CQ

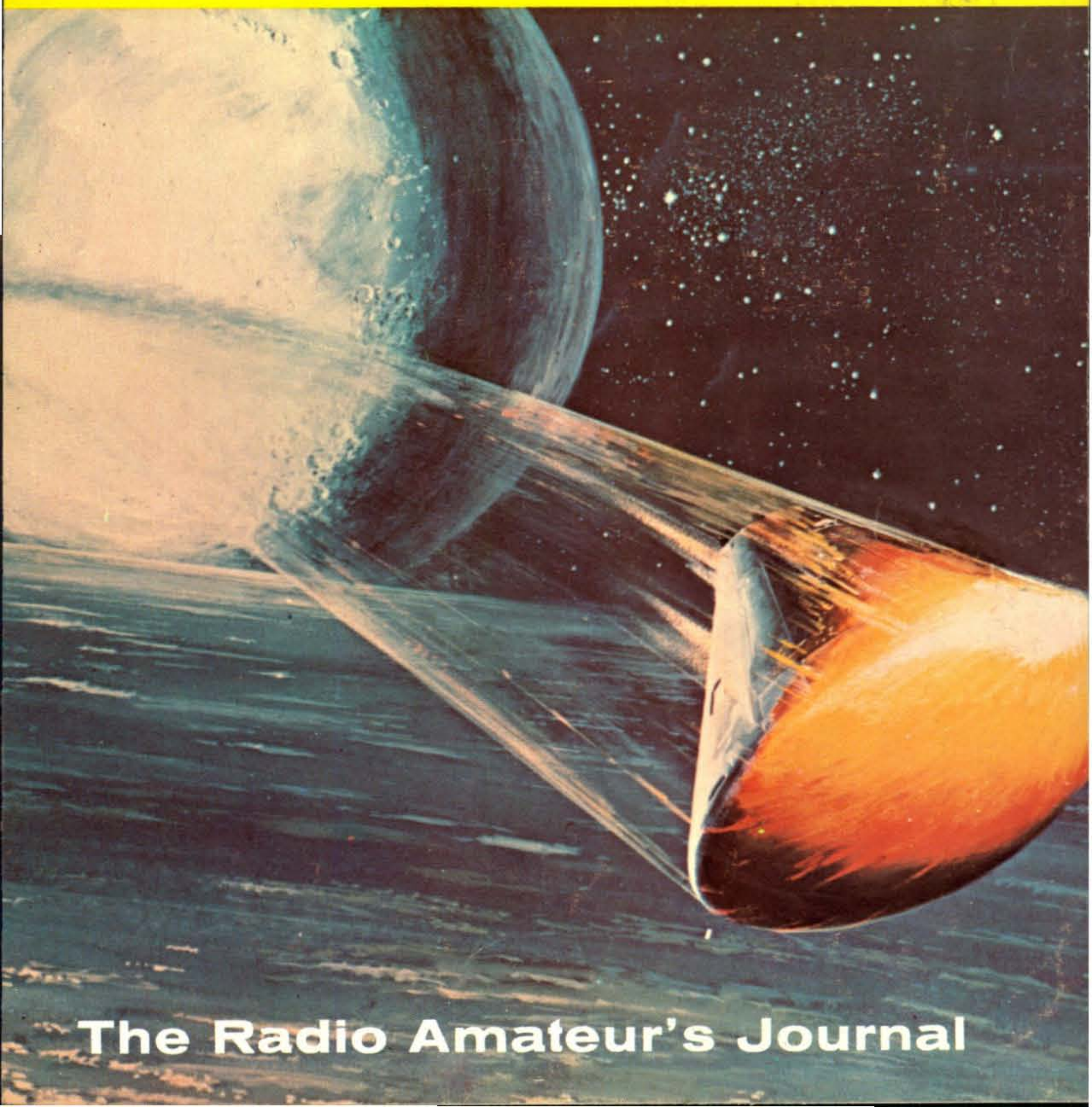
ICD

March 1969

75¢

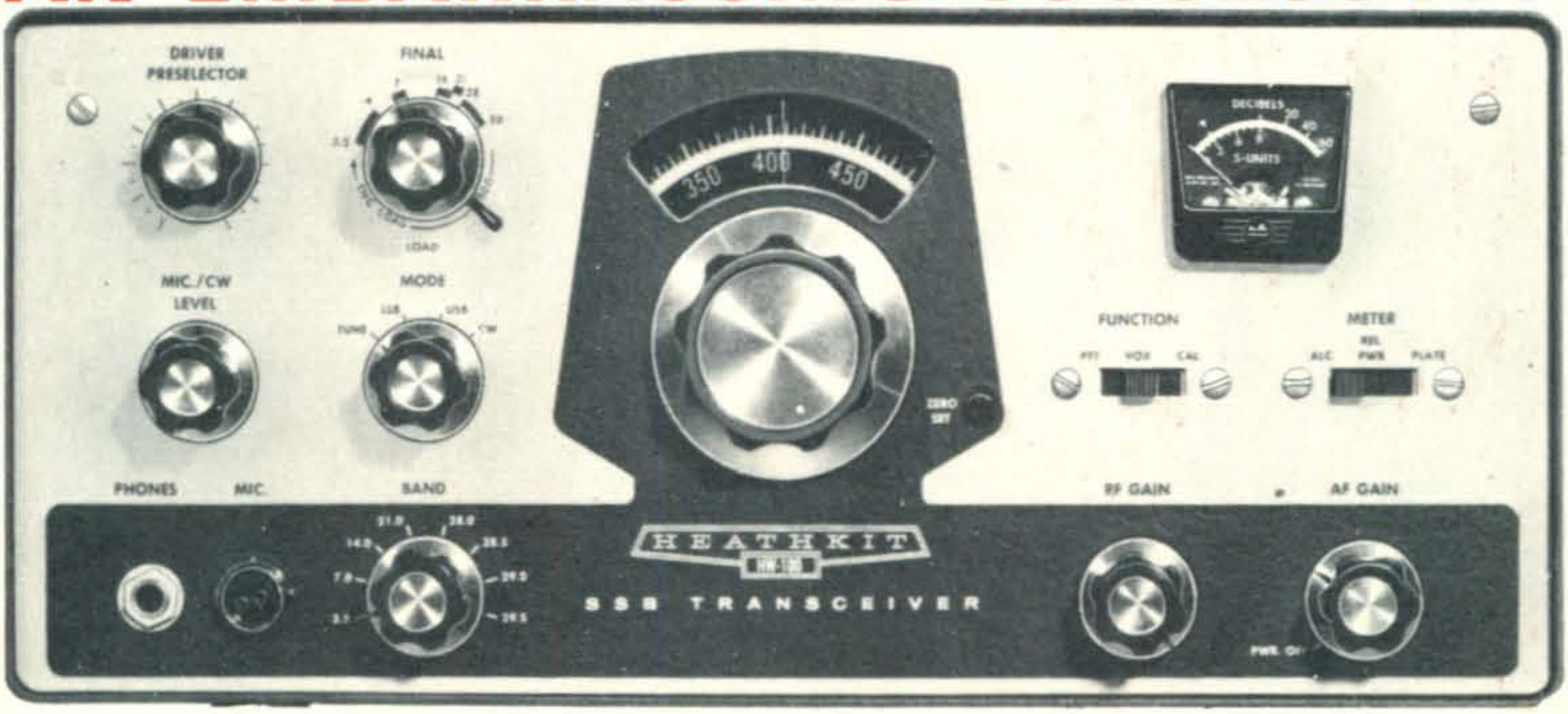
THE VOICE OF APOLLO-8

Page 17



The Radio Amateur's Journal

AN EMBARRASSING SUCCESS . . .



The Heathkit® HW-100

A year ago Heath introduced the HW-100. We thought that its excellent features and low cost would make it a well accepted rig. It was not only well accepted, it was an embarrassing success. Within the first few weeks our entire stock of HW-100's was sold out. For the first time in our history, we had to put a piece of ham gear on allocation.

But now you can buy your HW-100 immediately, and join the thousands of hams who have already discovered the real meaning of the word "value". Order a top performing rig for your shack now — the HW-100 . . . one of the hot ones from the hams at Heath.

Kit HW-100, 18 lbs., no money dn., $22 mo. **$240.00***
Kit HP-13A, DC power supply, 7 lbs., $7 mo. **$64.95***
Kit HP-23A, AC power supply, 19 lbs., $5 mo. **$49.95***
Kit SB-600, 8 ohm speaker, 6 lbs. **$18.95***

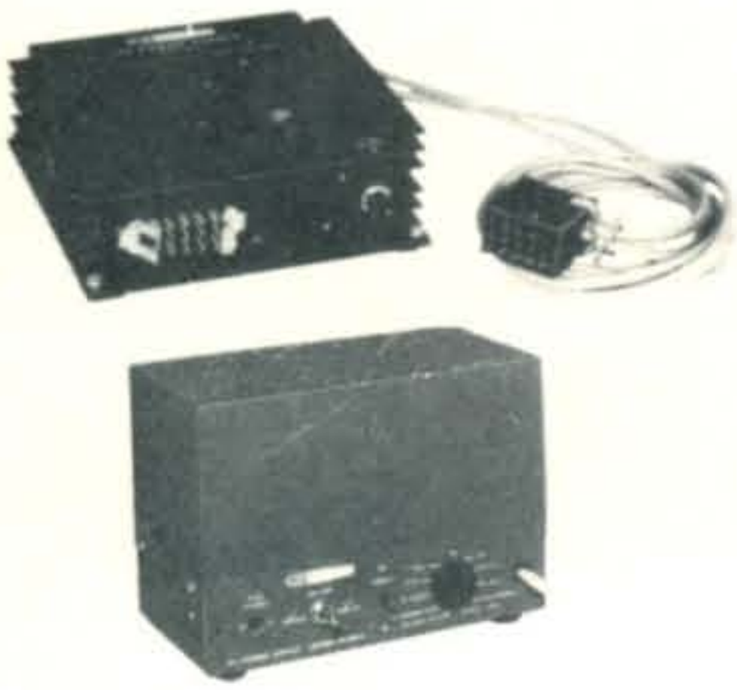
HW-100 SPECIFICATIONS — RECEIVER. Sensitivity: Less than .5 microvolt for 10 dB signal-plus-noise to noise ratio for SSB operation. **Selectivity:** 2.1 kHz minimum at 6 dB down 7 kHz maximum at 60 dB down (3.395 MHz filter). **Input:** Low impedance for unbalanced coaxial input. **Output impedance:** 8 Ω speaker, and high impedance headphone. **Power output:** 2 watts with less than 10% distortion. **Spurious response:** Image and IF rejection better than 50 dB. **TRANSMITTER. DC Power input:** SSB: (A3j emission) 180 watt P.E.P. (normal voice: continuous duty cycle). CW: (A1 emission) 170 watts (50% duty cycle). **RF Power output:** 100 watts on 80 through 15 meters; 80 watts on 10 meters (50 Ω non-reactive load). **Output impedance:** 50 Ω to 75 Ω with less than 2:1 SWR. **Oscillator feed-through or mixer products:** 55 dB below rated output. **Harmonic radiation:** 45 dB below rated output. **Transmit-receive operation:** SSB: PTT or VOX. CW: Provided by operating VOX from a keyed tone, using grid-block keying. **CW Side-tone:** Internally switched to speaker or headphone, in CW mode. Approximately 1000 Hz tone.

• Solid-state (FET) VFO • 80-10 meter coverage • 180 watts input PEP SSB — 170 watts input CW • Switch selected USB, LSB or CW • Crystal filter for sharp selectivity • Full coverage on all bands with 500 kHz per band segment • Smooth vernier control of frequency with patented Harmonic Drive® dial mechanism • Outstanding frequency stability • Built-in 100 kHz calibrator • Separate offset CW carrier crystal • TALC • Built-in S-meter • Quiet, enclosed relays • Run fixed or mobile with HP-23A or HP-13A power supplies • Easy assembly with circuit board-wiring harness construction

Microphone input: High impedance with a rating of —45 to —55 dB. **Carrier suppression:** 45 dB down from single-tone output. **Unwanted sideband suppression:** 45 dB down from single-tone output at 1000 Hz reference. **Third order distortion:** 30 dB down from two-tone output. **RF Compression (TALC*):** 10 dB or greater at .1 ma final grid current. **GENERAL. Frequency coverage:** 3.5 to 4.0; 7.0 to 7.3; 14.0 to 14.5; 21.0 to 21.5; 28.0 to 28.5; 28.5 to 29.0; 29.0 to 29.5; 29.5 to 30.0 (megahertz). **Frequency stability:** Less than 100 hertz per hour after 30 minutes warmup from normal ambient conditions. Less than 100 Hz for ± 10% line voltage variations. **Modes of operation:** Selectable upper or lower sideband (suppressed carrier) and CW. **Dial calibration:** 5 kHz. Calibration: 100 kHz crystal. **Audio frequency response:** 350 to 2450 Hz. **Transistors:** MPF105 FET — VFO; 2N3393 — Voltage regulator. **Rear apron connections:** CW Key jack; 8 Ω output; ALC input; Power and accessory plug; RF output; Antenna; Spare. **Power requirements:** 700 to 850 volts at 250 ma with 1% maximum ripple; 300 volts at 150 ma with .05% maximum ripple; —115 volts at 10 ma with .5% maximum ripple; 12 volts AC/DC at 4.76 amps. **Cabinet dimensions:** 14 13/16" W x 6 5/16" H x 13 3/8" D.

*Triple Action Lever Control ™

Run Fixed Or Mobile With These Heathkit Power Supplies



HP-13A Solid-State Mobile Power Supply . . . now with a higher DC input voltage range for compatability with newer cars. All solid-state circuitry produces high, low & bias voltages from a 12-16 VDC (negative ground) input. Primary & filament lines are circuit breaker protected. Rugged silicon rectifiers & heavy-duty filter capacitors, mounted on a solid circuit board, provide trouble-free operation. Mounts almost anywhere — measures only 7 3/4" x 7 5/16" x 2 3/8". Run mobile with the HP-13A now.

Kit HP-13A, 7 lbs. **$64.95***

HP-23A Fixed Power Supply . . . provides high & low B+, bias and filament power for your HW-100, from an AC line. Features switch selection of two low B+ voltages, fixed & adjustable bias, plus 6.3 or 12 V filament power. All controls and connections are conveniently mounted on the side for easy access when mounted in the SB-600 Speaker. The primary circuit is protected against overloads & short circuits by a circuit breaker. 120/240 VAC operation too.

Kit HP-23A, 19 lbs. **$49.95***

Mail order prices; F.O.B. factory.

FREE! World's Largest Electronic Kit Catalog

- **Deluxe Color TV** . . . the sets you've read about that give better performance yet cost no more; three models: 295, 227 & 180 sq. in. rectangular; exclusive built-in self-servicing aids. Custom, wall, or cabinet installation. New optional wireless remote controls, and new Heathkit antenna line.
- **Transistor Organs** . . . deluxe 19-voice and low cost 10-voice Thomas models in kit form — save up to $500. Also VOX "Jaguar" combo organ at $200 savings.
- **Electric Guitar Amplifiers** and accessories...amps, "fuzz" booster, microphones and speakers.
- **Portable and Table Radios and Phonographs** . . . AM, FM, shortwave radios . . . mono or stereo phonographs.
- **Stereo/Hi-Fi Components** . . . stereo receivers (including the famous Heathkit AR-15), amplifiers, tuners, speakers, turntables.
- **Amateur Radio Gear** . . . world's most popular line . . . SSB transceivers, transmitters, receivers, accessories.
- **Citizen's Band Radio** . . . fixed and mobile transceivers, walkie-talkies.
- **Test and Lab Instruments** . . . a complete line for home & hobby, shop, educational and industrial use. Newly designed and styled.
- **Scientific and Educational** . . . Berkeley Physics Lab, Malmstadt-Enke instrumentation including Analog/Digital equipment, kits for home & classroom study.
- **Marine Electronics** . . . radiophones, RDF, depth sounder, fuel vapor detector.
- **Photographic Aids** . . . Heath/Mitchell Fotoval® and Colorval® darkroom computers for perfect B&W and color printing; electronic photo timer.

New . . . Over 300 Kits For Every Interest . . . Save Up To 50%

MAIL COUPON NOW!

- **Biggest Selection . . . Over 300 Kits**
- **Up to 50% Savings**
- **Easiest To Build**
- **World Famous Easy-To-Understand Construction Manuals**
- **Highest Quality Components**
- **Best Performance**
- **Unique Creative Satisfaction**
- **Pride Of Achievement**
- **Free Technical Consultation**
- **Easy Credit Terms**

HEATH COMPANY, Dept. 12-3
Benton Harbor, Michigan 49022
HEATHKIT
Please send FREE Heathkit Catalog

Name _____
(please print)

Address _____

City _____ State _____ Zip _____

CL-339

See page 110 for New Reader Service

a complete amateur radio station

in one portable package

SWAN *Cygnet*

A 5 BAND 260 WATT SSB TRANSCEIVER WITH BUILT-IN AC AND DC SUPPLY AND LOUDSPEAKER

$395

The new Swan Cygnet is a complete SSB transceiver, with self contained AC and DC power supply, microphone and loudspeaker in one portable package. The Cygnet features full frequency coverage of the 10, 15, 20, 40 and 80 meter bands with a power input rating of 260 watts P.E.P. in single sideband mode, and 180 watts CW input. A crystal lattice filter at 5500 Kc is used in both transmit and receive mode, and provides excellent selectivity with a 2.7 Kc bandwidth at 6 db down. Superior receiver sensitivity of better than ½ microvolt makes it easy to pull in those DX signals, and with the Cygnet, if you can hear them, you can work them. Audio fidelity is in the well known Swan tradition of being second to none; providing smooth, natural sounding voice quality. The Cygnet is temperature compensated on all bands, featuring solid state oscillator circuitry with zener regulation which permits wide variation in supply line voltage without frequency shift.

Unwanted sideband suppression is 45 db, carrier suppression 60 db, and distortion products are down approximately 30 db.

The new Cygnet is designed to provide efficient, high quality communications in the 5 most commonly used amateur bands. Its low cost is a tribute to Swan's well known techniques in value analysis, and simple, direct circuit design. Above all, these techniques lead to a high degree of reliability and foolproof performance. Dimensions are: 13" wide, 5½" high, and 11" deep. Weight is 24 lbs.

The transceiver comes complete with AC and DC input cords, and carrying handle; thus making it the most versatile and portable set on the market, and certainly the best possible value.

Amateur net **$395**

P.S. Yes, for our customers who require some of the extra features, there will be a deluxe version of the Cygnet coming soon, which will sell for approximately $495

ASK THE HAM WHO OWNS ONE

SWAN
ELECTRONICS
OCEANSIDE, CALIFORNIA
A Subsidiary of Cubic Corporation

MARCH, 1969 VOL. 25, No. 3

CQ

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 Miami, Florida. Subscription Prices: one year, $6.00, two years, $11.00, three years, $15.00. Entire contents copyright by Cowan Publishing Corp. 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

See page 110 for New Reader Service

Ted Henry needed a rugged linear triode. So he came to us.

Two rugged Eimac 3-500Z high-mu triodes are featured in Henry Radio's new 2K-3 linear amplifier. Henry designed the amplifier around versatile Eimac power tubes because these popular triodes are ideal for grounded-grid operation at the 2 kW PEP SSB input level, and at the 1 kW DC input level for CW, AM and RTTY. Users of this new Henry rig will enjoy a conservative plate dissipation rating of 1000 watts for year-in, year-out reliability under key-down service. Henry's choice should be your choice. For more information on the 3-500Z and on Eimac's line of power tubes for advanced transmitters, write Eimac Amateur Services Department or contact your nearest Varian/Eimac distributor.

Eimac®
division of varian

ZERO BIAS

ONCE again, in 1969, the Congress of the United States will attempt to rectify an error in the original "Reciprocal Licensing" measure passed in 1964. The error—or ommission—allowed amateur operation by foreign nationals visiting the U.S. (when proper applications were made, and when proper reciprocal agreements existed between the U.S. and the particular foreign government), but did not permit similar privileges for individuals who had emmigrated to the U.S. and were applying for U.S. Citizenship.

Last year, Representative Theodore R. Kupferman of New York took the first step in that direction with the drafting of a Bill (H.R. 16764) designed to permit such operation. Predictably, H.R. 16764 died in committee, but with the recent re-election to the Senate of K7UGA, Barry Goldwater, the hopes of immigrant would-be operators rose once again. Also, predictably, Senator Goldwater has taken the bull by the horns, and introduced in the 91st Congress a Joint Resolution "To amend the Communications Act of 1934 to provide that certain aliens admitted to the United States for permanent residence shall be eligible to operate amateur radio stations in the United States and to hold licenses for their stations."

The Joint Resolution labeled S. J. Res. 27 was introduced January 23, 1969, read twice and referred to the Committee on Commerce for study.

We sincerely hope that the efforts of Mr. Kupferman, Mr. Goldwater, and the firebrand behind the whole situation, George Pataki, ex-YO2BO, will not be in vain, and that we'll see the amendment become law during this session of Congress. Amateurs can help assure the success of the measure by making their feelings known to their state's Representative and Senators. A Post Card, Radiogram, Telegram or letter stating your desires may not move mountains, but when it comes time for a vote, Joint Resolution number 27 may sound familiar to *your* Congressman because of *your* letter. Please write today.

On the Cover

Our cover this month depicts the flaming re-entry of three U.S. astronauts aboard an Apollo space capsule. The artist's rendition. courtesy of NASA, is a fitting keynote for this issue of *CQ* which features a very special, and very exclusive story about the amazing communications system which brought three astronauts to a moon orbit and back with textbook precision and reliability. The story comes from Howard Kelly, K4DSN, a television newscaster at WFGA-TV (Channel 12) in Jacksonville, Florida, and *CQ's* own WPX Award Chairman. Howard was right in the middle of the story of Apollo 8 as it was happening, since his station often acts as a pooling center for the three major networks during space shots. In months to come we'll be receiving regular news stories from K4DSN on the Man in Space program, helping keep *CQ* Number One in space coverage in amateur radio.

Not to be outdone by NASA, the Project MOONRAY group at NASTAR in Long Island, N.Y. outlines the details on communicating through the all-amateur transponder which they hope to be able to have on board one of the later Apollo moon shots. Their story begins on page 36.

73, Dick, K2MGA

See page 110 for New Reader Service

The Classic Feed System

By W. E. "BARNEY" ST. VRAIN, WØPXE
DESIGNING ENGINEER - CLASSIC FEED PROJECT
MOSLEY ELECTRONICS, INCORPORATED
4610 N. Lindbergh Blvd., Bridgeton, Mo. 63042.

Code 182

SINCE the introduction of multi-frequency beams several years ago, the method of feeding such antennas has been a subject of much disagreement. When these antennas were introduced Mosley Electronics ran a series of advertisements in the technical magazines explaining the method used on our Trap-Master and Power-Master series. Since that time we have tried a wide variety of feed systems endeavoring to improve on the original system.

Testing Other Feed Systems

In testing, we found a three-band gamma system ineffective without isolation networks which resulted in a feed system cost about equal to the antenna cost; with a system using hairpins, the cost proved low but the system did not provide a better match than the original Mosley matching system. It became quite clear to us that the Mosley system was hard to beat, for we had found only one slight disadvantage: the elements needed to be stagger tuned to raise the feed point resistance from about 30 to 50 ohms. This slight detuning, which proved advantageous in increasing the bandwidth, brought about, in turn, a slight gain loss of about 0.5 to 1.0 db. at resonance.

The Classic System

In order to give hams a new choice in beam matching systems and an antenna featuring maximum gain with increased bandwidth, we devised the matching method used on our new Classic antennas--Balanced Capacitive Matching (Patent Approved)--a method which takes advantage of the principle that antenna resistance at the center driving point increases as the antenna length increases. Figure No. 1 shows the radiator element of a three-element beam at resonance having an impedance at the driving point (Z_A) of about 30 + J0 ohms. If the element is made longer, Z_A can be raised to about 50 + J50 ohms (Figure No. 2). Since the reactance is inductive, it can be cancelled with a series capacitor of 50 ohms reactance, leaving 5 ohms feed point resistance (Figure No. 3) Series capacitors used on the Classic antennas are made by inserting a suitabl length of heavily insulated wire into eac half of the element tube at the center. The wires are terminated in a plastic tube enclosure with a type "N" connector for connection of the coaxial cable. To isolate the outer coax conductor from ground, the coax line is coiled for a few turns near the antenna end. This is designed to prevent the very unlikely effect of "Feed Line Radiation."

Fig. 1.

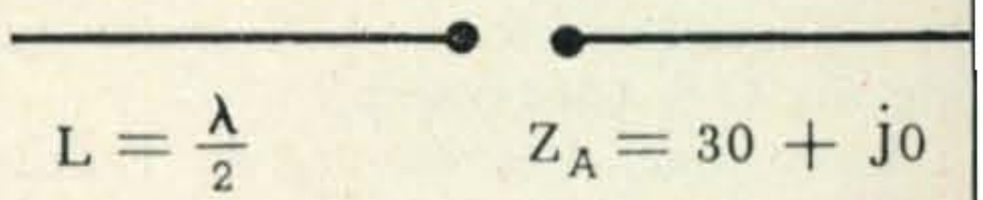


Fig. 2.

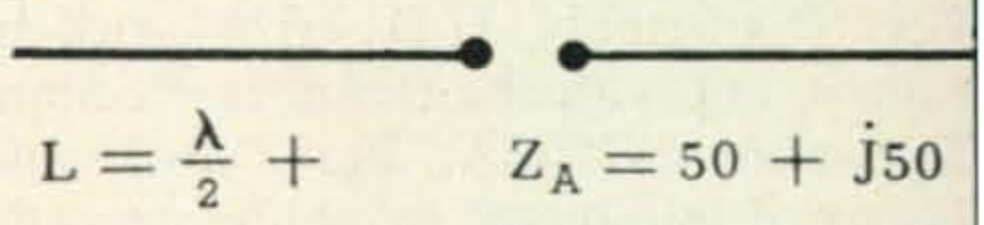
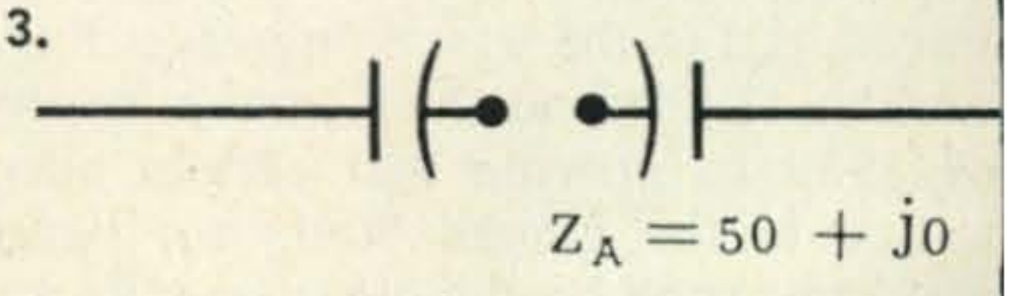


Fig. 3.

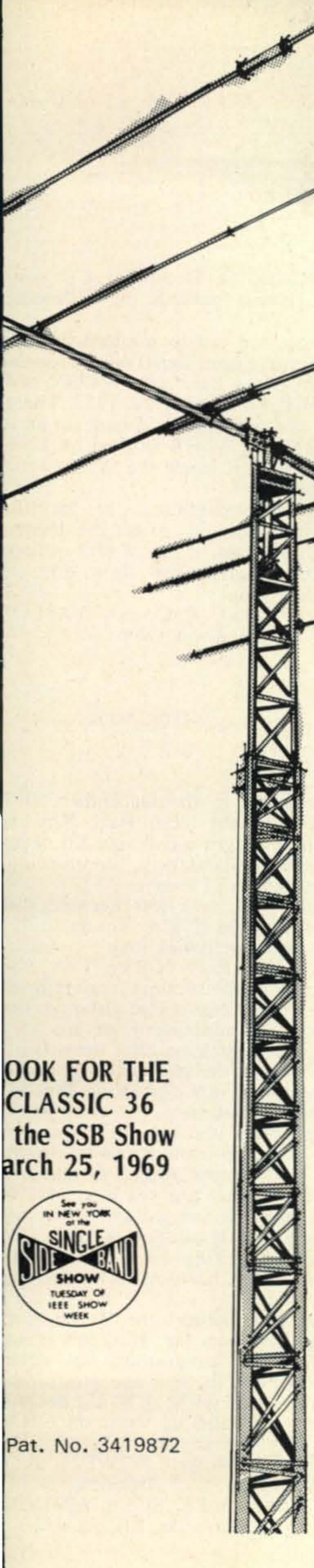


Conversion to Other Bands

Classic beams are not designed for 40-meter or other conversion. The Classic Feed System has a fixed capacity which is not easily changed. This capacity is not high enough for the antenna to operate on 40 meters without making the element excessively long. The engineers at Mosley designed the Classic Feed to give the ham increased bandwidth and extra gain on all bands. It is our conviction that discriminating DX'ers will find these new beams specifically suited to their needs.

See page 110 for New Reader Service

The Classic 36



Mosley TRAP MASTER

With 'Patent Approved' Classic Feed System*

You've been hearing about the Classic Feed System and its phenomenal success in three-element configurations. Now—in response to repeated requests—this revolutionary new matching system, Balanced Capacitive Matching, has been incorporated into the original six-element configuration of DX-proven TA-36 to create the new Classic 36. This tri-band beam, rated for maximum legal power on 10, 15, and 20 meters, features the Classic coax-fed balanced element for more efficient beam performance, increased bandwidth, and maximum gain.

As the latest addition to the world-famous Mosley Trap-Master line of amateur antennas, the Classic 36 offers: *frequently-imitated, never-improved-upon Mosley Trap-Master Traps; automatic bandswitching by means of exclusively designed, high-impedance parallel resonant Trap Circuits; weather-tested Trap-Master construction.*

Satisfied TA-36 owners can convert their beams to the Classic 36 with the new TA36/CL36 Conversion Kit.

The Mosley name is your guarantee: Mosley builds quality antennas and stands behind them. Write factory direct for complete specifications and performance data, including VSWR curves and gain figures.

Dept. 181B

Mosley Electronics, Inc.

4610 N. LINDBERGH BLVD., BRIDGETON MO. 63042

OOK FOR THE
CLASSIC 36
the SSB Show
arch 25, 1969

See you IN NEW YORK at the SINGLE SIDEBAND SHOW TUESDAY OF IEEE SHOW WEEK

Pat. No. 3419872

Our Readers Say

Correction

Editor, *CQ:*

My letter published in December *CQ* contained an error. Please publish the following correction.

W4HHK has pointed out to me that he was not the first to bounce a ham signal off the moon. This was done by Ross Bateman, W4AO, and Bill Smith, W3GKP, on January 27, 1953. There was no two-way communication, I believe, until 1960, when W1BU and W6HB worked on 1296 mc. W4HHK and W2UK made the first 144 mc meteor-scatter contact.

Important individual contributors *are* identifiable but it takes some digging to get the details. This might be remedied if a careful writer brought "200 Meters and Down" up to date. It would make a good serial.

Thomas E. Coates, WA8FQJ
Englewood, Ohio

Youth Speaks Out

Editor, *CQ:*

I refer to the letter in the December 1968 *CQ*, OUR READERS SAY, from Paul Ninken, W2WDH (how he ever got a call sign I'll never know.), condemning, slandering, denouncing, and reproving the youth of today.

I am a teenager, 17, was just licensed last June, and like a multitude of other young adults, am interested in other activities than "...smoking pot and in Sugar Easy X-Ray." We, the youth of America, have done many unmentioned things for people, but it seems that although the vast majority of the middle-aged set are very understanding to our problems, that there is always some faction that thrives on the exploitation of the minority of our age group that indulges in worthless activities.

I got into Amateur Radio because I *was* fascinated at "...picking up a mike and talking to a brother Ham 2000 miles away." Granted, a great number of teenagers are not interested in communications, which is fair and good, but just look at those who are! It puzzles me that OM W2WDH mentioned picking up a mike rather than a key, whasamater, been on s.s.b. too long to remember the code?

The one thing that bothers me the most is that it seems that those in Mr. Ninken's group *love* to stereotype our generation, but never bother to mention those in their age group that get on that rats' nest of QRM, CB. I'll bet my bottom QSL that the ratio of teens on CB is lower than that of oldsters.

I challenge Mr. Paul Ninken, W2WDH, to an apology to the young hams of America.

Bernard K. Skoch, WN5VPE
Jacksonville, Arkansas

NEW FROM INTERNATIONAL

FM-2400 FREQUENCY METER

- For Mobile Or Base Station Use
- Tests Predetermined Frequencies 25 - 470 MHz
- Portable . . . Use It Anywhere

The FM-2400 is designed for testing and adjustment of mobile and base station transmitters and receivers at predetermined frequencies between 25 and 470 MHz. The FM-2400 provides an accurate standard frequency signal to which the transmitter can be compared. This same signal is applied to the associated receiver(s), thereby assuring an accurate frequency adjustment on all parts of the communications system.

Up to 24 crystals may be inserted into the meter for the selection of the frequencies required for testing of the system transmitters and receivers. The frequencies can be those of the radio frequency channels of operation, and/or of the intermediate frequencies of the receiver between 100 KHz and 100 MHz. Self contained unit. Battery operated.

FM-2400 (meter only)	**$395.00**
RF Crystals with temperature run	**$23.50** ea.
IF Crystals	
200 - 2,000 KHz	See Catalog*
2,001 - 13,000 KHz	See Catalog*

*WRITE FOR FREE CATALOG

INTERNATIONAL

CRYSTAL MFG. CO., INC.

10 NO. LEE • OKLA. CITY, OKLA. 73102

See page 110 for New Reader Service

Announcements

Benton Harbor, Michigan

The BARA Club Auction will be held on March 16, 1969. It will be at the Downtowner Cafeteria, Benton Harbor between the hours of 10 and 5 P.M. There will be free parking, drawings for door prizes and luncheon food will be available. For a map and bulletin contact: Paul Playford, W8AEF, 653 Pearl Ave., Bridgman, Mich. 49106.

Stolen Equipment

On or about Jan. 1, 1969, the premises of the Grumman ARC (Bethpage, L.I.) were broken into and the following equipment was stolen:

(1) Collins 32S-1 Transmitter, Serial No. 10891. (1) Collins 75S-3 Receiver, Serial No. 10779. (1) Collins 312-B-4 Station Control, Serial No. 52496.

Please direct any information with regard to the recovery of said equipment to: Emmett Goodman Sr., WA2JFA, 18 Apollo Lane, Hicksville, L.I., N.Y. 11801. Tel. No. 516-WE 1-5717.

Midland, Texas

The Midland Amateur Radio Club (W5-QGG) of Midland, Texas has scheduled its annual 'Swapfest' for Sunday, March 23, 1969 in the Midland County Exhibition Building. An informal dance will be held Saturday night, March 22. Further information and advance registration forms may be obtained by writing P.O. Box 967, Midland, Texas 79701.

Knights Round Table QSO Party

The Knights Round Table Local Net of Milwaukee, Wisconsin announces their upcoming QSO Party. It will start at 0000 GMT March 30, 1969, and end 2400 GMT April 6, and is open to all operators, on all bands and all modes of transmission. Point system will be as follows: RST and QSO number, five points for each Wisconsin contact, ten points for each Milwaukee contact, fifteen points for each net member contact. Awards will be, first place—trophy, all others, certificates. Deadline for applications is April 26. Logs along with fifty cents to be sent to Net Control, Joseph F. Williams, WA9TSG, 114 East Brown St., Milwaukee, Wisconsin 53203.

[*Continued on page 97*]

See page 110 for New Reader Service

Please don't call it a TRANSCEIVER...

Some people don't like transceivers. Too much **compromise,** they claim . . . only **separate** transmitters and receivers can deliver really top-notch performance under all conditions . . .

Pretty hard to argue that point . . . UP UNTIL NOW!

BUT NOW . . . SIGNAL/ONE brings you the DELUXE INTEGRATED STATION . . . .

. . . **more** performance than any transmitter/ /receiver combination

. . . **more** convenience than any transceiver

. . . **unprecedented versatility**

WHATEVER YOUR CHOICE IN THE PAST . . .

COMPARE IT POINT-BY-POINT with the NO-COMPROMISE CX7 . . .

COMPARE the CX7 with **any receiver** for sensitivity, selectivity options, dynamic range, AGC merit, VFO smoothness, interference rejection . . .

COMPARE the CX7 with **any transmitter** for continuous power output in **all** modes, P.A. ruggedness, crisp audio punch, low distortion, instant CW break-in and spotting, quick band-change . . .

COMPARE the CX7 with **any transceiver** for total size and weight . . . the extreme flexibility of its dual-channel system . . . the convenience of its completely self-contained design . . .

CONSIDER the CX7's **incomparable** frequency coverage and readout precision . . . aerospace-bred excellence in engineering and craftsmanship . . . built-in "extras" . . . overall versatility . . .

"It Speaks for Itself"

signal/one

A Division of ECI (An NCR Subsidiary)

2200 Anvil Street N. • St. Petersburg, Florida 33710

SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

I am riting you post-hasty on acct. I having trubble like I not having before. The trubble I having is that I not having any trubble.

And, not having any trubble can reely be big trubble. How can I riting you to telling you about Scratchi's problems when not having any?

Resently all kind good things happening. Even good old IPOIO law is evidently being repeeled. You know about IPOIO, Hon. Ed. –the Inate Perversity of Inanimate Objects.

Likesame one day before dee-x contest you blowing to Hon. Smithereens only toob in your rig that local deelers not stocking–that IPOIO. Or like finding you having to rite two checks reel fast, and finding you only having one check left in checkbook.

Or when blowing resistor in rig, it being the one you desiding to mounting under the tubular capacitors, and you having to unsodder eleventeen conneckshuns to et to it. Or, the fuse you blowing is the one size you not having in junk box. That all being IPOIO.

Not happening to Scratchi resently, which reely disturbing me. Like take the other day. I dropped a piece of toast on the floor, and it landed butter side up! Before that I running out of gas in Hon. Jeep. Gess where? Rite in front of gas stayshun. I even coasted in.

I just making out my income tax–finding I have a refund coming! Putting rig on air, calling Hon. Test twice and signing, and a UA9 coming back to me! Checking standing-wave ratio on beem and it measuring less than 1:25 to 1! As you can see Hon. Ed., I in reel big trubble!

Absolutely nothing going wrong. Other day I tripping on rug when walking into shack,

[*Continued on page 14*]

See page 110 for New Reader Service

Looks aren't everything.

This new Ham Cat may be the best looking ham mobile antenna you've ever seen, but that's just the half of it.

After all, beauty is as beauty does, and this one does it better than any other ham antenna you can buy.

First of all, it's got a shake-proof sleeve clutch that folds over when you want to garage it.

Which also means you can change from one band to another in a couple of seconds by simply unscrewing one complete coil and tip rod unit and screwing another onto the foldover mast.

It's also strong enough to take a knock without bending. And the turnover mast is a hefty ⅝" solid rod of highly polished, heat-treated aluminum.

We've also done away with the old-fashioned plastic shrink tubing and sealed the light-weight precision-wound coils in an indestructible epoxy-fiberglass sleeve. (Which is a distinctive white that'll add to the beauty of your car.) And, all fittings are heavy chrome-plated brass.

The new Ham Cat combines higher Q with wider bandwidth performance, without using a lossy-heat generating coil like the others use. So it not only looks beyond your wildest dreams, it works beyond them, too.

It's also designed on a nominal 52 ohm impedance so you don't have to have any special matching. (Any length coax will work.)

The Ham Cat mobile ham antenna is at your Hy-Gain dealer (he's the best one under the sun) right now.

And it's there at a price all the others are charging for half of what you get in this antenna.

And that's the real beauty of it.

ELECTRICAL

- Nominal 52 ohm impedance—no special matching device needed.
- Widest bandwidth, highest power handling —Vs.—heat drift ratio available.
- Lowest VSWR in any mobile available.

MECHANICAL

- Turn-over mast is hefty ⅝" dia. solid rod of highly polished heat-treated aluminum.
- All connections are standard ⅜-24 thread.
- Mast folds over, swivels, and turns over. You can mount it on bumper deck. In addition, this flexibility makes it easy and simple to change coils.
- Coil and tip rods are a one-piece assembly. Coil diameters are constant, only lengths change.
- Shake-proof sleeve clutch facilitates quick band changeover and fold over for garaging.

THE **Ham cat**

MOBILE HAM ANTENNA FROM HY-GAIN

HY-GAIN ELECTRONICS CORPORATION
N.E. Highway 6 at Stevens Creek
Lincoln, Nebraska 68501 **Dept. AC-3**

THE MOST ADVANCED ANTENNAS UNDER THE SUN

Scratchi [*from page 12*]

landing flat on my back on the floor, a sliding half-way across room underneath table. I thinking—Hot Diggity my troubb are over. No indeedy. Looking up at und side of table and discovering rare QSL ca I losing cupple months ago. It sliding out drawer and stuck under table.

I even afraid to opening male. Resen getting big stack of QSL cards from feller QSL'ing to yeers ago. Getting copies of mag zines even though subscripshun have expire Next thing you knowing I getting letter te ing me I winning contest or something.

Scratchi been thinking of putting anten way up in foothills about a mile from t shack, but not wanting to spend money feed-line from rig to antenna. Any day expecting to getting letter from sumbud telling me how to doing it. Either that o inheriting one mile good grade coax.

Hon. Ed., it scary. I getting so despri desiding to make something bad happe Going into shack, firing up rig, grabbing n on VFO and giving it a big twist to taki signal way out of band. Taking mike, calli seek-you, and feller in New York comi back pronto.

This surprizing me, so asking him to gi me rough freakwency check. He tell me th I rite smack dab in middle of fone ban Hokendoke!! I checking, and he rite!! N VFO have slipped out of calibrayshun. can't even doing anything wrong rite!

Woe is me. Oh, eggscoosing me one minu Hon. Ed. Land line tellyfone are ringing.

Hot diggity for reel! Everything fine agai Everything are peeches and skim milk (Scra chi on diet)! Scratchi in reel big trubble. Th fone call from local lawyer-type feller. I being sued for cupple thousand bux. What grate and gloryus feeling!

Hon. Law Suit are having something to with the twenny foot antenna on Hon. Jee Seems it knocking down power line a mon ago. Don't worry about it, Hon. Ed. Boy boy it are good to be back to normal agai I riting you soon from the pokey.

Respectively you
Hashafisti Scratch

Remember to check pages 34 and 35 for the CQ WPX SSB Contest rules.

See page 110 for New Reader Servi

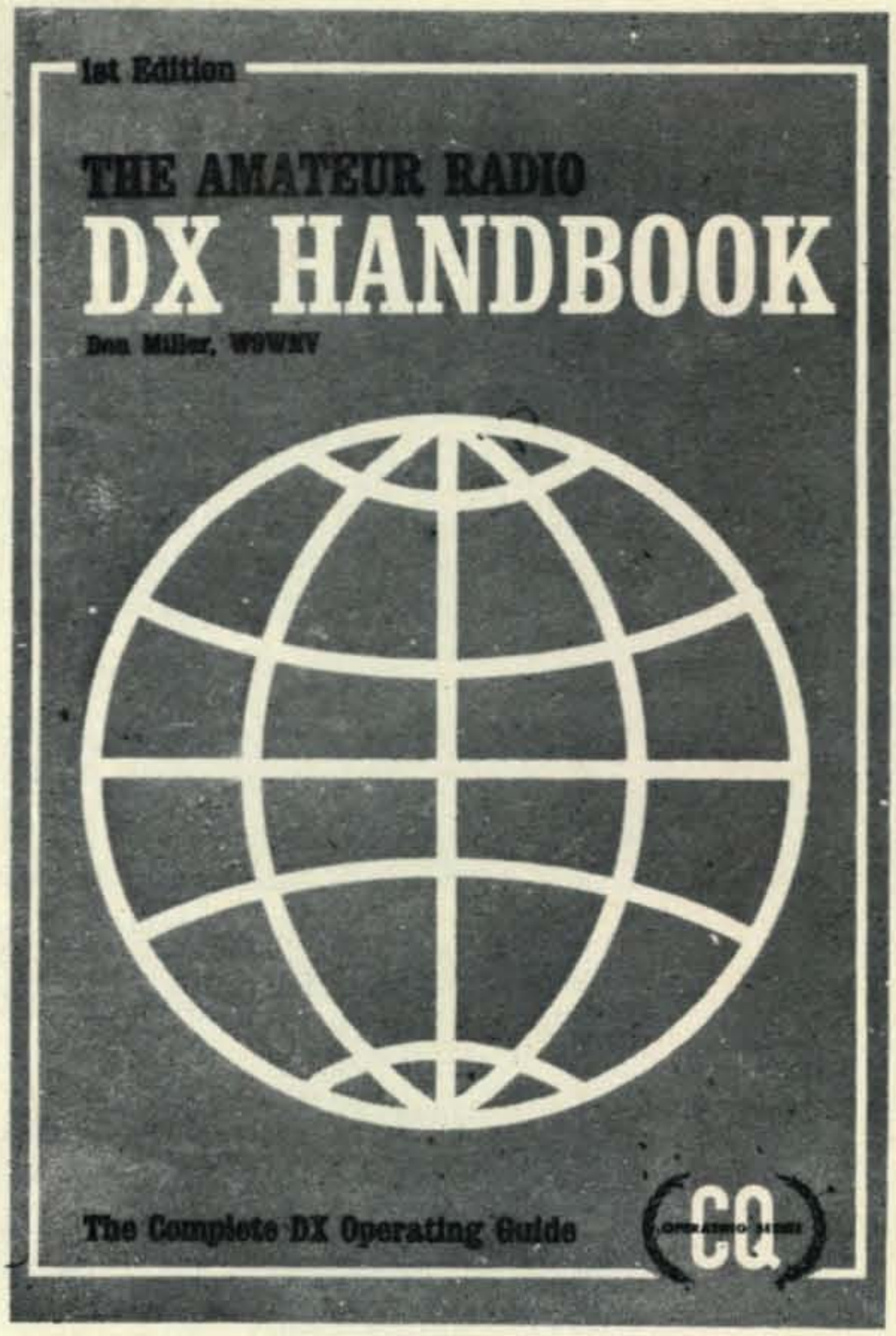
SPECIAL NOTICE

e Amateur Radio DX Handbook is off
presses and in the mail. CQ read-
who ordered their copies direct from
publisher will have their copies as
s issue of CQ is being prepared.
ndreds of local distributors and book
res will also have copies in stock.

s book is the absolute, most com-
hensive sourcebook available on DX
the Radio Amateur. It contains every
nceivable piece of information he'll
ed toward working better DX.

e chapter headings are listed below,
hough they don't come close to doing
s fantastic volume the justice it
serves. You have to see a copy to
preciate just how valuable it is.

anticipate that our first print run will
exhausted within the next month. To
ake sure you get your copy while
ey're still available, check your local
tributor or order direct from the pub-
her. The price is $5.00 for 200 pages
priceless reading.



roduction

Propagation
ateur Frequencies and the DXer
DXer: International Factors and Local
Regulations
DX Station
rking DX From the Home Station
bile DXing

DXing From the Rare Location

QSLing
The SWL DXer
DX Contests
DX Awards
DX Clubs
Great Circle Bearing Charts

an Publishing Corp., Book Division
anderventer Ave., Port Washington, L.I., N.Y. 11050

sed is $_____ for _____ copy(ies) of the **AMATEUR DIO DX HANDBOOK**

e .....Call .. ..

t .....

.....State .....Zip .....

ork City and State residents add applicable sales tax.

Price:

$5.00

See page 110 for New Reader Service

POWER

NCL-2000 Linear Amplifier

another great one from NRCI

The NCL-2000 is desk-top dynamite in the form of a 2000-Watt 5-band linear amplifier. If you want high efficiency, superb linearity, operator-oriented design, and contest-winning punch in a pile-up, the NCL-2000 is your kind of linear. NRCI reliability engineering also assures that there's no need to retune with every frequency shift. Turn on the legal limit in this beautiful package.

☐ Frequency Range: 80, 40, 20, 15 and 10 meter bands, with significant band-edge overlap for MARS service. ☐ Input Power: SSB — 1000 Watts average, 2000 Watts PEP. AM, CW, RTTY — 1000 Watts. ☐ Output Power: SSB — 1300 Watts PEP minimum on all bands. AM — 300 Watts minimum. CW, RTT — 600 Watts minimum. ☐ Drive Requirements: 2 to 200 Watts, PEP, adjustable. ☐ Output Impedance 40 to 60 Ohms (minimum). ☐ Power Supply: Built-in solid-state design. 115 V.A.C. or 230 V.A.C. Draws 1 amperes maximum at 230V. ☐ Tubes and Semicon ductors: Two 8122 ceramic tetrode output tubes plus 13 semiconductors. ☐ Fully metered, safet engineered.

PLUS: ALC provisions, internal dummy exciter loa full-access front and rear panel design, and time de day, plate overload, plate power and antenna relays

AMATEUR NET PRICE: $685.00

See your favorite dealer, or write directly to factory for complete specifications and description

NATIONAL RADIO COMPANY, INC.

NRCI

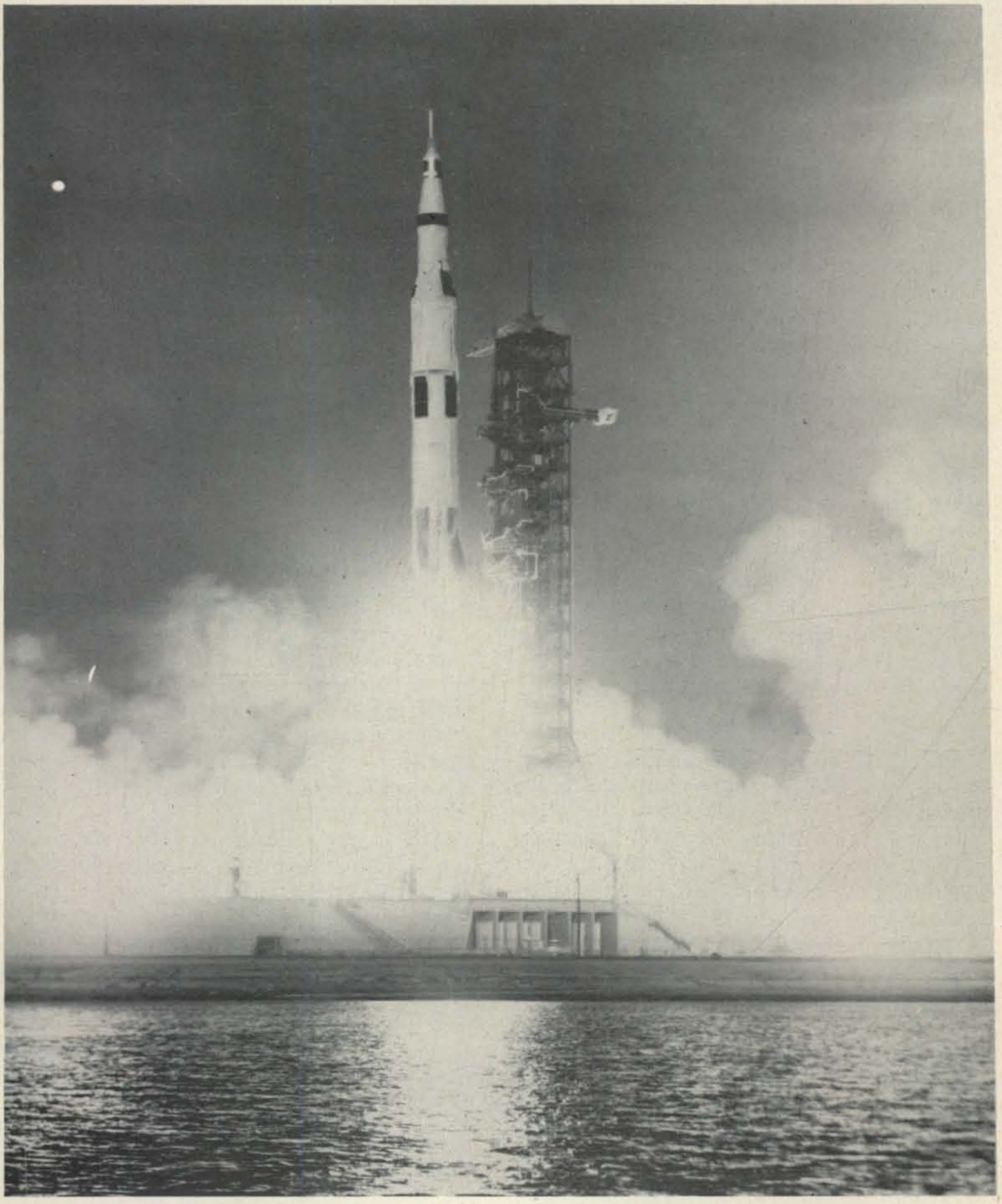
37 Washington Street, Melrose, Mass. 02176
Telephone: (617) 662-7700 TWX: 617-665-5032

International Marketing through: **Ad. Auriema, Inc., 85 Broad Street, New York, New York 1000**

See page 110 for New Reader Service

The Voice of Apollo-8

BY HOWARD W. KELLEY,* K4DSN



Apollo-8 leaves the pad December 21, 1968 at 7:51 A.M. At this moment communications are handled basically on v.h.f./a.m. with a 2100 mc backup and data link. It takes 7,500,000 lbs. of thrust to get the Saturn 5B and spacecraft off the launch hill.

See page 110 for New Reader Service

The Voice of Apollo-8

BY HOWARD W. KELLEY,* K4DSN

THE world is still reveling over the remarkable success of the Apollo-8 moon mission. Among its many successes, the flight introduced new strength into communication theories and practical applications. To the Greeks, Apollo was a god of light and if Apollo-8 did little else it certainly shed a lot of it on modern science.

Telecommunications aboard the spaceship had to be something special to be able to provide voice, television, telemetry, and tracking and ranging back to earth. It had to also provide communication among the astronauts in the spacecraft and include the central timing equipment for synchronization of other equipment and correlation of telemetry gear. All of this and still be small, compact, and require minimum drain on the craft's power plant.

The key to the entire telecommunications system in the Apollo series is a new innovation in the tracking network known as Unified S-band. The S-band of frequencies occupies from 1550 mc to 5200 mc.

Unified S-Band

The actual equipment includes two phased-locked transponders and one f.m. transmitter all housed in a single unit. The transponders operate on 2106.4 mc and 2287.5 mc with the f.m. section emitting on 2272.5 mc with identical power outputs of 300 milliwatts. Both sections feed amplifiers increasing their outputs to 2.8 or 11.2 watts.

*6563 Sapphire Drive, Jacksonville, Florida 32208.

The fact that this system does use this particular stretch of frequencies and puts out what some hams might regard as flea power is not really so important as what the system can do in terms of the Apollo mission.

Unified S-band combines the functions of acquisition, telemetry, command, voice, television, and tracking on *one* radio link. This means much fewer antennas to cope with as well as transmitters and receivers, but preserving the capacity to process all the needed data.

This single frequency system makes things simpler on the ground, too. Practically all of the jobs of a tracking station can be performed on one high-gain antenna. For a tracking ship at sea more data can be compiled with less equipment.

Range Measuring System

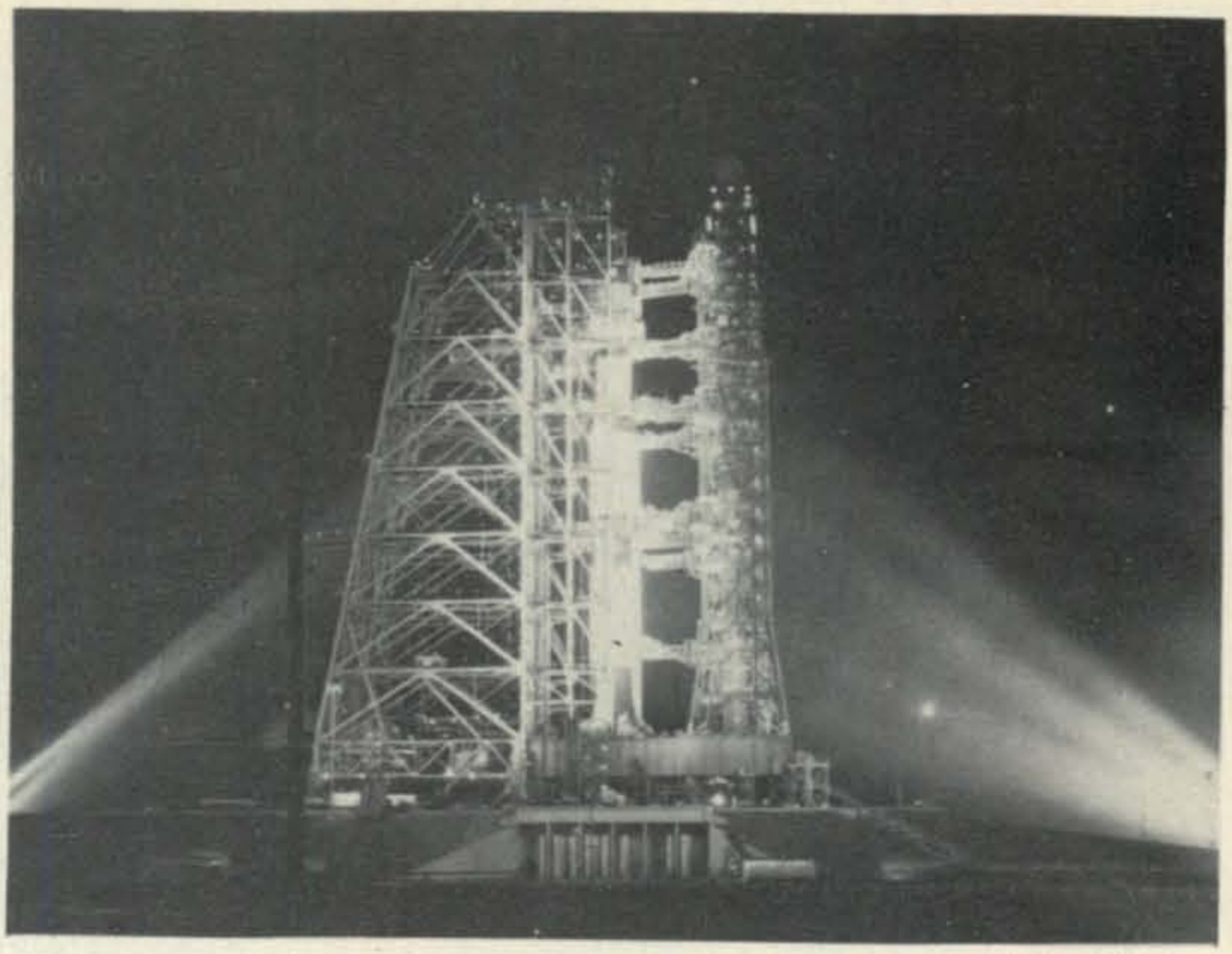
S-band tracking is by the two-way or double-doppler method. In this technique, a stable carrier of known frequency is transmitted to the spacecraft where it is received by the phased-locked receiver, multiplied by a know ratio, and then re-transmitted to the ground for comparison. Because of this, S-band equipment is also referred to as the S-band transponder.

To determine spacecraft range, the ground station phase-modulates the transmitted carrier with a pseudo-random noise binary ranging code. This code is detected by the spacecraft's S-band receiver and used to phase-modulate the carrier transmitted to the ground. The ground station receives the

Table I—Frequency Chart of Apollo Moon Missions

Freq. (mc)	*Mode*	*Information*
2287.500 (sec)	PM	Voice, tracking/ranging, data
2272.500	FM	TV, data
2106.400 (pri)	PM	Voice, tracking/ranging, data
296.800	AM	Voice, data
259.700	AM	Voice, data, Apollo-to-moon
243.000	AM	Recovery beacon

See page 110 for New Reader Service



The night before launch and the Apollo-8 stands majestically on Pad 39 at the Merritt Island Moonport on Florida's east coast. The 363-foot "bird" weighs 6,200,000 lb. with a full load of propellant.

signal and measures the amount of delayed time between transmission of the code and reception of the same code, thus obtaining an accurate measurement of range. Once established, this range can be continually updated by the double-doppler measurements.

Data and Voice Link

The ground stations also can transmit data commands and voice to the spacecraft by means of two subcarriers: 70 kc for up-data and 30 kc for up-voice.

The S-Band transponder is a double-super-

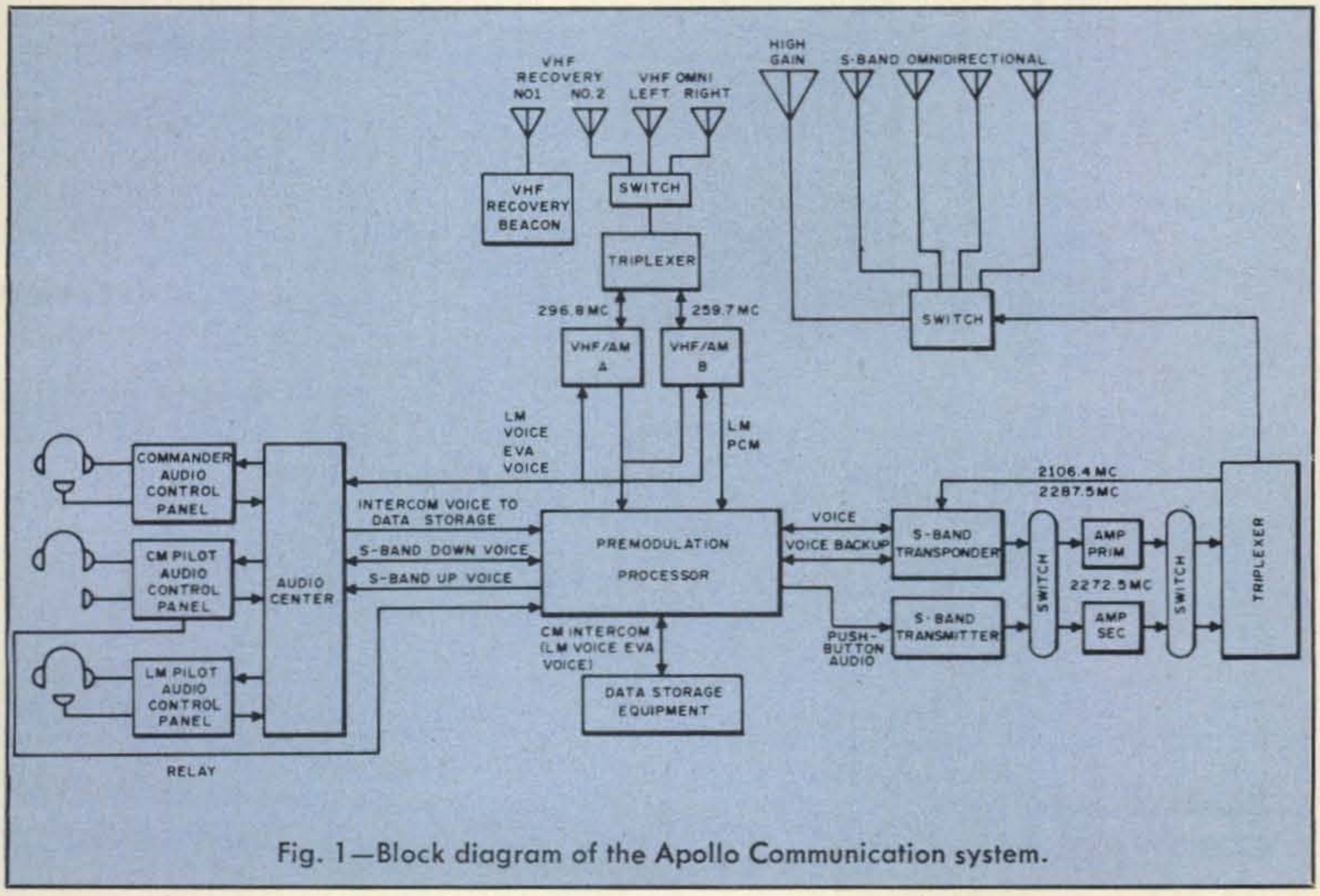


Fig. 1—Block diagram of the Apollo Communication system.

See page 110 for New Reader Service

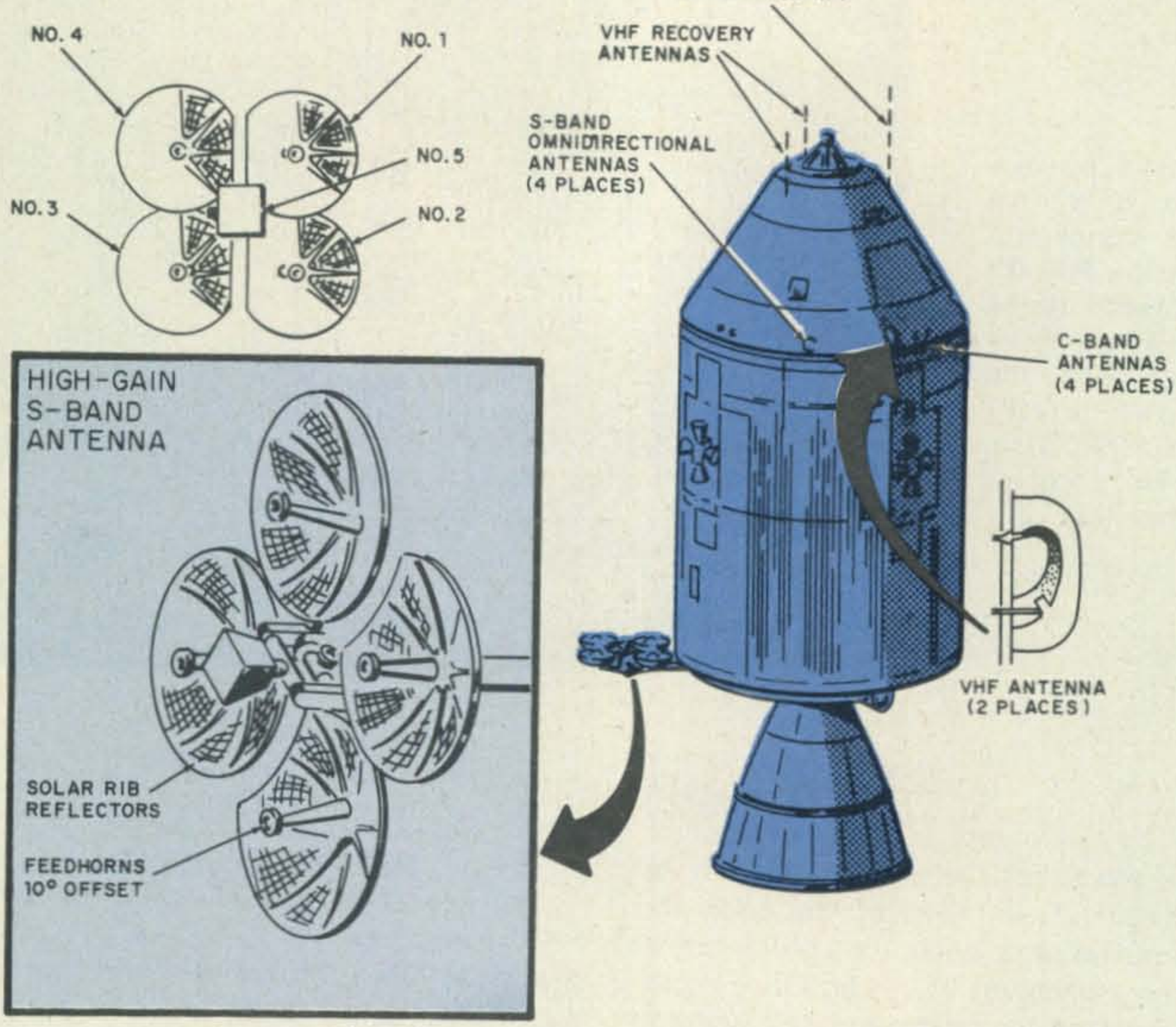


Fig. 2—The S-band high-gain antenna system aboard the Apollo spacecraft. Different antenna combinations provide five different gains and beamwidths as required for various communications situations.

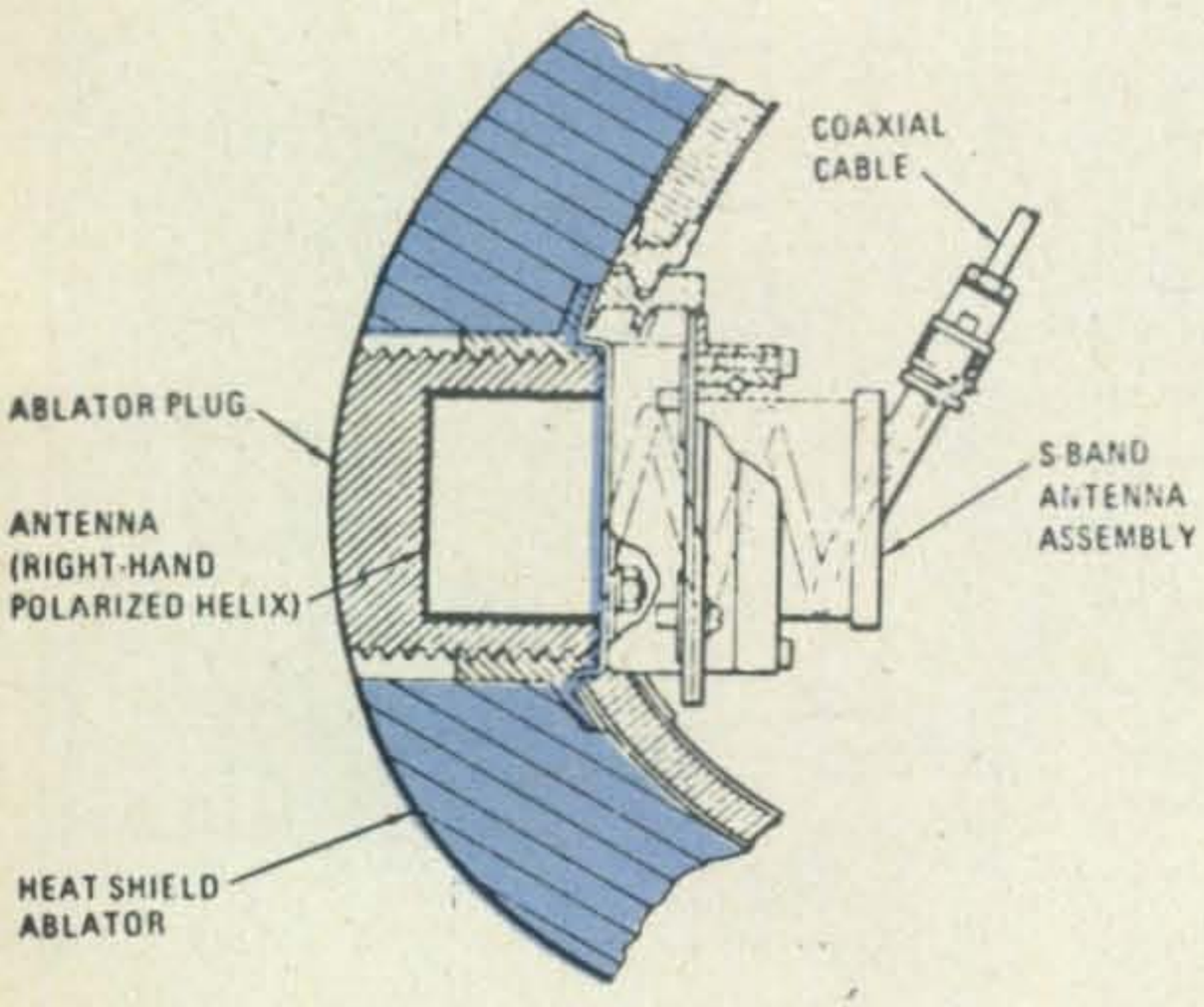
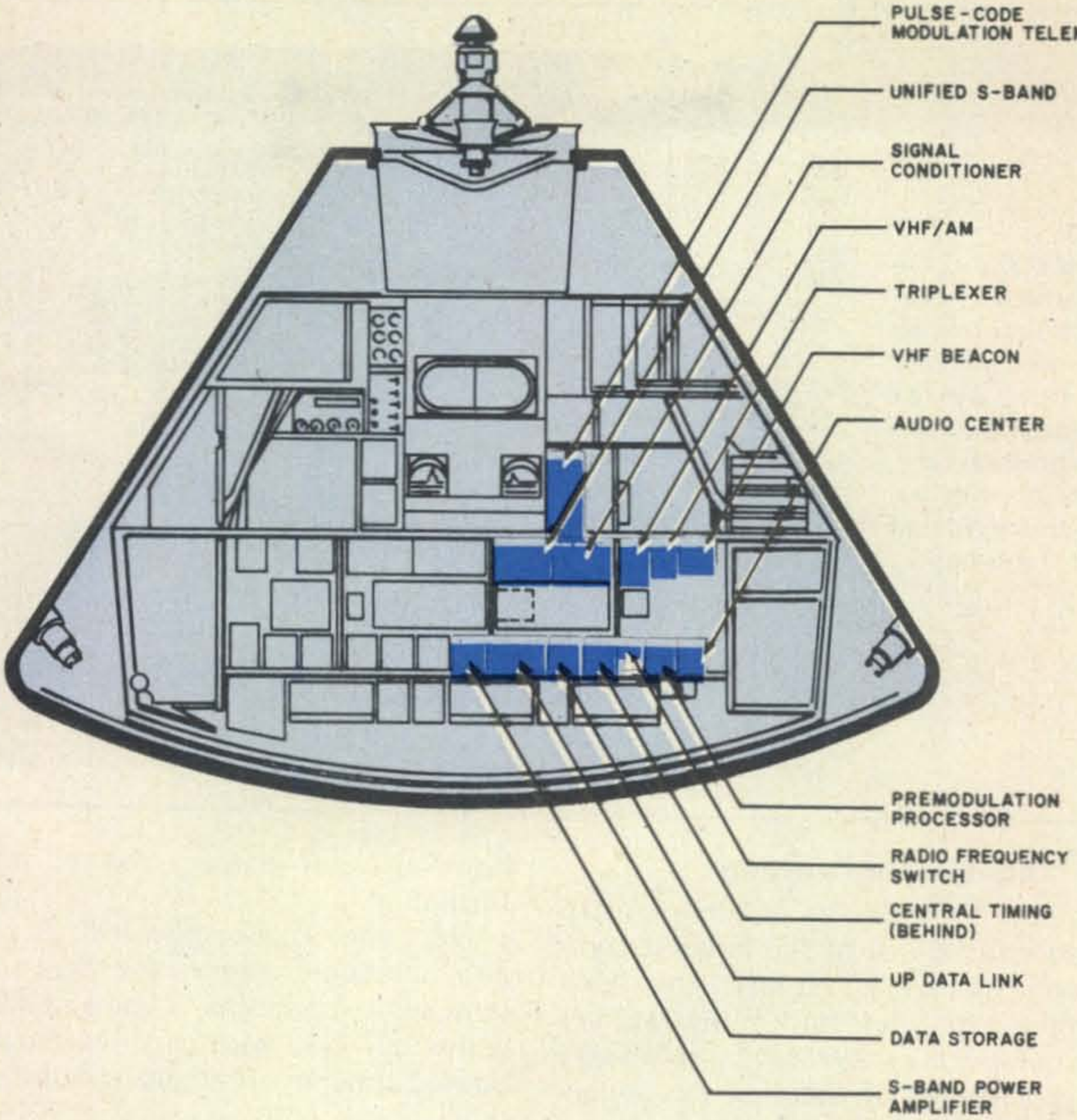


Fig. 3—Four S-band omnidirectional antennas are surface mounted on the spacecraft to provide back-up service for the high gain directional antennas in deep space, and primary coverage in near-earth situations.

het phase-lock loop receiver that accepts a p.m. signal with its two subcarriers, and a pseudo-random noise code when ranging is desired. This signal is supplied to the receiver through a triplexer in the S-band power amplifiers and presented to three separate detectors: the narrow-band loop phase detector, the narrow-band coherent amplitude detector, and the wide-band phase detector. In the latter, the i.f. is detected, and the 70 and 30 kc subcarriers are extracted, amplified, and routed to the data and voice discriminators in the premodulation processor. In the loop-phase detector, the i.f. signal is filtered and detected by comparing it with the loop reference frequency. The coherent amplitude detector provides the a.g.c. for receiver sensitivity control. In addition, it detects a.m. on the carrier from the high-gain antenna system.

The S-band equipment also contains a separate f.m. transmitter which permits sci-

See page 110 for New Reader Service



Location of Apollo telecommunication equipment.

entific, TV, or playback data to be sent simultaneously to the ground while voice, real-time data, and ranging are being sent through the transponder.

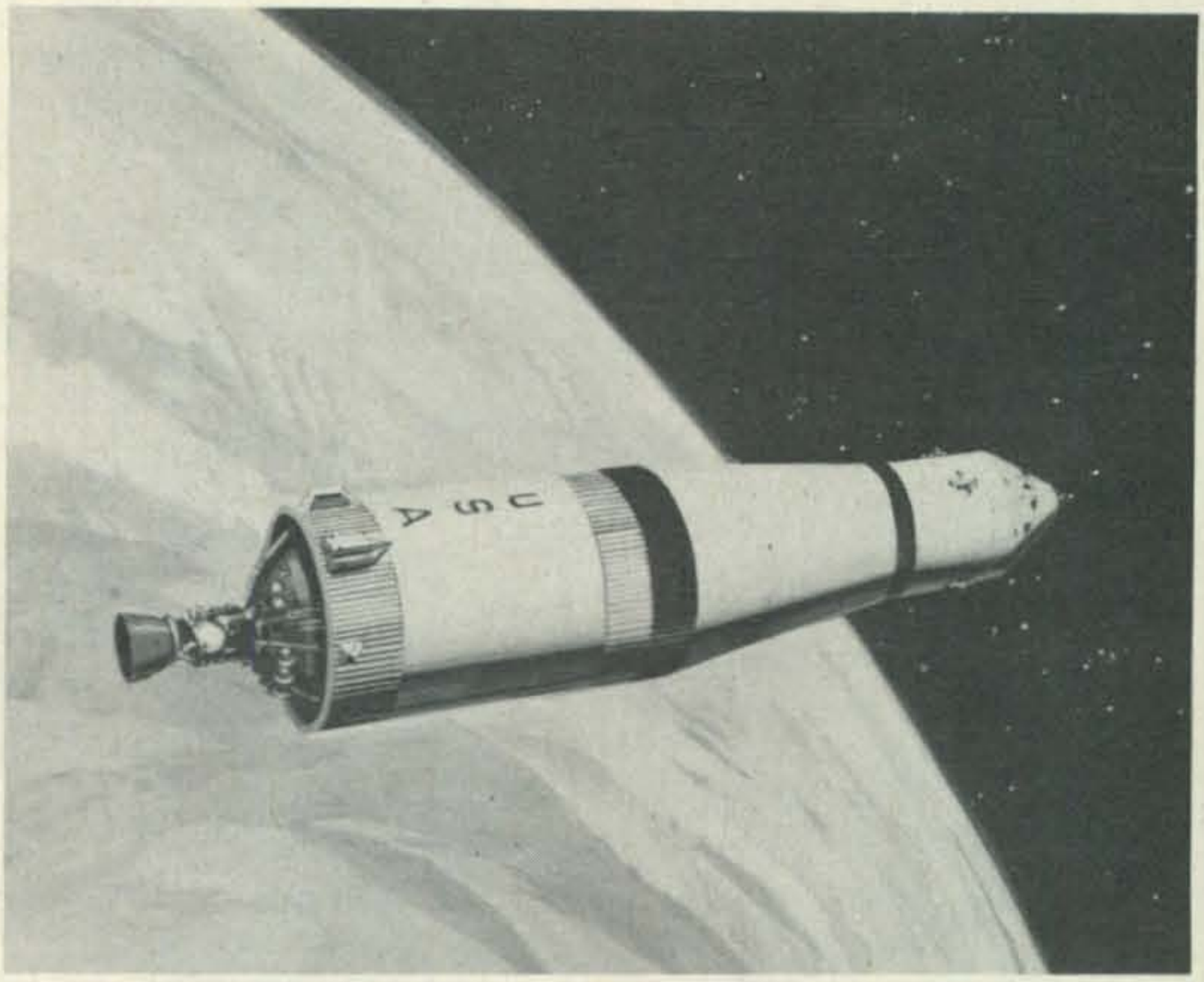
All received and transmitted S-band signals pass through the triplexer. Received signals from the antenna are fed through the triplexer to the receiver, but transmitter outputs are sent first to a pair of amplifiers. Here the signals may either be bypassed directly to the triplexer and out to the antennas, or amplified first if extra signal strength is called for, and then fed to the triplexer. Both low and high power (2.8 and 11.2 watts) are available. The high-power final is automatically chosen for the f.m. transmitter.

Figure 1 shows the audio, r.f. and antenna section in relation to other systems.

The source of much of this space-to-earth communication is the astronauts themselves. Each wears a headset that contains two independently operated earphones and two microphones with self-contained preamps. There is a separate audio control panel for each man that enables him to select any possible combination of transmitting and receiving sources. Push-to-talk is accomplished by a button on the electrical umbilical cable feeding the spacesuit. This button doubles as a key for c.w. in an emergency. At the flick of a switch each man can go from manual to VOX operation.

The audio signals go direct to the premodulation processor where nearly all forms of spacecraft data are assimilated, integrated, and distributed. It accepts signals from telemetry, data storage, TV, central timing, and audio center equipment. It modulates, mixes, and switches these signals to the appropriate transmitter or tape recorder.

See page 110 for New Reader Service



The third stage of the huge Saturn rocket pushes the spacecraft and the three Apollo astronauts out of earth's orbit and into a new world. All communications with the spacemen are carried out on the S-band.

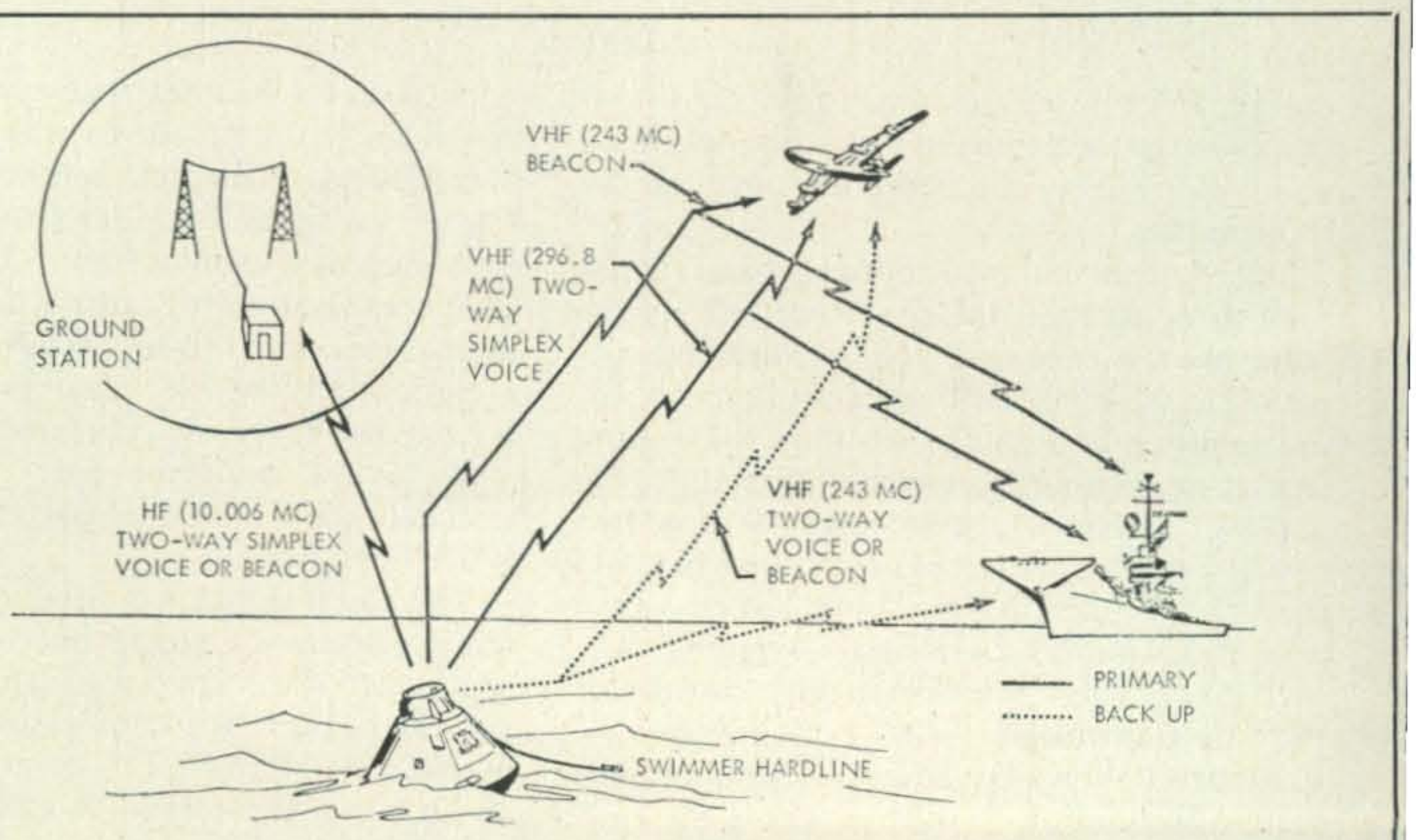
Equipment Function

During the launch, ascent, near-earth phases and splashdown of the mission communication is maintained basically through a 5 watt output a.m. v.h.f. transmitter-receiver combination (primary 296.8 mc, secondary 259.7 mc) capable of simplex or duplex operation. S-band is used as a secondary voice source during these phases of the mision, however, as a primary means for data information.

Once the Apollo spacecraft is in orbit or goes into outer space, the entire operation switches over to the S-band system. When communication with earth is not possible, a limited amount of audio can be stored on tape.

During recovery the a.m. v.h.f. gear and

[*Continued on page 95*]



Methods of communication after splashdown.

See page 110 for New Reader Service

The world's best Ham Antenna

The Hy-Gain DX Long John high frequency beam is far and away the best amateur beam in the world.

It comes in 5 models from 10 to 40 meters. (See specs.) The DX Long Johns are optimum spaced parasitic arrays that are designed to deliver the maximum theoretical electrical performance and greatest mechanical strength and durability attainable on the amateur bands.

You won't find another like this the world over. That's because Long Johns are built like the commercial antennas Hy-Gain makes.

So, each is built to a very rigid commercial specification, using only the finest aluminum and stainless steel.

And, every Long John comes with Hy-Gain's exclusive Beta Match and a super-power balun to make sure you get the top electrical energy transfer with minimum SWR.

When you really start getting serious about DXing, you'll be ready for the Long John. Because with one, you'll have the whole world at your hands.

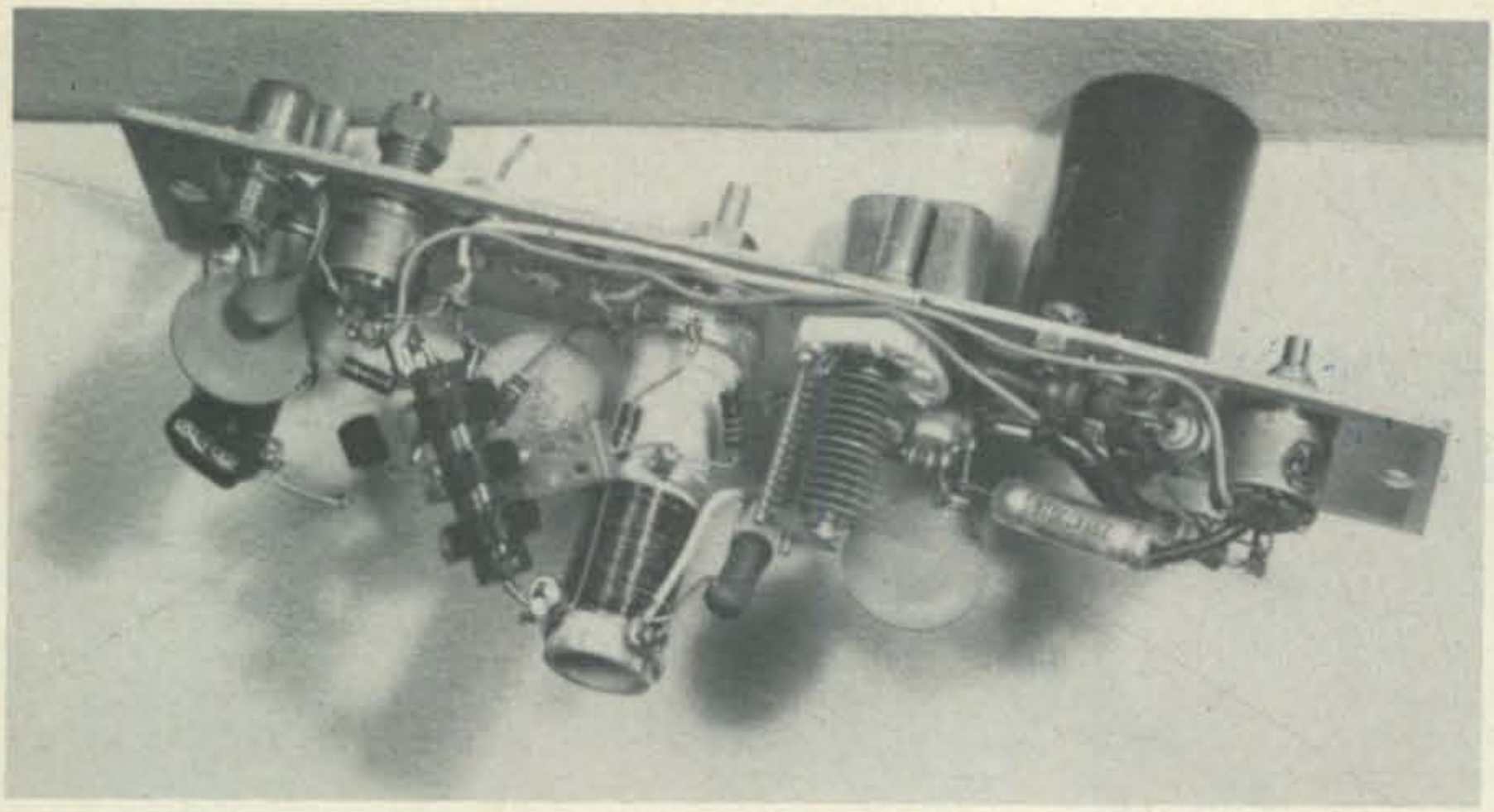
The DX Long John from Hy-Gain*

SPECIFICATIONS	Model 204B 4-Element 20 Meter	Model 403B 3-Element 40 Meter	Model 205B 5-Element 20 Meter	Model 106B 6-Element 10 Meter	Model 155B 5-Element 15 Meter
ELECTRICAL					
Forward Gain	10.33db	9.45db	13.45db	14.5db	13.45db
Front-to-Back Ratio (Average)	23db	25db	28db	22db	20db
Front-to-Side Ratio (Average)	40db	35db	40db	30db	30db
Maximum Power (RF)	5 KW	5 KW	5 KW	5 KW	5 KW
VSWR (at resonance)	1.2:1 Max.	1.2:1 Max.	1.2:1 Max.	1.2:1 Max	1.2:1 Max.
Feedpoint Impedance	50 Ohms	50 Ohms	50 Ohms	50 Ohms	50 Ohms
Half-Power Beam Width (E Plane)	53	59	48	42	47.5
Half-Power Beam Width (H Plane)	72	79.5	64	54	60
Frequency Range (Megacycles)	14 to 14.35	7 to 7.3	14 to 14.35	28.0 to 29.7	21.0 to 21.150
Approx. Bandwidth at Resonance (2:1 SWR)	325 KC	225 KC	370 KC	600 KC	600 KC
Polarization	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.
MECHANICAL					
Longest Element	38 ft.	73.5 ft.	38 ft.	18 ft.	24'8"
Element Diameter (Largest)	1½ in.	2½ in.	1½ in.	1½ in.	1½ in.
Boom Length	31 ft.	46 ft.	46 ft.	32 ft.	31'10"
Boom Diameter (Largest)	4½ in.	4 in.	4 in.	3¼ in.	3½ in.
Turning Radius	24.1 ft.	42.2 ft.	29.7 ft.	17.6 ft.	20.3 ft.
Maximum Wind Survival (No ice)	125 MPH	125 MPH	125 MPH	125 MPH	125 MPH
Wind Load (100 MPH)	360 lbs.	720 lbs.	555 lbs.	224 lbs.	274 lbs.
Total Wind Surface Area (Square Feet)	12.8	23.6	18.1	5.6	6.9
Net Weight (Assembled)	116 lbs.	250 lbs.	185 lbs.	151 lbs.	151 lbs.
Total Number of Elements	4	3	5	6	5
Shipping Weight	160 lbs.	300 lbs.	250 lbs.	167 lbs.	167 lbs.
Shipping Volume (Packaged BCP)	8.9 cu. ft.	21.9 cu. ft.	12.5 cu. ft.	7.8 cu. ft.	7.8 cu. ft.
Shipping Cartons	3	4	3	2	2

For recommended rotators and supporting structures, see Hy-Gain Technical Data Reports on Model RP75 rotating steel pole and Model R-3501 rotators.

Y-GAIN ELECTRONICS CORPORATION • N. E. Highway 6 at Stevens Creek • Lincoln, Nebraska

See page 110 for New Reader Service



Underside view of the v.h.f. phase modulator shows, from left to right, the output connector, (Inductor L_2 is located underneath the connector but is blocked from view by the capacitors.), the Bias Adjust pot, L_1 and the diodes, C_1, T_1, and the A. F. Gain.

A PHASE MODULATOR FOR XTAL CONTROLLED V.H.F. TRANSMITTERS

BY FRANK C. JONES,* W6AJF

THE circuit shown here is useful in obtaining a phase modulated or frequency modulated output from a crystal controlled two meter transmitter. A great many two meter or 146 mc transmitters use crystals in the 8 mc range, so the circuit constants were set up for this range. The phase modulator coil, L_1, has an inductance range of about 25 to 40 microhenrys and the output coil L_2, a center range in the 2 microhenry region. For 6 mc crystals L_1 center range should be around 50 and the output coil L_2 about 3 microhenrys. For 4.5 crystals, the coil values should be around 100 and 6 microhenrys

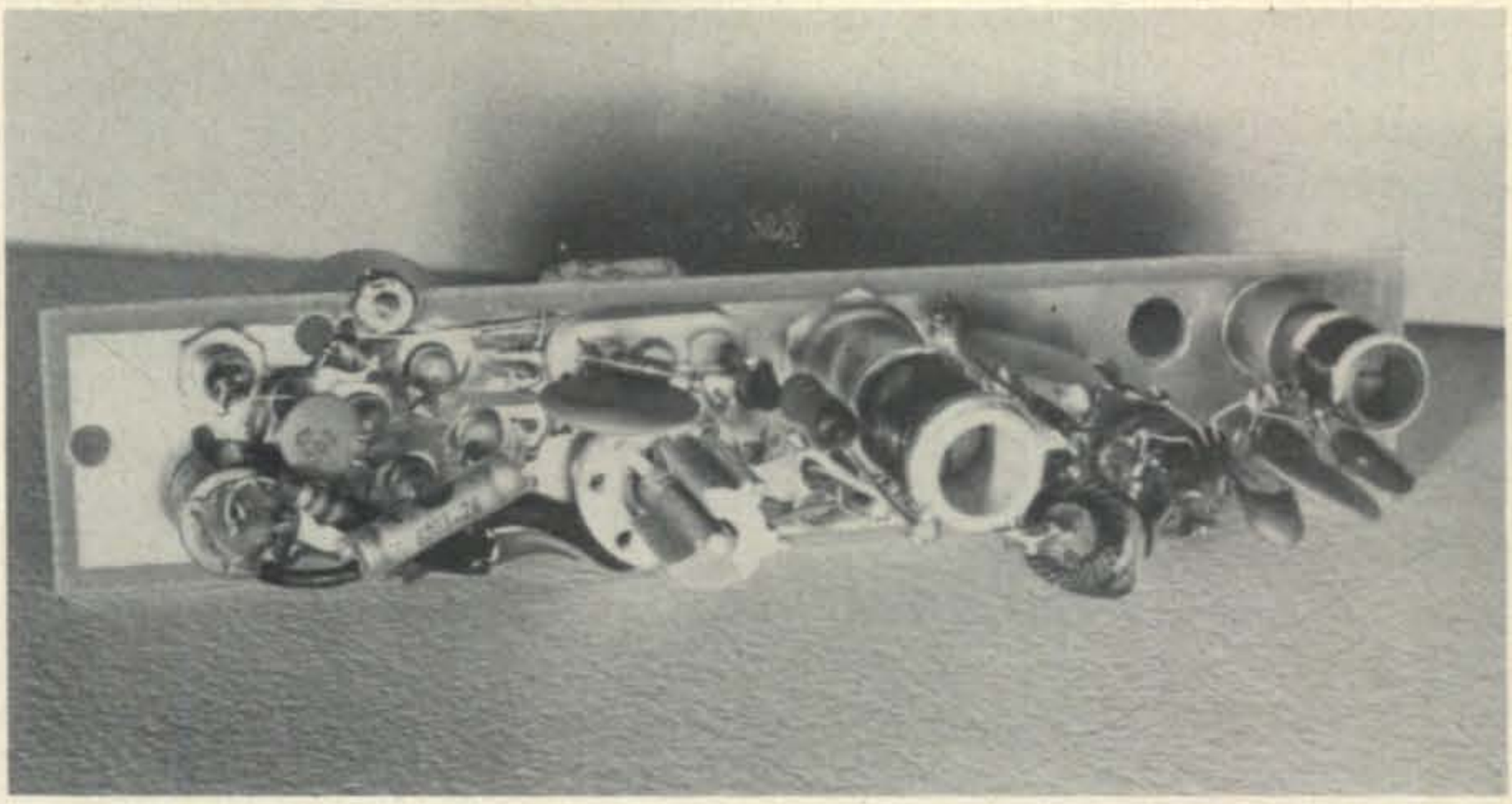
Circuit Description

Since this unit is a solid state device, F.E.T. units were used in the crystal oscillator and buffer stages. Motorola MPF105 transistors work effectively and are in the one dollar class. Silicon diodes such as 1N645 are usable as variable capacitor diodes though they require two or three times as much audio frequency voltage drive as would a regular variable capacitance diode in the 5 to 15 mmf range. Some 1N645 diodes are better than others but the main thing to measure is their back resistance as checked with a high range volt-ohmmeter. The back resistance should be at least 1000 megohms which is the usual value measured here on a few dozen samples. The units are rated at about 200 p.i.v. and 200 ma in power rectifier service. Small power diodes or even "top-hat" diodes are apt to have a capacitance of 5 to 15 mmf with a few d.c. volts of back bias. Computer diodes are not suitable since the capacitance is much lower. The 1N645 diodes are reasonably priced, and a pair of new ones shouldn't cost more than about a dollar.

The phase modulation circuit is slightly different than those usually shown using a reactance tube or transistor or diode as a reactance device across a coil in the output of a crystal oscillator. The two diodes are used like a pi-network with a slug tuned coil set somewhat above resonant frequency of the crystal. In effect the drain output circuit of the crystal oscillator is the input side of the pi-network and the high impedance gate of the buffer stage is across the output side. This

*850 Donner Avenue, Sonoma, California 95476.

See page 110 for New Reader Service



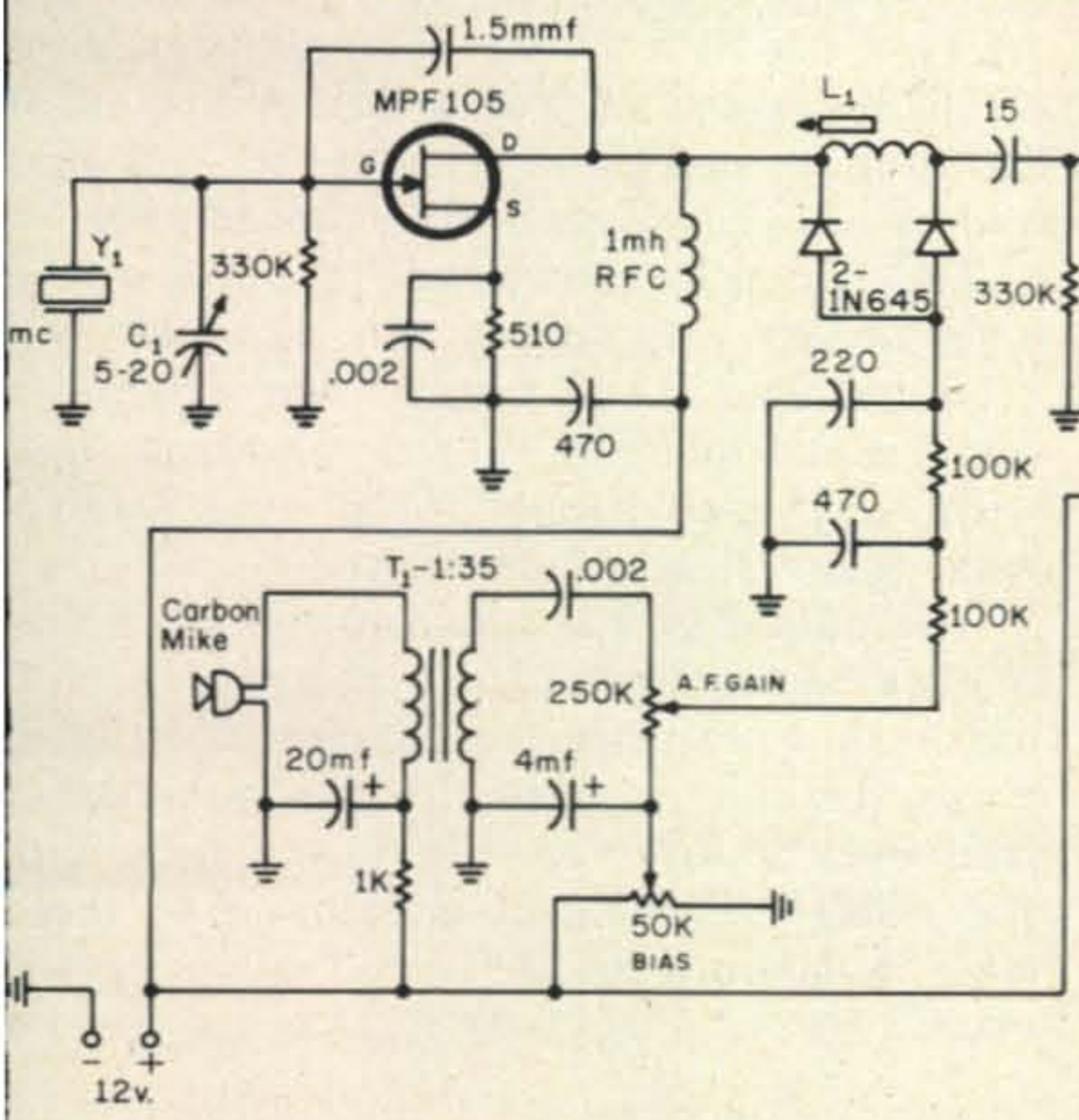
Second underside view of the modulator showing more details of the layout.

reduces the resistive load on the phase modulated coil L_1, and make it easier to get the desired phase angle change with swings of audio voltage. Some frequency modulation probably takes place since this circuit is part of the crystal oscillator, so if extremely pure phase modulation is desired, an extra buffer stage and LC circuit would be needed to isolate the oscillator from the phase modulator. Monitoring the output on two meters indicated acceptable results without an extra buffer stage.

Output Circuit

The output F.E.T. stage acts as an extremely high impedance load on the phase modulator and increases the volt or two of r.f. to about 30 or 40 milliwatts of power into a 50 ohm load, such as the base input of a low-power bipolar transistor doubler or tripler. The input impedance of the latter is apt to be about 50 ohms and it will double the frequency and increase the power to about 60 or 70 milliwatts with a good transistor. A tripler will about break even on power in and out values unless it is a really "hot" transistor, or the system is regenerative. In general, bipolar transistors are better than F.E.T.s for frequency doubling or tripling (also lower priced).

The coupling capacitor from L_1 to the F.E.T. buffer gate was chosen so the r.f.



L_1—55 t. #30 e., 5/8" long on 1/2" dia. slug tuned form; F slug.

L_2—14 t. #26 e., 1/4" long on 3/8" dia. slug tuned form; F_1 slug.

T_1—Carbon mike to grid transformer, approximately 35:1 step up.

Y_1—Crystal, 8+ mc.

Fig. 1—Circuit of a phase modulator suitable for v.h.f. service. All resistors are 1/2 watt; all capacitances one or greater in value are in mmf and capacitors less than one are in mf except where noted otherwise. The output is 30 to 40 mw into a 50 ohm load.

See page 110 for New Reader Service

voltage from gate to source was about one volt. The buffer should operate in the Class A region in order to have high input impedance. This circuit will work even when the F.E.T. is diven into the class B region with lower input resistance such as with an F.E.T. doubler but the phase modulator has to work harder, and regular variable capacitor diodes such as the Int. Rect. Corp. 6.8 Sc20, or PSI PC-112-10 diodes or more modern 10 mmf at 4 volts bias 1N series, are needed. These are more expensive than small power rectifier silicon diodes.

If regular fairly low capacitance diodes of these types are to be used, less a.f. voltage is needed. A 20 to 1 turns ratio transformer in place of the 35 to 1 unit shown in the circuit and photograph, can then be used for connection to the usual carbon microphone. The 1000 ohm resistor from +2 volts was chosen to furnish about 10 ma of current to the carbon microphone. Some units require as much as 50 ma or more in which case a lower value of resistor in the supply lead is needed, such as 200 ohms.

The back bias for the diode modulator was obtained from a potentiometer across the 12 volt supply. It should be adjusted for best sounding modulation as monitored in a phase or frequency modulation v.h.f. receiver.

The 250K pot acts as a deviation control for setting the bandwidth swing on 144, 220, 432, or 1296 mc.

Construction

This unit was built on a surplus piece of copper plated epoxy board about 6 inches long and 1⅛" wide. This will fit into a 6 inch wide chassis as a protective and shielding case. Additional units such as frequency doublers, triplers and amplifiers of either tube or transistor types may be mounted in this chassis. The MPF105 transistors were soldered into the circuit using a pair of long nosed pliers as a heat sink clamped on the transistor leads between the plastic case and the soldering joints. Half inch diameter potentiometers were used for back bias and deviation controls in order to save space. The 5 to 20 mmf variable capacitor (or a 5 to 25 mmf adjustable NPO ceramic trimmer) was included in order to move the crystal frequency into an f.m. net channel. For example, the crystal frequency can be moved a few mc in the two meter band.

Some F.E.T. crystal oscillators with UC734, TIS34, MPF105s, etc., require a small added capacity of 1 to 2 mmf connected from gate to drain as shown in the circuit diagram. Some transistors will oscillate well enough without this capacitor. A very high gain F.E.T. in the buffer stage might tend to oscillate with a 15 mmf gate coupling capacitor. If this problem arises at proper adjustments of L_1 and L_2, use a smaller coupling capacitor such as 5 or 10 mmf, or a higher value of source bias resistor in this stage.

A. F. Circuit

The audio system is about as simple as possible. If some other type of microphone is to be used such as a high impedance crystal mike, a two stage resistance coupled amplifier with MPF103s, should provide approximately a volt or so of a.f. output. This would mean close talking type of operation. If three stages are used for a desk type of microphone, an audio gain control may be needed in addition to the "deviation" control. The latter is really just an a.f. output voltage control.

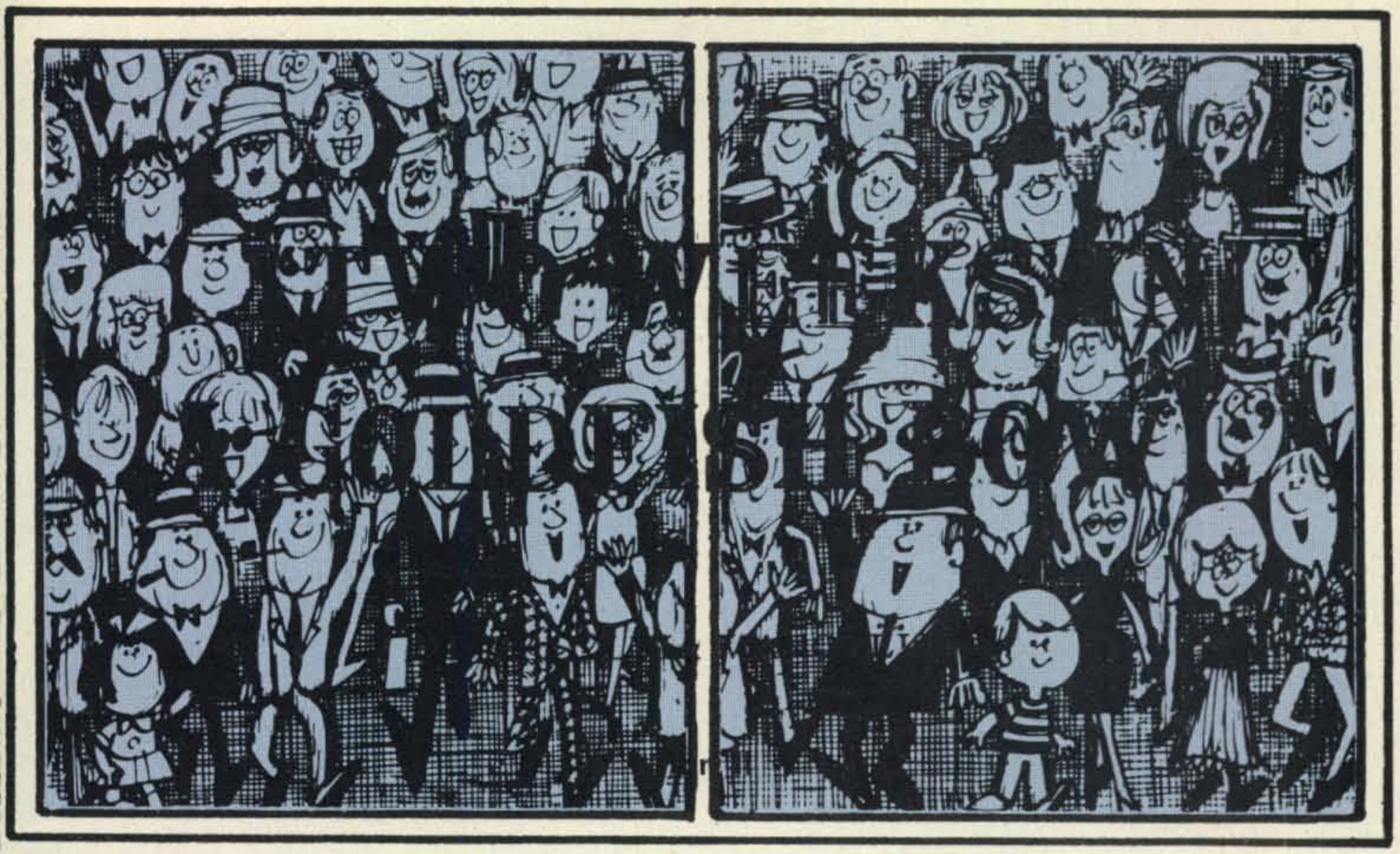
Producing f.m. at two meters requires more a.f. voltage than for 220 mc. Using this unit for 432 mc requires very much less a.f. At 1296 mc with a frequency multiplication of 162 times, the a.f. gain or deviation control has to be turned down to near the back bias and by-pass capacitor end of this control.

The circuit as shown will function with a 6, 9 or 12 volt supply but 12 volts will produce better r.f. output for driving a doubler or tripler stage. It has also been used with an 18 volt supply for driving a fairly good sized tripler stage.

The output coil is tuned to the same frequency as the crystal for maximum r.f. into the load, a transistor or 50 ohm coax lead. The other coil L_1 is usually tuned to a higher frequency in order to obtain oscillation with the crystal. This effect is familiar to those who have used triode tuned plate crystal oscillators with tubes or F.E.T.s. ■

PLEASE USE YOUR ZIP CODE NUMBER ON ALL CORRESPONDENCE

See page 110 for New Reader Service



CAN a radio amateur be said to be radiant over the air? Radiant, like a bride? W2LEC was radiant, for his was the indubitable first QSO with GB2LO. He glowed like a final fit to bust.

All hell broke out after that first QSO. It's surprising how many people are around on a Monday morning, when something unusual crops up on the air. The combination of intriguing callsign and tremendous signal, from that 200 ft. high quad, brought them all out, like bugs in Spring. Second QSO went to G3WRU/M, who had helped during the GB2LO tests, by moving his car all over London to give comparative reports. "I'm 500 yards away, heading in your direction through thick traffic," said Graham, "Is there anywhere I can park?" Just as well ask a Texan if Alaska is the biggest State.

Our duty policeman was outside, as wrought with curiosity as any 80 inches of City of London copper could ever be said to be. They've seen just about everything, these boys, but maybe this one had never seen a radio station in a goldfish bowl before.

"Exhibition radio car approaching, Sergeant," I said. There's nothing like rapid promotion for getting someone to do what you want. "Where can he park?"

"Bring it right up here on the pavement (sidewalk) madam," he suggested. As in a dream, G3WRU/Mobile found himself escorted up onto the sidewalk next to the studio, by a policeman.

"My friends are never going to believe this!" he uttered, as the policeman saluted, then stood loving guard by the car.

The operators had been briefed on the details of the City of London and its Festival. Sometimes enthusiasm might have clashed with accuracy. Far distant amateurs accepted, with good nature, our claim that real estate in the City is the most expensive in the world, which is true. They were well mannered enough to accept, too, the wide spectrum statement that this same estate costs £250 ($600) a square inch. Inch-shminch, foot-shmoot—who cares? Since when did adver-

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

Lunchtime crowds at GB2LO.

See page 110 for New Reader Service

The mobile installation of G3WRU/M, who was allowed to park on the sidewalk, with the blessing of the police.

tising rely on accuracy for effect?

There is a technique to talking big, though, which our operators perfected, although talking big is un-British. The height of that antenna, for instance—it must be conceded that 200 ft. is high, by any standards. In Europe, 200 ft. might as well be 2,000. Only one Italian and one Russian (at Moscow University) antenna are higher. My son, G3UML, who will be wasted in the electronics career he has chosen, for he should go straight onto Madison Avenue, developed an enviable, delicate, throw-away casualness when describing the GB2LO antenna.

Our home antenna is a telescopic tower, resting at 25 ft. and rising to 60 when Don Miller is somewhere that he isn't. So, when we speak to a W6, with his California Kilowatt and 100 ft. tower, Laurie is properly humble. But every dog has his day. G3UML was operating GB2LO and working a gaggle of W6's, one of whom he congratulated on the quality of his signal.

"Maybe it's because I've got my antenna at 160 ft." suggested the W6.

"Really," replied Laurie, in that tone which makes people loathe the British (and do their darnedest to copy them!) "Ours is at 200 ft!" This left the W6 a very worried man indeed.

Five main roads intersect at Holborn Circus, pronounced "Hoe-b'n," where the GB2LO Goldfish Bowl huddled against the bulk of the *Daily Mirror* building. The police assess that 45,000 vehicles a day pass the spot. The noise was so great you could touch it and taste it. The double windows helped keep it within bounds, but the police insisted that all three studio doors be kept open, for safety, when the station was open to the public, so most of the time the traffic noise, together with the normal ruckus of a healthy s.s.b. station, amplified for the audience on the sidewalk, approached a pitch that was almost more than human nerves could stand. An hour of this treatment was as much as most operators could tolerate. One feature which we had not thought to include in our list of operators' essential qualifications was physicial toughness.

An average of 3,000 people a day visited the station. Most were content to stand outside, adequately entertained by the talk-through system. Many were enticed inside and wandered through, to get a closer look at the works and to ask questions. Usually the public were receptive and entranced even by the barrage of QRM and QRN that we couldn't always avoid blasting at them.

Talk-through was achieved by feeding the mic direct to the transceiver and to the high impedance mic input circuit of the public address amplifier. The speaker was similarly connected to a low impedance mic input. When the contact was good, we turned up the volume of the talk-through. But of course radio conditions were awful. Have radio amateurs ever been known to admit that conditions are anything other than awful? So we couldn't always be as discriminating as we'd have liked. Nevertheless, GB2LO made 1,500 contacts in 13 days' operation, with 100 countries.

After only one day, we could see, from the excitement GB2LO was generating all over the amateur world, that we would have to extend operating time beyond the period the station was open to the public—11 A.M. to 4 P.M. Plaintive complaints came from VK/ZL and the West Coast that they wouldn't get a bite of the cherry. So G3UML did two all-night stints, in which he said he had been the center of some of the biggest DX pile-ups he had ever heard, and there was some c.w. night operation, too.

Within seconds of the first, sensational C[all] from John Graham, G3TR, President of the Radio Society of Great Britain, the Goldfish Bowl phone began to ring. Surprisingly, few of the calls concerned TVI! This is the advantage of operating in a place with few residents, like the middle of the Arizona Desert, or the City of London. On Sunday we did interfere a little with the organ in a nearby church, but barefoot operation solved that problem. One day I got a frantic call from the offices of a mighty insurance com-

See page 110 for New Reader Servi

ny, across the road.

"You're coming through on our dictaphone stem!"

"So what do you want we should do?" I plied. They should have taken out insurnce against such a contingency!

Most of the enquiries were to ask what equency we were using and could we be ceived on a transistor radio. Time and again had to explain that, no, it could only be one if you had the local oscillator of a cond receiver to beat with the received gnal. By the end of the exercise, I almost nderstood what it was I was explaining.

One of the first calls came from the B.B.C. was natural that they should take a lively terest in GB2LO, considering that "2LO" as the callsign of one of the world's first ireless stations, that transmitted from Lonon in the early 1920's and developed into hat is known now as the B.B.C. They feared the GB2LO Story in several programs.

In the B.B.C. World Service program with hich I am connected, *World Radio Club*, e had, understandably, covered the story in me detail. Now I had a call from another rogram. Could they come along with a tape corder right away and interview me?

"Be my guest," I coo-ed, swallowing what as left in my glass. The *Daily Mirror* had unched GB2LO in the only possible decent ay!

Minutes later I was closeted with the .B.C. man in an empty *Daily Mirror* office. e switched on his recorder, gave me one ading question and I talked for ten minutes, ithout hesitation, succintly, fluently and, ore remarkable, logically. He switched off nd eyed me with some respect.

"They told me you were good," he said, ut never how good!"

"They never told you how good I can be fter four glasses of champagne, darling!" I plied.

B.B.C. apart, we had plenty of favourable ublicity. Technical magazines the world over ave gone to town on the story. The *Daily Mirror* (daily circulation 5½ million) had a elightful front page story and a couple of ther useful snippets. The "quality" papers ere gracious enough to refer to their noisy val's scoop, but the other popular papers nored us. We heard on the tomtoms that ny one of them would have been glad to play ost to GB2LO, if they had been approached. t was the good luck of R.S.G.B. and the *Daily Mirror* that they got us first.

GB2LO's distinguished neighbour — Sir Alec Rose's tiny sailing boat, *Lively Lady*, in which he had just completed a single-handed circuit of the world.

GB2LO really was a goldfish bowl. The biggest crowds assembled at lunchtime, when office workers are glad of any diversion to enliven their lunchtime stroll. Some regular customers stood, noses pressed against the glass, for close on two hours. Some brought their lunch sandwiches and munched through the QRM.

I guess some of the public didn't understand much of what they were hearing. Hundreds of miniskirted young girls flocked round the studio, like brightly colored, leggy birds, quite captivated, but I got the idea they thought the operators, especially the younger ones, were real, live Disc Jockeys. There was a lot of nudging and grimacing and giggling outside the studio and as much straightening of ties and esoteric fiddling with transmitter controls inside.

Across the road was another *Daily Mirror* City Festival exhibit and one we were proud to have as neighbour. A middle-aged Englishman called Alec Rose had, that week, completed a single-handed circuit of the world in a tiny sailing boat, and been knighted by the Queen on his triumphant return. The boat, *Lively Lady*, so small I wouldn't have crossed Central Park Lake in her, was on public display and Holborn Circus was gay with bunting and flags, including a message in naval code straddling the road, in which we had a vested interest.

The evening *Lively Lady* was to arrive was cold and wet, yet a crowd gathered to see her, so do the British love anything small and brave. There was a great taradiddle of diverted traffic and barriers across the road and impatient police, whilst the last of the decorations was hoisted into place. Then the string broke. A *Daily Mirror* workman ran

ee page 110 for New Reader Service

All kinds of people inspected GB2LO. The gentleman in the formal rig was on his way back from a garden party at Buckingham Palace.

across the studio.

"Got any insulation tape, mate?"

In this context, "mate" conveys no biological sentiment. It's basic Cockney for:

"This is a democracy, whether you like it or not!"

A piece of insulation tape? What a question to ask a coven of radio amateurs!

So there, proudly blazoned across the road, was the message: "THE CITY OF LONDON AND THE DAILY MIRROR SALUTE SIR ALEC ROSE!" held up by a small piece of R.S.G.B. insulation tape! So is history made by Joe Soaps like you and me.

To run an exhibition station for a couple of days is one thing. To run it for two weeks takes stamina. Our operators collaborated staunchly in what became, towards the end of the two weeks, a physical endurance test. Because those doors had to be open, sometimes it was stiflingly hot in the Goldfish Bowl, sometimes so cold we had to wear coats. The British Summer can produce a temperature swing of 30 degrees in as many hours. Meals, although they were excellent and cheap, because we were allowed to use the heavily subsidised *Daily Mirror* Staff Canteen, had to be rushed, because lunch-hour was rush-hour and everybody who could be available was needed "on stage" during the normal lunch hour.

"On stage" is an apt phrase. GB2LO was Show Biz. Soon we were even using theatrical jargon—"Curtain up!" when it was time to raise the blinds and commence the day's performance; "Overture beginners!" to get operator, logger and public relations personnel in position before each opening; and, of course, the inevitable "The Show must go on!"

And Show it was! You had to play to the gallery and often the gallery responded with all the verve you would expect from a London audience. One of the best Stateside signals into G had been, consistently, for many years, that of W1JFG, Willard Cook, Hopedale, Mass. Willard can always be relied on to be there and to be loud and clear. GB2LO contacted Willard and explained where we were and what we were doing.

"QRX," said an excited Willard, "I read about that somewhere. Yes, I remember, there was an article and picture in *CQ Magazine*. I've got it right here!"

The signal was 5/9 with no QRM and the audience outside lapped up the flat, New England voice like it was Frank Sinatra.

By coincidence, of course, I had that issue of *CQ* with me. I riffled through the pages, found the item and held it up for the crowd to see. They clustered round as it were an unexpurgated *"Last Exit"* I was showing them, the ones in front interpreting for the unfortunates in back. There was what public relations people call *spontaneous immediacy* about the situation, which would have been difficult to contrive, even for a public relations expert. And I could have sold that copy of *CQ* a dozen times or more.

The Show must go on! Of course we had an emergency, tears through the greasepaint. And it was a riot. Nothing small time for R.S.G.B. Our backstage emergency involved the Mayors of New York, Washington and Philadelphia and the Lord Mayor of London. no less!

Once GB2LO was launched and I could see it was a success, I thought I could never again have an idea to top it. How can you gild a lily? But, trying to sleep after the excitement of the first day, I suddenly thought:

"Why can't the Mayor of New York talk to the Lord Mayor of London, via GB2LO?"

Why not, indeed? My ever-loving husband, G3NMR, was snoring at my side. This always irritates me. If I can't sleep, nobody shall sleep. I kicked him awake and explained my new idea.

"Lord Mayor won't be allowed to speak. Not a licensed amateur," he grunted, rather nastily, I thought, then he went off to sleep again.

I lay there thinking about that for an hour or so. But if we asked the G.P.O. ever so nicely, even the G.P.O. couldn't be so dense as to refuse permission for the City of London's First Citizen to say a dozen words on GB2LO. They must realize what a tourist attraction such an episode, stage-managed, would be. And Britain needs tourists and

See page 110 for New Reader Service

needs to provide the tourists that do come with something to write home about. In the silence of the suburban night it all worked out logically.

Next morning I had a word with a friend who is a very high-ranking official at the American Embassy in London.

"Let me work on it, honey," he said, "and I'll call you tonight." He worked on it. Late that night I had a call direct from Washington, from another influential friend.

"Do you want the Mayor of New York only, or would you like the Mayors of Washington and Philadelphia, too. honey?" he asked.

"Let's not be niggardly," I replied. "Let's have all three!"

"All we need is a cable from your G.P.O. to the F.C.C. that they will agree, in this one instance, to our using phone patch to link up the three Mayors in one QSO."

Phone patch and 3rd party traffic are, of course, banned in Britain.

An hour later came another Washington call.

"Don't worry about that cable. The F.C.C. have agreed to waive the phone patch clause, in view of the exceptional circumstances."

F.C.C. might be on the ball and wide visioned. Not so the British G.P.O. To our request for permission for the Lord Mayor to say a few words of greeting to three American Mayors, the reply was an unequivocal, bland NO!

I raged and roared and blazed.

"They can't be that stupid! They can't! Besides, I remember that the Lord Mayor of London is above the law within the 1.03 square miles of the City of London. He even takes precedence over the Sovereign in the City. If he wants to talk, he may talk. If anybody complains there's probably a law on the Statute Book that entitles him to have them hanged, drawn and quartered and their heads stuck up on poles on top of London Bridge, or, better still, burnt alive...!"

We must call the Embassy and explain that it was no-go for the Mayors' historical QSO. Fulminating, I discussed the matter with G3BID, Edgar Wagner, who is the cleverest man I know.

"You'll never budge them," he said, "Things like 3rd party traffic, phone patch and allowing unlicensed persons to talk over an amateur rig will never be permitted in Britain, because they might threaten the State's monopoly of telephone and telegraph services. But calm down and ask any American why *they* don't have an outgoing QSL Bureau. Few of them have bothered to find out. They just accept things as they are and join an organization like R.S.G.B. to get the QSL facilities. If they do delve deep enough, they might get quite a surprise!"

The Lord Mayor of London, Sir Gilbert Inglefield, signs the visitors' Book for R.S.G.B. General Manager, G4AR, Eric Dowdeswell.

On July 18, after a gruelling morning rehearsing and recording at the B.B.C., I was having a quiet lunch with my Producer in the B.B.C. Staff Canteen, not as good as the *Daily Mirror's*, but posher. An otherwise delightful man, he has yet to be persuaded that amateur radio affairs should have as prominent a bite of his program as broadcast DX news. I am working on this problem, friends, and hope, by dint of good example and the basic sweetness of my nature, to make him see things my way.

I was in process of working on it when there came an urgent phone message. Would I return to GB2LO at once because:

a) the rig had blown up;

b) the Lord Mayor was to visit the station at 3 P.M.;

c) a News Team from yet another B.B.C. program was waiting to interview me in the Goldfish Bowl.

An R.S.G.B. member who is one of that elite corps, the London taxi drivers, had been sent out to fetch me. He had presented himself to us on the first day of GB2LO, an s.w.l. eager to do anything to help. Each day he appeared for an hour. Where did he leave his taxi in that hotbed of no-parking and fire-breathing policemen, we asked.

"The cab breaks down nearby each day and I leave it with the hood up!" Never did a London taxi drive with such verve and determination through the thick of the City traffic.

I found chaos. The rig had broken down

See page 110 for New Reader Service

Waiting for the sked with A.R.R.L.—G3TR, John Graham, President of the Radio Society of Great Britain, with G6CL, John Clarricoats, and the author. G6CL is wearing his chain of office as Mayor of Enfield.

and my husband was in process of fixing the replacement. Praise be our fiercely contested decision to use commercial gear. Imagine trying to trace and repair a fault in home-brew equipment in one hour!

My husband had been dragged from his business at the busiest hour of the busiest day of the week, to do the exchange. In shirt sleeves, sweating, unshaven, missing his lunch, racing against time, using words I didn't know he knew, he looked as unsavory and villainous as a Corsican bandit on an off-day. If he was still around when the Lord Mayor arrived, we must pretend he didn't belong to us. Otherwise bang would go the image I had been so careful to build and sustain, at GB2LO, of radio amateurs as urbane and respectable citizens.

I coped with the B.B.C. reporter, who was doing a program in Finnish, this time, about GB2LO. He kept asking tactless questions about why the British-made equipment had broken down.

"Nonsense!" I retoned, "the British equipment is perfect. It's the American mic and the Japanese cabling that failed!"

Strangely enough, it was the American mic and Japanese cabling that had failed and set everything else awry. That's public relations.

The duty policeman was all calm.

"Don't worry, madam, it'll be alright, you'll see!" he soothed, as I tried to call the Lord Mayor's office, to make sure he was coming. I was trigger happy about hoaxes. The day GB2LO opened the police got a squeal that 300 hippies were on their way to "take over" the station.

A police inspector came to say the police had no information the Lord Mayor was planning a visit. Therefore the Lord Mayor would not be coming. He was still there when the Lord Mayor's secretary called to say the Boss was on the way.

Meanwhile the substitute rig was in action and contacting W2RP. "Charles, if you want the QSO of a lifetime, QRX about 5 minutes," we said. Charles QRX'd.

The Lord Mayor arrived and you'd have thought we had been preparing for him for a week. The ashtrays were emptied, the floor swept, everybody's hair was in place, except my husband's, and we bundled him neatly out of one door as the Lord Mayor entered the other. Like stage extras a group of American tourists appeared, cameras clicking.

"Welcome to GB2LO, my Lord Mayor," I purred, all public relations and Lanvin's *Arpege*, "there's an American radio amateur in New York standing by to send greetings to the City of London."

W2RP was hoarse with excitement but he carried the occasion off beautifully. Afterwards he told us that, in his long amateur radio career, this had been the highlight.

He wasn't the only amateur who rose splendidly to the occasion. The GB2LO operators were instructed to concentrate on the interesting and informative stations, who would remember there could be several hundred members of the public listening and to quit the technical talk but join with us in the job of entertaining the public, for the sake of amateur radio, everywhere. I thought this might have meant cutting short at least one QSO in two. I was wrong. Almost every contact realized what was required of him. You could practically see radio amateurs all over the world sitting up and preening their whiskers, as they shared our responsibility. One after another they came back with interesting descriptions of their home towns and their jobs, with reminiscences, often funny, of visits to London, with comments about British miniskirts and weather and beer and with beautifully phrased greetings to the listening crowds.

Perhaps the most exciting moment of this exciting fortnight came when R.S.G.B. contacted A.R.R.L. There on sked was John Huntoon, W1LVQ, A.R.R.L. General Manager. In London we had operating G6CL John Clarricoats. This was the first time that R.S.G.B. and A.R.R.L. had ever had an official amateur radio contact. Which make

[*Continued on page 100*]

See page 110 for New Reader Servic

HOWARD W. SAMS BOOKS FOR THE AMATEUR

Advanced & Extra-Class Amateur License Handbook

by Howard S. Pyle, W7OE. Provides all the information you need to obtain your advanced—or extra-class license. Makes preparation for these top licenses far easier for present holders of lower licenses. Includes sample questions for each exam. 192 pages.
20649, *only*.....**$3.95**

General-Class Amateur License Handbook

by Howard S. Pyle, W7OE. A complete guide, including typical FCC test questions and answers, to help you prepare for the Technician, Conditional, or General-Class radio exam. 144 pages. **20639,** *only*.....**$3.25**

Building Your Amateur Radio Novice Station

by Howard S. Pyle, W7OE. Provides complete, easy-to-follow construction details for building an inexpensive transmitter and receiver, plus several valuable accessory items, for Novice or General Class operation. 128 pages. **20050,** *only*.....**$3.75**

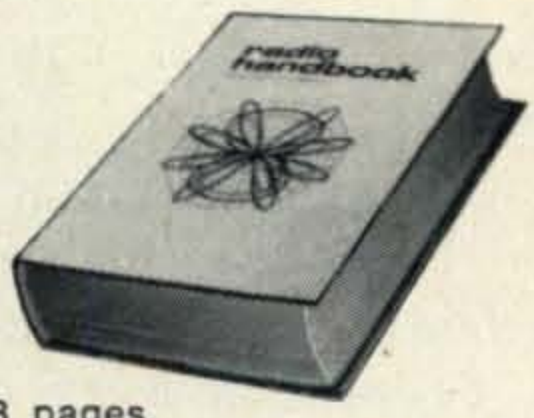
International Code Training System

by International Teaching Systems, Inc. Special programmed charts and 33⅓-rpm recordings help you receive at 2-3 wpm in just a few minutes. You'll be receiving and sending up to 22 wpm with less than an hour of recorded instruction. 96 pages; 6 record sides.
20138, *only*.....**$7.50**

Famous **Editors & Engineers** Books

17TH EDITION OF THE FAMOUS

Radio Handbook



Tells how to design, build, and operate latest types of amateur transmitters, receivers, transceivers, and amplifiers. Provides extensive, simplified theory on practically every phase of radio. All original data, up-to-date, complete, 848 pages.
EE-167, *only*.....**$12.95**

The VHF Amateur

by Robert M. Brown, K2ZSQ/W9HBF. Completely updated handbook incorporating the finest material on vital vhf subjects from the rare back issues of the famous *VHF Magazine*, plus new data of great interest to both old and new vhf men. 160 pages.
EE-65060, *only*.....**$4.50**

Commercial Radiotelephone License Q&A Study Guide

by Woodrow Smith & Robert Welborn. Invaluable preparation for the exams. Questions cover first four elements of the radiotelephone license exam. Answers are detailed and comprehensive. 272 pages.
EE-031, *only*.....**$6.95**

Single Sideband: Theory and Practice

by Harry D. Hooton, W6TYH. The one-source guide to ssb, covering origin and principles, derivation of ssb signals, carrier-suppression techniques, sideband selection, and a complete analysis of ssb equipment. 388 pages. **EE-350,** *only*.....**$6.95**

Transistor Radio Handbook

by Donald L. Stoner, W6TNS & Lester A. Earnshaw, ZL1AAX. Covers the use of transistorized communications equipment for amateur and commercial applications. Provides simplified theory, plus practical construction projects for solid-state equipment. 180 pages.
EE-044, *only*.....**$5.00**

Amateur Radio Incentive Licensing Study Guide

by Robert M. Brown, K2ZSQ/W9HBF and Tom Kneitel, K2AES. Fully explains the new incentive licensing which affects both newcomers and old-timers. Covers all the new FCC Regulations and band allocations. Includes sample exams for Novice, Technician, Conditional, and General-Class licensing. 160 pages.
EE-050, *only*.....**$2.75**

Amateur Radio Construction Projects

by Charles Caringella, W6NJV. Shows how to build novice transmitters, converters, all-band phone-cw transmitter, and others. Provides detailed, easy-to-follow building and operating instructions. 136 pages.
20045, *only*.....**$3.25**

Ham Antenna Construction Projects (2nd Ed.)

by J. A. Stanley. Practical guide to custom-building your own antennas; describes all types of arrays, installation, tuning up and testing; shows you how to make the best use of antenna power. 160 pages.
20654, *only*.....**$3.95**

101 Easy Ham Radio Projects

by Robert M. Brown & Tom Kneitel. A selection of easy-to-build, inexpensive circuits for a variety of worthwhile ham devices. Provides brief descriptions, construction hints, diagrams, and parts lists; includes substitution guide appendix. 160 pages. **20674,** *only*.....**$3.95**

Transistor Transmitters for the Amateur

by Donald L. Stoner, W6TNS. Shows how to build solid-state crystal checker/calibrator, low-power cw xmitter and eight other transistorized projects. 128 pages.
20450, *only*.....**$3.25**

Amateur Radio Antennas (2nd Ed.)

by Harry D. Hooton, W6TYH. Provides full details on theory, design, construction, and application of antennas. Tells how to select the best antenna system for optimum performance. 176 pages. **20611,** *only*....**$3.95**

Practical Ham Radio Projects

by Charles Caringella, W6NJV. Includes circuit diagrams, parts lists, and detailed instructions for building 12 unique and useful ham shack devices at the lowest possible cost (no item exceeds $50). 128 pages.
20042, *only*.....**$2.95**

Transistorized Amateur Radio Projects

by Charles Caringella, W6NJV. Presents a complete selection of transistorized ham radio construction projects for the beginner as well as advanced amateur. Includes several printed-circuit board projects and the negatives for etching them. 140 pages.
20570, *only*.....**$3.50**

So You Want to Be a Ham (4th Ed.)

by Robert Hertzberg, W2DJJ. Completely revised to include information on the incentive licensing. This is the book to have to learn about amateur radio, ham equipment, operating procedures, and how to pass the FCC exam. 192 pages. **20607,** *only*.....**$4.50**

ABC's of Ham Radio (3rd Ed.)

by Howard S. Pyle, W7OE. Enlarged and updated to include all the study material required to obtain the novice-class license. Covers latest FCC regulations, including new incentive licensing provisions. 144 pages.
20638, *only*.....**$2.95**

Amateur Radio Mobile Handbook

by Charles Caringella, W6NJV. Provides complete information for going mobile. Explains circuitry and construction of commercially bulit mobile amateur equipment. Shows how to build mobile converters, transmitters, transceivers, and modulators, etc. 176 pages.
20035, *only*.....**$3.50**

HOWARD W. SAMS & CO., INC.

Order from any Electronic Parts Distributor, or mail to Howard W. Sams & Co., Inc., Dept. CQ-3
4300 W. 62nd St., Indianapolis, Ind. 46268

Send the following books: Nos._____

_____ $_____ enclosed

☐ Send FREE 1969 Sams Book Catalog

Name_____
PLEASE PRINT

Address_____

City_____ State_____ Zip_____

See page 110 for New Reader Service

Announcing

THE CQ WORLD WIDE WPX SSB CONTEST

April 12-13, 1969

I Contest Period: Starts: 0000 GMT Saturday. Ends: 2400 GMT Sunday. Only 30 hours of the 48 hour contest period permitted for Single Operator stations. The 18 hours of non-operating time may be taken in up to 5 periods anytime during the contest, and must be clearly indicated on the log. Multi-operator stations may operate the full 48 hours.

II Objective: Object of the contest is for amateurs around the world to contact as many amateurs in other parts of the world as possible during the contest period.

III Bands: All bands, 3.5 thru 28 mc may be used, but operation is confined to two-way single sideband *only*.

IV Type of Competition: 1. Single Operator (a) All Band, (b) Single Band. 2. Multi-operator, All Band, *only*. (a) Single Transmitter, (only one signal permitted) (b) Multi-Transmitter, (one signal per band permitted)

V Exchange: Five figure serial number, RS report plus a progressive three digit contact number starting with 001 for the first contact. (Continue to four digits if past a 1000) (Multi Transmitter stations use separate numbers for each band.)

VI Points: 1. Contacts between stations on different continents count three (3) points.

2. Contacts between stations on the same continent but not in the same country count one (1) point. (Exception: Contacts between stations in different countries in North America count two (2) points. (This applies to contacts within N.A. boundries only.)

3. Contacts are permitted between stations in the same country for the purpose of obtaining a Prefix multiplier, but have no QSO point value.

The WAC continental boundries will be the standard.

VII Multiplier: The multiplier is determined by the number of different prefixes worked.

A "prefix" is considered to be the two or three letter/number combination which forms the first part of an amateur call. (W1, W2, WA2, DL1, DJ, 4X4, 5A1 and etc. See WPX rules.)

Each prefix may be counted only *once* during the contest.

VIII Scoring: 1. Single Operator (a) All Band score, total QSO points from all bands multiplied by the number of different Prefixes worked. (b) Single Band score, QSO points on that band multiplied by the number of different Prefixes worked.

2. Multi-Operator stations. Scoring in both these categories is the same as the All Band scoring for Single Operator.

3. A station may be worked once on each band for QSO point credit. However, prefix credit can be taken only *once* regardless of the band.

IX Awards: Certificates will be awarded to the highest scoring station in each category listed under Sec. IV.

1. In every participating country.

2. In each call area of the United States, Canada and Australia.

All scores will be published. However to be eligible for an award, a Single Operator station must show a minimum of 12 hours of operation. Multi-operator stations must show a minimum of 24 hours.

A single band log is eligible for a single band award *only*. If a log contains more than one band it will be judged as an all band entry, unless specified otherwise. However a 12 hour minimum is required on the single band.

In countries or sections where the returns justify, 2nd and 3rd place awards will be made.

X Special Awards: 1. WORLD—Single Operator, Single Band. A trophy donated by Jack Chalk, KW6EJ.

2. WORLD—Single Operator, All Band. A Trophy donated by Paul Bavassano, I1RB.

3. WORLD—Multi-operator, single transmitter. The Ted Thorpe, ZL2AWJ Memorial Award, donated by Don Miller, W9WNV.

4. WORLD—Multi-operator, multi-transmitter. The Chuck Swain, K7LMU· Memorial Award, donated by Don Miller W9WNV.

5. CANADA — Single Operator, Single Band. A Trophy donated by Gene Krehbiel, VE6TP.

6. OCEANIA—Single Operator, All Band.

See page 110 for New Reader Service

WORLD-WIDE WPX SSB CONTEST

Page 1 of 5 Pages

CALL 4U1ITU Log For 14 Mc Band COUNTRY ITU

(Use separate log for each band.)

DATE / Time GMT	STATION	SERIAL NUMBER Sent	SERIAL NUMBER Received	Fill in only when QSO is mult. PREFIX	Points
0003	K1HVV	59001	57004	K1	3
05	WA2SFP	59002	57004	WA2	
06	VE1HI	58003	59001	VE1	
09	HI8XAL	59004	59003	HI8	
10	K3EWA/VO1	57005	57003		
12	VE6TP	57006	56006	VE6	
25	WA4PAP	56007	56010	WA4	
36	W9EWC	55008	55011	W9	
48	KV4CL	56009	53009	KV4	
56	VE1HI	55010	43001	DUP	0
OFF.	0100 -	0400 -	3 HRS.		
0405	YV5BIG	59011	59008	YV5	3
09	YV5AGD	59012	59009		
11	HK4RET	58013	57051	HK4	
13	HC1EY	57014	56090	HC1	
33	CX9CO	56015	55091	CX9	
45	PY1CQ	56016	55100	PY1	
0406	VK9GN	56017	56516	VK9	
12	VK2APK	57018	57525	VK2	
13	VK3UV	56019	56320	VK3	
14	VK3AXX	56020	56140		
35	ZL1KG	56021	56615	ZL1	
47	KW6EJ	55022	55555	KW6	
OFF	0700 -	1000 -	3 HRS.		
1000	G3NMH	53023	59026	G3	1
02	DL4FS	57024	57061	DL4	
03	DL4SK	59025	54561		
05	DJ6WT	59026	54770	DJ6	
17	ST5NG	56027	56600	5I5	3
26	I9BB	57028	57[illegible]21	I9	1
29	DL4FS	59004	59002	DUP	0
36	OH2AM	58030	58162	OH2	1
42	4X4FM	56031	56[illegible]2	4X4	3
53	UR2AR	57032	57461	UR2	1
OFF	1100 -	1700 -	6 HRS.		
1201	JA1BEA	55033	57112	JA1	3
05	VU2DBZ	55034	55140	VU2	
10	UL7JA	55035	57181	UL7	
15	UA9KHA	55036	55306	UA9	
20	DU1FH	55037	55475	DU1	
			TOTAL POINTS THIS SHEET	31	91

CQ Form 1069 eff. Feb. 1968

A sample log sheet already filled out. Official log sheets are available from CQ, see (7.) below.

A trophy donated by Jack Chalk, KW6EJ.

XI Club Competition: No club award is planned at this time, however one may be given if sufficient interest is shown.

XII Log Instructions: 1. All times must be in GMT. The 18 hour non-operating periods must be clearly shown.

2. Use a separate sheet for each band.

3. Prefix multipliers should be entered only the FIRST TIME they are contacted.

4. Logs must be checked for duplicate contacts and prefix multipliers. Recopied logs must be in their original form, with corrections clearly indicated.

5. A prefix check list is not only desirable but a *must* for proper contest operation. (It is recommended that you also send it along with your contest log.

6. Each entry must be accompanied by a Summary Sheet listing all scoring information, the catagory of competition and the contestant's name and mailing address in BLOCK LETTERS.

Also a signed declaration that all contest rules and regulations for amateur radio in the country of the contestant, have been observed.

7. Official log and summary sheets are available from *CQ*. A large self-addressed envelope with sufficient postage or IRCs must accompany your request.

If official forms are not available you can make your own by following the attached sample, with 40 contacts to the page.

(Daystrom Limited has made an International Log Form which is available to Canadian amateurs. We will supply them with Summary Sheets. Write to: 1480 Dundas Highway East, Cooksville, Ontario.)

XIII Disqualification: Violation of the regulations of amateur radio in the country of the contestant, or unsportsmanship conduct, or taking credit for incorrect QSOs or Prefixes, or duplicate contacts in excess of 3% of the total made, will be deemed sufficient cause for disqualification.

Actions and decisions of the Committee are official and final.

XIV Deadline: All entries must be postmarked *no later* than May 15, 1969. In rare isolated areas the deadline will be made more flexible.

Logs go to: CQ WPX SSB Contest Committee, 14 Vanderventer Avenue, Port Washington, L.I., N.Y. 11050. ■

See page 110 for New Reader Service

COMMUNICATING THROUGH MOONRAY

BY KENNETH J. DOYLE,* WA2QMC

MANY readers, in response to several recent articles[1,2] on Project MOONRAY, have requested information concerning the type of equipment needed to work through the lunar package. NASTAR[3], originator of Project MOONRAY, has chosen enough of the parameters to make reasonably accurate predictions of antenna, receiver and transmitter requirements at this time.

Background

Project MOONRAY is the original concept of Nick Marshall, W6OLO, President of NASTAR. Nick was formerly Technical Director of the OSCAR program and responsible for design, development, engineering and testing of OSCAR's I, II and III: Project MOONRAY has been actively pursued at NASTAR since 1967 under the able leadership of W60L0.

MOONRAY will be a five pound, isotope fueled-thermo-electric powered, 432 mc translator that will be capable of relaying all types of amateur signals from any one part of the world to any other, both locations being line-of-sight to the moon. NASTAR will ask NASA to take the MOONRAY package along on the third Apollo/LM lunar mission sometime in the early 1970's, and have it placed on the lunar surface by one of our Astronauts, (hopefully a ham). NASA is also interested in MOONRAY's ability to act as backup emergency communications package and as a site relocator beacon. NASTAR is presently preparing a technical proposal to NASA. This proposal will outline in detail the technical and engineering aspects of the project including objectives, equipment description, overall size and weight, power requirements, spacecraft and environmental constraints.

Design Philosophy

The MOONRAY design philosophy is to build a free-access u.h.f. translator that will be usable by as many Amateurs as possible while providing world-wide coverage. The target design objective for the continuous operating lifetime of the package is one year, which, of course, depends on several factors including the ability of MOONRAY to survive thermal cycling, high intensity neutron and gamma flux radiation damage, solar radiation, cosmic rays, meteorites, erosion, semiconductor degradation, fatigue, etc.

A summary of MOONRAY parameters is given in Table I. An excellent analysis of the basic parameters can be found in a recent *CQ* article[2].

Frequencies

The translator will operate in the 432 mc band, with an up-link frequency (Earth-to-Moon) near 440 mc and a down-link frequency (Moon-to-Earth) near 430 mc. These frequencies have been chosen to provide the widest possible separation between input and output channels to permit full duplex operation while remaining within the internationally allocated part of the 70 cm band. Six to twelve channels of telemetry will time share with the translator. During the first minute of every 10 minute period, normal operation of the translator will be interrupted and the "SS" identifier and telemetry sequence will be transmitted in Morse code.

A separate command shut-off receiver and decorder, inside the MOONRAY package, operating near 450 mc will permit earth-based turn-off and later, turn-on of the

*NASTAR, P.O. Box T, Syosset, N.Y. 11791.

See page 110 for New Reader Service

MOONRAY transmitter.

C. W. Or Voice?

While MOONRAY wil be capable of translating virtually any type of emission, c.w. appears to offer the best threshold sensitivity. Researchers have found that the human ear can detect the presence of a single audio tone as much as 20 db below the noise[4]. Slow c.w. keying, on the order of 5 to 10 w.p.m.. can be copied with better than 90 percent readability with signal-to-noise ratios of −10 db or less. In comparison, voice signals usually require a 4 db to 6 db S/N ratio for the same intelligibility.

A c.w. signal normally occupies a bandwidth of 100 cycles or less as compared to 2 kc or more for a voice signal. Thus, our c.w. receiving bandwidth need only be 1/20th of that required for voice. This results in a 13 db advantage of c.w. over voice due to bandwidth considerations alone. Also, ten or more c.w. stations can occupy the same space normally occupied by only one voice station.

From the above, it is obvious that far less power and a smaller antenna will be needed for c.w. communication than for voice. It is for this reason, that all calculations in this article will assume that c.w. is being used.

Up-Link And Down-Link Power Budget

Let us now calculate the MOONRAY I up- link and down-link power budget based on the parameters of Table I. The power budget, shown in Table II, is simply a tabulation of system gains and losses, including space path losses from which we can obtain the minimum effective radiated power (e.r.p.) and receiving system sensitivity needed by an earth station for c.w. communications through MOONRAY.

- TYPE OF UNIT:
  Free access dual frequency duplex translator with time-shared telemetry.
- MOONRAY DESIGN OBJECTIVE:
  One full year of continuous operation with usable signals world-wide.
- OPERATING FREQUENCIES (Approx.)
  Up-link (earth to Moon).....440 mc
  Down-link (moon to earth)....430 mc
  Telemetry
  (time-shared with translator)..430 mc
  Command Turn-off
  (and Turn-on) .....450 mc
- MOONRAY RECEIVER (All Solid State and integrated circuitry)
  †Noise figure.....1 to 3 db (Estimated state of the art by 1972)
  †Sensitivity .....−164 dbw
  †Selectivity.....5 kc at 3 db points
  Signal acceptance....c.w., a.m., f.m., s.s.b., FSK, AFSK, m.c.w., FAX & SSTV
- MOONRAY TRANSMITTER (All solid state and integrated circuitry):
  Type of Modulation....Narrow Band f.m. (or p.m.) (Hard Limiting employed)
  †Output Power....2.8 Watts (3.8 dbw)
  Telemetry.....6 to 12 channels of data in Morse Code
  Identifier ....."SS"
  Command
  Shutdown .....Earth-originated command turnoff (and turnon) capability
- MOONRAY ANTENNA (10 foot diameter Parabolic Dish—Aluminized Mylar):
  †Gain.....17 db at 3 db points
  Beamwidth.....16° at 3 db points
  Orientation .....Fixed, towards Earth's center
  Polarization .....Linear
- MOONRAY POWER SUPPLY:[7]
  Type....Isotope fuel Thermoelectric converter
  Voltage (from d.c./
  d.c. converter).....10 VDC ±0.5 Volt
  Current .....500 ma
  Nominal Continuous
  Power Output.....5 Watts DC
  Thermal Surplus..200 Watts of Heat
  Operating Lifetime
  (Isotope half-life).....87½ Years
  Nominal Power Supply Life
  (Continuous Duty).....2 to 5 Years*

Table I—Proposed parameters for Moonray I. Parameters marked by (†) are used in the Power Budget Calculations of Table II. Nominal power supply operating life (*) end point will be determined by the ability of Moonray I to survive thermal cycling (Lunar days and nights), high intensity neutron and gamma flux radiation damage, solar radiation cosmic rays, meteorites, erosion, semiconductor degradation, fatigue, etc.

See page 110 for New Reader Service

Table II—
Moonray I Power Budgets for C.W.

- UP-LINK POWER BUDGET:
  - Noise Power Density (10 log KT).....−204 dbw
  - MOONRAY Receiver Noise Figure.....3 db
  - MOONRAY Receiver Bandwidth (5 kc).....37 db
  - MOONRAY Receiver Sensitivity .....−164 dbw
  - Path Loss.....197 db
  - MOONRAY Antenna Gain.....17 dbi
  - Required S/N Ratio for c.w.....0 db
  - Misc. Losses.....3 db
  - Minimum Required Effective Radiated Power of Earth Station.....19 dbw (80 Watts)
- DOWN-LINK POWER BUDGET:
  - Path Loss.....−197 db
  - MOONRAY Transmitter Power .....3.8 dbw
  - MOONRAY Antenna Gain.....17 dbi
  - Required S/N Ratio for c.w.....0 db
  - Misc. Losses.....−3 db
  - Required Earth Receiving System Sensitivity .....−179 dbw

Table II—Moonray power budgets for c.w.

Note that in calculating the down-link power budget, we introduce a loading factor of −6 db. It is a typical characteristic of hard-limiting translators that if two signals are present in the passband and one of these signals is stronger than the other by 6 db *or more*, then the weaker of the two signals will be supressed by another factor of 6 db.[5,6] In other words, the stronger signal will command a disproportionate amount of power. This, of course, assumes that both c.w. signals are key-down at the same instant. Thus, the −6 db loading factor can be considered as a worst case estimate when two or more stations are operating key-down simultaneously.

Earth Station Requirements

From Table II, we find that an earth station, using c.w., need only have an effective radiated power of 19 dbw (80 watts) and a receiving system sensitivity of −185 dbw in order to communicate through MOONRAY. The *overall* S/N ratio will be −3 db.

To obtain your own station's effective radiated power (e.r.p.) and receiving system sensitivity, determine your transmitter power output, receiver noise figure and bandwidth, and antenna system gain. Note that the antenna system gain is calculated by subtracting any transmission line loss from the antenna gain expressed in *db over an isotropic source* (dbi). Most amateur antennas are measured with reference to a dipole. But, a halfwave dipole has a gain of approximately 2 dbi. Therefore, it is equivalent to 10 db +2 db or 12 dbi. Beware of the gain claims of many antenna manufacturers. They may be high by 3 db or more. When designing lunar communications systems, it is always best to be on the conservative side.

Receiving System Sensitivity

The receiving system sensitivity, *S*r, may be calculated from the following formula:

$$S_r = 10 \log kTB - Gr + NF$$

where S_r = Receiving system sensitivity.
k = Boltzmann's constant (1.38×10^{-23} joule /°K).
T = System temperature (290°K = room temp.).
B = Receiver noise bandwidth.
G_r = Receiving system antenna gain (in d. b. i.) which is the receiving antenna gain minus line loss.
NF = Receiver noise figure in db over kTB.

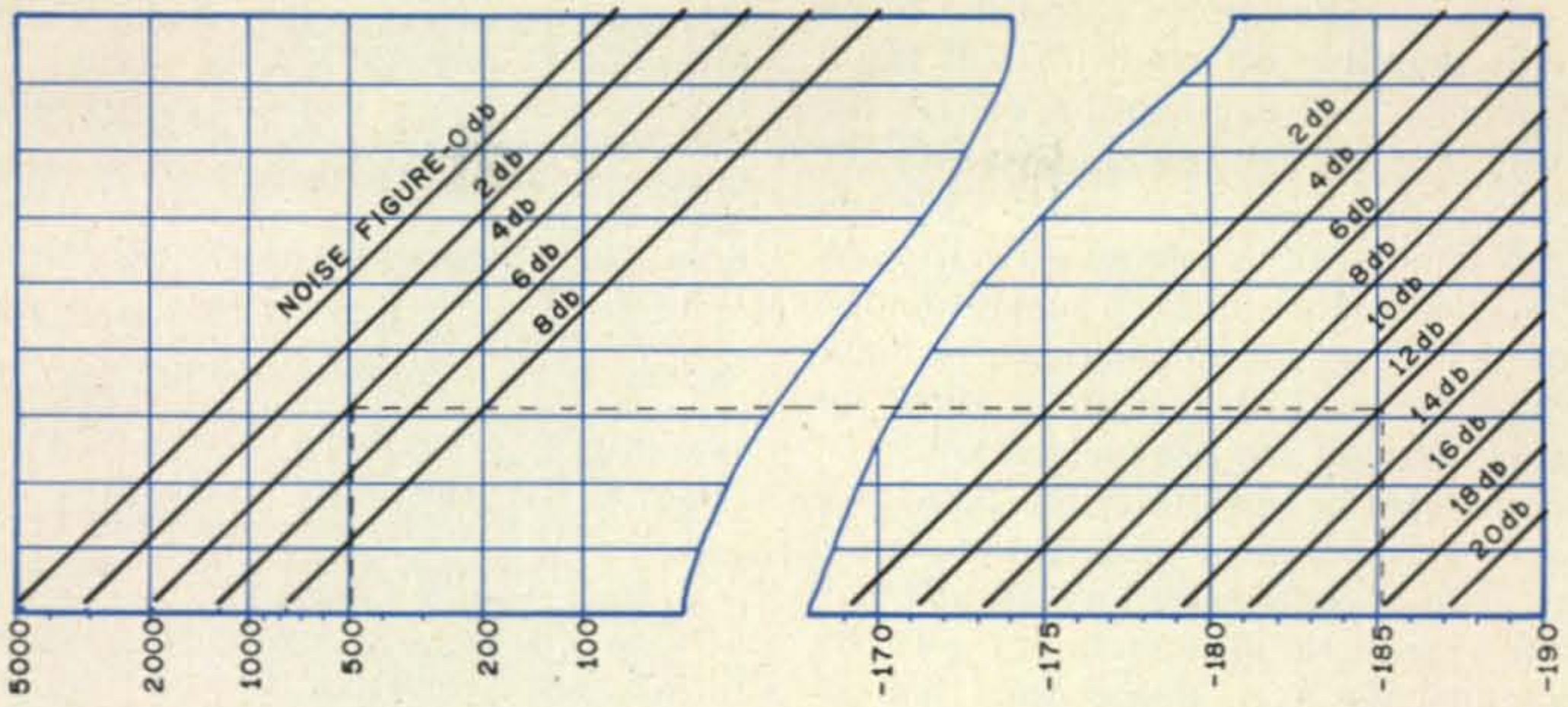
If you prefer, the graph shown in fig. 1 may be used. Find your receiver bandwidth on the scale at the bottom left hand side of the graph. Draw a vertical line up to the applicable receiver noise figure curve and then a horizontal line from this point to the receiving antenna system gain, *G*r. Drop a vertical line from this point in order to determine the receiving system sensitivity, *S*r.

As an example, (illustrated by dotted lines) a typical station may have the following parameters:

Bandwidth:	500 c.p.s.
Receiver Noise Figure:	4 db
Receiving Antenna Gain:	14 dbi
Transmission Line Loss	−2 db
Net Ant. System gain (*G*r):	12 dbi

Locate 500 cycles on the bandwidth scale; draw a vertical line to the 4 db noise figure curve. Then, draw a horizontal line from this

See page 110 for New Reader Service



Receiver Bandwidth (HZ) Receiving System Sensitivity (dbw)

Fig. 1—Receiving system sensitivity graph.

point to the Gr = 12 dbi curve. Drop a vertical line from this point to find the receiving system sensitivity of −185 dbw.

Effective Radiated Power

Likewise, as shown in fig. 2, the effective radiated power (e.r.p.) of any station can be calculated from:

e.r.p. = 10 log Pout + Gt

where: Pout = Transmitter power output (in dbw).

Gt = Transmitting antenna system gain (in dbi) (Transmitting antenna gain minus line loss.)

Again, the transmitting antenna system gain, Gt, is the transmitting antenna gain expressed in dbi minus the transmission line loss. (In most cases where the same antenna is used for both transmitting and receiving, Gt and Gr will be the same.) For example, as shown by the dotted line in fig. 2, a station with a transmitter power output of 5 watts and an antenna system gain of 12 dbi will have an effective radiated power of 19 dbw.

Moonray vs. Moonbounce

At this point, it is interesting to compare the differences in equipment needed to work moonbounce and via MOONRAY. Typical 432 mc moonbounce stations have large antennas with gains of approximately 30 dbi and transmitter power outputs of 300 watts or more. Received signal-to-noise ratios seldom exceed 0 db and are usually between −3 db and −15 db. If we were to use the same antenna for MOONRAY work, we could obtain a −3 db S/N ratio with an earth-based transmitter output of only 80 *milliwatts*.

Recapitulation

From the above analysis, we can see that the equipment needed to work through MOONRAY is minimal. Stations with 5 watts r.f. output power, a low noise transistor converter and a small yagi antenna are theoretically capable of intelligible, long range, line-of-sight communication. The signals would be weak but very readable in the absence of QRM.

The calculations presented here are based on a 5 kc MOONRAY receiver bandwidth. There is a possibility that this parameter will be changed to 10 kc to minimize the frequency accuracy required by the earth station

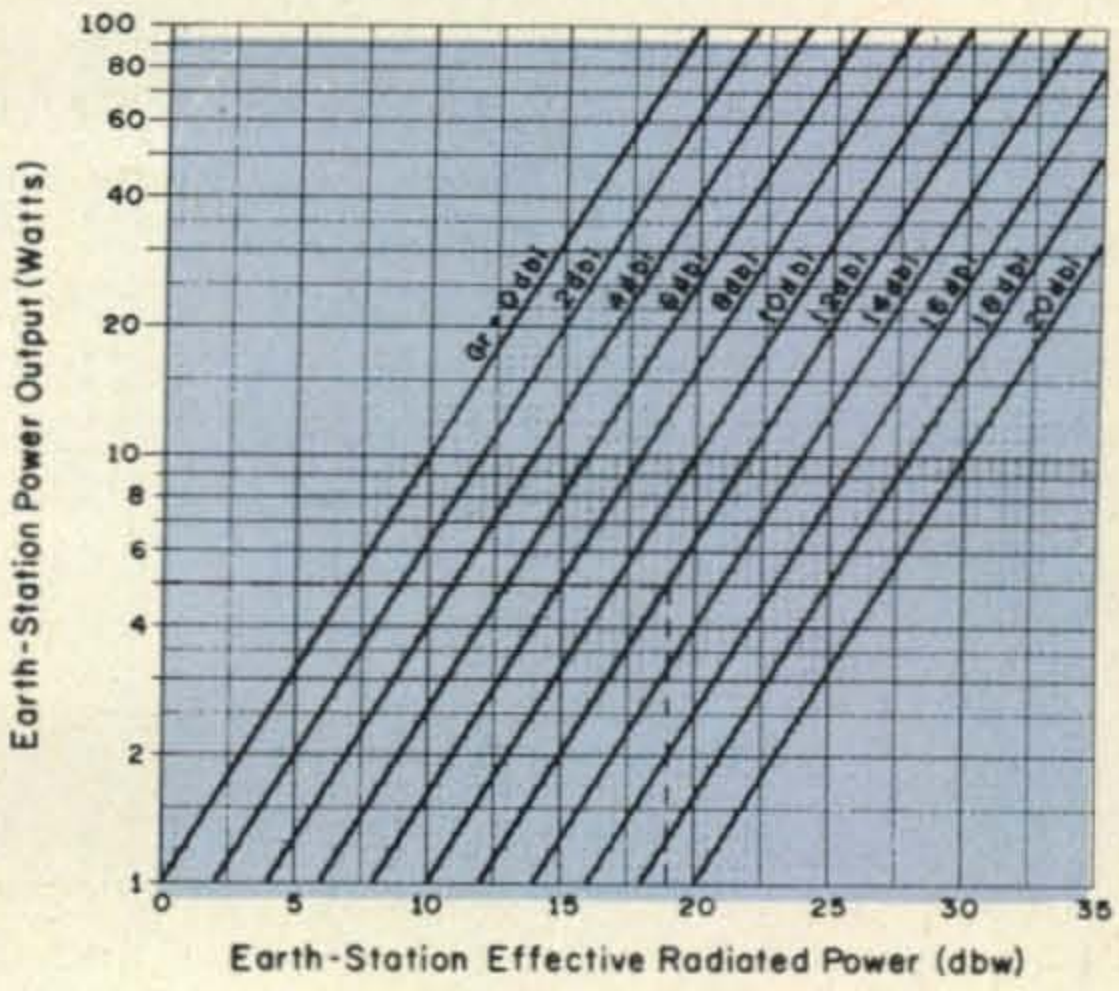


Fig. 2—Earth station effective radiated power (e.r.p.).

See page 110 for New Reader Service

and to increase the number of stations that could work simultaneously through MOONRAY. This doubling of bandwith will result in an *overall S/N* degradation of 1.8 db. However, this will not materially affect the calculations presented here since excellent c.w. copy is possible as low as −10 db *S/N*. Thus in choosing an overall signal-to-noise ratio of −3 db in our calculations, we have given ourselves a 7 db margin to allow for parameter changes and unexpected losses.

It should also be obvious at this point that MOONRAY I is practical and feasible using current state-of-the-art techniques and will allow the average radio amateur of the 1970's to communicate over tremendous line-of-sight distances via the moon, using low power in the 70 cm band.

Future Articles

Several construction articles will follow during the next year or so describing typical antenna systems, low noise front ends and converters suitable for use with MOONRAY as well as methods and techniques for acquiring, tracking and using the MOONRAY I translator.

Many of the techniques and methods have already been described in various amateur publications over the past several years and are directly applicable to MOONRAY. An excellent bibliography has been published[8] and is recommended for those wishing to broaden their understanding of the role of the radio amateur in space.

An Invitation

Interested amateurs living or visiting on Long Island are invited to visit NASTAR facilities, where the MOONRAY design and development work is being done. We are located on the Campus of Nassau College, Garden City, Long Island, New York (formerly the site of the old Mitchell Field Air Base). For directions or additional information write: NASTAR, P. O. Box T, Syosset, N.Y. 11791.

Acknowledgement

The author wishes to extend thanks to Nick Marshall, W6OLO/2, for his encouragement and invaluable assistance and to Grace Weidmann, XYL of W2DMB who retyped the manuscript several times before it reached its final form. ■

REFERENCES

[1]"Project: MOONRAY, Ham Radio From The Moon?" *CQ*, July, 1967, p. 18.
Fisk, J., "Moonray, Amateur Operation From The Moon," *73*, July 1967, p. 80.
Dunkerley, W., "Moonray," *QST*, November 1967, p. 56.
Ross, R., "Project Moonray," *CQ*, December 1967, p. 44.
"Project Moonray," *73*, April, 1968, p. 60.
[2]Stover, H. A., "Project Moonray," *CQ*, September, 1968, p. 72.
[4]Beranek, L., *ACOUSTICS*.
[5]Sevy, J. S., "The Effect of Multiple CW and FM Signals Passed Through a Hard Limiter on TWT," *Aerospace Corporation*, El Segundo, California, March, 1963.
[6]Schwartz, J. W., *et al.*, "Modulation Techniques for Multiple Access to a Hard-Limiting Satellite Repeater," *Proceedings of the IEEE*, Vol. 54, No. 5, May, 1966, p. 763.
[7]Bryant, J., "A Discussion of Thermoelectric Power Supplies," *Ham Radio*, September, 1968, p. 48.
[8]Marshall, N. K., "Amateur Radio in Space—A Bibliography," *Ham Radio*, August, 1968, p. 60.

See page 110 for New Reader Servic

See page 110 for New Reader Service

HOW ABOUT A MINI TRANSMITTER HUNT?

BY JULIAN N. JABLIN,* W9IWI

HAVE you had it with chasing around on rainy nights, looking for a transmitter hidden in the boondocks? Or is your group a low-frequency gang whose idea of a d.f. loop is a 20 meter quad? Then here is a hidden transmitter hunt for you, and the field of action can be a restaurant table with a dozen hams around it.

The idea is simple: build a transmitter the size of a pencil stub mine measures 3/8" × 1⅛") with a range of a foot or two, hide it in full view, and challenge your ham buddies to sniff it out with a broadcast-band transistor radio. It's not as easy to find as it seems.

The transmitter (fig. 1) is a simple Hartley oscillator with the oscillations blocked to produce coded clicks. This, and the alternate circuit of fig. 2, were adapted from "Bio-Medical Telemetry" by R. Stuart Mackay (John Wiley & Sons), a fascinating book for any technically-minded ham. The original transmitters are intended to measure and transmit temperature information from the digestive tracts of animals undergoing various experiments.

Construction and selection of components are more important than the circuits themselves. You are aiming at extreme miniaturization. After selecting the components breadboard the transmitter to assure that everything is working right and then work toward putting together the smallest package that you can make. In the breadboard stage lead length and parts placement are not important; it is hard to get this rig not to work. And if it works in haywire form, it will transmit well in its final form.

*9124 N. Crawford Avenue, Skokie, Illinois 60076.

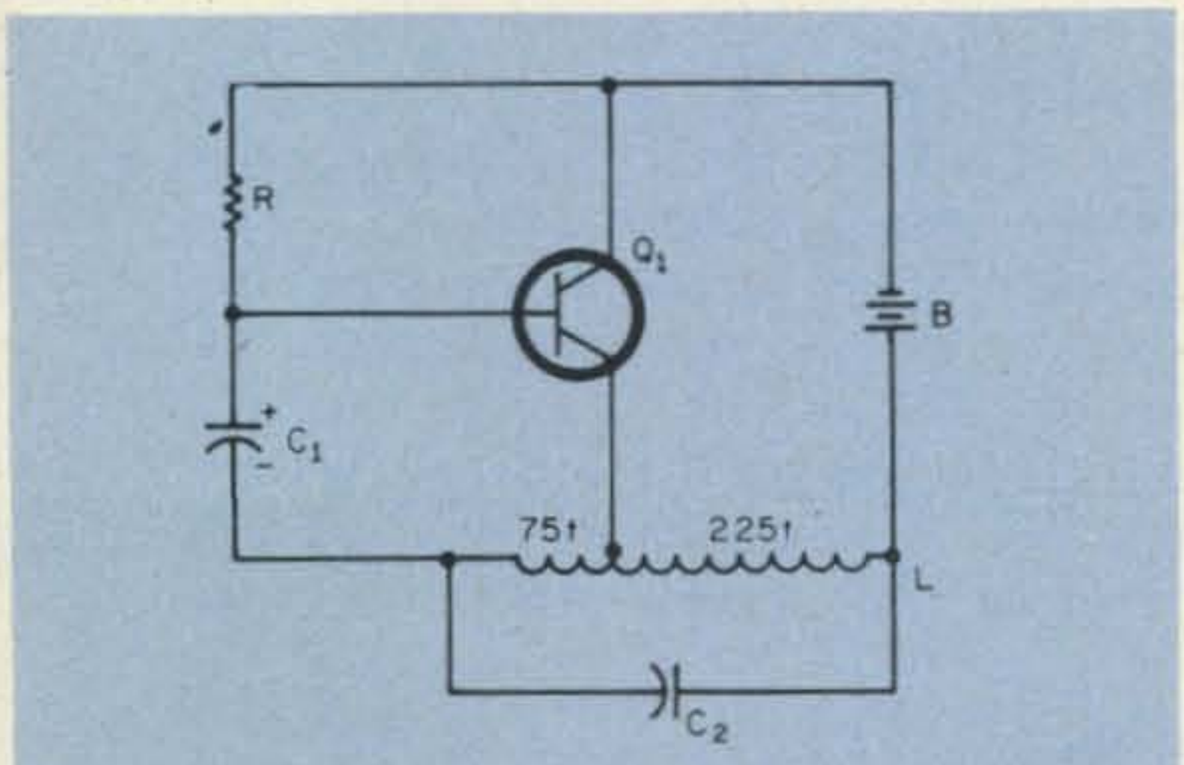


Fig. 1—The author's "Mini-Transmitter" which measures 3/8" in diameter by 1⅛" in length.
B—#312 Mallory, Burgess or Eveready.
C_1—1 mf, 3 v.
C_2—100 mmf disc ceramic.
L—300t #43e, tapped at 75t, 1/4" dia (see text).
Q_1—See text.
R—1 meg, 1/4 watt or smaller.

Components

Look for the smallest possible component. Electrolytic capacitor C_1 will probably be the largest item. I found a Japanese import about the size of a 1/2 watt resistor. Resistor R should be a 1/8 or 1/4 watt unit. You can find both of these on surplus computer boards, where they come out to a few cents each, but sub-miniature parts are available through such distributors as Allied Radio, Newark or Lafayette at moderate prices. Changing the values of C_1 and R will change the rate at which the transmitter clicks.

Almost any N.P.N. transistor designed for R.F. use will work although for the reasons given below you may prefer an epoxy-encapsulated transistor to one in a metal case. If you have a P.N.P transistor, reverse the battery polarity. I used a silicon transistor; if you try a germanium unit, you may get away without resistor R.

The coil is scramble wound on a small plastic form. A drinking straw, with a couple of cardboard end washers to hold the wire in place, will do fine. It should be possible to use a form with a large-enough diameter to slip a tiny transistor inside, saving space. In this event, use an epoxy transistor; a metal-cased semi-conductor would act like

See page 110 for New Reader Servi

ıg and change the inductance of the coil. se fine wire, about #43. I took mine from e secondary of a junked transformer. Tin a ng end, wind the 75 turns, and twist a loop r the tap, tinning the loop. Then continue th the 225 turns, tinning the other end. eep track of which end of the coil is which. nally, smear the coil with epoxy cement hold everything together. When dry, ce-ent C_2, the smallest disc ceramic you can d, to the end of the coil.

The battery is an "odd-ball" item which is ite easy to find. The Mallory, Burgess or veready #312 mercury cell is about the ze of a well-worn pencil eraser. Other mer-ry cells (W-1, 400, 575) are larger and ll do. Any store that sells batteries for aring aids or electronics watches will have ese cells in stock.

Making contact to the mercury cell is a rned nuisance, as the heat of soldering will in it. I drilled holes the same diameter as e battery in two scraps of phenolic copper-ad PC board. Then I soldered copper foil ross the hole in the foil side. Finally, I cut d filed the board to produce two round sulated wafers with copper bottoms to hich I soldered lead wires. These wafers are us battery holders, with the battery fitting the holes and the whole "sandwich" held gether with a narrow strip of electrical tape, in fig. 3. A #312 cell has kept my trans-itter running for several weeks.

Final assembly of the transmitter is accom-ished by clipping all leads short, juggling e components to take the smallest physical ace, soldering everything together and ipping off the loose ends. Use the smallest on you have, and solder quickly, heat sink-g with long-nose pliers where possible. beral doses of epoxy glue will hold things place and provide some insulation. If you an to hide the transmitter in a moist "en-ronment" seal it in a scrap of Saran wrap.

Operation

The transmitter should produce a regular icking across the whole broadcast band. se a small transistor receiver and tune to quiet place in the band. The range of the t-up depends on the transistor in the trans-itter and the nature of the receiver, and will n from 18 to 36 inches. The best receivers not always have the best repsonse, so try y cheap transistor radios available. Orienta-on of the receiver loop-stick antenna with e transmitter affects the signal strength, of

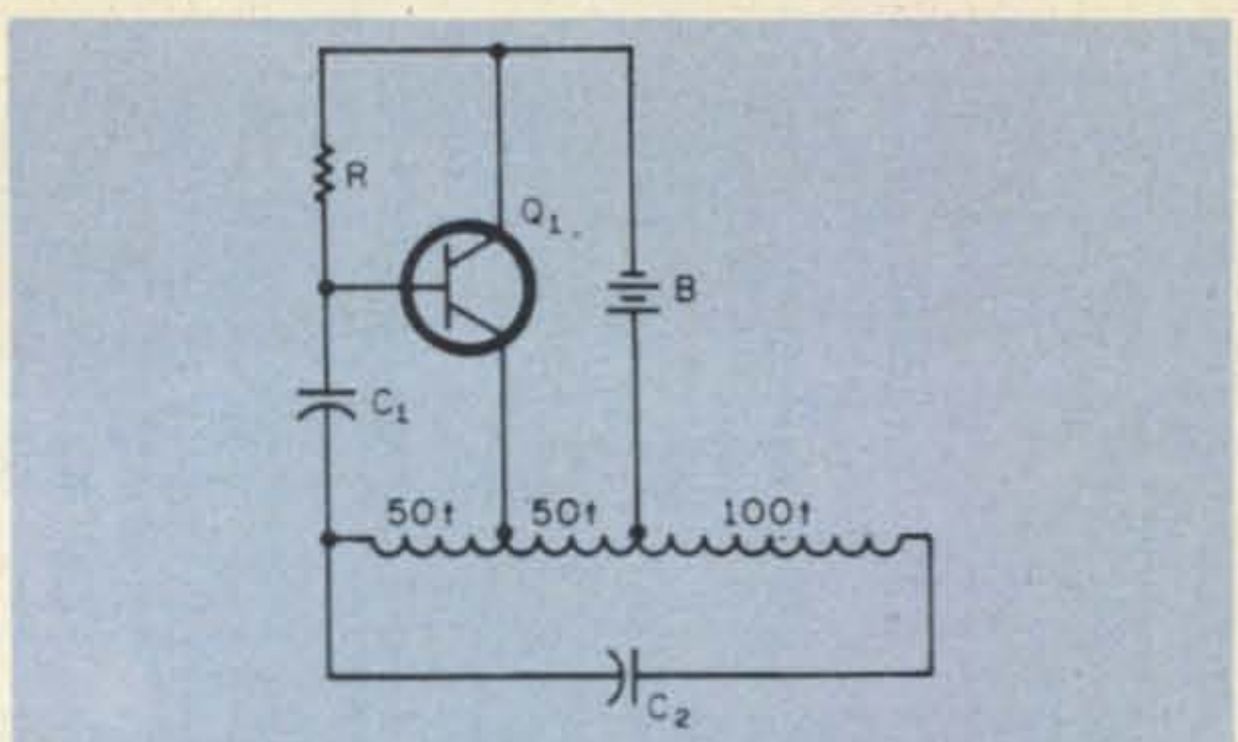


Fig. 2—An alternate Mini-Transmitter circuit; the double-tapped coil is said to result in greater signal strength.
B—Same as fig. 1
C_1—0.68 mf.
C_2, Q_1, R, same as fig. 1.
L—200t #43e, tapped at 50t and 100t, 1/4" dia.

course, and this is part of the hidden-transmitter hunt.

The circuit of fig. 2 is said to have a somewhat longer range than that of fig. 1. Construction would be about the same. I have found the transmitter of fig. 1 to be entirely adequate, and so have not yet tried fig. 2.

At our club's monthly dinner meeting, I scooped a hole in a small pickle, inserted the transmitter, and plugged the hole with scraps of pickle. Then I put the pickle back in the relish bowl—*after* I was sure that no one was in a mood to eat any more. We used one receiver and the fellows took turns trying to find the transmitter. I gave very few details, simply telling them to listen for a coded signal somewhere. I did specify that the signal source was on top of the table. In any hunt of this kind, hams will hold the receiver right on top of the signal source and will refuse to believe that the transmitter is in a piece of bread, a pipe bowl or other innocent object. Perhaps they are looking for a six foot rack and panel job! ■

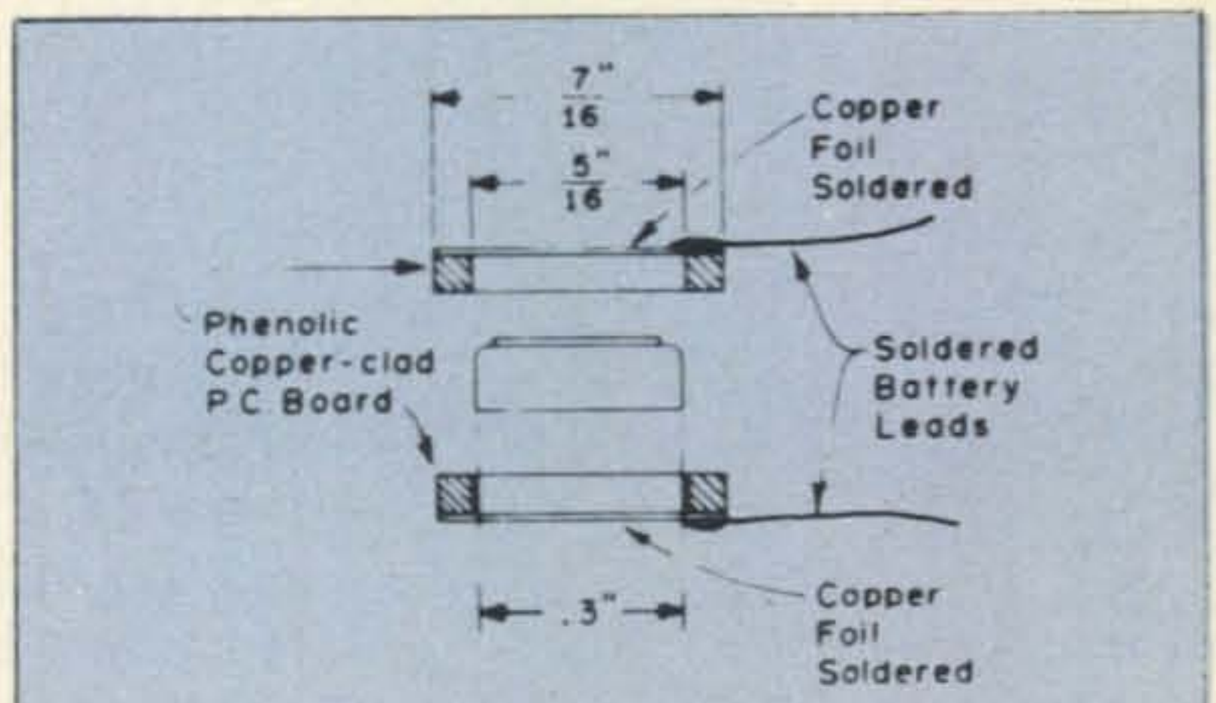


Fig. 3—One arrangement for a battery-holder for the #312 mercury cell (not to scale).

e page 110 for New Reader Service

"There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper, and the people who consider price only are this man's lawful prey."

JOHN RUSKIN

CQ's advertising rates are three times greater than th
of one competitor and one and a half times greater t
those of a second. At the same time, CQ's readership
approximately ten times that of the first competitor
four times larger than the second.

Advertising in CQ is still the best buy in the Ham Ra
Market!

See page 110 for New Reader Servi

We're first... because we offer more.

HENRY RADIO

Let us prove it to you.

BOB HENRY
WØARA

FAST SERVICE: You can depend on faster service because Henry Radio has large stocks of Collins, Swan, Drake, Hallicrafters, Hammarlund, Hy-Gain, Tristao, Johnson, Mosley, National, Telrex, Waters, New-Tronics, Galaxy, Tri-Ex and many other receivers, transmitters, antennas, towers and parts at low prices. Plus, of course, the superb new 2K-3 Linear Amplifier.

BIG TRADES: Henry wants trade-ins. We trade big. Tell us what you want — what you have to trade. Get Henry's offer. We pay cash for receivers and transmitters too.

TED HENRY
W6UOU

TIME PAYMENTS: Get what you want and pay by the month. Henry gives you better terms because we finance all terms ourselves.

SATISFACTION: Henry Radio has satisfied thousands of customers since 1927. Ask any ham about us.

PERSONAL ATTENTION: You get personal attention. Bob Henry runs the Butler store . . . Ted Henry is in charge at the Los Angeles store . . . and Walter Henry runs the Anaheim store. Write, phone, wire or visit any of these stores for personal service. Send us your orders and inquiries. Export inquiries solicited. Also, military, commercial, industrial and scientific users . . . please write for information on our custom line of high power communication linear amplifiers and RF power generators.

SPECIAL OFFERS: Currently Henry is featuring a versatile antenna package program that is second to none. Write for literature.

WALTER HENRY
W6ZN

WRITE, PHONE OR VISIT A HENRY RADIO STORE TODAY:

ry Radio Stores

	CALL DIRECT . . . USE AREA CODE
Butler, Missouri, 64730	816 679-3127
11240 W. Olympic, Los Angeles, Calif., 90064	213 477-6701
931 N. Euclid, Anaheim, Calif., 92801	714 772-9200

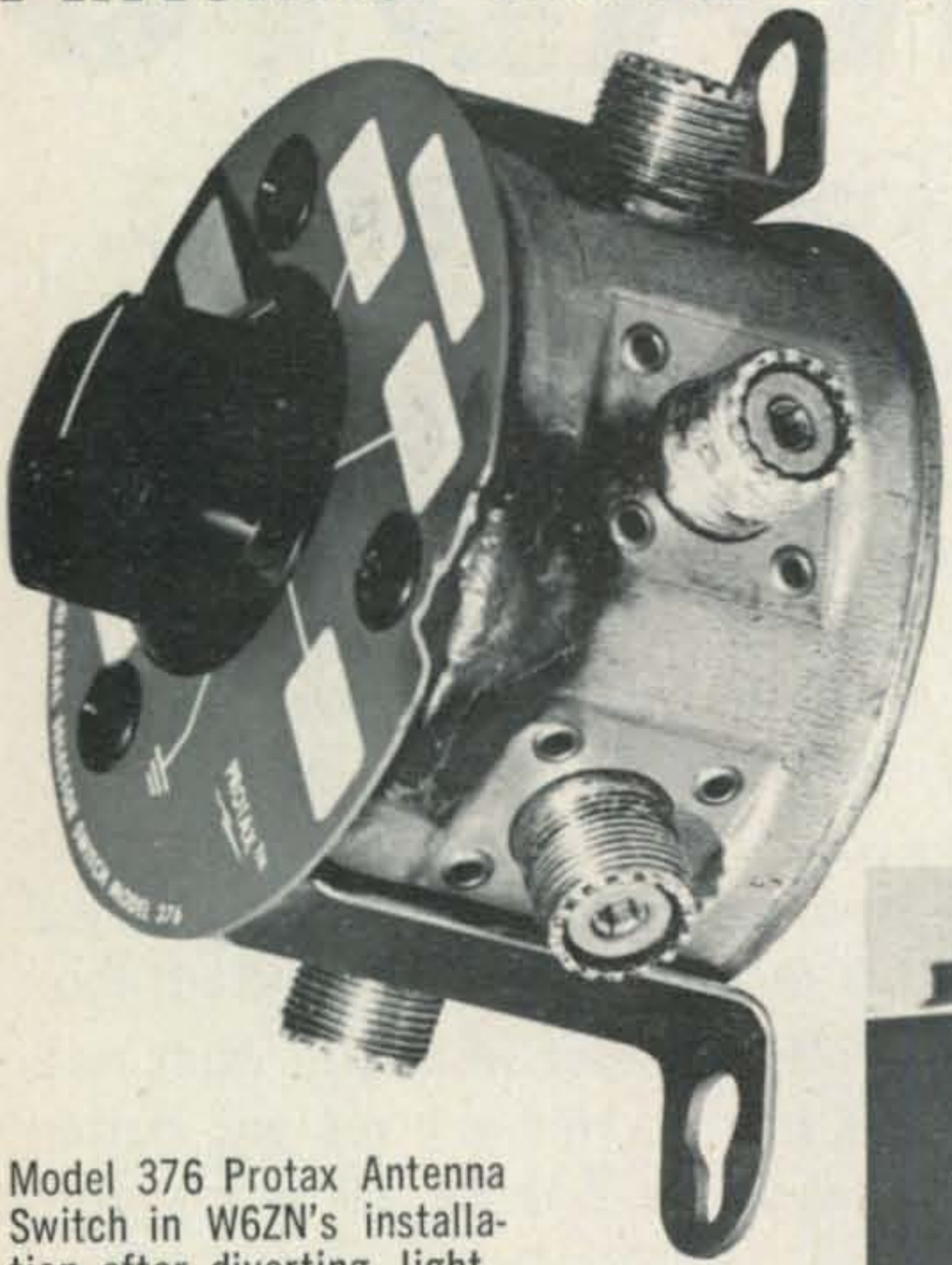
"World's Largest Distributor of Amateur Radio Equipment"

This $12.50 PROTAX®

Antenna Switch...

saved...

Walt Henry's (W6ZN) $2300. Rig

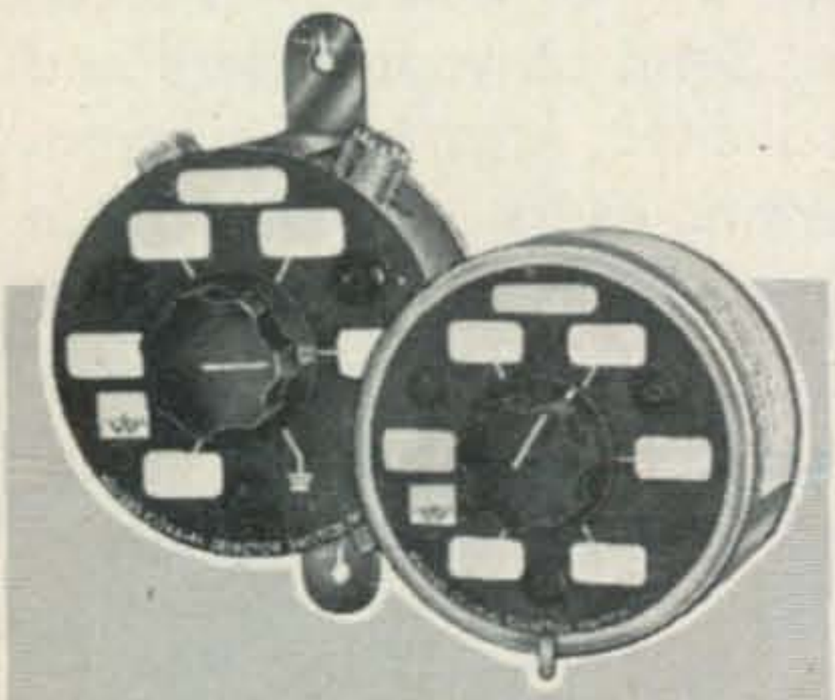


Model 376 Protax Antenna Switch in W6ZN's installation after diverting lightning charge to ground.

A while back, Walt Henry (W6ZN) of Henry Radio Stores was co merely to sell Waters Protax Coaxial Switches with automatic groun Today, Walt not only sells them but swears by them. Seems he inst a 376 Protax on his home rig. And the rains came... with a l lightning! Walt's antenna took a jolt, passed it down the feed into the Protax. The Protax passed it to ground. Sure, the s took a licking, but $2300 worth of fine gear didn't. Waters rep the switch! Free!

Is your rig as well protected?

PROTAX Switches operate through 150MHz



Furnished with knob escutcheon plate, eraseable marking panels and mounting bracket on 376.

PROTAX Mod. 375 . . . 6 position rear mounted axial connectors $13.95

PROTAX Mod. 376 . . . 5 position side mounted radial connectors $12.50

PROTAX Mod. 380 . . . 3 position rear mounted axial connectors. $12.45

WATERS
MANUFACTURING INC.
WAYLAND, MASS. 01778

Waters Manufacturing is a member of Electronic Industries Associa

Front view of the Heath HW-100 s.s.b. transceiver with the two knobs mounted. The new drive system provides a 6:1 tuning ratio for fast traverse and a 36:1 ratio for fine tuning.

THE 2&2 DIAL FOR THE HW-100

BY PAUL J. KIRSCH,* WA8ASQ

THE title of this article pertains to the ngth of time necessary to complete this odification to the HW-100. It takes two eeks to order and receive the parts and two urs to install.

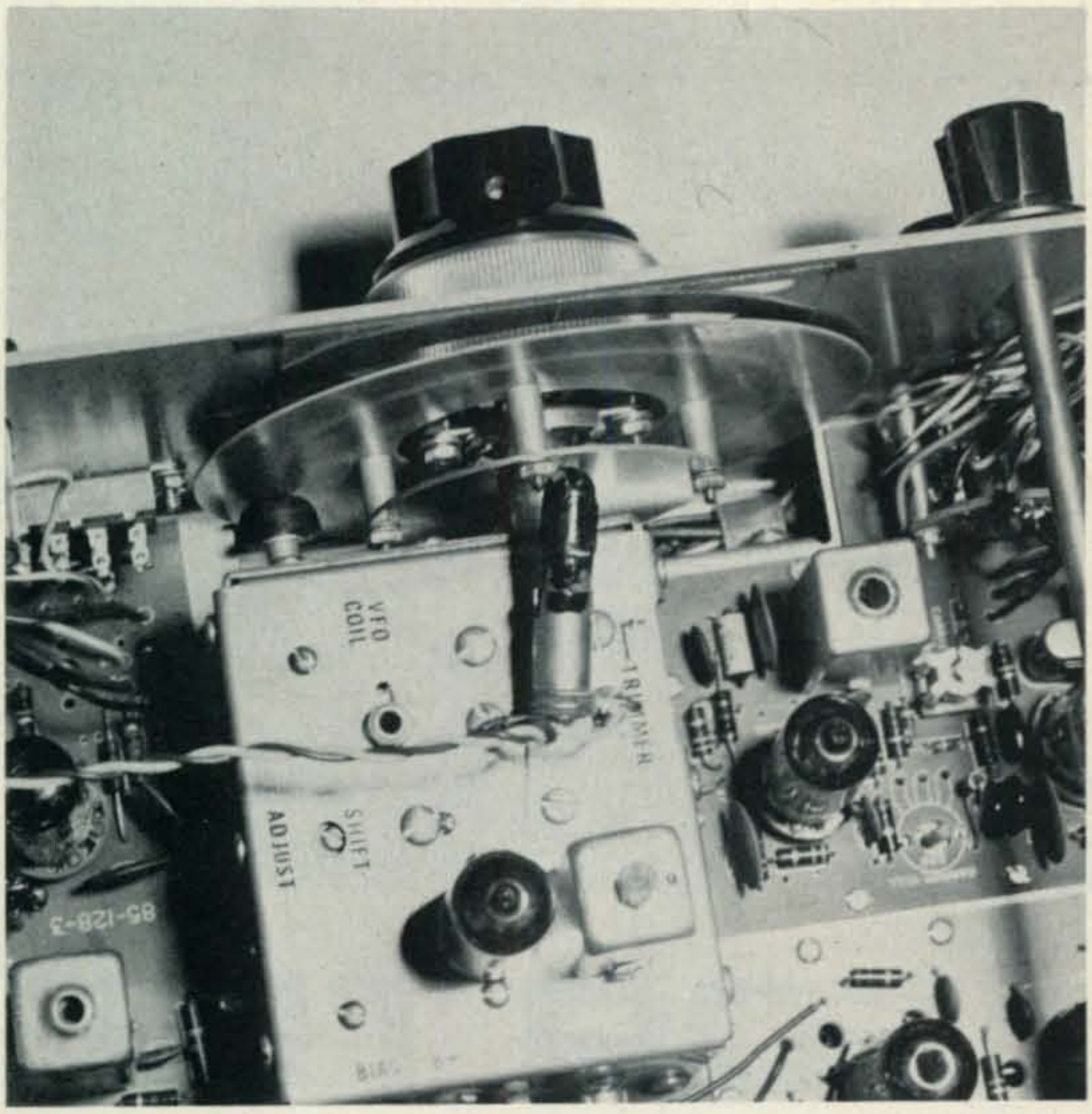
Obviously, this article is directed to owners the new HW-100, Heath's fine little five- nd transceiver.

While the HW-100 is electrically an ex- llent piece of machinery, the dial vernier at they have named the "Harmonic Drive" an all-plastic affair which is something else ain. It depends on the lubricant for smooth rformances and, as you well know, any bricant is susceptible to temperature varia- ns, and if you are mobile with this toy, u will find it almost impossible to fine-tune, for example, 50 cycles.[1] Now, I take pride in my kit assembly work so when I assembled my HW-100, I spent almost as much time trying to get a smooth action from the dial mechanism as I did assembling the kit. I found when the temperature in the car exceeded 80 degrees, as when the car is parked and the windows closed, the dial would stick and when it was cool from one night it would grab. After a couple of weeks I started twisting dials on every rig I could lay my hands on. I finally came across the "Swan" transceiver vernier, and to those who have twisted that dial, they know how fine and smooth a

4158 Foch, Livonia, Michigan 48154.

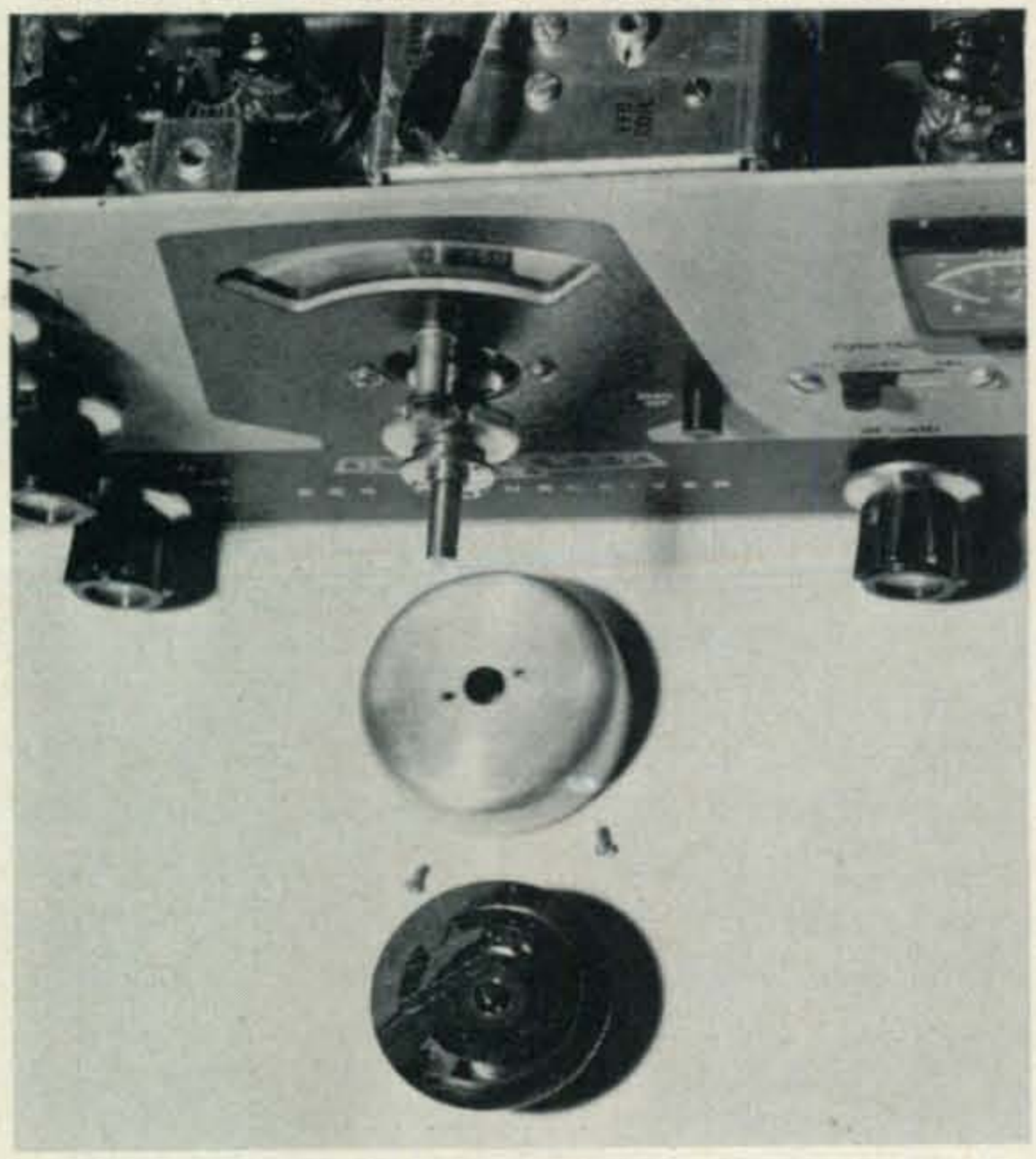
[1]The Heath Co., aware of this problem, has made available a new lubricant that clears up the problem in most instances. The author's modification, however, will also provide two speed tuning.

e page 110 for New Reader Service



Rear view of the modified dial assembly of the Heath HW-100 s. s. b. transceiver.

vernier it is, with a 6-1 high speed movement for rapid transverse of the dial and a 36-1 fine tune adjustment. I adapted this dual speed dial to the HW-100 and that's where the title of the article comes from, two weeks to order and receive the necessary parts from "Swan" of Oceanside, California and two



Front view of the Heath HW-100 showing the added vernier drives with the knobs removed.

hours to install. When yo
place your orders, ask fo
the two ball drive vernie
and the two knobs; tot
cost is $5.87. There are n
holes to drill, only a coup
of shafts to cut down. Yo
will also need six 9/16 inc
spacers. The photograp
should help clear up a
questions.

Modification Procedu

The steps *ala* Hea
Technique are as follow

1. Remove the v.f.o. a
all of the harmonic dri
components.

2. Measure back 1/4 inch from the
ring slot on the v.f.o. capacitor shaft a
cut it off.

3. Remove the stop bolt from the v.f
box and file the nut flat on one side, so th
the dial retaining collar can rotate freely
the v.f.o. shaft when the collar is up agai
the v.f.o. housing.

4. Cut 1/4 inch off of the shaft of o
Jackson ball drive so that the units, wh
connected together, will be as close as p
sible to each other.

5. Disassemble the plastic dial plate fr
the metal plate.

6. Using four 9/16 inch spacers and nec
sary length of screws, remount the plate d
to the metal plate, so that the dial face
9/16 inch ahead of the plate.

7. Slip the retaining collar, dial plate, a
pressure spring onto the cut-down shaft.

8. Place the ball drive that is cut down o
the v.fo. shaft and secure it. Bring the col
with the long set screw up against the d
plate and, with the v.f.o. out of the set, adj
the stop as per the instruction manual.

9. Place this assembly onto the cha
and put the four v.f.o. mounting nuts
but do not tighten them.

[*Continued on page 102*]

See page 110 for New Reader Serv

ore than 5 million two-way trans-itters have skyrocketed the demand r service men and field, system, and & D engineers. Topnotch licensed xperts can earn $12,000 a year or ore. You can be your own boss, build ur own company. And you don't ed a college education to break in.

OW WOULD YOU LIKE to earn $5 to $7 an hour...$200 to $300 a week .$10,000 to $15,000 a year? One of ur best chances today, especially if u don't have a college education, is the field of two-way radio.

Two-way radio is booming. Today ere are more than *five million* two-ay transmitters for police cars, fire ucks, taxis, planes, etc. and Citizen's nd uses—and the number is grow-g at the rate of 80,000 per month.

This wildfire boom presents a solid ld opportunity for trained two-way dio service experts. Most of them e earning between $5,000 and 0,000 a year *more* than the average dio-TV repair man.

Why You'll Earn Top Pay

e reason is that the U.S. doesn't rmit anyone to service two-way ra-o systems unless he is *licensed* by e FCC (Federal Communications ommission). And there aren't ough licensed experts to go around.

This means that the available li-nsed expert can "write his own ket" when it comes to earnings. me work by the hour and usually arge at least $5.00 per hour, $7.50 evenings and Sundays, plus travel penses. Others charge each cus-mer a monthly retainer fee, such as 0 a month for a base station and .50 for each mobile station. A sur-y showed that one man can easily maintain at least 15 base stations and 85 mobiles. This would add up to at least $12,000 a year.

How to Get Started

How do you break into the ranks of the big-money earners in two-way radio? This is probably the best way:

1. Without quitting your present job, learn enough about electronics fundamentals to pass the Government FCC License. Then get a job in a two-way radio service shop and "learn the ropes" of the business.

2. As soon as you've earned a reputation as an expert, there are several ways you can go. You can move out, and start signing up your own customers. You might become a franchised service representative of a big manufacturer and then start getting into two-way radio sales, where one sales contract might net you $5,000. Or you may be invited to move *up* into a high-prestige salaried job with one of the same manufacturers.

The first step—mastering the fundamentals of Electronics in your spare time and getting your FCC License—can be easier than you think.

Cleveland Institute of Electronics has been successfully teaching Electronics by mail for over thirty years. Right at home, in your spare time, you learn Electronics step by step. Our AUTO-PROGRAMMED® lessons and coaching by expert instructors make everything clear and easy, even for men who thought they were "poor learners."

Your FCC License... or Your Money Back!

By the time you've finished your CIE course, you'll be able to pass the FCC License Exam with ease. Better than nine out of ten CIE graduates are able to pass the FCC Exam, even though two out of three non-CIE men fail. This startling record of achievement makes possible our famous FCC License Warranty: you'll pass the FCC Exam upon completion of your course or your tuition will be refunded in full.

Find out more. Mail the bound-in post-paid card for two FREE books, "How To Succeed In Electronics" and "How To Get A Commercial FCC License." If card has been detached, use coupon 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 on card for G.I. Bill information.

CIE Cleveland Institute of Electronics
1776 East 17th Street, Cleveland, Ohio 44114

Please send me without cost or obligation:

1. Your 44-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 _____

Accredited Member National Home Study Council **CQ-43**

low to get into one of today's hottest money-making fields—*servicing 2-way radios!*

's flying high. Before he got his CIE training and FCC License, Ed Dulaney's only fessional skill was as a commercial pilot engaged in crop dusting. Today he has own two-way radio company, with seven full-time employees. "I am much better financially, and really enjoy my work," he says. "I found my electronics lessons rough and easy to understand. The CIE course was the best investment I ever made."

***Business is booming.** August Gibbemeyer was in radio-TV repair work before studying with CIE. Now, he says, "we are in the marine and two-way radio business. Our trade has grown by leaps and bounds."*

VERTICAL ANTENNAS

Part X

BY CAPTAIN PAUL H. LEE,* W3JM

A folded unipole antenna less than a quarter wave long can be used to transform the low input resistance of a short vertical antenna to a resistance which is more reasonable to match and drive. The author discusses the operation and design of the folded unipole antenna in this installment.

VERY low input resistance is often present in antennas. This is due to the antenna being very short electrically or to the mutual impedance present from another nearby antenna. The coupling network required to match a low resistance (of the order of one or two ohms, or less) to a 50 ohm line is not difficult to compute, but it may include some rather impractical values of reactance. A short series fed antenna looks capacitive, and its capacitive reactance is usually quite high; the shorter the antenna the higher the reactance. The series coil necessary to resonate it (called a "helix" in low frequency or very low frequency work) usually contributes considerable loss in itself, and it is therefore desireable to get rid of it if possible and use some other method of matching and feeding power to the antenna. The Type UG and the NORD antennas described in Part III[73] are designs which accomplish this. It will be noted that each of these uses a folded unipole type of feed. Folded antennas as a class or type provide a means of securing the desired impedance transformation within the antenna itself, thus simplifying the required matching network.

*5209 Bangor Drive, Kensington, Maryland 20795.

[73]Lee, P. H., "Vertical Antennas—Part III," *CQ*, August 1968, p. 52.

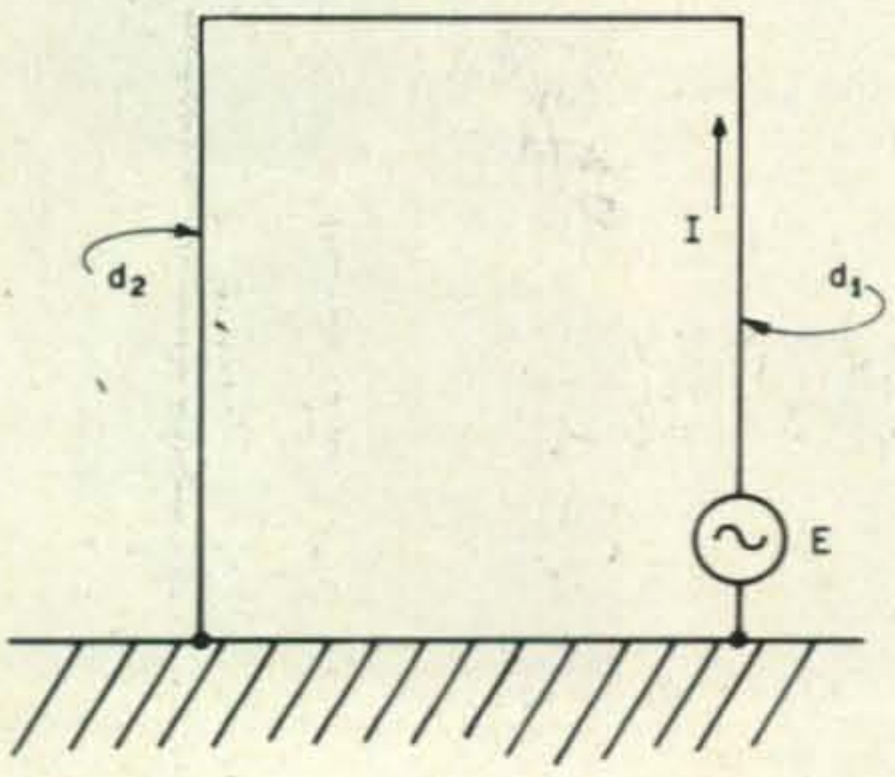


Fig. 90 — Basic circuit of the folded unipole antenna.

Folded Dipole

It is likely that all readers are familiar with the folded dipole. Some may be using one for transmitting, but it is much more probable that one is being used for TV reception, as the folded dipole is the "driven element" of most such v.h.f. Yagi arrays. The reason for its use in that application is the very one mentioned previously, to present a more favorable impedance match to the 300 ohm transmission line than would be possible if an ordinary linear dipole were used.

The folded unipole is nothing but a half of a folded dipole, with ground replacing the other half. It is represented in fig. 90, which shows a simple single fold unipole antenna. To analyze this antenna and its operation, let us assume a generator voltage, E_1, and proceed to determine the current, I, flowing in the lower end of part d_1, of the antenna. Roberts[74] has shown an analysis of this type of antenna. Figure 91 is the equivalent circuit of fig. 90, for purposes of the analysis. Also assume that the antenna is 90 electrical degrees tall.

By use of three generators shown in fig. 91, we can by the principle of superposition

[74]Roberts, W. V., "Input Impedance of a Folded Dipole," *RCA Review*, Vol. 8, No. 2, June 1947, p. 289.

See page 110 for New Reader Service

add the currents produced by each generator to find the current in the lower end of part d_1. The polarities of the generators are shown by the arrows. Since each generator is producing the voltage E_1, and generators 2 and 3 are opposed, the lower end of part d_2 is at ground potential. Generators 1 and 3 produce a voltage $2E_1$ which is impressed on the lower end of part d_1. In view of these facts· fig. 91 is in fact equivalent to fig. 90.

As the next step in the analysis, assume for a moment that generator 3 is shut down, and as a result there is only a voltage $2E_1$ developed by generators 1 and 2 between the lower ends of parts d_1 and d_2. It was stated previously that the antenna is 90° tall. Thus, inasmuch as parts d_1 and d_2 form a transmission line of 90° length which is shorted at its upper end, the input resistance between d_1 and d_2 for this transmission line case is very high, and only a very small transmission line current will flow through generators 1 and 2, and into the lower end of part d_1.

Next, assume for a moment that only generator 3 is producing any voltage, and that generators 1 and 2 are shut down. In this case, the lower ends of parts d_1 and d_2 are effectively connected together at the same potential, as far as generator 3 is concerned, assuming zero internal impedance in the generators. Thus parts d_1 and d_2 act merely as a 90° vertical radiator (in parallel). Assume that the radiation resistance of this vertical radiator is R, and that it is being driven by generator 3, which is supplying a current equal to E_1/R to this parallel combination of conductors d_1 and d_2. But since there are two conductors the current, $I=E_1/R$, divides between them. If the conductors d_1 and d_2 are of the same diameter, the current will divide equally between them. Thus I_1, the current in part d_1 is equal to $1/2 \times E_1/R$, and I_2, the current in part d_2, is the same.

Now if all three generators, 1, 2 and 3, are working at the same time, the voltage impressed at the bottom end of part d_1 is $2E_1$ and the current in it is $1/2 \times E_1/R$ plus a very small amount of transmission line current produced by generators 1 and 2 in series as described above. Since Ohm's Law applies, and resistance equals voltage divided by current, the input resistance at the lower end of part d_1 is:

$$R_{IN} = \frac{2\ E_1}{\frac{1}{2} \times \frac{E_1}{R}}$$

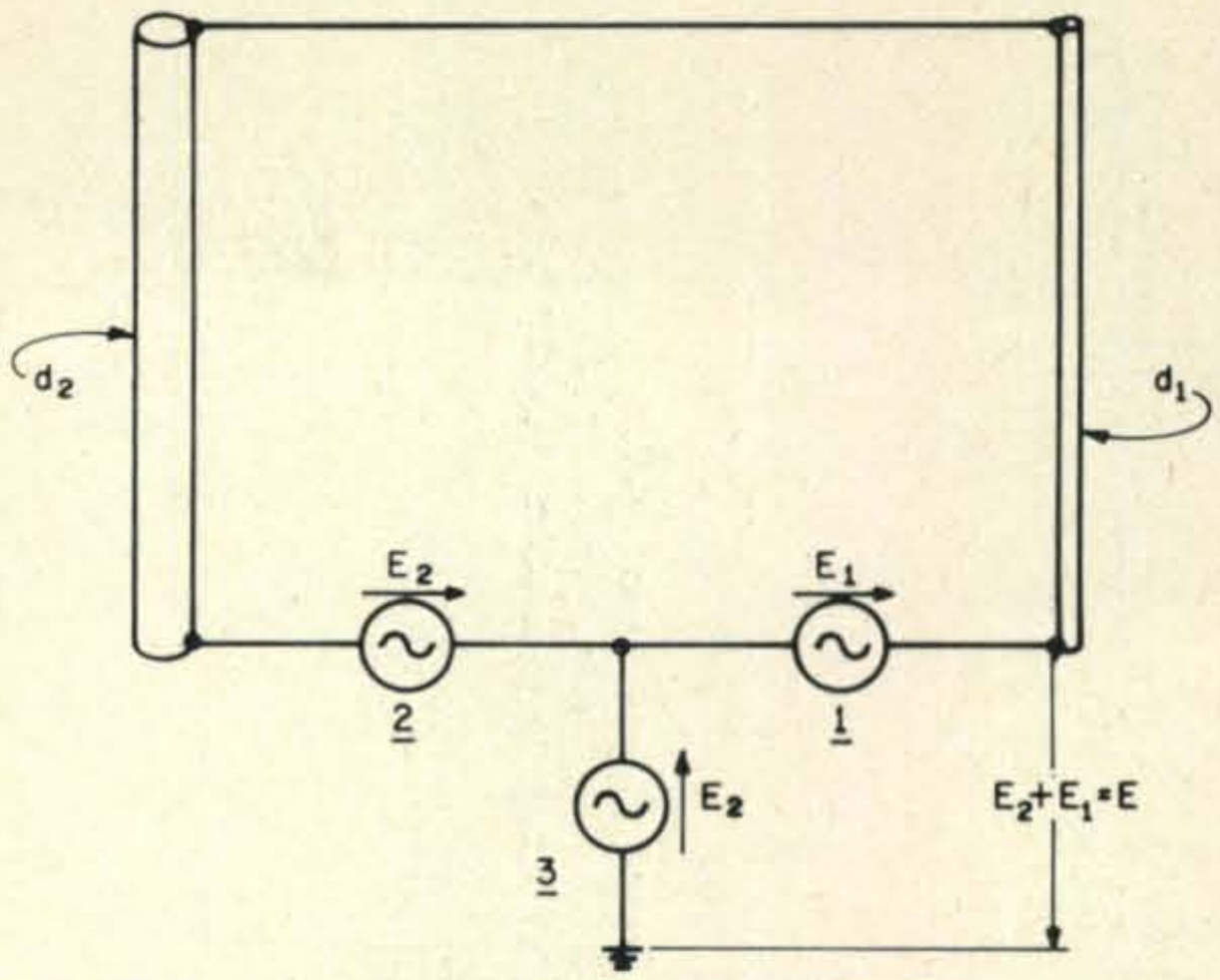


Fig. 91—Equivalent circuit of the folded unipole that can be used for analysis.

which is equal to approximately $4R$. This is true provided that parts d_1 and d_2 are close together. The impedance transformation (for equal size conductors d_1 and d_2) is approximately 4.

This transformation ratio can be expressed in the form of an equation:

$$\rho = \frac{Z_1}{Z_0} = (1 + n)^2$$

where Z_1 = input impedance of the folded unipole antenna.
Z_0 = input impedance of a single element depole.
n = input current ratio $I_2\ I_1$ (For equal size conductors this equals 1.)

Unequal Conductors

So far in this analysis the case of equal size conductors has been discussed. Now, however, with the transformation ratio expressed in terms of the current ratio (which depends on conductor size), we can consider the case of unequal size conductors, which is shown in fig. 92. As in the previous case, generators 2 and 3 are alike and produce equal and opposing voltages E_2, which place the bottom end of part d_2 at ground potential. However, generator 1 must now be producing a voltage E_1 of such value that no current will flow through generator 3 when generator 3 is not providing any voltage. In this case E_1 is not equal to E_2, and its determination is one essential part of the problem. The division of the antenna current between parts d_1 and d_2 (when generators 1 and 2 are not generating

See page 110 for New Reader Service

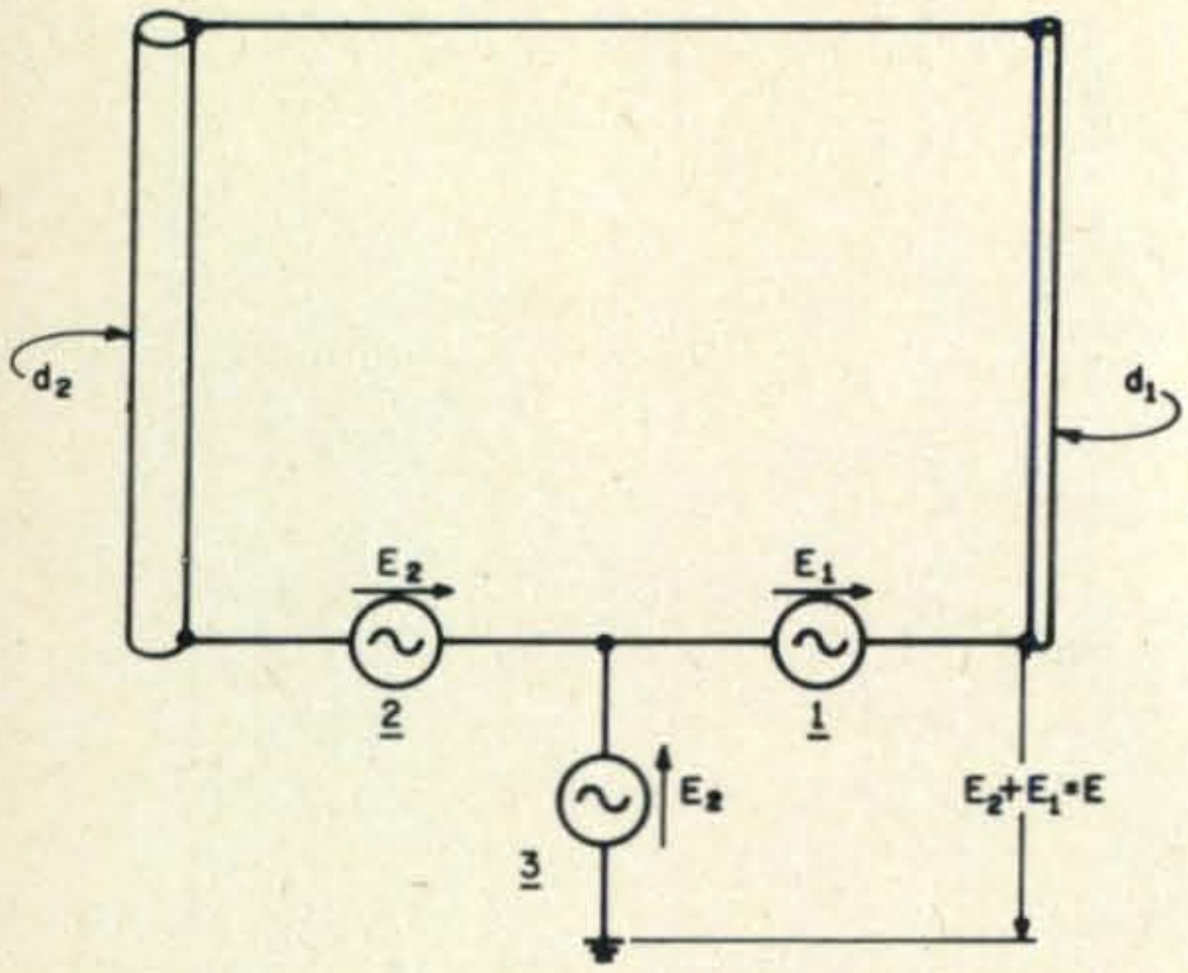


Fig. 92—Equivalent circuit, for analysis, with unequal diameter elements.

and generator 3 is generating) is the other part of the problem. Roberts uses an electrostatic or capacitive method of analysis[74], whereas Guertler uses another more complicated method.[75] The former described here. Simply stated, the currents will divide directly in proportion to the ratio of the capacities to ground of the two elements, whereas the voltage ratio will be the inverse of this. Thus, in the analysis we can assign capacities C_1 and C_2 to parts d_1 and d_2. Refering to fig. 92, then:

$$\frac{E_2}{E_1} = \frac{C_1}{C_2} \quad or \quad E_2 = E_1\left(\frac{C_1}{C_2}\right)$$

[75]Guertler, R. "Impedance Transformation in Folded Dipoles," *Proceedings of IRE*, Sept. 1950, p. 1042.

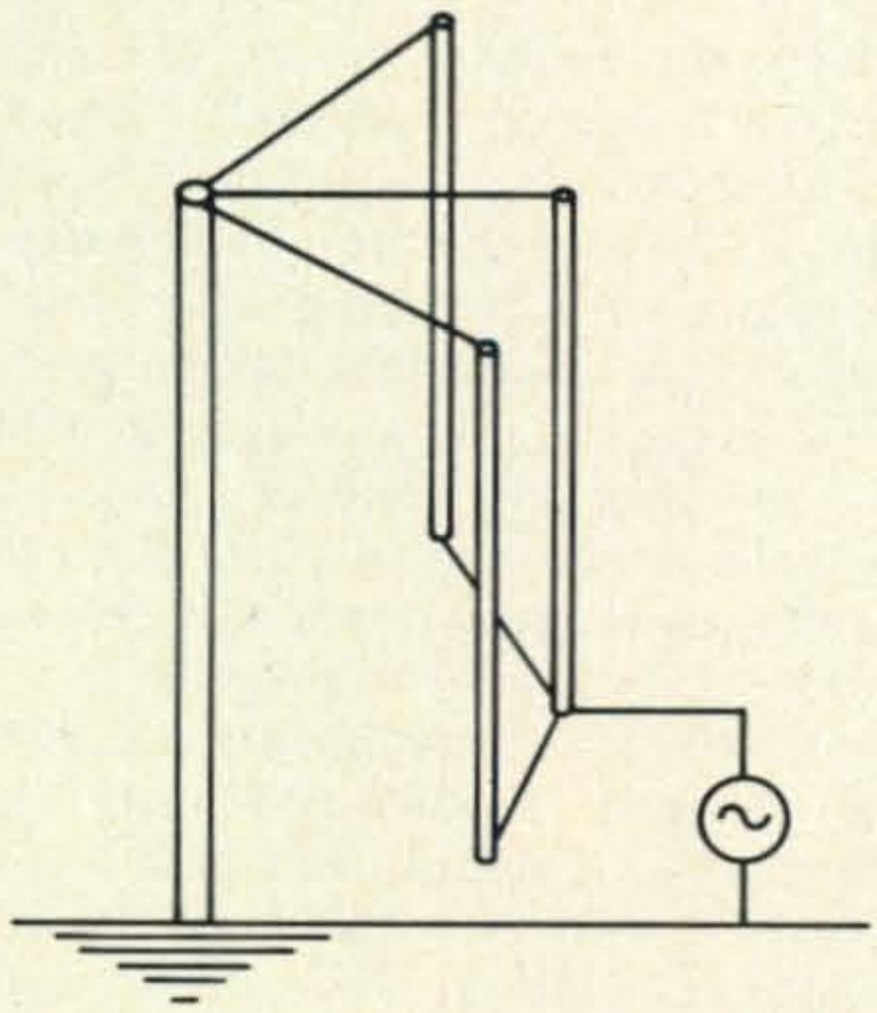


Fig. 93 — Multiple fold configuration for increased bandwith.

Considering the whole thing as a vertical antenna of parallel conductors, the current I_1 at the bottom end of part d_1 will be:

$$I_1 = I \times \frac{C_1}{C_1 + C_2}$$

where I is the total antenna current due to generator 3.

Inasmuch as parts d_1 and d_2 are a 90° shorted section, the transmission line current, which is very small, can be neglected for practical purposes, and the total current due to generator 3, which we called I, is equal to E_2/R, where R is the radiation resistance of the two parts connected in parallel. The input resistance at the lower end of part d_1 (the driving point resistance of the folded unipole) is:

$$R_1 = \frac{E_2 + E_1}{I_1}$$

From this we can derive:

$$R_1 = R\left(1 + \frac{C_2}{C_1}\right)^2 \quad or \quad \rho = \left(1 + \frac{C_2}{C_1}\right)^2$$

.This last equation says that the resistance (or impedance) step-up ratio is proportional to the ratio of the conductors' diameters. (Their capacities are proportional to their diameters.) The step-up ratio is inversely proportional to the diameter of the driven fold or element, and directly proportional to the diameter of the grounded element or tower. The spacing between fold and tower enters into the picture slightly also, but it is not critical.

This antenna has fairly good bandwidth, but the best way to increase the bandwidth is by increasing the number of folds, as in fig. 93.

It can also be shown that the transformation ratio is:

$$\rho = \left(1 + \frac{Z_1}{Z_2}\right)$$

where Z_1 is the characteristic impedance of a two-conductor transmission line made up of conductors of the smaller diameter, and Z_2 is the characteristic impedance of a two-conductor transmission line made up of conductors of the larger diameter, with the spacing of each of these two lines equal to

See page 110 for New Reader Service

the center-to-center distance of the two conductors of the antenna.

It is assumed in the above equation that the tower is grounded, and the smaller conductor (or fold) is fed. The impedance step-up will always be greater than four in this case.

Short Unipole

Thus far a folded unipole 90° tall has been discussed. Now we must turn to the case of the short folded unipole, something much less than 90°, which is the case where the method of feed gives us the greatest advantage of impedance step-up, enabling us to get rid of the helix with its inherent losses. Some assume that the transformation in the short case is the same as that in the 90° case but this is not correct, because in the short case the transmission line currents present become of appreciable magnitude and can no longer be neglected.[76] In this case, fig. 94 applies. Reactances have been arbitrarily added to the two branches of the circuit of fig. 92 for the sake of the analysis. As in the previous case, we can consider the whole thing as an antenna consisting of parallel conductors fed by generator 3, and also we must consider the transmission line case where generators 1 and 2 are in series feeding the short section of transmission line. The circuit of fig. 94 can be replaced by an equivalent circuit as shown in fig. 95. The sections of the unipole have been replaced by boxes containing certain impedances. Z_1 and Z_2 are the impedances to ground of the two parts of the unipole, and Z_{12} is a complex impedance representing a mutual impedance between the two parts (or elements).

As the first step in this analysis, consider the antenna mode, where generators 1 and 2 are not producing voltage, and the configuration is being excited by generator 3. The current, I, will divide into two parts, I_1 and I_2, in accordance with the transformation ratio as previously explained, for $Z_1/Z_2 = \rho$. If the currents I_2 and I_1 are to be in phase and of the ratio $\rho = I_2/I_1$, which they must be in the antenna case, then jX_1 must equal $\rho \times jX_2$. As far as Z_{12} is concerned, no current flows in it, since points 1 and 2 (lower ends of parts d_1 and d_2) are at the same potential and parts d_1 and d_2 are effectively in parallel.

[76]Leonhard, J. *et. al.*, "Folded Unipole Antennas," *IRE Transactions on Antennas and Propagation*· Vol. AP-3, No. 3, July 1955, p. 111.

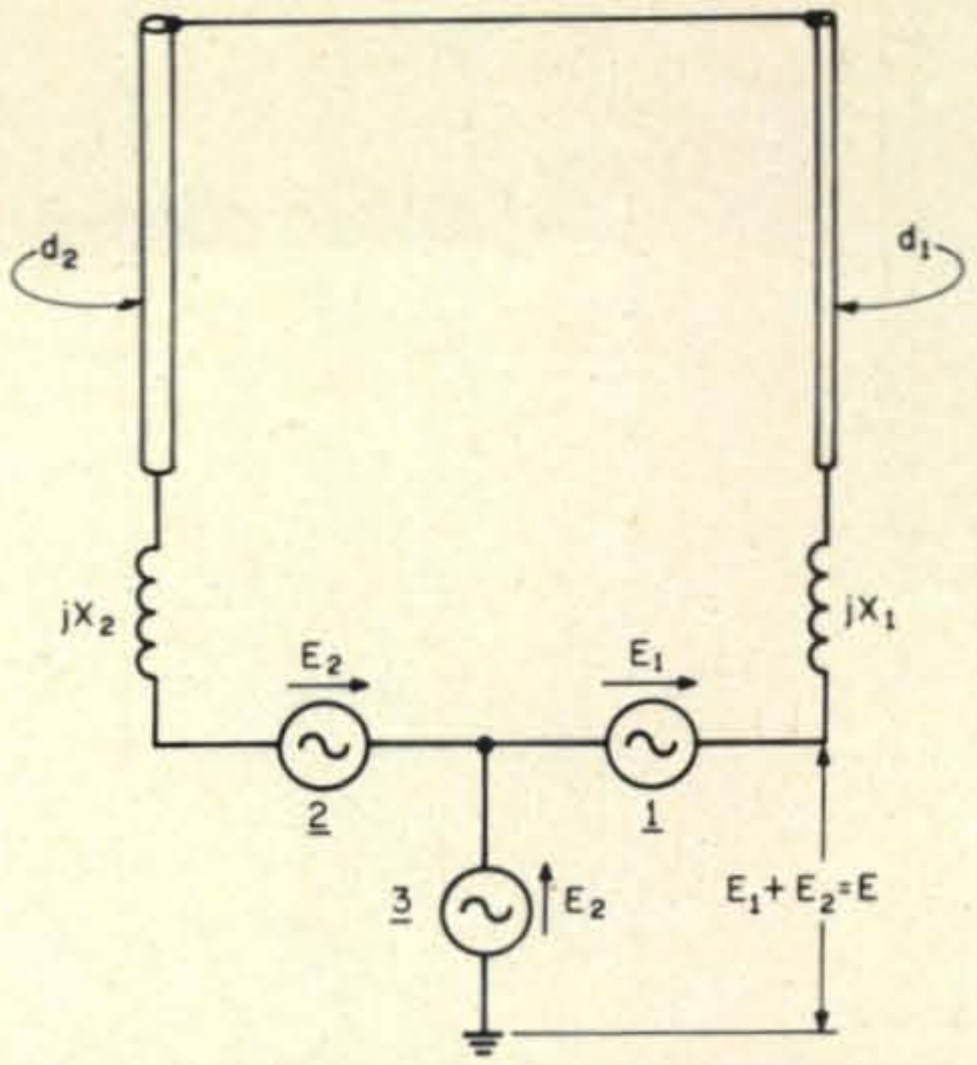


Fig. 94—Equivalent circuit, for analysis, of the short folded unipole.

Now to consider the transmission line mode, we assume generator 3 is not producing. In order for the currents in Z_1 and Z_2 to be equal and opposite, which they must be in this case, E_1 must equal ρ times E_2. Since E_1 plus E_2 equals E (refer back to fig. 90). E_2 is equal to $E/(1+\rho)$, and E_1 is equal to $E\rho/(1+\rho)$. This is shown in fig. 96.

We are now ready to examine the input impedance of the unipole, at feed point F, fig. 96. The total current flowing at F is the sum of the antenna mode current and the transmission line mode current. Let the former be designated by I_A and the latter by I_T. By shorting out the lower generator 3 we have the sum of generators 1 and 2 driving the unipole as a section of transmission line. I_T is therefor determined from the following equation:

$$I_T = \frac{\left[E\left(\frac{\rho}{1+\rho}\right) + \frac{E}{1+\rho}\right]}{j\,(X_2 + \rho X_2 + X_L)} =$$

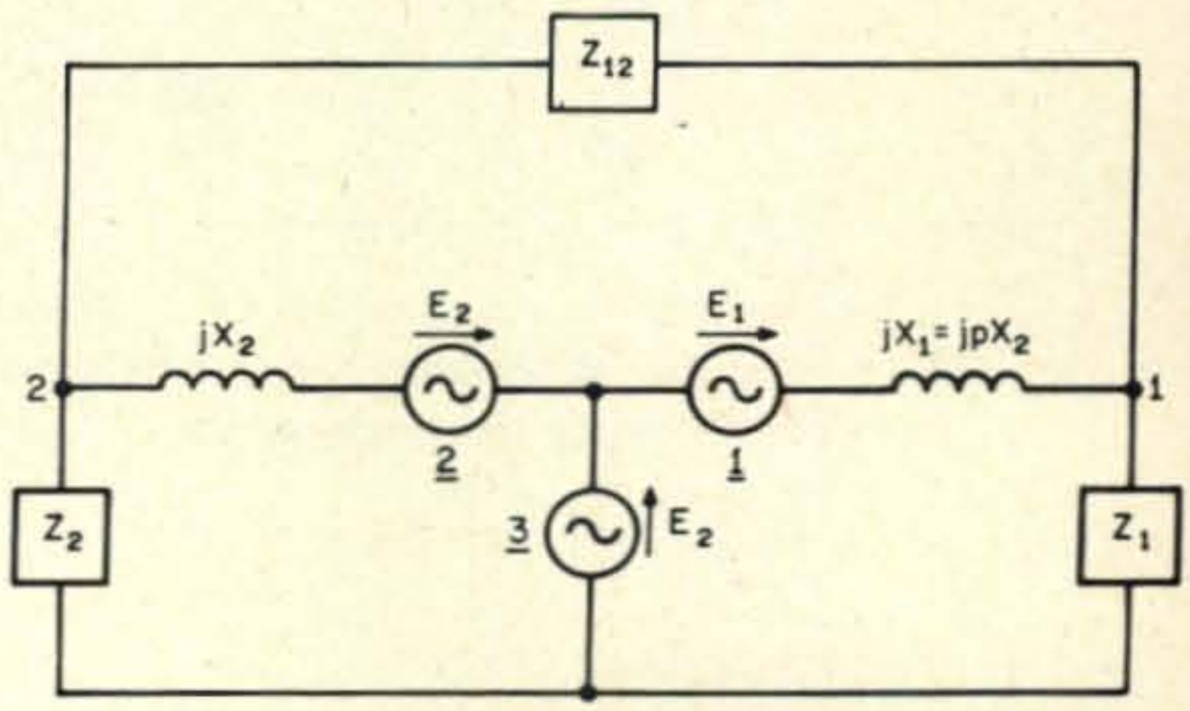


Fig. 95—Equivalent schematic of fig. 94.

See page 110 for New Reader Service

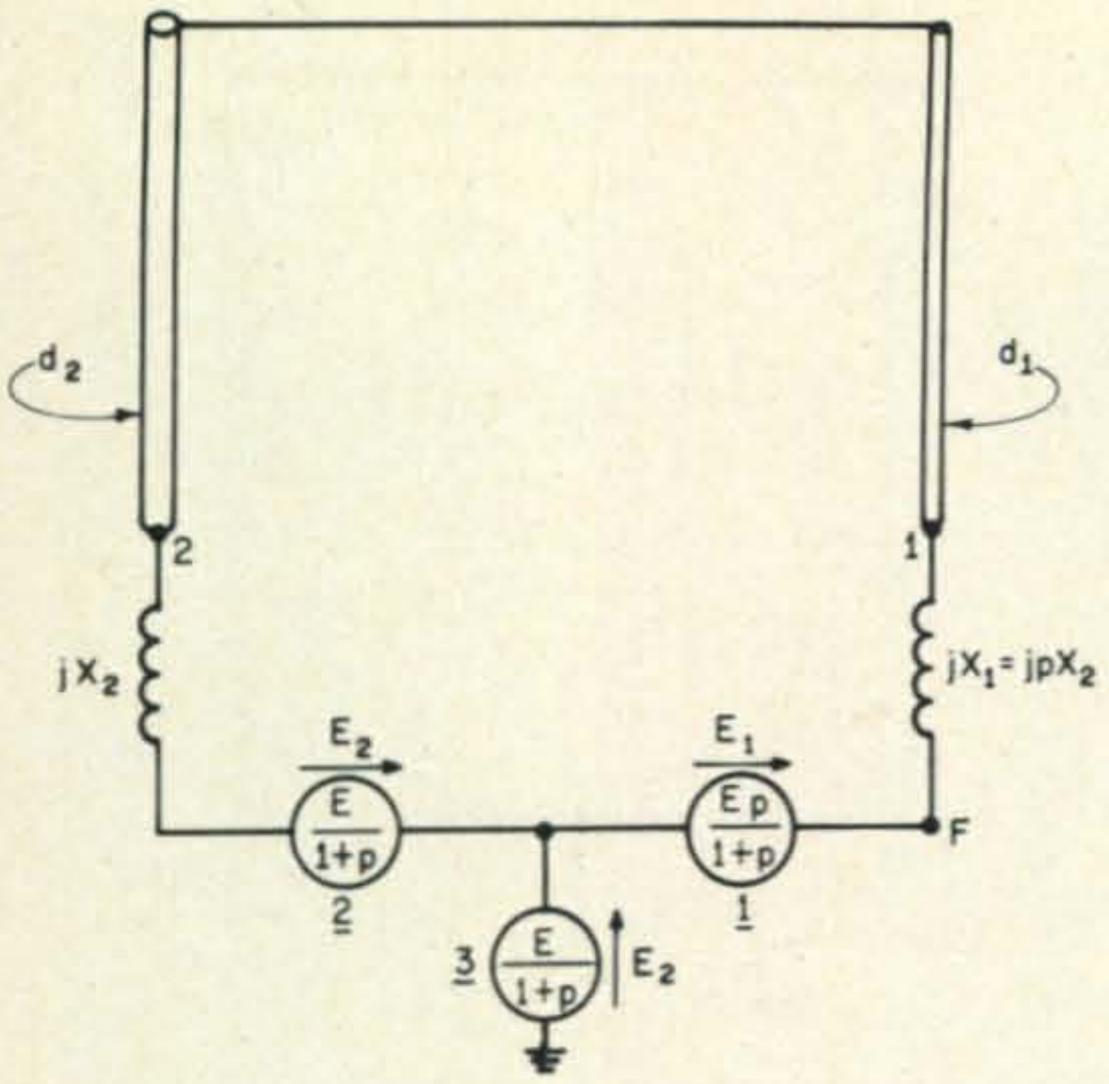


Fig. 96—Equivalent circuit of the folded unipole showing the generators in terms of E and P.

$$\frac{E}{j\,[X_2(1+\rho)+X_L]}$$

where X_L is the transmission line inductance of the shorted section.

The antenna current is found by shorting out the two upper generators 1 and 2. Since points 1 and 2 are then at the same potential, the two conductors of the unipole are considered to be combined into a single vertical radiator, whose input impedance we shall designate by $R_a - jX_a$. The reactance will be negative because the radiator is shorter than 90°. The values of R_a and X_a can be determined by consideration of the radiator's L/D ratio and its electrical length, and by consulting fig. 13A and 13B of Part II of this series.[77] We also have X_2 and ρX_2 in parallel in this antenna mode, in series with $R_a - jX_a$. The parallel combination of X_2 and ρX_2 equals $[\,\rho/(1+\rho)\,]X_2$, and the driving voltage for the antenna mode is $E/(1+\rho)$.

The total antenna mode current is, therefore:

$$I_{A\,(TOTAL)} = \frac{\left(\frac{E}{1+\rho}\right)}{\left[R_a - jX_a + j\left(\frac{\rho}{1+\rho}\right)X_2\right]}$$

Only a fraction of this, however, flows in part d_1 of the unipole. That fraction is:

$$I_A = \left(\frac{1}{1+\rho}\right) I_{A\,TOT}$$

or:

$$I_A = \frac{E}{[R_a(1+\rho)^2 - jX_a(1+\rho)^2 + j\rho(1+\rho)X_2]}$$

From feedpoint F of the unipole to ground, the input impedance is:

$$Z = \frac{E}{I_A + I_T}$$

From this let us now subtract the value of jX_1 (equals $j\rho X_2$) to obtain the true input impedance:

$$Z_{IN} = \frac{E}{I_A + I_T} - j\rho X_2$$

By substituting the values of I_A and I_T in this equation, we can find the input impedance as a function of X_2 as shown in the equation at the bottom of the page.

The equivalent circuit of the short folded unipole is shown in fig. 97. In the case of the 90° folded unipole, the circuit of fig. 97 and the preceding equation can be used, and since in that case X_a is zero (the antenna is self-resonant), X_2 is zero and X_L is infinite (shorted quarter wave line), the resultant $Z_{IN} = R\ (1+\rho)^2$, which would be expected.

[77] Lee, P. H., "Vertical Antennas–Part II," *CQ*, July 1968, p. 25.

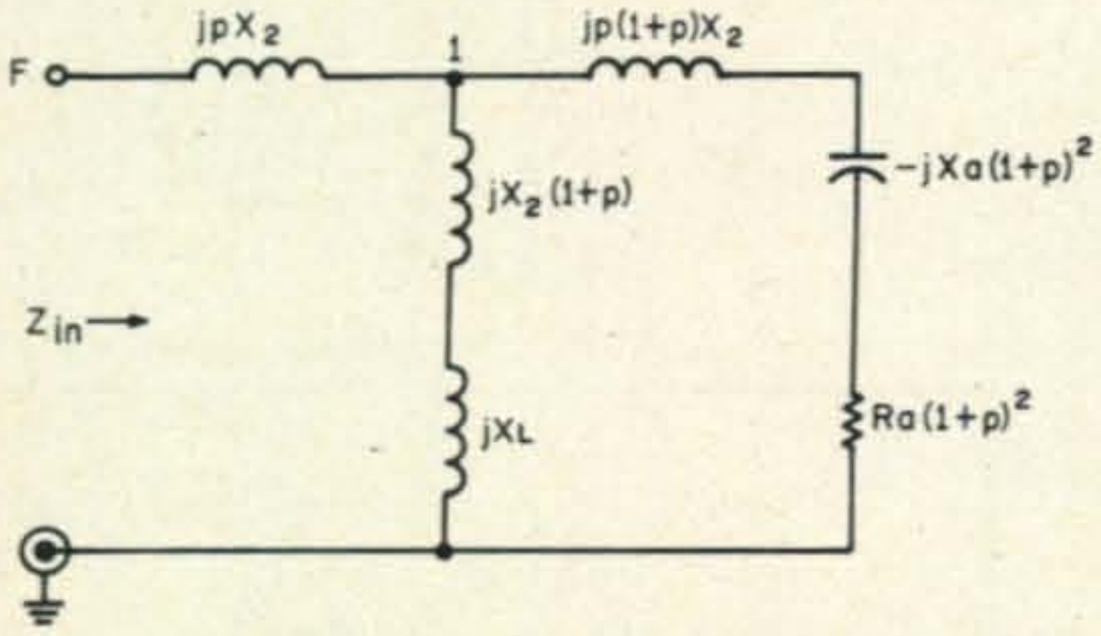


Fig. 97—Schematic diagram of the equivalent circuit for input impedance, Zin.

$$Z_{in} = \frac{1}{\dfrac{1}{[R_a(1+\rho)^2 - jX_a(1+\rho)^2 + j\rho(1+\rho)X_2]} + \dfrac{1}{j\,[X_2(1+\rho)+X_L]}} - j\rho X_2$$

See page 110 for New Reader Service

Thus the general case does fit the 90° special case.

From all of this we observe that the unipole multiplies the input resistance and reactance of the antenna by the factor $(1 + \rho)^2$, and it also transforms these new values of R_a and X_a through an equivalent circuit T-network action due to its inherent transmission line mode. The final result is dependent on the value assigned to X_2. In the case of the grounded base short tower, which is quite common, X_2 is of course absent from the circuit. However, use of X_2 can be quite beneficial if optimum efficiency and bandwidth are desired.

Summary

To summarize, the input impedance of the short folded unipole is influenced by a number of factors. First, it depends on the division of currents between the fed and unfed conductors, on the presence of considerable transmission line currents in the fed and unfed conductors, and on the value of an impedance which can be connected between the unfed conductor (or tower) and ground. The reactance of a short vertical antenna can be reduced by increasing the diameter/length ratio of the antenna. This is done by dropping wires down from outrigger arms connected to the top of the tower, and connecting them in parallel with the tower. This is in effect a "fattening" or broadbanding action, as described in Part VII of this series.[78]. Such a structure can be easily modified to the folded unipole method of feed by driving one or more of the drop wires, while the rest are either left connected to the tower or grounded through a reactance X_2. Such a configuration is shown in fig. 98.

An additional advantage of the folded unipole is that the antenna structure is at d.c. ground potential, and no static discharge devices are required. If X_2 is not employed the tower is actually grounded, and lighting circuits, transmission lines to other antennas such as u.h.f. and v.h.f. arrays, and rotator control circuits can be run right up the tower without any isolation.

In this Part, both the general and the special cases of folded unipole antennas have been summarized. In Part XI I am going to discuss the effects of ground on the efficiency and vertical patterns of antennas, and the necessity (or lack thereof) for a ground system at the base of a vertical antenna.

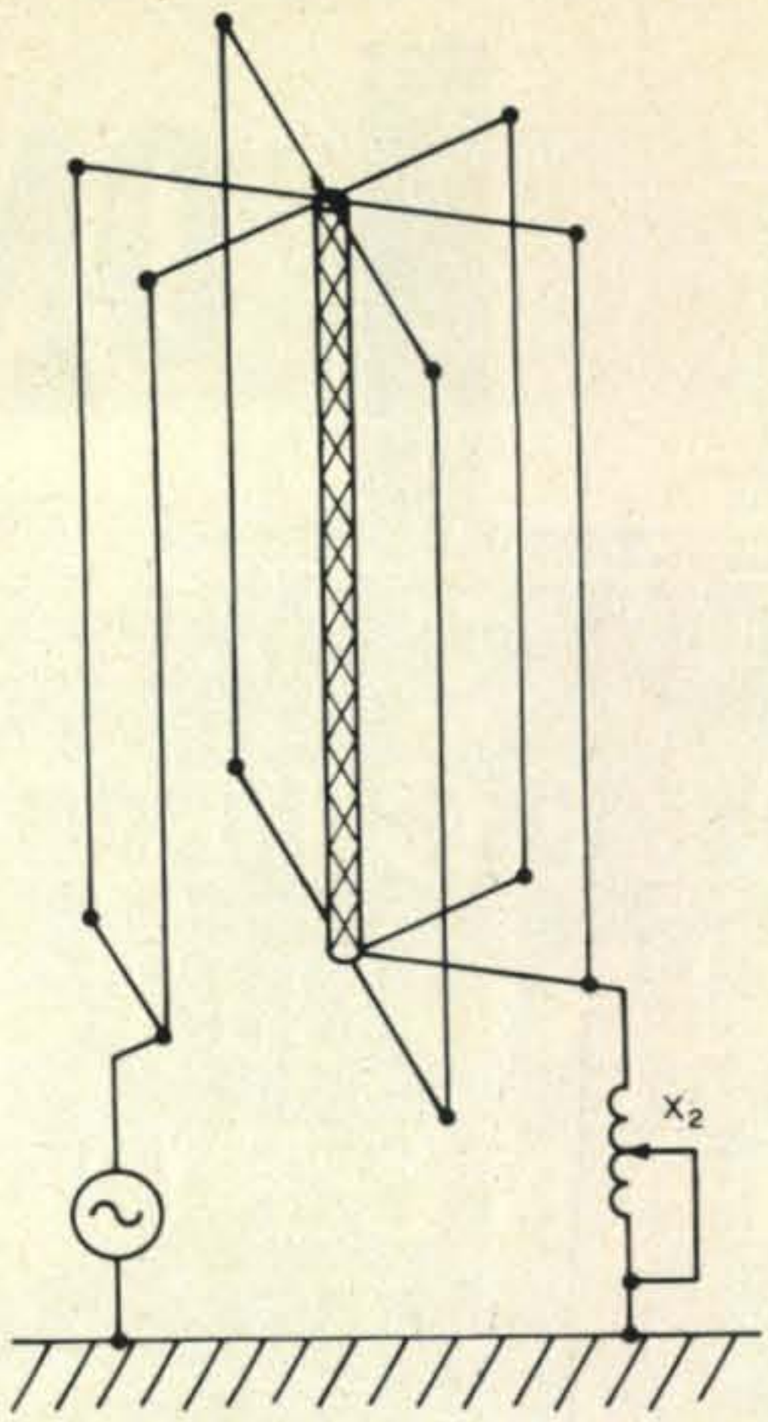


Fig. 98—"Fattened" or broadbanded tower fed as a folded unipole with multiple folds.

Errata

We regret that there are several typographical errors in Part VII in the December 1968 issue. On page 62, at the top of the right hand column, the equation should read:

$$Spacing\ S_n = R_n - R_{n+1} = R_n\,(1-\tau)$$

The second sentence in the second paragraph on that side of the page should read:

Thus for a given angle α, there is a minimum value of τ:

On page 63, in the first paragraph below fig. 74, the equation should read:

$$Spacing\ S_n = R_n - R_{n+2} = R_n\,(1-\tau)$$

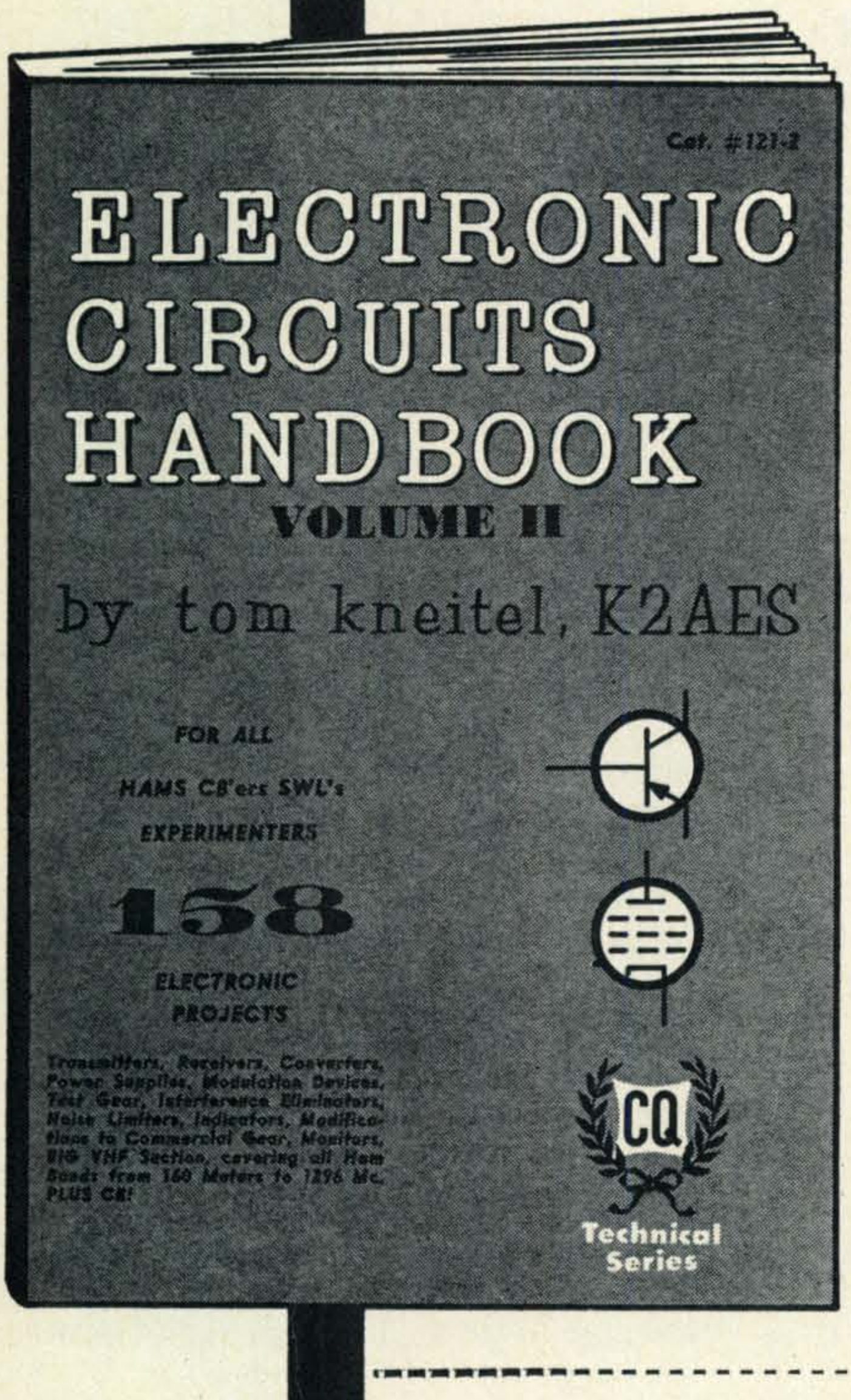
[*To Be Continued*]

Back issues of *CQ* containing earlier installments of "Vertical Antennas" by Capt. Paul H. Lee, W3JM, are available from the *CQ* Circulation Department, 14 Vanderventer Ave., Port Washington, N.Y. 11050. Price per copy is $1.00, with the exception of January 1969, which is 75¢. The entire series is planned to run twelve consecutive installments.

[78]Lee, P. H., "Vertical Antennas—Part VII," *CQ*, Dec. 1968, p. 59.

See page 110 for New Reader Service

ONE MORE TIME



Volume I was a sellou
Here's your chance to get i
on the follow-up to the Ele
tronic Circuits Handbook!

Tom Kneitel, K2AES, has dug u 158 more electronic projects aime at making life in ham radio a sna Included in Volume II of the Ele tronic Circuits Handbook are tran mitters (1 watt to a kilowatt), r ceivers, power supplies, modulatio devices, test gear, QRM killers, mod fications to commercial gear, mon tors—all this plus a special adde BIG VHF section. There's somethin here for every band from 160 mete to 1296 mc/s! Keep it around th shack to get you out of that sudde panic when the radio store is close and all you can rely upon is th overflowing junk box. How man books will give you a poor man's 4 or 80 meter transmitter while simu taneously solving the problem what to do with that 117N7GT th you've had lying around for 9 year

Quick, send $3 and we'll rush yo an early copy of Electronic Circu Handbook, Vol. II.

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 ELECTRONIC CIRCUITS HANDBOOK, 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 _____

See page 110 for New Reader Service

See you at the Harrison SINGLE SIDE BAND SHOW TUESDAY OF IEEE SHOW WEEK

WHAT'S FREE IN NEW YORK?
The BIG Eighteenth Annual Single Side-Band Show
THAT'S WHAT

EVERYONE IS INVITED!

Here's your big opportunity to see all the newest Ham gear from the leading manufacturers, and to talk directly with the factory people. All at the 1969 Single Side-Band Show, Tuesday, March 25th, from noon to 9.

All Hams, would-be Hams, CB-Hams, and their friends! Come to the Penn Top Room of the STATLER-Hilton Hotel, 7th Avenue and 33rd Street, New York City (opposite Pennsylvania Station).

SHOW SPECIALS! Big Savings

FREE!

TECHNICAL SESSIONS
Informative discussions by the experts from leading equipment manufacturers.

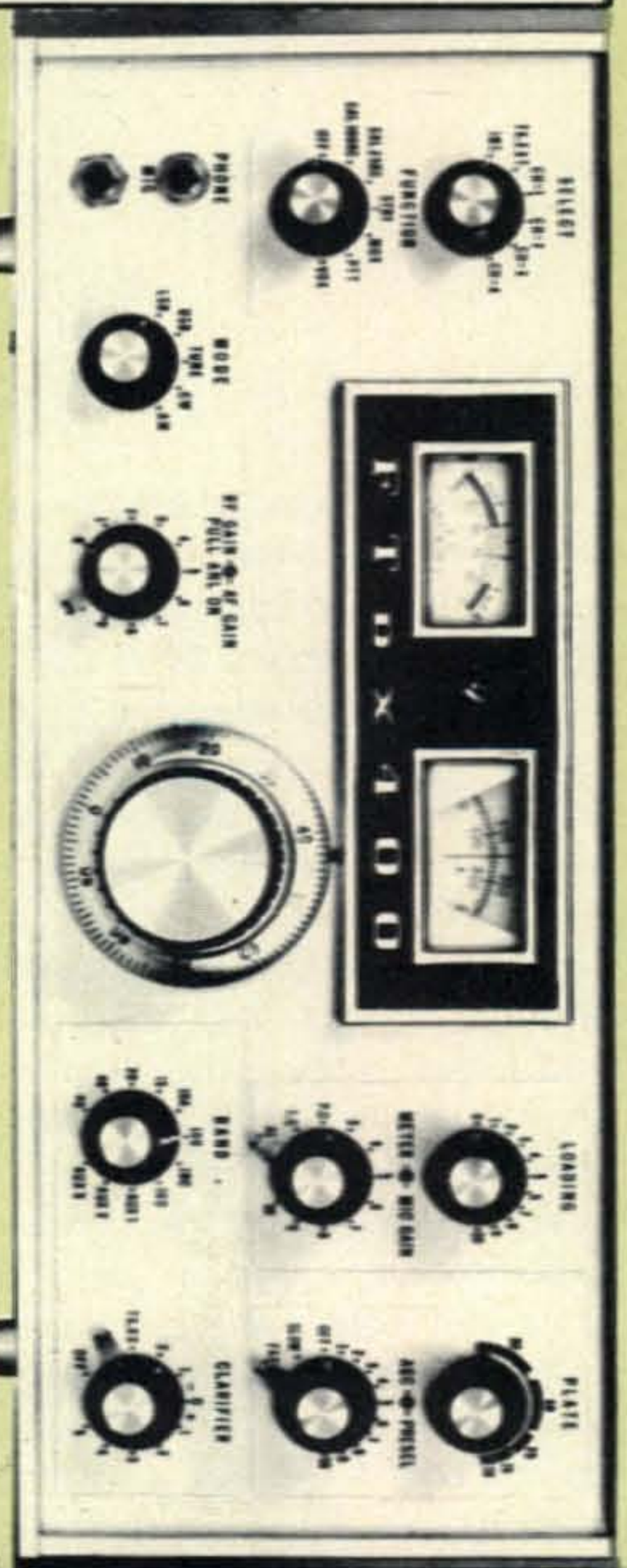
FREE!

VALUABLE PRIZES
Awarded every hour on the hour. (Be sure to bring your Ham License.)

Come—see the bare INSIDE STORY
(top-less and bottom-less)

OF THE ONE THEY'RE ALL TALKING ABOUT

...the YAESU
FT DX 400



Can't make it to the BIG SHOW?

Just send us your check for $599.95 and we'll deliver, prepaid, a brand new FTdx-400 to you, PDQ! (If you prefer, EASY TERMS arranged.)

Coordinated, in the interest of Amateur Radio, by

Harrison
"HAM HEADQUARTERS, USA"®

NEW YORK CITY
8 Barclay St.
(212) BArclay 7-7922

JAMAICA, L. I.
139-20 Hillside Ave.
REpublic 9-4101

FARMINGDALE, L. I.
Route 110 at Smith St.
(516) 293-7995

ee page 110 for New Reader Service

A HOMEBREWED SLOT ANTENNA FOR 432 MC

BY RICHARD M. BALDWIN,* K4ZQR

A LOT of hams must have built the homebrew slot for two meters, judging from the mail I have received since this article appeared in February 1965 *CQ*[1]. Many of these letters asked dimensions of the slot for different frequencies in the two meter band; others simply expressed satisfaction in the performance achieved. The original slot for two meters was 45″ × 15″ and was cut for 145 mc. One of the advantages of the slot antenna is that it is a broadbanded device, and I used mine quite successfully on a MARS frequency at 143.95 mc without any change in its dimensions. The purist who wants to cut exactly at 144.1 for example, would make the slot dimensions 46¾″ × 15¾″, not a very great difference as you can see.

All of this has no bearing whatsoever on a homebrew slot for 432 mc except to point up one of the main advantages of this fine antenna our British cousins have been using so successfully on u.h.f. The 420 mc band is 50mc wide, and if you plan to operate up in this rarified atmosphere it is well to have an antenna which is tolerant of frequency variations, gives excellent gain, and is compact in size. The slot is the best answer I can think of to all three.

My interest in this band, by the way, deve oped when the ham TV bug bit, but that not part of this story. Suffice it to say tha this antenna does a real fine job on ham TV and the one I built was from dimensions ob tained from the Indiana TV and U.H.F. Clu an organization of avid ham TV'ers located a over Indiana and meeting every six to eigh weeks in Indianapolis. Several of us Kentuck ham TV enthusiasts have been commuting t Indianapolis for these fascinating meetin held at Naval Avionics. With no claims as t originality in design, let us proceed to buil it. I might say that you can also buy th British version which is imported and cu rently advertised for about $25.00.

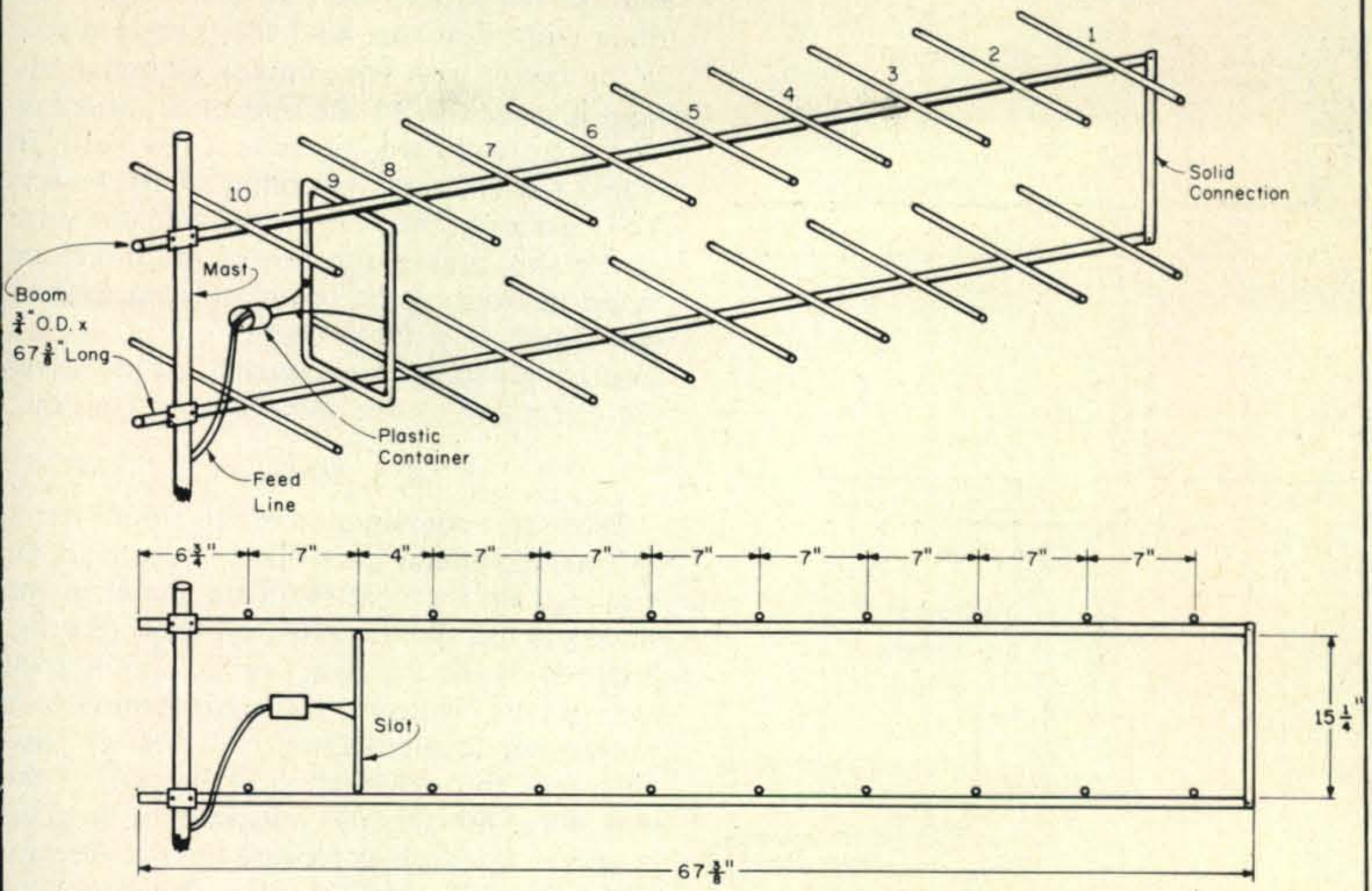
Materials

For raw materials I can suggest the sam procedure recommended in the first articl pay a visit to the TV stores in your city, an the chances are you might be able to scroung some old TV antennas. If they throw the away as fast as they put up new color a tennas, then try to arrange to be present an pick up the pieces. What I am saying is th you should be able to get material for litt or nothing, but you'll need several old T antennas as this slot is a ten over ten, and th means two booms and twenty elements i cluding the slot.

*409 Kaelin Drive, Louisville, Kentucky 40207.

[1]Baldwin, R.M., "The Homebrew Slot Antenna," *CQ*, Feb. 1965, p. 26.

See page 110 for New Reader Servi



Element Lengths	
1—10¼"	6—11"
2—10½"	7—11⅛"
3—10⅝"	8—11¼"
4—10¾"	9—Slot
5—10⅞"	10—13½"

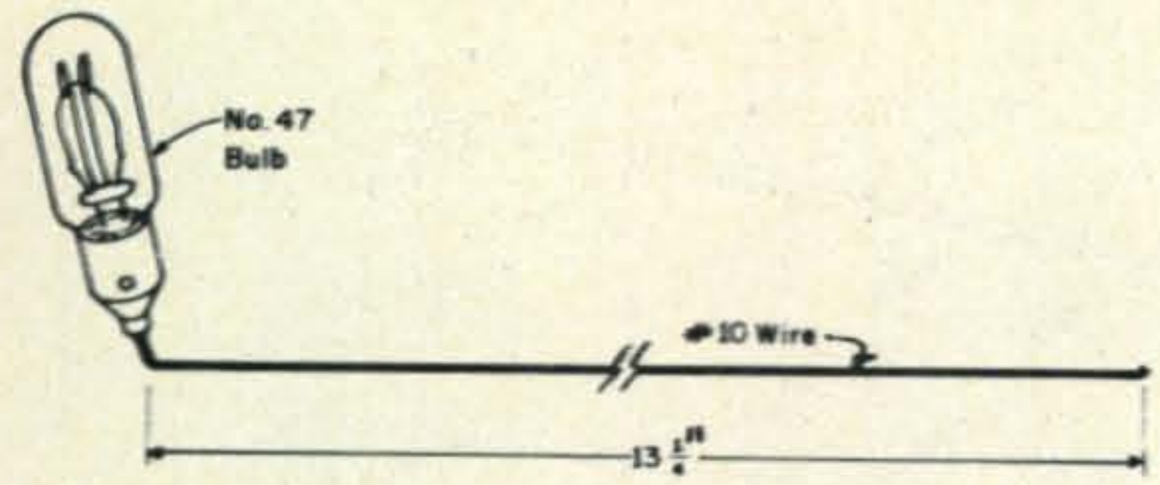
Fig. 1—Two views of the 432 mc slot antenna and details of the driven element. All elements are fabricated from 3/8" o.d. aluminum tubing while the booms and the forward upright are made from 3/4" o.d. aluminum tubing.

Construction

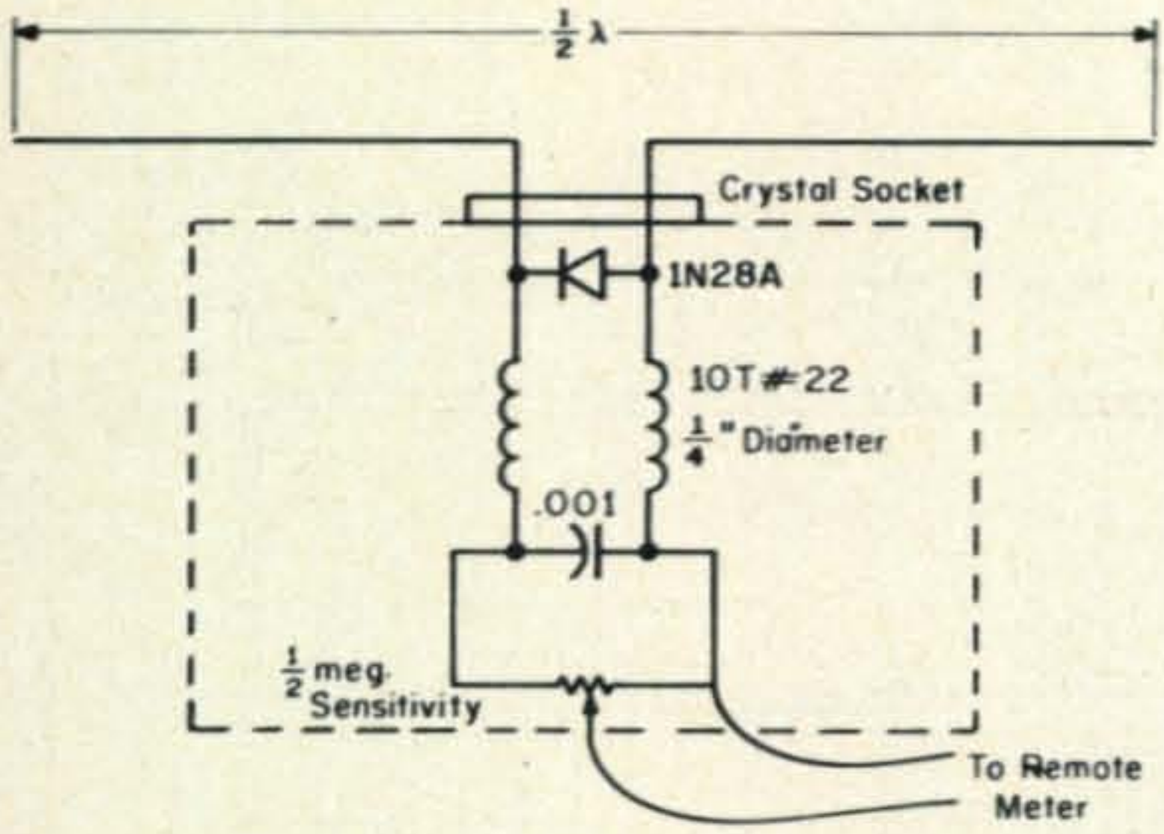
Figure 1 is a sketch of the antenna and the dimensions of its elements. As you see, it has two booms approximately 68" long and at least 3/4" in diameter. No regular TV boom will be this long, and you'll either have to piece them together or resort to other sources for aluminum tubing for the booms. If you piece them do it well so that the joint is strong. These booms are spaced 14⅞" apart by the slot, and they are clamped to the mast by TV clamps behind the reflector which is element ten. A solid spacer also joins the booms just in front of the first director, so the assembly really is rigid after you mount it. The front spacer can be the same material as the booms, or it can be slightly smaller in diameter. Bolt it securely to each boom.

Make the reflector, and the directors out of ordinary 3/8" O.D. TV antenna elements. You will need two of each length listed in the table. The slot itself is best made from 3/8" solid aluminum rod, as it bends nicely at the corners, and is more rigid. While this is recommended, I made mine out of hollow TV elements and it works OK, although it isn't as easy to make a nice looking job or to attach the impedance matching stubs which are 5⅜" long. These should be attached by self tapping screws through holes drilled in the slot at the mid-points on each side. They are angled toward each other, and then paralled about an inch from the ends to fit in two holes drilled in a piece of polystyrene about a half inch apart. Thread a self tapping screw and a washer into the end of each stub to attach the leads of your transmission line.

See page 110 for New Reader Service



(A)



(B)

Fig. 2(A)—Simple test dipole using a #47 bulb as an indicator. (B)—Simple u.h.f. field strength meter that may be used as a tune-up aid. The antenna wire for both units should be #10, a half wavelength long, 13¼". The dotted line indicates a small metal enclosure sealed against the weather and mounted on the roof. The sensitivity control is set according to the power of your transmitter.

The reflectors and directors may be attached at the indicated points either with nuts and bolts or with pop rivets. I drilled holes and used pop rivets and it worked out well. In either case put a lock washer between the element and the boom, it helps prevent turning.

Pattern

One of the advantages of this antenna is that it is small enough for you to build in the basement, or wherever your workshop is, and still be able to get it out of the door in one piece. This means you can hook it up to your transmitter while it rests on a table or across a couple of chairs and check out the radiation pattern. You can also test various feed lines before you put it up on the mast. For a simple r.f. indicator solder a no. 47 dial lamp to the end of a piece of stiff wire 13¼" long, as shown in fig. 2(A). Use number ten wire if you can, or at least something stiff. You can hold this simple dipole in the center with your fingers, or better still tape it crosswise to the end of a yardstick. The lamp will light for quite a few yards in front of your beam, depending on the power. You can also trace the r.f. around the edge of the slot, and at the tips of the directors. Stand in front of the beam and you can see how large a pattern comes off of it. It's surprisingly sharp; move even a few inches off the direct line of fire and the lamp goes out.

F. S. Meters

We used a combination of this simple tester and a little home brew field strength meter mounted on the roof (with the meter in the shack) to test out various feed lines. (See fig. 2[B].) Between the two you can get a good idea of how efficiently you are matching your transmitter to the antenna. At first we tried coax feed through a balun at the ends of the slot stubs, but this did not produce as good results in our case as feeding the slot directly with foam 300 ohm TV cable. Other users of this antenna tell me that they feed the slot with coax with no balun. You can check your own particular situation out easily in the shack with these two handy gadgets and a few lengths of feed lines. Details are shown in fig. 2.

Having determined how you are going to feed it, be sure to weather-proof your connections at the antenna. You can use a plastic container and seal it with cement.

Because the slot has quite a sharp directional pattern, you really should provide a means of rotating it unless you plan to work only one direction on 432. If you followed the advice about putting a little field strength meter on the roof, you will find this little device handy in helping you at all times to get all possible r.f. out of your antenna. Simply rotate the antenna enough toward the field strength indicator to get a good reading and tune for maximum output.

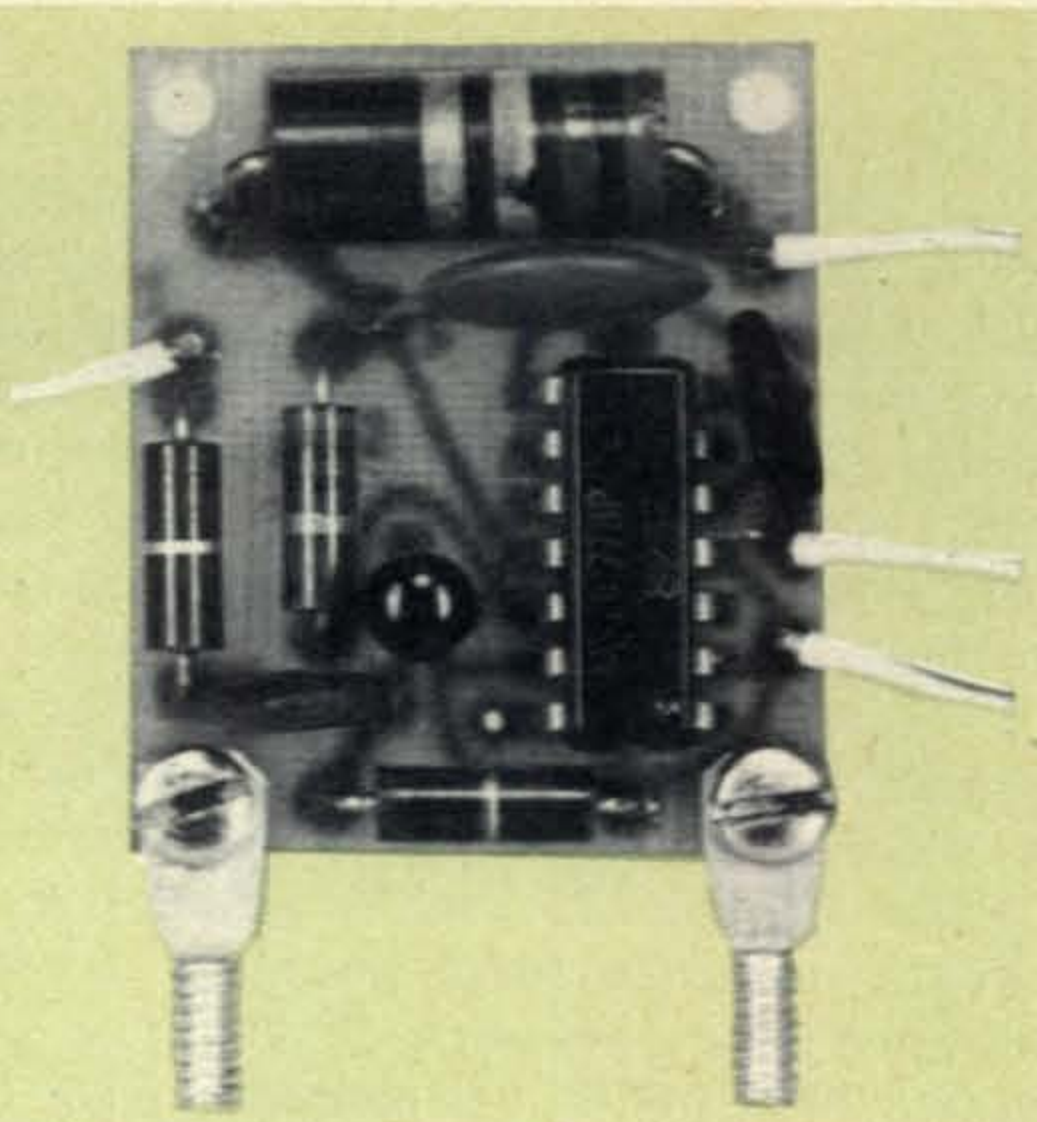
If I've sold you on the slot for 432, perhaps you are now wondering how to get on ham TV. This is beyond the scope of this article but there has been quite a lot of good material published in *CQ* and other magazines in the past few years.

Whether you're simply tired of QRM, or interested in looking at your pal's ugly mug as well as talking to him, try the 420 to 450 mc band. It's easier than you think, and lots of fun.

See page 110 for New Reader Service

CQ Reviews:

The Paxitronix IC-3 Frequency Divider for 25 kc Markers



BY WILFRED M. SCHERER,* W2AEF

MANY of the modern receivers are equipped with a 100 kc crystal calibrator for accurately locating the band edges or other intermediate 100 kc points. With the new band subdivisions in force due to incentive licensing, 25 kc markers are a desirable feature for pinpointing the limits of these band segments.

With receivers incorporating a 100 kc calibrator, or where an external calibrator is available, a 4:1 frequency divider driven by the calibrator will provide the necessary 25 kc signals. Such a device is the Paxitronix IC-3, a solid-state affair using an integrated circuit.

It is built on a printed-circuit board slightly more than 1¼" square with a maximum height of about 1/2" taken up by the components. Its very small size and compactness make it feasible for installation in about any existing receiver. Furthermore, it may be powered from the receiver B-plus.

Principal of Operation

A bi-polar transistor (2N5133) and a dual flip-flop integrated circuit (Motorola MC778P) are the active devices employed. The 100 kc calibrator signal is applied to the transistor which triggers the first flip-flop, thus providing a 2:1 frequency division. This divider in turn drives the second flip-flop which again divides the frequency by two, for a total frequency division of 4:1, resulting in 25 kc signals derived from the original 100 kc source.

Operation of the device requires approximately 3 v.d.c., but to allow operation from receiver B-plus potentials of 100-180 volts, a dropping resistor is incorporated in the IC-3 to drop the applied potential as needed. If power is to be obtained from a higher- or lower-voltage source, a different value dropping resistor is used and is thus supplied with the unit according to the different source voltage as specified by the customer at the time of ordering. The current drain is 5-10 ma, depending on the supply voltage.

The IC-3 will function with any 100 kc calibrator that is capable of delivering 1-1.5 volts r.f. into a 100,000-ohm impedance, which just about takes in all those generally in use, including solid-state jobs.

Installation

The Paxitronix IC-3 is supplied with hardware for installing it horizontally on an insulated spacer. In cases where space is at a premium, it also may be mounted vertically on a bracket or with spade lugs such as with which our sample was supplied. There are four inter-connecting leads, one for input, one for output, a B-minus or ground and the B-plus.

Complete installation instructions are provided to cover a variety of situations, including methods of switching power. Operation also may be had from the a.c. heater supply by rectification to a d.c. voltage as obtained separately.

Performance

We tested the IC-3 with a number of different receivers using their built-in 100 kc

*Technical Director, *CQ*.

See page 110 for New Reader Service

calibrator, or an external one, for a driver. Good signal levels were obtainable at the 25 kc increments in all cases, even up through the 50 mc band. Although the model tested was the standard one for use with supply sources of 100-180 volts, it still functioned quite well with as low as 40 volts, but as might be expected, with a somewhat lower output.

The output is a square wave and as such is made up primarily of odd-order harmonics, so some of the 50 kc intervals may be found weaker than the 25 and 75 kc ones. If this should occur, a small coupling capacitor bridging the output of the first flip-flop to the output of the IC-3, will provide higher-level 50 kc intervals. This will also hold up the 100 kc points a bit better, which otherwise were found weaker than normally obtained from the 100 kc calibrator operated alone. In respect to the latter, it might be noted that the 100 kc calibrator will always work through the IC-3, unless a means of switching is used to bypass the frequency divider.

Since the IC-3 provides many more signals throughout the frequency spectrum than does a 100 kc oscillator, namely those at 25, 50 and 75 kc intervals, care must be exercised in distinguishing the correct points on multiple-conversion receivers or those easily subject to r.f. intermodulation products, images or other type spurious responses such as often experienced even with a 100 kc calibrator used alone.

The IC-3 frequency divider will be found a most useful adjunct for defining the band limits and as such will be an aid for minimizing the possibility of receiving a pink ticket from the f.c.c.

It is now priced at $7.25 postpaid and may be obtained from Paxitronix, Inc., Box 1038, Boulder, Colorado 80302. —*W2AEF*

CQ Reviews:

The Caringella Compressor-Pre Amplifier Model ACP-1

BY WILFRED M. SCHERER,* W2AEF

ONE of latest compressor amplifiers to arrive on the scene is the Caringella Electronics Model ACP-1 Solid State Compressor-Preamplifier which is furnished in kit form.

Since the functions and advantages of employing such a device should be fairly well known through past descriptions of other gear designed for the job, we'll not go into a detailed dissertation thereon, except to simply state that an audio compressor maintains a relatively uniform output level with varying input levels when operated within the design specifications.

Thus, the modulating level of a transmitter can be maintained up to maximum capabilities without over- or under-modulating it, making speaking-voice levels and positions around the microphone less critical for sustaining optimum amplitudes.

A true compressor is distinguished from a "clipper-type" one in that the latter merely clips the waveforms to a specific level which can thereby be maintained, but such a process can introduce considerable distortion. On the other hand, a true compressor automatically varies the amplifier gain as needed to sustain a given level, and what is most important, it does so without introducing adverse distortion that might otherwise not only result in unpleasant sounding a.f. quality, bu

*Technical Director, *CQ*.

The Caringella Model ACP-1 Solid-State Compressor-Preamp.

See page 110 for New Reader Service

which also might cause splatter or other undesired distortion products.

The ACP-1 is a true compressor combined with a pre-amplifier. It employs five transistors and one diode. Referring to the block diagram at fig. 1, the first amplifier stage utilizes an f.e.t., Q_1, to provide a high-impedance input and ensure a low input-noise level. The second and third stages incorporate silicon bi-polar transistors, Q_2-Q_3.

The output from Q_3 is rectified by D_1 with the resulting d.c. voltage amplified by Q_4 (another silicon unit) the output from which is used to control the bias on Q_5 that is a germanium transistor operated in its linear collector-to-emitter resistance region.

Any change in Q_5's base current, as a result of any bias changes from Q_4, thus causes the transistor to function as a current-sensitive variable resistor. The collector-to-emitter resistance is in series with the ground return for the emitter bypass, C_6, at Q_2. Therefore, as the resistance of Q_5 varies, the bypassing effect of C_6 likewise changes and alters the gain of Q_2.

The result is that as the level of the input signal rises, the amplifier gain decreases and accordingly reduces the output from Q_3. Similarly, the opposite effect takes place when the input amplitude drops. Compensation at the output is thus obtained with varying input-signal levels.

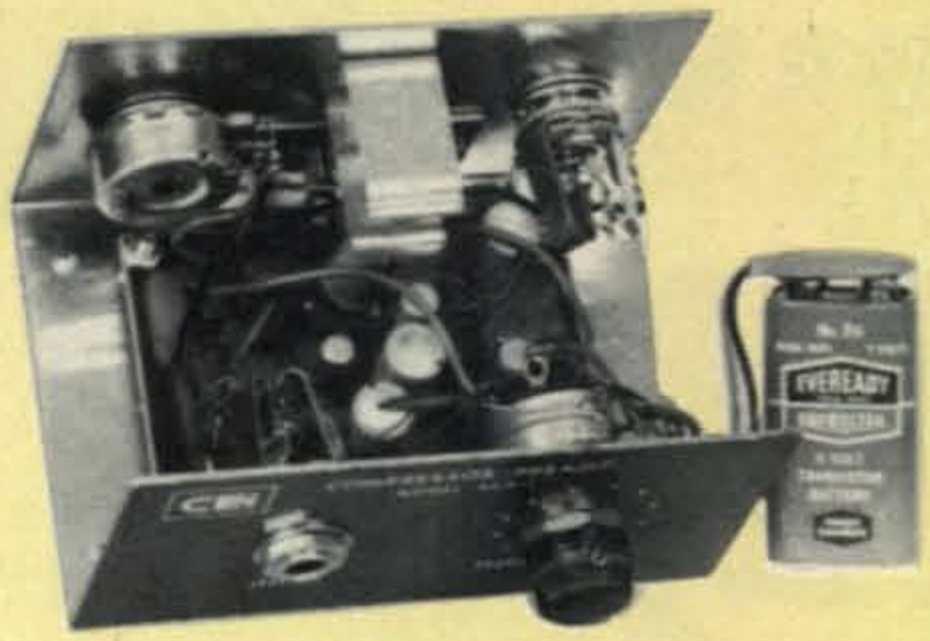
The amount of compression is controlled by a potentiometer that varies the input level to the unit. The output level of the compressed signal is adjusted by another control at the output of the device.

Construction

Except for the controls and connectors, the ACP-1 is assembled by the user on a glass-epoxy printed-circuit board which is then installed in a small metal box. Three-way jacks are used for input and output connections, thus permitting push-to-talk operation to be conducted directly through the unit without any external wiring to the transmitter needed.

The input jack is on the front panel along with the input-level or compression control. A switch on the control activates the unit which is powered by a self-contained 9-volt transistor-radio battery. Power also may be obtained from an external source for which there are screw-type terminals on the rear of the box.

Also on the rear is the output jack and a



Interior view of the ACP-1. The battery is held by the clip at top center.

finger-adjust control for setting the output to the proper modulating level.

The assembly work can be done in 2-3 hours. In this connection, it would be more convenient to install the completed circuit board in the box *before* the jacks and the two controls are mounted. If it is installed after these other components are in place, as per the instructions, you'll have to bend the sides of the box outward to insert the circuit board. Other than this, no assembly problems were encountered in putting our unit together.

Performance

Compression with the ACP-1 commences with an input potential of 1 millivolt and holds the output level constant with inputs of 2-40 mv, thus providing a flat compression range of 26 db. With 1-2 mv input, the output is held to within 3 db. The maximum output attainable with compression is 200 mv (output control fully advanced).

With input levels below 1 mv, the device simply functions as a conventional pre-amplifier with a 40 db voltage gain.

When the input level exceeds 40 mv (with the input-level control at maximum), no further compression is realized and the output rises sharply. Microphone levels seldom ex-

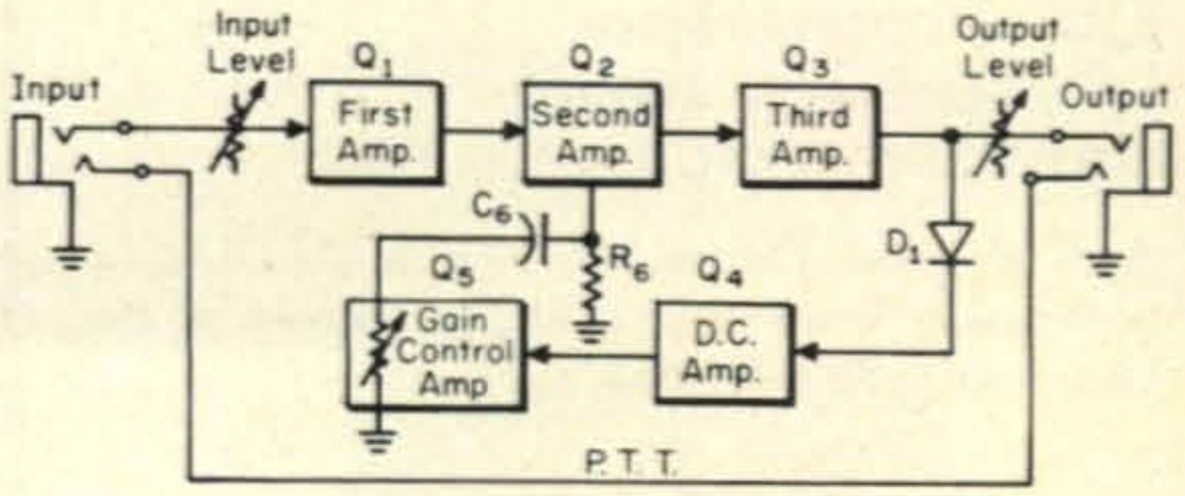


Fig. 1—Composite block diagram for the ACP-1. C_6 is the emitter bypass for Q_2. See text for details.

See page 110 for New Reader Service

ceed 40 mv with normal speech, so compression under these conditions can be maintained during on-the-air operation; however, shouting or whistling into the mic at a close proximity to it, will exceed the compression capabilities and produce a higher output from the amplifier. To avoid these consequences with high-level input signals, the input must be reduced accordingly with the panel control.

The ACP-1 has a very fast attack time of 1 millisecond. No overshoot is therefore experienced until compression takes hold on initial voice impulses, as is sometimes found with other devices designed for this application. The release time is approximately 2 seconds.

In addition, checks made by a distortion analyzer with the amplifer in operation with full compression, indicated no significant distortion.

For applications with radio transmitters, an r.f. bypass capacitor at the gate of the input f.e.t. minimizes the possibility of r.f. feedback. With this arrangement, the frequency response through the unit is 20-5000 c.p.s.

The ACP-1 also may be used to advantage for maintaining a high uniform level for p.a. systems or recorders, in which case removal of the r.f. bypass will permit a response of 20-20,000 c.p.s.

The unit has an input impedance of 500,000 ohms and is thus set up for use with high-impedance microphones. The output impedance is 5000 ohms.

There is no built-in provision for bypassing the compressor. If this is desired, the unit must be disconnected and the microphone then be connected directly to the related equipment.

Power requirements for the unit are 9 v.d.c. (with internal battery) or 9-12 v.d.c. at 3-5 ma (from an external source). Dimensions are 2½" × 4¼" × 3½" (H.W.D.) and it is finished in hammertone brown.

The Model ACP-1 Compressor-Preamplifier is priced at $18.50 (kit) with two matching 3-way phone plugs (you don't have to shop around for these), and complete assembly instructions. Battery is not supplied. The manufacturer is Caringella Electronics, Inc., P. O. Box 327, Upland, California 91786. —*W2AEF*

See page 110 for New Reader Service

DX

BY JOHN A. ATTAWAY,* K4IIF

It's a real pleasure to write this month's column under relaxed circumstances, usually we are hurrying around with many family and professional obligations to worry about and only a minute here and there for amateur radio. The majority of our column writing is done between the hours of five and six in the morning, so it is a luxury this month to be writing at three in the afternoon on the balcony of the XYL's family home in KP4-land with a mild breeze blowing in off the Caribbean.

Spring is upon us again, and between the vernal equinox and the summer solstice we should have good DX. The second ARRL Contest weekends come up this month followed shortly by the CQ Worldwide WPX Contest in April. Check Frank Anzalone's CONTEST CALENDAR for the exact dates because these are good times to chase zones, prefixes, and countries.

Since writing the February column we have begun to worry about the future of the radio amateur's ability to promote international understanding through his hobby.

*P.O. Box 205, Winter Haven, Florida 33880

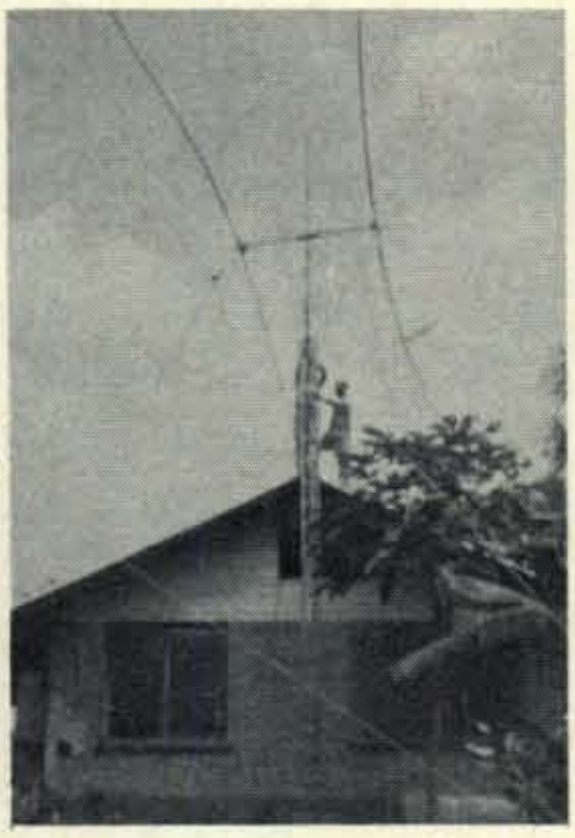
SSB DX Honor Roll

W2TP 317	K6CYG 305	K1IXG 288	G3WW 269
VK3AHO 315	K6YRA 305	K2LV 286	K8ONV 269
WA2RAU 315	WA8AJI 304	W6EUF 286	MP4BBW 267
W9ILW 315	W6YMV 303	K8RTW 286	G2PL 265
TI2HP 313	W0QVZ 303	F2MO 283	G2BVN 264
W3NKM 313	W2BXA 302	W3KT 281	W2MJ 261
WA2IZS 312	G3AWZ 301	W1LLF 280	DL3RK 259
G3FKM 310	G6TA 301	W6UOU 280	G3DO 259
KP4CL 310	W3DJZ 301	W4RLS 279	W6WNE 259
DL9OH 310	XE1AE 298	K4OEI 279	PJ2AA 258
W2RGV 309	5Z4ERR 298	K4HYL 276	K1SHN 257
W4OPM 309	K2DX 297	DL1IN 276	WA2EOQ 256
G8KS 307	W4QCW 297	W7DLR 276	W6BAF 254
W5KUC 307	W4SSU 297	K9EAB 273	K6CAZ 254
K6LGF 307	W4UF 295	K9LUI 273	PA0SNG 252
W8DE 307	W4PAA 294	W6RKP 272	W1AOL 250
I1AMU 305	W8EVZ 293	PZ1AX 271	
W2ZX 305	W2FXN 292	G3NUG 270	

There are many more DX stations on c.w. than are on s.s.b., and when the next sunspot minimum occurs all contacts with those c.w. stations will be over the frequencies 14.000-14.100 and 7.000-7.050 mc. The 10 and 15 meter bands will be useless for international contact at that time. But look, 100% of the 7 mc c.w. DX frequencies will be available only to the tiny minority of amateur extra's, as 7.050-7.100 mc is a phone band elsewhere in the world. Since RTTY is prevalent around 14090, rendering the top of the lower 100 kc segment of 20 meters improper for DXing, over 50% of the 14 mc c.w. DX frequencies will also be available only to extra class license holders. This is a dangerous situation, so we have petitioned the FCC not to carry through their original intent to further restrict the c.w. DX bands next November. This petition is the subject of De Extra which follows:

De Extra

To: Secretary, Federal Communications Commission, Washington, D.C. 20554



On the left is Hal Hanlin, ex-KC6BW, of the Micronesia Mission. Hal gave many a DXer a new one with the 20 meter quad shown on the right.

Ed Peck, W6LDD, of Oakland, California. Ed is an attorney and was a member of the 1967 CQ DX Awards Advisory Committee. He is a member of the Northern California DX Club.

See page 110 for New Reader Service

Paul Weiss, K2SBW, of Scotch Plains, N.J. Paul is a country chaser and since Nov. 1966 does most of his DXing on s.s.b. However, he reports that the DX stations on s.s.b. don't QSL as well as the ones on c.w.

From: Dr. John A. Attaway, K4IIF, DX Editor, CQ Magazine, (P.O. Box 205, Winter Haven. Fla. 33880)

Subject: Petition for modification of new rules under Section 97.7a which affect operating privileges in the amateur service.

Object: To prevent a severe restriction on the U.S. amateur's ability to enhance international good will, and to provide a more effective use of a critical portion of the amateur spectrum.

Dear Sir,

As you are aware, one of the most important objectives of the amateur service is to enhance international good will through person to person contact between individuals of various nationalities. The amateur service fullfills this objective very well as evidenced by the hundreds and sometimes thousands of daily contacts between U.S. amateurs and their counterparts all over the world, including the developing countries and the countries of the communist block. This activity is known as DXing, and these amateurs who devote a substantial share of their time to it are known as DXers.

Dave, W4AZK, one of the top operators from the Florida DX Club.

In most areas of the world only a very small percentage of the amateurs are able to own the sophisticated and expensive equipment necessary for s.s.b. operation. Consequently, many more international contacts are made using the c.w. mode than are made by voice. Two of the most important bands for these contacts are the 14 and 7 mc bands, particularly during the years of minimum sunspot activity when the 21 and 28 mc bands are useless for long distance communication. In the 14 mc band DX contacts are made on c.w. between 14.000 and 14.100, except for an area near 14.090 which is used predominately for Radio-teletype. The frequencies from 14.100 to 14.200 are used by oversea's amateurs as a phone band, so our DXers do not transmit c.w. over this portion of the band as a courtesy to the oversea's operators.

In the 7 mc band DX contacts on c.w. are made between 7.000 and 7.050 mc, the segment from 7.050 to 7.100 also being used overseas as a phone band. Consequently, if the amended section 97.7a goes into effect in its entirety on Nov. 22, 1969, over 50% of the 14 mc c.w. band and 100% of the DXing segment of the 7 mc band will be available only to holders of the amateur extra class license.

Figures furnished me by the Amateur and Citizen's Division of the FCC show that 9 months after the announcement of the amending of Section 97.7, only 2.6% of the some 260,000 U.S. amateurs held the amateur extra class license. This figure will rise, and probably reach or exceed 5% during 1969. However, for several years the majority of the c.w. frequencies for international contact will only be available to a tiny minority of U.S. amateurs. This will be a *most severe blow* to our ability to enhance international good will through person to person contact. It will also leave these frequencies open to intrusion by unauthorized services which are becoming an increasingly severe problem.

Most amateurs obtain their licenses when they are still young and in school, and have relatively few responsibilities. However, soon they are in their peak productive years and have families and responsible positions in business, government, and industry. They then become more interested in enjoying the few moments they have available for amateur radio rather than using them for tedious

See page 110 for New Reader Service

tudy. Therefore it will take many years to roduce a significant number of extra class cense holders. As we cannot afford to allow ur frequencies to remain lightly populated uirng this interval, I petition:

That the portion of Section 97.7a which adds the frequencies 14.025-14.050 mc and 7.025-7.050 mc to the list of those assigned exclusively to the amateur extra class license holders as of November 22, 1969, be rescinded so that those frequencies may continue to be used by the holders of advanced and general class licenses. The frequencies 14.000-14.025 and 7.000-7.025 would still be exclusively for amateur extra class license holders.

No other changes are asked at this time, but is suggested that a study be undertaken o insure the most effective use of the bands nd prevent future inequities. The petitioner eels that such a study will show that an llocation of only 10 kc for the amateur xtra class license, rather than 25 or 50 kc, ould provide a better balance of band usage, articularly in the case of the 14 and 7 mc ands.

The WAZ Program

News winners of the Worked All Zones ward this month were:

WAZ S.S.B.: SM7ASA–627, VE3EVU–28, W6ZC–629, HP1JC–630, PY1MB–31, VK4MY–632, WA6QWN–633, and K1AA–634.

WAZ Phone: K9COS–402 and OZ3Y–03.

WAZ C.W.–Phone: K4RDU–2554, WA-LMY – 2555, SM2COP – 2556, W6BPO – 557, SP2AOB–2558, DJ2TK–2559, WB-FOV–2560, K4CEB–2561, K4QIE–2562, VA6QWN–2563, K8UHB–2564, DJ3FW–565, and HB9PL–2566.

Complete rules and application blank for VAZ may be obtained by sending a self-ddressed, stamped envelope to DX Editor. .O. Box 205, Winter Haven, Florida 33880.

The WPX Program

Our successful prefix chasers include:

WPX S.S.B.: K9HDZ – 382, VP7NF – 83, UA1DJ–384, DJ3WW–385, and HP-JC–386.

WPX S.S.B. Contest: SK5AJ – 13 and VA2SFP–14.

WPX Phone: YV5BPU–162, CO8RA–63 and DJ3WW–164.

ee page 110 for New Reader Service

Left, CQ DX Editor, K4IIF, and right, Stew Perry, W1BB, posing with Stew's CQ DX Hall of Fame plaque. The photo was taken in the shack of Bob Waters, W1PRI, after last August's New England DXCC dinner given in honor of W1BB. *(Photo courtesy of W1PRI)*

WPX Mixed: W8KSR–186 and K4UTI –187.

WPX C.W.: W4DRK–899, DJ1QX–900, UA1DF–901, UW3FD–902, OK1PT–903, OE2LEL–904, K8NQP–905, and W2GUZ –906.

Endorsements: *S.S.B.:* HP1JC – 500 and DJ3WW–250.

C.W.: UA1DF–450 and OK1PT–350.

Mixed: W9ZTD–600, W8KSR–600, and K6SDR–450.

Continental: Europe: DJ1QX, OK1IQ, UA1DJ and W9ZTD.

Africa: W9ZTD.

Complete rules and application blank for WPX may be obtained by sending a self-addressed, stamped envelope to WPX Award Manager, K4DSN, 6563 Sapphire Drive, Jacksonville, Florida 32208.

The WPNX Program

The latest top Novice DXers and their certificate numbers are:

Don E. Stradley, WN1JOF–9

John O. Tucker, WN0UUM–10

Complete rules and application blank for WPNX may be obtained by sending a self-addressed, stamped envelope to WPNX Award Manager, K4GRD, P.O. Box 524, Lakeland, Florida 33802.

The VPX Program

The first winner of the new Verified Prefixes award for s.w.l.s is:

Lavoyd Kuney, WPE8AD, winner of Verified Prefixes (VPX) Certificate No. one. Lavoyd has confirmed over 2100 QSO's of which 1200 were DX, using an HQ-180A, HQ-215, and an NC-98, with 3 separate antenna systems. He is 51 years young and carries the U.S. mail.

Lavoyd Kuney, WPE8AD
7618 Beaverland
Dertoit, Michigan 48239

This was a Phone award with endorsements to 400 prefixes.

Complete rules and application blank for VPX may be obtained by sending a self-addressed, stamped envelope to VPX Award Manager, K4DSN, 6563 Sapphire Drive, Jacksonville, Florida 32208.

S.S.B. DX Award Program

100 Countries	200 Countries
DY4PX–539	PY3AHJ–161
VK9WD–540	
HP1JC–541	

Complete rules and application blanks for the CQ S.S.B. DX Awards may be obtained by sending a self-addressed, stamped envelope to S.S.B. DX Award Manager, W8HDB, 3785 Susanna Drive, Cincinnati, Ohio 45239.

Here and There

Indian Ocean DXpedition – Steven Gibbs, VQ8CC, hopes to be able to visit St. Brandon and Rodriguez sometime during the period March to May, 1969. Call signs will be VQ8CCB (St. Brandon) and VQ8CCR (Rodriguez). Operations will be on all bands 160 – 10 meters using Drake equipment. Further information about dates and times of operation, frequencies to be used, and QSL arrangements will be announced when they are definitely known.

VR6TC–If you send W5OLG an s.a.s.e. with approximate date and band you want a VR6TC QSO he will try to arrange a sked for you.

Arkansas DX Association Net–This is a DX information net on 3860 kc every Monday night at 0030 GM. It is open to all amateurs interested in DX regardless of call area.

International Call Areas Award (ICAA) –The International DX Organization (IDXO) set up by the 4U1ITU boys in Geneva is sponsoring this award to promote and stimulate friendly and skillful DX operation on the 160 - 10 meter bands. It will resemble CQ's WPX Award, but all 50 of the states may count separately. Callsigns not in line with ITU regulations will not be recognized. Also not to be recognized are islands normally uninhabited, and neutral or demilitarized zones.

W9IOP 2nd Op.–This helpful guide has recently been updated and should be on every DXer's desk. For info contact Publications in Electronics, 216 West Washington Ave., South Bend, Indiana 46601.

QSL Manager's Directory – This very helpful publication can be obtained from Bookbinder, P.O. Box 54222, Terminal Annex, Los Angeles, CA 90054.

QUAX–QUA = Here is news of *X = Ten*. This is the 6-8 page monthly bulletin about DX and propagation phoenomena on the 28 mc band. Sample copies may be obtained from SM4DXL, Djurgardsv. 35C, S-681 00 Kristinehamn, Sweden.

Rare DX Interested in DX–Rasheed YK1AA, recently applied for 2 way s.s.b. WAZ and received certificate No. 634.

Baker smashes Troster–Just joking of course. Dave and Jack aren't karate-chopping each other, but the W6WX–278, 71[illegible] to W6ISQ–278, 414 points in the CQ World-wide Phone Contest in October was about as close as any scores we've seen.

New CANAD-X Members–New members of the Canadian DX Association are VE2DCX, VE2DHH, VE2UN, VE3BAP, VE3BUC, VE3BYN, VE3FEC, VE3TB, VE4SD, VE5GG, VE6AQL, VE7AQR, and VE7BVM.

Volunteer QSL Manager–Steve Barry WA3HUU, 384 Union Street, Uniontown, Pa. 15401 would like to be QSL Manager for a DX station.

G3DO–Apologies to George for omitting his s.s.b. WPX score of 617 prefixes from the Honor Roll which appeared in the Nov

See page 110 for New Reader Servic

ember, 1968 issue. George's phone total is now 715, and his mixed score is 755.

DX Bulletins

As the West Coast DX Bulletin boys say: "If it is over 10 days old, it's history and not news." Consequently, you can't rely on a monthly magazine for your DX tips. Every serious DXer should take 1 or more of the DX only publications which appear weekly or biweekly. Those which we receive include:

West Coast DX Bulletin, 77 Coleman Drive, San Rafael, Calif. 94301

Long Skip, c/o VE3HJ, 48 Wimpole Drive, Willowdale, Ontario, Canada

DX'-press (In English), c/o A. J. Dijkshoorn, PAØTO, Jan van Gelderdroof 11, VOORSCHOTEN, The Netherlands

DX News-Sheet, 62 Belmore Rd., Norwich, Nor. 72T, England

DX-MB (In German), c/o DL3RK, *895 Kaufbeuren,* Box 262, Germany

The DXers Magazine, Route 1, Box 161-A, Cordova, S.C. 29039

Long Island DX Association Buletin, c/o W2GKZ, 43 Cameron Drive, Huntington, N.Y. 11743

GB2SM Desires RTTY Skeds

An RTTY installation, recently added as a permanent feature to Science Museum Demonstration station GB2SM, has proved very popular with our visitors. We are anxious to bring our interest in RTTY to the notice of all radio amateurs. Our normal demonstration times are Monday-Friday at 1030-1100 and 1500-1530 GMT. If any station can offer us regular short contacts on any of the bands 80-10 meters during these times we would be most appreciative. Schedules may be arranged through Mr. W.K.E. Geddes, Science Museum, South Kensington, London, S.W. 7, England.

160 Meter News

According to reports from Stew, W1BB, and Herb, KV4FZ (WØVXO), Transatlantic DX Test No. 1 for the 1968/69 season was a big success. Stew reports many W/VE/EU QSO's as far west as W9-land with signals up to 5/8/9 and everyone having a ball. W1BB himelf worked 17 DX stations. Herb found that in KV4-land the European stations peaked an hour earlier than in the states. He logged in 2-way QSO's with EI9J, G3RPB, PY2BJH, G3TSA, G3LIQ, and G3RXH.

There was also a good turnout for the

Left to right, YN4JAB and W5QPX during the recent visit of the former to the latter's QTH. YN4JAB's XYL is YN4EB and one of his daughters is YN1YB and the other is YN4DAH.

Transpacific Test with fair to good conditions. KH6GLU worked 21 North American and 4 Japanese stations. He has a 500 ft. Vee up 100 ft. NE/SW in an isolated area of Molokai Island and is really putting KH6 on the 160 map. Ed says that east coast USA stations should use 1800-1803 and all other 1993-1996 to avoid Loran QRM.

During the CQ Worldwide C.W. Contest in October, Sam Harris, W1FZJ/KP4 made a fine 160 showing working many Europeans with a 2-element, steerable array.

Herb, KV4FZ, also reports working K9-SBL/Mobile in downtown Chicago on 160 meter s.s.b. with Q5 signals both ways. W9UCW heard the QSO and rushed out to

Father William J. O'Donnell, MM, TG5WJ better known as Bill (WB2GJR), op at K2ESE during mid and early '60's. Bill is ex-K90BS, from Chicago area, and still retains the call of WB2GJR along with the TG5WJ callsign. He will keep the latter call for some time . . . since he is permanently assigned to Guatemala.
(Photo via K2DDK)

See page 110 for New Reader Service

One of the top DXers of Europe, Dr. Alfonso Porretta, I1AMU, of Rome, Italy.

his car where he also contacted KV4FZ. These contacts were not prearranged, but were a simple answer to a CQ call. Herb couldn't copy either of the 9-land stations on a horizontal antenna, proving the worth of the vertical for 160 DX.

CQ DX Award's Advisory Committee

These are the folks who guide us in the interpretation of the CQ DX Award's rules, and vote on the nominees for the DX Hall of Fame. Any disputes in the award's program are resolved by a majority vote of the Committee. Fortunately, however, as zones and prefixes are relatively non-controversial entities the Committee has had a relatively peaceful year with little work to do. Each Committee member is also authorized to verify cards for WAZ and the CQ S.S.B. DX Awards if you prefer to have your cards checked near your home QTH rather than mailing them to CQ.

The Committee members, the DX Clubs they represent, and their addresses are as follows:

Ron Kreger, VE3DLC, Canadian DX Association, 30 Zenith Drive, Scarborough, Ontario, Canada

Ray Walker, W1DHL, New England DXCC, 8 Yukon Ave., Watertown, Mass. 02172

Frank Anzalone, W1WY, (CQ Contest Editor), 14 Sherwood Road, Stamford, Conn. 06905

Howard Klein, WB2EPG, Long Island DX Association, 123-60 83rd Ave., Kew Gardens, New York

Ben H. Stevenson, W2BXA, North Jersey DX Association, 50 Sycamore Rd., Colonia, New Jersey

Bob Wilson, W3GHD, Frankford Radio Club, 139 Campbell Ave., Havertown, Pennsylvania

Joe Hiller, W4OPM, Virginia Century Club, 2208 Dinwiddie Road, Bayside, Virginia Beach, Virginia 23455

Howard Kelley, Jr., K4DSN, Florida DX Club, (CQ WPX Manager), 6563 Sapphire Drive, Jacksonville, Florida 32208

Frank Campbell, W5IGJ, West Gulf DX Club, 2153 University Blvd., Houston 25, Texas

Gary A. Stilwell, W6NJU, Southern California DX Club, 7164 Rock Ridge Terrace, Canoga Park, California 91304

Dave Baker, W6WX, Northern California DX Club, 930 Colby Ave., Menlo Park, California 94025

Louise Rippe, W8HDB, Ohio Valley Amateur Radio Association, (CQ S.S.B. DX Award Manager), 3785 Susanna Drive, Cincinnati, Ohio 45239

Bob Thibert, W9ARV, Northern Illinois DX Association, 708 W. Illinois Ave., Palatine, Illinois

Dick Spenceley, KV4AA, Member-at-Large, P.O. Box 403, St. Thomas, Virgin Islands 00802

Mike Ferguson, WA8GGN, Member-at-Large for WPX, 2335 Niles Ave., St. Joseph, Michigan 49085

New Award's Checkpoint

Mexican DXers may now have their cards for WAZ and the S.S.B. DX Awards checked in their own country. The XE-land checkpoint is manned by Fernando L. Vallarta, XE1AE/4A1AE, P.O. Box 27 240, Mexico 7, D.F., Mexico.

Pacific DX Net

A Pacific DX Net has been organized by the Aloha DX Club. It meets Fridays at 0700 GMT with Ed, KH6KLU as NCS. The purposes of the net are to disseminate current DX news in the Pacific, promote regular activity from remote station, and assist members in working toward DX Awards of the Pacific area. Correspondence should be directed to Ed at Box 762, Kaunakakai, Molokai, Hawaii 96748.

QSL Information

A2CAQ—Via ZS9Q
CN8HD—To W2GHK
CR3KD—c/o W2CTN
DU1OR—Via W2CTN
PJ0CC—c/o W2ADE, J. A. Doremus, Pocono Rd., Mountain Lakes, N.J.

[*Continued on page 98*]

See page 110 for New Reader Service

ESSCO *Presents*

A NEW PERFORMER

★ for CW

★ for REMOTE CONTROL

★ SEND

★ RECEIVE

★ MONITOR

A Valuable Addition to Any Ham Shack

The ESSCO "aud-dit-or" model AD-1

★ Pre-record a CQ or any traffic on your tape recorder, then play it back through the AD-1. It will key your transmitter using a high speed relay at speeds greater than 40 words per minute.

★ Use the AUD-DIT-OR with your code practice oscillator. Listen to your keying simultaneously with the CW transmission. Makes the old monitoring methods obsolete.

★ Re-generate a CW signal (where law permits) from your receiver.

★ Use the AD-1 for remote control* operation of various appliances, television set, garage door, slide projector, etc.

COMPLETE, READY TO USE, TESTED AND GUARANTEED **$24.95**

F.O.B. CAMDEN, N.J.

* EXTERNAL RELAY REQUIRED

ESSCO *"Teletype Specialists"*

324 ARCH STREET CAMDEN, N. J. 08102

Phone: (609) 365-6171

See page 110 for New Reader Service

Propagation

BY GEORGE JACOBS,* W3ASK

A considerable improvement is expected in DX propagation conditions during March and the early spring months, on long openings between the northern and southern hemispheres. This is a seasonal affair, and should be most noticeable on openings between the United States and South America, southern Africa, Australasia, and the southern Asiatic regions. This improvement is expected to take place on all h.f. amateur bands, epsecially during the sunrise and sunset periods.

The following is a thumb-nail picture of h.f. amateur band propagation conditions forecast for March, 1969. For specific times of DX openings, refer to the DX Propagation Charts which appeared in last month's column. This month's column contains Short-Skip Propagation Charts valid from March 15 through May 15, as well as Propagation Charts centered on Alaska and Hawaii. The Short-Skip Charts contain band opening forecasts for predominantly *one-hop* openings for distances varying between 50 and 2300 miles.

For average day-to-day propagation conditions expected during March, see the "Last Minute Forecast", which appears at the beginning of this column.

10 Meters: Excellent DX openings forecast to nearly all areas of the world from shortly after sunrise through the late afternoon hours. Excellent short-skip openings are also forecast during the daylight hours over distances varying between approximately 1300 and 2300 miles.

15 Meters: Expected to be the optimum DX band during the daylight hours. Excellent openings are forecast to all areas of the world from shortly after sunrise through the early evening hours. Excellent short-skip openings are also expected during the daylight hours, between distances of approximately 1000 and 2300 miles.

20 Meters: Expected to remain open t one area of the world or another, almo around-the-clock. DX conditions shou peak during the sunrise period, and aga during the late afternoon and early evenin hours. Excellent short-skip openings a forecast for the daylight hours, betwee short-skip openings between 1300 and 230

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

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for March 1, through April 15, 1969 (color)

	Forecast Rating & Quality			
Days	(4)	(3)	(2)	(1)
Above Normal: 3, 7, 9, 17, 20, 3, 9.	A	A-B	B	B-C
Normal: 1-2, 4-6, 8, 11-12, 15-16, 18-19, 21, 24, 28-31, 1-2, 4, 6-8, 10, 12-13, 15.	A-B	B	C	D
Below Normal: 10, 13-14, 22-23, 25, 27, 5, 11, 14.	B-C	C-D	D	E
Disturbed: 26.	C-D	D-E	E	E

How To Use These Charts

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

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

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

On the "Short-Skip" Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. Note the forecast rating for later use.

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

4—This month's Propagation Charts are based upon a transmitter power of 75 watts c.w.; 150 watts s.s.b., or 300 watts d.s.b., into a dipole antenna one quarter-wave above ground on 160, 80 and 40 meters and a half-wave above ground on 20, 15 and 10 meters. For each 10 db increase above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss reception will become poorer by one level.

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

6—These Propagation Charts are valid through May 15, 1969. These Charts are prepared from basic propagation, data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

See page 110 for New Reader Servi

iles should be possible during most of the ours of darkness as well.

40 Meters: Fairly good DX openings re forecast to many areas of the world rom sundown through sunrise, with conitions peaking during the hours of darkness. xcellent short-skip openings are expected etween 50 and 750 miles during the daylight hours, and between 500 and 2300 miles night.

80 Meters: Seasonally higher static levels re expected to make reception somewhat oisier than during the past winter months, ut some fairly good DX openings are still xpected to occur during the hours of darkess. Excellent daytime short-skip openings re forecast over distances varying between pproximately 50 and 250 miles. During the ours of darkness the short-skip range hould increase to between 200 and 2300 iles.

160 Meters: No skip openings are expectd during the daylight hours due to high olar absorption, although groundwave proagation should be possible over distances f up to several dozen miles, or more. As ight falls, the band should begin to open for kip propagation, and openings as great as 300 miles are forecast for the hours of arkness and the sunrise period. Occasional X openings are likely to occur during this me period.

Sunspot Cycle

The Swiss Federal Solar Observatory at urich reports a mean monthly sunspot umber of 113 for December, 1968. This sults in a 12-month smoothed sunspot umber of 107 centered on June, 1968. A moothed sunspot number of 102 is forecast r March, 1969. The present sunspot cycle appears to be declining slowly from its maximum value, which occurred sometime last year.

According to a recent study conducted by Bob Cooper[1], K6EDX, a considerable increase in trans-equatorial 6 meter openings should take place during March and the early spring months. The best path for T.E. openings from the United States is into South America, and the best time is during the evening hours, between 8 and 11 P.M. local time at the path mid-point. There is also a very slight possibility of a regular F-layer opening on 6 meters between the USA and southern and tropical regions, during the afternoon hours.

Short-skip openings due to sporadic-E propagation are expected to increase by late March, and an occasional 6 meter opening should be possible over distances between approximately 1000 and 1300 miles.

Auroral activity is expected to continue to increase during March, with the likelihood of a number of v.h.f. ionospheric short-skip openings of the auroral-scatter type. Check the "Last Minute Forecast" at the beginning of this column for those days that are forecast to be disturbed or below normal. These are the days on which v.h.f. auroral-type openings have their best chance of occurring.

Not much meteor activity is expected during the month, but some v.h.f. meteor-type openings may be possible when minor meteor showers peak on March 16 and 26.

Next month's column will contain DX Propagation Charts centered on all the major areas of the world, for use during the spring months. 73, George, W3ASK

[1]The study is summarized by Bill Smith, WB4HIP in "The World Above 50 Mc.", *QST*, Sept. 1968, pp 94-96.

CQ Short-Skip Propagation Chart

MARCH 15-MAY 15, 1969

BAND OPENINGS GIVEN IN
OCAL STANDARD TIME AT PATH MID-POINT
(24-HOUR TIME SYSTEM)
Distance From Transmitter (Miles)

nd eters)	50-250 Miles	250-760 Miles	750-1300 Miles	1800-2300 Miles
0	*Nil*	09-13 (0-1)	07-09 (1) 09-12 (1-2) 12-13 (1-3) 13-15 (0-3) 15-17 (0-2) 17-20 (0-1)	07-08 (1) 08-09 (1-2) 09-12 (2-3) 12-15 (3-4) 15-17 (2-3) 17-19 (1-2) 19-20 (1)
15	*Nil*	08-09 (0-1) 09-15 (0-2) 15-18 (0-1)	07-08 (1) 08-09 (1-2) 09-15 (2-4) 15-18 (1-3) 18-19 (1-2) 19-22 (0-1)	07-08 (1) 08-09 (2-3) 09-15 (4) 15-18 (3-4) 18-19 (2-3) 19-21 (1-3) 21-22 (1-2) 22-00 (0-1)
20	11-13 (0-1) 13-15 (0-2) 15-17 (0-1)	07-08 (0-2) 08-09 (0-3) 09-11 (0-4) 11-13 (1-4) 13-15 (2-4) 15-17 (1-4) 17-19 (0-3) 19-21 (0-2) 21-07 (0-1)	06-07 (1-2) 07-08 (2-3) 08-09 (3-4) 09-17 (4) 17-19 (3-4) 19-21 (2-4) 21-23 (1-3) 23-02 (1-2) 02-06 (1)	06-07 (2) 07-08 (3) 08-10 (4) 10-15 (4-3) 15-21 (4) 21-23 (3-4) 23-00 (2-3) 00-02 (2) 02-04 (1-2) 04-06 (1)

ee page 110 for New Reader Service

40	06-07 (1-2) 07-09 (2-3) 09-19 (3-4) 19-22 (2-3) 22-00 (1-2) 00-06 (0-1)	06-07 (2-3) 07-09 (3-4) 09-11 (4-3) 11-13 (4-2) 13-15 (4-3) 15-20 (4) 20-22 (3-4) 22-00 (2-3) 00-03 (1-2) 03-06 (1)	06-07 (3-2) 07-08 (4-2) 08-09 (4-1) 09-11 (3-1) 11-13 (2-1) 13-15 (3-1) 15-17 (4-2) 17-19 (4-3) 19-22 (4) 22-00 (3-4) 00-03 (2-3) 03-06 (1-2)	06-08 (2-1) 08-15 (1-0) 15-16 (2-0) 16-17 (2-1) 17-19 (3-2) 19-00 (4) 00-03 (3-4) 03-06 (2-3)
80	07-08 (3-4) 08-11 (4) 11-18 (4-3) 18-22 (3-4) 22-00 (3-4) 00-03 (2-3) 03-05 (1-2) 05-07 (2-3)	07-08 (4-2) 08-11 (4-1) 11-16 (3-0) 16-18 (3-2) 18-20 (4-3) 20-00 (4) 00-03 (3-4) 03-05 (2-3) 05-07 (3)	07-08 (2-1) 08-11 (1-0) 11-16 (0) 16-18 (2-1) 18-20 (3-2) 20-03 (4) 03-05 (3) 05-07 (3-2)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-2) 22-03 (4-3) 03-05 (3-2) 05-07 (2-1)
160	05-07 (4-2) 07-09 (3-1) 09-17 (2-0) 17-19 (3-1) 19-20 (4-2) 20-05 (4)	05-06 (2-1) 06-07 (2-0) 07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (2) 20-22 (4-3) 22-03 (4) 03-05 (4-3)	05-06 (1) 06-19 (0) 19-20 (2-1) 20-22 (3-2) 22-03 (4-3) 03-05 (3-2)	05-06 (1-0) 06-19 (0) 19-20 (1-0) 20-22 (2) 22-03 (3-2) 03-05 (2-1)

ALASKA

OPENINGS GIVEN IN GMT‡

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	20-22 (1) 22-00 (2) 00-01 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-01 (2) 01-02 (1)	13-15 (1) 20-22 (1) 22-01 (2) 01-03 (3) 03-05 (2) 05-06 (1)	06-13 (1) 07-12 (1)*
Central USA	20-23 (1) 23-01 (2) 01-02 (1)	18-20 (1) 20-23 (2) 23-01 (3) 01-02 (2) 02-03 (1)	14-16 (1) 20-23 (1) 23-02 (2) 02-04 (3) 04-05 (2) 05-07 (1)	07-14 (1) 08-12 (1)*
Western USA	20-23 (1) 23-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-02 (4) 02-04 (3) 04-05 (2) 05-06 (1)	16-18 (1) 18-20 (3) 20-00 (2) 00-02 (3) 02-04 (4) 04-05 (3) 05-06 (2) 06-10 (1)	07-09 (1) 09-12 (2) 12-14 (1) 09-10 (1)* 10-12 (2)* 12-13 (1)*

HAWAII

OPENINGS GIVEN IN HAWAIIAN STANDARD TIME†

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	08-09 (1) 09-11 (2) 11-13 (3) 13-15 (2) 15-16 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-17 (3) 17-19 (2) 19-20 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-20 (4) 20-22 (3) 22-04 (2) 04-06 (3) 06-07 (2) 07-08 (1)	18-20 (20-22 (22-01 (01-02 (02-03 (20-22 (22-01 (01-02 (
Central USA	08-09 (1) 09-10 (2) 10-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-09 (3) 09-12 (2) 12-13 (3) 13-16 (4) 16-18 (3) 18-20 (2) 20-21 (1)	09-13 (1) 13-15 (2) 15-17 (3) 17-21 (4) 21-00 (3) 00-05 (2) 05-07 (3) 07-09 (2)	19-20 (20-22 (22-03 (03-04 (04-06 (20-23 (23-03 (03-04 (
Western USA	08-09 (1) 09-11 (2) 11-12 (3) 12-14 (4) 14-15 (3) 15-17 (2) 17-19 (1)	06-07 (1) 07-09 (2) 09-11 (4) 11-14 (3) 14-17 (4) 17-19 (3) 19-21 (2) 21-22 (1)	15-17 (3) 17-21 (4) 21-00 (3) 00-02 (2) 02-04 (1) 04-06 (2) 06-08 (4) 08-10 (3) 10-15 (2)	18-19 (19-21 (21-22 (22-04 (04-05 (05-06 (21-22 (22-23 (23-04 (04-05 (05-06 (

†Hawaiian Standard Time is 5 hours *behind* EST; hours *behind* CST; 3 hours *behind* MST; 2 hours *beh* EST and 10 hours *behind* GMT. For example, when it noon or 12 hours, in Honolulu, it is 5 P.M. or 17 ho in NYC and 2 P.M. or 14 hours in Los Angeles.

*Indicates predicted 80 Meter openings. Openings 160 Meters are also likely to occur during those tim when 80 Meter openings are shown with a forec rating of (2) or higher.

‡To convert to Local Standard Time in Alaska, *subtr* 8 hours from the times appearing in the Chart in Pacific Standard Time Zone; 9 hours in the Yuk Zone; and 10 hours in the Alaskan Standard Ti Zone. To use GMT in other areas of the United Stat *subtract* 5 hours in the EST Zone; 6 hours in the Zone; 7 hours in the MST Zone and 8 hours in the Zone. For example, when it is 18 GMT it is 10 A.M. San Francisco and 1 P.M. in NYC.

SHOPPING-CART MOBILE

I know you have heard of maritime mobile, aeronautical mobile, and just plain mobile but, have you ever heard of "shopping-cart" mobiling? It all happened last fall when Ray Cunningham, WA8OKE, went to Arizona to visit with relatives. His car was going to be tied up for several days for repairs so Ray removed his gear from the car. As usual, amateur antennas were taboo at the apartment building where Ray and his XYL were staying. So, not to be deterred by such an asinine ruling he used a shopping-cart for mobility from the apartment to the carport where he had an antenna clamped to the carport roof and he used the 12 volt batte of a rental car for power input. All I can s is that this is the apex or pinnacle of son thing.

See page 110 for New Reader Serv

VHF TODAY

BY ALLEN KATZ,* K2UYH

Bill, K2TKN with contest winning 432 mc 48 element collinear yagi array and screen reflector. Picture taken by Rich, K2RIW at Central New Jersey VHF Society's antenna measuring contest.

is the element of surprise, among others, ich attracts many amateurs to the u.h.f. ctrum. How far can you work on 432 mc any u.h.f. band for that matter? No one ows the answer to this question for sure. e records are continually changing.

It is known that troposheric propagation is primary means of extended range u.h.f. mmunication, and that layer type (tem- ature) inversions tend to favor the lower .f.-u.h.f. bands, while duct type inversions or the higher ones. We all know of some casion where 144 mc and 220 mc were in cellent shape, while 432 mc appeared dead r was it just lack of activity? On other hts 432 mc has been open while 144 mc remained normal. Similar phenomena ve been observed on 1296 mc and above. What meteorlogical conditions favor one e of tropospheric propagation over an- er is not clearly understood; nor is it pre- ely known where one propagation type ds and the other begins.

As amateur participation on these higher nds increases, it will contribute more owledge of these special propagational nditions. Eventually enough information l be made available that all the pieces will in place and another challenge of radio l be met.

When it comes to predicting how far you work under normal conditions, the sit- ion is vastly different. We have devoted eral past columns to a discussion of ateur communications from the systems nt of view.[1] In these columns we pointed the importance of individual pieces of system on the overall system perform- e, but we never really discussed the path loss (the signal power lost between the transmitting and receiving antennas) except to note the obvious fact for a given path condition, the better your overall system performance, the further you would be able to communicate.

One reason for not stating actual values of path loss is that most amateurs are not interested in normal condition, but in abnormal condition. And it is precisely these special propagational conditions (as noted earlier), which cannot be predicted at present. However, it can be useful to know what the normal range capabilities of your station are, if for no other reason then to know if it is operating as it should.

At v.h.f. and u.h.f. frequencies there are

Olie, K3MAW with his 32 element 1296 mc array also at C.N.J. VHF Society's A.M.C. Thanks goes to K2RIW for this shot also.

* Skytop Road, Cedar Grove, N.J. 07009.
[1] HF Today, *CQ*, p. 35, April 1968.
F Today, *CQ*, p. 90, August 1968.

page 110 for New Reader Service

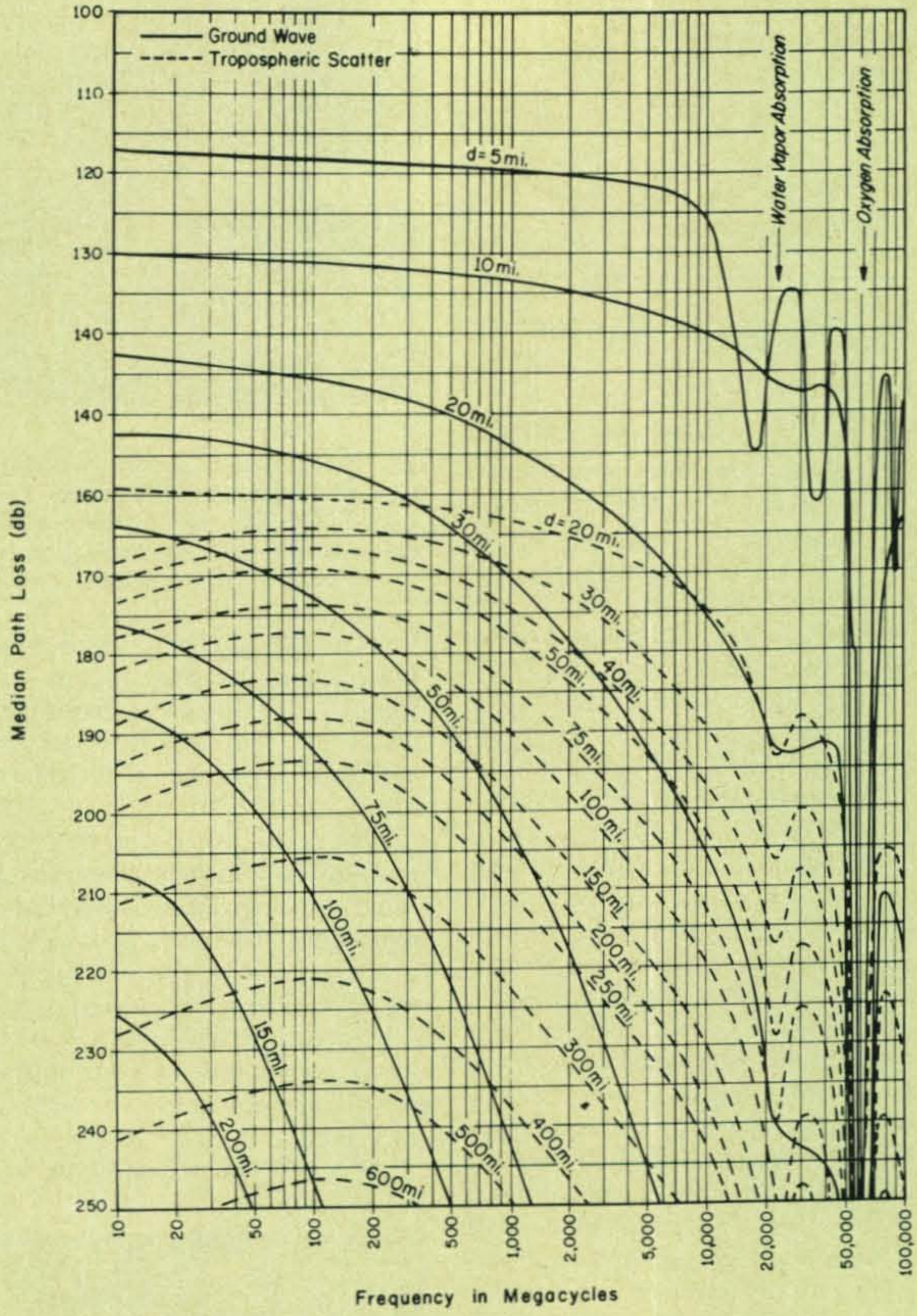


Fig. 1—Median path loss as a function of freq. and distance (zero degree take-off angle).

basically two normal modes of propagation. The first is ground wave (radio line of sight) propagation which predominates for short range communication. The second is tropospheric scatter propagation, a process by which small amounts of radio energy are scattered back to earth by the residual turbulance of the atmosphere. The loss due to this second form of propagation varies with time of year and day. In general it is best during the summer and late evening—early morning hours and worst during the winter and noon hours.

Figure 1 illustrates median values of p loss for both forms of propagation a function of frequency and distance. This c was obtained from a National Bureau Standards Technical Note.[2] In interpret this data the take-off angle of your ante is very important. The losses given in fig 1 are for a zero degree horizon. For e degree your horizon is below zero degr

[2]"Characteristics of Point-to-Point Troposph Propagation and Siting Consideration", Ki Rice, and Maloney, *National Bureau of St ards Technical Note*, October 1961.

See page 110 for New Reader Ser

u lose approximately 12 db of path loss, ewise each degree your horizon is above you gain approximately 12 db of path loss. u can determine your horizon by climbing ur tower with a transit or by means of ological maps and compensating for the rvature of the earth. A typical horizon dition is illustrated in figure 2.

Figure 3 demonstrates how the average ge of a station may be determined using ure 1. The example station happens to cor- pond to our present 432 mc setup in empted communication with a similar ipped station. With an assumed zero de- e take-off angle which does exist in most ections from our QTH, we therefore uld be able to absorb 230 db of path loss d still maintain a 1 to 1 signal-to-noise ratio he receiving end. Whether a 1 to 1 s.n.r. is easonable choice for c.w. communication erves further discussion. Based on passed perience, we suggest its adoption (for the ent) as the detection critera. Thus, accord- to figure 1, we should be able to work 0 miles regularly on 432. Whether this is case, we cannot say at present, not having d the 96 element array up long enough. though a similar calculation for our prev- s array indicated a 300 mile reliable ge—which was indeed the case.

A similarly equipped station on 144 mc uld have a reliable range of almost 475 les (assuming the same low sky tempera- e). However, to maintain the same antenna n on 144 mc would mean having an an- na 9 times as large in area. Such an an- na is not impossible to achieve on 2 meters ce it is relatively easy to obtain large ef- tive areas with yagi arrays. But for equal ed (not gain) antennas at two meters, the rage distance would actually be less (down about 350 miles) due to the loss of 9.5 db both the transmitting and receiving an- nas. Thus we are forced to conclude all ngs being equal, the higher one goes in quency the further his reliable communi- ions range should be. At the present ateur state of the art 1296 mc probably resents the best band for furthest consist- communications.

New 1296 Moonbounce Record

On Nov. 9, 1968 G3LTF and WB6IOM ceeded in a two-way informational ex- nge on 1296 mc. This contact betters the sting 1296 EME record (W1BU-KH6UK) about 400 miles. During previous tests

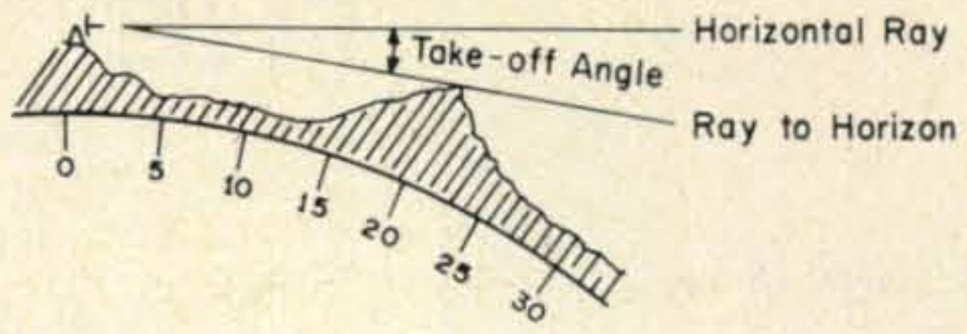


Fig. 2—The determination of the take-off angle.

WB6IOM has been able to detect G3LTF's Moonbounce signals, however the signal level was such that no information was exchanged.

Since the last tests a special code was devised to facilitate the transmission of information. Transmissions of 2 seconds on—2 seconds off were used for identification purposes. Upon positive identification of the opposite station, sending rates were increased to 5 seconds on —5 seconds off. Because of the unorthodox coding system, we do not know if the ARRL will recognize this contact and are awaiting their confirmation.

Equipment at G3LTF consisted of 15 foot dish, 150 watt transmitter and 2 db parametric amplifier. G3LTF received W6IOM's signals by ear about 5 to 6 db over the noise in a 100 cycle bandwidth.

WB6IOM used a 10 foot dish, 500 watt output transmitter and 1 db paramp. Peter was never able to hear G3LTF's signals, but they were clearly visible in his pen recorder output which had a 2 second post detection time constant. This report was received thanks to the *VERON VHF Bulletin*. These fellows do a fine job at getting moon bounce and OSCAR news distributed quickly.

Good Day on 432 MC

What's a good day on 432 mc? Well, it depends upon who you are. Some stations who have never seriously operated 432 mc might consider it to be working several sta-

[*Continued on page 100*]

Transmitter Output Power	200 Watts	= 23 dbw
Transmitter Antenna Gain	96 el. Array	= 20 db
Receiver Antenna Gain	96 el. Array	= 20 db
Transmission Line Loss	7/8" Heliax	= -3 db
Noise at the Receiver 1kc. Bandpass	3db NF Preampt Normal 432mc. Sky Noise	= 170 db
Total (1:1 SNR)		= 230 db

From Fig. 1 determine distance which corresponds to 230 db and 432 mc.

Distance (approximately) = 400 miles

Fig. 3—The determination of the Median Communications range.

page 110 for New Reader Service

THE award PROGRAM

BY ED HOPPER,* W2GT

THE STORY OF THE MONTH–"DOT", K5BTM, after these commercials. Dot, K5-BTM received USA-CA-2500 Award, Mixed; USA-CA-2000-Award, endorsed ALL 14 MC A3A; USA-CA-1500 and USA-CA-1000 Awards endorsed ALL 14 MC A3A, Mixed and ALL MOBILE. Bertha, WA4BMC (See "STORY" on Bertha, page 88, *CQ*, May 1967) received USA-CA-2500 and USA-CA-2000 Mixed Awards. Floyd, K7WQJ qualified for USA-CA-2500 Mixed Award. Durwood, W4RMT hit the jack pot with USA-CA-2000, 1500, 1000, and USA-CA-500 Awards all endorsed, ALL SSB. Bob, GW-3NWV, the only GW station to qualify for USA-CA, received USA-CA-1000 Award, ALL SSB. A USA-CA-500-Award, endorsed ALL A-1, went to Rick, K9OVK and USA-CA-500 Awards, endorsed Mixed went to. Jerry, WAØLYO; Lou, WB2CDZ and to "Nob," JA1KSO, a 19 year old student. And I nearly missed mentioning that "Ukie" W4-SWW received a USA-CA-1000 Mixed Award and Carol (Bless those Gals) received

FLASH!

JA1KSO—Nobuyasu Itoh
First Individual/Single Operator
Asian Station to Qualify
For USA-CA-Award.
(KA9MF CLUB STATION)
(Qualified in April 1968)

USA-CA-500 and USA-CA-1000 Award endorsed, ALL Phone.

Dot Dickenson, K5BTM

Dot, the K5*B*ig *T*exas *M*ama, is marrie has four sons, 10 grandchildren, and 2 gre grandsons. Although the OM is not a ha he is sure helpful in keeping the antenn and other equipment in working order.

Apparently the first amateur in the fam was the youngest son, Bob, K5WWL, a when he received his license (1960) and we into the Navy—Dot also became an amate so they could keep in touch. Then shor another son, "Cotton", K5YFK and XY Helen, K5YFC, joined them from Guthr Oklahoma.

Now the two sons of "Cotton" and Hele Mike, WA5UUE and Lee, WA5UFK, ha also joined in from Guthrie, Oklahoma they have fine family round tables—see like they could almost start their own Net.

Since Dot has had two strokes and nu erous heart attacks, she has retired and am teur radio fills a large part of her time. Y amateur radio is a most wonderful hobby f retired people and shut-ins.

Her specialty now is County Hunting, a she insists the County Hunter Guys and G are certainly a great bunch, always ready go out of their way for needed counties a a great help in assisting all to get throu

*103 Whittman St., Rochelle Park, N.J. 07662.

Dot Dickenson, K5BTM.

See page 110 for New Reader Serv

USA-CA HONOR ROLL

2500

5BTM 37
VA4BMC 38
7WQJ 39

2000

5BTM 53
VA4BMC 54
V4RMT 55

1500

K5BTM 82
W4RMT 83

1000

K5BTM 140
W4SWW 141
K7WUR 142
W4RMT 143
GW3NWV 144

500

K90VK 691
WA0LYO 692
K7WUR 693
WB2CDZ 694
W4RMT 695
JA1KSO 696

the many mobiles wandering around the S.

Dot says her latch string is always out and any County Hunters have stopped by her TH for an eye ball and a cup of coffee or a.

Dot insists she is always late, and even r birth came a day late for a Christmas esent—yes, she was born the 26th of Decem- r and was 65, December 26, 1968.

And she has met many of the County unters and Mobileers at Dayton and also enver YLRL Conventions and she had the nor of being elected "Sweetheart" in 1964 one of the Nets and received a beautiful Sweetheart Trophy".

K5BTM is the proud owner of over 200 wards/Trophies. Among her many credits clude membership in ARRL, YLRL, TEN, NWTEN, "Family Team", LCLYLN, YL, RUN #151, YLISSB #129, WJC, H-K5-6, A1-Op and T.O.O.

Her USA-CA claims are: USA-CA-500 ward #336, ALL A-3, dated February 964; and then on November 16, 1968— SA-CA-1000 #140, USA-CA-1500 #82— ese endorsed ALL 14 MC SSB, Mixed and LL Mobiles. Also on November 16, 1968— SA-CA-2000 #53, endorsed ALL 14 MC SB and USA-CA-2500 Award #37, en- rsed Mixed.

Naturally the counties are hard to get, now at Dot is at the 2500 mark, but she doesn't ind as it gives her something to strive r, the thrill of hearing a new one. She does ve 12 states completed and some like ermont (1), Maine (1), Hawaii (1), Illinois), Florida (3), Utah (2), and Maryland com- ete as soon as the QSLs arrive. Not a bad cord for 4 years of County Hunting.

At the start of County Hunting, the rig as a Viking Valiant and an HQ-145 with a i-band beam for 10-15-20 and dipole for and 75.

The present rig is a Galaxy III Transceiver nd with her QTH being about mid-way be- veen the East and West coasts, good reports e received from most of the U.S.A.

Dot, K5BTM & son, K5WWL.

Continued Good Hunting Mrs. Robert Dickenson, better known to the County Hunters as "Dot".

Letters

Ulo, WB6LNS, (ES6E, 1938-41), writes "Greetings from a fellow QCWA member. Am writing for help for CR6EI, who is interested in the USA-CA Program.

A great number of his W/K QSLs do NOT mention counties and he wonders whether any book exists which would help him identify the counties.

CR6EI's son wants to correspond with a stamp collector to exchange specimens. Any takers? Write WB6LNS, Ulo Vilms, 7072 Topaz, Alta Loma, California 91701, for more details. (Yes, USA-CA rules have been sent and a POD 26—to assist in identifying the counties—has been sent by Gil, W5QPX).

ED., KH6GLU, VR3DY, KP6AP, writes: "Sorry for not sending in regular reports, but not much county activity here... During Field Day I operated from Kalawao County... So all QSOs with KH6GLU/KH6 during ARRL FD 68 netted the recipient a KALAWAO COUNTY QSO.

Haven't received any correspondence lately regarding either Maui or Kalawao, so thought

[*Continued on page 82*]

Islands-On-The-Air Award.

ee page 110 for New Reader Service

You say your taxes were raised?

You missed three payments on your Jaguar XK-E?

You had to turn in your Playboy Club Key?

Your salary was cut?

You say the F.C.C. has expressed interest in your four different calls?

You say food is so expensive it's cheaper to eat money?

You say you invited your boss to dinner and during the soup course the finance company repossessed your furniture?

You say your XYL backed the family car out of the garage after you backed it in the night before, and now you can't get to the Newsstand to get your monthly copy of CQ?

HOLD IT!!

While we are in no position to alter the tax structure, give you a raise, or sway the F.C.C., We can save you a pile of cash on CQ! So drop that anchor, pick up a pen and dash off a CQ subscription right away!

1 yr. ..... I PAY ONLY $ 6.00 ..... a savings of $ 3.00
2 yrs..... I PAY ONLY $11.00 ..... a savings of $ 7.00
3 yrs..... I PAY ONLY $15.00 ..... a savings of $12.00

And now with all this newfound money at your disposal, you can begin to really live again!

CQ • 14 Vanderventer Avenue • Port Washington, N.Y. 11050

Dear OM:

Enclosed please fine $..... for ..... Year(s) Subscription to CQ, The Radio Amateur's Journal.

☐ NEW: Start with.....issue.
☐ RENEWAL

Name . . . . . Call . . . . . .

Address . . . . . .

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

RATES: 1 Year.....$6 ☐ 2 Years.....$11 ☐ 3 Years.....$15 ☐

See page 110 for New Reader Servic

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)	5.00		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

USA-CA [*from page 79*]

I'd remind everyone still needing them that I am QRV for skeds 160-10 meters c.w.-s.s.b. from 0330 GMT from Kaunakakai (Maui County) Molokai. Will go to Kalawao County again for Field Day 1969, and sooner if enough county hunters request it.

Our Club is now sponsoring a WORKED ZONE-31 AWARD and I'll send details and sample as soon as received from the printer." **Gil, W5QPX,** Writes: "May I suggest that the County Hunter Mobile operators, while riding around the country side, stop at the small town post offices (3rd Class) and pick up the used issues of POD 26. There must be hundreds of these laying around under the counters and in the back rooms of the small post offices.

Although they are expendable and disposable, seems that most Postmasters/Postmistresses just dislike throwing them away. The new ones cost $3.75, but there have been no important changes since 1965, so the old ones are still of great value in identifying the counties".

Awards

The Islands-On-The-Air Awards (IOTA): Mentioned in *CQ* of June 1965, issued by Geoff Watts *(DX NEWS-SHEET)* 62 Belmore Road, Norwich, NOR 72T, England have some additions and some changes of rules to help these interested.

In addition to the Silver Cup awarded each year to the world-champion station (also top s.w.l.) in the yearly IOTA Contest, a Cup will now be awarded to those who claim all 12 IOTA Awards:—

IOTA-AF	IOTA	Africia Award
IOTA-AN	IOTA	Anarctica Award
IOTA-AS	IOTA	Asia Award
IOTA-EU	IOTA	Europe Award
IOTA-NA	IOTA	North American Award
IOTA-OC	IOTA	Oceania Award
IOTA-SA	IOTA	South America Award
IOTA-CC-100		Century Club 100 Award
IOTA-WW	IOTA	World Diploma

The Rare Ones Of New Orleans Award.

Nights At The Round Table Award.

IOTA-AI	IOTA	Arctic Islands Award
IOTA-BI	IOTA	British Isles Award
IOTA-WI	IOTA	West Indies Award

QSL requirements for the last three of the awards listed have now been made easier, and replacement pages for your IOTA Directory may be had from Geoff Watts for 1 IRC. The 18-page *Directory-Of-Islands* gives all the islands and island-groups which count for IOTA, and also contains information on all the awards, with full details of the IOTA CONTEST. Send 4 IRCs (Air-mail—6 IRCS) to Geoff Watts.

Nights At The Round Table: Please note new QTH of Custodian: Phyllis McCarthy, WA2PVB, 403 Riverdale Ave., West, New Shrewsbury, New Jersey 07724. Issued for the required 50 mc QSOs with member stations after November 1, 1963 and confirmed by QSLs. 25 air miles of Newark, N.J., 12 contacts required, 25 to 100 miles of Newark, 8 contacts required. 100 or more miles, 3 contacts required. Member stations of Nights At The Round Table are: WA2QCQ (now a silent key), WA2PVB, WA2BXP, WB2FEQ, WB2HOW, WB2HQQ, WA2MVI, K2OKA, WA2PWZ, WA2QPC, WA2VTJ, WA2-VYM, WA2YWM, WA2JNG and K2EFN. There is no charge for this certificate.

The Rare Ones Of New Orleans: The Group of 8 businessmen and amateur radio operators (formed 4 years ago) is pleased to offer this award. This Group was chosen by the City of New Orleans to represent them during the Celebration of the 250th Anniversary of the City of New Orleans and for that event, special certificates signed by the Mayor as well as medallions were awarded. During that 30-day period, this group of 8, made in excess of 7,000 contacts. This AWARD is available to any amateur for establishing two-way communication with each one of the eight-member group, one time, any band, any mode, on or after January 1, 1965. There is no charge nor certification required; submit log extract only. Each station worked must have received your

See page 110 for New Reader Service

Cornhusker County Award.

Club, Inc., of Lincoln, Nebraska and is available to any amateur or s.w.l. The basic award is issued for working or hearing 40 Nebraska Counties, and extra Seals for 60, 80 and ALL 93 Counties. Basic Award, 75¢, Seals for s.a.s.e. Send GCR List to Award Custodian, WAØKGD, Michael Nickolaus, 4921 Tipperary Trail, Lincoln, Nebraska 68512. Award is free to B/P.

QSL and each member will QSL 100% for cards received. The Group has one common mailing address, thus permitting more than one card to be sent in an envelope: P.O. Box 29265, New Orleans, Louisiana 70129.

Members of the Group are:

K5USO, Marv, The Old Alligator Agitator
WA5NJU, Mac, The Green Bullfrog
W5QNO, Bob, The Bald Headed Turtle
W5DNB, Russ, The Blue Crab
K5FZL, Morris, The Pin-feathered Pelican
W4PKI/5, Louie, The Pink Shrimp
WA5RIO, Emile, The Baby Crawfish
W5VSR, Buddy, The Purple Catfish

(Note, the finished AWARD has the aforementioned figures on it in color). While members of the Group work all bands, "Group frequency" is 7.255 plus or minus 5, each night 1900 to 2400 CST., and at the Spiced Olive Cocktail Hour, same frequency, 1700 to 1800 CST on Sundays only. Award of the Certificates confers Associate Membership and related privileges.

Cornhusker County Award: This award is sponsored by the Lincoln Amateur Radio

Editor's Notes

Million thanks for all the many SEASONS GREETING CARDS and WELL WISHES, actually from all over the world—also thanks for the fine box of candy.

I have been having *MUCH* fun checking into the Independent County Hunter Net on 14336 as often as possible, what a fine bunch, and the NCSs are doing great—many many thanks for all the FB QSOs and QSLs, so if I am slow in answering your mail, it is because I'm on the NET or sending out QSLs for the many new COUNTIES worked!

Again thanks to Gil, W5QPX for sending a POD 26 to each of the following: CE8AA, CR6EI, CR7IZ, ON6NH, and 4S7DA—did you realize that a new POD 26 now costs $3.75?

Mike Nickolaus, WAØKGD, 4921 Tipperary Trail, Lincoln, Nebraska 68512 is willing to offer his service as QSL Manager for a deserving DX COUNTY HUNTER.

ACTUALLY I am taking good care of mail received, so don't hesitate, write and tell me – How was your month? 73, Ed., W2GT.

BY THE WAY...

Lee J. Miller, WA7AEL, (on the right) an electronics technician at the National Center for Radiological Health's Southwestern Radiological Health Laboratory, Las Vegas, Nevada recently received the U.S. Department of Health, Education and Welfare Superior Service Award. Lee received the award for "extreme competence" in an emergency operation of a short-wave radio which was the only communications link with flood-stricken Fairbands, Alaska for about four four days last August.

The award was presented to Mr. Miller by Dr. Philip R. Lee, Assistant Secretary for Health and Scientific Affairs of the Department of Health, Education and Welfare at a ceremony at the National Institutes of Health in Bethesda, Maryland.

James G. Terrill, Jr. (left) Director of the National Center for Radiological Health, Rockville, Maryland congratulates Lee upon receiving this award. ■

See page 110 for New Reader Service

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

March	1-2	ARRL DX Phone Contest
March	1-16	IARC Prop'tion CW/RTTY
March	8-9	YL/OM CW Contest
March	8-9	RSGB BERU Contest
March	15-16	ARRL DX CW Contest
March	21-23	Novice WAS Party
March	22-24	Virginia QSO Party
March	29-30	Florida QSO Party
Mar 29-Apr	13	IARC Propagation Phone
April	5-6	SP DX CW Contest
April	**12-13**	**CQ WW WPX SSB Contest**
April	19-20	Helvetia 22 Contest
April	26-27	PACC CW/Phone Contest
April	26-27	ONE LAND QSO Party
May	24-25	YL International SSB
July	19-20	Minnesota QSO Party
October	4-5	VK/ZL/Oceania Phone
October	11-12	VK/ZL/Oceania C.W.
October	**25-26**	**CQ WW DX Phone Contest**
October	**29-30**	**CQ WW DX C.W. Contest**

ARRL DX Contest

Phone: March 1-2 **C.W.:** March 15-16
Starts: 0001 GMT Saturday
Ends: 2359 GMT Sunday

This is the second half of the annual ARRL marathon. If you were unable to take a crack at it last month, you can give it a go now. But you are never going to catch the guys who already put in a week-end.

Get your logs in the mail before April 12th, and they go to: ARRL Communication Dept., 225 Main Street, Newington, Conn. 06111. (As if you didn't know.)

IARC Propagation Contest CW/RTTY

0001 GMT March 1 to 2400 GMT March 16
Phone: 0001 March 29 to 2400 Apr. 13

The "contest with a purpose" was covered in last month's CALENDAR. Remember its CPR Zones, not the *CQ* Zones boundries, you use in this one. If you didn't already send for the CPR map you're in trouble. Better get one before you send in your score. Complete details in last month's CALENDAR.

You have until June 1st to mail your log to: L. M. Rundlett, IARC Contest Committee, 2001 Eye Street, N.W., Washington. D.C. 20006.

YL/OM C.W. Contest

Starts: 1800 GMT Saturday, March 8
Ends: 1800 GMT Sunday, March 9

This is the c.w. week-end for the YLs to see how many OMs they can work. See page 12 of January *CQ* for all the details.

Get your log in the mail before March 24th to: Ebba Kristjansson, VE5DZ, P. O. Box 71, Colonsay, Saskatchewan, Canada.

RSGB BERU Contest

Starts: 0001 GMT Saturday, March 8
Ends: 2359 GMT Sunday, March 9

This announcement is for the benefit of our Canadian neighbors and friends in the Caribbean area. It's the annual contest open only to RSGB members residing in countries of the British Commonwealth around the world.

Its been around a long time, this is the 32nd event. It's a c.w. only contest and complete rules appeared in the September issue of *Radio Communication*, the RSGB magazine.

Mailing deadline for your logs is April 1st, and they go to: BERU Contest Committee, RSGB, 35 Doughty Street, London WC1, England.

Novice WAS Party

The Sierra Nevada ARS members will be active on the Novice bands, between 24:00 PST March 21 and 24:00 PST March 23rd, to make Nevada available for those needing that state for their WAS.

Club members will be found on the following frequencies: 3710, 3735, 7160, 7175, 7190, 21120 and 21150.

Send your QSL cards to the individual stations or to Ken Slough, WA7HVX, 1606 Laiola St., Reno, Nevada.

*14 Sherwood Road, Stamford, Conn. 06905.

See page 110 for New Reader Service

Virginia QSO Party

Starts: 1800 GMT Saturday, March 22
Ends: 0200 GMT Monday, March 24

The Roanoke Valley ARC is sponsoring this one to make Virginia counties available for the USA-CA and Old Dominion awards.

Phone and c.w. are considered separate contests and separate logs are requested.

Exchange: QSO nr., RS/RST and QTH. County for Va. stations, state, province or country for all others.

Scoring: One point per QSO. Va. stations will multiply their total QSO points by the sum of states, provinces, countries and Virginia counties worked for their final score. Out-of-state stations multiply their QSO points by the number of Va. counties worked. (Max. of 98) (Do not count Va. as a state or Canada as a country.)

Frequencies: C.W.–3560, 7060, 14060, 21060, 28060. Phone–3930, 7235, 14240, 21310, 21400.

Awards: The highest scoring station in each state, province and country will receive a certificate. (What about Va. stations?)

Mailing deadline for logs is April 30th, and they go to: Roanoke Valley ARC, Att: WA4BIX, 110 Union Street, Salem, Virginia 24153

Florida QSO Party

Three time periods:
1500-2000 GMT Saturday, March 29
0000-0500 GMT Sunday, March 30
1400-2400 GMT Sunday, March 30

Florida Skip, the amateur radio magazine announces its fifth annual QSO party.

Phone and c.w. are separate contests, the same station may be worked on different bands for QSO points and Fla. stations can work in-state stations but for QSO points only. (And for the WAFC award.)

Exchange: QSO nr., RS/RST and QTH. County for Fla. stations, and state, VE province or country for all others.

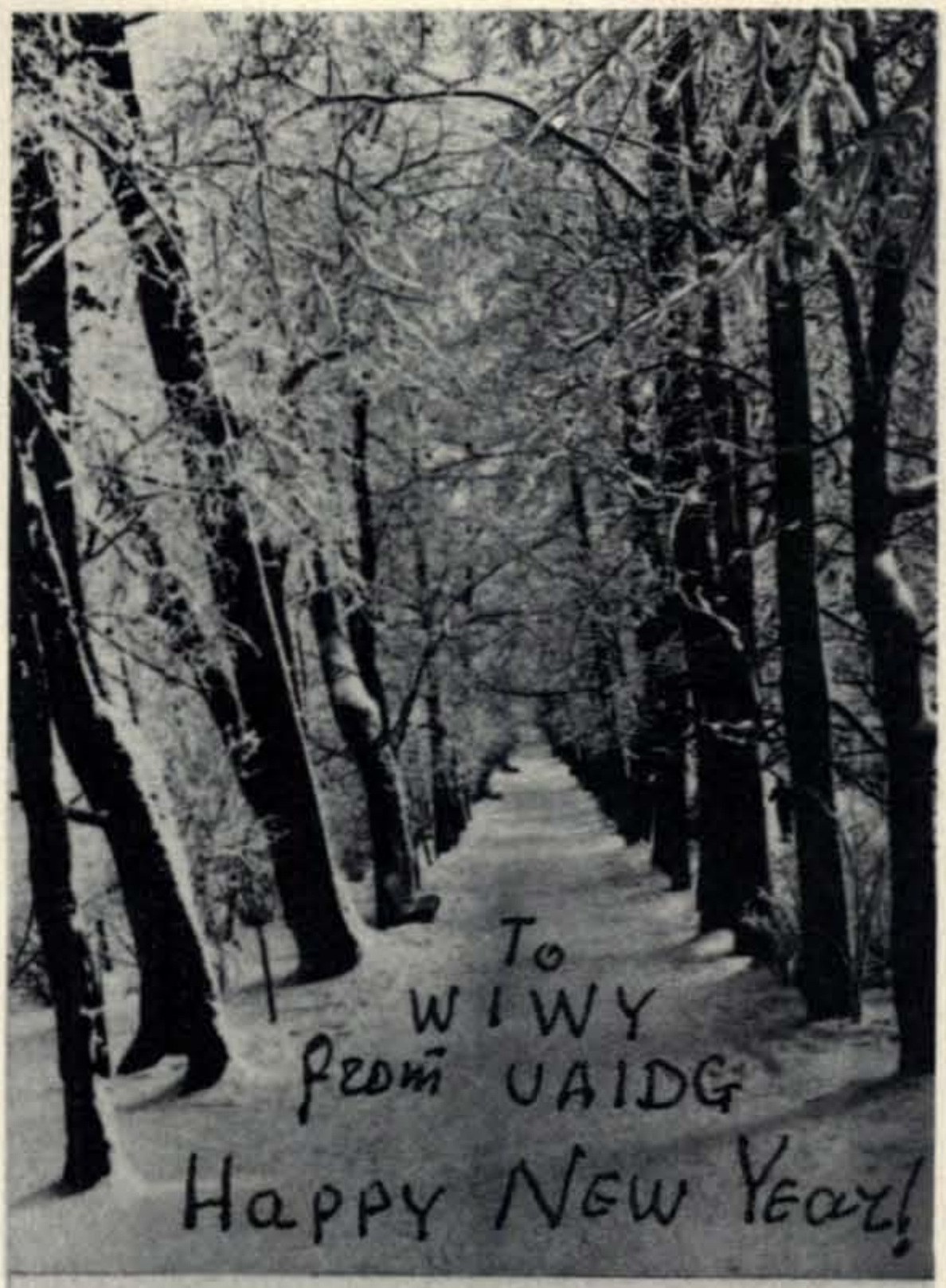
Scoring: Fla. stations, 1 point per QSO, multiplied by the number of states, VE provinces and countries worked.

Other stations: 1 point per QSO multiplied by the number of Florida counties worked. (Max. of 67) In addition bonus points will be given for Fla. counties worked as follows: First 15, 100 points; second 15, 200 points; third 15, 500 points; all 67 counties, 1500 points.

Frequencies: C.W.–1815, 3560, 7060, 14060, 21060, 28060. Phone–1815, 3860, 7360, 14260, 21360, 28860.

Awards: Certificates to the top scoring stations in each state, province and foreign country. (5 or more contacts) And each Fla. county to both single and multi-operator winning stations. (Multies must show 50 or more contacts) Trophies to the "Top Banana" in the following three catagories: Out-of-state, Florida single and Florida multi-operator. (C.W. and Phone scores are not to be added)

Mailing deadline is April 30th to: *Florida Skip*, Contest Chairman, P. O. Box 501, Miami Springs, Fla. 33166. Include a 6¢ stamp for copy of issue with the results.



Most of the pictures we receive are the same stereotype photos of rigs, antennas, etc. It's a relief to receive a little gem like this one once in a while. I'd like to share this New Year greeting from UA1DG with you.

SP DX C.W. Contest

Starts: 1500 GMT Saturday, April 5
Ends: 2400 GMT Sunday, April 6

It's the world working the SPs on c.w. only in this one.

1. Use all bands, 3.5 thru 28 mc.

See page 110 for New Reader Service

1968 RTTY Sweepstakes Results

The Top Ten stations were: PY2CQ, ON4CK, I1KG, W5QCH. DJ6ZBA, WA-8BOT, W2RUI, EL2N, VK3KF and W9HHX. All are the winners of the "CARTG" Plaque.

In addition, the following stations are also the winners of awards in special catagories: W8CQ, VK3KF, W9HHX, W20-ER, I1AHN and Paul Menadier.

2. There are two divisions: Single operator, single band and all band; and multi-operator, all band only. (Single transmitter only) SWLs may also send in an entry.

3. Exchange: RST report plus a 3 figure QSO number starting with 001 for all foreign stations. Polish stations will send the RST report plus their powiats letters. (*ie:* 579WA, 579CP)

4. Each QSO is worth 3 points.

5. Your multiplier is determined by the number of different powiats worked on each band.

6. Final score, total QSO points multiplied by the number of different powiats worked on a particular band for single band entries, and the sum from all bands if it's an all band entry.

7. Certificates to the top scorer in each catagory, in each country. Also 2nd and 3rd place awards will be made in countries where returns justify, but for all band entries only. (Contest contacts may be credited for the many PZK awards, and applications may be sent along with the contest log.)

8. Use a separate log sheet for each band and indicate the multiplier only the first time it is worked. Include a summary sheet listing all the scoring information and your name and adress in BLOCK LETTERS. Logs must be checked for duplicate contacts and accuracy of the scoring, on penalty of disqualification.

Mailing deadline is May 1st and logs go to: PZK Contest Manager, P.O. Box 320, Warszawa 1, Poland. (Indicate SP DX Contest)

Helvetia 22 Contest

Starts: 1500 GMT Saturday, April 19
Ends: 1700 GMT Sunday, April 20

The HB boys usually make every effort to activate all 22 Cantons, especially the rare ones, so here is your opportunity to snag that elusive H 22 Certificate.

Use all bands, 1.8 thru 30 mc, c.w./c.w. and phone/phone. The same station may be worked once on each band for QSO and multiplier credit, either on c.w. or phone.

Exchange: The RS/RST report plus a progressive contact number starting with 001. Swiss stations will also include their Canton. (*ie:* 579001/ZH)

The 22 Cantons are: AG, AR, BE, BS, FR, GE, GL, GR, LU, NE, NW, SG, SH, SO, SZ, TG, TI, UR, VD, VS, ZG, ZH.

Scoring: Each contact counts 3 points. Your multiplier is the sum of Cantons worked on each band, a possible 22 on each band. Final score, total QSO points from all bands, multiplied by the sum of Cantons from all bands.

Awards: Certificates to the top scorer in each country and each call area in the United States and Canada.

Logs: Use a separate log sheet for each band, indicate a Canton the first time it is worked, and check your log for duplicates and accuracy. Include a summary sheet showing the scoring and other information, your name and address in BLOCK LETTERS, and a signed declaration that all rules and regulations have been observed.

Mail your log within 30 days to: Marius Roschy, HB9SR, USKA Traffic Mgr., Ch. des Grenadiers 8, 1700 Fribourg, Switzerland.

CQ World Wide WPX SSB Contest

Complete rules will be found on page 34 of this issue. Also a brief rundown in last month's CALENDAR.

No changes have been made, they are the same as last year. The compulsory rest periods for single operator stations is being retained by popular demand. And counting the prefix multiplier *only once* during the contest is also retained because we still think it's the practical thing to do. (You fellows have not been very responsive with any suggestions.)

Also keeping in mind that there are now two divisions in the multi-operator section, single and multi transmitter.

Don't overlook the six Trophies that are now available for different catagories and sections.

Editor's Notes

A couple of issues ago I said that all certificates had been mailed and that you should

[*Continued on page 100*]

See page 110 for New Reader Service

Q AND A

BY WILFRED M. SCHERER,*
W2AEF

Antenna Sense

It is not unusual to hear amateur operators complain of QRM that makes a QSO either difficult or impossible, which in many cases makes them give up on a particular QSO. This need not always be so if, under certain conditions, one uses a little common sense relating to the handling or selection of antennas for reception.

During times when the bands are mobbed with strong signals, (as is often the case on contest weekends), QRM is experienced not only from on-, near-on or adjacent-channel signals, but also due to inadequate receiver performance in the way of poor signal-handling capabilities. This results in cross modulation, r.f. inter-modulation or other spurious responses caused by exceptionally strong signals that may be present, even relatively far removed from the desired signal.

In this respect, during the past few months we have made quite some extensive measurements on many receivers in relation to their linearity characteristics. Of these, the inter-modulation products usually are the first to appear as cross modulation, splatter or noise. The results indicated such effects to commence with two or more signals of 300 μv with many of the popular amateur receivers and transceivers· while signals up to near 3000 u.v. were required for these effects with the better receivers.

When observed on an accurately calibrated or honest S-meter with an S-9 reading required for a 50 μv signal, these levels represent signals of from S9 + 15 db to S9 + 35 db! No wonder then that the bands often sound so noisy, that operators unjustly blame a fellow amateur for splatter or that one is unable to pinpoint the source of elusive spluttering sounds that often clutter up the band on a particular receiver. Yes, this also may even include those Teletype signals that seem to creep into the picture occasionally.

One approach to the problem, besides obtaining a better receiver, is to reduce the overall signal levels applied to the receiver to the point where the receiver deficiencies can be minimized. This may be accomplished by use of an attenuator at the antenna input or by reducing the r.f. gain.

Although this will effectively reduce the receiver sensitivity in relation to a specific signal-to-noise ratio, you're not going to have much luck copying weak signals anyhow under the aforesaid conditions, no less having difficulty in reading moderately stronger ones, so some deterioration in the S/N ratio is not going to be too meaningful from this standpoint.

Another method which we have found very effective in combating QRM, is to use a separate antenna for receiving, one that may have lower gain or different directivity than a high-gain beam antenna otherwise used for transmitting.

On innumerable occasions we have noted with quite some amusement that by employing only a 6-8 foot indoor antenna, we have realized good Q-5 copy, of even DX signals, under conditions where other local amateurs have been unable to copy such signals, because of strong signal levels from their beams which raised havoc with the receiver.

On the other hand, re-orienting the beam to a point where the effects from strong signals originating from a certain area can be minimized, but to also where at the same time your signal can be adequately heard by the station you're working, will often provide a way out toward making a QSO more comfortably possible. Kicking the other guy's S-meter to S9 plus-de-plus is not necessarily always required to carry on a Q5 QSO, unless you're one of those S-meter-happy fellows needing glowing reports to satisfy your own vanity.

So, when you're beset with QRM difficulties, give a little throught to and follow through with a little "antenna sense". We have found it works—maybe you will too!

Novice Station Equipment

QUESTION: I have some equipment all lined up and was wondering if you would comment on it. This is a Heathkit HR-10B receiver

*Technical Director, *CQ*.

See page 110 for New Reader Service

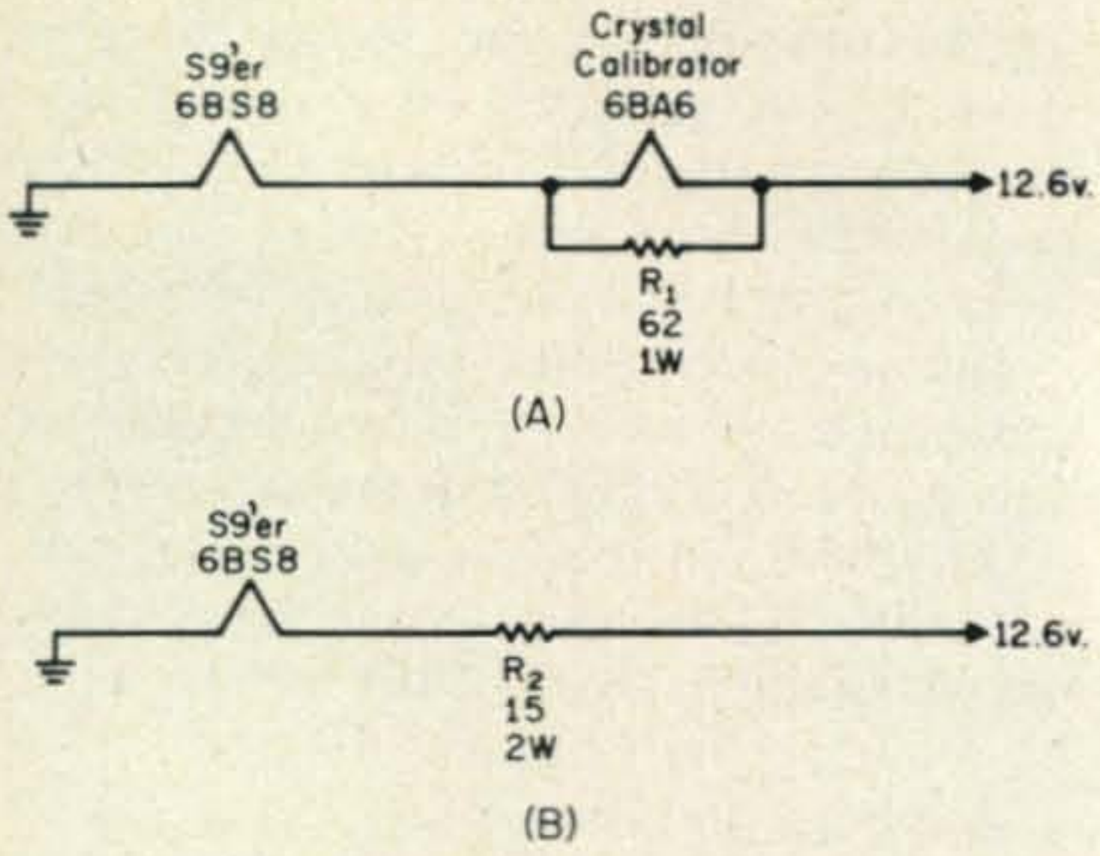


Fig. 1—Setup using 6BS8 tube with 12.6-volt heater supply in Swan 350. (A)—6BS8 heater in series with that of 6BA6 to be used for the crystal calibrator. If a 6BK7B is issued in the S-9'er, R_1 should be made 43 ohms, because this tube draws slightly higher current (.45 a.) than the 6BS8. (B)—6BS8 heater in series with a 15 ohm 2 watt resistor may be used alone.

and DX-60B transmitter that cover the 80-10 meter amateur bands. Do you think this is a good Novice station setup? I should appreciate your comments as my dad and I are both interested in amateur radio.

ANSWER: A Novice amateur station consisting of the Heathkit HR-10B Receiver and the DX-60B Transmitter should provide an excellent setup which also will not become obsolete when you advance to a General-Class Licensee, as it will enable operation on the General class and higher class frequencies and modes.

Another good setup, but strictly for operation in only the c.w. bands on 80, 40 and 15 meters is the Heathkit HW-16 Noviee CW Transmitter.

Data on Craftonics CT-120 Transmitter

QUESTION: I recently bought a Craftonics Model CT-120 Transmitter. I've been trying to locate a manual for it, but without success. A letter to the manufacturer's address was returned stamped "no such address." Can you supply any data on this unit?

ANSWER: We have not been able to locate any data on the Craftonics CT-120, but if any of our readers should have such available, we'd appreciate any related information. Please communicate directly with Dale E. Frie, Box 361, Chugiak, Alaska 99567.

Element Lengths for ZL Special Antenna

QUESTION: I have been working on a version of the ZL-Special two-element beam using the same length for both elements as given by U.S. authors. Some foreign writers state that the maximum forward gain occurs when the reflector is 6% longer than the driven element. Is that statement based on published experimental work?

It seems to me that a driven beam should have elements of equal length. Maybe its a case of adopting a new religion (driven beams), but to be on the safe side they retain some features of the old ones (parasitic beams)!

ANSWER: We have no information on which the queried statement was based; however, it most likely would be true if the element spacing were such that would not allow the interconnecting phasing section to be the correct length for the required phasing. Otherwise, we see no reason why the reflector should be longer if the spacing, phasing and current ratios in each element are properly maintained. This is the way it is done with broadcast antennas.

S-9'er With Swan 350

QUESTION: Having had good results in the past with the MK I and MK II S-9'er described in *CQ* for May 1956 and December 1959, I should like to build one for my Swan 350 which has a 12-volt heater supply. Is there a 12-volt substitute for the 6.3-volt 6BK7B or 6BS8 originally used in this S-9'er? If not, can I connect the 6.3-volt tube heater in series with that of the crystal-calibrator, substituting a 6BA6 for the 12BA6 calibrator tube?

ANSWER: A 12-volt tube for the job might be the 12AV7. Or, as you have suggested, the 6BS8 heater may be connected in series with the calibrator-tube heater using a 6BA6 for the calibrator. Since the 6BS8 draws 0.4 a. and the 6BA6 takes 0.3 a., the 6BA6 heater should be shunted with a 62-ohm 1-watt resistor. The setup is shown at fig. 1A.

Another method is to use the 6BS8 heater alone with a series-dropping resistor of 15 ohms (2-watt). The setup is shown at fig. 1B.

Articles on HRO-50/60

QUESTION: Have you any articles on the HRO-50 or HRO-60 receivers?

ANSWER: The only articles we have on the subject is "15-Meter Coils for HRO-60," January '64 *CQ*, page 52. Back copies are available from the Circulation Dept. at $1.00 each.

See page 110 for New Reader Service

Source for Used Motorola FM Gear

QUESTION: Where can I obtain used Motorola FM gear for converting to 2 meters and for what price?

ANSWER: Suggest you contact the following for information on used Motorola FM gear:

Gregory Electronics
249-C Route 46
Saddle Brook, N.J. 07662

F M Surplus Sales Co.
100 Tremont Street
Roxbury, Mass. 02120

Metering Safety Measures

A number of readers have questioned the possibility of voltage breakdown and a shock hazard at the meter zero-set screw with the metering setup described in the October 1968 Q & A Column; also suggesting it might be safer to install the "circuit" resistor (R_2) in the B-minus lead, instead of the B-plus one.

Since the case in point involved a 3000-5000 volt circuit, such a change would be a desirable safety measure, inasmuch as the insulation-breakdown rating on the "insulated" type meters is in the region of 1200 v.

In any event, such a change would be a must at even lower voltages with older type meters that have a *metal* adjusting screw. We can well remember the day many years ago when we were breaking in a new man on a broadcast transmitter. Before he could be warned he asked, "What is this meter for?", at the same time touching the metal set screw on the plate-voltage meter. Needless to say, in an instant he was rolling across the room on the floor. Luckily, there was an otherwise happy ending to the story.

It might be noted, however, that if the circuit resistor is installed in the B-minus lead, the meter will indicate the sum of the plate and screen-grid currents if a tetrode is involved along with a common power supply for both tube elements.

The circuit resistor also may be installed in the cathode or filament center-tap return, in which case the total meter reading will include the control-grid current. A small amount of self bias also will be introduced by the resistor.

Where such situations may not be desirable, thus requiring installation of the circuit resistor in the B-plus lead, a safety measure that can be employed is to mount the meter on an insulated panel behind a protective glass or clear-plastic window.

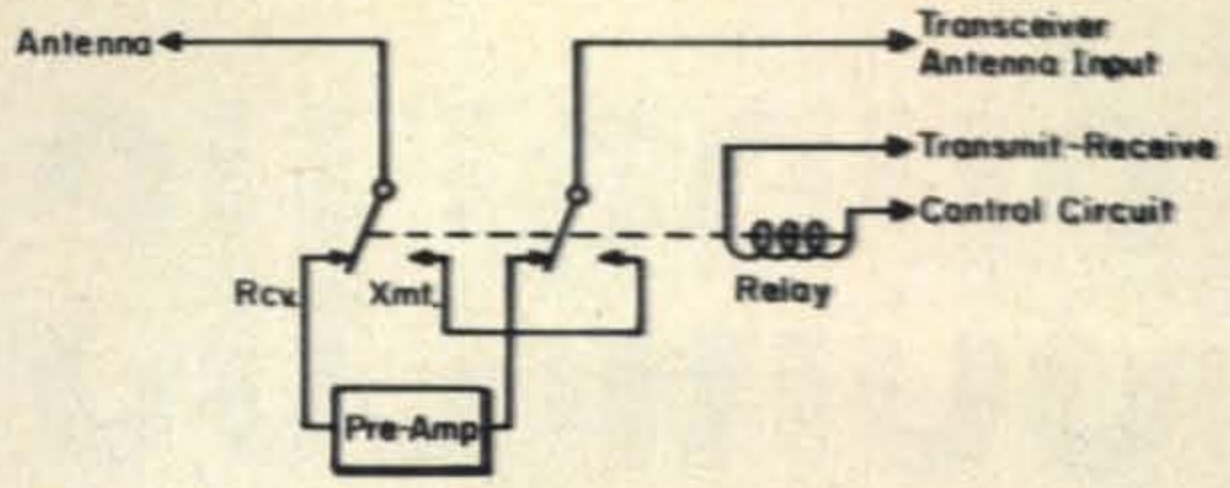


Fig. 2—Relay circuitry for bypassing transceiver outboard pre-amplifier during transmit.

An additional safety measure for the voltmeter function, is to be sure to install the voltage-dropping resistor, R_3, in the B-plus side of the meter as shown in the original diagram for the referred-to- metering setup. Also, connect a small neon bulb across the meter terminals.

Pre-Amplifier Switch With Transceiver

QUESTION: I wish to use an outboard preamplifier with a transceiver. How may the pre-amp be automatically bypassed on transmit?

ANSWER: The pre-amplifier for the transceiver may be bypassed on transmit using an auxilliary relay as shown at fig. 2.

Lafayette HA-350 Receiver On 160 Meters

QUESTION: Is there a simple way to modify the Lafayette HA-350 receiver for 160-meter operation or does a converter have to be used for this.

ANSWER: The best bet for 160-meter reception with the HA-350 is to use an outboard converter as described in the March '68 Q & A Column with the following changes:

Use a 9 mc crystal and Miller antenna coil #B-5495-A. The i.f. will be in the 7 mc band, so the mixer-output circuit should be tuned to about 7.3 mc. Use the 7 mc band on the HA-350 and read the frequency on the *white* scales of the dial where 2 mc will be at 500: 1.7 mc will be at 200 on the dial.

Prop-Pitch Motor Conversion

QUESTION: Have you any information on conversion of the prop-pitch motors?

ANSWER: Information we have on a conversion for the prop-pitch motor may be found in the August 1949 *CQ*, page 20. The title is "Quick Change for Prop-Pitch Motor." This describes how to alter the unit to rotate at 1 r.p.m. with 9-volts applied. Presumably, the speed can be raised by running the motor with near the normally higher voltage. ■

See page 110 for New Reader Service

SURPLUS sidelights

BY GORDON ELIOT WHITE*

Two more interesting surplus pieces from the intelligence community turned up here in the Washington area this winter. I found both, brand new, in General Services Administration sales. One, an AFSAV-133C, demodulator, was manufactured by Radiation Inc., for the National Security Agency. The other, an EP-66-ISPC Echoplex unit, was made by Kahn Research Laboratories, probably for the Department of State.

Now neither of these devices promise to become common in every surplus dealer's shelves, but the AFSAV-133C has started to turn up in the usual disposal channels, and the Echoplex is an interesting application of scrambling techniques which could have value for improving reliability of voice signals.

The AFSAV-133C (Fig. 1) is a radioteletype (RTTY) demodulator, similar in basic design to the DEN-35 (*CQ* Surplus Column, July, Sept., Oct. 1968). It weighs about the same (105 pounds) but is of later design. My information puts the DEN-35 at about 1950 and the AFSAV-133C is dated 1960. The later unit is smaller, taking only fourteen inches total height in a standard 19 inch rack, compared to the DEN-35 (AFSAV-35) which was 26 inches high. The AFSAV-133C consists of two units, the demodulator itself (at bottom of Fig. 1) and the power supply–indicator unit (at top of Fig. 1). The demodulator could be operated independently, if a source of 150 volts d.c. and 6.3 volts a.c. power is provided. Tuning might be difficult without the 'scope presentation, but certainly not impossible. Figure 2 shows the hookup of the two units, with J-1 the input/output jack and J-2 the power/indicator connector.

*5716 N. King's Highway, Alexandria, Virginia 22303.

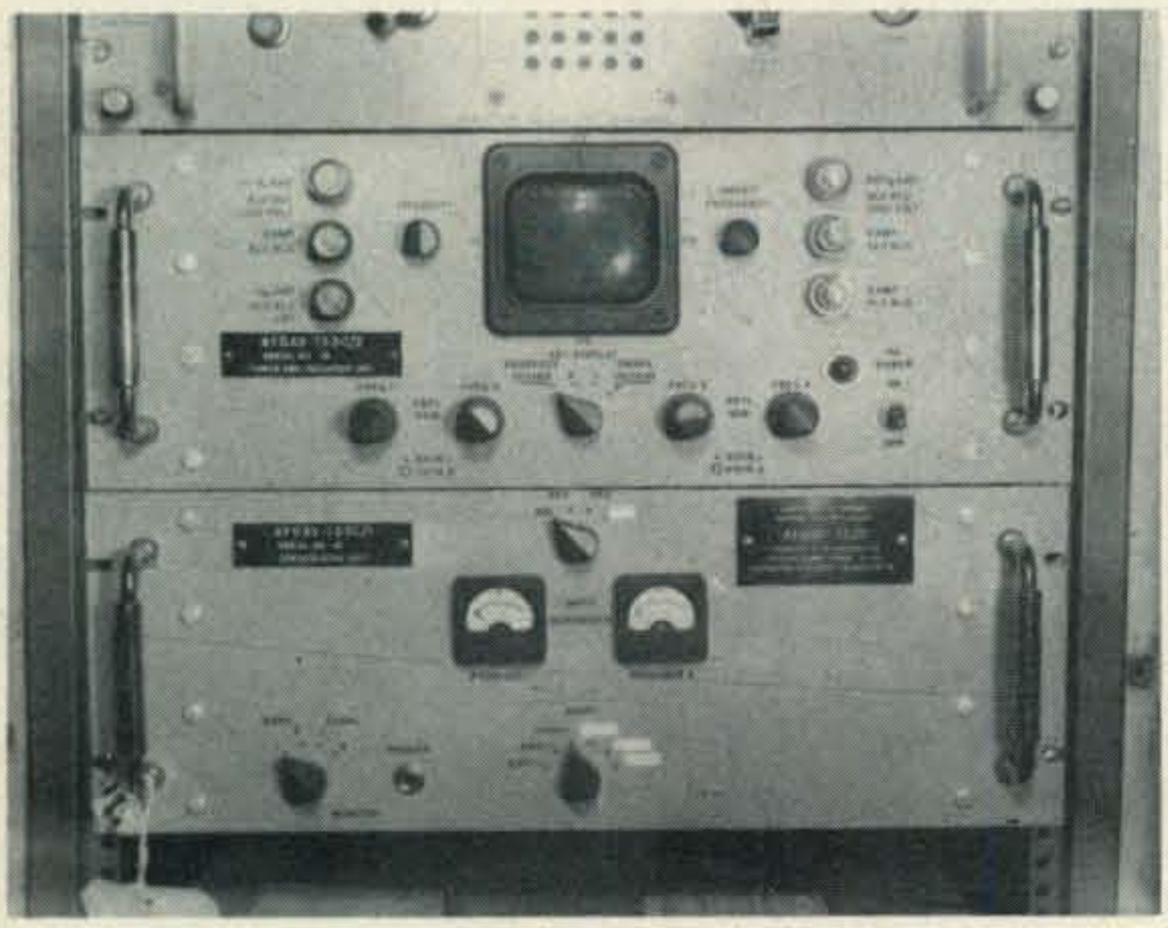


Fig. 1—Photo of AFSAV-133C.

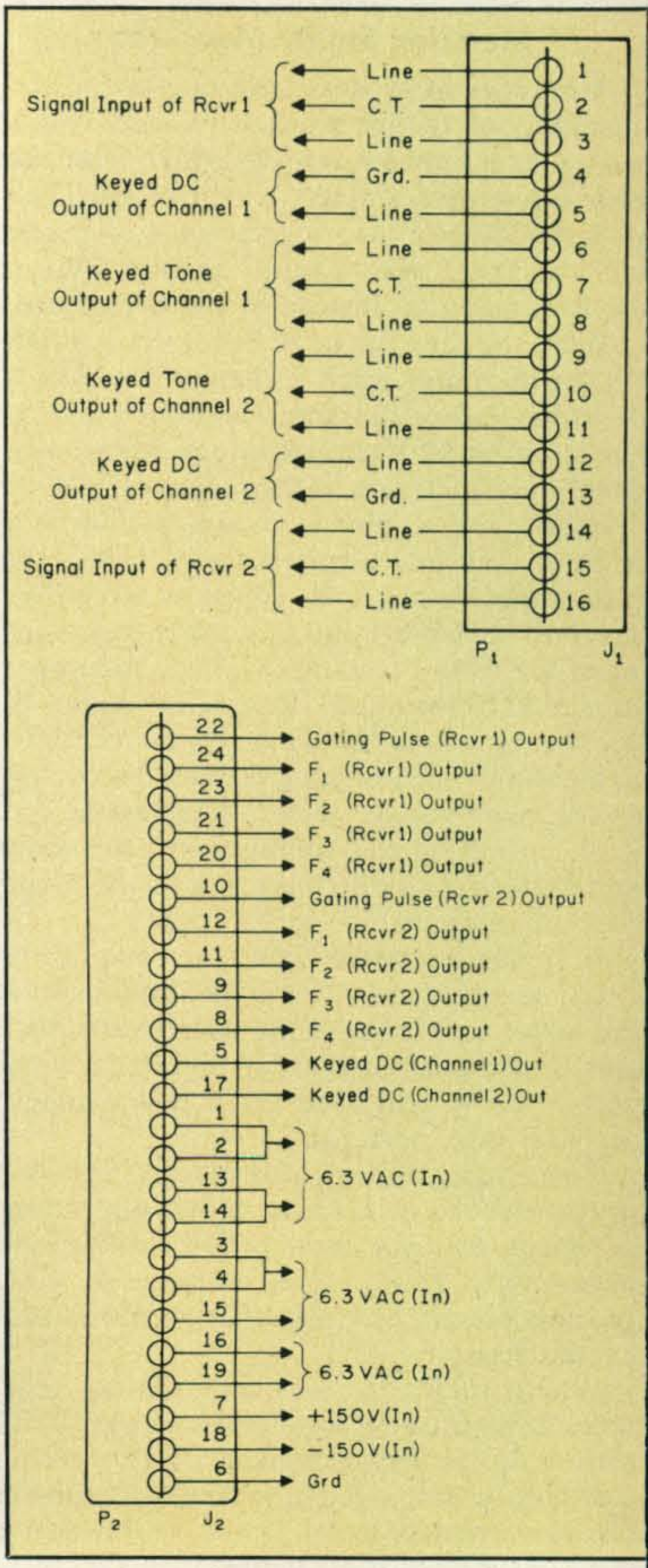


Fig. 2—Diagram of connections to AFSAV-133C

See page 110 for New Reader Service

This system compares very favorably with the more common CV-89 demodulator, and its close cousin, the CV-60. I have found it to give far better copy on fading signals. though it is not quite as convenient to use as the CV-89 *et al.*

Like the DEN-35, the AFSAV-133C is designed to copy twinplex frequency shift keyed signals. These are commonly used on many commercial high-frequency channels, particularly in Latin America and among Soviet Bloc countries. Cuba, notably, transmits 60 word per minute, plain-language twinplex from Havana much of the day. The unit will of course copy single-channel, ordinary FSK (or AFSK) RTTY signals.

Twinplex, briefly, is a method of using a single transmitter to carry two independent channels by time-sharing, without the complexities of full time-division multiplex (MUX in the communication jargon). Where standard frequency-shift keying uses two frequencies, 850 cycles apart, for Mark and Space, Twinplex requires four frequencies, nominally 250 c.p.s. apart.

For example the basic frequency of 3,501.9 kc would represent Mark in channel A and Mark in chanel B; 3,502.15 kc would give Mark in channel A and Space in channel B; 3,502.4 kc would be Space on channel A and Mark on channel B; 3,502.65 kc would give space on channel A and Space on channel B.

If channel B was idle—as is often the case, I find, in the signals from Havana, 3,501.9 would give Mark on channel A and 3,502.4 kc would be space on channel A, while channel B would remain marking. This would be a normal 500 c.p.s. shirt FSK signal in the first channel. Likewise ordinary FSK signals may be copied as if they were half of a twinplex transmission.

Though twinplex was used early in the development of MUX by the Soviets (much to the consternation of U.S. monitors for a short while) Northern Radio Corporation, 143

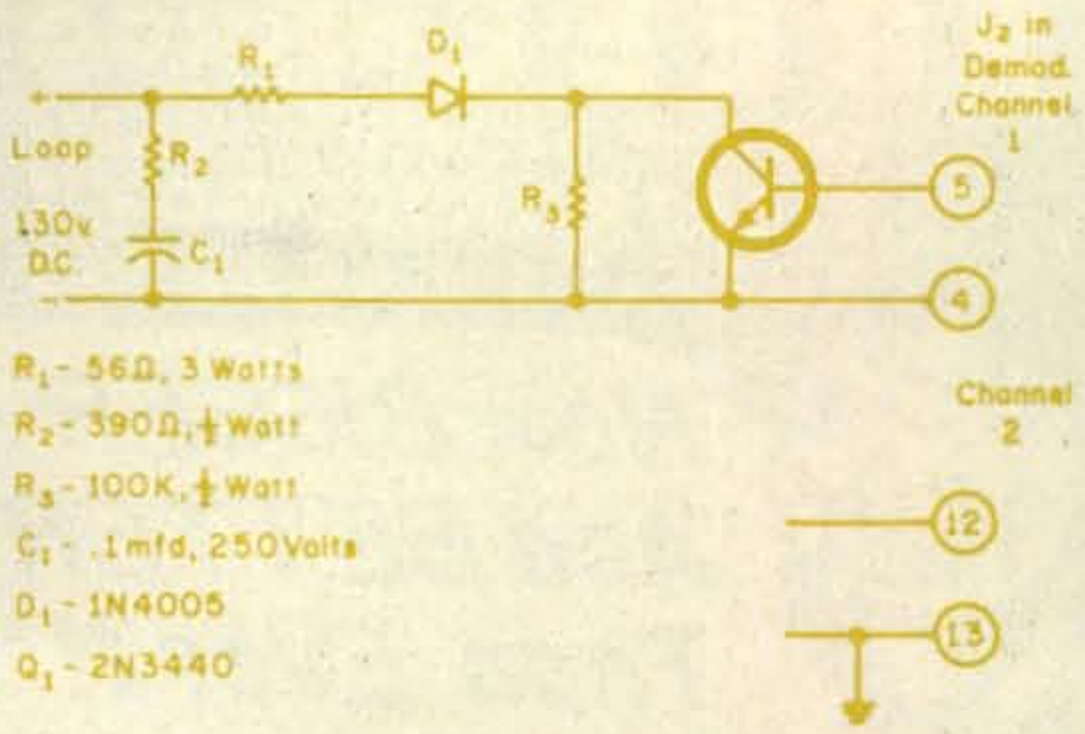


Fig. 3—Transistor keyer for AFSAV-133C. Adjust the voltage deviation for minimum swing to protect the keying transistor, which will switch with a voltage change of less than zero to plus one volt. It might be a good idea to clamp the negative side of the d.c. output to ground with a diode and use a voltage divider to reduce the positive excursion.

West 22nd Street, New York, produces commercial twinplex MUX gear, notably the Type 178 receiving converter and the Type 177 transmitting combiner. Frederick Electronics, Frederick, Md., also makes MUX systems of this sort.

Input to the ASFAV-133C is audio, 600

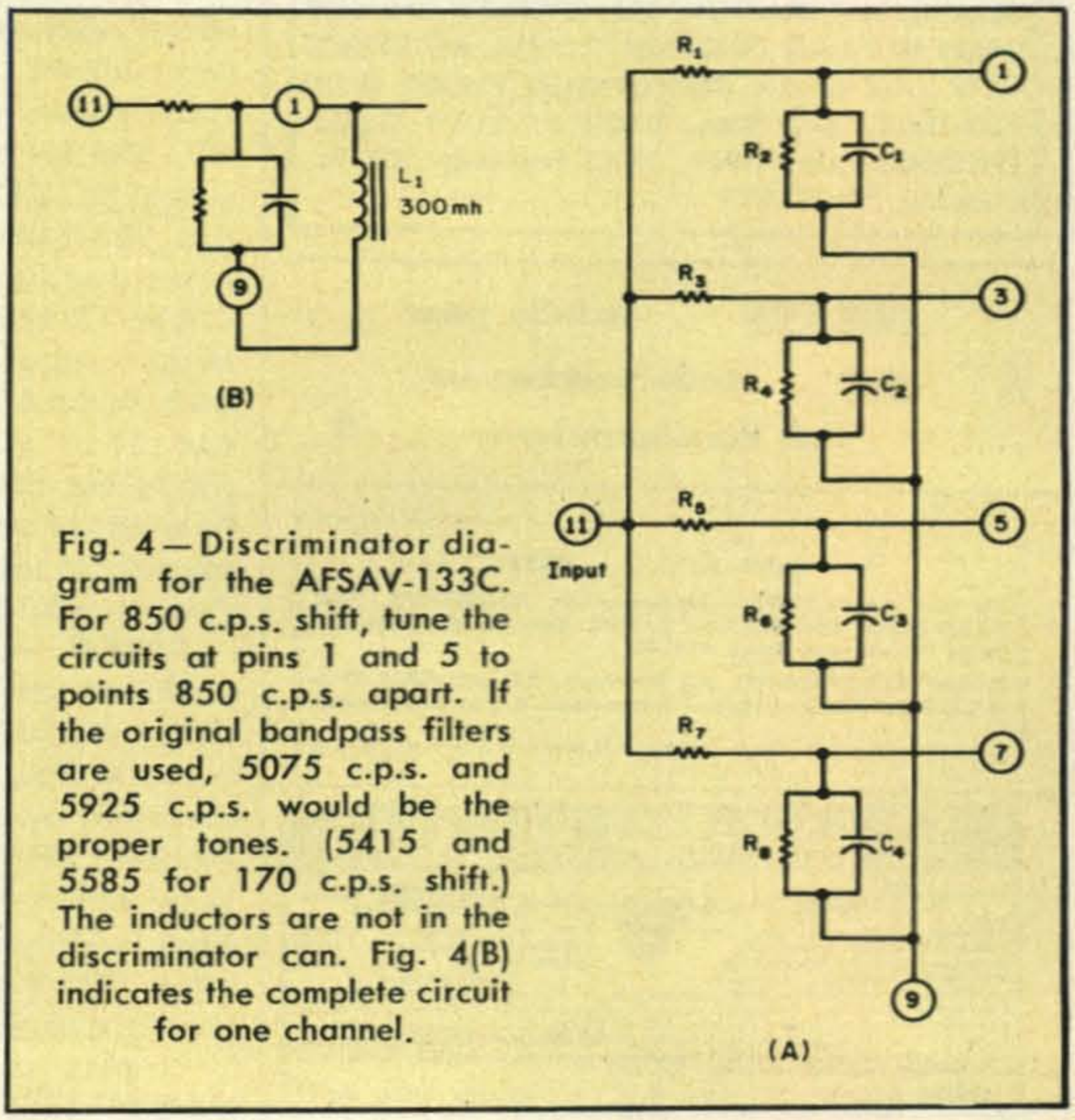


Fig. 4—Discriminator diagram for the AFSAV-133C. For 850 c.p.s. shift, tune the circuits at pins 1 and 5 to points 850 c.p.s. apart. If the original bandpass filters are used, 5075 c.p.s. and 5925 c.p.s. would be the proper tones. (5415 and 5585 for 170 c.p.s. shift.) The inductors are not in the discriminator can. Fig. 4(B) indicates the complete circuit for one channel.

See page 110 for New Reader Service

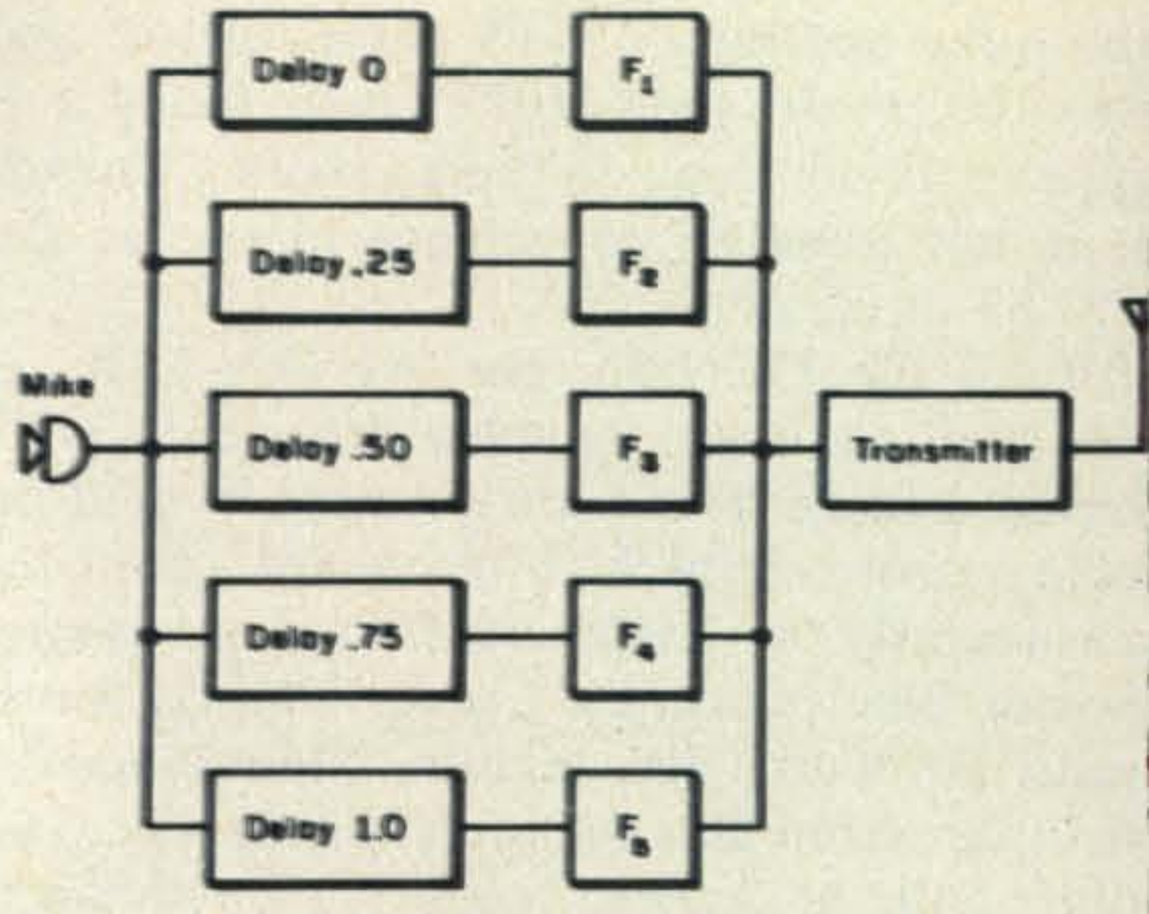


Fig. 5—Block diagram of EP-66 Echoplex.

ohms nominal, *between 4 kc and 7 kc*. This is a higher audio frequency than normal de modulators available to amateurs require but this means only that in receiving one mus offset the beat-frequency oscillator differentl so as to place the output tones in the pass band of the AFSAV-133C. Center frequency should be 5.5 kc.

Two receivers may be used, if desired, fo space-diversity reception, a technique which gives greatly improved reliability in the pres ence of fading signals.

Outputs are (1) on-off keyed audio tone which may be fed to an associated tone demodulator, say the AFSAV-39C, a Nor thern Radio #104, R-446-UC or R-551-UC etc., and (2) a keyed d.c., with mark repre sented by +15 volts and space by −15 volts d.c. This could easily drive a transistor loop keyer (see Fig. 3).

The Demodulator is equipped with three input bandpass filters, 1, 2 and 4 kc wide, in each channel, selectable by a front panel con trol. There is a spare position in case othe filters are desired. This could conveniently be used for an amateur channel, with a filte capable of accomodating frequencies from 2 kc to 3 kc for standard 2125/2975 tones.

SHIFT switch S^3 chooses among three available, plug-in discriminator networks fo shifts of 250 c.p.s., 500 c.p.s. or 1000 c.p.s between frequencies. A 250 c.p.s. shift wa described above in the explaination of the twinplex MUX mode. Available vacant posi tions readily permit construction of up to three additional discriminators, say for 170 c.p.s., 425 c.p.s. and 850 c.p.s. plug-ins fo standard single-channel reception. See Fig. 4.

Display of an incoming signal on the AFSAV-133C indicator should be a cross

See page 110 for New Reader Service

but unlike the ordinary + display, on this unit each "leg" of the cross represents one of the four twinplex frequencies. The object is to tune the receiver so that all four legs are equal amplitude.

The circuit of the AFSAV-133C accepts the audio input, passes it through the selected bandpass filters, with indication of level on the appropriate VU meter.

Tubes V_1 and V_3 are triode limiters, with clipping in diodes $CR_{1,3,5,7,9}$. The square wave output from the limiters is amplified in V_{3B} and V_5, giving low impedance to the discriminator stages. Cathode followers V_9 and V_{11} are directly coupled to selector diodes and a series of jacks used to set up different Mark/Space assignments. Diversity selection is made in diodes $CR_{13,28}$, which allow the stronger signal to drive the succeeding stages when two receivers are used.

Tubes V_{15} and V_{17} form a flip-flop or slicer circuit and are followed by V_{19}, a cathode follower, which provides the low-level d.c. output, or keys V_{7B}, a tone oscillator putting out a 3 kc audio signal. Tubes V_{7A}, V_{21} and V_{23} are part of the d.c. output circuit, providing clipping and a low impedance output to pin. 22 of J-2.

The unit will not compete with the TT/L with its DTC circuit, but if it can be obtained inexpensively, it can represent a real bargain in an RTTY demodulator. If you have an interest in seeing what goes on in those twinplex circuits, it is one of only three surplus units I have seen capable of handling this brand of MUX.

The EP-66-1-SPC unit, built by Kahn Laboratories, Freeport, Long Island, is relatively new on the surplus market, in fact this model "scrambler" was produced only 30 months ago, in August, 1966. The device is one of the several modes of providing privacy for phone conversations. In Washington, gray telephones in scores of Pentagon and other offices where classified data needs to be discussed are equipped with scrambling units of which echoplex may be one. Most of the so-called "privacy" devices take the voice and split it into a number of frequency segments which are then inverted or juggled before transmission. At the receiving end, an un scrambler puts the voice back together.

Actually, such devices are pretty much obsolete today. They may conceal information briefly, but are not safe against a determined eavesdropper who can tape record the scrambled conversation and meticulously re

See page 110 for New Reader Service

run it through a computer-programmed decoding process. Not everyone can afford to do this sort of thing on a large scale, but even commercial spies can take the time to unscramble important conversations, and where national defense is involved, the risk may be unacceptable.

More sophisticated scramblers today are built around digital techniques. The voice frequencies are divided into multiple channels, which are treated as digital "bits" which may be scrambled in virtually infinite ways which are far more difficult to "break." The original "Vocoder" was such a digitalized voice scrambler which later spawned a large family of digital or pulse code modulation techniques. With the rise of digital techniques for computer and communication use, almost all encryption devices today are based on digital modes, leaving voice-frequency scramblers for low-security applications.

Echoplex offers more than merely a degree of security. Through selective-delay features it provides time diversity which tends to counteract the short, deep fades which are most serious in high frequency radio circuits. In addition, by spreading out voice peaks, up to 7 db higher modulation levels may be used without exceeding 100 percent a.m. modulation on peaks of the speech wave.

The circuit of the Echoplex involves a set of filters which break up a voice signal into five different segments. Each set of filters is fed through a different time delay circuit, to an endless tape loop, in such a way that the first voice segment is delayed .25 seconds, the second .50, the third .75 and the fourth 1.0 second with the fifth sent undelayed, before being transmitted. At the other end of the circuit the process is reversed, with delays of 1.0, .75, .50 and .25 seconds being reintroduced in proper order to reconstruct the voice signal.

Obviously, the filters and the delay times may be juggled in different ways to provide a certain degree of difficulty to anyone listening to the circuit.

The diversity feature is provided by the delay times which act to offset losses of signal in deep fades which last less than a full second. Since the delay tape sends portions of the voice signal separated by a full second, even a complete fade cannot cancel the entire signal unless it lasts longer than a second. A fair degree of intelligibility is obtained from the remaining segments of the voice.

The EP-66 units is quite complex, with most of its circuits transistorized, and with jack panels provided to jumble the voice segments. I have no photo of the unit, but if anyone has one of these devices I can provide Xerox copies of the operating manual, including a schematic diagram. Fig. 5 is a block diagram of the Echoplex system, which is a patented product of the Kahn Laboratories.

The *sine qua non* of crypto work is the purely random cypher, in which each character is represented by a number chosen at random. An infinitely-random based cypher is unbreakable by even modern computer methods, but it is costly to prepare the tapes which are used in true-random crypto, and the process of sending the encrypted message is slow. There are ways to accomplish this, but don't try to make one for commercial sale if you work out your own little jiffy code machine. The National Security Agency does not permit commercial use of true-random code devices. Although legally, there is no federal monopoly, N.S.A. has ways of preventing private enterprise in the crypto field. ■

Apollo 8 [*from page 22*]

recovery intercom equipment are used to maintain contact with ground stations and with frogmen. An automatic 3 watt line-of-sight v.h.f. beacon is triggered just prior to splashdown. The small a.m. transmitter is modulated by a keyed 1000 c.p.s. tone.

Antennas

There are nine antennas aboard the Apollo series of space vehicles. More than half of the radiators are associated with Unified S-band equipment.

The S-band high-gain antenna (fig. 2) provides sufficient gain for two-way contacts at lunar distances. To accomplish this, the antenna can be oriented manually or automatically toward ground stations for maximum efficiency. The radiator has three modes of operation for transmitting and two for receiving. The gain and beamwidths are:

Mode	Gain	Beamwidth
Wide-TX	9.2 db	40°
Wide-RX	3.8 db	40°
Medium-TX	20.7 db	11.3°
Medium-RX	22.8 db	4.5°
Narrow-TX	26.7 db	3.9°

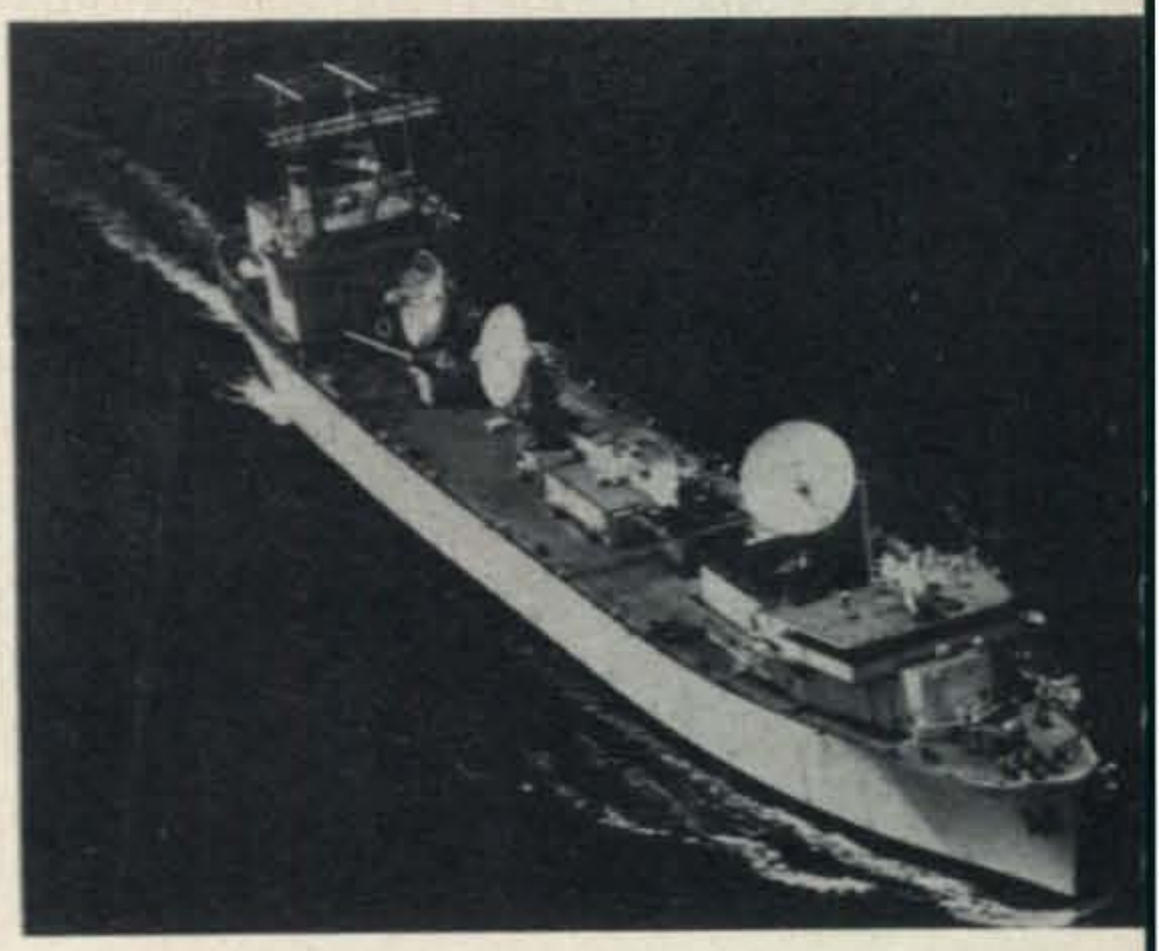
See page 110 for New Reader Service

The astronauts tune the antenna manually with the use of an S-meter. After acquiring the signal, the antenna automatically tracks it within the travel limits of its gimbal mount.

This high-gain antenna, which is responsible for the excellent TV pictures sent back to earth during the Apollo-8 flight, consists of a four-parabolic dish array whose attendant feed horns are offset 10° for the desired propagation pattern and a cluster of four feed horns enclosed in the center. In the "wide" mode, the center feed horns are used for transmission and reception. In the "medium" mode, one of the parabolic antennas is used for transmitting and all four of the dish-reflectors are used for receiving the S-band signals. In the "narrow" mode, all four dish reflector antennas are used for transmitting and receiving.

The four S-band omni-directional antennas (fig. 3) transmit and receive all S-band signals during the near-earth phase and back up the high-gain antenna in lunar operations. The antennas are flush mounted, right-hand polarized helical, and in a loaded cavity. They are rated at 15-watts c.w.

The v.h.f. omni-directional antennas and ancillary equipment consists of two v.h.f.



The tracking network for the Apollo mission includes 14 ground stations strategically placed around the globe. In addition, five specially equipped ships were converted to support the lunar mission. The key to the entire system is an innovation called Unified S-band which allows a multitude of information in several different modes to be transmitted through one radio link using one high-gain antenna.

scrimitar radiators, a triplexer, antenna switch, and the necessary signal and control circuits. The portable life-support communication equipment also can be checked

See page 110 for New Reader Service

through this system.

The v.h.f. triplexer is a passive, three-channel filtering device which enables three items of v.h.f. transmitting and receiving equipment to utilize one antenna simultaneously. The three channel filters are composed of two tuned cavities each, which function as bandpass filters. No power is required by the device and there are no external controls.

The v.h.f. antennas are omni-directional with approximately hemispherical radiation patterns; full omni-directional capabilities can be had by switching from one antenna to the other.

There are two v.h.f. recovery antennas stowed in the forward compartment of the command module. Each consists of a quarter-wave stub, 11 inches long, and a ground plane. However, the system is set up so that the recovery beacon transmitter or the main v.h.f. transmitter can swap antennas either by manually switching or manually disconnecting and reconnecting the proper antennas.

This was the setup for Apollo-8—the space mission that punctuated 1968. The same configuration is scheduled for Apollo-9 with some refinements and likewise for missions 10 and 11 to follow. The v.h.f. and S-band equipment double for communication with the LM (Lunar Module), that vehicle that will actually take the first U-S man to the moon's surface. ■

Announcements [*from page 10*]

Baltimore, Maryland

The B&O / C&O RRS. Amateur Radio Club's 10th annual Dinner Dance will be held at the American Legion Hall in Arbutus, Maryland on April 19, 1969. Tickets are $5.00 per person and must be obtained by April 5th. Tickets and further information may be obtained from Joseph W. Zorzie, W3LBC, B&O / C&O RRS. A. R. C., B&O Central Bldg.—107, Baltimore, Maryland 21201.

Johnson City, N.Y.

The tenth annual New York State Southern Tier Hamfest sponsored by the IBM Amateur Radio Club, QCWA, AREC and affiliated clubs will be held on April 19, 1969 at St. John's Memorial Center in Johnson City, N. Y., starting at 1 P.M. Adult tickets $4.50 and student tickets $2.50. Ad-

See page 110 for New Reader Service

vance sale only. Closing date on ticket sales is April 16. Afternoon activities include speeches, displays and contests. Surprise events throughout the day. Banquet/Dinner promptly at 7 P.M. Tickets and full particulars may be obtained from ticket chairman, Joe Kuntz, WA2ZTY, 1020 Forrest Road, Endwell, N.Y. 13760.

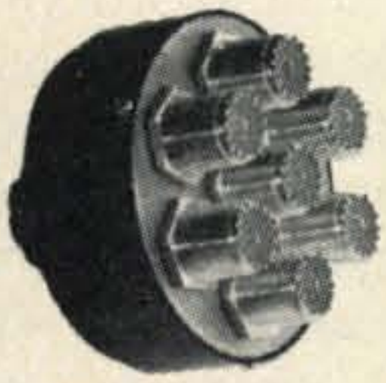
DX [*from page 70*]

DU1UP–To WB6GFJ
EL2BE–c/o WB8ABN
EP2BQ–Dr. Harry McQuillan, c/o Dept. of Geology, Pahavi University, Shiriz, Iran
EP2KB–Via W3HNK
ET3USA–V. N. Olake, VE3IG, 287 Kathleen Ave., Sarnia, Ontario, Canada
FØKI–c/o G2DHV
FB8XX–To FR7ZD
FK8AU–c/o VE3ACD
FM7WV–Via F3KK, Box 111, Grenoble, France
FR7ZR/G–To P.O. Box 103, St. Pierre, Reunion Island, Indian Ocean
FY7YQ–c/o WA4GQM, 392 Byron Drive, Memphis, Tenn. 38109
GC3SVK–Via G3TZZ
HBØLL–To WA4WAO
HKØBMO–c/o WA6AHF
HL9WK–Via K7CHT
HQ2GK–To VE1ASJ
HR2AFK–P.O. Box 254, San Pedro Sula, Honduras
HSIDD & HSIMM–Via WA4VOE
HV3SJ–c/o WB2ETI
JA4AS–Via K6PIH, 721 North 20th. St., San Jose, California 95112
KP6AQ–c/o W5 Bureau
KV4FZ (ex-WØVXO/KV4)–Box 310, Christiansted, St. Croix, V.I.
KR6IS–Via KR6RL, Box 4356, APO San Francisco, CA 96235
KX6DR–To WB6SJS
KZ5TC–Via W1EII
LAØAD–c/o W2CTN
MP4MBO–Via G3POA
OD5FB–To WB6HGU
ON8IR–Via G2DHV
PYØBLR–Dalton R. de Barros, Box 10, Guanhaes, Minas Gerais, Brazil
PYØDX–Via PY7ACQ
PYØOK–To PY2SO
PYØOM–c/o PY2SO
PYØSP–Via PY7AOA
TA1IB–c/o W4GHV
TA3AB–R. E. Stone, W5RBO, P. O. Box 416, Anna, Texas 75003
TF2WKX–To WA6IFG
TJ1AL–c/o W2MES
TJ1AU–P.O. Box 115, Ebolowa, Cameroon
VK2BKM/VK2–Via W2CTN
VK2BPO/VK9 and VK2BRJ/VK9–To Bob James, W4WS, Box 635, Dunedin, Fla. 33528
VK9CR–c/o W2CTN
VK9KS–Via W1YRC
VK9RJ–To K6UJW
VP1RC–c/o WB6EFA
VP7NP–Via WB6SJS
VP8FL, VP8JG, VP8JS, and VP8JI–To Eric R. Chilvers, 1 Grove Road, Lydney Glos., England
VS5RCS–c/o 9M2NF
VS6FX–Via W2CTN
XW8CS–To VE6AO
YA2HWI–c/o W9FLJ
ZD9BL–Via WA6AHF
ZS3C, ZS3D, & ZS3BP–c/o K4RTA
3AØAV–To I1ZBS
4X4UF, 4X4VB, 4Z4BL, & 4Z4DX–Via WA4WTG
5W1AS–c/o WB6KBK for QSO's after July 1, 1968
5Z4KO–Via WA1GIA
601GB–To W1YRC
6W8DY–c/o VE4SK
8QALK–Via P.O. Box 53, Bangalore 1, India
9X5AA–To W1YRC
9Y4VU–c/o WA3EPB

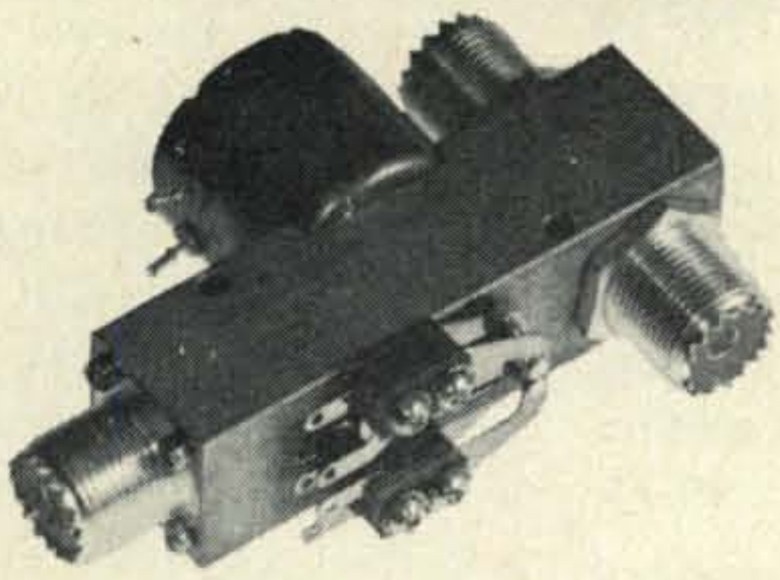
73, John, K4IIF

See page 110 for New Reader Service

LET DOW-KEY HELP SOLVE YOUR ANTENNA SWITCHING PROBLEMS . . .



SP6T
MANUAL
78-0604



SPDT
REMOTE 115V ac
60-262842

SP6T
REMOTE 115V ac
71-260401

SERIES 78 The series 78 coaxial switches are manually operated with true coaxial switching members (not wafer switches). They are offered in 2, 3, 4 & 6 position (illustrated) types, plus a transfer or crossover and DPDT. The useful frequency range is 0-1 Ghz except 500 Mhz using UHF connectors. The unused positions are open circuited or non-shorting. Also available with other type connectors such as N, BNC, TNC or C.

SERIES 60 The series 60 are remote operated, of rugged construction and designed for low-level to 1 KW use. The unit illustrated is equipped with a special high isolation connector ("G" type) at the normally closed or receive position. This "G" connector increases the isolation to greater than -100db at frequencies up to 500 Mhz, although it reduces the power rating through this connector to 20 watts. This is also available with other type connectors such as BNC, N, TNC,, C or solder terminals.

SERIES 71 High power 6 position switches commonly used for switching antennas, transmitters or receivers at frequencies up to 500 Mhz. The unit is weatherproof and can be mast mounted. The illustrated unit has the unused input shorted to ground. It is also available with a wide range of connectors, different coil voltages and non-shorting contacts or resistor terminations. Each of the six inputs has its own actuating coil for alternate or simultaneous switching.

DOW - KEY COMPANY

ORDERING INFORMATION:
Contact your local electronics distributor or Dow-Key sales representative, or write direct to the factory.

2260 INDUSTRIAL LANE • BROOMFIELD, COLORADO 80020
TELEPHONE AREA CODE 303/466-7303 • P. O. BOX 348

MODEL RTY-3

Improved model of our solid state RTTY receiving converter. Three shift frequencies, 850, 425, and 175 cycles. This audio filter converter has proved itself in many ham shacks. The circuit is made up of limiter, amplifier/filter driver, 3 stage filter, detector, pulse shaper, and selector magnet keyer. 100 volt 60 ma. loop supply included.

Still only **139.95**

Model RTY-3SB filters, tuned for operation with SSB transceivers **179.95**

Model RTY-3K same as Model RTY-3 but with built-in AFSK keyer. **159.95**

AQUADYNE INC.

P.O. Box 175 EAST FALMOUTH, MASS. 02536

See page 110 for New Reader Service

VHF [*from page 77*]

tions 200 or so miles away, but not Doug Armes, K2ACQ. Doug, the only winner of *CQ's* past Century Club certificate on 432 mc, starts his day every morning by working several stations in N.Y.-N.J. area about 300 miles from his Western New York QTH—your author among them. So that when Doug has a good day, it *is* a good day; and he had several good days between October 8th and the 15th. During this time, he worked W9UNN (Ill.), KØDOK (Mo.), K8DEO (Ohio), VE3EVW (Ont.), VE2LI (Que.), W4FJ (Va.), W5RCI (Miss.), W8MNT (Mich.), K2UYH (N.J.), K1JIX (Mass.), K2YCO (N.Y.), W3RUE (Pa.), W1QVF (Conn.), That is a total of 11 states, 2 Provinces, 8 U.S. call areas, and a maximum distance of 880 miles. All the above contacts were made with random calling, including the one which was probably Doug's biggest thrill —the QSO with W5RCI in Marks, Miss. This contact was made at 7:30 A.M. on a Wednesday morning. Doug runs 600 watts input to a pair of 4X150's. His antenna is a 128 element Collinear array up 60 fed with RG-17U. For receiving, he uses a transistorized preamp into a 6CW4 converter and a 75A4. That's what a good day is on 432 mc! ■

73, Allen Katz, K2UYH

Contest Calendar [*from page 86*]

be receiving yours. However I did not anticipate the dock strike that has tied up all shipping out of New York. So you fellows overseas are probably still waiting for your awards. Sorry fellows.

I do know that all of a sudden the incoming logs slowed down to a trickle, with the exception of those sent Air Mail. I'm sure those sent via surface mail will eventually get through but it might hold up the final results depending on when the strike is settled. We hope to make it for June and July as in past years.

73 for now, Frank, W1WY

Sylvia [*from page 32*]

you wonder where all the public relations officers have been hiding all these years! GB2LO chalked up a remarkable score of "firsts." Prefix-wise it caused a sensation; it achieved the biggest publicity program ever

See page 110 for New Reader Service

sustained by amateur radio anywhere; broke new ground and broke down old pr judices. But if it had achieved only this or historic QSO, between A.R.R.L. an R.S.G.B., it would have justified all the e fort that went into it.

At 1500 GMT on July 20, John Grahar G3TR, President of the Radio Society Great Britain, closed the station, as he ha opened it on July 8. For two hours befor hand we had been warning that GB2LO mu close down on sked. It was a time of day wh Stateside was coming in fast and there was last minute pile-up that vied with the D Miller farragos, American stations clawi each other out of the way, pushing up th antennas, pushing up their power, in a frant frenzied effort to get a QSO with this uniq station while there was time. But John w ruthless.

"Sorry, gentlemen," he apologized, as closed with the last QSO, K8CFU, "but tha it!"

Otherwise, we'd have been there still.

2 & 2 Dial [*from page 48*]

10. Using two nuts as spacers (appro mately 1/8 inch) between the mounting l of the drive and the rear of the front pan slip a 3/4 inch × 4-40 screw through two horizontal holes in the front panel a secure loosely. Cut off the excess scr length.

11. From the front of the panel, slip second ball drive onto the shaft and, us two 9/16 inch spacers with 1 inch × 4 screws and washers through the lugs, sec the second ball mount through to the vertical holes on the panel.

12. Tighten the four screws of the v.f making sure the dial is parallel to the fr panel.

13. Tighten the inside ball drive, shif it around as necessary for free operation

14. Tighten the outside ball drive firs the shaft, then the holding screws while justing for free operation.

15. Install the knobs.

Several things are now apparent. You have a dual speed vernier operating at a ratio for fast transverse and a 36:1 ratio fine tuning. There is no longer any quency skipping, dial sticking, and on ro roads, no "woubulation" of the signals. N you are set for operation with your drive.

See page 110 for New Reader Se

NOW. . . YOUR BEST SOURCE FOR DRAKE

DRAKE MN-4
Matching Network
$90.00

DRAKE MN-2000
Matching Network
$160.00

A Drake MN-4 or MN-2000 matching network is a worthwhile addition to any amateur station where peak performance is desired. Basically identical, except for power handling capabilities, the MN-4 and MN-2000 enables feedline S.W.R.'s of 5:1 to be matched to the transmitter. If input impedance is purely resistive, even higher S.W.R.'s can be handled.

DRAKE T-4XB
Transmitter
$430.00

The T-4XB is an all-band, all mode transmitter providing 200 watts p.e.p. input on s.s.b. or a.m. and a conservative 200 watts on c.w. Transceive capability is provided for, when used in conjunction with the Drake R-4 series receivers. Solid state linear permeability tuned v.f.o. produces better than 100 cycle stability, and 1 kc calibration. 160 meter operation with accessory crystal. VOX or PTT. Sideband suppression better than 60 db.

DRAKE R-4B
Receiver
$430.00

The R-4B Receiver is a top quality all-band s.s.b. receiver providing the ultimate in versatility. With accessory crystals, the R-4B covers 160 m., MARS frequencies, CB, WWV, etc., or up to 5 mc continuous coverage for use with VHF converters. Features passband tuning, noise blanker that works on a.m., c.w., and s.s.b., notch filter, crystal lattice 1st i.f. filter for low cross-modulation. Gear driven dial on solid state p.t.o.

DRAKE W-4
Directional
RF Wattmeter
$49.50

The new Drake W-4 directional, through line, RF wattmeter represents a significant advance in wattmeter design. Through the use of printed circuits, toroids and other techniques, performance is attained which up to now was available only in units selling for more than twice the price. The W-4's accuracy meets or exceeds that of these units.

NOW IN STOCK
THE NEW
TR-6 TRANSCEIVER

$599.95

ARROW ELECTRONICS, INC.

- 900 Rte. 110, Farmingdale, N.Y. 516—MYrtle 4-6822
- 225 Rte. 46, Totowa, N.J. 201—256-8555
- 97 Chambers St., N.Y., N.Y. 212—DIgby 9-4411
- 525 Jericho Tpke., Mineola, N.Y. 516—Ploneer 2-2290
- 18 Isaac St., Norwalk, Conn. 203—838-4877

ee page 110 for New Reader Service

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 35¢ per word. **Minimum Charge $2.00.** No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day in the second month preceding date of publication.

Subscribers to **CQ** are entitled to one free 3-line ad per month. Ad copy must be accompanied by mailing label from subscription copy of **CQ.**

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein.

Direct All Correspondence & Copy to: **CQ Ham Shop, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.**

FOR SALE: Heath SB-301 Receiver, with 3 filters, $250.00. K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, L.I., N.Y., 11050.

WANTED: Heath 610 oscilloscope at reasonable price. Kirby Kautz, 11 Berkshire Court, Huntington Station, New York 11746.

TRADE: 250 watt amp., mod/pwr supply. 813/811's/3B28's/816's. Built to plug into Ranger. Swap for receiver of equal value. Write: W. E. Thurston, 216 Cottage Rd., South Portland, Maine 04106.

FOR SALE: Johnson signal sentry, like new, unused—$10 or $10.50 PPD. Trade for Vibroplex key. Bill Moss, WA8AXF, 715 Harvey St., Petoskey, Mich. 49770.

FOR SALE: Hammarlund HQ-170A, clock, switching for 2 m conv. & 6 m pre-amp. Mint condition. Orig. carton—$250. Harold D. Mohr, K8ZHZ, 5670 Taylor Rd., Gahanna, Ohio 43020.

FOR SALE: Teletype Model 19—$100; Hallicrafters S-108 rcvr — $75; Lafayette 2m converter — $15. WA2HWJ, 7 Elmtree Lane, Huntington Sta., New York 11746.

FOR SALE: Swan 250 and 117 xc perfect condition —$290. Or trade for good comm. rec. J. Wilson, 1733 Foster Rd., Las Cruces, New Mexico 88001.

WANTED: Brandes Navy-type headphones with swivel ball joint headband. Also is there an SP-600 LF around for sale? W6QV, 10912 Sherman Grove, Sunland, Calif. 91040.

FOR SALE: Early HRO with coils, power supply and manual. Good working condition. Also HRO-60 "A" and "E" coils. Best offer on any or all. Will ship, must sell. Ronald Keuler, 331 Saratoga St., Chilton, Wisc. 53014.

FOR SALE: National Sixty 4 band receiver. Broadcast and 1.6 to 31.0 mc—$40. B. F. Ryan, 4350 Kraft Ave., Studio City, Calif. 91604.

FOR SALE: Complete ham station consisting of Heath Marauder (HX-10) and Hammarlund HQ-170 plus speaker and 80/40 meter Hy-Gain dipole—never used. Price $400. Write Ronnie Benfield, 107 Glenburnie Dr., New Bern, North Carolina.

FOR SALE: SBE-34 with mike, SWR bridge—$300 or make offer. 75, 40, 20 meter Hustler antennas—$25. Knight v.t.v.m. (KG-625) — $30. Mechanical filters, F455-FA21 or F455-Y21—$20. Dean Gearhart, 48 East Jefferson, Naperville, Illinois 60540.

FOR SALE: Taesu FT-100 all band transistorized s.s.b./a.m./c.w. transceiver, mind condx w/mike. Hustler mobile antenna w/all except 15M resonator. Will ship. $320 takes all. Franklin, 38 Raffaele, Kincheloe AFB, Mich. 49788.

HOSS TRADER Ed says if you don't buy your han gear from him, you might pay too much. Write o telephone the "Hoss" for excellent cash quotes an trades anywhere in the U.S.A. New equipment, dis continued items: Swan 500—$379; Galaxy 5 Mark II- $309; Hy-Gain TH6-DX beam—$109; RA-A receiver- $309. New Rohn 50 ft. foldover tower, PPD—$19 New Mosley TA-33 beam and Demo Ham-M rotor- $179. Used equipment: Drake 2A's—$129; SX-11 HT-44 & supply—$459; TR-4—$409; T4-XB—$349; R4- —$319; Swan 500C—$409; KWM-2—$649; Ham-M ro tor—$89.50; SB-34—$299; Eico 753 & 751 supply- $159; Swan 350—$259; SX-101—$129. Ed Moor Wholesale Radio Co., Box 506, DeWitt, Arkansa 72042. Phone (501) 946-2820.

FOR SALE: Receiver band changing rotary switch 25¢ PPD. Free catalogue available. Bob-Frank Elec tronics, P.O. Box 1327, Harrisburg, Pa. 17105.

FOR SALE: Johnson Viking KW match box—$10 Excellent condition, WA4YDT, 2523 Woodfin, Cha tanooga, Tenn. 37415.

FOR SALE: SB-34 SBE 4 band transceiver, brand ne —factory sealed box—$325. No trade. John West P.O. Box 176, Grandview, Missouri 64030.

WANTED—QST's—Last four issues needed to com plete 1916—FEB, MAY, JUNE, JULY. Any reasonabl price paid. K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Washington, L.I., New York 11050.

WRL's used gear has trial-guarantee-terms! Gonse G28—$99.95; Heath SB300—$299.95; HW22—$89.9 HW-10—$129.95; Hallicrafters SR34AC—$149.95; SX 146—$189.95; Globe VHF62—$79.95; Swan 400/420- $299.95; 400/406—$239.95; Galaxy 300—$139.95; V- $229.95; Vmk2—$279.95; Hundreds more—Free "blue book" list. WRL, Box 919, Council Bluffs, Iowa 5150

WANTED: Early Atwater Kent and RCA radio & parts Former employee, now collector. (Crystal & batter sets only.) Frank Atlee, 92-31st Ave., St. Petersbur Beach, Florida 33706.

FOR SALE: SBE-34 with mike, swr bridge—$300 make offer. 75, 40, 20 meter Hustler antennas—$2 Knight vtvm (KG-625)—$30. Mechanical filters, F45 Fa21 or F455-Y21—$20. Dean Gearhart, 48 East Jef erson, Naperville, Ill. 60540.

DECADE COUNTER KITS—$13.95. Proffessional qu lity readout. Free information. Display Electronic Box 1044, Littleton, Colo. 80120.

LINEAR BUILDERS: 100 MFD @ 3000 VDC conde sors—$30 each. Basil J. Weaver, 1831-B Ave. M, Lu bock, Texas.

3 PLASTIC HOLDERS will frame and protect 60 card $1.00 or 10 holders—$3. Prepaid and guarantee Patent 3309805. Tepabco, Box 198Q, Gallatin, Te nessee 37066.

RTTY GEAR for sale. List issued monthly. 88 or 4 Mhy toroids, uncased, five for $2.00 postpaid. Ellio Buchanan and Aassociates, Inc., 1067 Mandana Blvd Oakland, Calif. 94610.

TEST EQUIPMENT WANTED: Any equipment made b Hewlett-Packard, Tektronix, General Radio, Stoddar Measurements, Boonton. Also military types wi URM-( ), USM-( ), TS-( ), SG-( ) and simil nomenclatures. Waveguide and coaxial componen also needed. Please send accurate description what you have to sell and its condition to Tuck Electronics Company, Box 7050, Garland, Tex 75040.

SELL: New NCX5 MKII $400.00, NCA P/S $75.0 NCL2000 $425.00, all for $850. Eight month Facto Warranty left. SB-34 $250.00, P&H LA500M, 1 K Linear $75.00, P&H PS1000B Mobile P/S $75.00, We ster Big "K" Mobile Antenna $25.00, all for $350.0 Also Panadapter, VHF Converters, Transmitters, A tennas, many others. Write for list. K2MLB Fra Grosso, P.O. Box 4, West Orange, N.J. 07052, pho 201-731-5064 (evenings).

See page 110 for New Reader Servi

ORTHERN California Hams: Best-deals—new and conditioned equipment. Write or stop for free estiate. The Wireless Shop, 1305 Tennessee, Vallejo, alif. 94590.

SL's BROWNIE W3CJI-3111 Lehigh Allentown, Pa. 3103. Samples 10¢ with catalog 25¢.

MC Antenna Tuners 2-30MCS, 1 KW plus. For long re or parallel feeders. $25.00 FOB. 40" infra-red aters 45% off list, send for brochure. RF CUSOMS, 253 Bellman, Warwick, R.I. 02889.

ELL: Hallicrafter 2000 PEP HT33A Linear modified r factory specs. to HT33B, in excellent condition, 250.00. G. S. Bean, 613 Asbury Road, Cincinnati, hio 45230.

SL's by RUTGERS VARI-TYPING SERVICE, Thomas ., Milford, N.J. 08848. Free samples.

OR SALE: R-100A mint w/spkr, S meter, xtal calib—55. T-150 xmtr—$40. VF-1 vfo w/hb supply—$10. dventurer 50 w cw—$15. W. R. Wortman, W5QNY, ox 305, Los Alamos, N.M. 87544.

OR SALE: EICO 753 w/ss vfo, 752 mobile supply, ustler antenna with 80 and 20 m resonator. $150. A8CKT, John Wagner, 662 W. Lincoln St., Caro, Mi. 3723.

ANTED: Millen grid dip meter. Must be in perfect ondition and reasonable. Russell F. Hardy, 45 West each Orchard Rd., Rayton, Ohio 45419.

Y-GAIN TRAPS, unused, blue plastic 2 pair 15 mtrs; pair 10 mtrs. $6.50/pair pp. All 5 pair—$25. A4NED, Box 468, Gainesville, Ga. 30501.

ASE FOR LIST of junque. Want mech filters for 5A4. Jack Short, W4UHA, Oxford, Ala. 36201.

ANUAL WANTED for BC-348-M receiver. Also CQ sue for June 1954. W. F. Montgomery, KZ5FN, Box , Gatun, Canal Zone.

ANTED: Instruction book or schematic for Graetz erie 171/7 receiver and OS8/U oscilloscope. C. R. oe, 6790 Bollinger Rd., San Jose, Calif. 95129.

OR SALE: KWM-1 acc, 35D-1 mt, 516E-1 dc supply, atch spkr/patch console. Offer? Have Drake MN-4 ant MN-2000. K6SDE, 610 Inwood Dr., Campbell, a. 95008.

OR SALE: 75A4 serial 4209 speaker with light excelnt—$325. Collins wattmeter 302C-1—$35. Collins 89A-2 patch—$15. Teletype model 15 converter CV-/URR—$75. T. E. Conley, 28 Bayberry Circle W. verpool, N.Y. 13088.

ANTED: SX 28 Hallicrafters receiver. Some work eeded. Price and condition first letter. W0FDS, 607 outh 4th St., Princeton, Minnesota.

OR SALE: DX-100B transmitter. Good condx, pick-up nly. $65. W4KAU, 617 Windsor Rd., Savannah, Ga. 1406.

OR SALE: RCA TM-21 color monitor, video DA's, two K-10 cameras, assorted TV electronics. Want cash good SSB transceiver, H. L. Harrington, 908 W. reauer Ave., State College, Pa. 16801.

OR SALE: Viking II with VF-1 vfo—$85. HQ-129X—75. BC-221AE—$45. 1500 v @ 500 ma CCS pwr upply parts—$25. 6 foot (19 inch panels) steel abinet—$20. SCR-522 converted—$20. Sorry no shiping. John W. Wingfield, 5323 Cobb Dr., Dayton, Ohio 5431.

OR SALE: Frequency meter BC-221-M. Perfect condx. ith calib. chart and tech manual TM 11-300. In etal case. $75. A. M. Fox, Box 895, Greeley, Colo. 0631.

ANTED: Old radio tubes all kinds made prior to 923. Also UV203, UV225, UV274. R. W. Schendorf, 10 Monroe Ave., River Forest, Ill. 60305.

OR SALE: DB 23 preselector, like new condx. Best ffer, plus shipping. Melvin L. Duke, W4MBE, 2510 owd Lane, Richmond, Va. 23235.

HOSS TRADER ED MOORY says if you don't buy your Ham gear from him, you might pay too much. Shop around for your best price and then call the "HOSS" before you buy! Close outs on new equipment: New Galaxy 5 Mk III, $309.00: Early Model Swan 500C, $409.00: SB-34, $329.00: R4-A Receiver, $319.00: New Swan 410C VFO and 22B VFO adapter, Reg. ($147.00) cash price $98.00: Hy-Gain TH6-DX Beam, $99.00. New Rohn 50 ft. heavy duty foldover tower prepaid, $194.00; New Mosley TA-33 Beam and Demo Ham-M Rotor, $179.00; USED EQUIPMENT: HQ-170, $159.00; Hallicrafters SX-117, HT-44, & supply, $439.00; Mint TR-4, $419.00; T4-XB, $349.00; R4-B, $309.00; Swan 350, $279.00; Ham-M Rotor, $79.00; ED MOORY WHOLESALE RADIO CO., Box 506, DeWitt, Arkansas 72042. Phone (501) 946-2820.

WANTED: Late model Airstream trailer for use as portable KW ham station. W7BIF, 107 Wyoming St., Boulder City, Nev. 89005.

FOR SALE: Heath HW-16 xcvr aligned at Heathkit. Mint condx.—$95 firm. Hy-Gain 18-AVQ, write for details. WB8BEG, 24126 Martha Washington, Southfield, Mich. 48075.

FOR SALE: HRO coils, new, unused for 14-30 mc only. Made originally for the grandfather HRO but will fit any model HRO. Will supply reference material on modifying for 6 and 15 meters. $6.00 each postpaid. J. Shank, 21 Terrace Lane, Eizabethtown, Pa. 17022.

COLLEGE Expense, complete station for sale. HT-37, 4-1000 homebrew linear, TR-44, relays, coax, mikes, beam, very cheap. L. Kirschemann, P.O. Box 633, Regent, No. Dak. 58650.

WANTED: Model TCU xmtr control unit for Swan SW-240. N. Wehrli, Box 1102, Ft. Stockton, Tex. 79735.

SELL: Sensitive Research 0-15 Ua. DC Standard, exc. $45.00, Sensitive Research 0-3 Ma. DC Standard, exc. $25.00. Others similar low priced. SASE. G. Samkofsky, 201 Eastern Parkway, Brooklyn, N.Y. 11238.

RTTY Information for the Amateur interested in RTTY. F. DeMotte, 4008 S. Atlantic Ave., Daytona Beach, Fla. 32019.

SELL: PS-150-120 Hallicrafters supply, $50.00, or swap 4-1000 and supply for H1 power matchbox. D.J. Anderson, 7816 Schultz Rd., Clinton, Md. 20735.

SELL: LM 13 freq. meter, 110vac p/s, self calib. book and manual, $50.00. W. Staudenmaier, 1229 Chanteloup Dr., Hendersonville, N.C. 28739.

FOR SALE: 52.525 MHZ FM rig. GE rcvr., xmtr., mic., cables spkr., control head, etc. 117vac. L. A. Gerig. R.R. 1, Morgan Rd., Monroeville, Ind. 46773.

SELL—trade a quantity of Jerrold wired TV accessories for ham gear. List on request. E. A Hubbel, 6633 East Palo Verde Lane, Scottsdale, Ariz. 85251.

FOR SALE: Apache xmtr and SB10 SSB generator with manuals $100. Need space. L. R. Palmer,10410 E. 39th Terr., K. C. Mo. 64133.

WANTED: Gonset GSB-2 2 mtr xcvr with AC supply. Write Tom Weiss, 2631 Woodward Rd., Cuyahoga Falls, Ohio 44221.

"DON AND BOB" discount sale. New Galaxy GT-500, AC supply, 465.00; Galaxy R-530 625.50; Hammarlund HQ-215 475.00; W-51 tower, prepaid freight, TH6DXX, HAM-M 589.95; Sony 250A station recorder 109.50; Write for discount quotes on new gear. New guaranteed surplus: Jennings Vacuum UCS-50010KV 30.00; Telex HMY2000 stethoscope headset 3.95; 6V10A transformer 3.95; 12V10A 4.95; GE 3B28 4.95; HEP-170 Epoxy diode, 2.5A, 1000PIV 39¢; Sangamo 4MFD, 4000V. 7.50; ANB Military 6000HM Headset with cord, band, plug 8.95; We carry many new non-current production tubes. Write for list on your needs. Collins repair station plus other lines. Don K5AAD, Bob WA5UUK, Madison Electronics, 1508 McKinney, Houston, Texas 77002 713-CA 4-2668

ee page 110 for New Reader Service

WANTED—32 S1 or S3—75S3B or transceiver—Wanted Drive MN2000. Will trade KWM2 or buy for cash if reasonable. WALXX, F. E. Coble, 251 Collier Avenue, Nashville, Tenn. 37211.

FOR SALE—Tri-Ex T588 88' tower, $150. Abt 90' 52 Ohm alum coax $30.00. Delivery within 100 miles. WA7GHQ/7, Paul J. Etcheberry, Jr., 2104 N.E. 45th Street, Seattle, Washington 89502.

FOR SALE—SX 96 excellent. $80.00 HX20 excellent $110.00. SB301 with CW filter $260.00. W80WJ, W8DWJ, E. C. Casey, 500 Norway Avenue, Cincinnati, Ohio 45229.

WANTED—1 K.W. RF Amplifier and 1 K.W. 2000V. power supply or parts. W2ISL—41 Allen Porterfield P. E., 41 Winnebago Road, Yonkers, New York (914) SP 9-6145.

TRADE: DX100 for HW-16 FOB, write Robert L. Sturgis WB 4BYJ, 310 Noel Road, Orange Park, Fla., 32073.

QSL's—BROWNIE-W3CJI-3111 Lehigh-Allentown, Pa. 18103. Richard E. Brown, W3CJI.

COLLINS 51 J-4 Overhauled, New filters in Nov. 68. Excellent condition. Trade for SSB transceiver or $400.00. C. A. Bowers, EP2CB, Box 2000, USDAO, US Embassy, APO New York 09205.

GONSET 50—Six meter transceiver excellent condition, $130.00. Also TA-40KR conversion kit. Adds 40 meters to any Mosley beam, with hardware, $30.00. H. G. Vandegrift WA0VMP, 4350 Heidelberg, Affton, Mo. 63223.

SB401, SB301, Microphone, keyer, low pass filter, dummy load for $350. Excellent condition. Steve Scott, Box 7201, USAF Academy, Colorado.

QSL Samples 10¢. Ken Hansen, WA9HGE, 3628 W. 80th Avenue, Merrillville, Indiana 46410.

BECKMAN Electronic frequency counters. 6023: transistorized, operates to 2MHZ $195.00. Higher frequency units available. Parts: Ivan L. Sundstrom, 131 Allen Avenue, Springfield, Ore. 97477.

MOTOROLA FMTRU-A1V(AF)1D—2 way mobile radios. 152-174 Mc. FM. Pair for $25.00; PE-103 dynamotor $7.50. Good used A-125A $10.00. 2 new Eimac 4X105A's $12.50 each. Art Crane W0UGU, 12865 Bell Road, Burt, Mich. 48417.

AVAILABLE NOW: Mainline TT/L-2 FSK demodulator. Solid state ST-3 and other TU units-filters-accessories. J. J. Electronics, Communications Specialist, Canterbury, Conn. 06331.

AMATEUR RADIO CERTIFICATE: Display impressive 8½" x 11 personally endorsed certificate in your shack. Send $1.00 to Amateur Certificate, Box 224, Miami, (Kendall Br.), Fla. 33156.

SELL: 3 EL full size 20 mtr beam $35.00; 10 sets QST 1951 to 1960 $25.00. M. A. George, W1BKG, 35 Ridgeway Avenue, Pittsfield, Mass. 01201.

Heath receiver with crystal calibrator—80-10 meters, Good condition $80.00. Also 25 watt Rlg, 80-10, Good condition $25.00 plus XTALS. After 5:00. Jay Friedman, WA2EXE, 484 Elmont, New York 11003.

Teletype model 28 R-T set, $125.00. Hallicrafters SX-108 receiver, $70.00. Model 19, $100.00. WA2HWJ, J. Hart, 7 Elmtree Lane, Huntington Station, New York 11746.

FOR SALE: Apache TX-1. Excellent condition $125.00. Also Eico 753 New neatly wired & operating $150.00. Both FOB this QTH. K2ABH Lt. Col. H. M. Russell, 83 Richmond Avenue, Deal, New Jersey 07723.

Powerstat* 0-135 Vac at v45 Amps, 60 Cycles, 75 lbs. $75.00. R. D. Mace, W6RW, 8600 Skyline Drive, Los Angeles, Cal. 90046.

FOR SALE—Marauder HX-10 made by Heath employee. Perfect craftsmenship $225.00. HW-29A. Sixer plus two crystals $35.00. WA90NZ, Larry Dunville, 18205 Denslow, South Bend, Ind. 46614.

WANTED—Antique radio Xmitting and receiving tube made prior to 1920. SM La Dage, W2EZM, 431 Oakland Avenue, Maple Shade, New Jersey 08052.

WANTED: Two meter skeds; AM, CW, or SSB. WA9QZ Al Ward, 402 Red Wing Lane, Barrington, Ill. 6001

Md. Hams: The CVTN now meets Monday, Thursda and Saturday. 125.62 MHz at 10 PM. W. Page Pyn WA3EOP, 717 Oak Hill Avenue, Hagerstown, M 21740.

FOR SALE: C. E. 20A exciter $75.00 tube test $15.00. 4 701A tetrode tubes with fil. xfmr $20.0 B. E. Fortner, W9FYM, 1538 S. Post Road, Indianapolis, Ind. 46239.

WANTED: Damaged or non working 75SL receiver be used for parts. Mike Ludkiewicz, W1DGJ, 1 Richmond Road, Ludlow, Mass. 01056.

WANTED: Burnell & Co. Model S-15000 Toroid SS filter. State price. J. A. Fredricks, K7GGJ, 314 Sou 13th Avenue, Yakima, Washington 98902.

WANTED: Rotator, TR44 or Ham-M State conditi & price. W. G. Nickless, W8HXZ, RTE 2—Box 48 Lowell, Mich. 49331.

Eico 723 Xmtr/Xtals, mint condx. $35.00 trade? Wa —RX preamp (DB-23) keyer paddle. Barry Gross W82RNL, 36 Gerhard Road, Plainview, N.Y.

PCT200 Panadapter, 3 BPL; 4-new 8236's; 5 ne 7360's. Want Norelco Carrycorder. Chester Benso W9IFB, 732 South 14th, Richmond, Indiana, 4737

FOR SALE: Collins 75S1 like new w/cw filter. $329. cash plus shipping. M. D. Ferguson, W5PMC, 92 Roanoke Drive, El Paso Texas, 79924.

FOR SALE: Eico 720 Transmitter $35.00, Eico 7 modulator $30.00, Hallicrafters SX-99 $50.00 (as i Heath Tower $45.00, Vanguard 2 meter convert $15.00 Relay $10.00, 10 xTals $12.00. R. Hajda WA3JDT, 4 Homer Street, Greenville, Pa. 16125.

FOR SALE: 1920-1922 QST's, Old 1920 Radio se Send SASE for list & prices. W4WSF, John C. Kanoc 224 Parkway, Winchester, Va. 22601.

SELL: Portable station ARC PORT forty only xtl co trolled see Jun 68 CQ p. 61 $30.00. 1.7 to 3 mc AF 5 receiver with pwr sup $20.00, tube 4-65 $8. Eddystone #893 dial $16.00 write W6BLZ—E. Marriner, 528 Colima Street, La Jolla, Calif. 9203

WANTED: Motorola Sensicon G or Uni-channel receiver for loband. For sale or swap Collins KWM mobile power supply, MP-2 $75.00. Schumache 12030 Washington Blvd., Los Angeles, Calif.

FOR SALE: Heath Marauder HX-10. Excellent con with extra set of new finals $200.00. DB23 Preselect $20.00. Les G. Arndt, W9ALP, 4522 So. Kedvale A enue, Chicago, Ill. 60632.

SALE: Drake R-4 & matching speaker with manu Excellent condition. $265.00 certified check or mon order. Will ship collect. R. M. Smith, K4KAK-WB6IE 916 West Cherry, Lompoc, Ca. 93436, W6FWR.

Mint KWM-2 with 516F-2 A supp., $695.00. 755-1 wi 312B-3, #31D Package $925.00. Wa5JXC, Wm. Beard, 5735 Willowbend Blvd., Houston, Texas 7703

SX115 $300.00, Apache $80.00 Mohawk $140.00. in mint condition. Will not ship. Chuck Evola, 142 Lenore, Detroit, Mich. 48239

WANTED: Collins 75 AF or newer rec. in perfe cond. J Wasiewicz, 229 Sarles Lane, Pleasantvil New York, 10570

WANTED: Sked with a KH6 or other Oceania stati and an Asia or Ja. for WAC. Kent Mc Corkle WN4JYB— 2715 Lilac Drive, Greensboro, N.C. 274

FOR SALE: Boom-less-quad-10-15-20 meters, metal electrically separated spreaders. *Built to ta* the rugged weather and high winds Never has be put up. Brand new, first come, first serve for $50. F.O.B. K4UCK Farmer Station, Ashboro, N.C. 272

See page 110 for New Reader Servi

WANTED—Ham-M rotor control. Bruce Grumstrup, WAQVBM, 1724 So. Bluff, Clinton, Iowa 52732.

WANTED: VHF equipment, entire station. Need to start from scratch. Want 2 and 6 meter xcurs capable of AM and GW. Need tower, rotor, beam. Entire deal not over $300.00. Single items accepted. R. Hajdak, WA3JDT, 4 Homer Street, Greenville, Pa. 16125.

FOR SALE: Hallicrafters gen coverage SX-122, xtal cal, speaker, mint condition—$225. K4JK, 2804 Broadview Dr., Huntsville, Ala. 35810.

FOR SALE: Drake DC-3, MMK-3 and Hustler ANT with 80 thru 15 resonators and body mount. Mint condx—$115 complete or trade for gud rcvr. L. Poulson, Granada, Minn. 56039.

FOR SALE: EICO 753, Elmac AF67, PMR-7, M-1070 with S meter, relay, pwr. plug, good condx. with manuals. K0HQW, T. Isaacson, Rt. 1, 883E, Branson, Mo. 65616.

WANTED: Comdel speech compressor. H. Smith, W8VVD, Box 452, Birmingham, Mich. 48012.

WANTED: Late model CRT tester and rejuvenator, mint condx and providing for new tube release charts. F. M. Miller, W5OYT, 315 S. E. Wilshire Ave., Bartlesville, Okla. 74003.

FOR SALE: BC-453, 190-550 kc, w/110 v power supply —$30. W3MTK, 329 Winter Quarters Dr., Pocomoke, Md., 21851.

WANTED: Good buy on a beam antenna. Boxed for shipping, 40-2 meters. Also need HA-2 transverter. K8UZX, P. O. Box 2, Washington, W. Va. 26181.

FOR SALE: SX-122 with crystal calibrator, gud condx, no scratches—$150. Rick Heckert, Route 23, Box 234, Kansas City, Mo. 64151.

FOR SALE: Collins 75A4, 2 filters, vernier dial, mint condx plus Collins Companion speaker. Reasonable. W2ASI, 15 Kensington Oval, New Rochelle, N.Y. 10805.

SALE—120 W. SSB X Mitter: $125.00. 1 KW Linear: $225.00 Transpac-TR10A: $30.00 Stamps for list and photos: W1MRR L. Kulhay, 19 Topstone, Danbury, Conn. 06810.

SALE—Ta33JR beam, good condx. Package deal. 4 new 4CX25 or (400 pep out ea) tubes in sealed packages and 4 Johnson sockets, Also 4 new 4E27A tubes. W4GHV, A. G. Barry, 135 N.W. Drive, Patrick AFB, Fla. 32925.

TRADE MAGAZINES—Have QST & CQ from 1930's on. Need QST 1/42, 1943, 7/45 & prior 9/34. Need various CQ, 73 and Ham Radio. W8EN, Cal Enix, 104 W. Chicago Road, Sturgis, Mi. 49091.

SELL—2 Heath CB-1 units with ground plane and Heliwhip antennas with 1 mobile 12 volt power supply unit. In good condition, $35.00 express collect. WOEJE, Jerry Miller, RFD8, Box 364, Springfield, Missouri 65804.

VIKING VALIANT $145.00—Swan 350, with calibrator, speaker & A.C., supply, $325.00. Clegg 99er, with VFO $95.00, or best offers. All are like new. WIEAR A. E. Jacques, 493 Main Street, Northboro, Mass.

VHF, TV, FM-DX — Old established club with new format. International column, picture page, and DX reports every month. Dues $3.50, US funds: samples 30¢. Worldwide TVFM DX Assn. WPE9TV F. S. Dombrowski, P.O. Box 5001, Milwaukee, Wisc. 53204.

SALE—Teletype model 14 R.O. base new, in original unopened carton. One only $6.00. J. Thomsen W9YVP, 8280 S. Tennessee, Claredon Hills, Ill. 60514.

SX117, HT 44, PS150, CABLES: First M.O. or Certified check for $575.00 Plus freight. WOFDK E. F. Wollack, 2122 Scenic Pl. St. Paul, MN.

WANTED—Collins 30S-1 and Collins 312B-5. State price and condition. W2HC—O. L. Presnell, 129 Harvard Street, Westbury, New York 11590.

WANTED: Heath HW-100 or similiar. Robert Hartman, 200 North East St., McConnell, Ill. 61050.

FOR SALE: EICO 720 cw xmtr, 40 & 15 m ants, key, 13 xtals, VFO adapter, B&W 550A coax switch mounted—$45. for all. WN5TVM, 695 Todd Ave., Beaumont, Texas 77707.

WANTED: QST before 1930. Sell—QST, 73 or CQ. E. Guimares, Jr., 17 West End Ave., Middleboro, Mass. 02346.

GENERAL RADIO heterdyne oscillator and other GR items. Write for list and prices. Carl C. Drumeller, W5JJ, 5824, N. W. 58th St., Oklahoma City, Okla. 73122.

DRAKE 2-B receiver, vernier knob and Drake speaker for $164. Aeronautical Center Amateur Radio Club, Postal Station 18, Oklahoma City, Okla. 73169.

FOR SALE: Central Electronics 100 v transmitter. Automatic tuning—$299. Bill Hanberry, 1340 Mountain View Ave., South Pasadena, Calif. 91030.

WANT—Alignment tool for older RCA shielded magic brain turners, identified by Riders Manual as RCA #12636. Dick Shuff, Plevna, Kansas.

WANTED: Gonset G-151-A F.M. Communitator, in good repairable condition. W. J. David K6KZT, 4434 Josie Avenue, Lakewood, California, 90713.

75A4 #4794 With 3.1 and 1.5KC filters, perfect condition, $400.00 firm. W9SRA Thos. Lesage, 7960 So. 116th Street, Franklin, Wisc. 53132.

FOR SALE: Grid Dip Meter, EICO model 700. 0.4-250 MHz, works perfect, $18.00. WA3BHY A. H. Bott, 340 South 24th Street, Quincy, Illinois 62301.

BC 348-Q Tuning Condenser needed. K8VBL, Thomas M. Truner, 301 Sabin, Kalamazoo, Mich. 49007.

SWAP—Kennedy model 281 amateur receiver and amplifier, for Grebe or Federal receiver. Thomas. Turner, 301 Kalamazoo, Michigan 49007.

ANTIQUE RADIOLA 17, serviceable condx wanted. State price and condition. Sell—Heath OP-1 professional scope. W2 OF O R. Mendelson, 27 Somerset Pl., Murray Hill, New Jersey 07971.

FOR SALE—Instructograph/10 tapes, $25.00. Heath VF1-VFO, New, $12.00. Pair 813's, $20.00. You pay shipping. KQTQM, Bll Congdon, Crane Lake, Minn. 55725.

CANADIANS: Complete amateur equipment service by licensed radio technician and amateur. VE6TW. Bob Fransen, Box 197, Sherwood Park, Alberta, Can.

SELL: Collins 75S-1 Rcvr $265.00, 32S-2 Exctr-Xmtr $375.00, HP-23 AC Pwr Sup $39.00. Low Hrs, One owner, Mint. Wanted: 312B-5 W4LPL. C.B. Presler, Jr. 115 Hearthstone Drive, Fayetteville, N.C. 28304.

RCA Employees SSB NET meets Monday Nights 8:30 P.M. EST. on 3885 ±2 KCS. W2KF Kne Miller, 309 Cherry Hill Blvd., Cherry Hill, N.J.

FOR SALE: H.Q. 170Ac RCVR factory press, spotless, guarantee, SRY no ship. Will SAC for $225.00 Phone MI 1-2559. WA2HQD Fred Colella, 105-18 131 Street, Richmond Hill, New York 11419.

SALE: HW-16, $1.00 plus shipping; 300 WTXMTR, VFO, XCUR, $118.00. WA1ISU Scott D. Rowley, P.O. Box 293, Williston Academy, Easthamton, Mass. 01027.

WANTED: Technical manual for VOX-3. Variable master oscillator by technical material, KL7GHB, G. Greene, 4157 Dorothy Dr., Anchorage, Alaska 99504.

ALUMA-FOAM COAX—Low loss for VHF. 10¢ per foot ppd. Samples 25¢. WOVLD, K. W. Morey, 803 West Sixth, Pittsburg, Kansas 66762.

SELL—3 speed 12" turntable, Garrard TPA-10 arm, base, like new. $25.00 BSR rec. chgr., base, "45" spindle, stereo cart., $15.00. V. R. Hein, 418 Gregory, Rockford, Ill. 61108.

See page 110 for New Reader Service

WANTED TO BUY: Old radio magazines, Popular Radio, Radio Broadcast, Radio News of the twenties and call books. Erv. Rasmussen, 164 Lowell, Redwood City, Calif. 94062

WANTED: January 1968 issue of CQ to complete collection. Alan Scott-WN6AJU—1606 N. Fuller Ave., Hollywood, California 90046

FOR SALE: Heath DX-60, Perfect, #65-HY-GAIN 5BDQ 80-10 meter doublet, #25-techceiver 6 transceiver-#15. Want TA33 or other tri-beam. Lee, K402Q, 9312 Habersham Drive, Louisville, Ky. 40222

FOR SALE: New Turner dynamic mike 90D-3 PTT mobile coiled cord fine for SSB. Cost $32.50 $20.00 post paid. Harold D. Mohr K8ZHZ 5670-Taylor Road, Gahanna, Ohio 43020

G31DG will swap English ham magazines for "QST" July-Sept. & Dec. 1921, Jan.-Mar. 1922. (IRC with inquiries, please). A. Herridge, 96 George Street, Basingstoke, Hants, England

WMMX wants old QSL's historical items, for our collection. Old "1XM" and "1MX" cards desired. M.I.T. Radio Society, W1MX, Box 558, 3 Ames Street, Cambridge, Mass. 02139

RTTY Journal & Fla. RTTY bulletin back issues wanted. Buy, swap or rent to dupe. Have spares—what have you? J. Sheetz K2AGI 5 Hansell Road, Murray Hill, New Jersey 07974

SELL: Teletype converter CV-57, with tech manual. $75.00. Also CE 100V perfect $300.00. G. Tate, 7 Artillery Road, Taylors, S.C. 29687

WANTED—Complete used Galaxy station. Please advise what you have and price. Thank you. Len Malone —WA5DAJ, 4305 Windsor Drive, Garland, Texas. 75040

FOR SALE—Brand new D-104 crystal mike, no stand. $14.00 post paid. R. Scott, W8FDN 371 Claymore Blvd., Cleveland Ohio 44143

SWAP HW-32A for G-76, T-150A/R-100A combo, or other TX-RX combo R.L. Guard—K4EPI, CMR Box 7542, Patrick AFB Fla. 32925

GALAXY OWNERS ATTENTION— Easily modify your Galaxy 111, 5, or MK1 to the new higher power of the MK111—SASE for details. WA5DAJ Len Malone, 4305 Windsor Drive, Garland, Texas 75040

FOR SALE: Wheatstone oiled 15/32" perforator tape for Bohme Keying heads. W6DOU, P.L. Lemon, 3154 Stony Point Road, Santa Rosa, Calif. 95401

75A4 used less than 10 hrs., extra-mint cond., all modifications, manual, $390.00. S. A. Tucker—W2HLT 51-10 Little Neck Pkwy., Little Neck, New York 11362

Members for 7170 kc. was net wanted. Membership bulletin for net. R. Hajdak—WA3JDT 4 Homer Street, Greenville, Pa. 16125

TUBES FOR SALE— RCA 7094, new $22.00. Two slightly used, $17.00 each. Free socket and heat dissipating plate connector goes with buyer of two or all. Eimac 4-400A, used, good. $17.00. Taylor 203z, two, used, good, $2.50 each. TZ-40, two new @ $4.00 each, two used, good @ $2.50. 830B, two, $4.00 the pair. Used, good. 814, G.E., never used $2.50. 815, RCA, good. $2.50. 211, RCA, new $2.50. Lewis 3C24-24G. New $4.50 Eimac 4x-150a. Two, look OK, not tested. $5.00 each. CR tubes, 2APL and 3FP7, also a 5BPL. Make offer. Also some good 2A3 @ $2.00 each. W2EEJ, Herbert Greenberg, 821 Rutgers Road, Franklin Square, New York 11010
(clearing Shack)

WANTED: PL-175-A or 4-400-A Send price & condition to Ernie Hendry K4CAH P.O. Box 939 Ft. Myers, Fla. 33902

WANTED: Anyone interested in putting out a novice technician and beginner bulletin. Also need someone with access to a mimeograph machine. R. Hajdak, WA3JDT, 4 Homer Street, Greenville, Pa. 16125

WANTED—60 Watt 2 meter F.M. Base station. Reasc able. K80X0

FOR SALE: Mint Drake T-4X/Ac4 $350.00. R-4A $3(00. Yaesu-Musen FL-2000DX with spares $185.(Want late TR-4 or KWM-2A. Bruce Wachtell WB6R(Box 433 Sausalito, Calif 90965

WANTED—HB liner, good operating condition, w or 2 803's in GG. 80 mtr coverage only is OK. Al 4-1000A socket & chimmney. Lindblom WNOMN 512 Grandview, Chillicothe, Mo. 64601

FOR SALE: Health 10-21 Scope. Excellent conditic Extras! $40.00 William Karl, WA2VSO, 24 Mill Stre Cooperstown, New York

WANTED: Heath SB620 or SB610 scope, low pa filter, Dummy load, Grid dip meter. Tom Dornba K9MKX, 19W167 21st Place, Lombard, Illinios 601

Hw-12, Clean, upper-lower sideband selection, $60. plus shipping. D.E. Halbakken—WA0PND, 414 Pr pect Blvd., Waterloo Iowa 50701

FOR SALE: SX96—excellent condition $90.00 HX with HB power supply $120.00. Will consider trac Edmund C. Casey MD-W8DWJ 500 Norway Avenu Cincinnati, Ohio 45229

SWAP—4-65's, 4E27's, 5-125B's, 4x150A's, 4CX250K Need 4-400A, 150 uF 4KV variable—K4EPI R.L. Gua CMR Box 7542, Patrick AFB Fla. 32925

RTTY VHF in Boston—Look for the "Beantown" cr on 51.192 MHZ; All on AM/AFSK, Many on Autosta R.G. Dick—WAIDPX, 6 Herbert Road Arlington Ma 02174

WANTED—Gonset 2 mlter sidewinder. Good Con tion. W3MSN, L. W. Briggs, 5400 Boulder Drive, Ox Hill, Md. 20021.

GONSET II—2 meter, 12 VDC? 117 VAC, AC & dords, mike and a crystal. $110.00. WA2CSE, R. Greenberg, 55 Bulson Rd., Rockville Ctr., N.Y. 115

SALE—Two 814 tubes with sockets and filame transformer. Also one 813 tube with socket. W7C Frank Kedl, 55 E. 8th Street, Sheridan, Wyo. 8280

SELL—Complete Swan 350 station USB/LSB, AC a DC pwr supplies, mobile antenna—2 coils, EV 7 mike $375.00. Also Mod 15tt $75.00. WQUSO, D. McNeil, 904 Mississippi Blvd., Bettendorf, Iowa 527

FOR SALE: Drake 2B, 2AC calibrator, 2BQ Q mult. speaker, $200.00 OR same with SB400, $450.00. Bo excellent. Going transceive. WA2WHN, I. W. Buxto 8 Briarcliff Drive, Merrick, New York 11577.

FOR SALE—EICO 723, 60 W CW Xmtr for 80, 40, 15 and 10 meters, $25.00. R. Gauger, 20 Glen La Glen Head, New York 11545.

WANTED—Early 1920's battery operated receiv and early wireless equipment. Also want CQ a QST binders. Radio equipment need not be in worki condition, state price. N. Wehrli, Box 1102, Ft. Sto ton, Tex. 79735.

WANTED—Novice Xmtr antenna and equipment. Ha recvr., need the rest. Earl Kroll, Ironton, Mich. 497

FOR SALE: Cent. Elec. 20A (table), QT-1, 458 V with Conv. $100. & Valiant 1 $100., both exc. P Smith, 804 Mena St., Mena Ark. 71953.

FOR SALE: HRO-500 W/Speaker mint condition b offer over $1,000.00; Johnson Invader 2000 excell condition & performance $550.; SBE-34 with VOX calibrator $275.; Johnson TR switch $10.; Model Teletype $400. and Model 19 $120., both clean & go condition. Moving to new QTH. Tom Austin, K4OTM/4, PO Box 2586, Mobile, Alabama 36601.

FOR SALE: Galaxy V MK3, VX35C VOX, AC-400 pov supply, G500 DC power supply, all for $540.00 Dem strator. Also a SX 100 very clean, $139.00. G. Scott K0 WFG, 2015 Beverly Blvd., N. Platte, Ne 69101.

See page 110 for New Reader Serv

ow! Direct rom W9IOP!

e new 1969 n Edition of the rld famous "SECOND OP" calculator

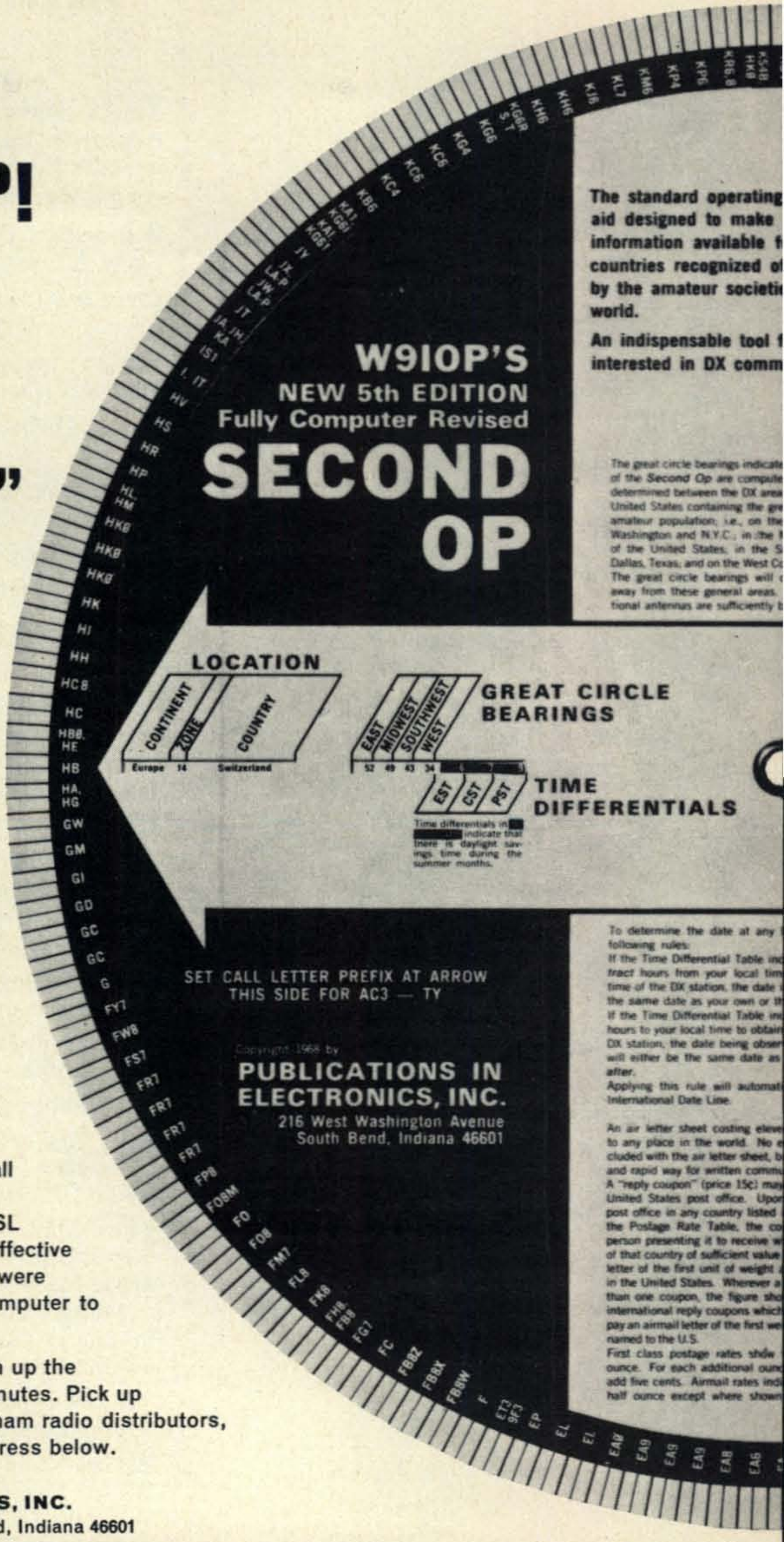
.50 *(Actual size 10-1/2" diameter)*

hether you are a beginning r or a long-time member e Honor Roll, a "Second Op" be your best friend in the shack. In just seconds es you accurate beam lings from the East, Midwest, t, and now the Southwest. also see time difference, zone, country, continent, and al rates instantly for every x. And there's also a handy e to log each prefix worked . . . confirming QSL's.

e 5th Edition "Second Op" is all in every way. Every current try and prefix is listed, plus QSL aus and other vital facts for effective enjoyable DX. Beam headings were rammed and checked by a computer to antee accuracy.

st a $1.50 investment can clean up the erwork in your ham shack in minutes. Pick up atest "Second Op" at leading ham radio distributors, rite direct to W9IOP at the address below.

LICATIONS IN ELECTRONICS, INC.
V. Washington Avenue, South Bend, Indiana 46601



e page 110 for New Reader Service

READER SERVICE

This Form Expires March 31, 1969

- ☐ Ameco, Division of Aerotron
- ☐ Aquadyne, Inc.
- ☐ Arnold's Engraving
- ☐ Arrow Electronics, Inc.
- ☐ B & F Enterprises
- ☐ Barry Electronics
- ☐ Cleveland Institute of Electronics
- ☐ Crystek
- ☐ Dayton Amateur Radio Association
- ☐ Dow-Key Company
- ☐ Eimac, Division of Varian
- ☐ Essco
- ☐ Fair Radio Sales
- ☐ Gordon, Herbert W. Company
- ☐ Hafstrom Technical Products
- ☐ Harrison
- ☐ Heath Company
- ☐ Henry Radio Stores
- ☐ Howard W. Sams
- ☐ Hunter Sales, Inc.
- ☐ Hy-Gain Electronics Corporation
- ☐ Instructograph Company
- ☐ International Crystal
- ☐ Jan Crystals
- ☐ Lampkin Laboratories, Inc.
- ☐ Liberty Electronics, Inc.
- ☐ Midway Antenna
- ☐ Millen, James Mfg. Co., Inc.
- ☐ Mosley Electronics Corporation
- ☐ National Radio Company, Inc.
- ☐ New-Tronics Corporation
- ☐ Publications in Electronics, Inc.
- ☐ RCA Electronic Components and Devices
- ☐ Radio Officers Union
- ☐ Signal/One
- ☐ Space Electronics, div. of Military Electronics Corp.
- ☐ Structural Glass Co., Ltd.
- ☐ Swan Electronics
- ☐ Telrex Communication Engineering Laboratories
- ☐ Waters Manufacturing, Inc.
- ☐ Weller Electric Corporation
- ☐ WRL World Radio Laboratories

CQ Reader Service
14 Vanderventer Ave.
Port Washington, N.Y. 11050

Sirs:

Please send me information on the products and services which I have checked above.

Name ..... Call .....

Street Address .....

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

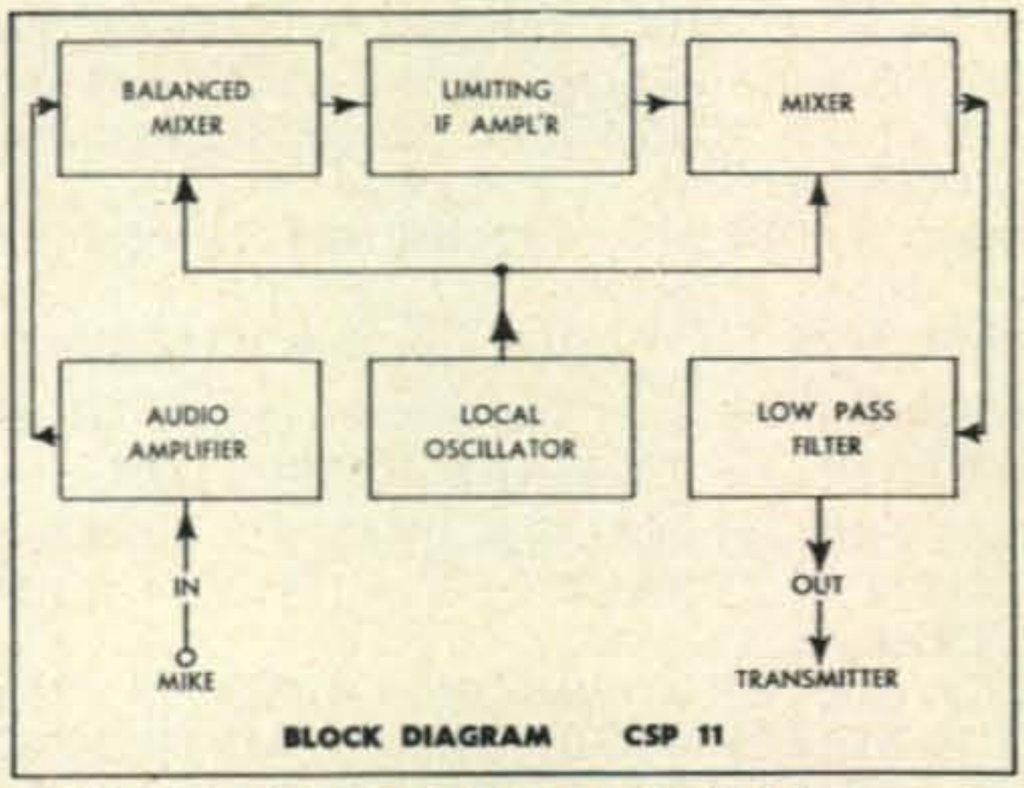
Advertiser's Index

For Sale—More Usable Sideband Talk Power

A new design of distortion free audio clipper
led the Comdel CSP 11 has been made
ilable to the trade. Frankly, we are enthused
out its performance from actual on-the-air
ts. Two NCX-5's were hooked up to a SPDT
ax antenna switch. One was barefoot with
e processor in series with its mike. The other
s using a BTI loaded to one kilowatt input
d the same mike without processer. **Reports
licate almost comparable results.** I am not
ing that the Comdel replaces the linear, but
o say that the greatly increased talk power
most obvious and therefore advantageous in
e ups or when the going gets rough.
The Comdel speech processer is in itself a
mplete miniature sideband transmitter and
eiver with a common oscillator. Its circuitry
ludes filters and limiters designed so as to
ep out the "crud" and at the same time, raise
e average level of the spoken voice by a fac-
of 10 db. Each human voice is different.
rious qualities of inflection, euphonics, and
plitude are characteristic of each of us in-
idually. Our human voice has a notoriously
v mean-to-peak signal ratio. Hence, the aver-
e signal, which determines the loudness at
e receiving end, is only a small fraction of the
al available peak power output. Conven-
nally, clippers are effective for increasing the
an-to-peak power ratio at the expense of
ere and often objectionable harmonic dis-
tion. Normally this distortion limits the
efulness of these clipping devices. In the
mdel speech processor, the objectionable
rmonic distortion is absent and the intelligi-
bility is enhanced by the unique circuit shown in the block diagram.

Conventional sideband transceivers or transmitters have power supplies which are designed for a duty cycle of about 15 to 25%. Application of the Comdel speech processor will make it necessary for the power supply to bear a substantially greater burden, since the average power is now approximately 60%. Thus the average transceiver of and by itself cannot be utilized advantageously by the Comdel. But if you have a transceiver which drives a linear with lots of room to spare, or if the linear that you have has a real bruiser of a power supply, such as may be found with the Henry II K or the BTI, or some Collins linears, or most home-brew linears, then the Comdel will positively amaze you with its effectiveness. The unit is completely transistorized and requires but 9 volts of DC at 18 miliamperes, with the negative side grounded. This power may be supplied by dry cells or by means of a dropping resistor from a higher voltage supply. The front panel provides an in and out switch which connects the microphone straight through the equipment, or shunts the microphone around the equipment, depending upon your own wish. The volume control provides a means for setting the peak level when the device is turned on. The Comdel is priced at $120.00, postage paid, in the continental limits of the United States. We have this very advantageous tool in stock, for immediate shipment, and we are heartily endorsing this product for use by radio amateurs or even commercial sideband stations. Literature is available for those seeking it.

- Instantaneous limiting action
- No appreciable distortion
- Talk power gain greater than 10db
- Completely compatible with SSB
- Optimum frequency response for voice
- Installs in microphone lead
- All solid state circuitry



BLOCK DIAGRAM CSP 11

HERBERT W. GORDON COMPANY

Woodchuck Hill, Harvard, Mass., 01451

Telephone 617-456-3548

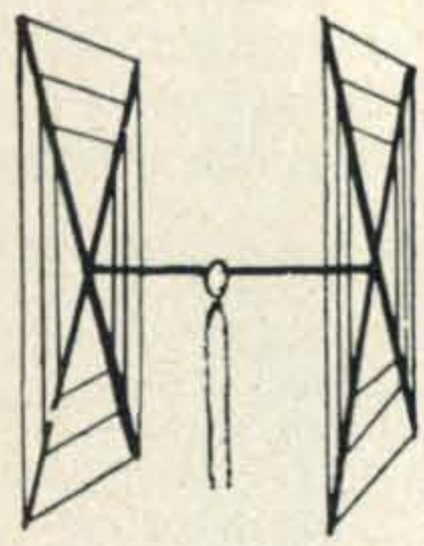
e page 110 for New Reader Service

GOTHAM ANTENNAS ARE MUCH BETTER OF COURSE, YOU PAY MUCH LESS

*How did Gotham drastically cut antenna prices? Mass purchases, mass production, product specialization, and **16** years of antenna manufacturing experience. The result: The kind of antennas you want, at the right price!*

QUADS

Worked 42 countries in two weeks with my Gotham Quad and only 75 watts...



W3 CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount; uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!

10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16' square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10' long x 1¼" O.D.; 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.

Radiating Elements: Steel wire, tempered and plated, .064" diameter.

X Frameworks: Each framework consists of two 12' sections of 1" OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞" tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.

Radiator Terminals: Cinch-Jones two-terminal fittings

Feedline (not furnished); 52 ohm coaxial cable

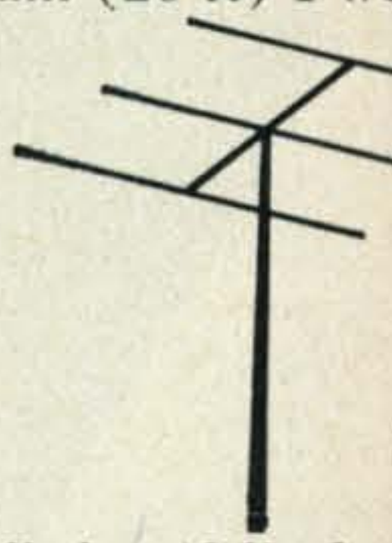
Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$35.00
10-15 CUBICAL QUAD	30.00
15-20 CUBICAL QUAD	32.00
TWENTY METER CUBICAL QUAD	25.00
FIFTEEN METER CUBICAL QUAD	24.00
TEN METER CUBICAL QUAD	23.00

(all use single coax feedline)

BEAMS

The first morning I put up my 3 ment Gotham beam (20 ft) I wo



YO4CT, ON5LW, SP9-ADQ, and 4U1ITU. THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history! Each beam is brand new; full size (36' of tu for *each* 20 meter element, for instance) solutely complete including a boom and all ware; uses a single 52 or 72 ohm coaxial line; the SWR is 1:1; easily handles 5 KW and 1" alumnium alloy tubing is employe maximum strength and low wind loadin beams are adjustable to any frequency i band.

2 EL 20	$19	4 EL 10	
3 EL 20	25	7 EL 10	
4 EL 20	32*	4 EL 6	
2 EL 15	15	8 EL 6	
3 EL 15	19	12 EL 2	
4 EL 15	25*	*20' boom	
5 EL 15	28*		

ALL-BAND VERTICALS

"All band vertical!" asked one sk "Twenty meters is murder these days. Let you make a contact on twenty meter phone low power!" So K4KXR switched to tw using a V80 antenna and 35 watts AM. H a small portion of the stations he wo VE3FAZ, T12FGS, W5KYJ, W1WOZ, ODH, WA3DJT, WB2FCB, W2YHH, FOB, WA8CZE, K1SYB, K2RDJ, K1M K8HGY, K3UTL, W8QJC, WA2LVE, MAM, WA8ATS, K2PGS, W2QJP, W4 K2PSK, WA8CGA, WB2KWY, W2IWJ, KT, Moral: It's the antenna that counts!

FLASH! Switched to 15 c.w. and worked IKN, KZ5OWN, HC1LC, PY5ASN, FG XE2I, KP4AQL, SM5BGK, G2AOB, CLK, OZ4H, and over a thousand other stat

V40 vertical for 40, 20, 15, 10, 6 meters	$
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$

HOW TO ORDER: SEND CHECK OR MONEY ORDER. WE SHIP IMMEDIATELY UPON RECEIPT OF ORDER BY RAILWAY EXPRESS, SHIPPING CHARGES COLLECT.

GOTHAM, 1805 Purdy, Dept. CQ, Miami Beach, Fla. 331

NOW—GALAXY PROUDLY UNVEILS

NEW Power!
NEW Features!
NEW Beauty!

THE EXCITING NEW

GT-550 TRANSCEIVER

5 BAND SSB
Mobile or Fixed Station

☆ AND A COMPLETE LINE OF HANDSOME
MATCHED ACCESSORIES!

The New Galaxy Wattmeter/Antenna Selector

The Powerful New Galaxy GT-550 TRANSCEIVER

The Beautiful, Matching Galaxy Speaker Console

"HOT," Husky, and Handsome!

You asked for it...now it's here! The new GALAXY GT-550 and a complete line of handsome matching accessories!

Your suggestions made it possible. We took your ideas—added some of our own and went to work. We built in new power, new conveniences—*such as a 25 kHz calibrator option, and no frequency jump when you switch sidebands*. Then we hired the best designers in the business to give GALAXY a distinctive "New Look"!

Our new GT-550 has all those great qualities of the famous Galaxy V's ...and then some! **It has new POWER...550 watts SSB**, making it the hottest transceiver made! **A new single scale VFO Dial** makes frequency interpolation child's play...the **new skirted knobs** make tuning and band-changing a split-second job...and, **that slick, king-sized finger-tip tuning knob** works like a dream! *Still the most compact—only 11¼ x 12⅜ x 6"!*

P.S. Sounds unbelievable but it's an even HOTTER receiver than our previous Galaxy V's!

Space prevents telling you all about the handsome, matched accessory line. Write for a free brochure that's loaded with exciting news!

GALAXY ELECTRONICS

"Pacesetter in Amateur/Commercial Equipment Design"

10 South 34th Street • Dept. **AA39** Council Bluffs, Iowa 51501

measure

The RCA WV-38A Volt-Ohm Milliammeter is a rugged, accurate, and extremely versatile instrument. We think it's your best buy. Only $52.00.* Also available in easy to assemble kit, WV-38A (K).

The RCA WV-77E Volt-Ohmyst® can be used for countless measurements in all types of electronic circuits. Reliability for budget price. Only $52.00.* Also available in an easy to assemble kit, WV-77E (K).

The RCA WG-412A R-C circuit box can help you speed the selection of standard values for resistors and capacitors, either separately or in series or parallel R C combinations. Only $30.00.* It's easy to use, rugged, and compact.

The RCA-500A all s state, battery opera VoltOhmyst elimina warm-up time, elimina zero-shift that can oc in tube operated v meters. Completely po ble. Only $75.00.* Co with shielded AC/ switch probe and cab

For a complete cata with descriptions a specifications for all R test instruments, w RCA Electronic Com nents, Commercial E neering, Dept. W15 Harrison, N.J. 07029.

*Optional Distributor resale pr Prices may be slightly higher Alaska, Hawaii, and the West

The RCA-WT-501A in-circuit out-of-circuit transistor tester is battery operated, completely portable. It tests both low and high power transistors, has NPN and PNP sockets for convenient transistor matching for complementary symmetry applications. Only $66.75.*

The RCA WC-506A transistor-diode checker offers a fast, easy means of checking relative gain and leakage levels of out-of-circuit transistors. Compact and portable, it weighs 14 ounces, measures 3¾ by 6¼ by 2 inches. Only $18.00.*

The RCA WV-98C Senior VoltOhmyst is the finest vacuum-tube voltmeter in the broad line of famous RCA VoltOhmysts. Accurate, dependable, extremely versatile, it is a deluxe precision instrument. Only $88.50.* Also available in an easy to assemble kit, WV-98C (K).

LOOK TO RCA FOR INSTRUMENTS TO TEST/MEASURE/VIEW/MONITOR/GENERATE

RCA