. post. in U.S.A. Proceeds for Charity. Check or M.O., K7ZOH/1, Box 251, N. Scituate, Mass 02060.

G.I. WRIST WATCH $6.95. Gov't. surplus catalog 10¢. B & F, 44, Hathorne, Mass. 01937.

WANTED: Tubes, transistors, semiconductors, test equipment, meters. Bernie W2MNP, Box 257, Canal Station, N.Y., N.Y. 10013.

HAMFESTERS Radio Club, Chicago, Illinois, proudly announces its 33rd Annual Midwestern Hamfest, Sunday, August 13, at Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, near Chicago. The Hamfest features manufacturer and distributor exhibits, swappers row, awards and a variety of activities for all. This year Hamfesters salutes the "Armed Forces". Also displays by the military. For complete details and map of the location, write: Gregory Purtock, WA9MRE, 2916 West Marquette Road, Chicago, Illinois 606029.

P.J. Bandmaster all Coax antenna, the traveling hams dream. Portable. Quiet reception, broad band. Write: Endres Electronics Systems, Rt 178, Lake Isabella, Calif.

HIGHLY Effective home study review for FCC commercial phone exams. Free Literature. Cook's School of Electronics, P.O. Box 36185, Houston, Texas 77036.

HEATH solid state multiplex twins, AA-14 & AJ-14 with bookshelf speakers, all in oiled walnut. Ranger 1 and Vanguard 6 mtr. converter w/10 mtr. out. Sell or trade for transceiver. Robert F. Cann W4GBB, 815 Ben Franklin Drive, Sarasota, Fla. 33577.

WANTED—QST's—Last four issues needed to complete private collection. 1916—FEB., MAY, JUNE, JULY. Any reasonable price paid. K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, L.I., New York 11050.

WANTED: Silver Dollars any date. Must see actual coin before I can make a firm offer. If interested in making a profit on your dollars send your silver dollars to me by insured mail. I will return any and all postage even if we can not come to terms. Coins not accepted will be returned immediately by insured mail. Send to HAM SHOP, c/o CQ MAGAZINE, Box CESR, 14 Vanderventer Avenue, Port Washington, L.I., N.Y. 11050.

QSL CARDS. Samples 25¢. Malgo Press, Box 375, Toledo, Ohio 43601.

1,000 EMBOSSED business cards $3.99. Free samples. Wagner Company, 6200 G Whitewood, Library, Penna. 15129.

PICTURE of yourself, rig etc., on QSLs made from your photograph. 250-$7.50, 1,000-$14.00. Samples free. PICTURE CARDS, 129 Copeland, LaCrosse, Wis. 54601.

HALLICRAFTERS HT-45 Linear 2KW Exclnt $275. W3CEX, 301-761-7119, Balto., Md.

AMATEUR Equipment repairing specialist. Transmitters-Receivers-Kits Wired Custom Building-Alignment-Calibration. Product Detectors Added—John Roache, W1SOG, Broadcast Chief Engineer 20 yrs. Prop. J-J Electronics, Windham Road, Canterbury, Conn.

WANTED: Military, Commercial, SURPLUS, Airborne, Ground, Transmitters, Receivers, Testsets, Accessories. Specially Collins . . . We Pay cash and freight. RITCO, Box 156, Annandale, Va. Area 703-560-5480 COLLECT.

TEST EQUIPMENT Data Handbooks, Military. For sale. Volumes one, two, three, four. Frederick Res. Corp. 1961 Publication . . . Four New Bound Books . . . $5.50 Postpaid, payment with order. RITCO, Box 156, Annandale, Va.

SELL: Heath HW-32 with AC and DC power supply. Good condition. Only $200. Mike K2QMM, phone 212 SP 6-8069.

1,000 gummed address labels, 50¢. 3 sets, same or different names, $1.25. Mart's, Box 454-F. Mackinaw, Illinois 61755.

RTTY gear for sale. List issued monthly. 88 or 44 Mhy toroids, uncased, five for $1.75, postpaid. Elliott Buchanan and Associates Inc., Oakland, California 94610.

$3,000.00 and more in free prizes at WRL's "Ham-Jamboree" May 20, 1967. 6 transceivers, including: Swan 500, Galaxy V mk 2, NC200, Eico 753k, 66'er, GSB6; two receivers, Hallicrafters SX146 and Drake 2C; Mosley & Hy-Gain tri-bander beams; 40' Delhi tower; SBE linear SB2LA; many other prizes by Collins, Tunaverter, Ami-Tron, etc., manufacturers displays. You must have your license and be present. WRL, 34th & Broadway, Council Bluffs, Iowa.

COLLINS 75A2 and DX100. Make offer. Will deliver within 500 miles. Bill WØECU, 6738 Saulsbury Arvada, Colorado 80002.

SELL CQ MAGAZINES—all good condition. Vol. 1 #1 through Vol. 5 #12 in CQ Binders. Vol. 6 #1 through Vol. 19 #9 loose copies. Solid run 225 copies. Any one or all $325. W2BNX.

CAPE KENNEDY Ham Fest sponsored by the Platium Coast Amateur Radio Society. 2nd annual hamfest at the civic auditorium Melbourne, Florida. Home making and flower shows. Swap tables and equipment auction the hit of the 1966 hamfest. Give aways every hour and of course BIG BIG door prizes. Fun for the XYL kiddies and the OM hisself. For information write P.O. Box 1004, Melbourne, Florida.

LATEST Swan 350. Sideband selector, VX-1, 117XC. Mint condition. $465. K4KYO, 475 So. Perkins Rd. Apt. 406, Memphis, Tenn. 38117.

WANTED: 75S-1, Philadelphia and N.J. areas only. Julio, 1123 Upsal St., Phila., Pa. 19150.

SELLING Out shack full of Military and Industrial gear. Great collection for a new "General" needing high power stuff. Send stamped envelope for list. Springsteed Depot, Glen Head, New York 11545.

WANTED: NCX5. Send particulars and price. All inquiries answered. Have Eico 753, all latest factory modifications. Glad to sked. $175. Ranger I factory wired, PTT. $75. Dean Straw, KH6DKD/1. #D3, 386 Prospect St., New Haven, Conn., telephone 203-562-7194.

CLUB EMBLEMS reproduced as embroidered patches. Send sketch, colors, size, quantity for quotation. Alabama Sportswear, Box 1505, Decatur, Alabama, 35601.

YOUR Card in glittering raised 3-D on blazing backgrounds becomes a beautiful collector's item. Samples 25¢ (refundable). 3-D QSL Co., Monson, "4", Mass. 01057.

SOLID STATE SALES would like to send you one of their catalogs. They have for sale transistors, rectifiers, zeners, SCR's biswitches and many other semiconductor devices in large and small quantities. All devices are checked and guaranteed. Integrated circuits (JK, SR, SRT, Flip flops and gates) with checked imputs and diagrams are available. Include 20¢ for handling which will be deducted from your first order. Solid State Sales, Box 746, Somerville, Mass. 02143.

FOR SALE: SB-10, $75; 75-A1, needs power transformer, $90; DX-100, as is, $60; Heath Seneca, needs some work, $120; all preceding with original manuals; two 250TH, $22. each; P.A. 400 linear (2-811-A's), needs mechanical work, $95. Will bargain. Write: Emlen Jones, c/o Amateur Radio Club, Fordham University, Box 510, Bronx, N.Y. 10458.

HAMFEST—Charlotte, N.C. two big days, June 10th and 11th. Many activities, loads of prizes, and free barbecue on Sunday. Huge air conditioned Park Center. Advance tickets $3.75 for both days. Write: Hamfest, Airport Station, Charlotte, N.C. 28208.

SWAP my 4-400A or 4CX350A tube for your Teletype Model 12 or 15. Hal, Box 283, Saxonville, Mass. 01706.

NEW DRAKE TR-4—$474.00, AC-3—$64.00, New Eimac 3-400Z tubes—pair $54.00 single $28.00, New Swan 500 with 117XC speaker/supply $478.00. All preceding new factory-sealed cartons, warranty cards. Don Payne, Box 525, Springfield, Tennessee 37172.

ALUMINUM tower—easy to erect. Crank down if desired. Inexpensive. Write postcard to David Lynn, 10511 Doe Run, Sappington, Mo. 63128.

SELL: B.C. 312 1.5 KC to 18 MC. Army surplus. $50.00. Gud Condx. R. Garcia, 52-14 39th Ave., Woodside, N.Y. 11377. 212-TW 8-5915.

ENTIRE Station only $300 cash. Includes Eico 753 transceiver (solid state front), home brew solid state power supply, heavy duty 813 linear (approx. 800 watts) is 3-band professional appearing. All good condition. Buyer ships. D. Wise, 1500 Euclid, El Dorado, Arkansas 71730.

FOR SALE: Paraboloid Microphone Mounts for field recording birds, animals. One commercial large spun aluminum long focus. Three fiberglass short focus form portable if slung. Used excellent. Send stamped envelope for details. Carl Frank WØCOS, RR #1, Rochester, Minnesota 55901.

HUNDRED QSL'S. $1.00 Samples, dime. Holland Printing, R3, Box 649, Duluth, Minn. 55803.

SWAP 6 meter GE FM mobile Rcvr & Xmiter complete for comparable 2 meter FM rcvr and xmiter. Write to Loyd Woodham, P.O. Box 113, Albertville, Alabama.

FOR SALE: 1 KW amp with p/s $120; Johnson Pacemaker upper and lower SSB AM CW 80-10-$150; Hammarlund HQ-110AC 160-6 $165; Heath HO-10 monitorscope $45; ASQ-6 squalo ant. for 6 mtr. $8; Stix Borok, 209-25, 18th Avenue, Bayside, N.Y. 11360.

FOR SALE: Complete 75 m. mobile station; Swan 175, HP-13 DC p/s, Hustler 75 m. ant., manuals, $175. William E. Goff WA2HSB, 5 Addoms St., Plattsburgh, N.Y. 12901.

FOR SALE: Gonset Communicator III, 6 mtr., good condition. $75. A. Steingart WB2MZE, 3356 Frederick St., Oceanside, N.Y. 11572.

CASH for Vanguard or Gem 6 or 2 meter converters. Write R. McCloud Box 32, Esopus, N.Y. 12429.

RTTY—Model 15KSR and table $80. Will trade. Want P.T. for Collins 51-J3 or J4 672042900. R. D. Clark W2WNW, 126 Slosson, Staten Island, N.Y. 10314.

10 MTR Mobile HE50, VFO, mic 6 xtals $35; Alliance Rotator $10; Telrex 6 el os 2 mtr beam $10; 6 mtr 20W trans $10; 6 mtr conv. $10; C. Copp W2ZSD, 6 Northfield Lane, Westbury, New York 11590.

FOR SALE: Hallicrafter HA-5 VFO, 80-2 mtrs; Globe 303 xmtr. Package deal only $90, firm. W. R. Schoppe WB2FWS, 31 Penny Drive, Huntington Station, N.Y. 11746.

WANTED: Collins mechanical filter F500B or E 30, wind direction and MPH indicator C. F. Albertoni K8JBE, 1410 Brookwood Drive, Suffield, Ohio 44261.

CODETYPER. Want to buy codetyper as sold by N. Dorfman. Write R. Long, 1688 Guilford Drive, Columbus, Ohio 43221.

UTICA 650 6 meters V.F.O., Sonar 150 Watt Linear $150 takes all. A. Gargani, 101 W. 89th St., N.Y., N.Y. 10024.

SELL: Gotham V-80 vertical, $7.50 plus shipping Ed Pinanski WA1DTK, 124 Essex St., Beverly, Mass. 01915.

TEKTRONIX Type 511AD with manual. 0 to 10 MHZ. $200. Henry C. Garretson, Box 175A, RD3, Troy, N.Y. 12180.

VIKING VALIANT F.W. 275 W. C.W. and HQ-170C w/Dow Key relay and monitor. Complete $325.00. H. Wroblewski WA9AAQ, 3747 S. Harvey Ave., Berwyn, Ill. 60402.

WANTED: A pair of 4-400A or 3-400Z tubes. State price & cond. Beebe, Box 387, Beverly, Ohio 45715.

WANTED: Perfect Collins 75A4, serial no. over 6000. Write to Bill Jacobs WA8AGV, 5990 Glenwood Ave., Boardman, Ohio 44512.

WANTED: VLF receiver, SP600LX, RAZ or AN/URR-2 or 212/SR. Quote price and condition. R. D. Clark W2WNW, 126 Slosson Ave., Staten Island, N.Y. 10314.

VIKING Matchbox 275 watt antenna coupler Model 250-23, mint condition, instruction manual, $23.00 or best offer. Col. Charles Felstead KH6CU, 1777 Ala Moana (2043), Honolulu, Hawaii 96815.

WANTED: Early vacuum tubes for my private antique wireless museum. Need DeForest spherical "AUDION" with candelabra screw base. UV203, 50 watter, R. W. Schnedorf W9LGH, 610 Monroe Avenue, River Forest, Ill. 60305.

SELL: SR-160, Make offer. Emil T. Rusin, 46 Wheelock, Buffalo, N.Y. 14206.

WANTED: 16" or larger reflecting telescope or components—swap ham gear, test equipment. A.C. Denson W1BYX 122, Rockville, Conn. 06066.

WANT: Collins 2.1 K.C. Mechanical filter F-455J-21 for 75A4 receiver. R. Phoenix W9HFN, E. Jackson St. Rd., Macomb, Illinois 61455.

WANTED: Two meter C.W. skeds into Ohio, Detroit, and Windsor area high power not required. D. W. Blystone K9ZNK, 812 Niles St., La Porte, Ind. 46350.

WANTED: Heathkit sideband adapter, model SB10. R. Audas KØDVJ, 9950 Parallel, Kansas City, Kan. 66109.

MINT F/W Central Elect. MM2 SSB-AM-CW Scope & tone generator 160-6 meters, cost $125. Sacrifice $45. L. W. Williams K3VAO, 513 Queen Anne Ave., Odenton, Maryland 21113.

SELL ME a Feb. issue of CQ 1945 to complete my file. A. Bates, W1RY, Box L, Hingham, Mass. 02043.

WANTED: Brand new 813's. H. B. Smith, W8VVD, P.O. Box 452, Birmingham, Michigan 48012.

SELL Clegg 99'er, 6M transceiver, 2 xtals, perfect condition. $95.00. Will share shipping cost. B. Wendrow, WA5QDY, 112 Rialto, Vicksburg, Miss. 39180.

XYL's-YL's enter crazy hat contest, 1968, SAROC, Hotel Sahara, Las Vegas, Nevada. Details Southern Nevada ARC, P.O. Box 73, Boulder City, Nevada 89005.

SELL DX 100 $75; HQ110 with clock $110; Viking Adventurer with H.B. modulator-power supply $30; RME DB23 Preselector $20; W. Derrick, W2LWO, 1 Swarthmore Rd., Somers Point, N.J. 08244.

FOR SALE: RME DB-20 preselector $15. Century tube checker, floor model $50. Eico model 625 tube checker, $18. 24 hour clock $6. R. Marsino, W2UGM, 66 Columbus Ave., Closter, N.J. 07624.

DX60, factory checked recently, $65.00, DX60, fair, $45.00, HQ 110A, less than 1 year old $150.00, Eico 753 used very little $200.00, HO-10 monitor, excel. cond. $50.00. Want 18 HT vertical, WA5PXH, 8025 Tonto, El Paso, Texas 79904.

COLLINS VFO's 70E-24 for 75A4 new $49. 70E-23 for KWS-1 new $39. Richard E. Mann, 430 Wilmot Rd., Deerfield, Illinois 60015.

WANTED: direct current amperehour meter good cond. Art Ferguson, VE3HP, 1534 Stoneybrook Cresc, London, Ontario, Canada.

CANADIANS: Wanted if price is reasonable. Teletype equipment. Models 15, 26, 14TD or 19. Contact Hart, VE3TA, Box 29, King City, Ontario.

BOOKS SOUGHT: "Who's Who in Amateur Radio" (1934), "SOS to the Rescue" (Baarslag, 1935) "Calling CQ" (De Soto, 1941) F. A. Herridge, G3IDG, 96 George St., Basingstoke, Hampshire, England.

WANTED: 500, 1000, 1200, 1500 cycle filters for 75A4. Bill Holman, KL7BAJ, Airport & Dale Roads, Fairbanks, Alaska 99701.

FOR SALE: Hallett shielded ignition system for Chevy V8, $35.00. Leroy J. Krenek, WA5KZE, 211 Hillwood Drive, North Little Rock, Ark. 72116.

SACRIFICE: NC300 w/speaker, Viking 500 w/spare 4-250A and P.S., first $350 cash. FOB L.A. area T. Almgren, 5112 Torida Way, Yorba Linda, Calif. 92686.

COLLINS station control SC 101 wanted for cash. H. Theim, WB6KID, 8050 Irondale Ave., Canoga Park, Calif. 91303.

75A4 two filters spkr $400 Johnson Phone Patch and Swr Ind. with coupler $18 & $28. C. Kaufman, WAØGUN, 231 So. Jasmin St., Denver, Colorado 80222.

SPRING SALE: QST, CQ, WRA, many other items, write needs. Bill Hayward WØPEM, 3408 Monterey Street, St. Joseph, Missouri 64507.

AF-67 Elmac Transmitter wanted. Please state condition, any circuit modifications and price. A. R. Bell, W8JCF, 5256 Philips St., Cleveland, Ohio 44137.

WANTED: Hallicrafters Transverter HA-2 with or without P-26 p/s. State condition and price. R. D. Ferree, W3JGB, 7539 Rogers, Upper Darby, Pa.

HEATH SIXER w/ptt/squelch $40. HB 6 mtr conv., int xtal 2 mtr conv. both in Miniboxes 7-11 IF $5.00 each. BC-1000 missing tubes $20., BC-603 MOD 30-45MC $20. CQ's 47-50 $15.00. Poptronics, Elec. World 56-62. Write to: E. F. Lankford, W4HHY, 511 Purnell Drive, Nashville, Tenn. 37211.

SELL or trade: GE pre-progress FM base station 50 watts output, 146.94 mc. $150.00. Joe Moomaw, W4FZG, 304 Valley View Dr., Staunton, Va. 24401

FOR SALE: Elmac A54H w/hb/ac/ps. 10-11-20-40-80 mtrs. S and W Electronics Mobil-Ceiver. Gonset Super 6 converter. All with manuals. Make offer Frank Shelton, W8NYH, Jenkinjones, West Va. 24848.

SUBURBAN RADIO CLUB HAMFEST, biggest in St. Louis on July 30 at Creve Coeur Lake Park. Main Prize, Heath HW-32. Advance Registration $1. from KØAHD. Joe Owings, 10217 St. Daniel Ln., St. Ann, Mo. 63074.

HAMFEST by Suburban Radio Club of St. Louis on July 30 at Creve Coeur Lake Park. Many prizes including Heath HW-32. Advance registration from Joe Owings, KØAHD, 10217 St. Daniel Ln., St. Ann, Mo. 63074.

HAMFEST by S.R.C. of St. Louis. July 30th at Creve Coeur Lake Park. Main prize is a Heath HW32, many others. Send $1.00 for advanced registration to: Joe Owings, KØAHD, 10217 St. Daniel Ln., St. Ann, Mo. 63074.

WHEATSTONE Morse code perforator, punches 15/32" tape for hi-speed automatic C.W. Sell for $45.00. Tested OK, and will include tech. data. Jim Cooper, W2BVE, 834 Palmer Ave., Maywood, N.J. 07607.

SALE or trade: 2 Meter 250W linear no p/s $30.00, QST 1946 thru 1959, 25¢ each. 40 Meter Hy-Gain beam $50., Turner broadcast mike $25. Want F.M. Hi-band units. W. J. Davis, K6KZT, 4434 Josie Ave., Lakewood, Calif. 90713.

SB-34 SB Mike, Mobile Mount, Webster Band Spanner, bumper mount, $295.00. Takes all. Used less than 2 hours. Dr. B. Morris, Box 309, Ripley, W. Va. 25271.

COMMUNICATOR IV, (mint cond.) 220 MC, cost over $400, for $150. Waters KW Wattmeter-dummy load $75. additional cleanup list SASE, C. E. Spitz, W4API, 1420 S. Randolph Street, Arlington, Va. 22204.

WANTED: Antique radio tubes made prior to 1920. Stanley M. La Dage, 431 Oakland Avenue, Maple Shade, N.J. 08052.

HAVE Ham Scan HO-13. Trade on cameras, linear, what else. Value $50. Write A. H. Davis, P.O. Box 831, Borger, Texas 79007.

WANTED: Collins KWM-2, KWM-2A, 32S-3 and 5S-3B and accessories. Also coils for Collins 30-K4 transmitter. Col. O. A. Heinleen, W7BIF, 107 Wyoming Street, Boulder City, Nev. 89005.

WANTED: 73 Magazine for June 1962 through July 1963. Advise condition and price. Al Brogdon, K3KMO, RD Box 390A, State College, Pa. 16801.

SELL: Friden Flexwriter, Model FPC5, Programatic, excel. cond., $250. Will answer all letters if you enclose stamp. J. Thomsen, W9YVP, 11001 S. Pulaski, Chicago, Ill. 60655.

SR-150 plus PS-150-120 supply and speaker, factory reconditioned April 67. $395. H. G. Cutler, K4KGF, 1514 Palmetto St., Clearwater, Fla. 33515

HEATHKIT Model SBA-300-4, 2 meter converter $17. M. W. Timpany, 209 W. Racine St., Janesville, Wisc. 53545.

WANTED: DMQ-2 surplus beacon transmitter. Give price and cond. W. D. Kinghorn, K7GSC/5, P.O. Box 1006, Alamogrodo, New Mexico 88310.

SELL: Knight T-150A transmitter, Knight R-100A receiver, Turner 254 mike, speaker, key $150 FOB Kent. M. D. Mercure, WA9GAM, 1168 Allerton St., Kent, Ohio 44240.

WANTED: exchange tape-letters with hams, BC station personnel, scouters, or ministers-any speed, any area. G. A. Bitner, WA5LTK, Box 381, Texico, New Mexico 88135.

Wanted: I want to buy early radio and wireless equipment for my amateur museum. Receivers, parts, loose couplers, tuners, early vacuum tubes, call books and wireless magazines, etc. Erv. Rasmussen, W6YPM, 164 Lowell, Redwood City, Calif. 94062.

COMPLETE Station: Adventurer with VFO, modulator $54. keyer, $25., HQ-150, $127. Norm Kohn, WA8MJD, 2758 West Park Blvd., Shaker Heights, Ohio.

WANTED: RBC-1 Navy rcvr manual also RBW-2 panadaptor manual, 592 tubes, Ham M Rotor. Philip D. Greenway, W4LRR, 234 Elden Dr. N.E., Atlanta, Ga. 30305

WANTED: Two meter SSB and CW skeds in any portion of band. D. W. Bystone, K9ZNK, 812 Niles St., La Porte, Ind. 46350.

BARGAIN: Knight T150A xmtr excel cond. $65. FOB. Also Lafayette Starflite 90 watt xmtr good cond. $25. FOB. Steven Kipstein Sr., WA9LHJ, RR1, Box 117, Oxford, Wisc. 53952.

WANTED: Harvey Wells TBS-50, cabinet. Must be in new or nearly new cond. Electronics in any condition. Robert L. Chilcote, WA4FLR, RR2, Woods Apts., Nokesville, Va. 22123.

WANTED: Old time QSL cards before 1930. Also looking for four letter QSL circa 1931-32. These were portable calls and linked like the following: W1ZZAB. John Alley, W1DMD, 298 Taunton St., Lakeville, Mass. 02346.

75A3 Rcvr w/calib, prod. det, 2M xtal conv, Panadapter, manuals, bargain at $300. 500W HB A, & CW xmtr, $75, w/o PS $50. V. Swanson, W6SND, 4922 Cevilville, La Crescenta, Cal. 91214.

WANTED: Used 8mm home movies. Castle, Blackhawk, Columbia, official, etc. H. B. Smith, W8VVD, 467 Park, Birmingham, Mich. 48009.

WILCOX recvr, xtal control, one freq, 3.1-10.0 mc. type F3, AM only, squelch, 3 inch rack mtg. Sale or trade. E. W. Sanders, W2AKU, 70 Maxwell Avenue, Geneva, N.Y. 14456.

ELECTRONIC Mon-Key Keyer. Good cond. Advance coax relay model CB1c2c12vd. 12v.dc coil also dpdt external contacts. Best offer takes either or both. Tom Rozier, W4BXV, Rt. 2, Quitman, Ga. 31643.

DRAKE R4A: very clean receiver, 8 months old. Serial #2333. First check for $299. I pay shipping. G. Golden, W1OZ, 83 Hammondswood Rd., Chestnut Hill, Mass. 02107.

FOR SALE: Bohme oiled tape 15/32" width, P. L. Lemon, W6DOU, 3154 Stony Point Road, Santa Rosa, Calif. 95401.

SELL 75A-4 3.1 kc filter ser. 1001 excellent cond. $295. NC-60 $35. 92121 manual for AN/SRT-14, 15, 16, $30. Robert Ireland, Pleasant Valley, N.Y. 12569.

RECEIVER, linear amplifier, SSB exciter and Heath equipment wanted, even if not operating. Sell or trade portable writer, camberas, quality components. J. Boer, K2OYN, 449 Hill St., Boonton, N.J. 07005

FOR SALE: QST, CQ Western Radio Amateur, other Misc books. Old GE Ham News. Bill Hayward, WØPEM, 3408 Monterey, St. Joseph, Missouri 64507.

FOR SALE: Misc. radio components such as switches, resistors, etc. Please send SSAE for list. A. C. Lewis, K4GGC, Box 100, Humboldt, Tenn. 38343.

WANTED: ARRL publication hints & kinks, Vol. 1, Write G. S. Corpe, W6LM, P.O. Box 308, Wrightwood, Calif. 92397.

WANTED: Kits, radio gear, new or partially assembled. G. N. Woods, WA4KCN, 3584 Galloway Avenue, Memphis, Tenn. 38122.

WANTED: For Model R.B.X.-1 HY-GAIN rotor/brake. A55Y. In any usable cond. Base plate part #1 & pinion bushing part #32. Will pay reasonable price & shipping. C. O. Rustin, W6JLW, 633 Corsicana Drive, Oxnard, Calif. 93030.

DX-40 & VF-1 fb on all bands CW & AM $50. 15 mtr kw linear 813s as in handbook with mod. & pwr supply $100. David Fulton, WB6NBO, 4977 Palo Dr., Tarzana, Calif. 91356.

FOR SALE: 75A4 with 2.1 3.1 filters matching speaker $400. Johnson Phone Patch 18, Johnson Dir. Ind. and Coupler $28. Charles Kaufman, WAØGUN, 231 South Jasmine St., Denver, Colorado 80222.

WANTED: Screwdriver type "Bristol Wrench" as used on SCR522 equipment, or source of supply of same. L. Sharp, VK4NS, 19 Kelso Street, Chermside, Brisbane, Australia.

NONTYPING Reperforator wanted (fully punched holes). Swap #15 TTY parts, BC645, Strouger switches, FM3A tuner, 16mm magazine Camera. D. Digby, K7SQH, 3134 Tallmadge Rd., Kent, Ohio 44240.

HT40 Tx, Pierson KE93 Rx, SX101 mk 3 Rx. Sell or trade for 2000 or 2500 watt 110 volt generator. W. Baxter, 402 E. Jacinto St., Tucson, Arizona 85705.

WANTED: Inductance bridge, good scope, lab type, trade 35 mm camera or cash. A. Pfalzer, K8WNT, 240 Beechwood Dr., Granville, Ohio 43023.

FOR SALE: 500 Watt modulator $65. Surplus gear BC units including pair 645 ant. tuning unit 1001-A modified TU75A six-meter. DeForest Honeycombs. 4E27, 4.250A. C. Frank, WØCOS, Creeknoll R1, Rochester, Miss. 55901

SWAN 350, 19 months old, factory updated and aligned in August, $330. Swan 512 D.C. supply, $90, Both for $400. J. L. Schroeder, W6UFJ, 5625 Quinn St., Bell Gardens, Calif. 90201.

SELL: Original owner of SX101A in excel. cond. FB SSB AM CW, rcvr. $150. Mike Schwartz, 4608 N. Central Park Ave., Chicago, Ill. 60625.

C.E. 20A Exciter with BC 458 VFO $90. H.B. professional looking G,G, 813 linear with 2500V power supply in rack cabinet, $125. K. Baker, WB2FNR, 11 Scotch Pine Drive, So. Hauppauge, N.Y. 11722.

SELL Instruction manuals for VHF motor mobile units T33G, T43GGV or U43GGT. $5.00 each. F. N. Saltus, K6AVF, 10074 Cristobal Drive, Spring Valley, Calif. 92077.

WANT: Motorola FMTRU-140D or equiv., 12V wideband w/acces. Prefer converted to 146.94. Send best offer. R. E. Beatie, 1904 E. 114 Ave., Tampa, Fla. 33612.

SELL Viking "500" unbuilt kit. 4-400A final. AN/ARC-27, Collins, Pwr. Amplr RF mod 2 ACDE. Charles T. Urban, K3IVI, 1815 So. 27th St., Phila., Pa. 19145.

SBE 34, $330, new SX-117-250. Want KWM1 or KWM-2. 4-1000 $30. F. L. Baker, W8QJR, Box 546, McComb, Ohio 45858.

COLLINS 75A2A rcvr 3a1 KC-800cy filters $260. Ranger I $75. HW12-HW32, $85. Hy-Gain Tribander $25.00. R. Monroe, K8JKI, 906 Wedgewood, St. Joseph, Mich. 49085.

SELL: Eico 425 scope $25., Knight xtal cal. $5., Millen Ant. preamp w. 10 & 20m coils $15., EMC 211 tube tester $10. or trade for J. E. Becker, K9WEH, 2435 Birchwood Lane, Wilmette, Ill. 60091.

WANTED: Sony tape recorder model 350 deck or 530; needRohn 25G 10 ft tower sections model CVM-5 mod. xfmr; ucs-300 vac-var turn head. R. Zurawski, WA8FVD, Rt. 1 Menominee, Mich. 49858.

FOR SALE: Heath SB-610 monitor scope DX60 transmitter, Collins SM1 mike, Instructograph code teacher. Sell either separately or together. Bob Kogen, WA9IBT, 5701 Sheridan, Chicago, Ill. 60626.

CANADIANS—HR-10 rcvr $50. HG-10 VFO with p/s $35. Allan Greer, VE7BUI, 7590 Grandview, Burnaby 3, B.C.

FOR SALE: ARC-1 2 meter transceiver $15. less tubes and dynamotor, electronics: 1946 to date $3.00 per vol. F. W. Chapman, W8TKR, 1367 Villa Rd., Birmingham, Mich. 48008.

FOR SALE: H-3 Wench for Trlastao Tower, clamps on the rung of tower. $10. E. H. Marriner, W6BLZ, 528 Colima Street, La Jolla, Calif. 92037.

"SAROC" 4-7 Jan. 1968, Hotel Saraha, Las Vegas, Nevada. MARS Seminar, Air Force, Navy, Army, QSL Box 73, Boulder City, Nev. 89005.

FOR SALE: Three yr. old Knight tube checker with late tube chart, $30. Alliance totator, $12. CDE worm type $20., both working order. F. Sonnek, Box 59, Mobridge, So. Dak. 57601.

P & H 6-150 Transverter $145., Hammarlund HQ 110AC like new $180, SB-401 with crystal pack, assembled, never used, $350. add postage. L. Fritz, WA8LHY, 7124 Wilson Mills, Chesterland, Ohio.

WANTED: RME 4301. K. Ferguson, W9GOW, 1240 Flora Lane, Florissant, Mo. 63031.

WANTED: Central 10A, 10B, or 20A SSB xmtr. Prefer 10B. State cond. and price. Radiogram or SASE. C. S. Zelich, 1668 North Avenue, Stratford, Conn. 06497.

LIKE NEW, 75S1 Collins $300., Hallicrafter HT40 with 13 novice xtals $60., both for $340. Lee Smith, WN5REM, 1710 Windlea, Euless, Texas.

SELL or swap Eico 720 Xmtr, Tom Dornback, K9MKX, 19 West 167 21st Place, Lombard, Illinois 60148.

WANTED: Novice transmitter of new novice returning home from Shriners Hospital for crippled children. Mr. Ed Metz, W3LI, 8400 Roosevelt Blvd., Phila., Pa. 19015.

LM-13 Freq. meter w/ps $25. Bandmaster TBS-50D $25. 6 and 2 500W linear $50., James C-1470 p/s 12 or 110V $40., CS-137 with 120 FT-243 xtals $20. BC314-D L/F Rec $15. W. J. Davis, K6KZT, 4434 Josie Avenue, Lakewood, Calif. 90713.

LIKE NEW: 80-10 SSB-CW-AM 130W Sommerkamp FL-200B transmitter $285.00, or trade for SB-401. R. O. Goodwin, W5OJX, Rt. 2, Box 70, Carriere, Miss. 39426.

FOR SALE: DX-60A ($55) HR-1C ($50) excellent shape, 2 meter xmitter $25. Johnson T-R switch $13.50, R. Bragg, 4634 No. 44th St., Phoenix, Ariz. 85018.

STARTER station-Johnson Challenger Two Novice three General xtals, Heath AR3 and OF1 all manuals first check over $125. takes all. S. Hecker, WA4OZG, 1327 Bolling Ave., Norfolk, Va. 23508.

ILLUSTRATED Certificate guide, 78 photos, descriptions. $1.00 German-English Vocabulary 1, 1o. Christian Zangerl, OE9CZI, A 6850 Dornbirn, Austria.

BRAND new 18th edition of Radio Handbook. $10.00 gets it postage paid. In original sealed cardboard box. R. E. McIntyre, W9WOM, 3137 Mayfield Rd., Cuyahoga Falls, Ohio 44224.

FOR SALE: HRO-60 w/coils/spkr $375. Wiking II w/vfo $175. CRT tester/rejuvenator (new) $35. all exc. cond. R. Luckingham, W1AKF, Main St., Box 44A, Coventry, Conn. 06238.

WANTED: Johnson KW matchbox or equivalent. State make, model, cond. and price. C. A. Kollar, K3JML, 142 W. South St., Nanticoke, Pa. 18634.

FOR SALE: HX-50A $300, HQ 170AC-VHF 2 & 6 mtr preamp & conv. $300. Both excel. cond. $575, for the pair. Bell 3 speed 110v tape recorder $18. HQ-100W/built in clock & s-200 speaker, Perfect cond $100. Peter Ludwig, 34-15 Parsons Blvd., Flushing, N.Y. 11354.

PAIR of 9 transistor walkie talkies channel 9, New cost $50, postpaid $30. Daleigh make, brand new, orig. packing. Floyd Fellows, 663 Washington Avenue, Santa Fe, New Mexico 87501.

SELLING out. SB-400, Sp-600JX, mobile supply, QST's, much more. Stamp for list. J. R. Shank, W3CNS, 21 Terrace Lane, Elizabethtown, Pa. 17022.

SELL, good cond. KWM-1 with 516F-1 ac supply, 516E-1 12 volt dc supply, 351D-1 mobile rack and cables. First $400 takes all. L. E. White, W2CNQ, 711 Highview Dr. Wyckoff, N.J. 07481.

WANTED: Unused Johnson 240-303-2 Hi-Power conversion package which upgrades Viking Invader 200 to the 2000 Dr. C. W. Fowler, W4TVC, 1618 Gatlin Ave., Orlando, Fla. 32806.

SALE! Double-Geniac computer, new, complete with manuals to design 100's of computer circuits. A steal at $10. R. E. Beatle, 1904 E. 114 Ave., Tampa, Fla. 33612.

WANTED: BW 850A, BW FC30A, Hy-Gain roto-brake or 40 mfd or larger at 6000vdc. R. Linkous, W7YBX, 5632 47th Ave. S.W., Seattle, Wash. 98116.

RTTY Model 15 with auto-car-ret and line feed, 14 typing reperf. with keyboard. Want model 28, R. M. Mendelson, W2OKO, 27 Somerset Pl., Murray Hill, N.J. 07971.

COLLINS 6 KC filter for 75A4, $27 Collins plug-in crystal calibrator for 75A-2 or 75A-3, $12. G. W. Hippisley, K1WJD, 20 Oakridge Ave., Natick, Mass. 01760.

SELL: Central Electronics 20A with matching VFO and QT-1, $110. R. H. Black, 10 Crest Drive, Bound Brook, N. J. 08805.

SALE: R-4, Ameco CN-144 14-18 I.F., AR-22R rotor. All for $275.00 or best offer for each. Richard Bricks, 256 Mt. Lucas Road, Princeton, N. J. 08540.

FOR SALE: Gonset G-50 best offer by March 1st. Write Milt Long WA8LDR, Box 255, Wooster, Ohio 44691.

SELL: Swan 240 Transceiver—DC power supply Hustler Mast—75, 40, 20 resonators—Turner Mike dash mount—stainless antenna mount—$275.00. Dr. M. D. Solomon K2MYW, 41 Westbrook Lane, Roosevelt, L. I., N. Y. 11575.

SELL: SSB Xctr Jan 1963 QST less filter. Needs work $120.00 worth new parts. No junk. Best cash offer. Might trade for needed used gear. All SASE answered. D. A. Grant W2DY, 8 Plymouth Rd., Hauppauge, L. I., N. Y. 11788.

WANTED: BD-77 Dynamotor. Any type Teletype Equipment to get started in RTTY. H. Turner W4EIV, 124 Manning Dr., Charlotte, N. C. 28209.

FOR SALE: Globe Hi-Bander 6&2 phone & C.W. Transmitter 50 Watts. EICO model 730 Modulator. Make offer. David Hirsch WB2QNG, 36 Fairchild Place, Whippany, N. J. 07981.

SALE or TRADE: BC-221-0 Metal case. Reg. P.S. Cal book & Manual. $75.00. Want ARR-15. T. A. Herrmann W7AOI, 2327 S.E. 72nd Ave., Portland, Oregon 97215.

FOR SALE: BC-453 with 115 vac PS; Heath 2er and 12V DC PS; Misc. meter TS-173 UR. J. I. Leskinen W2RUZ, 33-45 172 St., Flushing, N. Y. 11358.

FOR SALE: Hickok model 288X crystal controlled signal generator. Covers 100 KC to 160 MC and 0 to 15 KC AF. With 10 to =38 DB meter. $50.00 sent REA. Bill Gode WA9NHQ, 1036 Hillside Rd., Northbrook, Ill. 60062.

WANTED: Your old Antique receiving and transmitting vacuum tubes with brass bases for private ham collection. R. W. Schnedorf, W9LGH, 610 Monroe Avenue, River Forest, Illinois 60305.

HW-12, HP-13 DC Supply, Shure 201 Mike, speaker, Hustler 75 mtr resonator, all guaranteed. $150.00 postpaid. Carroll G. Welker WA3GQQ, 151 Kimber Drive, Bridgeville, Pa. 15017.

WANTED: Ameco 220Mc converter 28 Mc IF reasonable. For sale, APT-5 w/man $40.00. Heavy prefer local. A. S. Johnson K7VQI/W6EPO, 229 Lindell Avenue, El Cajon, Ca. 92020.

WANTED: To buy SSB Transceiver—Swan, SBE, National, Halli. With or Without P.S. Cash for right offer. Contact me evenings at 212-762-2570. Pete Ludwig, 34-15 Parsons Blvd., Flushing, L. I., N. Y. 11354.

WANTED: Motorola P-8464 pwr supply (110vac60watt) for 80-D base station, for cash or swap new Model 28 Trans-Dist (LCXD) Will answer letters if you send stamp. J. Thomsen W9YVP, 11001 S. Pulaski Rd., Chicago, Ill. 60655.

WANTED: Collins Mechanical Filters (500 B-08-526-9007-00) (500B-14-526-9030-00) (500B-31-526-9008-00) (500B-60-526-9009-00) C. F. Albertoni K8JBE, 1410 Brookwood Dr., Suffield, Ohio 44261.

SSB-CW-AM Xmtr Viking 2, VFO, B & W 51SB-B, PTT, VOX. Also provision to power & mod. a 6N2 or similar VHF rig. Price on request. Rich, Greenberg WA2CSE, 55 Bulson Rd., Rockville Ctr., L. I., N. Y. 11570. 516-678-1523.

WANTED: Linear amplifier using 4-1000A or 4CX1000A without tubes. Tabletop preferred. In good working order. Write price and weight to T. F. Keim VE8AH, P. O. Box 1123, Inuvik NWT, Canada.

NOVICES—Am QRO. Must sell A-1 cond. Conar 400 Xmtr, $25.00. M. Gosnell WN2WVY, 11 Orchard Circle, Suffern, N. Y. 10901.

WØCVU on the air since 1913. A member of ARRL for 50 years. Look for me on SSB 14,275 KC. Chas. W. Boegel WØCVU, 1500 Center Pt Rd NE. Cedar Rapids, Iowa 52402.

SWAP 5" Knight oscilloscope for receiver or other Ham gear. Tom Dornback K9MKX/19W167, 21st Place, Lombard, Illinois 60148.

DRAKE 2A mint $150.00, 2AQ $20.00, 2AC $5.00. All $170.00. Factory reconditioned 1966. Original Box. Perfect Apache $110.00. J. B. Kennerdell WB2UTJ, 220 Forest Orchard Park, N. Y. 14127.

FOR SALE: New BC45, $8.00; 6&2 mtr trans 20W with modulator $30.00; HE 50 ten mobile, VFO, crystals, mike $40.00; Cushcraft stacked Halo $10.00. Charles Copp W2ZSD, 6 Northfield Lane, Westbury, L. I., N. Y. 11590.

ANTENNA: Super Broadband Double "Z" Quad—40, 20, 15, 10 Meters—Low cost—Light weight—"Boomless" High gain Design. Plans $3.00 PP. WB6OHK, Astro-Beam, Dept. C., 1749 Dorothea, Visalia, Calif.

"TRANSVERTERS" Hallicrafters HA-2, HA-6 and P-26 power supply. Used only few hours in perfect condition best offer over $200. W4CYE, 1724 Center St., Holly Hill, Florida.

DXpeditions—You supply cards and logs and I'll quill work. R. G. Beaudet W1YRC, 2 Rocky Crest Rd., Cumberland, R. I. 02864.

WANTED: Coil strip for R-25/ARC-5 command receiver, tunes 1.5 to 3 mcs. J. Lincoln K1NQI, 12 Crestview Terrace, Wallingford, Conn. 06492.

75A4 #2818 with 0.5 and 3.1 kc filters and speaker, $375.00; Heath Marauder, $190.00; Both excellent operating condx. Edward Rebennack WA5EID, 386 Tudor Ave., New Orleans, La. 70123.

PROJECTION Television components wanted. Need optic systems and projection tubes. State price and condition. J. Krizsan K8YVJ, 2519 Ashurst, Cleveland, Ohio. 44118.

TOROIDS, 44 or 88mh, any 5/$2.00, Polar Relay $2.30, Relay Socket 70¢, all p.p. USA. E. W. Evans K40EN, 220 Mimosa Lane, Paducah, Ky. 42001.

B & W Matchmaster (unused) power meter S.W.R. & Watts output to 125 watts. Good thru 11 meters. ¼ orig. cost. $20.00. Harold D. Mohr K8ZHZ, 5670 Taylor Rd., Gahanna, Ohio 43020

FOR SALE: Hallicrafters Model SX 99 receiver. Old but little used because of illness. Price $99.00. This receiver is at present in Penn State, Pa. Write me for address where it can be seen. F. B. Phillips W3LIK, R.D. 2 box 331, Sharon, Pa. 16146.

DEPTH SOUNDER for sale. Heathkit model M1-11. Wired, new. $60.00 C. P. Baldwin W1EFF, 1938 Pownal Rd., Gray, Maine 04039.

OLD TIMERS NIGHT—April 20, 1967 at 8:00 P.M. to be held at the Egyptian Radio Club, Inc., W9AIU, Located near Granite City, Illinois. All hams welcome. Don't miss this evening of entertainment. Refreshments. No Admission.

TEST EQUIPMENT Data Handbooks (Military) for sale. Volumes one, two, three, four. Frederick Research Corp. 1961 Publication . . . Four new bound books . . . $5.50 postpaid, payment with order RITCO, Box 156, Annandale, Virginia.

FACTORY wired Ameco 6m and 2m converter, $25. each or $50 for both with power supply included, D. Sunday W8ABX, R#3 Box 8, Three Rivers, Mich. 49093.

COMPLETE 275 wts station, Viking Valiant, HQ 170C ES Dow Key Relay $325.00. All mint Henry Wroblewski WA9AAQ, 3747 S. Harvey Ave., Berwyn, Illinois 60402.

DRAKE 2A with Q-multiplier and speaker, and Xtal Calibrator $200.00. Hammarlund HX-50 $250.00, both in excellent cond. D. Deatrick WA8OLD, 2940 Hickory Lane, Ann Arbor, Mich. 48103.

SX-140 receiver good condition. 80 meters thru 6 meters, asking $65. or equal value in trade. What have you? K. Birmingham WB2IFC, 413 Holmes Drive, Burlington, N. J. 08016.

HEATH Receiver GR91-.55-30mc and Alliance Rotator U 98 for sale or trade. Make offer. Sanford Mathis KØTVX, RR 4, Paola, Kans. 66071.

LAFAYETTE KT-320 + spkr —$60.00. Globe Scout 65A (slightly modified) $45.00. Both work, with manuals and shipping prepaid (USA) W. K. Brown WB2ULS, 53930 Baker Rd, Orchard Park, N. Y. 14127.

For further information, check number 18, on page 110

READER SERVICE

NAME_____ CALL_____
(Please Print)

ADDRESS_____

CITY_____

STATE_____ ZIP CODE_____

Please send me more information on your ads in the June 1967 *CQ* keyed as follows:

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	Total Inquiries				

Void after June 1967

CQ MAGAZINE, Dept. RS
14 Vanderventer Ave.
Port Washington, L. I., N. Y. 11050

For further information, check number 39, on page 110

advertisers index

Phone Results [*from p. 46*]

so "no operating." Too bad OM, "no certificate," you lost out to CT1PK.

It might be of interest to some of you to know that PAØFM is ex-PJ2AA who used to stir up some activity in the barren Caribbean. George is now back home bucking the European QRM.

The IØ prefix used by IØKDB was a special call John got assigned just for contest operation.

Some of the fellows are still plugging for a shorter contest period, and there might be some justification for this request, especially from the gruelling all band operation. However the single band feature of our contest is the answer for those who cannot put in the full time. With all bands now open there are plenty of categories to choose from, although W2TQR says he found it difficult to find sleep time with the 20 meter band open around the clock.

Also missing were some of the YLs we always look forward to hearing so that we can pass on our 88. However Molly made her usual fine effort at ZE1JE, Eva teamed up with the OM and won an award for DJ3YL, and Iris and the OM stopped off at the Azores and gave the gang a rare one from CT2YA. State-side the only one we recall is Paula at WA1ANR. Our apologies if we missed any.

We are sorry that we found it necessary to disqualify K8HIR in the multi-operation division and single operator UA3BK. The rule regarding excessive duplicates and accuracy of contacts is pretty specific. It might be well to keep in mind that all the members of the Committee are avid contest men and have a good idea of what is going on. So don't press your luck.

We passed the 1000 mark this year, 1062 logs to be exact, an 18% increase over last year. And as usual we are generous with our awards, 345 certificates will be going out to winners in 107 countries.

We had the same committee as last year working on this one. Andy Bodony, WB2CKS, Fred Capossela, W2IWC, Ben Lazarus, W2JB, Andy Malashuk, W1GYE, and yours truly. We could have used a lot more help. You fellows could make our task much easier by double checking your log and scoring, and also by using official forms whenever possible. Its going to be quite a challenge getting the c.w. results out in time for the next issue, but we'll make it.

73 for now, Frank W1WY

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
CXZCO 2,600,923	3.5	18	7	15	27
	7.0	35	13	18	63
	14.0	769	36	76	2202
	21.0	597	31	82	1736
	28.0	994	27	72	2871
	TOTAL	2413	114	263	6899
IØRB/4U 2,141,150	3.5	82	8	25	96
	7.0	296	27	65	541
	14.0	881	38	122	1924
	21.0	691	36	83	1893
	28.0	103	17	37	221
	TOTAL	2053	126	332	4675
ET3WH 2,139,696	3.5	1	1	1	0
	7.0	53	11	27	150
	14.0	1013	37	85	2883
	21.0	830	28	60	2368
	28.0	409	21	53	1203
	TOTAL	2306	98	226	6604
DL1KB 1,896,156	1.8	2	1	2	1
	3.5	99	9	37	149
	7.0	119	17	46	268
	14.0	505	30	65	1434
	21.0	474	29	57	1342
	28.0	693	27	42	2044
	TOTAL	1892	113	249	5238
SM6VR 1,364,967	3.5	101	7	26	109
	7.0	63	15	32	97
	14.0	527	32	72	1311
	21.0	485	29	52	1346
	28.0	426	25	43	1236
	TOTAL	1582	108	225	4099
PAØGMU 1,114,785	1.8	12	2	6	11
	3.5	160	9	33	178
	7.0	119	11	35	156
	14.0	1084	36	99	2879
	21.0	89	18	33	184
	28.0	49	14	19	131
	TOTAL	1513	90	225	3539

Muli-Operator Single Transmitter top six.

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
YV9AA 6,195,211	1.8	2	1	2	2
	3.5	142	15	38	382
	7.0	349	22	64	976
	14.0	1196	38	123	3478
	21.0	1620	32	79	4562
	28.0	923	28	75	2584
	TOTAL	4232	136	381	11983
OH2AM 5,465,610	1.8	3	2	3	2
	3.5	321	17	50	391
	7.0	416	31	68	691
	14.0	1560	38	121	4286
	21.0	1263	36	95	3329
	28.0	409	29	68	1096
	TOTAL	3972	153	405	9795
YV5AKP 4,782,505	3.5	127	14	39	359
	7.0	317	22	58	921
	14.0	1289	36	109	3788
	21.0	1306	27	77	3660
	28.0	639	23	50	1783
	TOTAL	3678	122	333	10511
K2GL 4,128,215	1.8	6	2	2	6
	3.5	128	17	45	341
	7.0	160	25	65	436
	14.0	849	38	120	2444
	21.0	764	34	109	2205
	28.0	680	28	74	1953
	TOTAL	2587	144	415	7385
W3MSK 3,811,934	1.8	3	2	3	4
	3.5	94	15	44	236
	7.0	212	28	66	585
	14.0	746	38	127	2151
	21.0	807	34	109	2381
	28.0	460	28	80	1284
	TOTAL	2322	145	429	6641
W3WJD 1,904,826	3.5	70	11	32	176
	7.0	97	23	52	268
	14.0	400	37	97	1143
	21.0	544	28	86	1575
	28.0	338	28	68	961
	TOTAL	1449	127	335	4123

Multi-Operator Multi-Transmitter top six.

IØKDB—John got the special IØ prefix just for the contest and it paid off with the highest QSO total from Italy, but he was short in the multiplier.

WRL gives you a FREE 2-week trial

ON THE *Great NEW* GALAXY V MARK 2

5 BAND TRANSCEIVER

NOW—even Better than Ever!

6 NEW Features:

- New 400 Watt Power
- New Precise Vernier Logging Scale
- New Solid State VFO
- New CW Sidetone Audio
- New CW Break-In Option
- New CW Filter Option

6 WAYS BETTER—

Yet Still Only $420.00

Satisfaction Guaranteed! (Serving Amateurs over 31 years!)

■ We have the great new Galaxy V Mark 2 in stock, and we're so confident you'll like it that we're going to make it easy for you to step up to this powerful 80 through 10 meter transceiver on a "no risk" two-week FREE trial! Just mail the coupon in for details. Remember, we give the highest trade-in on your present equipment...offer an easy monthly payment plan *(no finance company—you deal directly with us).*

Send in the coupon today, just check off your interests and mail.

"The House the HAMS Built!"

Leo I. Meyerson
WØGFQ
President

WORLD RADIO LABORATORIES CQ-18S
3415 West Broadway, Council Bluffs, Iowa Zip 51501

Please send me the following: (F.O.B. Council Bluffs, Iowa)

- ☐ Information on 2-week trial
- ☐ Galaxy V Mark 2 Brochure
- ☐ A.C. SUPPLY—$79.95
- ☐ GALAXY V Mark 2—$420.00
- ☐ Quote me a trade
- ☐ Fixed Station Package—$597.55
- ☐ Mobile Package—$606.50
- ☐ FREE WRL 1967 Catalog
- ☐ Enclosed is my Money Order ☐ Check ☐ Charge it

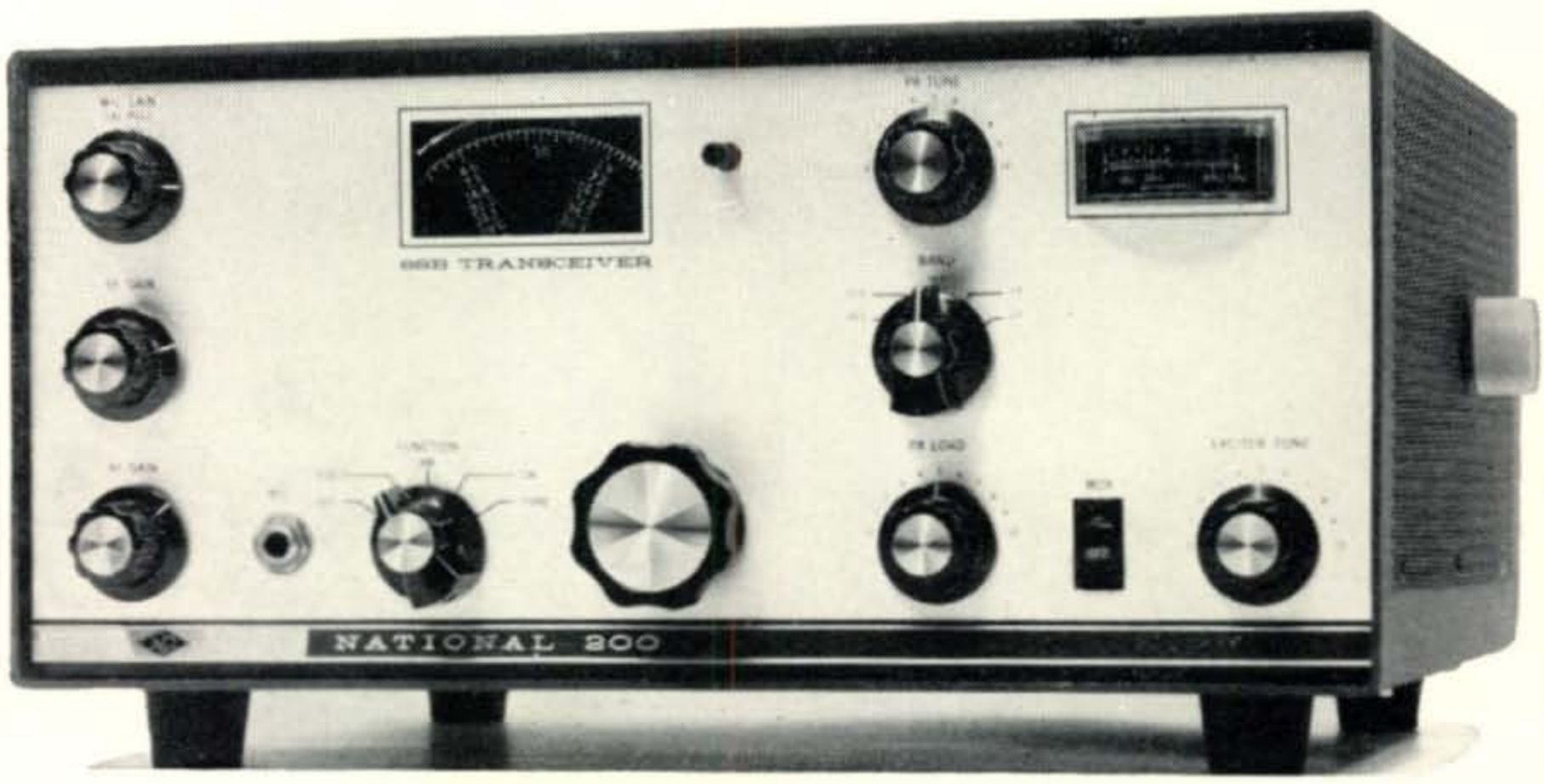
Name _____ Call _____

Address _____

City _____ State _____ Zip _____

For further information, check number 12, on page 110

Join the National 200 club



Own the most versatile 5-bander on the market ...priced even lower than a kit rig!

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."**

Feature this for $359! ■ Complete coverage of the 80 through 10 meter bands. ■ 200 Watt PEP input on SSB, plus CW and AM. ■ Separate product and AM detection plus fast-attack slow-release AGC. ■ Crystal-controlled front end and single VFO for high stability, and identical calibration and tuning rate on all bands. ■ Crystal lattice filter for high sideband suppression on transmit, and rejection of adjacent QRM on receive . . . plus solid-state balanced modulator for "set-and-forget" carrier suppression. ■ Operation from new low-cost AC-200 supply or from NCX-A or mobile power supplies. ■ ALC. ■ 45/1 planetary/split gear tuning drive. ■ Automatic carrier insertion in AM and CW modes. ■ Panel meter automatically switched to S-units on receive. ■ Universal mobile mount included.

ONLY $359.
with National's full One-Year Guarantee

National Radio Company
37 Washington Street, Melrose, Massachusetts 02176

For further information, check number 32, on page 110

Powerhouse!

Choose an RCA Power Tube for every Amateur Application

At RCA, power tube engineers are constantly working to improve the line—to provide the best possible tube for each amateur's choice of band, mode, and power. Check the tabulation ...see your authorized RCA industrial tube distributor for the *right* tubes for your rig—CW or phone—in the bands you operate. For specific tube data sheets write to RCA Commercial Engineering, Section F-15M Harrison, N.J. 07029.

RCA Electronic Components and Devices

The Most Trusted Name in Electronics

A FEW OF THE MANY RCA POWER TUBES FOR AMATEUR USE

Frequency	Power	Tube Type	Remarks
Up to 60 MHz	low	6146B/8298A	The latest version of the original RCA-developed "standard"
	medium	pair of 6146B/8298A	General use RF amplifier or AF modulator
	high	813	
Up to 500 MHz	low	8072	Ideal for VHF/UHF
		8462	Quick-heat type for mobile use
	medium	8121	No chimney or expensive socket required
	high	8122	Low-drive requirement
500 MHz and above	high	7650	KW (CW) input up to 1215 MHz

Available from Your RCA Industrial Tube Distributor.

For further information, check number 33, on page 110