CQ

May 1972
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CQ YE1....
The Story of 9NCTY... p 14

The Radio Amateur's Journal

08240

New digital readout

Provides precise readout of frequencies on all Heathkit receivers & transceivers

New Heathkit SB-650 Digital Frequency Display... another "first" from the hams at Heath.

179.95*

- Resolution to within 100 Hz ±1 count
- Compatible with all Heathkit SB Receivers and SB and HW Multiband SSB Transceivers
- Six bright readout tubes display MHz, kHz and hundreds of Hz
- Full 80 through 10 meter coverage

You asked for it and Heath produced it. An exciting piece of ham gear to bright-light frequencies... readable from up to 30 ft. away The new SB-650 digital frequency display reads the three frequencies of a heterodyne circuit; then computes and displays the actual signal received or transmitted. All within a tight 100 Hz accuracy. Six bright digital readout tubes show you exactly where you are as you tune across the 80 through 10 meter bands, from 3 to 40 MHz. The SB-650 lets you read kHz to five places... plus tenths of a kHz.

And talk about compatibility. The SB-650 is designed to team up with all Heathkit SB-Series Receivers and Heathkit SB- or HW-Series Multiband Transceivers. When it's in combo with a transceiver, the "650" calculates and displays both transmitted and received frequencies. To make installation easier, the SB-650 manual fully describes and illustrates all inter-connections necessary for the specific Heath gear you own.

The addition of a Digital Frequency Display will in no way degrade your station's performance — and when teamed with budget equipment, such as the Heathkit HW-101, the SB-650 can give you pinpoint tuning accuracy to rival transceivers costing hundreds of dollars more!

The all solid-state circuitry uses 35 ICs and six transistors. An IC voltage regulator protects the devices from failure due to overvoltage, a common problem with discrete regulators. A built-in memory assures non-blinking operation, and there's a special circuit to minimize last-digit jitter.

Your SB-650 assembles in just four to five hours ... because IC's and display tubes plug into sockets on the double-sided glass epoxy board. And because there are no tuned circuits, only four easy internal adjustments are needed to get your "650" peaked up and ready to go.

The SB-650 Digital Frequency Display. It's got to be one of the most "up-and-coming" pieces of ham gear ever offered. It's another trend-setting "first" you can count on... from the hams at Heath.

Kit SB-650, 9 lbs., mailable **$179.95***

SB-650 SPECIFICATIONS — Frequency Range: 3-40 MHz (80-10 meters). **Frequency Display:** 6 display tubes (kHz to 5 places, plus tenths of kHz.) **Maximum Viewing Distance:** 30 ft. **Maximum Input Signal:** 5v rms. **Accuracy:** 100 Hz ±1 count. **Compute Time:** 160 msec. **Sensitivity:** Adjustable. **Input Impedance:** 2000 ohms. **Internally Generated Spurious Frequencies:** Approx. 0.25 uV equivalent signal level. **Crystal (clock) Frequency:** 1 MHz. **Crystal Aging Rate:** Approx. 10 ppm/yr. **Ambient Crystal Stability:** Approx. 10 ppm from +10 to +65° C. **Ambient Operating Temperature:** 0°-+40° C. **Ambient Storage Temperature:** −55° to +80° C. **Power Source:** 120/240 VAC, 50/60 Hz, 10 W. **Dimensions:** 3½" H x10" W x 10" D.

...to team up with the hottest combo in ham radio!

Heathkit SB-303 Receiver

319.95*

- Receives USB, LSB, AM, CW & RTTY, 80-10 meters
- 15 MHz WWV reception
- Compatible with the new SB-650 Digital Frequency Display

The Heathkit SB-303 — heart of the renowned SB-series separates — with the signal seeking capability the general and advanced ham wants. Its standard, trend-setting features provide the full-blown versatility you want... without the expense of those "add-on-dollars" options. And its compatibility with the new Heathkit SB-650 Digital Frequency Display offers you even greater operating convenience.

The SB-303 sports full transceiver capability with the Heathkit "400" or "401", three-position AGC, 25 kHz calibration, antenna and power connection for two VHF converters, 15 MHz WWV reception. All this with 2.1 kHz selectivity, less than 0.25 uV sensitivity and 60 dB image rejection.

The exclusive Heath factory assembled and aligned LMO, with 1 kHz dial readout, assures you of peak performance and incredibly smooth linear tuning. And a new RF attenuator lets you adjust sensitivity for optimum signal handling. The SB-303 solid-state design utilizes 27 silicon transistors and one IC for instant warmup, plus 100 Hz stability in 10 minutes. A dual-gate MOSFET front end provides outstanding dynamic range and large signal handling capacity with low distortion.

Wiring harnesses, nine plug-in circuit boards and an extender board make assembly, alignment and maintenance easy. As always, the famous Heathkit assembly manual guides you a simple step at a time.

Kit SB-303, 21 lbs. **319.95***
SBA-301-1, optional 3.75 kHz AM crystal filter, 1 lb. **21.95***
SBA-301-2, optional 400 Hz CW crystal filter, 1 lb. **22.95***

Heathkit SB-401 Transmitter

229.95*

- Transmits USB, LSB & CW with 100W PEP
- Built-in power supply

Here's the high-performance transmitter that teams up with the "303" to deliver full transceive capabilities on a budget. The SB-401 covers 80-10 meters; transmits USB, LSB & CW with 100 W PEP. A single front panel switch selects transceive or independent operation of "401" and 300-series receiver. The optional SBA-401-1 crystal pack makes the SB-401 compatible with any receiver. There's also a built-in 120/240 VAC power supply. And a modular sub-pack packaging and assembly procedure add to the ease of building the SB-401. A hot competitor in any ham shack — order yours, today.

Kit SB-401, 36 lbs. **299.95***
SBA-401-1 crystal pack, 1 lb... **29.95***

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Benton Harbor, Michigan 49022

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☐ Enclosed is $_____, plus shipping.

Please send model(s)_____

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Address_____

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Prices & specifications subject to change without notice.
*Mail order prices; F.O.B. factory. AM-266

New FPM-300, a low-priced, versatile, compact SSB/CW transceiver with latest high performance FET and integrated circuits plus extended coverage.

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This new radio, with built-in AC-DC power supply, is compactly designed with modular construction techniques for effective and reliable service in fixed, portable and mobile use for amateur, Civil Defense, CAP, MARS, RACES and other utility HF Communications Services.

The new transceiver has premium type glass epoxy printed circuit board construction for greater reliability, routine maintenance and features the latest state-of-the-art solid state devices throughout. The All-American made radio, priced at only $595, is also equipped with a unique integrated circuit speech compressor design for extended "talk power" plus many other built-in features—all good reasons why you should be talking with a Hallicrafters.

For additional data see your Hallicrafters distributor or write or phone:

The Hallicrafters Co., 600 Hicks Road, Rolling Meadows, Ill., 60008 U.S.A.
Phone: 312/259-9600

You should be talking with a Hallicrafters.

CQ

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The Radio Amateur's Journal

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DEPARTMENTS

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

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OTHER MULTI-BAND ARRAYS AVAILABLE

Elements shortened to show details.

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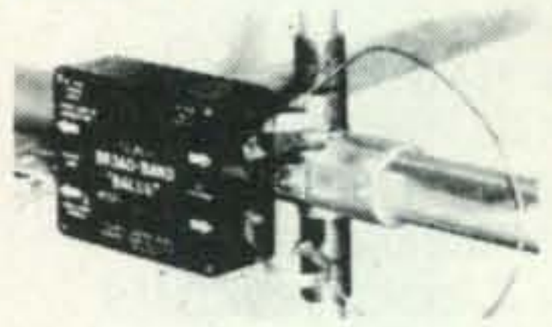

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Mod. 2M814C-	2 mtr. 8 el. array, 16.5 DB gain, 300 W pow. rat., 1.375" x 14' boom	59.00
Mod. 6M516-	6 mtr. 5 el. array, 13 DB gain, 400 W pow. rat., 1.5" x 16' boom	63.95

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OUR READERS SAY

Armed Forces Day

Editor, *CQ:*

On Saturday, May 20th, K1FCO the amateur radio station of the 143rd Communications Flight, Rhode Island Air National Guard, will be operating in conjunction with Armed Forces Day. A very attractive commemorative certificate will be mailed to all hams who contact K1-FCO on this day. The operating schedule is as follows:

14.310 mHz ±5 kHz	s.s.b.	1300Z-1430Z
21.375 mHz ±5 kHz	s.s.b.	1430Z-1530Z
50.7 mHz	a.m.	1300Z-1530Z
7.280 mHz ±5 kHz	s.s.b.	1300Z-1530Z

To qualify for a certificate, just make a 2-way contact with K1FCO and send your QSL card and a self-addressed stamped envelope to K1-FCO, 143D Comm. Flight., T.F. Green Airport, Warwick, RI 02886.

SSGT. Raymond A. Allard, K1MEZ
Warwick, RI

Okinawa Retrocession

Editor, *CQ:*

This is to inform you that as of 1500 hours GMT, 14 May 1972, the KR6 prefix will terminate and will be replaced by KA6.

The Okinawa Amateur Radio Club (OARC) will change its title to Okinawa Radio Club (ORC). QSL cards may be sent via KA6 QSL Bureau, Okinawa Radio Club, Ft. Buckner, APO San Francisco, Ca. 96331.

QSLs sent to the above address are limited to members of the radio club. Suggest that prior to sending QSL card, the sender determine by asking whether he should send direct or via the bureau.

Request has been submitted to ARRL for the Ryukyu Islands to remain a separate country for DX purposes. You will be informed when action has been taken on this request.

We have also been informed that there will be no third party traffic from KA6.

Gordon R. Hale, KR6RH
President, OARC
APO 96248 San Francisco, Cal.

Grandfather Clause

Editor, *CQ:*

I cannot agree with whatever rationale is conjured up to support the automatic advancement of an amateur who has held a license of any class to Extra class simply on the basis of having held

[*Continued on page 86*]

Only an **MC-4** can "top" a **Drake TR-4**

the optimum Sideband Transceiver

(Sometimes even the MC-4 ends up on the bottom . . .)

Adding an MC-4 Mobile Console, with its excellent wattmeter and built-in speaker, is the only way to improve a Drake TR-4.

BUILT-IN TR-4 FEATURES

- **Full Frequency Coverage** on all amateur bands 10 through 80 meters. No additional crystals required.
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- **Output Impedance Adjustable** with pi-net.
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- **100 kHz Crystal Calibrator**
- **Price $599.95 Amateur Net**

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MC-4 Mobile Console (shown in photos above.	**$ 69.00**
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DC-4 12 VDC Solid State Power Supply	**$125.00**
34PNB Noise Blanker	**$100.00**

TR-4 SPECIFICATIONS: • **Frequency Coverage:** Full coverage on all amateur bands 10 thru 80 meters, in seven 600 kHz ranges: 3.5 to 4.1 MHz, 7.0 to 7.6 MHz, 13.9 to 14.5 MHz, 21 to 21.6 MHz, 28 to 28.6 MHz, 28.5 to 29.1 MHz, 29.1 to 29.7 MHz. • **Solid State VFO:** Has linear permeability tuning. Tunes 4.9 to 5.5 MHz for all ranges. • **Dial Calibration:** 10 kHz divisions on main tuning dial and 1 kHz divisions on the tuning knob skirt. • **Frequency Stability:** High stability solid state VFO tunes same range on all bands. Drift is less than 100 cycles after warm-up, and less than 100 cycles for plus or minus 10% line voltage change. • **Modes of Operation:** SSB Upper and Lower Sideband, CW and AM. • **Misc:** 20 tubes including voltage regulator; two transistors; 8 diodes; 100 kHz crystal calibrator built in; Dimensions: 5½" high, 10¾" wide, 14⅜" deep. Weight: 16 lbs . . . **TRANSMITTER:** • **Single Sideband:** 300 watts P.E.P. input power, VOX or PTT. Two special 9 MHz crystal filters provide upper or lower sideband selection on any band, without the necessity of shifting oscillators. • **CW:** Power input 260 watts. Carrier is shifted approximately 1000 cycles into one sideband, and mixer and driver are keyed. Grid block keying is free from chirps and clicks. Automatic transmit/receive switching when key is operated. CW sidetone oscillator for monitoring. • **AM:** Controlled carrier AM screen modulator is built-in. 260 watts P.E.P. input. Low carrier power increases 6 times to 50 watts output at maximum modulation. This system is compatible with SSB linears. VOX or PTT. Diode detector used for receiving on this mode. Product Detector can be used by switching manually . . . **RECEIVER:** • **Sensitivity:** Less than ½ microvolt for 10 dB S/N • **I. F. Selectivity:** 2.1 kHz at 6 dB, 3.6 kHz at 60 dB. • **Antenna Input:** Nominal 50 ohms. • **Audio Response:** 400 to 2500 cycles at 6 dB. • **Audio Output Power:** 2 watts. • **Impedance:** 4 ohms.

MC-4 SPECIFICATIONS: • **Frequency Coverage:** 1.8-54 MHz • **Line Impedance:** 50 Ohm resistive • **Accuracy:** ± (5% of reading +3 watts) • **Power Capability:** 300 watts forward or reflected • **Controls:** Front panel 2-position switch selects forward or reflected power • **Speaker:** 3" x 5" oval, 2.98 ounce ceramic mag.

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Announcements

Rockaway, New York

The Rockaway Amateur Radio Club will hold its annual Spring Auction and F.Mers Get To-Gether on Friday evening April 28, 1972 at 8:00 P.M. at the Hall of Science, 111th. St. & 48th Ave., Corona, N.Y. at the old World's Fair grounds. Doors will open at 6:00 P.M. to accept items for the sale. Two dollars donation at the door will include refreshments. For further information contact Auction Chairman Al Smith, WA2TAQ, P.O. Box 341, Lynbrook, N.Y. 11563.

Claycomo, Missouri

The P.H.D. Amateur Radio Association will hold their third annual Northwest Missouri Hamfest on Sunday, May 7, at the U.A.W. Hall, across from the Claycomo Ford Plant on U.S. Highway Alternate. The time for the Hamfest will be from 9:30 A.M. to 4:30 P.M. There will be many exhibits and activities. For more information write to: P.H.D. ARA, P.O. Box 11, Liberty Missouri 64068.

Livingston, New Jersey

The Livingston Amateur Radio Club will hold their annual ham gear auction, Friday evening, April 21, at 8:00 P.M. at the Recreation Hall in Memorial Park, Livingston, N.J., across the street from Livingston High School. All interested buyers (no dealers, please) are welcome. The building will be open at 7:30 P.M.

Birmingham, Alabama

The Birminghamfest this year will be on Sunday May 7 at the Exhibition Hall at the Alabama State Fairgrounds near Five Points, West in Birmingham. For entertainment, prizes, contests, net meetings, eyeball QSO's and fun for the entire family, plan to attend. For further information contact the Birmingham Amateur Radio Club—W4CUE, P.O. Box 603, Birmingham, Alabama 35201.

Rochester, New York

Rochester is the location for the 39th annual Western N.Y. Hamfest and VHF Conference the weekend of May 13th. Activities start Friday night at the Rowntowner Motor Inn, hamfest headquarters, followed by a full day of programming with outstanding speakers. Special activities include MARS, AREC, QCWA, general interest and v.h.f. meetings, YL fashion show and a huge flea market, the largest in the northeast. Hamfest location: Monroe County Fairgrounds, Route 15A, near Thruway exit 46. Registration only $3.00, with banquet in advance only $7.00. Advance sale closes May 6th. Additional information available from WNY Hamfest, Box 1388, Rochester, N.Y. 14603.

Sharon, Mass.

The Sharon Amateur Radio Association will be holding its second annual auction on Saturday, May 20. It will be at the QTH of Dave Fisher WA1LXE, 30 Ames Court, Sharon, Mass., starting at 1 P.M. Directions available by writing to WA1LXE. Bring your surplus gear.

Wabash, Indiana

The Wabash Co. Amateur Radio Club will hold their fourth annual Hamfest at the Wabash Co. 4-H Fairgrounds, Wabash Indiana, Sunday May 21, rain or shine. Admission is $1. There is no set-up charge for the flea market. Activities include tech talks, free bingo for XYLs and door prizes. Free parking. Camping is available on the grounds Saturday night. For more information write: Bob Mitting, WB9-DKH, 663 N. Spring St., Wabash, Ind. 46992.

Humbolt, Tenn.

The Annual Humboldt Amateur Radio Club Hamfest will be held Sunday afternoon, May 21, at the Shady Acres City Park, Trenton, Tenn. There will be door prizes, flea market, ladies activities, and a playground for the children. For further information contact W4IGW, Edgar Holmes, 501 N. 18th Ave., Humboldt, Tenn., 38343.,

Pittsburgh, Pennsylvania

The 18th Annual Breeze Shooters Hamfest will be held on Sunday, May 21 at White Swan Park (Parkway West, 4 miles east of the Greater Pittsburgh Airport). There are no entry fees and parking is free. Prizes, tables and Swap & Shop are available as is the amusement park for your family. Check-in on 29.0, 50.4, and 146.94 mHz. For further information contact Chuck Thomas, WA3MWM, 7022 Blackhawk Street, Pittsburgh, Pa. 15218.

Lake Delton, Wisconsin

The Yellow Thunder Amateur ARC will hold their second annual "Yellow Thunder Hamfest" on May 27, 1972 at the Dellview Hotel in Lake Delton, Wisconsin. Program will include MARS, v.h.f. repeaters, ARPSC and other meetings, with a banquet in the evening. There will be a swap shop outside the hotel. Lake Delton is in the heart of the famed Wisconsin Dells vacationland for all the family to enjoy. Registration will begin at 12:30 P.M. C.S.T. and will be $5.25 in advance or 5.75 at the door. For registration or additional information write to J. P. Anderson, WB9EWR, 624 14th St., Baraboo, Wisconsin 53913.

Amboy, Illinois

The Rock River Radio Club of Dixon, Illinois are holding their sixth Hamfest at the Lee County 4-H Center in Amboy, Ill., on May 28, from 9:00 A.M. on. Plenty of parking and camping sites available. First prize at their drawing will be a GT-550 with power supply. Advance tickets are $1.50, $2.00 at the door. For further details contact: Carl Karlson, RRRC-Hamfest, P.O. Box 99, Nachusa, Illinois 61057.

Redington Beach, Florida

On June 16-18, the YL International SSB'ers will hold their convention at the Tides Hotel on Redington Beach in Florida. For complete details and reservation information contact: Jack Whitley, W4CZS, 11340 6th St. E., Treasure Island, Florida 33706.

John Gore Memorial Scholarship

The Foundation for Amateur Radio, Inc., a non-profit organization, with its headquarters in Washington, D.C., announces its intent to make the annual award of the John Gore Memorial Scholarship for either graduate or undergraduate study. The Scholarship pays $500 for the academic year. Upon re-application, it is subject to being renewed for succeeding years.

Licensed radio amateurs who intend making a career in electronics or related sciences may now request the application for the academic year 1972-1973. Requests should be addressed to the Chairman, Scholarship Committee, 8101 Hampden Lane, Bethesda, Maryland, 20014. Requests for applications must be postmarked prior to May 31, 1972.

To be eligible for the award, applicants must have completed at least one year in an accredited college or university and must be enrolled in a course of studies leading to a degree. They must be radio amateurs holding a valid FCC license of at least a general class level. All things being substantially equal, preference will be shown to applicants from the area served by the Foundation—the District of Columbia, Maryland and Northern Virginia; however, applicants wherever resident are eligible.

The Foundation is devoted exclusively to promoting the interests of amateur radio and to those scientific, literary and educational pursuits that serve to advance the purposes of amateur radio.

John W. Gore, in whose honor the Scholarship is named, was until his death in 1960, the President of the Foundation. A prominent radio amateur for many years, he was a Vice-President of the Bethlehem Shipbuilding Corporation in Baltimore, Maryland.

For further information write to: H. F. deCourt, 8101 Hampden Lane, Bethesda, Md. 20014.

Stolen Equipment

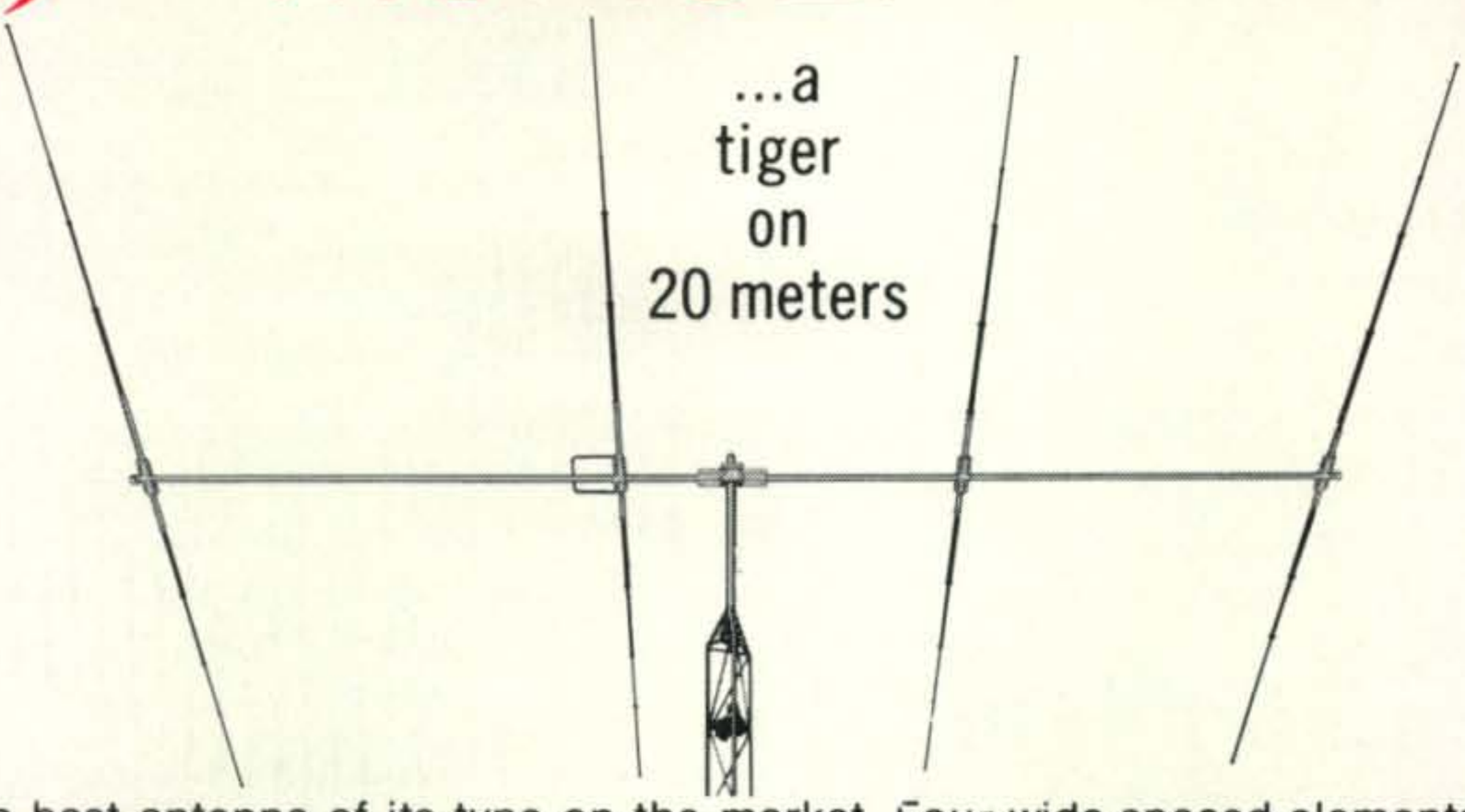
Stolen from the car of Clem Mathias, W6NPV, on January 25, a 2 meter FM Standard transmitter SRC 806M, serial number #102703. Anyone with information can contact Clem at: 3134 Coronado Ave., Imperial Beach, California 92032.

Jerry Macari, WA2KDB, reports that his Lafayette HA-410, (model #10014) 10 meter mobile transceiver was stolen. It was part of a CD Emergency unit. Jerry has made modifications to the unit which make it easy for him to identify it. He is offering a reward.

On February 3, 1972, YAESU Model FT-101 Transceiver, S/N 107036, equipped with c.w. filter, was stolen from the automobile of WA2-YSW while it was parked in the driveway at his home. Please contact Frank W. Widmann, 328 Farwood Road, Haddonfield, N.J. 08033 or Officer Latham, Police Headquarters, Borough of Haddonfield, 242 Kings Highway East, Haddonfield, N.J. 08033, if you can provide information leading to the recovery of the equipment.

for the most advanced antennas under the sun!

HY-GAIN 204BA MONOBANDER



The best antenna of its type on the market. Four wide spaced elements (the longest 36'6") on a 26' boom along with Hy-Gain's exclusive Beta Match produce a high performance DX beam for phone or CW across the entire 20 meter band.

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- Feeds with 52 ohm coax
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The 204BA Monobander is ruggedly built to insure mechanical as well as electrical reliability, yet light enough to mount on a lightweight tower. (Recommended rotator: Hy-Gain's new Roto-Brake 400.) Construction features include taper swaged slotted tubing with full circumference clamps; tiltable cast aluminum boom-to-mast clamp; heavy gauge machine formed element-to-boom brackets; boom 2" OD; mast diameters from 1½" to 2½"; wind survival up to 100 MPH. Shipping weight 51 pounds.

See the best distributor under the sun...the one who handles the Hy-Gain 204BA Monobander.

Model 204BA (4-element, 20 meters).....**$149.95**
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Model 103BA (3-element, 10 meters).....**$ 54.95**

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Improves transfer of energy to the antenna; eliminates stray RF; improves pattern and F/B ratio. **$14.95**

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Q AND A

WILFRED M. SCHERER, W2AEF

Loading on FTdx-560

QUESTION: I read with interest your review and evaluation of the Yaesu Musen FTdx-560 transceiver. I wonder if you could send me the c.w. plate-current (IC) readings corresponding to the c.w. power of 260 watts you measured? I assume that the 260 watts is a nominal value with the limits varying between perhaps say 300 watts on the 80-meter band to 165 watts on 10.

ANSWER: We have not retained a record of the p.a. plate current with c.w. operation of the FTdx-560. The nominal input for this mode would be about 500 watts (E_p 800 v., I_p 600-625 ma, depending on condition of tubes). On our tests, we tuned up for maximum *output* which, with 117 v.a.c. applied, produced 260 watts output on all bands, except 21 mHz where it was 275 watts. There is no need to worry about the input as long as you're properly resonated and fully loaded. Too little loading will result in excessive screen current.

V.O.X. Delay on TR-4

QUESTION: My question concerns the value of R_{108} in the Drake TR-4 needed to shorten the v.o.x. delay for break-in c.w. Have you any suggestions on how to go about it?

ANSWER: The v.o.x. delay on the Drake TR-4 may be shortened by decreasing the value of R_{106} (not R_{108}) or that of C_{143} (see notation for R_{106} on the TR-4 schematic). The amount of change will have to be determined experimentally in accordance with the actual delay you desire. You might start off simply by disconnecting C_{143}. This should provide instant release, but may cause the relay to clatter with keying.

Q & A is a free technical assistance program offered by **CQ** to its readers. We ask your cooperation to enable us to assist as many amateurs each month as possible. Always include a self-addressed stamped envelope with your question. Only one question per letter, please. Before writing to ask where a published article appeared, try to find it yourself by consulting the annual indexes of the various amateur magazines. Mail questions to: **CQ** Q & A, 14 Vanderventer Ave., Port Washington, N.Y. 11050.

Everyone has something.

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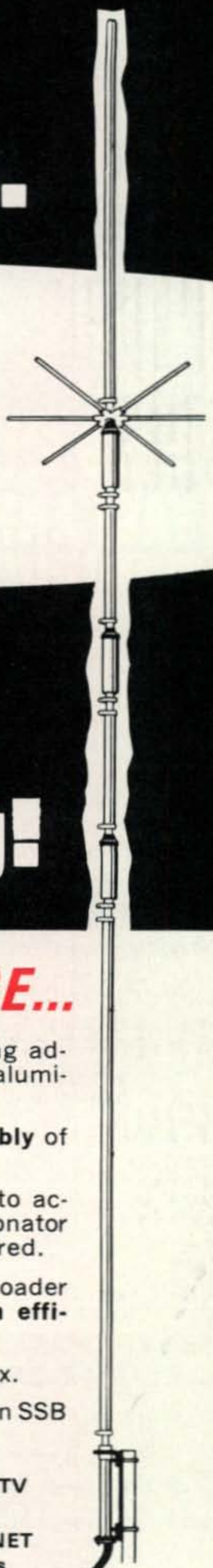
40 THROUGH 10 METERS



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One Setting for TOTAL BAND COVERAGE...

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- Solid one inch **fiberglass trap forms** for optimum electrical and mechanical stability.
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CB Rigs to 10-Meters

QUESTION: I have a Lafayette Model HE-20C CB transceiver. Is there any way I could convert it over to the 10-meter band?

ANSWER: We have no specific data on converting the HE-20C transceiver over for 10-meter operation. However, helpful information on how to go about making such conversions will be found in an excellent article on the subject in *QST*, February 1967, p. 20.

Remote Switching of Crystals in Trunk-Installed Mobile Transceiver

QUESTION: How can I add 3 or more crystals for an f.m. transceiver installed in an automobile trunk and make it possible to switch crystals from the driver's seat?

ANSWER: Figure 1 indicates circuitry for employing diode switches for shifting crystals in a trunk-installed mobile transceiver and using a mechanical switch at the driver's position.

HT-37 V.F.O. Instability

QUESTION: I have a Hallicrafters HT-37 which has a frequency shift. This occurs on all bands in all modes. The shift is 200-600 Hz. It seems to be very abrupt. I have owned

[*Continued on page 84*]

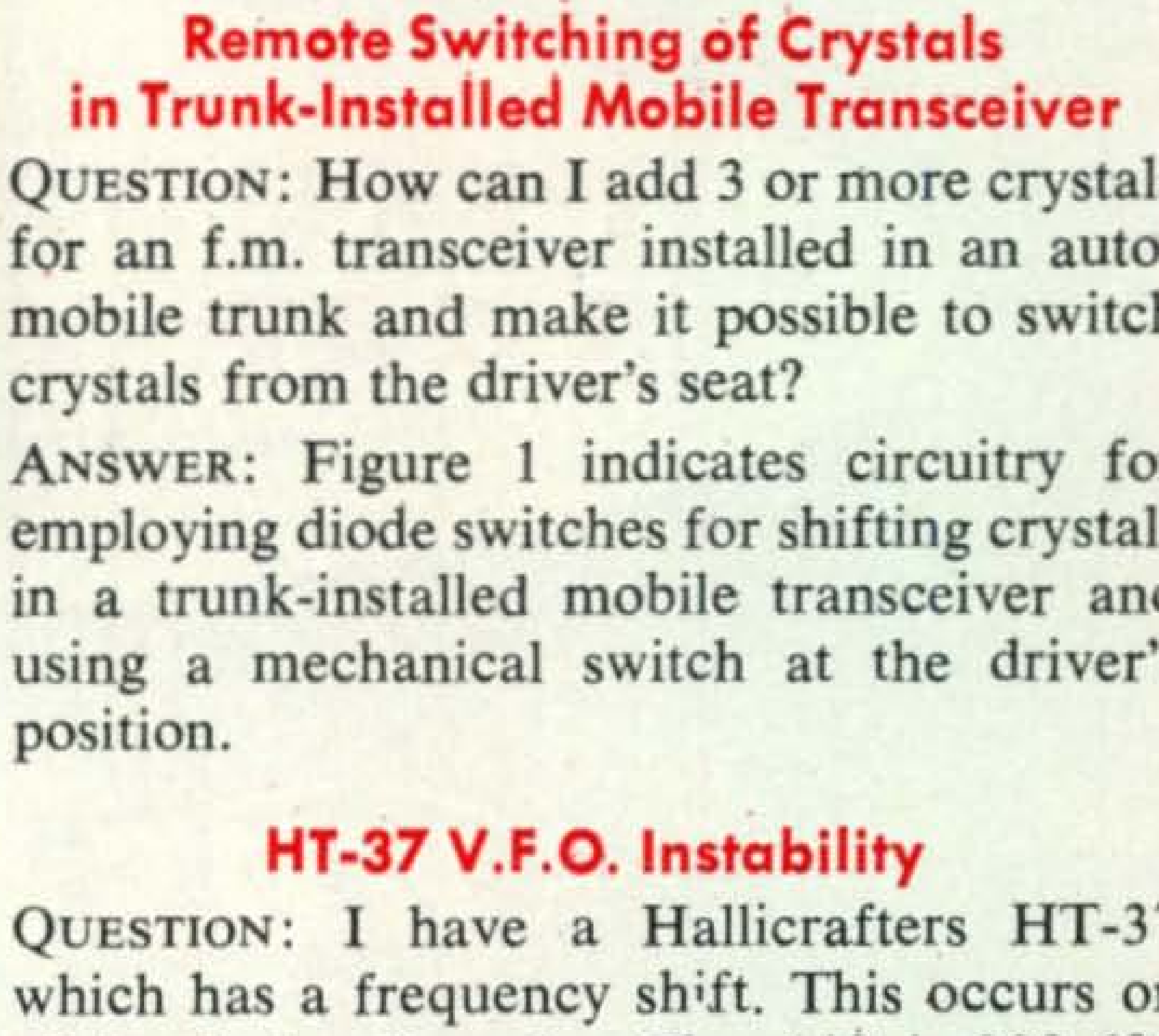
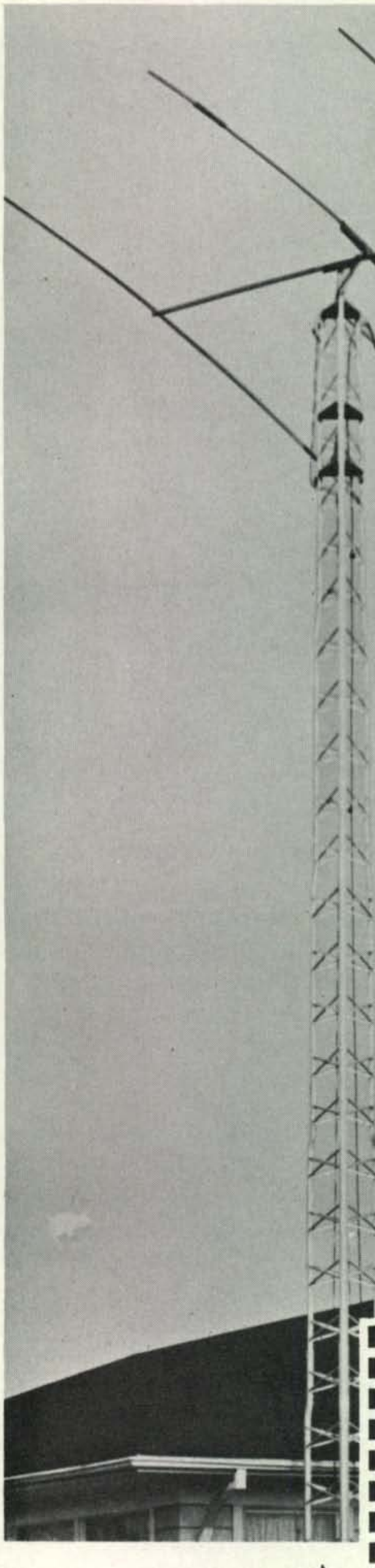


Fig. 1—Circuitry for remote switching of crystals. Switching diodes D_1-D_3 may be germanium types with low forward resistance, high back resistance. The 47K resistors may have to be decreased to get the diodes to conduct sufficiently. Mount all components, except the switch, directly in the transceiver. C_7-C_9 trimmers are required to bring the crystals to exact desired frequency. The range of the capacitors may have to be changed, depending on the crystal characteristics and the other circuit capacitances. 1—2.5 mh r.f. chokes may be used in place of R_4-R_6.



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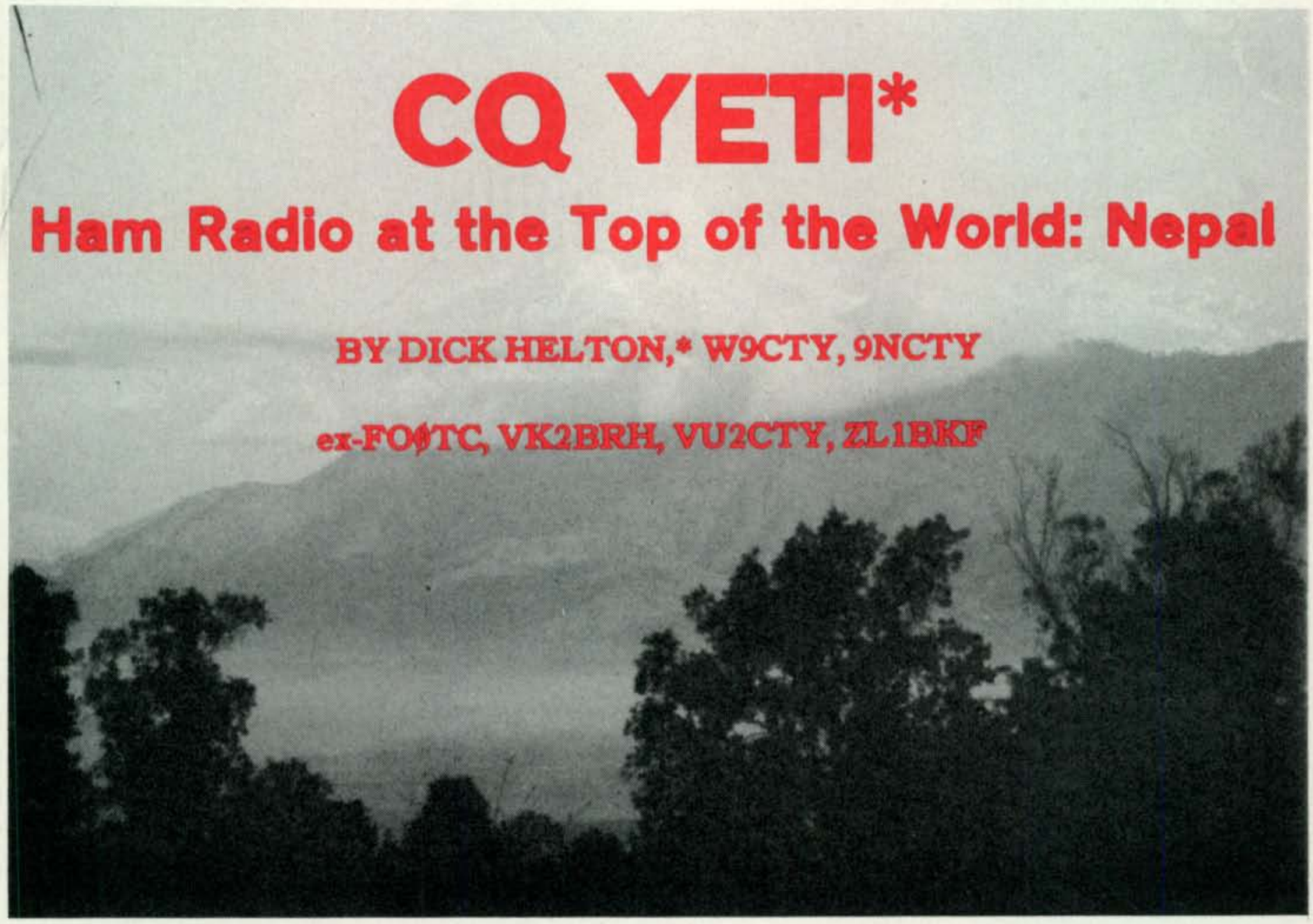
CQ YETI*

Ham Radio at the Top of the World: Nepal

BY DICK HELTON,* W9CTY, 9NCTY

ex-FO8TC, VK2BRH, VU2CTY, ZL1BKF



View from the shack at 9N1MM . . . across the Kathmandu Valley to the Himalayas.

"GOOD morning, ladies and gentlemen . . . welcome aboard Royal Nepal Airlines flight 206 from New Delhi to Kathmandu. Our flying time will be approximately 2 hours and 40 minutes, and our altitude will be 15-thousand feet."

"Fifteen-thousand feet," I protested to my wife, Janice, "We're going to be flying toward mountains over 25-thousand feet high and this guy is flying at 15-thousand?"

"Don't worry about it," she replied, "I'm sure he's flown this trip many times."

"But these people believe in reincarnation ...so it really won't matter that much to him. For us, it's a total commitment."

At that, we began lurching down the runway at Palam airport...both propellers biting into the early morning mist, streaking our window...and creating a rainbow effect as we turned east into the sun. It was the beginning of what was to be our most memorable journey to another country...indeed, Shangri-la lay just ahead, waiting to be discovered.

Some 45-minutes later, after we had been soaring through an immense cloud for about 30-minutes, that twinge of uneasiness that always accompanies flying with an unfamiliar airline over unfamiliar terrain began to creep upon us again. And then...without warning... the sky cleared and there was no question about where we were. Looming ahead of us some 100-miles...the Himalayas. To describe that moment would be to cheapen it. The next thirty minutes or our journey would be spent busily snapping pictures, and going forward into the cockpit to have the crew point out the various peaks to us. The peaks of Manaslu, Annapurna, Dhaliguri, Everest. All too soon, it seemed, we were landing at Tribhuvan airport, watching for the KWM-2 to be unloaded, hoping it had somehow managed to get aboard the aircraft at New Delhi. Sure enough, the familiar grey suitcase tumbled from the plane. Next came Customs... a procedure we had come to dread, following our experience in New Delhi. To digress for a moment...

When we arrived in New Delhi from Bangkok we had come to a country preparing for a war with Pakistan. Security was at a maximum. Customs checks on everything were mandatory. Needless to say, arriving in such

---

*Nepalese for "Abominable Snowman."

*c/o WBBM, 630 North McClurg Court, Chicago, Ill. 60611

a situation with a transceiver in a suitcase was less than standard procedure. Armed with a sheaf of letters from the Indian telecommunications department, with whom I had been in contact for some eight months arranging for a license, I presumed there would be no difficulty in getting right through. Two hours later, with everyone else gone from the airport, and my wife giving me a somewhat less than wanton look, I realized the folly of my earlier assumption. Actually, it was not that we were being considered as spies...quite to the contrary. It was the value of the KWM-2 and my possible sale of it in India that had the authorities worried. Try best as I could, I could not convince them that it would leave with me two days later on the trip to Kathmandu. Finally, an "agreement" was reached. I would leave the KWM-2 with the Customs authorities at the airport, picking it up when I returned with the actual license from the Indian government. Since it was 6 in the morning, that would not be done until the following afternoon. At that point, everything, including ham radio, became secondary to one very necessary thing...SLEEP!

The following afternoon, it was off to the Telecommunications office . . . again armed with the letters. No trouble here, I assured my wife, as I'd had this license in the works for eight months. Right? Wrong! It was as though they really hadn't expected that guy over there in Chicago would really show up at the appointed hour on the appointed day. Could I come back in two days...the license will be ready then. Impossible, we would be in Kathmandu. After much give and take, they were persuaded to type out the license, if I would cross the street to the post office to purchase Indian postal orders for 15 rupees. We complied, and therein lies another story...which will not be dealt with at this point. Time, space and language limitations do not permit full discussion!

Three hours later, we left the Telecommunications office...duly licensed as VU2-CTY. Now, off to the airport, for more fun and games with the Customs officers. To make a long story short, it took another 2-hours at the airport to get the KWM-2 out of customs...the necessary documents signed, a pat on the back and farewell from the Chief customs officer. The Indians are a very thorough people, especially when they are contemplating a war...

As those thoughts surged through my head at the airport in Kathmandu, I wondered what was to come next. The grey suitcase was placed on the Customs counter, weighing its full 53 pounds, and looking very suspect.

Father Moran, 9N1MM, and the author's wife, Janice.

"Open please."

"Here it comes", I thought. But I was armed with my letters from the Nepalese Telecommunications board . . . and that did the trick. Few questions, a friendly smile, and we were in a car headed for downtown Kathmandu.

For those who have not been to Kathmandu, which includes a sizeable portion of the world's population, it can only be described as being in perhaps the most beautiful setting in the world. Bounded by the Himalayas some 40-miles to the north, and the green foothills to the south, it is a quiet valley of lush greens, mustard yellows, and vibrant hues of the rainbow filling each tree and shrub. The air is so clear and pure that the contrast in colors is far beyond anything we had encountered on previous journeys.

I had made arrangements to stay at the hotel Annapurna, considered by most to be one of Kathmandu's finest. Hopefully it

Left to right: 9N1JK, Lorenz Prinz, 9N1MM, Father Marshal Moran, and 9NCTY, the author, Dick Helton. At the time of this picture, October 1971 these were the only three licensed hams in Nepal.

would be tall...this thought as I scanned the horizon for anything over three stories. Nothing.

As we pulled into the three story Annapurna, it occurred to me that operating with a whip out the window was going to be something less than desirable. But, that's what ham radio is all about...making the best of the worst.

Soon, we had checked into the hotel, secured a room, scanned the view which was remarkable, and decided ham radio could have the day off. For now a quick trip around the block to get our bearings, a bite to eat, and some sleep.

One of the more common modes of transportation in Kathmandu is the bicycle, so we rented two and headed for the Singha Durbar, an imposing stucco structure containing more than 18-hundred rooms. It was a former residence of Nepalese monarchs, now converted into government offices. After getting lost a couple of times in the building itself, we finally found the Telecommunications office, presented our correspondence and the license was prepared. It was an educational experience, talking with these men who are in charge of setting up much of Nepal's communications systems. They are still quite primitive but are being upgraded quite rapidly now. Microwave stations are now being placed throughout the country, to facilitate communications within Nepal as well as to the outside world.

Soon the license was brought in from another room . . . completely hand typed. It was Nepalese license AMR-4, and the call sign was 9NCTY. I asked them if it should not be 9N1CTY. They replied it didn't have to . . . 9N was the designation for Nepalese radio stations. It occured to me at the time that once I got on the air, much of my time would be spent explaining the call sign. That proved to be a very accurate assumption.

Later that evening, the first contacts were made. The portable antenna, actually a modified mobile whip, was stuck out the window. Contacts into Southeast Asia proved to be no problem, with signal reports coming back as S8-9. Soon, I met one of the two full time hams in Nepal, Lorenz, 9N1JK. We had a long chat, he being somewhat astounded at hearing someone other than 9N1MM working from Nepal. The next day, Father Moran, 9N1MM, gave me a call, and then drove in from his school some eight miles south of Kathmandu to visit. To say that Father Moran is a man of remarkable influence in Nepal would be to understate the fact. He is a man one instantly admires, not only for what he has done in his 20-years in Nepal (20 more in India prior to that) but for what he continues to do in helping the Nepalese people educate themselves. And, since he was from Chicago, we had a great deal to talk about other than ham radio.

It was never really intended to do a great deal of hamming from the hotel room. The logistics were just too poor. The antenna was only 20-feet above ground, hemmed in on two sides by building. Every time I wanted to use the a.c., I had to tear down the plug on the air conditioner to put on my power supply cord. Try as I might in Kathmandu, I could not find an adapter or plug that would fit into the hotel sockets. My earlier experiences as VK2BRH, ZL1BKF, and FOØTC had shown me that the hotel management does not appreciate hams "borrowing" the plugs off their lamps and air conditioners. Since the main thrust of the venture would be in the DX contest the last two days in October, we decided to forego much of it at the hotel and take in the beautiful scenery offered in the countryside.

As noted earlier, one of the prime modes of transportation in Nepal is bicycling. One can rent a very fine Chinese bicycle for about 50-cents a day...very cheap transportation. With these bikes we rode up and down the hills of Kathmandu...long, sloping hills that are often hard to perceive until the sweat begins to form on your brow. Kathmandu also has a great number of automobiles, mostly Japanese in make. The sound of horns, bike bells, and klaxons blends into the street sounds of the people. The horns and bells are quite necessary, because the streets are used as much for pedestrian traffic as for mechanical. Mothers carrying their babies, old men and women with large bundles of rice on their backs, beggers seeking a handout. This is the street scene in Nepal. Of course, there are the ever present cows . . . being the sacred animal. If you order something described as beef in a Nepalese restaurant, be assured you are not eating beef . . . you're more likely eating buffalo.

Dining in Nepal can be a pleasant experience, or a disaster. Perhaps the finest restaurant in Kathmandu is operated by a transplanted Russian, Boris Lissanovich. He

Typical countryside. near Kathmandu. Workers in the fields are harvesting rice. All labor is done by hand. No machinery or animals are used. This scene has remained unchanged for centuries.

operates a place known as the Yak and Yeti bar... where you'll find famous mountain climbers (Hillary, *et al*), diplomats, and others who come to Kathmandu. It has a very European atmosphere, the cuisine is superb and the prices are most reasonable. We dined at the Yak and Yeti more than once, and enjoyed each time as though it were our first.

Although quite remote, Nepal nevertheless is in a most critical point in terms of the world political picture. It is between two long time foes, mainland China and India. Keeping tabs on the American interests in the country is Ambassador Carol Laise, a delightful woman, and a true friend of ham radio. She has asked favors of 9N1MM more than once, and they have a great friendship. As we visited in her home, ham radio was the dominate theme of conversation. She, as were most people in the Embassy, was quite surprised that the Nepalese government had granted me a license. It seems that some foreign hams have been waiting for years on license applications.

For the last two days of our nine day visit to the country we were transported by Land Rover to Godavari by Father Moran. It is only an eight mile trip, but takes nearly 45-minutes over a bumpy, dusty, winding road. However the trip is certainly worth the effort. The Godavari school, run by Father Moran and a number of other Jesuits, is attended by several hundred Nepalese boys. They attend grades 1 through 12, and it is a school of highest caliber. The main building is the home of a former ruler of Nepal, situated at the base of a 10-thousand foot "hill...when compared to the Himalayas. From this location, one looks down over the Kathmandu Valley, beyond to the Himalayas. It is a study in tranquility and majesty.

The "shack" at 9N1MM is complete with a full complement of gear, capped by a 6-element tri-bander. Directly to the North, as one beams across the pole to the United States, lies mainland China and the Soviet Union. For one who has been confronted with the East and West coast "aluminum curtains" while operating from W9, it is no less disconcerting to hear those Russian signals. They were everywhere on 20, 15, and 10, and working through them during the contest was often difficult. Needless to say, picking up Russian prefixes was no problem.

Even with my love for ham radio, my love for nature proved to be greater at Godavari. One of the Priests serves as gardener for the school, and he has a display of orchids that is beyond ones wildest imagination. They proliferate across the grounds . . . small and large and of a wide variety of colors. Persimmons the size of oranges are over your head, and flowers of every hue beckon at your feet. The contrast of colors makes it appear to be a plastic world... but it is all very real, and very beautiful. Janice and I spent many hours just walking the grounds, watching the stars at night, picking out Jupiter's moons with the unaided eye.

All too soon, it was time to say goodbye. We made a quick trip to the home of Lorenz, 9N1JK, before heading back to the airport for the trip home. Lorenz lives in Patan, an ancient city just south of Kathmandu. The

[*Continued on page 82*]

An Improved Crystal Calibrator Using Solid-State Techniques

BY GEORGE F. MOYNAHAN,* W6AXT

WHEN calibrating a transmitter, receiver or transceiver it is often desirable to have reference points closer together than those provided by the usual 100 kHz vacuum tube type crystal oscillator. Fortunately, modern solid-state technology, including the use of integrated circuits as frequency dividers, makes it very simple to derive, from a 100 kHz crystal, calibration points spaced as close to each other as one wants. When I decided to build a new calibrator for my National NCX-5 Mark II transceiver, it seemed that 20 kHz intervals throughout the spectrum would be about right for my use. It was also clear that these could be obtained by following the 100 kHz oscillator with a chain of three J-K flip-flops, in order to divide by 5.

The XCU-27 frequency calibrator which the National Company builds for use with this transceiver as well as with some of their other equipment is very much like the one which I had previously built and not much different electrically from those used by other manufacturers. It is connected electrically and supported mechanically by a standard octal socket on the back of the transceiver. Switched 300 volts d.c. and unswitched 12 volts a.c. are provided for the operation of this oscillator. My goal was to construct a completely solid-state unit which would plug directly into that same socket, would require no internal changes in the transceiver and which would neither draw excessive current nor require high wattage dropping resistors. The voltages available are scarcely well-adapted for this purpose, but it worked out fine in the long run.

A block diagram of the oscillator and the divider chain is shown in fig. 1.

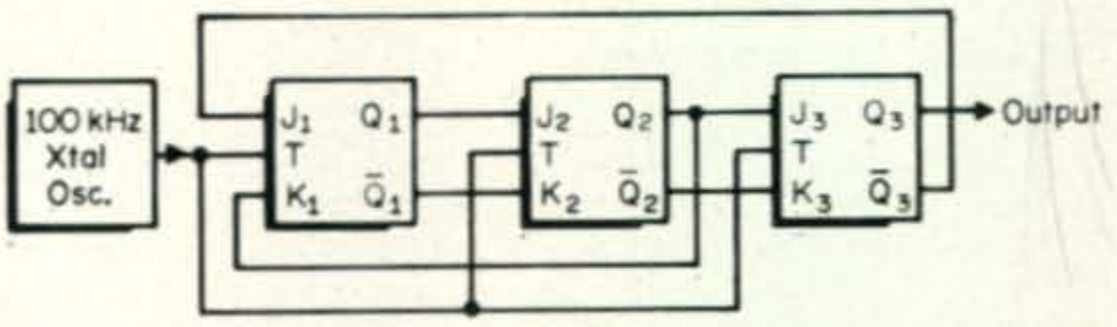


Fig. 1—Block diagram of the 100 kHz crystal calibrator with 20 kHz marker output. The crystal oscillator output is rich in harmonics so that strong reference points are available throughout the h.f. spectrum.

*School of Engineering, San Jose State College, San Jose, Cal. 95114.

The crystal calibrator shown mounted in position at the rear of the author's NCX-5 transceiver.

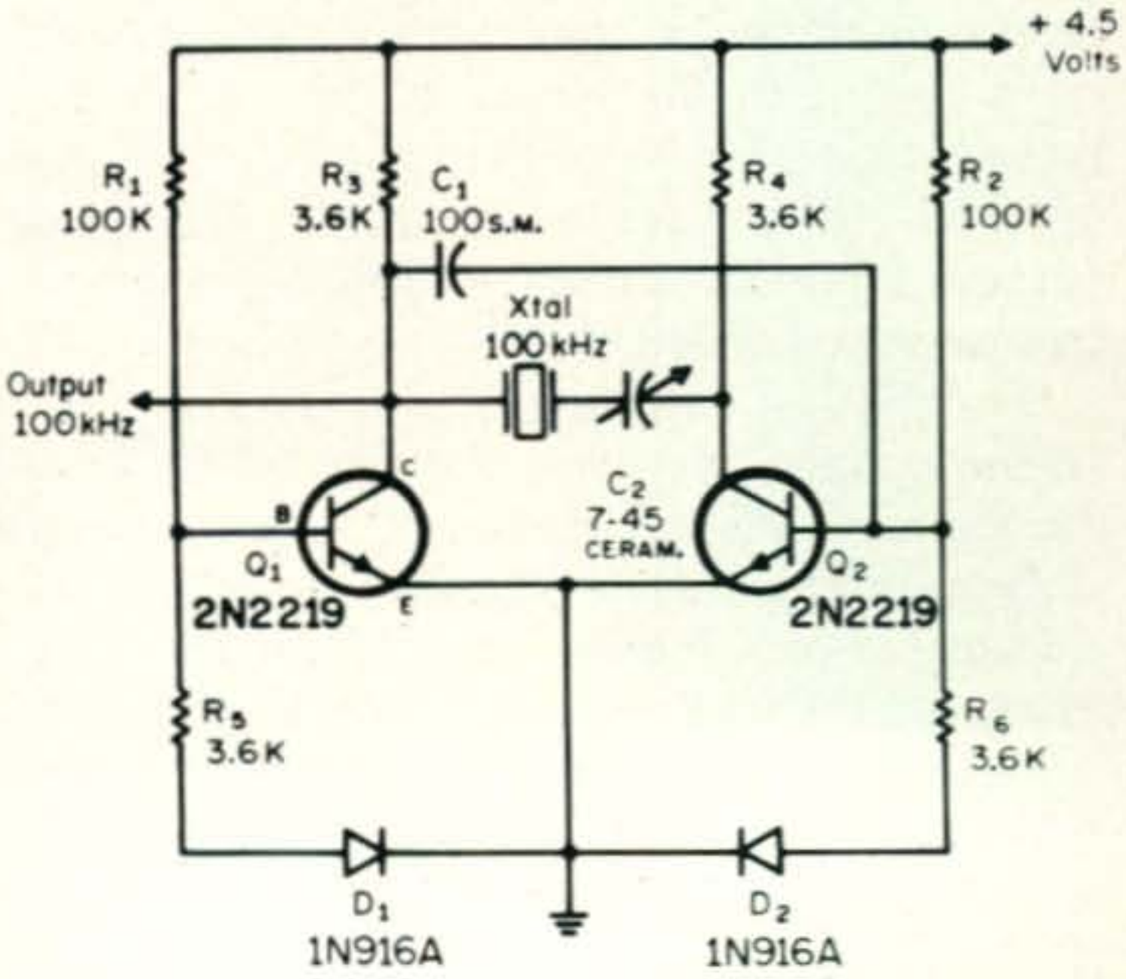


Fig. 2—Schematic of the 100 kHz crystal oscillator. Diodes D_1 and D_2 are used to stabilize the output of the circuit and can be eliminated if desired, with R_5 and R_6 being grounded directly.

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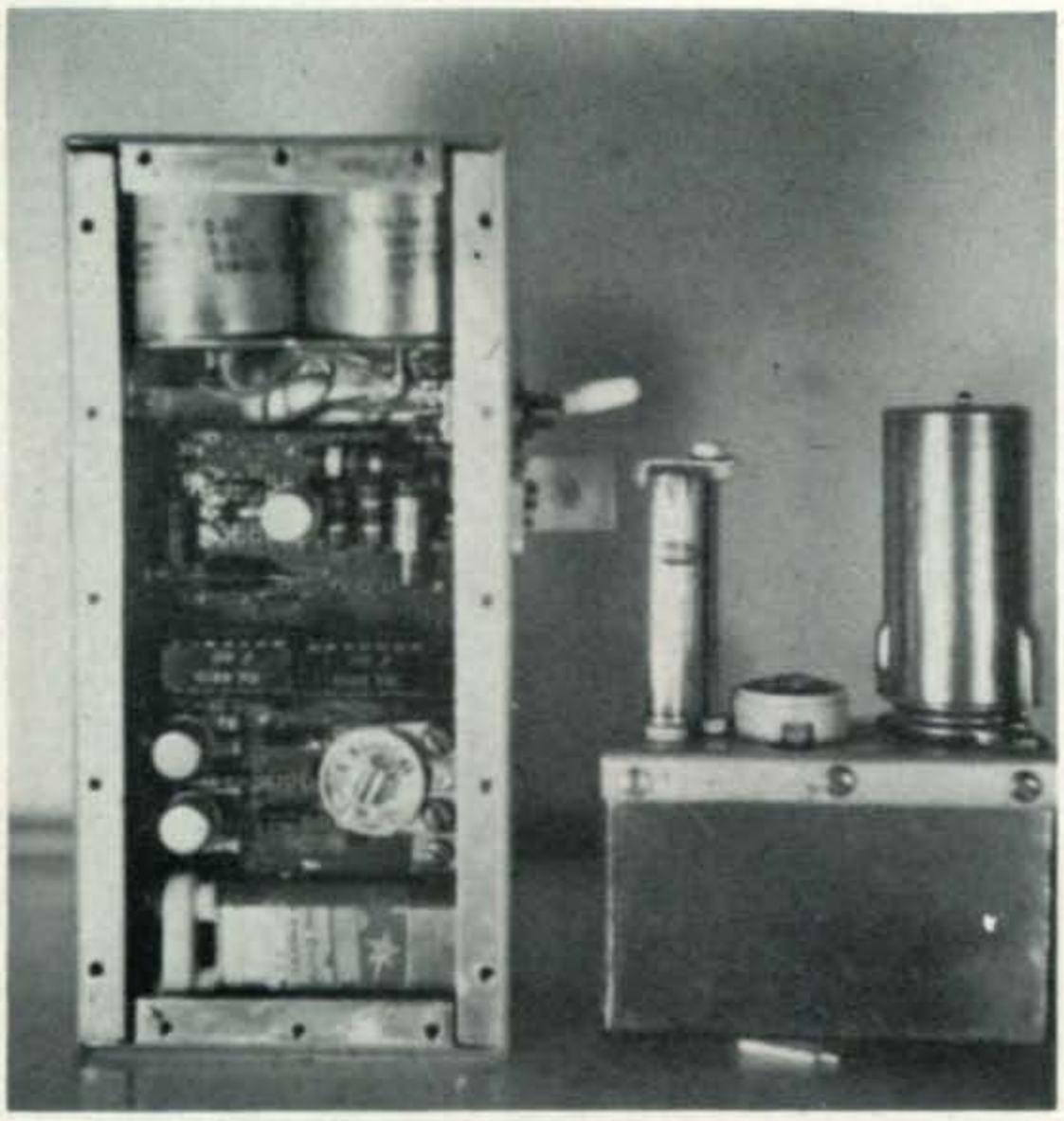

Interior view of the calibrator showing general parts layout. The 100 kHz oscillator is at the bottom with the divider chain at the center. At the top is the power supply/control circuit with C_1 and C_2 mounted at the very top. The switch on the side of the solid state calibrator is not shown in the schematics, but by-passes the divider chain when necessary. The old vacuum tube calibrator is shown for comparison.

The oscillator uses two NPN transistors as shown in fig. 2. I used a pair of 2N2219's because I happened to have them, but the choice is not critical and any transistors of a generally similar type should do. The selection of the type 1N916A's in the base bias circuit of the transistors is equally uncritical; almost any small silicon type signal diode will do. As a matter of fact, these diodes may even be eliminated although they do help stabilize the performance of the oscillator.

The IC flip-flops which I used are Fairchild Type DTμL9097's. Their selection was based largely upon their availability, and almost any similar J-K or R-S flip-flops would probably do equally well. These particular units are packaged in dual in-line 14 lead packages and each contains two complete J-K flip-flops.

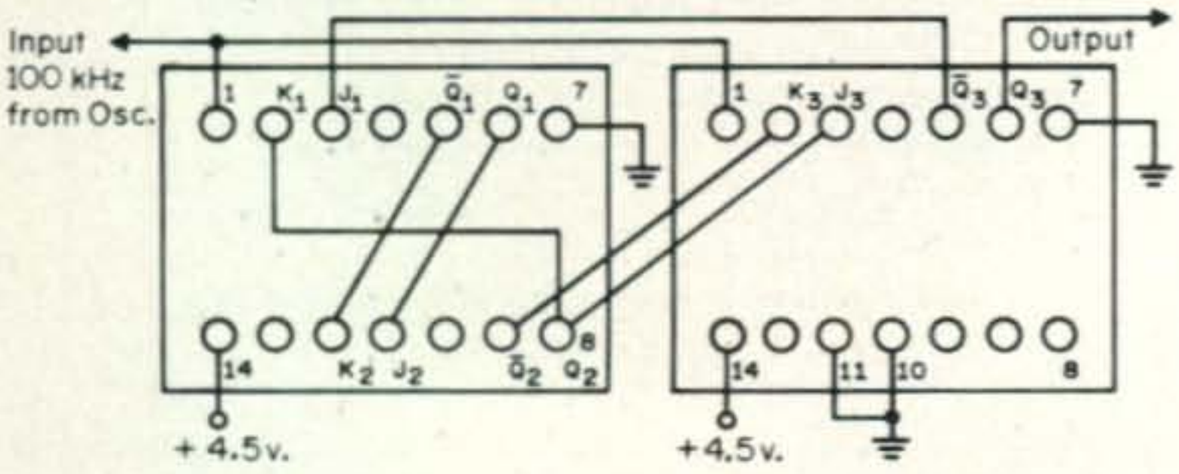

Fig. 3—Wiring diagram of the divide-by-five chain using two Fairchild DTuL 9097 IC's. Note that the IC's are viewed from the bottom.

However, they are interconnected in such a way that they are not entirely independent from each other. Interconnections of these particular flip-flops to form a divide-by-five chain is shown in fig. 3. It turns out that if terminals 11 and 12 of the second chip are left ungrounded reference markers are generated at 10 kHz intervals instead of 20 kHz. In generating calibration points at 20 kHz intervals only three of the four available flip-flops are used, and schemes for using other varieties can be worked out easily following the block diagram.

At first, it seemed that furnishing power to the unit and of switching it off and on would be a problem if the transceiver were to remain unmodified, but solid state devices came to the rescue and the solution proved to be simple. Low voltage d.c. was obtained by rectifying, filtering and then regulating power from the 12 volt a.c. source. The unit was turned off and on by means of a 2N2219 transistor used as a switch using the 300 volt d.c. source through a 470 ohm 1/4th watt resistor to control the base current of this transistor. Operating voltage for the unit is regulated by a 6.8 volt, 1 watt, Zener diode and then dropped through a 47 ohm resistor to 4.5 volts at which the IC's are rated. Figure 4 is a diagram of the power supply and control circuit.

Several views of the assembled unit are shown in the photos, together with the older vacuum tube unit which the solid-state model has replaced. This calibrator has met the design goal and seems to perform in a highly satisfactory manner. Other builders will probably want to modify the mechanical and perhaps the electrical design to meet their individual requirements. The choice of components is not critical and modification of the design should not be especially difficult. ■

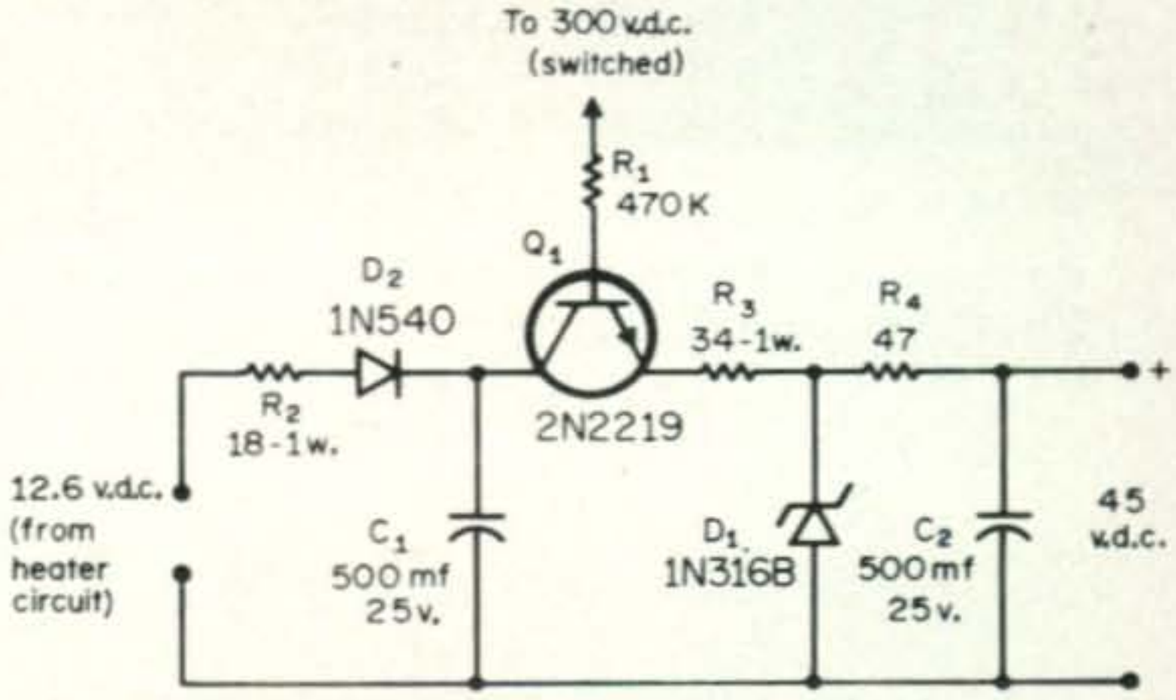

Fig. 4—Power supply and switching circuit for the calibrator. D_2 is a 1N3016B 6.8 v. 1 w. Zener diode.

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General Purpose Wide Band Amplifier

BY AUBREY B. HUTCHISON, JR.*

Unless you've used a "black box" amplifier around the shack or lab, you may not appreciate the usefulness of a wide-band general-purpose amplifier. The amplifier described here may be used singly to provide 10 db gain from 10 kHz to over 100 mHz or up to 40 db gain over a narrower bandwidth. Two or more amplifiers may be placed in series for still more gain.

THE average amateur normally does not have the test equipment or special parts to construct wide band amplifiers for general purpose use. However, here is a wide band amplifier for general purpose use that is easily built.

Several projects ago, I required a simple high gain non-tuned amplifier for amplification of signals before detection. While the chief objectives were stable gain, nevertheless, we did realize a wide amplifier with amplification up to 250 mHz (about 3db) of gain. I have found many applications for this amplifier since completing the original project. To list just a few: wide band oscilloscope amplifiers, i.f. amplifiers following a converter, a wide band pre-amp., an r.f. Amplifier for c.w. monitors and many other uses.

The basic amplifier consists of two Fairchild 2N5126 transistors (somewhat like the 2N918) in a d.c. coupled circuit. Transistor Q_1 is a normal common emitter stage with the base bias determined from the voltage drop across the emitter resistor of transistor Q_2. Since this method of obtaining bias for transistor Q_1 introduces d.c. negative feedback, the resulting circuit is stable for both power supply and temperature changes. At 20 db of gain the maximum variation in gain is normally 1/4 to 1/2 db throughout the total operating frequency range. For most ham

*5780 S.W. 11 St., West Miami, Fla. 33144

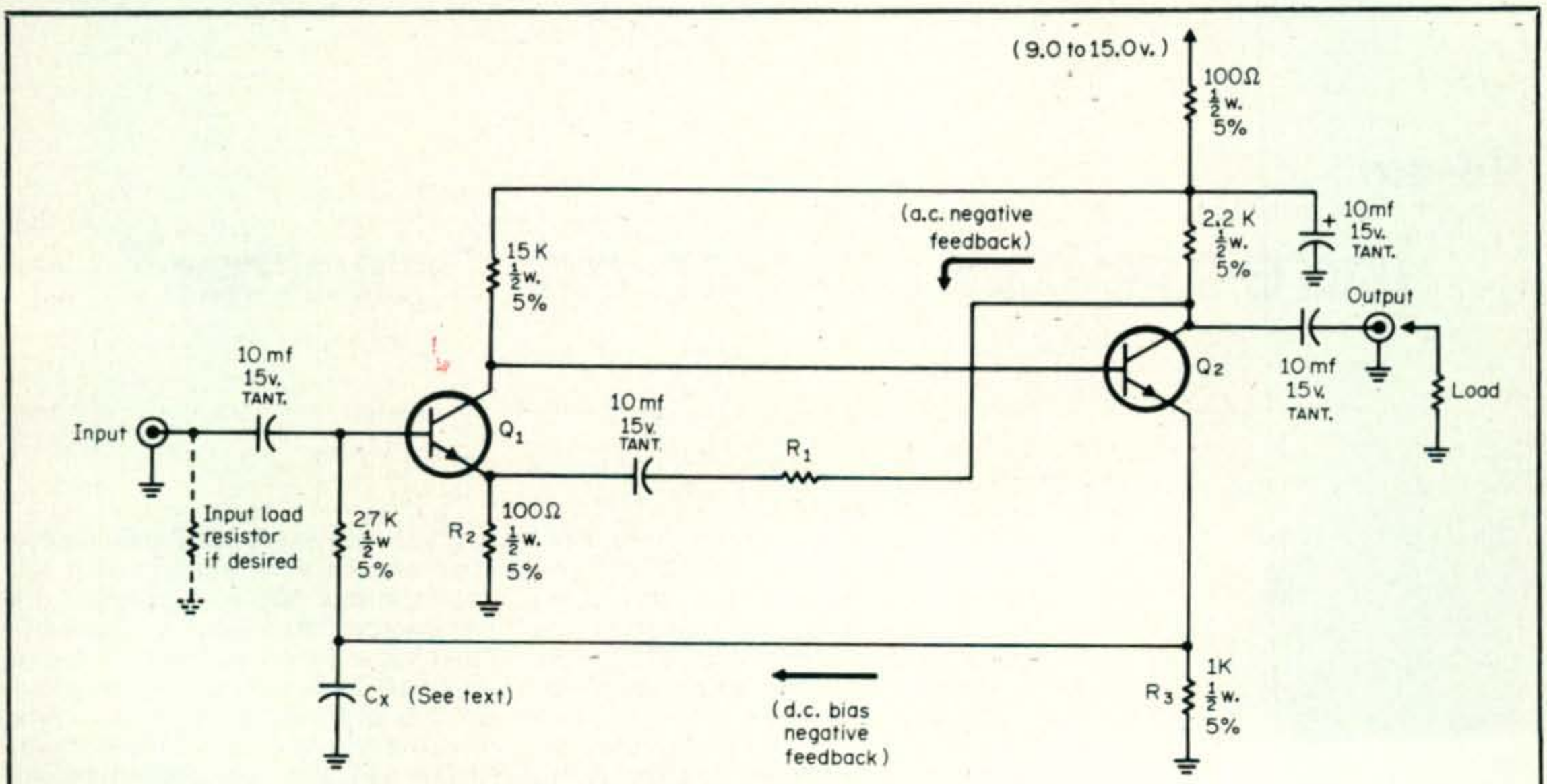


Fig. 1—Circuit of the general purpose wide band amplifier. Resistor R_1 is adjusted to vary the gain. Voltage gain (approx.)$=(R_1+R_2)/R_2$. Maximum gain is generally 38 to 44 db. Maximum output voltage is about 1.0 volt p.p. Circuit designed for 1000 ohm loads (usable for driving low level transistor circuits).

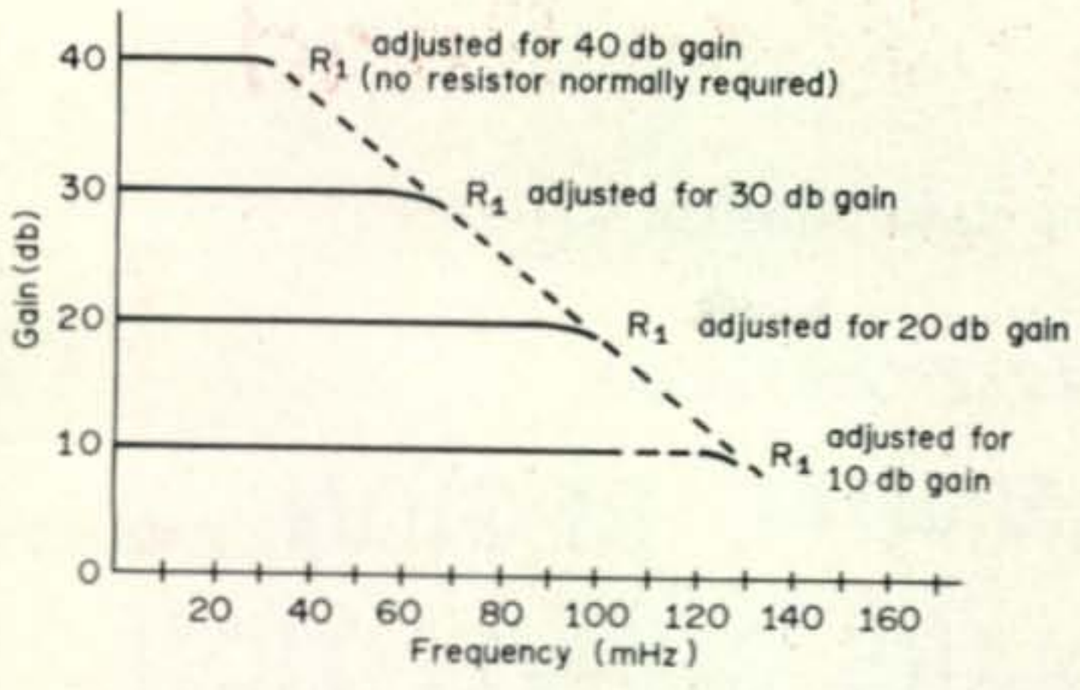


Fig. 2—Gain response of wide band amplifier. Note that the bandwidth increases as the amplifiers gain is reduced.

projects this gain stability is considered ample.

Although there is some a.c. negative feedback introduced by the bias network, it is considered small compared to the a.c. negative feedback network between the collector of transistor Q_2 and the emitter of transistor Q_1. The 10 mf coupling capacitors are for d.c. blocking only and do not effect the frequency response.

Transistor Q_2 is simply a direct-coupled stage with a maximum open circuit gain of about 2 times (6db).

Gain of the overall circuit is determined primarily by the ratio of resistors R_1 and R_2. (See fig. 1)

For the maximum flatness of the response, a small mica capacitor Cx may be shunted across resistor R_3. As the frequency increases, capacitor Cx will cause the gain of transistor Q_2 to remain at a higher level than it would without Cx. This causes the overall amplifiers response to be extended out as shown in fig. 2. Slight adjustment of capacitor Cx may create an amplifier that has option performance for any specific gain; however, the author recommends the value of 100 pf for Cx for best overall general value

Several of these amplifiers may be installed in series; however, shielding will normally be required when the total overall gain exceeds 60 db. At 20 db gain each, 3 amplifiers will handle signals as high as 400 microvolts before the last stage overloads. For gains greater than 60 db, a tuned circuit or filter at the input may be required to reduce overloading, due to the wide band noise.

A recent application of this amplifier is the amplification of pulsed light signals detected by a photo diode. Two series connected amplifiers proved to be ample amplification in this application.

For low impedance applications, the emitter follower shown in fig. 3 should be useful but may limit the higher frequencies. ■

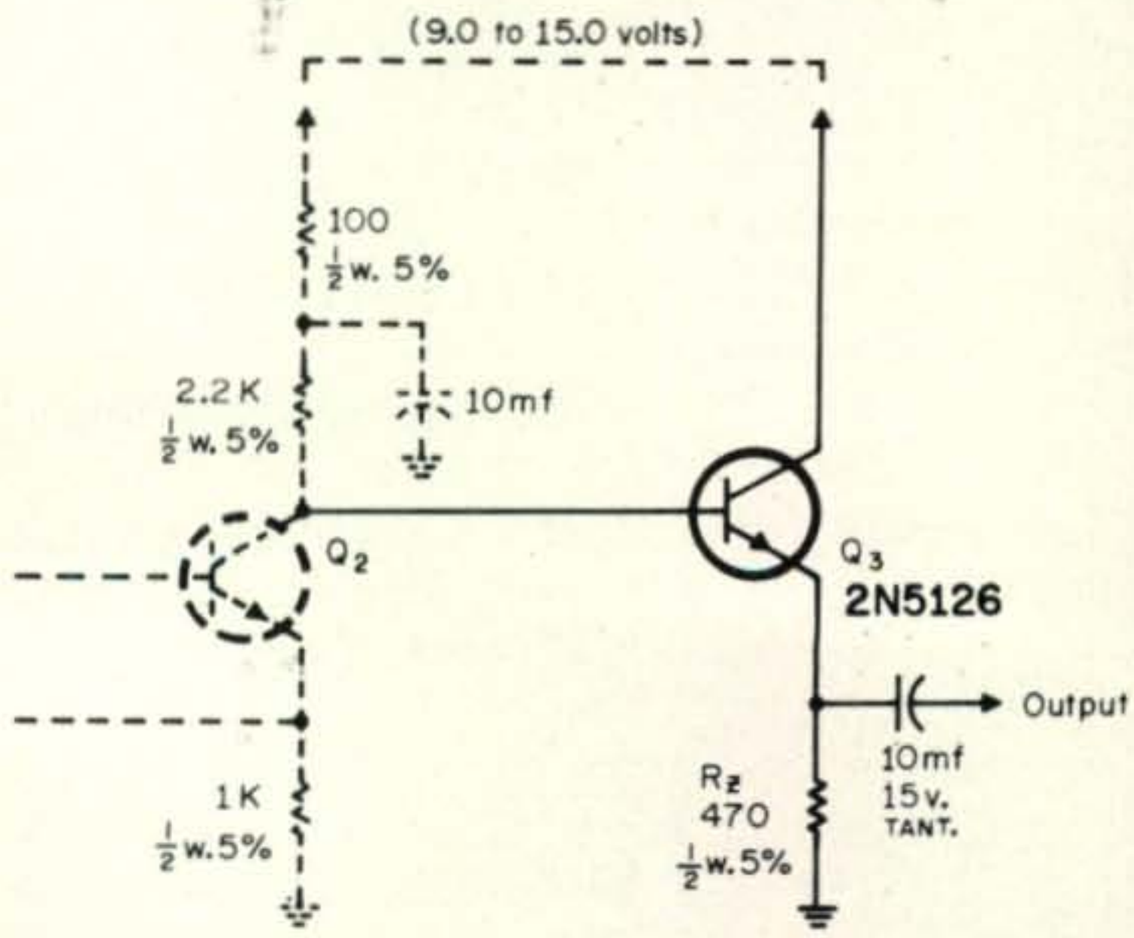


Fig. 3—Emitter follower circuit for low impedance applications. Resistor Rz may be varied in value for best output performance. Lower values may tend to cause Q_3 to run warm. Values lower than 100 ohms are not recommended.

CQ Reviews: The Inoue IC-21

BY GLEN E. ZOOK,* K9STH/5

ONE of the old-timers in the "ham only" f.m. equipment business in Inoue of Japan. Their equipment has been imported first by a firm in the Phoenix area, and now by several amateur radio dealers. Inoue's latest feat is the IC-21, a 10 watt output, 24 channel rig for 2 meter f.m. Several features not found on amateur only f.m. rigs have been included in the IC-21 including the 24 channels and front-panel deviation control. Much of the circuitry is similar to the smaller IC-20 model which is being marketed along with the IC-21.

Technical Details

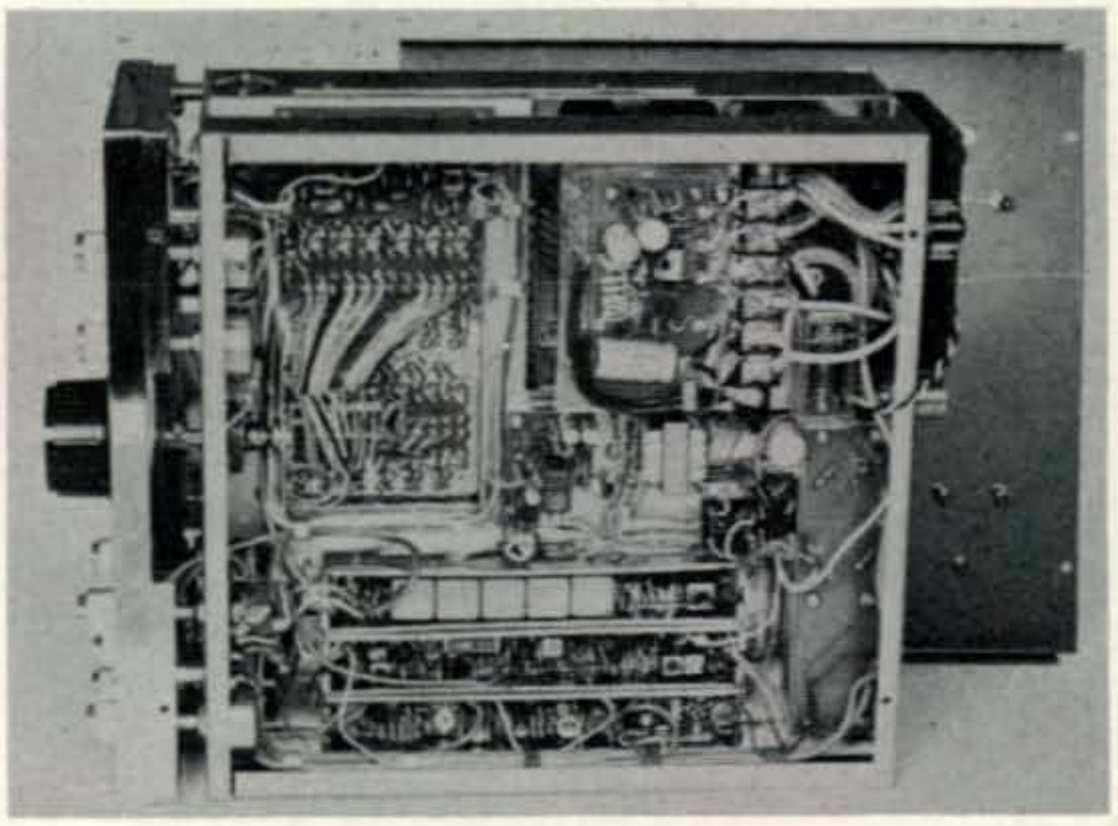
The Inoue IC-21 is a fully solid-state 2 meter f.m. transceiver. Power output is 10 watts in the high-power range and 1 watt in the low power range. The 24 channels are selected by a 12 position switch with a second 2 position switch to choose between sections giving the total 24 channel capabilities. Other front panel controls include power amplifier tuning, squelch/discriminator meter calibrate, volume, receiver incremental tuning, s.w.r. meter calibration, deviation control, and a switch to change the S meter from relative output to reffected power. Also included is a separate discriminator meter.

Transmitter: The transmitting section of the IC-21 employs 11 stages of r.f. getting from the 18 mHz crystal oscillator to the final amplifier. Crystal multiplication is eight times. Modulation is by the phase method. The transmit audio is well processed including IDC and filter. A high s.w.r. protection circuit is provided to shut down the transmitter when reflected power becomes high enough to cause possible damage to the final transistor. The microphone provided with the IC-21 is dynamic.

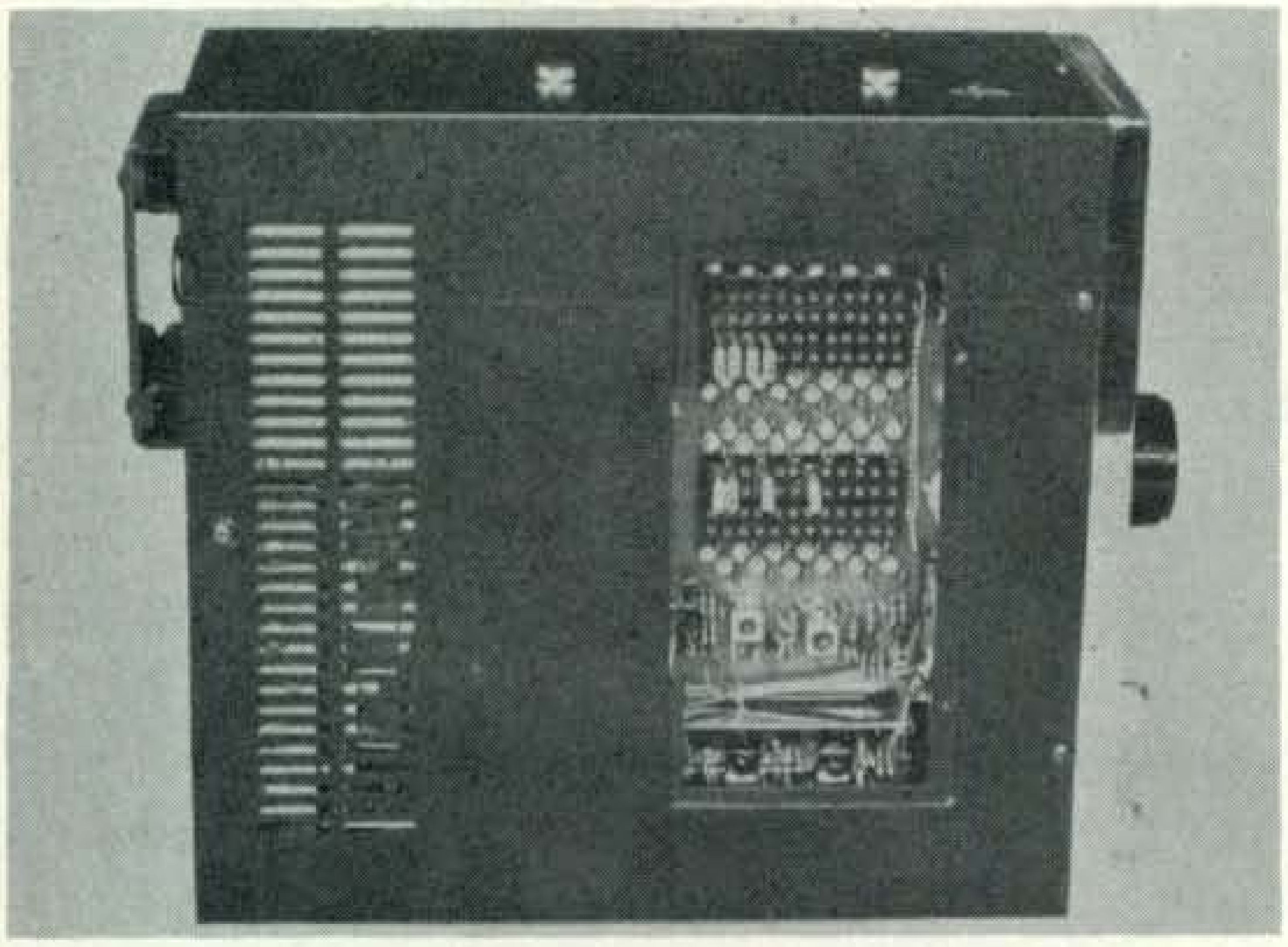
Receiver: The receiving section of the IC-21 is also fully solid-state, dual-conversion (10.7 mHz high i.f. and 455 kHz low i.f.), with provision for 24 crystal-controlled channels. The front-end consists of a pair of JFET's in cascade feeding a helicalized cavity r.f. filter (similar to the later "Motrac" front end cavities). The 2 meter signal is then fed into a bi-polar mixer. Conversion signal is provided by one of 24 crystals which may be selected from the front panel. These crystals operate in the 15 mHz range and are multiplied 9 times to provide the 1st injection frequency. The resulting 10.7 mHz i.f. signal is amplified in a single stage and applied to the 2nd mixer. A 2nd oscillator at 10.245 mHz is provided to convert the signal to 455 kHz. This 2nd oscillator frequency can be varied about ±5 kHz by the receiver incremental

*FM Editor, *CQ*.

The Inoue IC-21 is a 24 channel, solid state, 2 meter f.m. transceiver. Note how the styling is along low frequency s.s.b. transceiver lines.



A large percentage of the circuitry of the IC-21 is on modular printed circuit boards.



The Inoue IC-21 has a convenient top hatch for ease in changing crystals and warping to frequency.

tuning control on the front panel. The 455 kHz signal passes through a ceramic filter, 4 stages of amplification, 1 stage of limiting, 1 stage of amplification, a second stage of limiting, and a final stage of amplification before being applied to the discriminator. The audio is processed in a single IC and applied to the output transistors. The squelch is noise derived. Metering is provided to read the "zero" point on the discriminator output. By varying the r.i.t. control (thus varying the 2nd oscillator frequency) an off-frequency signal can then be brought into the center of the receiver passband. A second metering is provided to read signal strength.

Power Supply: The IC-21 can be operated either from a 12 volt external source or from an internal 117 v.a.c. 60 Hz supply. The built-in supply utilizes transformer, rectifier stack, regulator and current limiting circuitry.

Inoue IC-21

GENERAL SPECIFICATIONS:

Size: 4⅜" × 9⅛" × 10¼"
Weight: 14 pounds
Power Requirements:
Transmit 13.5 v.d.c. @ 2.1A
Receive 13.5 v.d.c. @ 0.2A
Accessories Furnished:
Mobile power cord
AC power cord
Microphone
Gimbal bracket

TECHNICAL SPECIFICATIONS:

	Claimed	Achieved
Receiver:		
Sensitivity (20 db quiet)	0.4 μv	0.25 μv
Adjacent Channel Rejection		
±30 kHz	50 db*	58 db
±60 kHz	none	65 db
Audio Recovery (full quieting)		
±5 kHz	1.5 W	1.7 W
±7.5 kHz	1.5 W	1.8 W
±15 kHz	1.5 W	1.8 W
Number of Channels	24	24
Frequency Stability	0.0025%	met
TRANSMITTER:		
Power output @ 13.5 v.d.c.	10W	13.5 W
Deviation	0-20 kHz	same
Frequency Stability	0.0025%	met
Number of Channels	24	24

*Specified at ±25 kHz

Specifications and Performance

After receipt the IC-21 was put through its paces under controlled circumstances. Both the internal 117 v.a.c. power supply and external 13.8 v.d.c. supplies were used with little differences between performance. Power output in the high power position was 13.5 watts, well above the rated 10 watts. Since the deviation is controlled from the front panel there is no preset deviation specification. The deviation could be varied from 0 to ±20 kHz. All frequencies provided in the test model were within the 0.0025% specifications on transmit. Audio quality was quite good.

The receiver also held up well in testing. The 20 db quieting sensitivity was 0.25 microvolts on the poorest frequency. All spurious responses were well over 60 db down. The adjacent channel selectivity using the 20 db quieting method was also quite good. The receiver handled deviations from ±5 kHz to over ±15 kHz with only a minimum of distortion at the higher levels.

Construction

Construction of the IC-21 is principally printed circuit techniques. The workmanship was quite good. Of note is that several subassemblies are provided to make servicing easier. All crystals are mounted on the same circuit board and a hatch is provided on the top of the IC-21 to make warping to frequency a snap without removing the entire transceiver case.

General Comments

The IC-21 is rather unique with several features. It is the first unit seen to date with a receiver incremental tuning, built-in s.w.r. direct reading meter, and a front-panel deviation control. The r.i.t. comes in handy when working simplex and the other guy is not

[*Continued on page 82*]

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You're looking at it in this solid state oscilloscope. The new B & K Precision 1465 is a triggered sweep oscilloscope with CALI-BRAIN – a built-in feature for measuring voltages, automatically without computation in seconds. CALI-BRAIN will measure peak-to-peak voltage on waveforms of any complexity – and at voltage levels from 10mV to 600 V. Only B & K scopes have CALI-BRAIN – a real advance in TV test equipment.

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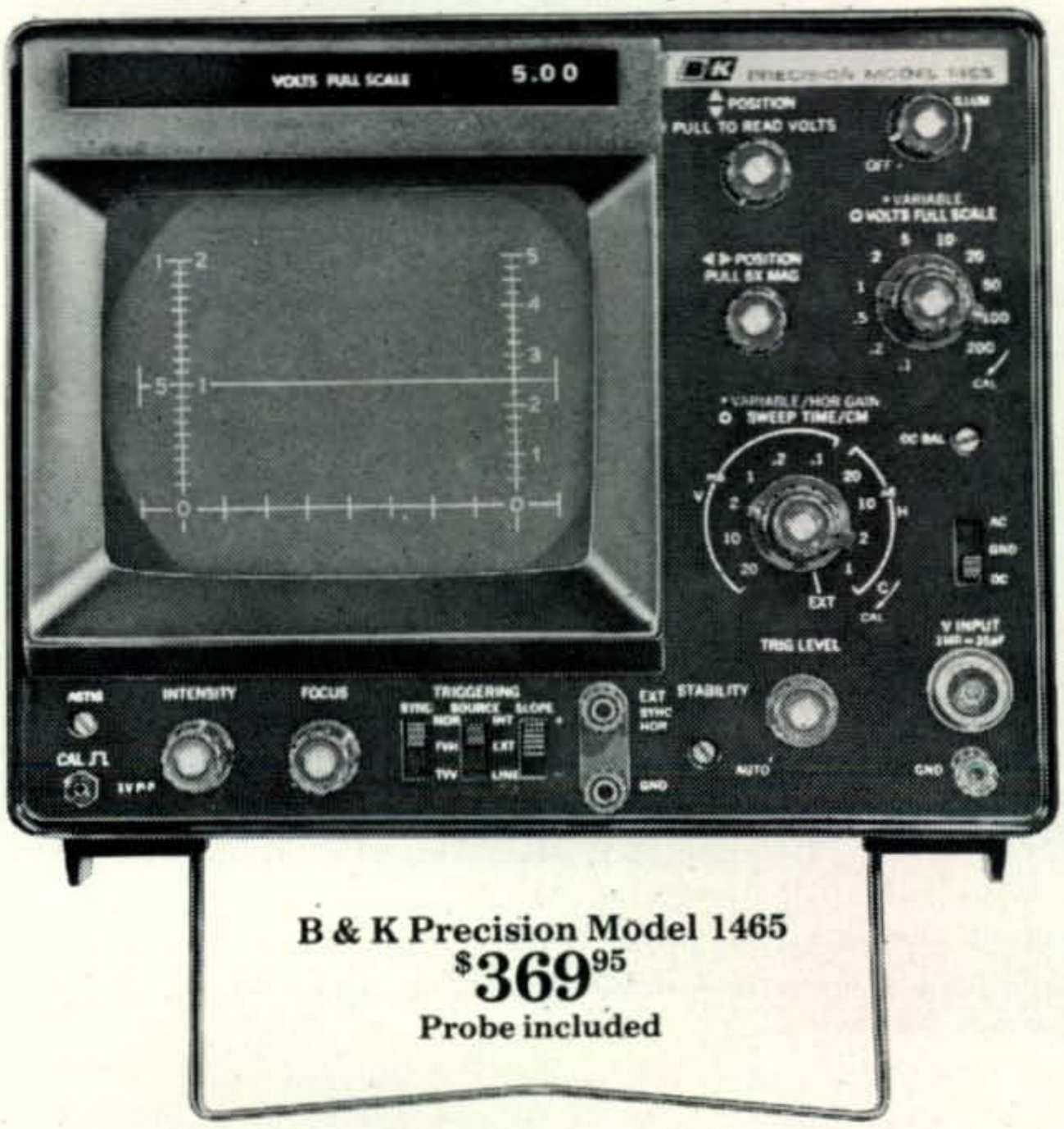

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Probe included

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C. A graduated scale on the graticule overlay is illuminated on either side of the scope screen. The scale corresponds to the full scale voltage indicator in the bezel.
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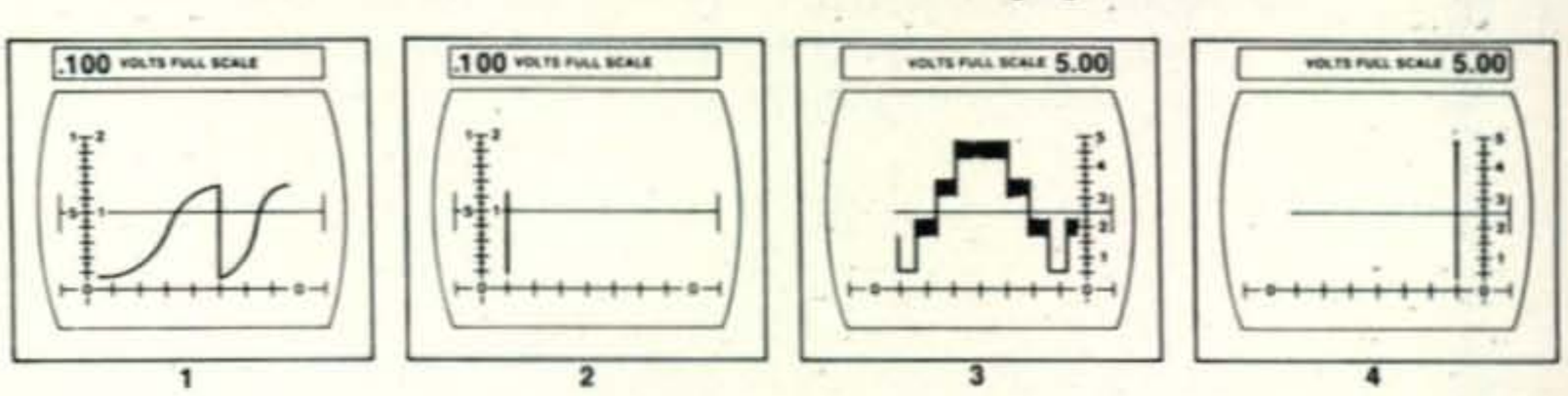

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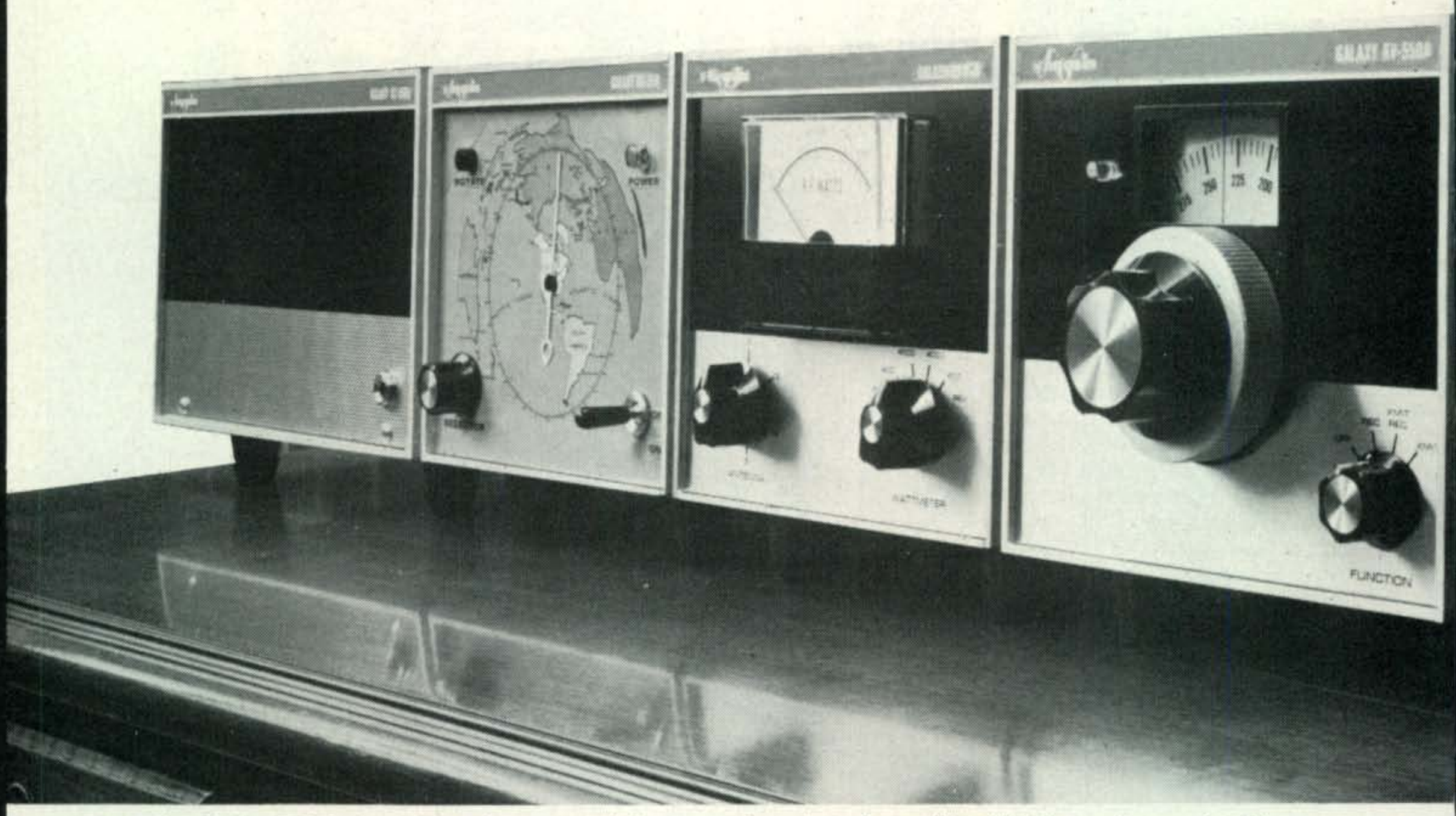

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F. M.

BY GLEN E. ZOOK,* K9STH/5

What do you do when the lights go out? Think for a moment. One of the reasons for good repeater locations (often at no cost) is the benefits the community can receive from the amateur f.m. operator during emergency situations. However, what happens if the repeater site is in the area hit by the emergency. Does your repeater have an emergency power source? Is there back-up equipment available to set-up a temporary repeater in an area which has not been hit? Is there a mobile repeater available to extend the range of hand-held equipment into the prime repeater? Does everyone have direct capabilities on the repeater output frequency? Are all units in top notch physical and electrical shape or have the receivers and transmitters declined because only low power was needed to hit the repeater and the high-power output of the repeater was suffcient to overload a 10 microvolt receiver? Do the regular users of the repeater know how to handle emergency situations or do they continue to rag chew and cover up real or simulated emergency traffic? Does your group take the time to help out in civic activities or do the members sit around and pat each other on the back and let REACT get the credit and do the job? Take a long, hard look at your local f.m. club or repeater group. If you cannot honestly answer yes to all the questions, then something needs to be done. Think about it.

Second Subject: Spring is here and summer is almost upon us. Many f.m'ers are on the road, on the water, and in the air. Unfortunately many amateurs do not understand the difference between mobile, aeronautical mobile, and maritime mobile. Just because you are in a boat or an airplane you are not necessarily anything except mobile. The only time maritime mobile or aeronautical mobile may be used is when on or above international waters. If you are on an inland lake or stream or in coastal waters you are not maritime mobile, just mobile. The same goes for flying. If you are above any sovereign nation, territory, or anything else except international waters you are just mobile. Use aeronautical mobile only when flying over international waters. Also, take a good look at the regulations covering operations in the various regions. For example 146 to 148 mHz is not available in all regions even though you are on or above international waters.

Along the same lines: Its mobile, portable, or just plain call sign. There is no specific classification as "fixed portable", "fixed mobile", "mobile in motion" or such. Also, as long as you are at your fixed station location there is no need to sign portable operation when using a hand-held unit. Well, enough opinion for now.

Technical Talk

Some amateurs consider antennae as an autumn subject. However, if you are like me, its sure nice to put up a new antenna or modify an old one when it is warm outside. Of course those of us who live in the southern portions of the country have warm weather longer than the other portions. Thus, f.m'ers in the northern reaches of the country have only a relatively short period of nice, warm antenna weather. Thus, this month's Technical Talk will deal with antenna tips.

To make things easy, the section will be divided into various topics with tips in each area.

Hardware

When erecting a new antenna make sure all hardware is of the correct size and rust-proof. Use lock-washers when needed. Cover feed-line connections (if screw-type) with RTV or a similar product to prevent oxidation resulting in TVI, lost signal (increased attenuation), etc. If the antenna has been up for a while it may be necessary to replace much of the hardware. This is double in areas of salt-water or air-pollution (and that is just about everywhere these days). Clean insulation materials to remove leakage paths caused by pollution.

R.F. Connections

The connection between the feed-line and the antenna may be made in many different ways. In most cases the feed-line attaches either through a standard connector or to a terminal strip. Either method is satisfactory, but both can be the cause of long-term problems due to water contamination of the feed-line. When a coax connector is used to get from the line to the antenna special care must be taken to keep water out of the line. First of all the shield of the coax must be soldered to the shell of the connector (assuming u.h.f. type connectors). This is to prevent oxidation build-up between the copper braid and the shell of the connector. Next the connector should be filled with silicone grease to help water-proof the connection. The big guys like Andrew furnish a small tube of silicone grease with each coax and heliax connector for this purpose. Finally the connection should be covered with several layers of high grade plastic tape. This doesn't mean that roll you picked up at the local dis-

*818 Brentwood Lane, Richardson, Texas 75080.

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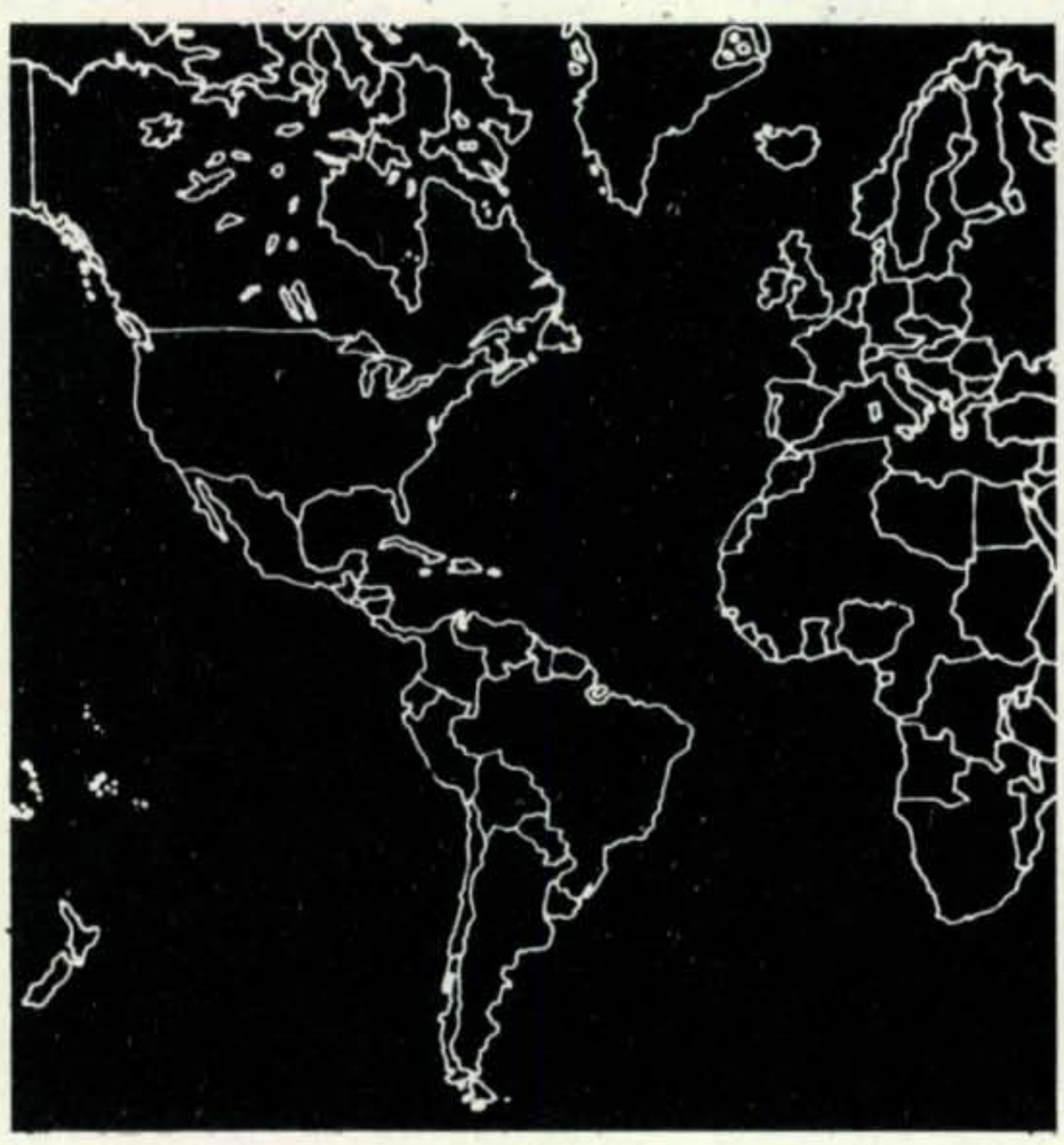

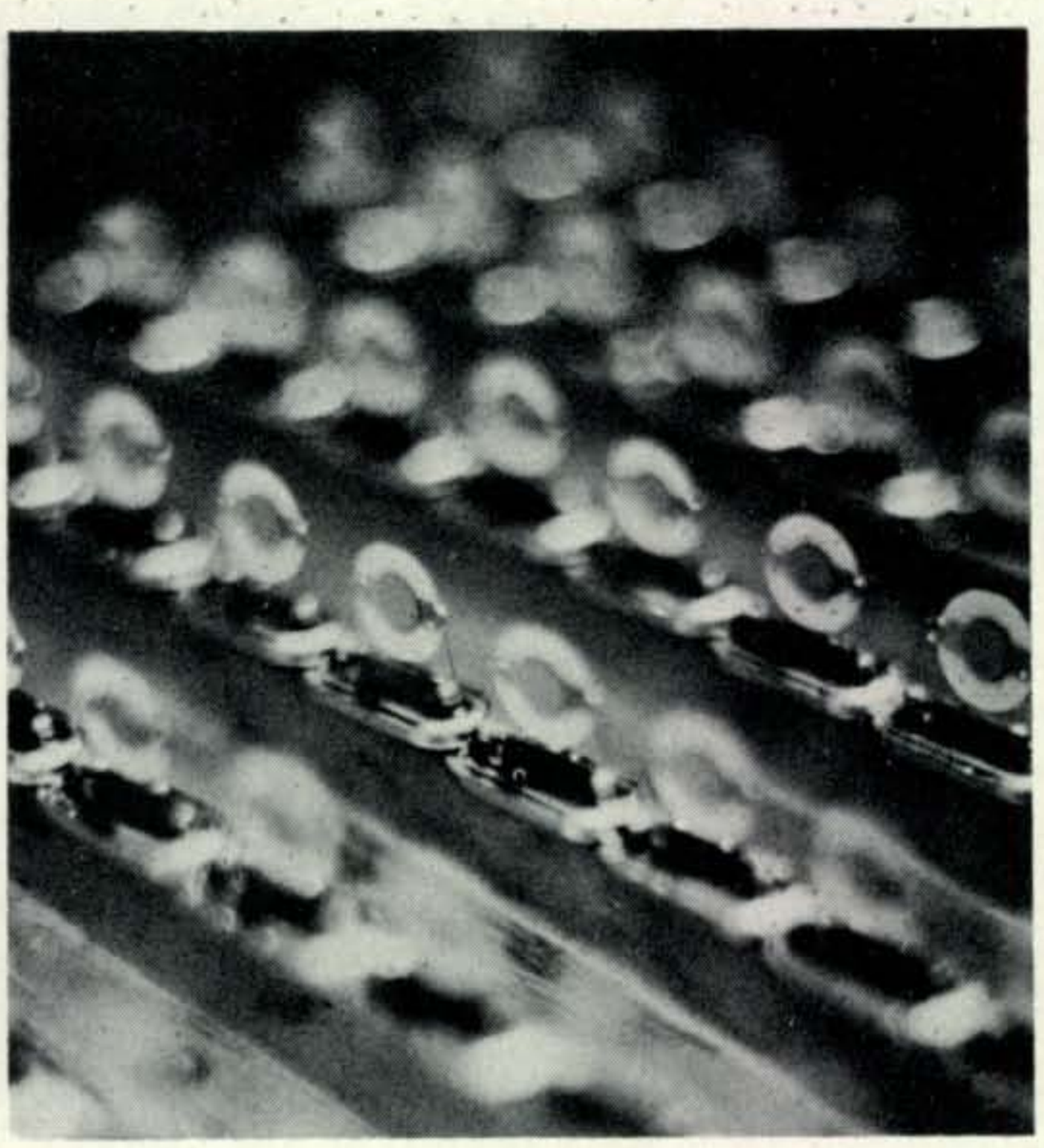

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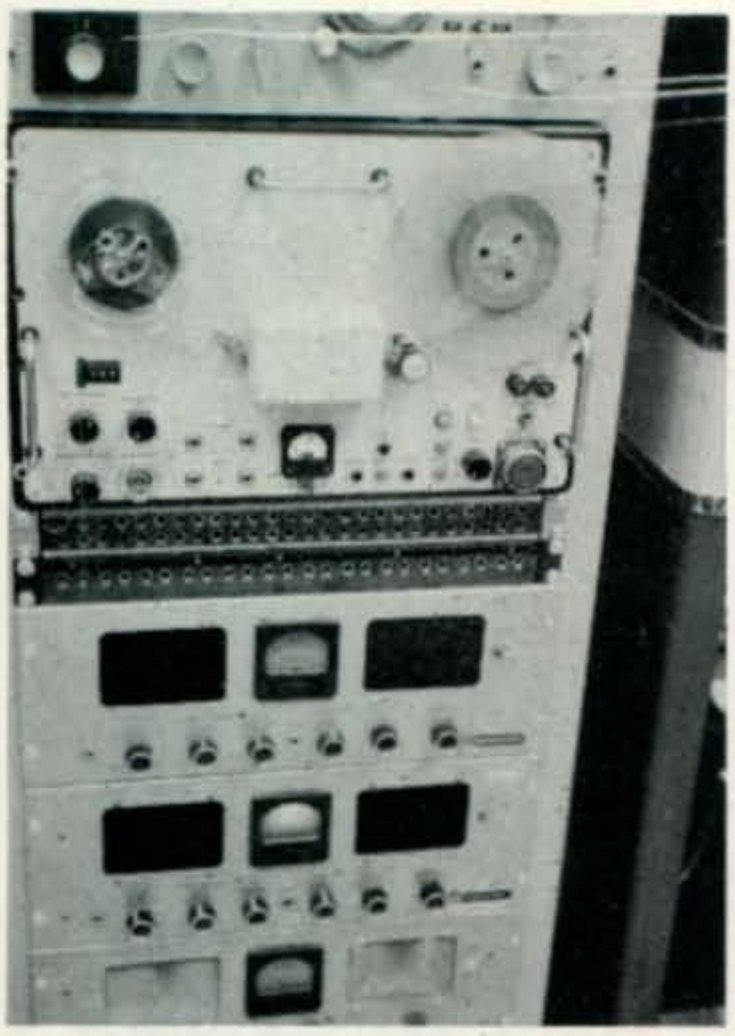

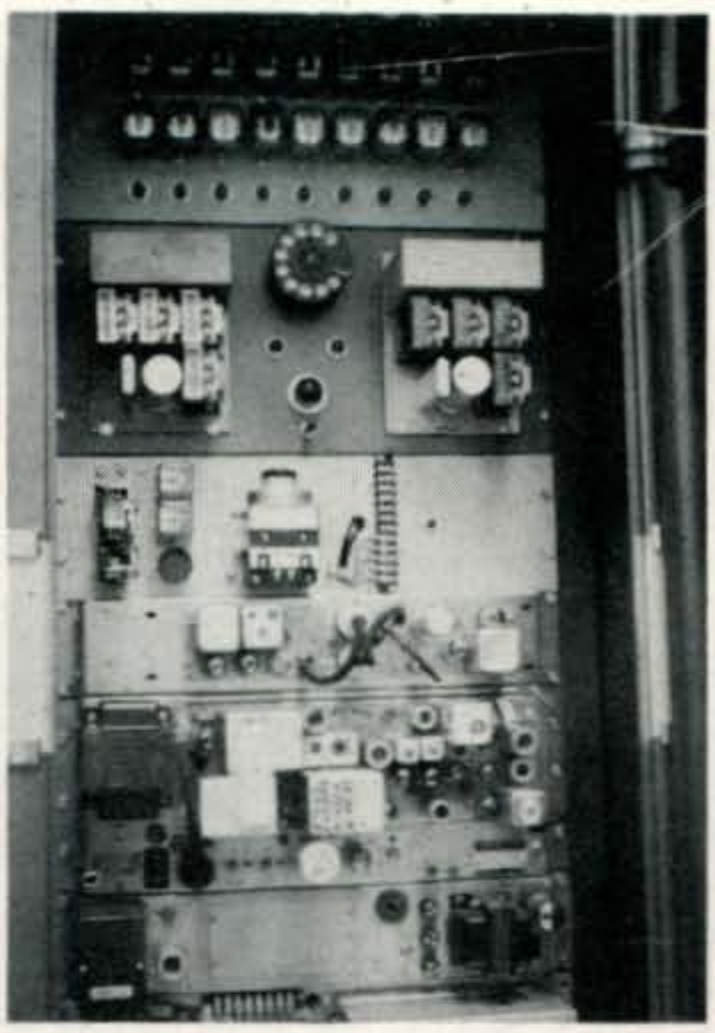

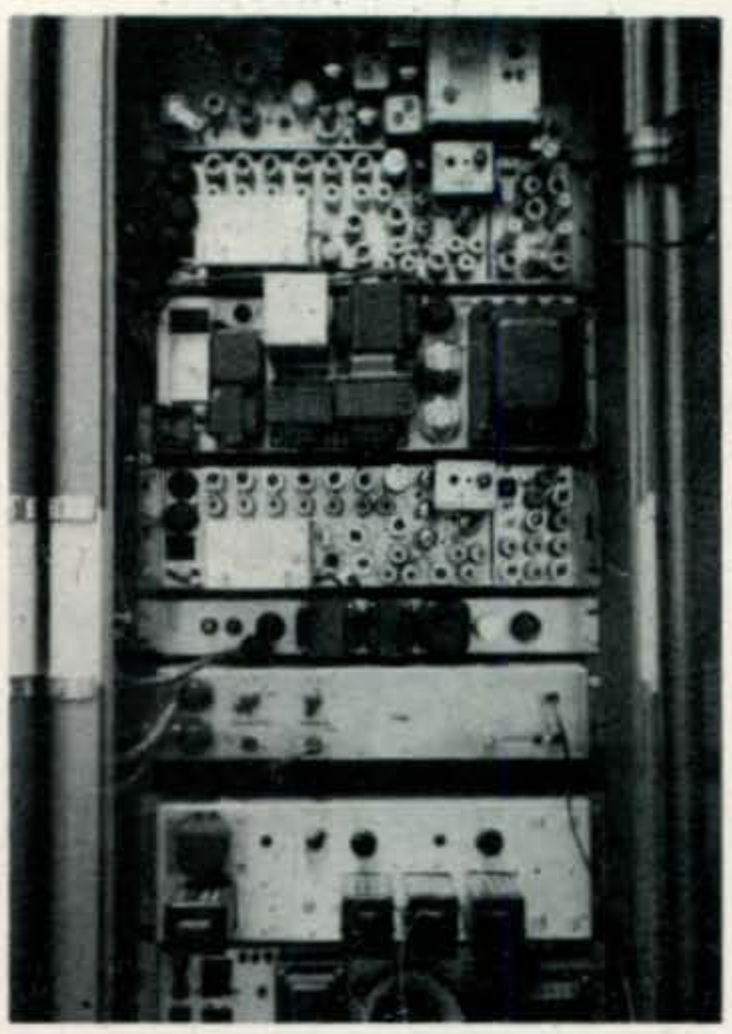

This is a look at K3GUW, the repeator of the Delaware Repeater Association, located in Wilmington, Delaware. Using Motorola Sensicon and G.E. Progress line equipment, four states are covered in a split-site concept. The transmitter is located about seven miles from the receiver and is connected by u.h.f. links, with additional u.h.f. links used as command channels. The repeater input is on 146.13 and output is on 146.73. *(Photos via Bill Morrow, WB2BUD)*

count store for 29c. Use the expensive kind which the local parts store wants a couple of bucks for. Tape is cheaper than coax. Some amateurs use various types of plastic food wraps to help waterproof connections. No matter what type of plastic is used, make sure both r.f. connectors are well covered as well as the coax for three or four inches. When the feed-line must be split to make connections to a terminal strip or similar, loop the line (coax or twin-lead) so that the opening is down. Also tape the feed-line at the split to keep out water. Put tape, RTV, or similar waterproofing at the terminals to prevent oxidation between the feed-line and terminal screws. If the antenna has been up for a while, clean the oxidation from the antenna connector with a small wire brush. Redo the feed-line connector completely. The actual original connector can be cleaned and reused, but cut back the line for a foot or so and resolder all connections.

Feed-Lines

The rule is the better the feed-line the better the installation. Small coax like RG58/U and RG59/U are not suitable for long runs (over 10 feet or so) on 6 or 2 meters. They should never be used for over three feet at 450 mHz if you expect not to lose much. Use RG213/U as a minimum. This is the same as RG8/U except that it has a non-contaminating jacket. Non-contaminating is the by-word. The losses in coax are enough when new, but a contaminated section can have 10 or more times the losses! Of course heliax or similar high-priced lines should be used when available. When using 300 ohm twin-lead care must be taken to keep the line parallel with metal objects or ground. Twisting the line as practiced by some TV installers will only cause line radiation and increased losses. If the line has been up for a while it should be cleaned to remove residue from air pollution. This residue increases line loss. Also, to prevent the wet-dry differences in losses coat the twin-lead with a thin layer of silicone grease. This will cause the water to drop off immediately and gives some protection from contaminants from the air. Never use shielded twin-lead. Take a good look at the losses in shielded twin-lead at v.h.f. and u.h.f. to see why. When securing coax to the tower or mast use either soft copper tie-wires or nylon tie-wraps. Plastic tape is easy to work with, but becomes brittle in cold weather. Since one does not want to have to climb the tower or lower the mast in cold weather it is best to have the line stay put. The same thing goes for rotor lines and anything else going up the tower.

Measurements

When installing a new antenna or after overhauling an old one it is necessary to make measurements. The most common is for s.w.r. Unfortunately the inexpensive "moni-match" type of s.w.r. bridge is useless at v.h.f. and u.h.f. because the pick-up section is too long when compared with the wave-length of the desired signal. Many amateurs have ruined v.h.f. and u.h.f. antennae just because they used an s.w.r. bridge designed for the 3-30 mHz range. A Bird 43 or similar thru-line wattmeter with the proper element is best. The Jones "Micro-match" is good at v.h.f. and u.h.f. and can also be used. When the unit is calibrated directly in watts remember that reflected power must be subtracted from forward power to get the actual power output

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of the transmitter. If a "moni-match" type of s.w.r. bridge is built with a very short pick-up section (per *ARRL VHF Handbook*) it can be used. However, it must be installed right at the antenna, for feed-line lengths will make a difference in the apparent reading. When adjusting element lengths or matching sections remember that an inch is many megahertz at v.h.f. and u.h.f. So, be careful.

Many amateurs have pet theories and actions when antennae are considered. These are often the result of many years of cut-and-try. However, many amateur f.m. operators are relatively new to amateur radio. Also, many old-time operators have never been above 10 meters before getting on v.h.f. f.m. Little things which have only a minor effect on antennae at 7 mHz can cause disaster at 144 mHz. Thus, if you haven't had much experience with v.h.f. and u.h.f. amateur antenna installations, follow the suggestions and keep the performance at the highest level possible.

F.M. West

The first annual Western Amateur FM Conference will be held in conjunction with the California Amateur Relay Council meeting on 2-3 June, 1972, in Fresno, California. Advanced registration is $8.00 and at the door $9.00. Registration and questions may be sent to Tom Hayward, WB6GVQ, 3122 Swift Circle, Clovis, California 93612. Talk in on 146.34/.94 and 52.525 mHz.

Repeater Directory Update

As promised updating of the repeater directory which appeared in the March issue begins with this column. The systems listed herein arrived too late to make the March edition. Since all information was received direct from the repeater organizations it should be correct.

		input	output	
W9ZPP	Indiana, Evansville	52.920	52.575	open repeater
WB8CRQ	Michigan, Interlochen	146.34	146.94	open repeater
K4BN	Tennessee, Memphis	146.34	146.94	open repeater
WA5LDL	Texas, Longview	146.34	146.94	open repeater
WA5YUP	Texas, Longview	146.28	146.88	open repeater
	Alberta, Calgary	146.34	146.94	open repeater

There will be more updating from time to time as information is submitted by the repeater organizations and clubs.

Boston

A large Air Force MARS meeting is scheduled for the weekend of 19 May in Boston. Although most sessions will be dealing with AF MARS activities there will be a seminar/bull session on f.m. for amateurs in general. At this time your columnist is scheduled to ramrod that portion of the meeting. Air Force MARS members should check with their local MARS directors for more information on this meeting.

Q & A

Q. Can I use a mobile telephone unit such as the Motorola TDL1000 series on 2 meter f.m.?

A. Some units originally used for mobile telephone service such as the General Electric DTO equipment may be modified for 2 meter f.m. with the addition of an audio output stage (to drive a speaker) and a squelch circuit. However, the TLD1000 and TLD1470 (RCC) Motorola and similar units built by other companies cannot be used for 2 meter f.m. The reason is that the MTS, IMTS, and RCC channel spacings between transmit and receive are identical within the type of service and, as such, the high i.f. frequency of the receiver is equal to this channel spacing. The lower stages of the transmitter actually provide the 1st oscillator injection for the receiver. Thus, only one crystal is used for both transmit and receive. This makes full duplex operation quite easy with the units for commercial operation. If you were to choose a crystal to receive 146.94 mHz the transmitted signal would be on 152.200 mHz with a TDL1000 series or on 153.400 mHz with the TLD1470 series. If the crystal were chosen for transmit on 146.94 mHz the received signal would be 141.680 mHz and 140.-480 mHz for the TLD1000 and TLD1470 respectively. Also, the built in diplexer will not go as close as 600 kHz. Thus, it is best to forget that nice 11 channel job and find something a bit more suitable.

Q. I am having some trouble with oscillation in the first r.f. stage of a Motorola "G" receiver. How can I cure it?

A. There are several possibilities. In some models of the "G" receiver (low and high band both) the r.f. amplifier is a 6AK5. In newer models this may be a 6EV5. Those models with the 6EV5 may oscillate if both cathode pins of the tube socket are not grounded (pins 2 and 7). The latest versions had both pins grounded and the earlier models did not. In both types (6AK5 and 6EV5) the oscillation may be cured by dropping the screen voltage to around 40 volts. This is most easily accomplished by placing a 100K to 150K 1/2 watt resistor from the screen to ground. Resoldering of the pins and grounds in the r.f. amplifier section also cures some oscillations. By the way, this fix works on several other oscillation problems in receivers using 6AK5 and similar tubes.

Q. How can I tell if a crystal oven is for 6 volts or 12 volts,

A. Assuming that the ovens are not marked an ohmmeter can sometimes help tell the difference.

[*Continued on page 88*]

ADD A LINEAR* TO MY FM RIG? Why not?
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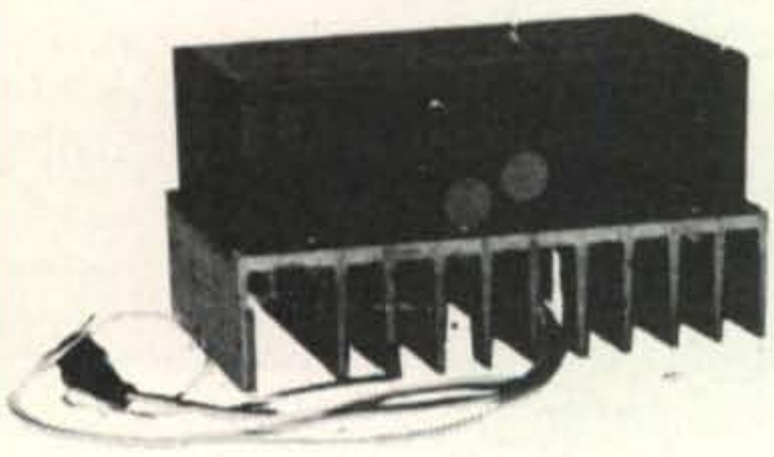

10-0

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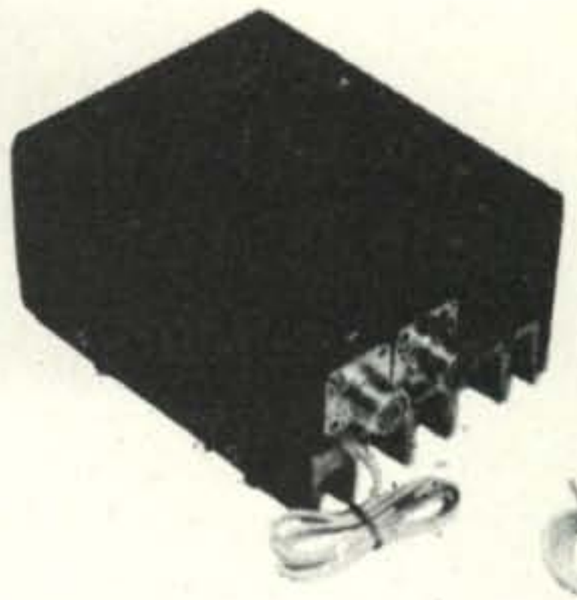

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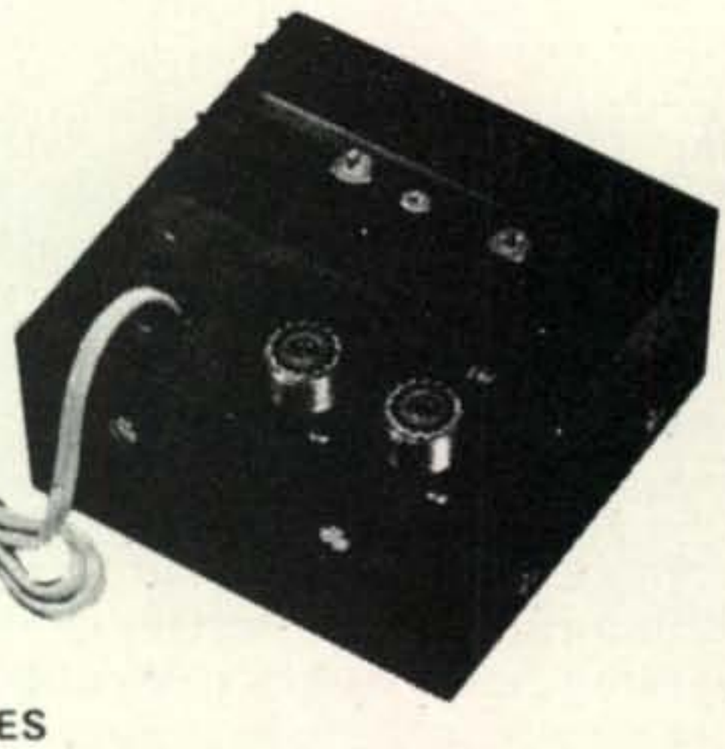

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* A common term for add-on amplifiers.

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Direct Etch Resist for Printed Circuits

BY BARRY D. BROWN*

ART and photo costs have traditionally forced one-of-a-kind circuits to be hand wired or made on crudely etched printed circuit boards. But now, a new dry transfer etch resist makes it easy to produce close-tolerance single or double-sided boards that are in all respects equal to boards made from large scale art masters.

The new Datamark dry transfer etch resist by Datak is printed in an assortment of accurate 1× scale transistor, IC and connector patterns together with donut pads, lines, curves and circles. Each design is printed with a tough plastic ink that will not break when transferring. The patterns rub directly onto copper and easily withstand strong ammonium persulfate and ferric chloride etches. Besides printed circuit boards, this versatile material can be used to correct film positives and for 1:1 scale art masters.

PCs are particularly easy if they are copied from existing artwork. Typical of these are constructing a circuit from a magazine article or modifying an existing design. On the other hand, if a board is started directly from a schematic, it's wise to do a pencilled full-scale layout as a guide.

To begin, make a 1:1 Xerox or diazo copy of the artwork; interleave it with a sheet of carbon paper and tape it to the cleaned and scoured copper-clad board. Mark very lightly all pad and pattern positions with a center punch. All pads that will be registered with mating pads on the other side of the board should be drilled through with a #60 or smaller drill. Trace over the conductor paths with a pencil or stylus, then remove the artwork copy. Now transfer pads and clusters to the foil by using the punch marks and drill holes as guides. Here are some transfer tips to assure a good solid resist pattern.

1. Keep the copper free of fingerprints, dirt and oil.

2. Accurately place each pattern; tack it down with finger pressure; then rub lightly with a ball point pen. The patterns transfer very easily so don't use excessive pressure.

3. Burnish each pattern down by protecting it with the blue backing paper and rubbing hard with a burnisher or the back of a pocket comb.

Next, the pads are inter-connected by following the carbon tracings with etch-resist tape or dry transfer lines. Remove each carbon line with a Q-tip moistened in thinner before you apply the resist.

Once the knack is acquired, you'll find dry transfer lines are easier to use than tapes—especially on crowded boards. A dry transfer line must not be cut over a pad. Instead, the position of the cut is determined, then the sheet is moved slightly so that the knife will cut over bare copper. Curved lines are made by cutting segments from the nesting circles.

To run taped conductor lines, place your thumb through the core of the tape roll, pull out a short length of tape and tack the end to your starting pad. Keep light tension on the tape roll with one hand and press the trace to the board by sliding a fingertip along its length. Cut the tape over a pad by pulling it up against a sharp knife.

When spacing conductors, the minimum safe distance is:

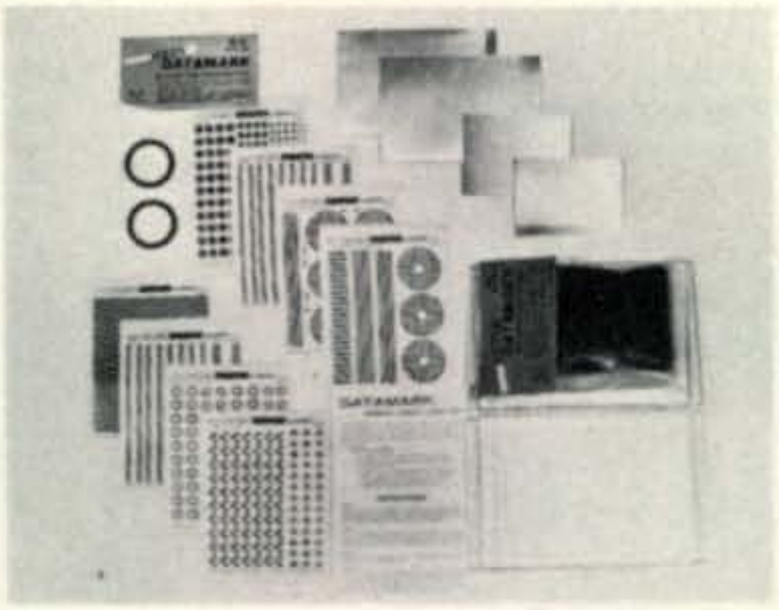
$$D = .025 + .0002V \text{ inches}$$

where V is the peak voltage between conductors. The current handling ability of 1/32″ and 1/16″ conductors is shown in the graph. For XXXP phenolic boards, it's best to limit total temperature (ambient + rise) to 70°C.

After the circuit is complete, the board should be burnished; then inspected for cuts, wrinkles and lifted traces or pads. These should be repaired before etching. Lastly, let the completed board sit in a warm place (80°-100°F) for at least 4 hours before commencing to etch. This allows the adhesive bond to develop its full strength.

[*Text continued on page 39*]

*P.O. Box 192, Sparks, Nevada 89431



The Datak Datamark PC Kit.

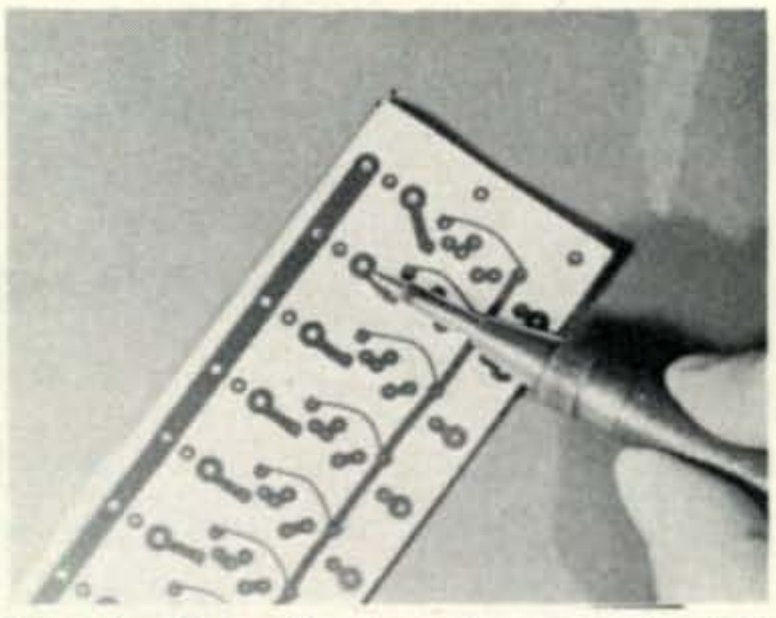


Fig. 1—Transferring layout to PC board.

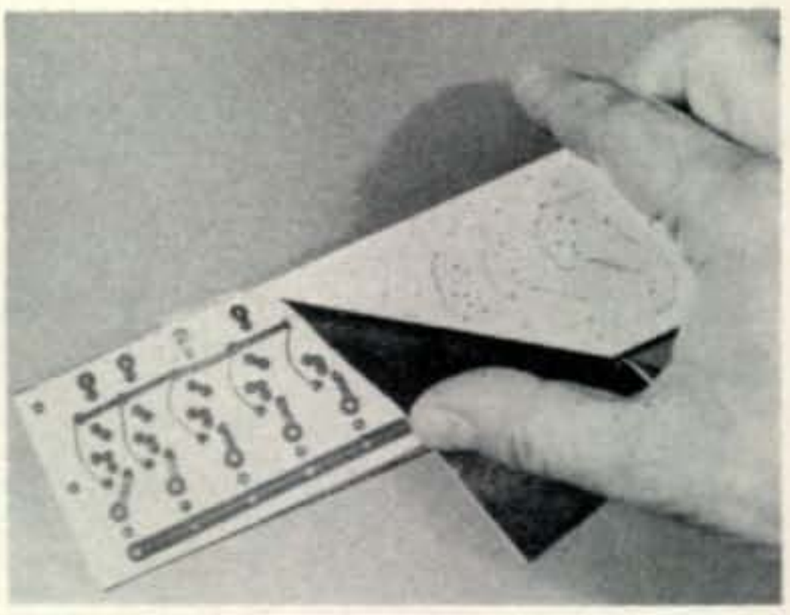


Fig. 2—Punch marks indicate pad centers.

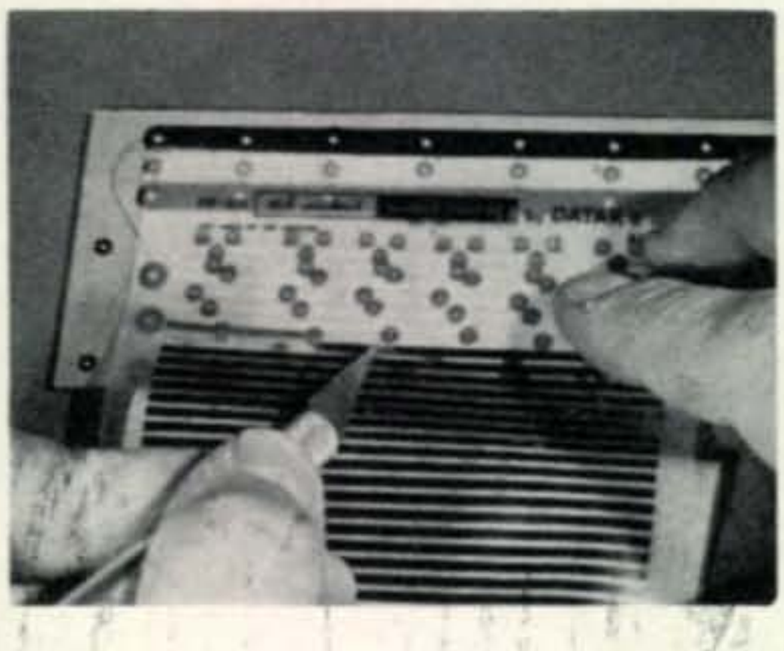


Fig. 3—Cut dry transfer lines over foil, not over pad.

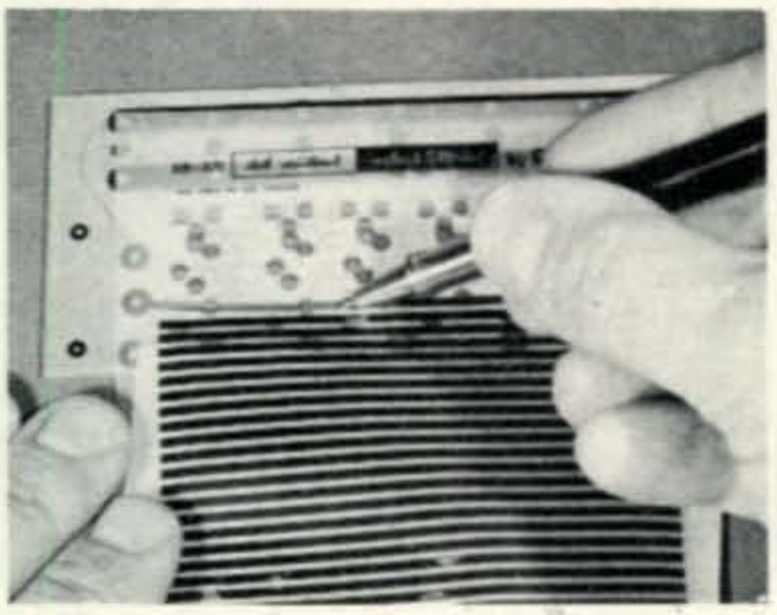


Fig. 4—Transfer the line using blunt stylus.

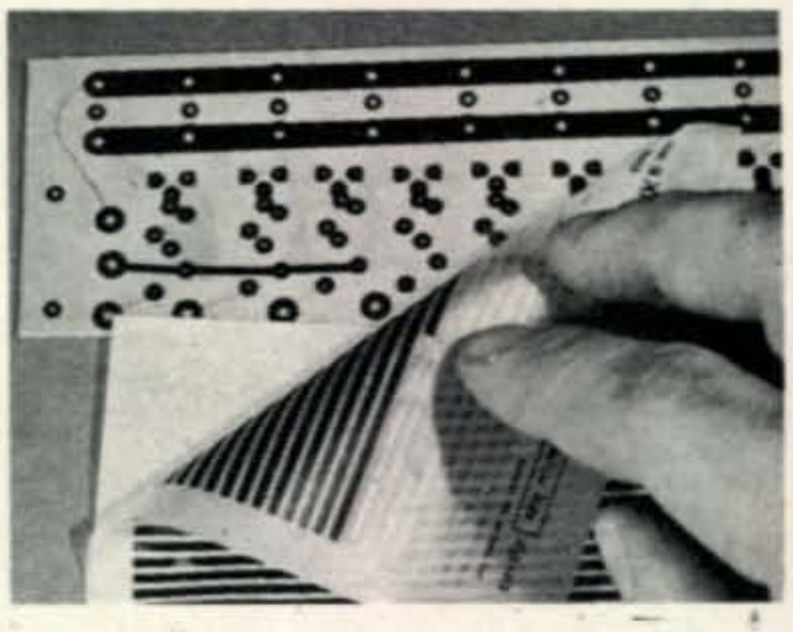


Fig. 5—Correctly located direct transfer line.

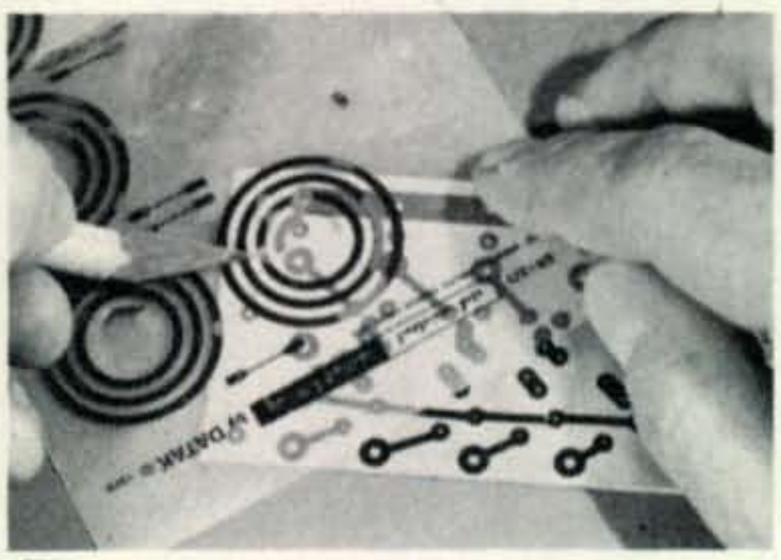


Fig. 6—Curved lines are cut from concentric circles.

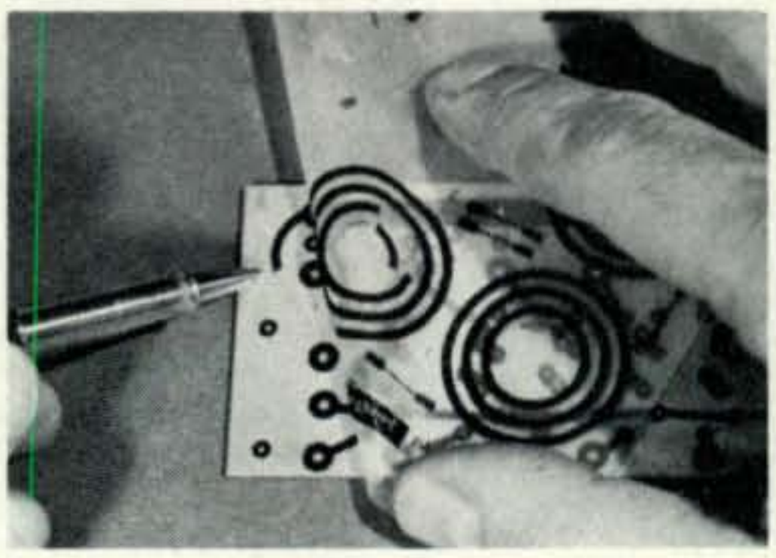


Fig. 7—Curve segement is transferred to board.

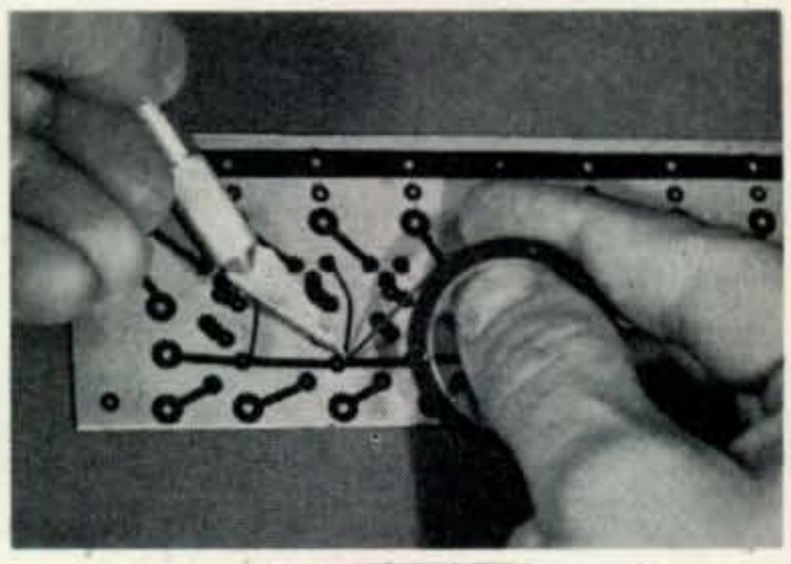


Fig. 8—Applying tape conductor lines for irregular curves.

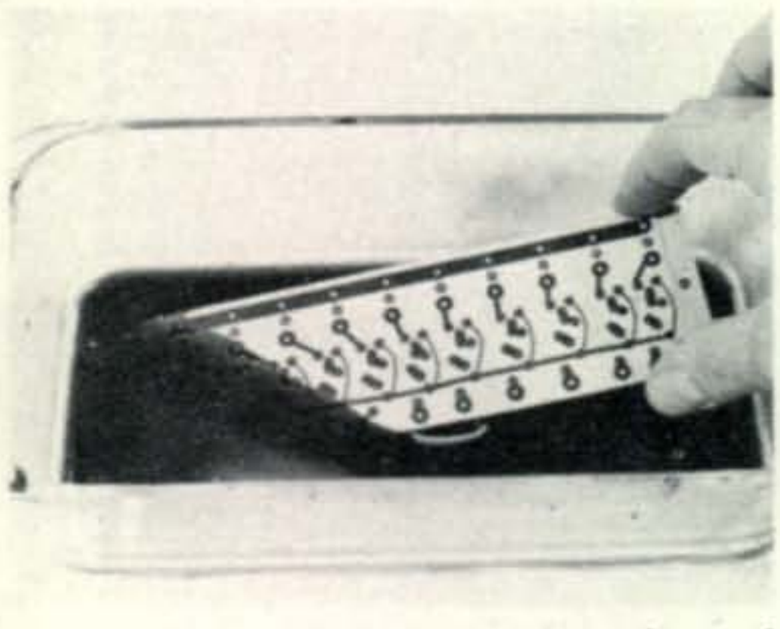


Fig. 9—After 4 hours curing board may be etched.

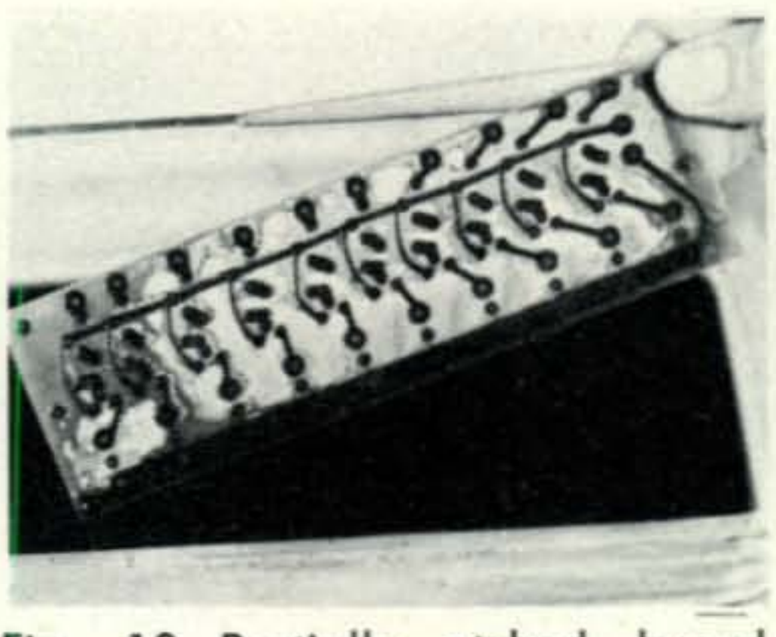


Fig. 10—Partially etched board (after 20 min.).

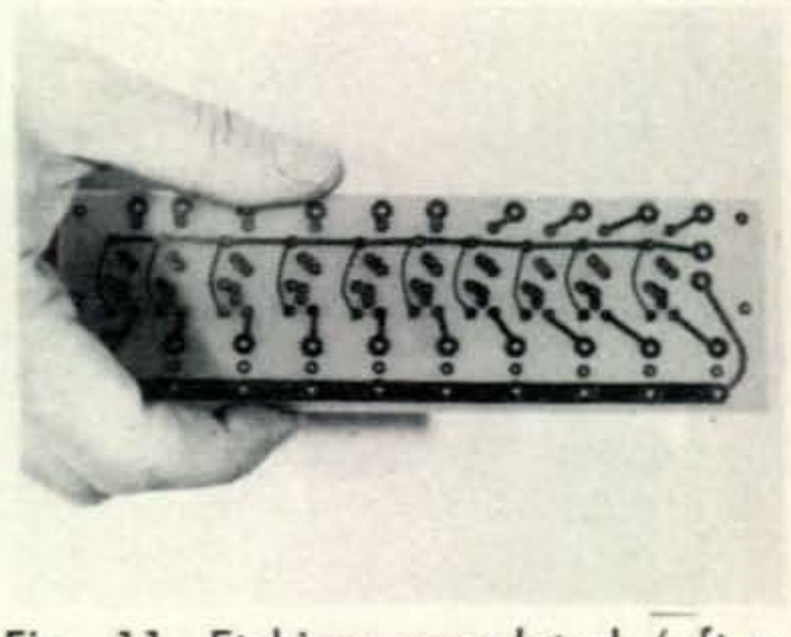


Fig. 11—Etching completed (after 30 min.).

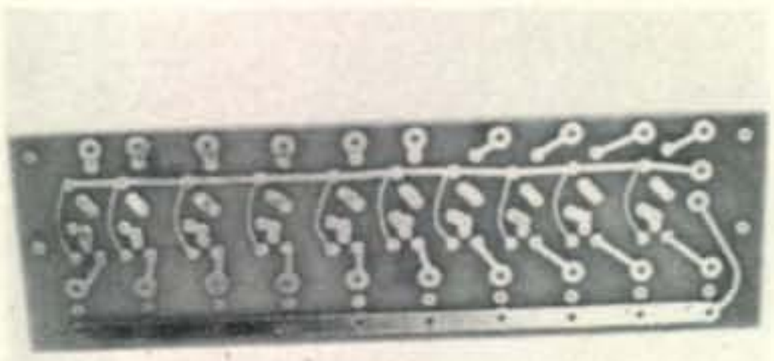


Fig. 12—Resist is removed and board cleaned.

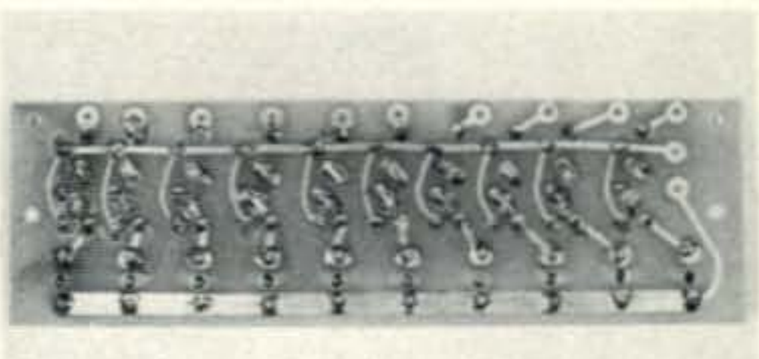


Fig. 13—After drilling holes in pads, components are mounted.

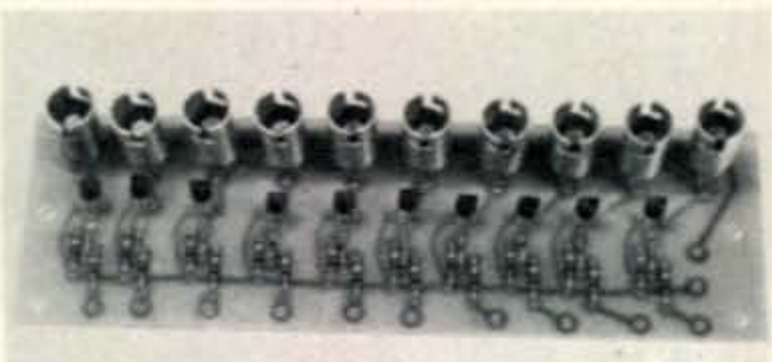


Fig. 14—Completed PC board assembly is neat and professional.

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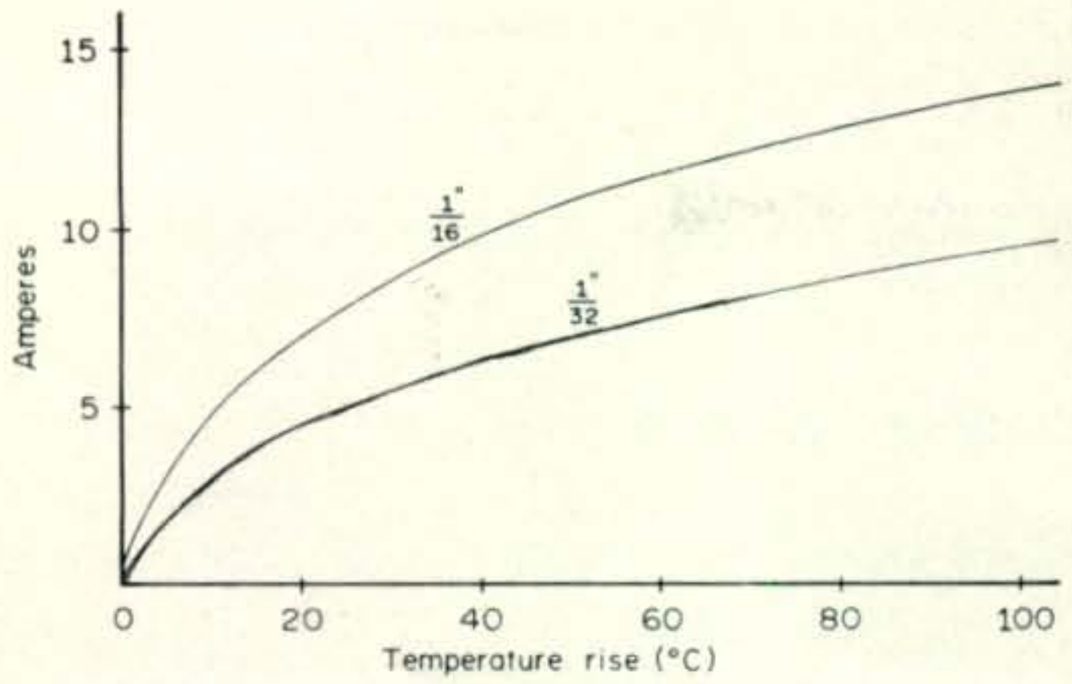


Fig. 15—Temperature vs. current curves for 2 ounce PC board conductors.

The etch bath used must be capable of removing all exposed copper within 25 to 30 minutes. If a board must be etched for a longer period, the water in the bath will start dissolving the resist adhesive. This will eventually cause the resist to float off the board. Many etch solutions available through electronic distributors are too slow, however most industrial spray and tank systems etch perfect boards. Datamark Dry Etch is available from distributors and will give excellent results. If you are at all doubtful about an etchant, try a test board first.

The Dry Etch solution contains anhydrous ferric chloride. It liberates heat when mixed with water and it attacks most metals, including many grades of stainless steel. When handling it, use glass, hard rubber or plastic containers and SLOWLY add the chemical to the water while stirring constantly.

Etch time is a function of temperature and agitation. A two ounce copper-clad board will be completely etched in 20 to 30 minutes if the etch is maintained at 125°F and the tray is continuously rocked. Without agitation, the same board can take 45 minutes to two hours. It's difficult to maintain the bath at 125°F while etching. The safest way we've found is to place the etch tank in a large tray or sink filled with hot (about 140°F) water. We use an 11×14 photo tray for the water bath and a Pyrex loaf pan for the etch tank.

The accompanying photos show the etching sequence and the completed circuit board. Agitating the tray causes turbulence of the etch around the edges of the board and the taped lines, so these areas etch out first. After etching is complete, the resist is peeled off with a razor blade, the copper is cleaned up with scouring powder and the board is ready to be drilled and loaded. ■

Summer Launch Planned For OSCAR-6

BY GEORGE JACOBS,* W3ASK

THE launch date for the next amateur satellite is rapidly approaching. It is scheduled to ride into space as a secondary payload on the ITOS-D weather satellite mission. If all goes according to plan, the launch should take place during late June or early July, although the date is subject to slippage.

According to the Radio Amateur Satellite Corporation (AMSAT)[1], the AMSAT-OSCAR-C (A-O-C) package will make up what will be called OSCAR-6 after it is successfully operating in space. The latest OSCAR will be a communications satellite, which will enable radio amateurs transmitting in the amateur two meter band to communicate with each other over distances as great as 4500 miles. This will be the third communications satellite in the OSCAR series; OSCAR-3 and OSCAR-4 previously permitted amateur communications to take place through them.

AMSAT reports that its A-O-B package, consisting of an Australian-built 145-to-435 mHz repeater and a German-built 435-to-145 mHz repeater *will not* be ready in time for the OSCAR-6 launch, but will be readied for future OSCAR missions.

A-O-C Package

The AMSAT-OSCAR-C package contains a 1.3-watt, two-to-ten meter linear repeater capable of receiving signals from radio amateur stations on the ground transmitting in the two meter band, between 145.9 and 146.0 mHz. The signals are then retransmitted from the satellite between 29.45 and 29.55 mHz in the ten meter band. Once in orbit, OSCAR-6 will be solar-powered, and it is expected to have an operating life of at least a year. The repeater has been tested successfully aboard separate aircraft flights over both the east and west coasts.

A 0.2-watt beacon will also operate on 29.45 mHz. The beacon will be keyed with 24 channels of telemetry data sent one channel at a time as three-digit numbers in Morse Code (A-1 emission). This will be the first time that Morse Code telemetry will be used with an OSCAR satellite, and it will enable stations on the ground to receive and decode the data with little more than a receiver capable of receiving c.w. signals in the ten meter band. Appropriate calibration information to be used with the telemetry signals will appear in next month's issue of *CQ*. The telemetry system will keep tabs on two dozen key operational and life characteristics of the satellite.

For identification purposes, the letters "HI" will be transmitted in Morse Code (. . . . . ..) at the beginning of each frame of telemetry data. These same letters have been used as an international call sign for each of the five OSCAR satellites launched previously.

Something else new aboard OSCAR-6 will be a Morse Code message storage unit. This unit will be capable of storing messages in Morse Code sent upon command. This system is called CODESTORE, and the messages will be retransmitted back to earth alternately with the telemetry transmissions. In this way, it is planned to keep amateur stations on the ground informed of orbital and operating data concerning the satellite, through messages transmitted directly from the satellite.

The satellite will be placed in an orbit similar to the one experienced with OSCAR-5. It is expected to circle the earth at an altitude of approximately 900 miles, will be inclined 102 degrees to the equator (which is equivalent to 12 degrees west of north), and will complete an orbit every 115 minutes.

The satellite's operation and messages to CODESTORE will be controlled from the ground by selected amateur stations.

A basic block diagram of the A-O-C, or OSCAR-6 two-to-ten meter repeater is shown in fig. 1.

---

*Space Communications Editor, *CQ*, 11307 Clara St., Silver Spring, Md. 20902

[1]AMSAT is a non-profit, scientific corporation dedicated to the development of radio amateur satellite communications. Participation and membership is open to all radio amateurs and other interested persons. For additional information write directly to AMSAT, P.O. Box 27, Washington, D.C. 20044.

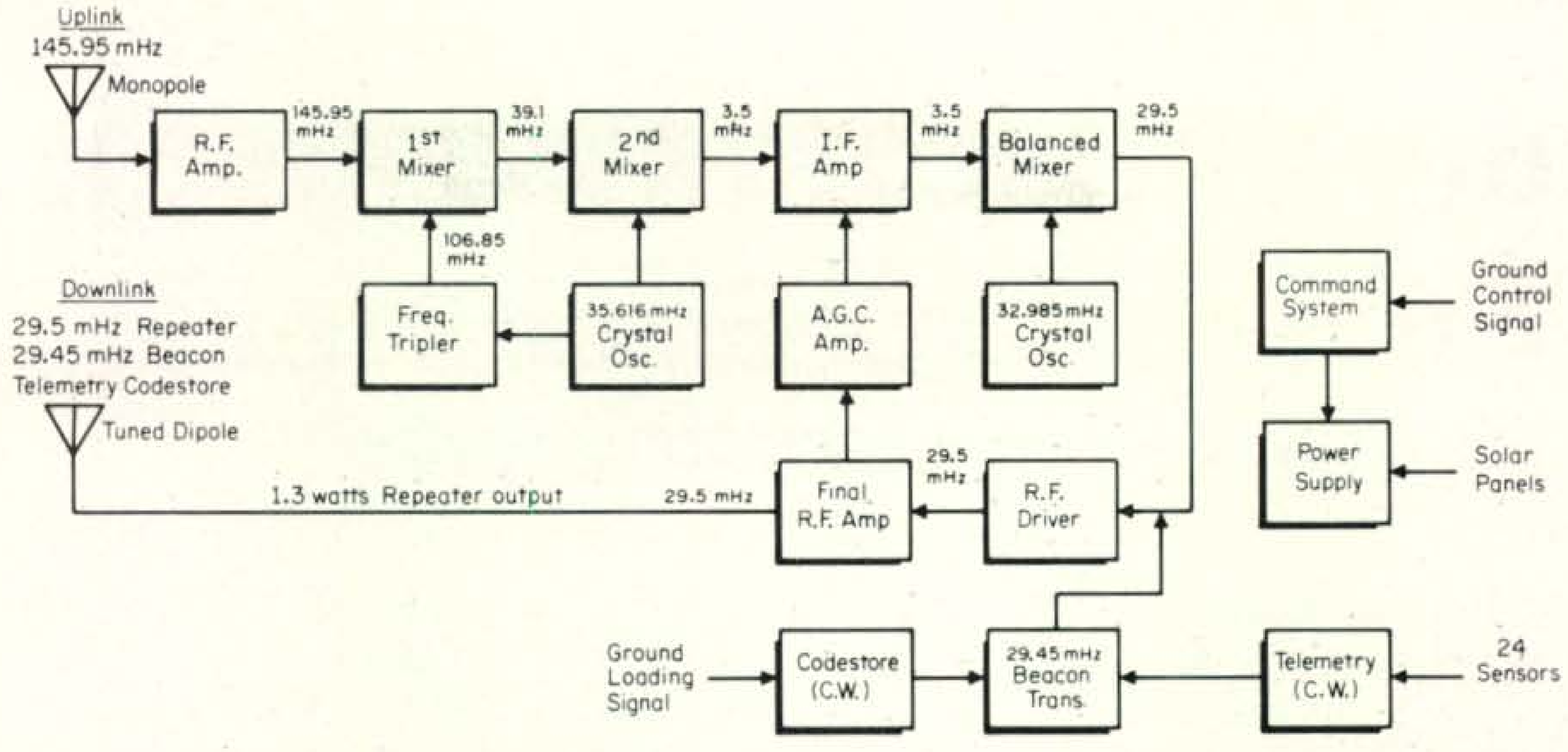


Fig. 1—Basic block diagram of the OSCAR-6 two-to-ten meter linear repeater.

What It Takes To Work Through The Satellite

OSCAR-6's launch is still at least a month away. This is being written to alert stations interested in communicating through the satellite to get their equipment ready. A feature article planned for next month's issue of *CQ* will contain more detailed information about the satellite.

Two meter transmission and ten meter reception equipment will be required to communicate through OSCAR-6. AMSAT suggests that for best results s.s.b. or c.w. should be used, since flyover tests demonstrated that a.m. and f.m. signals are sometimes not very readable through the repeater. If a two meter transmitter is not available, a *transverter* can be used to convert the output of a ten, twenty or six meter s.s.b. or c.w. transmitter to two meters. Transverters of this type are available from several amateur radio equipment manufacturers. They also have the added advantage of providing a v.f.o. capability if the basic transmitter already has a v.f.o.

According to AMSAT calculations, it will require approximately 100 watts, *effective radiated power* (e.r.p.) for a ground station to provide a strong enough signal to enter the space-borne repeater. Effective radiated power is defined as the r.f. power *output* of a transmitter (in watts), multiplied by the gain of the antenna (compared to a dipole), along the path between the ground station and the satellite.

High gain, fully rotatable antennas capable of tracking the satellite and a transmitter running the legal power limit will, of course, assure communications through the satellite. However, such elaborate facilities *are not* required and *are not desirable,* since they could very easily overload and capture the repeater. AMSAT, for example, recommends a simple installations consisting of a 100 watt (power output) transmitter working into a dipole or ground plane antenna. This will provide more than the required e.r.p. and pointing the antenna at the satellite would not be necessary.

The satellite's antennas will be linearly polarized; a monopole will be used for reception on two meters and a tuned dipole for transmission on ten meters. While linearly polarized antennas can be used by ground stations to communicate through the satellite, to avoid Faraday fading circularly polarized (either left or right handed) transmitting and receiving antennas are recommended. Crossed dipoles should be adequate for this purpose in most situations.

Just about any h.f. receiver capable of receiving s.s.b. and c.w. on the ten meter band should be suitable for receiving the ten meter downlink signals.

The use of transceivers is **not** recommended. Separate transmitting and receiving equipment should be used because it is highly desirable that stations be able to monitor their own down-link signals while transmitting.

Novices and Technicians Can Participate

The Federal Communications Commission has notified AMSAT that certain regulations will be waived as they apply to OSCAR-6,

[*Continued on page 84*]

CQ Reviews:

The Allied Radio Shack Series 190 Receivers

BY WILFRED M. SCHERER,* W2AEF

ALLIED Radio Shack has recently introduced two dandy low-cost solid-state receivers that embody some of the finest Japanese craftsmanship we've run across. There are two models.

The AX-190 is primarily an amateur-band receiver providing full coverage of the 3.5-28 mHz amateur bands, the 15.0-15.5 mHz s.w. band for WWV, the 27 mHz Citizen's Band, with the addition of an auxiliary spare position for use in any one 500 kHz segment between 3.5 and 10 mHz.

The SX-190 is primarily an s.w.l. shortwave broadcast band receiver covering the s.w. bands of 5.7, 7.0, 9.5, 11.5, 15 and 17.5 mHz plus the Citizen's Band and the 3.5 and 14 mHz amateur bands (7 mHz band is included in the s.w. BC range). In addition, there are two auxiliary spare positions one for use between 3.5-10 mHz, the other for between 10-30 mHz.

Except for the different bands, both models are otherwise identical, with the following features: a.m., s.s.b. (u.s.b. or l.s.b.), c.w. reception; 4 kHz selectivity, Q-Multiplier for peaking or rejection-notch; r.f. preselection tuning; linear frequency-tuning rate with calibration in 1 kHz increments over a 500 kHz segment for each band; 100/25 kHz crystal-controlled calibrator; S-meter; a.g.c.; a.m. noise limiter; r.f. and a.f. gain controls; v.f.o. and h.f.o. outputs; line/tape-recorder output; separate headphone and speaker jacks; operation from a 117 v.a.c. or 12 v.d.c. power source with built-in facilities.

*Technical Director, *CQ*.

The Allied Radio Shack AX-190 amateur-band receiver. Except for the different bands, the Model SX-190 s.w. broadcast-band version is identical.

Technical Data

The receivers have a complement of 4 FET's, 22 bipolar transistors, 13 diodes plus 2 zener diodes and 2 thermistors. Referring to the block diagram at fig. 1, double conversion is employed with a variable 1st i.f. of 2420-2920 kHz and a fixed 2nd i.f. of 455 kHz.

Referring to fig. 2, the r.f.-input amplifier is rather unique. It consists of two FET's in a cascode configuration using three individual r.f. circuits for preselector-tuning. Two of these circuits are at the input of the r.f. stage where they are coupled to each other through a resistive attenuator consisting simply of a potentiometer. The third tuned circuit is at the output of the r.f. stage. Use of the three circuits, instead of the customary total of two, ensures better r.f. preselection for higher image- and i.f.-signal rejection as well as that of other unwanted input signals.

Extremely sharp preselector tuning is had with image rejection on the AX-190 measured as 90, 78, 74, 60, 50 db and i.f.-signal rejection as 50, 70, 90, 105, 100 db on the 3.5, 7, 14, 21 and 28 mHz bands respeciively. Similar results were also obtained on the nearest related s.w. bands with the SX-190.

I.f.-signal rejection (of the 1st i.f.) is further enhanced by a bandpass filter at the antenna input. The preselector has two ranges, one is 3.5-10 mHz, the other is 10-30 mHz. The preselector dial calibration is exceptionally accurate accordingly.

Another novel arrangement at the r.f.

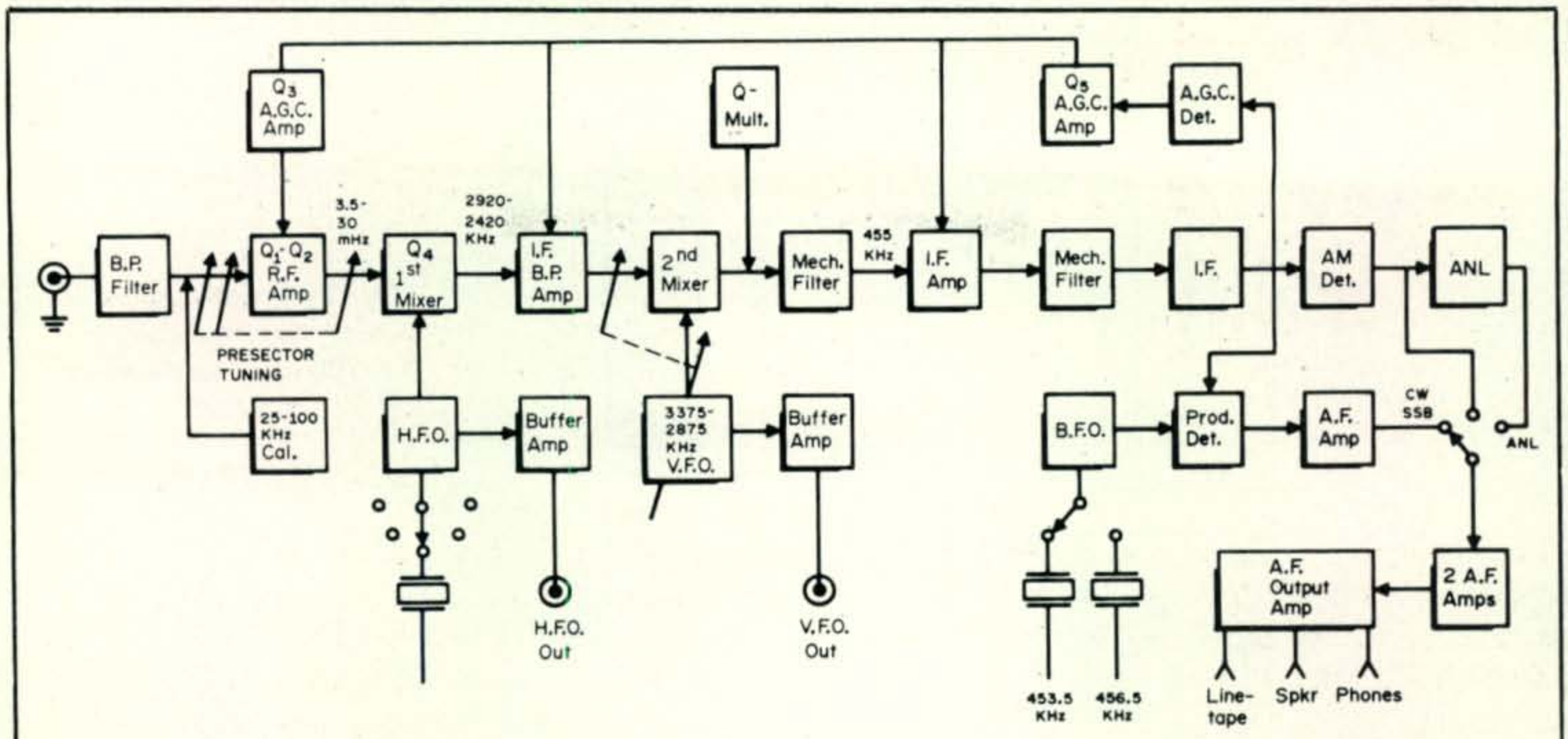


Fig. 1—Block diagram for the AX-190 and SX-190 receivers. Details are given in the text.

stage is the r.f. gain and the a.g.c. setup. The a.g.c. is obtained from voltage doubling diodes at the last i.f. stage. The rectified r.f. is then applied to a transistor d.c. amplifier at the collector of which is obtained the a.g.c. potential from the arm of control R_2 which is ganged with the arm of R_1. The a.g.c. potential is applied to the base of transistor Q_3 the collector/emitter junction of which is in series with the source resistor of the first FET (Q_1).

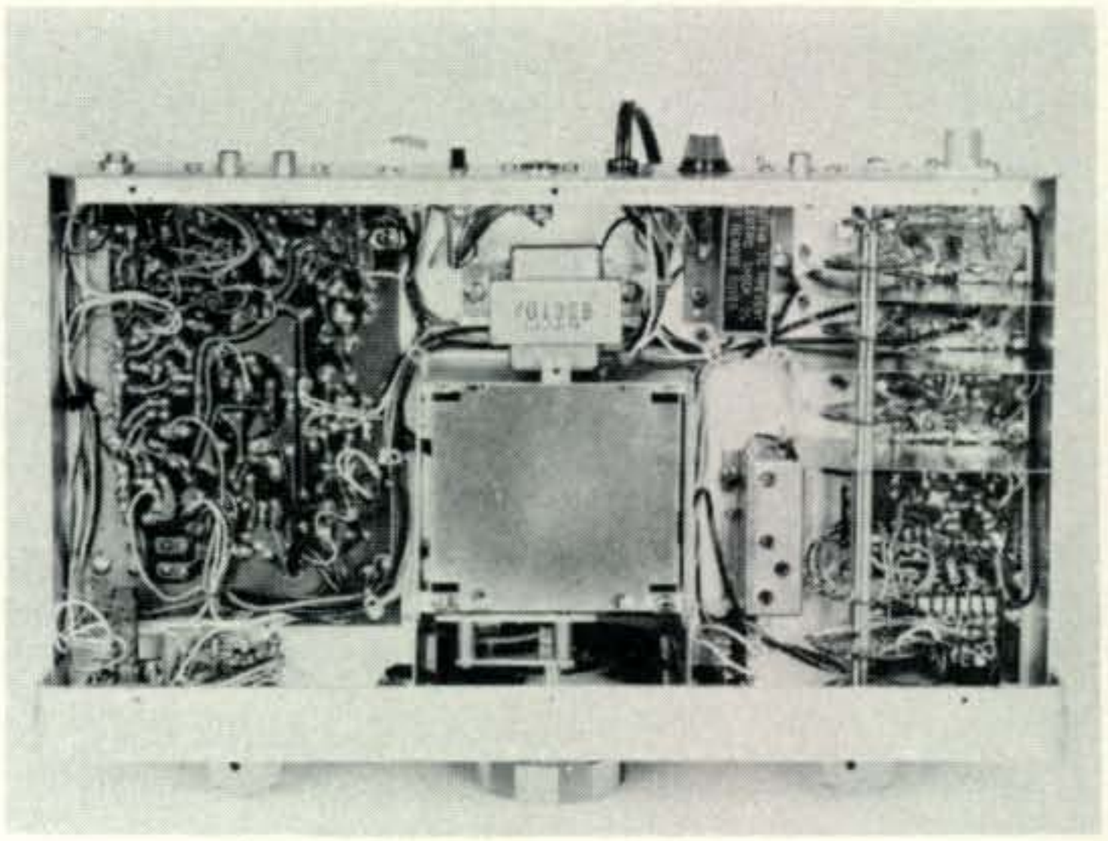
Changes in the a.g.c. potential applied to Q_5 then cause its collector/emitter resistance to vary accordingly and since this resistance is in the source circuit of the FET, the gain of the latter similarly follows the a.g.c. changes.

For reducing the r.f. gain, R_2 is rotated toward the ground end. The fixed bias (from Q_5 collector) applied to Q_3 then changes, reducing the bias on the FET and thus its gain. At the same time, R_1 rotates toward its ground end, reducing the coupling between the first two tuned circuits.

A.g.c., also applied to the 2nd mixer and the 1st 455 kHz i.f. stage, is handled in the conventional manner.

The S-meter responds instantaneously, since it is located at the emitter of the a.g.c. d.c. amplifier where the time constants of the a.g.c., which are located at the output of the amplifier, have no effect on the operation of the meter. The a.g.c. attack is exceptionally fast without any evidence of distortion or harshness on the attack with s.s.b. signals. The release time, however, is a bit fast for s.s.b. use and there are some pumping effects when background noise is present. The a.g.c. characteristics otherwise are such as to hold the a.f. output level within 12 db with r.f. input changes of 100 db (1-100,000 μv).

The 1st mixer is an FET with the r.f. signal applied to the gate, the heterodyning-oscillator signal to the source. The oscillator is crystal-controlled using a bipolar transistor. The crystal frequencies are equal to 2.920 mHz plus the frequency of the low end of the desired r.f.-signal range. For crystals below 17.920 mHz the oscillator is tuned to the fundamental frequency; for higher-frequency crystals it is tuned to the 3rd overtone. An emitter-follower buffer amplifier, after the



Bottom view of the AX-190. The lower part of the box for the v.f.o. is at the center.

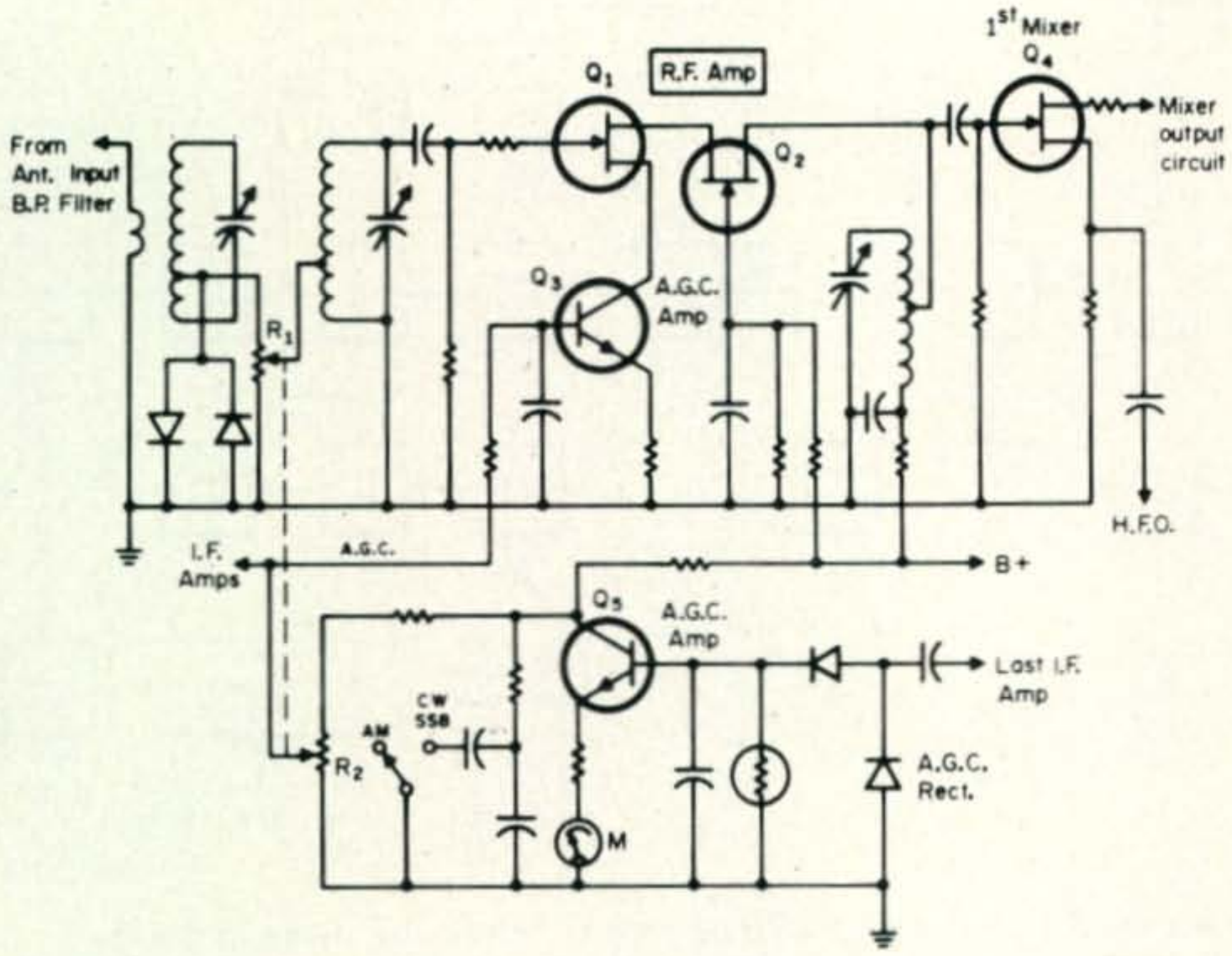


Fig. 2—Front-end and a.g.c. circuitry of the AX-190 as described in the text.

crystal oscillator, feeds an h.f.o.-output jack on the rear of the set.

A 2920-2420 kHz amplifier precedes the second mixer. It has a fixed bandpass circuit along with a tunable bandpass-coupled circuit ganged with the v.f.o.-tuning control. The 2nd mixer is a bipolar transistor with both the r.f. and v.f.o. signals fed to the base.

The v.f.o. functions from 3375 to 2875 mHz and employs an FET with a tuned-gate circuit. Output is taken from the drain. As with the h.f.o., an emitter-follower buffer feeds a v.f.o.-output jack.

There are two 455 kHz i.f. stages each with an individual mechanical filter at its base input. Two other transistors at the i.f. input make up the Q-multiplier.

A diode envelope detector for a.m. feeds a series-gate noise limiter. The s.s.b./c.w. product detector is a four-diode ring type feeding an additional amplifier ahead of the normal a.f. amplifying chain which ends up with an n.p.n. and p.n.p. transistor in a Darlington configuration with individual output jacks for speaker or headphone use. The "undistorted" a.f. output with this set-up measured 0.5 watts at 300 Hz and 0.75 watts at kHz.

The b.f.o. is crystal-controlled with either a 453.5 or a 456.5 kHz crystal switched in for u.s.b. or l.s.b. operation as the need requires. The 3 kHz change is not compensated at the v.f.o., so the receiver must be retuned 3 kHz when sidebands are changed. The 455 kHz i.f. section has a passband of 4 kHz at 6 db down and since the b.f.o. crystals are only 3 kHz apart in frequency, the reinserted carrier then falls within the i.f. passband near the side of the selectivity curve required for u.s.b. or l.s.b. selection as the case may be. This spot is hardly down the selectivity curve, with the result that the unwanted-sideband suppression at 1 kHz is only 12 db.

The Q-multiplier peaking position is somewhat broader than usually experienced, but it can be used to improve the sideband suppression to 16 db without deteriorating the intelligibility of an s.s.b. signal as otherwise would result in too sharp a peaking characteristic. The Q-multiplier rejection position provides a 20 db notch, but the rejection curve is quite broad and thus lowers much of the desired passband by 10-14 db.

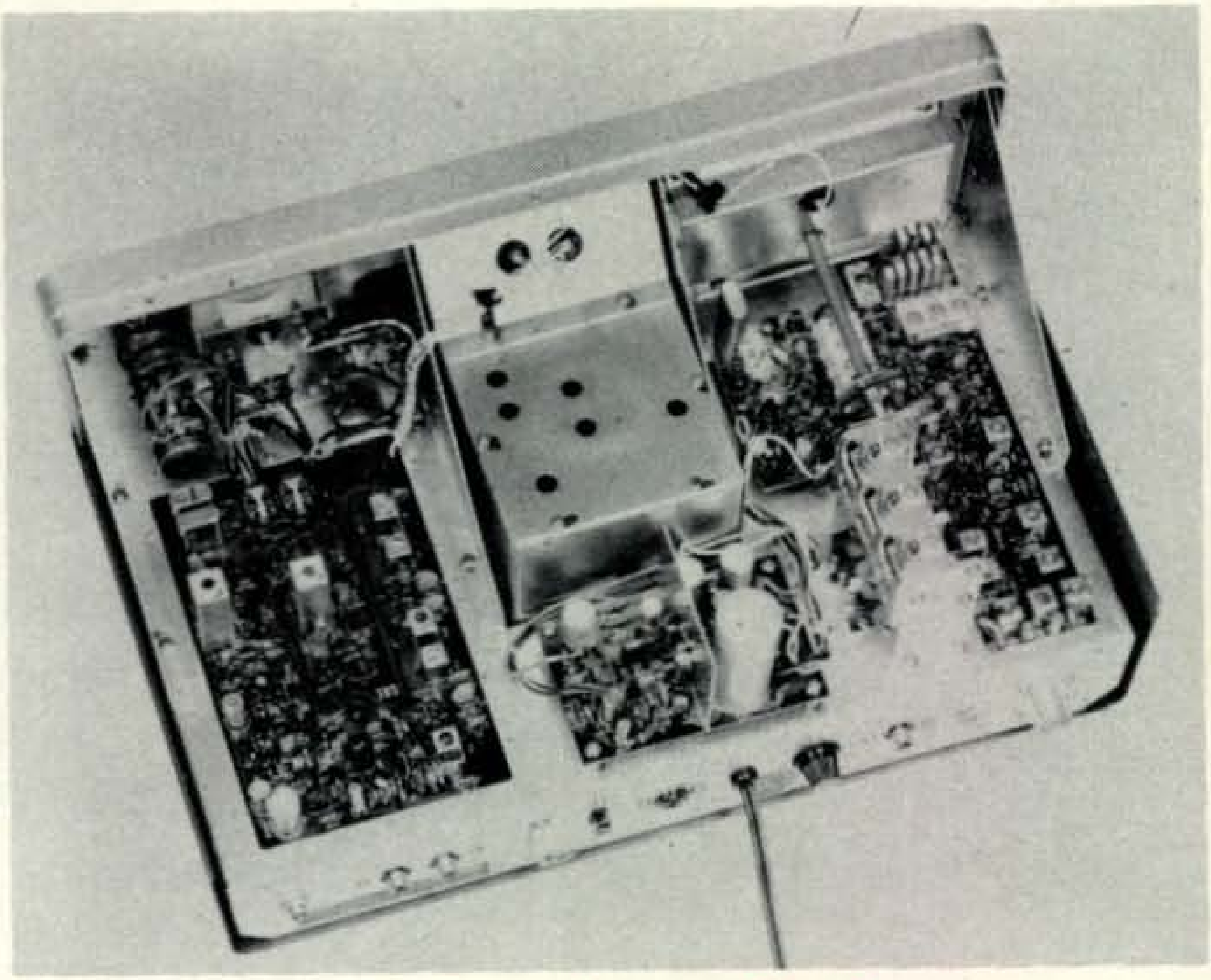
The calibrator employs a 100 kHz crystal oscillator that drives an amplifier which is coupled to the antenna input to provide marker signals at 100 kHz intervals. For 25 kHz signals, a multivibrator is switched in between the oscillator and the amplifier.

The a.c.-operated power supply employs silicon diodes in a full-wave rectifier followed by a transistorized voltage-regulating setup. For operation from a 12 v.d.c. source, the input of the regulator is switched from the rectifier output to a d.c.-input connector. Overload protection is provided by a 1 a. fuse at the regulator input.

Construction

The 190 receivers are built using several

Top view of the AX-190 receiver. The v.f.o. and variable-i.f. bandpass tuning circuits are in the box at the center. In the center foreground is a board with the a.f. section and power-supply components. At the right of the v.f.o. is the calibrator board. The r.f.-circuit board is at the right with the h.f.o. crystals at the upper-right corner. The three-gang preselector-tuning capacitor is at the left of the board. The i.f., b.f.o. and detector sections are on the board at the left. Brackets at each end of the panel and at each side of the v.f.o. box provide firm bracing to the chassis.



individual printed-circuit boards for various sectons of the set. Resistors and capacitors are identified on the boards by value, while other components are designated by schematic number, facilitating circuit tracing should servicing become necessary. This also may be aided by following the circuit runs which are indicated in black on the component side of the boards.

The boards are installed on a heavy-metal chassis with a satinized aluminum-finish panel and knobs. Pushbuttons are engaged for power on-off and the calibrator operation. Quite a few brackets between the panel and the chassis provide bracing that gives exceptional sturdiness to the whole setup.

A large black escutcheon is behind the tuning control dial and runs across the top of the panel where it has a full-length elongated window behind which are the S-meter, a calibrated dial for the preselector and the maintaining dial for the receiver frequency. The latter is a circular one calibrated in 10 kHz steps. The tuning control has a dial calibrated in 1 kHz steps spaced 3/16" apart over a 50 kHz range for one revolution. This dial can be slipped on its shaft for indexing to the calibrator signals. A finger hole is provided on the face of the tuning knob to make rapid excursions over the range easily possible.

The phone jack is on the panel, the speaker jack is at the rear. Terminals for remote standby control also are at the rear along with phono jacks for line/tape and oscillator outputs. The receiver is housed in a dark gray wrap-around type case consisting of top and bottom half-shells.

Operation and Performance

The receivers are nice looking jobs with a solid feel to them. There is no flimsiness about them as often experienced with some of the low-cost Japanese-built gear. The tuning is quite nice; however, the finger hole in the tuning-control knob might have been made deeper to prevent one's finger from slipping out of it during fast tuning.

A mode switch selects a.m., a.m. with a.n.l., l.s.b. or u.s.b. (s.s.b./c.w.). Since when sidebands are switched the receiver must be retuned 3 kHz, there are three individual hairlines at the dial fiducial for keeping track of the receiver calibration in each mode of operation. The reference line for a.m. is at the center, to the left and right of which are those for u.s.b. and l.s.b. respectively.

Besides some of the statistics and the performance comments already mentioned in the text, others are as follows:

The sensitivity of the receivers measured an average of 0.25 μv for 10 db S+N/N on s.s.b. and c.w. and of 0.5 μv on a.m. Band-to-band gain, referred to 14 mc, was +4, +13, +5, +1 on the 3.5, 7, 21 and 28 mHz bands. An average of 100 μv was required for an S9 meter reading on all bands. Signal-handling capabilities (cross modulation, r.f. intermodulation, overload, etc.) were somewhat better than jobs using bipolar transistors, but not up to the more sophisticated ones using FET's.

Care must be taken to set the preselector at the proper point; otherwise, signals at other spots may be tuned in which are different-

[*Continued on page 84*]

Noise and Noise Generators

Part I

BY JOHN J. NAGLE,* K4KJ

The subject of noise in receivers has received scattered coverage in the amateur publications over the years, but more often than not, such coverage has been limited to a single approach to noise measurements or the construction of a specific instrument. The following article begins a comprehensive discussion of receiver noise and its measurement, and the design of noise generators.

ONE of the most informative single measurements that can be made on a v.h.f. or u.h.f. receiver is its noise figure. Fortunately, the equipment needed to make meaningful noise figure measurements is relatively simple. This article will discuss some of the various forms that a noise generator can take and the design considerations for a practical noise generator needed to measure receiver noise figures into the u.h.f. region. This equipment can be designed in a relatively simple and straight-forward manner.

Noise is the limiting factor to weak signal reception. By noise we refer to natural noise such as the random motion of electrons in a conductor or semi-conductor or the shot effect in vacuum tubes.

The motion of electrons in a conductor is not uniform but fluctuates in a random manner; if enough amplification and bandwidth are available, this random motion becomes discernible and is called noise because of the way it sounds in a loud speaker or headphones. Similarly, the emission of electrons from the cathode of a vacuum tube is random and generates noise. Transistors and other active devices also generate noise. In a well-designed receiver, the tubes or transistors in the first r.f. amplifier will be the principal contributor of this type of noise. The important thing to remember is that this type of noise can never be eliminated, only minimized. There is a theoretical minimum below which it is physically impossible to reduce the noise power generated in any circuit. If development effort is not to be wasted, a receiver designer must know how close he is to the theoretical limit in relation to his specifications. As one approaches the theoretical limit, the law of diminishing returns applies and a greater expenditure of time and effort is necessary to obtain a reduction in the system noise output.

Our definition of noise specifically excludes man-made noise such as that caused by fluorescent lights, home appliances, leaky power line insulators, and similar devices. These noise sources can be completely eliminated in theory and usually in practice.

Two other types of noise which should be mentioned are atmospheric and galactic noise. These are natural noises that are picked up by the antenna along with the desired signal. A good example of atmospheric noise is static. Above about 50 mHz static becomes inconsequential and galactic noise predominates. At frequencies below about 30 mHz atmospheric noise is so great that it usually over-rides the receiver noise, except in the worst receivers.

For frequencies above about 30 mHz therefore—v.h.f. and above—the noise originating in the receiver is usually the most significant. It is this receiver noise over which the receiver designer has the most control and for which he needs a noise generator to adjust the receiver for a minimum noise figure.

The noise performance of a receiver is usually specified in terms of its noise factor or noise figure. The noise factor may be described as follows: The r.f. input to the receiver consists of the desired signal energy

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plus a certain amount of noise energy. The ratio of these two energies is the input signal-to-noise ratio, S_i/N_i. If the receiver were perfect and generated no noise of its own, the input signal and noise would both be amplified by the same amount so that the *ratio* of the desired signal energy to noise energy at the output of the receiver, S_o/N_o would be the same as the input. No receiver, however, is perfect; any practical receiver will generate some internal noise of its own. This receiver noise is added to the input noise so that the output signal-to-noise ratio will be less than the input signal-to-noise ratio. The more noise that is generated internally within the receiver, the lower will be the output signal-to-noise ratio, as compared to the input signal-to-noise ratio. The *ratio* of the input signal-to-noise ratio to the output signal-to-noise ratio is therefore a measure of the generated noise within the receiver and is called the noise factor. Mathematically,

$$\text{Noise factor} = \frac{S_i/N_i}{S_o/N_o}$$

From the above discussion, it can be seen that a perfect receiver—one that generated no internal noise—would have a noise factor of unity since the output signal-to-noise ratio would be equal to the input signal-to-noise ratio. It can also be seen that the more noise there is generated within the receiver, the higher will be its noise factor. The objective in receiver design therefore is to have a noise factor that approaches unity as closely as economically possible.

So far we have discussed noise factor. In the technical literature, one is more likely to see the term noise figure. The noise figure of a receiver is just the noise factor expressed in decibels (db). Thus noise figure is given by

$$\overline{\text{NF}}\ (\text{db}) = 10 \log_{10} (\text{noise factor})$$

A perfect receiver therefore has a noise figure of zero db and a receiver with a noise factor of two has a noise figure of 3 db.

The signal-to-noise ratio at the output of the receiver determines the weakest usable signal that can be received; any reduction in the internally generated noise will increase the sensitivity of the receiver. The noise generator, through its ability to enable one to measure the receiver noise factor, will aid the receiver designer in adjusting the receiver so that it adds the lowest possible noise to the output signal.

Methods of Measuring Noise Figures

Perhaps the most direct method of determining the noise figure of a receiver would be to measure the noise power output of the receiver with the receiver input terminated in a resistor equal to the receiver input resistance at room temperature. If the receiver were perfect, its output noise power would be due entirely to the noise generated by this resistance. The actual receiver output noise power is then compared with the theoretical noise power output of an ideal receiver (one that did not generate any noise) with the same gain and *noise* bandwidth. The noise figure is the ratio of these two powers expressed in db. The difficulty with this procedure is that it requires an accurate knowledge of the receiver gain and *noise* bandwidth. The gain is not too difficult to determine with relatively simple equipment; the noise bandwidth, however, is more difficult to evaluate since in general it will not be the same as the 3 db bandwidth but will depend on the shape of the receiver overall frequency response curve.

Knowledge of the receiver gain or noise bandwidth is not required if two resistors are used, each at a different temperature. If the receiver under test were ideal, changing its input from the cold resistor to the hot resistor would change its noise power output by the ratio of the hot temperature to the cold temperature.

One commercially available noise generator based on this principle uses the two temperatures, 77.3°K (the boiling point of liquid nitrogen) and 373.2°K (100°C, the boiling point of water). The change in noise power output is thus 373.2/77.3=4.83 or 6.8 db. (It should be remembered that the noise power output of a resistor is proportional to its absolute temperature.)

Since the receiver contributes noise of its own, the increase in noise power will be less than 6.8 db. By taking the actual ratio and applying an involved, but not too difficult, mathematical equation the receiver noise figure can be obtained. Since the noise power output depends only on temperature and not upon any active elements, generators of this type can be used for standardizing other types of noise generators.

The disadvantage of using resistors are that the noise power output can not be conveniently varied and it is not practical to

[*Continued on page 81*]

1972 Armed Forces Day Communication Tests Announced

THE radio amateur operators' contributions to the field of communications, assistance in promoting international goodwill and military morale and providing emergency services, are recognized by every echelon of the military services. Each year, on the third Saturday in May, the Department of Defense sponsors the observance of Armed Forces Day. This year's observance, the twenty-third, will be held on Saturday, May 20, 1972. As in past years, as one of the many Armed Forces Day Programs, the Departments of the Army, Navy and Air Force will conduct radio communication tests. These tests are designed to be a tangible demonstration of the firm and long-standing Department of Defense policy to encourage and support amateur radio activity and the partnership and mutual respect enjoyed between the US amateur and the US military.

The communication tests will consist of military-to-amateur crossband operations, using c.w., voice (s.s.b.) and radioteletype (RTTY) modes of operation and c.w. and RTTY receiving tests. Special QSL cards confirming crossband communications will be forwarded to those amateurs who establish two-way contact with participating military stations. Certificates will be awarded to those who aptly demonstrate their operating ability and technical skill by receiving an acceptable copy of the Secretary of Defense originated c.w. and/or RTTY message(s) transmitted during the receiving portion of the communication tests. Interception by shortwave listeners will not qualify for a QSL card in confirmation of communications. However, anyone who has the equipment and the ability may copy the Secretary of Defense messages and receive a certificate.

Military-To-Amateur Crossband Test

The military-to-amateur crossband operations will be conducted from 20/1400 GMT to 21/0245 GMT. The military stations, WAR, NSS, NPG and AIR will transmit on military frequencies and listen for amateur stations transmitting in the portions of the amateur bands indicated below. Additionally, consistent with operational and training commitments, a US Navy aircraft using the call sign NSSAM, will conduct crossband operations on frequencies listed below while flying at 21,000 feet over various cities at times indicated. Amateur operators should monitor the frequencies plus or minus one hour.

[*Table on facing page*]

C.W. Receiving Test

A c.w. receiving test will be conducted for any person capable of copying International Morse code at 25 words per minute. The c.w. broadcast will consist of a special Armed Forces Day message from the Secretary of Defense addressed to all radio amateurs and other participants. The schedule for this broadcast is as follows:

Time	*Transmitting Station*	*Frequencies (kHz)*
20 May 1972		
21/0300 GMT	WAR—Army	4030, 6997.5 14405
20/2300 EDST	NSS—Navy	4012.5, 7350, 14385
20/2000 PDST	NPG—Navy	4005, 6971.5, 14375
	AIR—Air Force	7305, 13997.5

RTTY Receiving Test

An RTTY receiving test will be conducted for any individual amateur or station possessing the required equipment. This is a test of the operator's technical skill in aligning and adjusting his equipment, and serves to demonstrate the growing number of amateurs becoming skilled in this method of rapid communications. The RTTY broadcast will consist of a special Armed Forces Day message from the Secretary of Defense to all radioteletype enthusiasts. The message will be transmitted at 60 words per minute in accordance with the following schedule:

*To be operated from Mt. Vaca.
†To be operated from Mt. Diablo.

Station	*Military Frequency* (kHz unless otherwise noted.)	*Emission*	*Amateur Band* (mHz)
WAR (Army Radio Washington, D.C.)	4001.5	c.w.	3.5-3.65
	4020	l.s.b.	3.8-4.0
	4030	RTTY	3.65-3.8
	6997.5	c.w.	7.0-7.2
	14405	c.w.	14.0-14.2
	20994	l.s.b.	21.25-21.45
NSS (Naval Communication Station, Washington, D.C.)	3385	c.w.	3.5-3.65
	4012.5	RTTY	3.65-3.8
	4040	l.s.b.	3.8-4.0
	6970	l.s.b.	7.2-7.3
	7301	c.w.	7.1-7.15
	7350	c.w.	7.15-7.2
	7380	RTTY	7.1-7.2
	13827.5	RTTY	14.1-14.2
	14385	u.s.b.	14.2-14.35
	14400	c.w.	14.0-14.1
NSSAM (Navy Aircraft)	Depart Washington, D.C. 20/1300 GMT; Providence, RI 20/1400 GMT; Buffalo, NY 20/1500 GMT; Indianapolis, IN 20/1630 GMT; Memphis, TN 20/1730 GMT; New Orleans, LA 20/1830 GMT; Tallahassee, FL 20/1930 GMT; Miami, FL 20/2030 GMT; Jacksonville, FL 20/2115 GMT; Spartanburg, SC 20/2215 GMT; Washington, D.C. 20/2300 GMT.		
	2790	u.s.b.	3.8-4.0
	49.692	a.m.	50.1-54.0
	143.820	a.m.	144.1-146.0
NPG (Naval Communication Station, San Francisco, Ca.	4001.5	l.s.b.	3.8-4.0
	4005	c.w.	3.5-3.8
	4010	c.w.	3.7-3.75
	6971.5	c.w.	7.0-7.1
	7301.5	l.s.b.	7.2-7.3
	7347.5	RTTY	7.1-7.2
	7365	c.w.	7.1-7.2
	13922.5	RTTY	14.1-14.2
	14356	u.s.b.	14.2-14.275
	14375	c.w.	14.0-14.1
	14389	u.s.b.	14.275-14.35
	*49.992 mHz	a.m., u.s.b., c.w., f.m.	50.0-54.0
	*143.7 mHz	a.m., u.s.b., c.w.	144-148
	†148.41 mHz	a.m., a.f.s.k.	144.1-148
	†148.95 mHz	f.m.	144.1-148
	*222 mHz	a.m.	220-225
AIR (Air Force Radio Washington, D.C.)	4025	l.s.b.	3.8-4.0
	7305	l.s.b.	7.2-7.3
	7315	c.w.	7.0-7.2
	13997.5	c.w.	14.0-14.2
	14397	u.s.b.	14.2-14.35

Military-To-Amateur Crossband Test Frequencies

Time	*Transmitting Station*	*Frequencies (kHz)*
20 May 1972		
21/0335 GMT	WAR—Army	4030, 6997.5 14405
20/2335 EDST	NSS—Navy	4012.5, 7350, 14385
20/2035 PDST	NPG—Navy	4010, 7347.5, 13922.5, 148.41 mHz
	AIR—Air Force	7305, 13997.5

Submission of Test Entries

Transcriptions should be submitted "as received." No attempt should be made to correct possible transmission errors.

Time, frequency and call sign of the station copied as well as the name, call sign (if any) and address, including Zip code, of the individual submitting the entry must be indicated on the page containing the test. Each year a large number of acceptable copies are received with insufficient information, thereby precluding the issuance of a certificate.

Entries should be postmarked no later than 25 May 1972 and submitted to:

Armed Forces Day Tests
Chief, Navy-Marine Corps MARS
4401 Massachusetts Avenue, N.W.
Washington, D.C. 20390
Mail Stop 394

Safe and Easy Field Day Antenna Raising

BY JOHN GREVE,*

Field Day is fast approaching, and with it the logistical problems of putting up efficient antennas in the field so they'll stay up, and doing the job without sending half the club off to the First Aid tent. The following article describes one well-organized CD group's technique

THE most feared—and often the most satisfying part of a field day is the erection of the antennas. There is no prettier sight than shining aluminum tubing etched against a clear blue summer sky. However, a 30′ push up tower buckled 10′ from the bottom can dampen any group's enthusiasm. Luckily there is a simple and reasonable solution to this problem. The apparatus to be described has been in use for 9 years by our local CD Communications group, often by people who have never raised an antenna before. This should testify to its simplicity and reliability.

Figure 1 is the base plate components for use at the base of each telescoping mast. They can be fabricated at any local welding shop. All components are readily available. Figure 2 shows the guy rope anchor. There are 6 of these required for each tower. If properly installed, the low profile will minimize the possibility of tripping and there are no sharp edges or points to impail the individual. Also, this design can be successfully driven into most soils and extraction is an easy task. The erection sequence follows. See figs. 3 and 4 for details.

1. Locate the desired spot and check for rocks or other obstructions that might interfere with the driving of the base stake or the guy anchors.
2. Lay the nested tower on the ground with the top pointing in the direction of the companion tower if two are to be used for the support of a long wire antenna.
3. Spread out the guy ropes in the approximately correct directions.
4. Drive the base stake and assemble the base hinge components.
5. Connect the guys at the 10′ elevation and raise the tower.
6. While one individual holds the tower vertical, have a second person stretch the guys and drive the three anchors at the correct locations. Tie the two front sets of guys to the anchors.
7. Drop the tower and extend to 20′ length. Attach guy ropes at the 20′ height.
8. Raise the tower and secure the two front guys to the anchors and again lower the tower.
9. Extend the tower to 30′ and place on a step ladder. Connect guys to the floating guy ring. Install the gin pole in socket at base of tower. Tie the 3 back guy ropes to the eye bolt at the end of the gin pole.
10. Use the gin pole as a lever and have one person pull tower up to vertical position. Also have a second person "walk" tower up from the extended end of the tower. Attach two front guys to anchors. Lower tower with one person walking tower down and second man using gin pole as a lever. Lower tower onto step ladder.
11. Attach rotator and antenna to tower. Tape rotator wire and coax to tower every 5 feet. Leave sufficient loop at rotator so coax will not tighten when antenna is rotated. Install cotter pins in tower at 10′

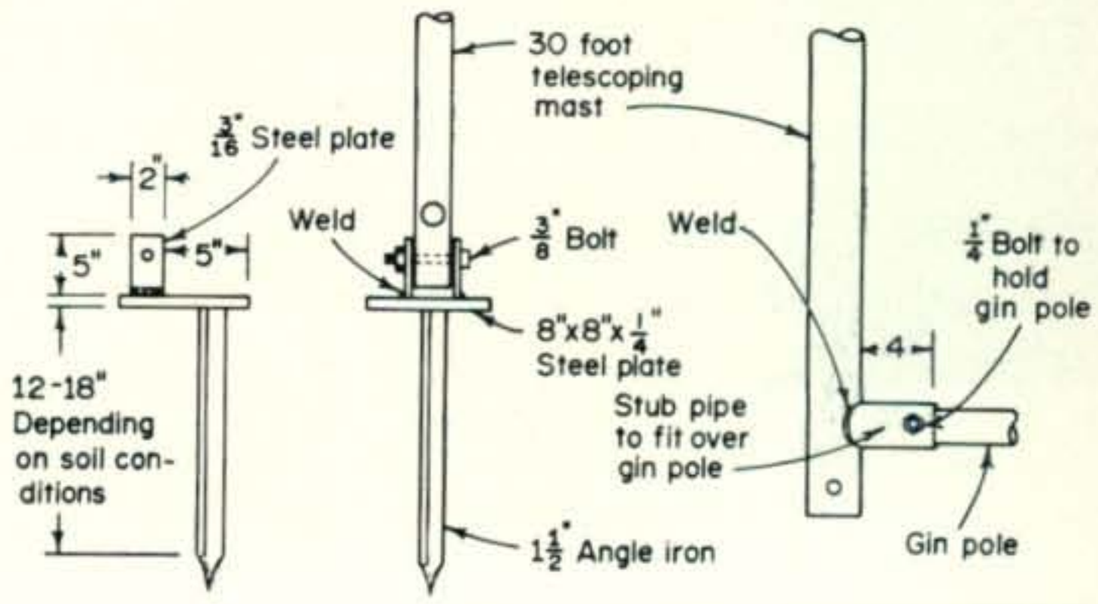

Fig. 1—Details of the construction of the base plate plate assemblies for the telescoping antenna masts.

*2210 30th St., Rock Island, Ill. 61201

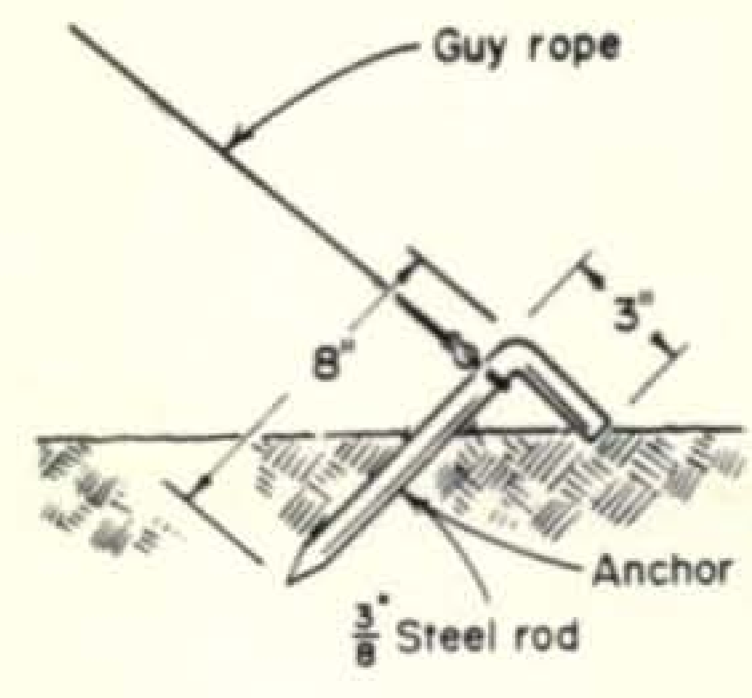

Fig. 2—Guy rope anchors are made from 3/8" mild steel rod sharpened slightly at one end.

and 20′ levels. If a long wire is to be installed between the two towers, attach pulley to top of tower. Be sure pulley is on correct side of tower. Thread a pull rope through pulley. Tie two ends of pull rope together so rope cannot pull out of pulley.

12. Check all hardware for tightness, and antenna for proper orientation when tower is in upright position. Raise tower as previously. Tower cannot get away if the task is performed quickly since the three sets of front guys are anchored. When tower is vertical, have one person stand on gin pole while the assistant unties back guys one at a time and transfers them to the back guy anchors. Plumb tower.

If done properly, the completed installation should look like fig. 3. The most convenient source of materials is a push up tower 10′ longer than the desired raised height. The 10′ top section is removed and used as the gin pole. This extra member can be conveniently stored inside the tower. The tower that remains is considerably stronger than originally as the weakest length has been removed from service.

Several procedures are required to keep the tower up during the day and night. Check and recheck the rope guy's tensions during the day and night. Rain and/or heavy dew can raise havoc with rope tensions. Wide excursions of temperature can also cause guys to slacken. If the ropes are allowed to get too tight, they might pull the ground anchors out allowing the tower to fall. Also, it is good practice to tie white strips of cloth on the guys at 3′, 6′, and 8′ levels to signal their location during the nightly sojourns to refuel the generator, etc. A 50 watt light bulb at the 20′ elevation of each tower will provide a surprising amount of illumination throughout the camp area and it also stabilizes the generator output by providing a minimum electrical load. Dimming of the remaining lights due to s.s.b. and c.w. operation of the transmitters is thereby minimized.

Taking the towers down can be as hazardous as their erection. With the system described above, the task is safe and simple. The procedure is as follows:

1. Turn off all power and shut down the generators.
2. Disconnect all coax and leadins to the radio equipment.
3. Lower the long wire and coil it up thereby removing a tripping hazard.
4. Have one man hold the gin pole down while a helper unties the ropes from the back anchors. As each rope is untied, it is transferred to the eye bolt connected to the extended end of the gin pole.
5. Have one person walk the tower down while a second person guides the gin pole up in the air. It is good business at this point to have extra people, one at each guy anchor to guide the downward progress of the tower. Towers can "get away" from the people lowering them due to sudden wind gusts during this operation.

[*Continued on page 85*]

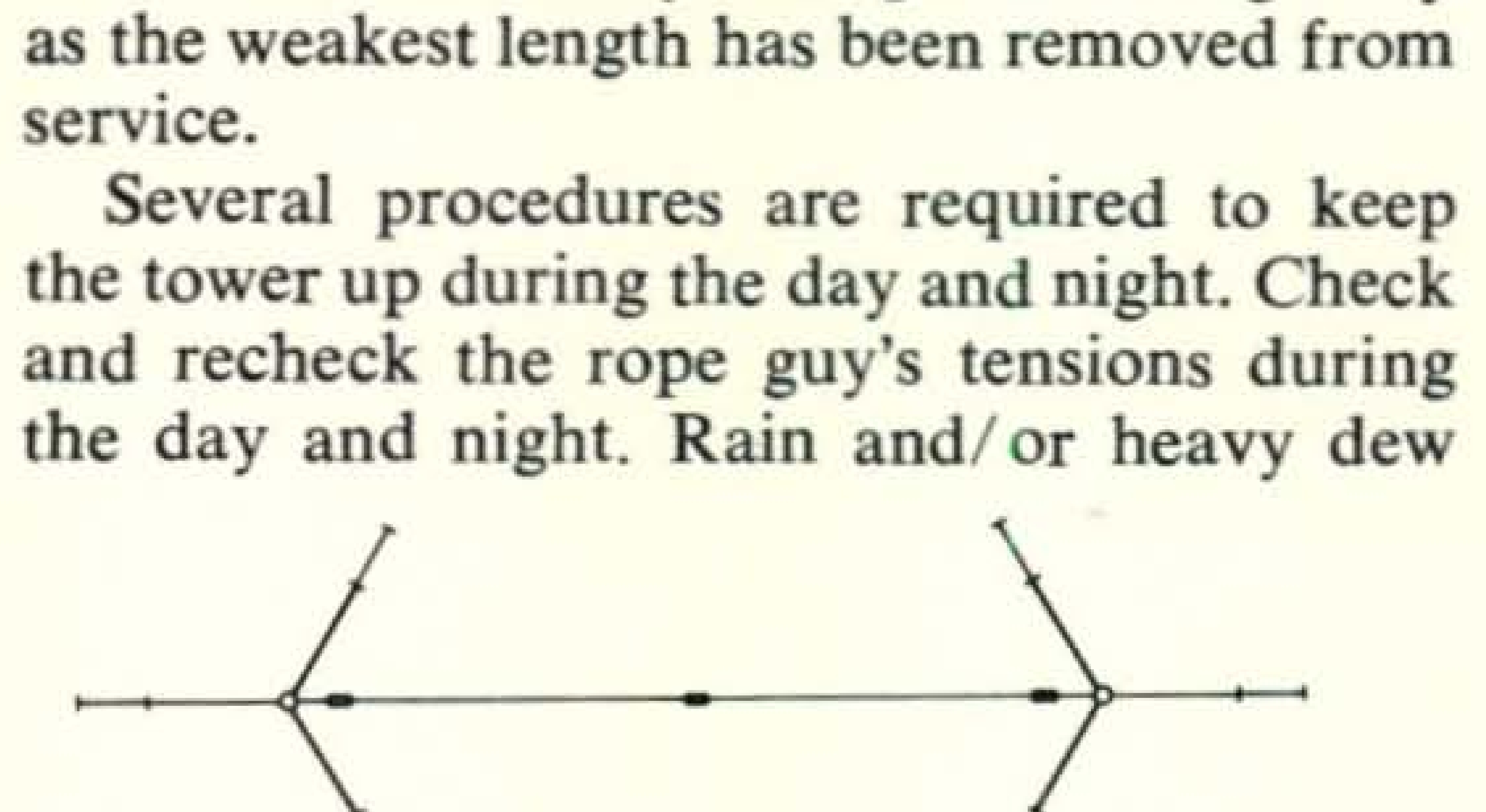

Fig. 3—Top and side views of the Field Day antenna installation described in the text.

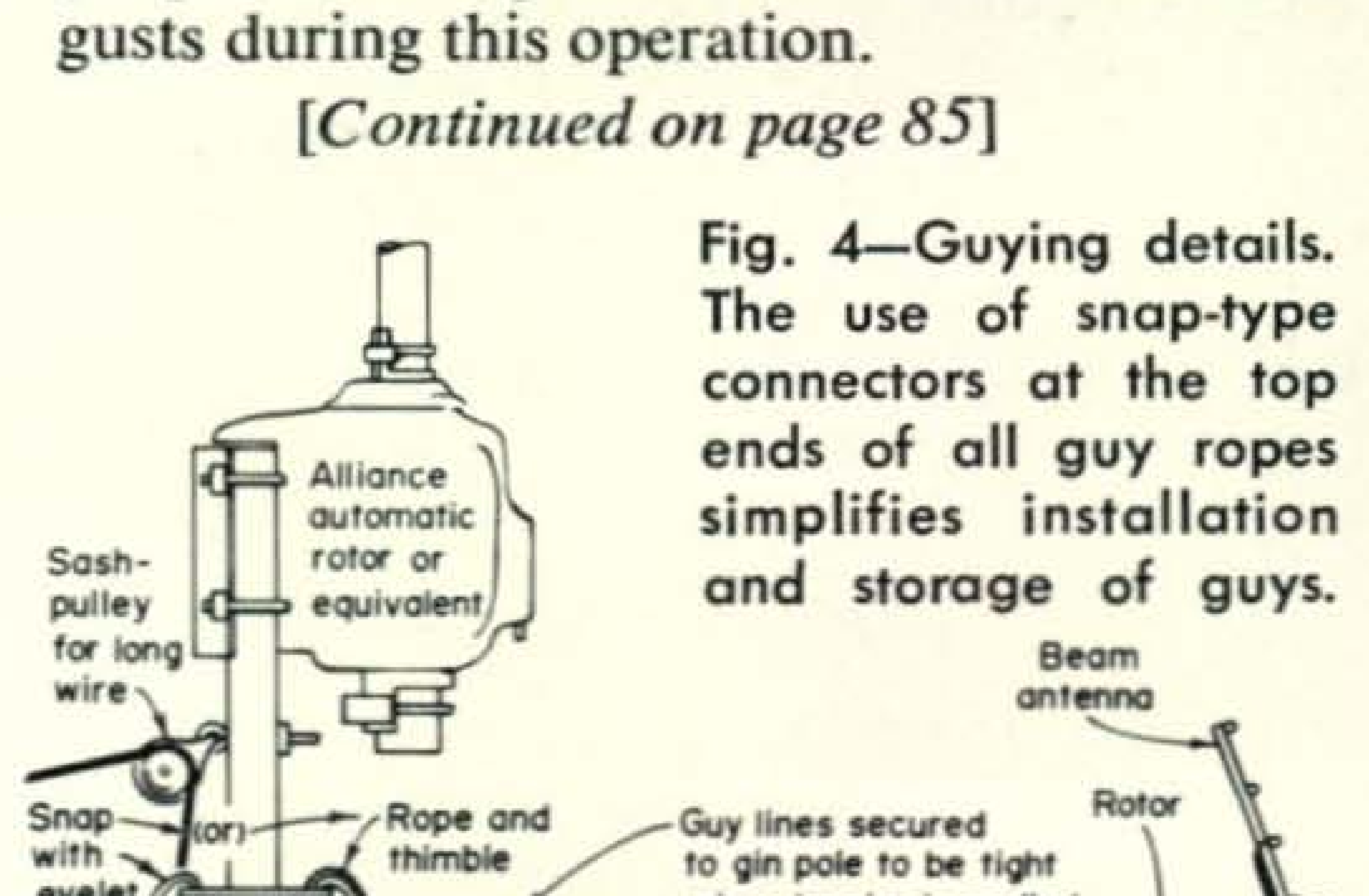

Fig. 4—Guying details. The use of snap-type connectors at the top ends of all guy ropes simplifies installation and storage of guys.

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

A GLANCE at the industrial surplus dealer's advertisement or catalog immediately makes one aware of such items as "surplus TTL Integrated Circuits—Brand New In Original Manufacturer's Boxes," "Special DTL DIP Sale" or "Just Arrived—Entire Inventory of MC700 series RTL User—Stock Up Now." To the initiated this is all quite meaningful, to the uninitiated, the abbreviations, not to mention the logic functions, are a complete puzzle. It is therefore appropriate to take a look at some of these chips and see how they work from a practical point of view.

Due to the tremendous variety of devices available, however, we will only consider digital devices this month and cover linear devices in the near future.

Before looking at the actual devices though, we must first review the operation of the basic logic functions that are available. All integrated circuits described here will be of the digital variety as already stated. This means that the input to a logic function, or the output from a logic function can only be in one of two states, either "0" (low), or "1" (high) as they are often called. Consider the drawing of fig. 1. If the 1K base lead of the

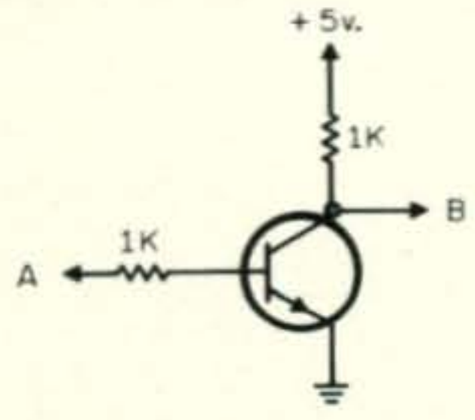

Fig. 1—Digital inverter discussed in text.

transistor, at point A, is grounded or has no voltage impressed upon it, we can say that the input to the transistor is 0 or low. The output at point B, will then be high (1) since the transistor is cut off. The term "1" or "0" comes from computer language for it is in this application that most digital integrated circuits are used. If we now apply +5 volts to point A, making it high, the transistor will conduct fully and the output, at point B, will become low.

Since all logic functions of the same family are designed to interconnect with each other, the low or 0 state is always specified to be from zero volts to the highest voltage on a transistor (or input) that will not turn on that transistor. Similarly, the high or 1 state is specified as the range of lowest voltage to B+ that, when connected to the transistor input, will turn it on.

The single transistor just used in the description is called an inverter in logic language. Its sole function is to invert a particular digital state. In most logic families, inverters are available packaged six to a chip. Such a chip is called a hex-inverter.

The second logic function we will consider is the gate. This is shown in fig. 2. Careful ex-

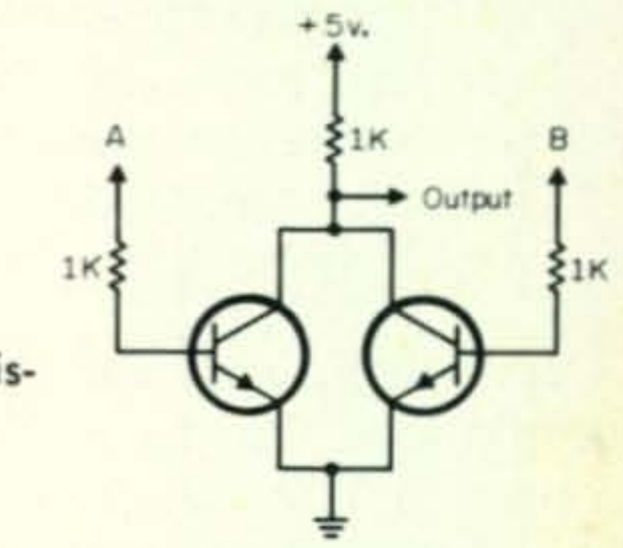

Fig. 2—Digital gate discussed in text.

amination of the circuit will show that it is simply two inverters connected "back to back" with a single collector resistor. The output of this gate will only become low if inputs A or B are made high. By adding additional transistors, the gate can be expanded to include any number of inputs and fig. 3 shows a four input gate. Again, for the output to become low, either A or B or C or D must be made high. Such use of a gate makes it an OR gate. There is another type of gate that is quite similar electrically to the OR gate and this is the AND gate. The AND function can easily be understood by a slight rearrangement of our point of view. If the end result of the circuit of fig. 2 is to be high, then inputs A and B must both be low. Similarly in fig. 3, A and B and C and D must be low to have the output high. Such gates are available in all varieties from two input versions to ones with eight or more inputs.

Other logic functions are available in digital integrated circuitry packages and some are more complex. They all should be well known from basic radio and electronic theory however. Some of these functions are: Flip Flops; Dividers (usually made up of several

*5 Melville Lane, Great Neck, N.Y. 11020

TEMPO...a quality name...a growing family

TEMPO "2000"
LINEAR AMPLIFIER

The Tempo "2000" Amplifier makes an ideal supplement to the Tempo "ONE" Transceiver. It is the smallest self-contained, full-legal-limit kilowatt amplifier in its price range. It has an entirely self-contained, solid-state power supply that makes it fully operational within three seconds from turn-on.

Price: $395.00.

TEMPO "ONE"
SSB TRANSCEIVER

.....represents the culminating achievement of many years of experience in the amateur radio field. Modern design, superb performance, high styling, sturdy construction, outstanding reliability, exceptional value.

Tempo "ONE" Transceiver	$319.00
AC/ONE Power Supply (117/230 Volt 50/60 cycle	$ 99.00
DC/1-A Power supply (12 volts DC)	$110.00

TEMPO DKT ELECTRONIC KEYER

The Tempo DKT keyer is the latest in electronic keyer design. Using integrated circuit techniques it provides the unique features of dot memory and single dot injection which, with a specially designed twin lever key assembly, affords effortless sending and perfect character formation regardless of speed.

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Truly mobile, the Tempo fmp-3 watt portable gives amateurs 3 watts, or a battery saving ½ watt, FM talk power anyplace at anytime. With a leather carrying case included, this little transceiver will operate in the field, in a car, or at home with an accessory AC power supply. The battery pack is of course included. Price:$225.00.

TEMPO LW 1500 DUMMY LOAD WATTMETER

The Tempo LW1500 load-wattmeter offers typical Tempo price-performance value. Designed for amateur or commercial use, the LW1500 is completely portable. An internal "D" cell battery powers the overheating warning light so no AC connections are necessary. The built-in handle and light weight make the load convenient for desk, bench, auto or field testing.

Price: $119.00.

Other Tempo products:

FMA (25 watt — 2 meter FM transceiver)
RBF-1 Wattmeter & SWR Bridge
VHF & UHF Amplifiers

Henry Radio

11240 W. Olympic Blvd., Los Angeles, Calif. 90064 — 213/477-6701
931 N. Euclid, Anaheim, Calif. 92801 — 714/772-9200
Butler, Missouri 64730 — 816/679-3127

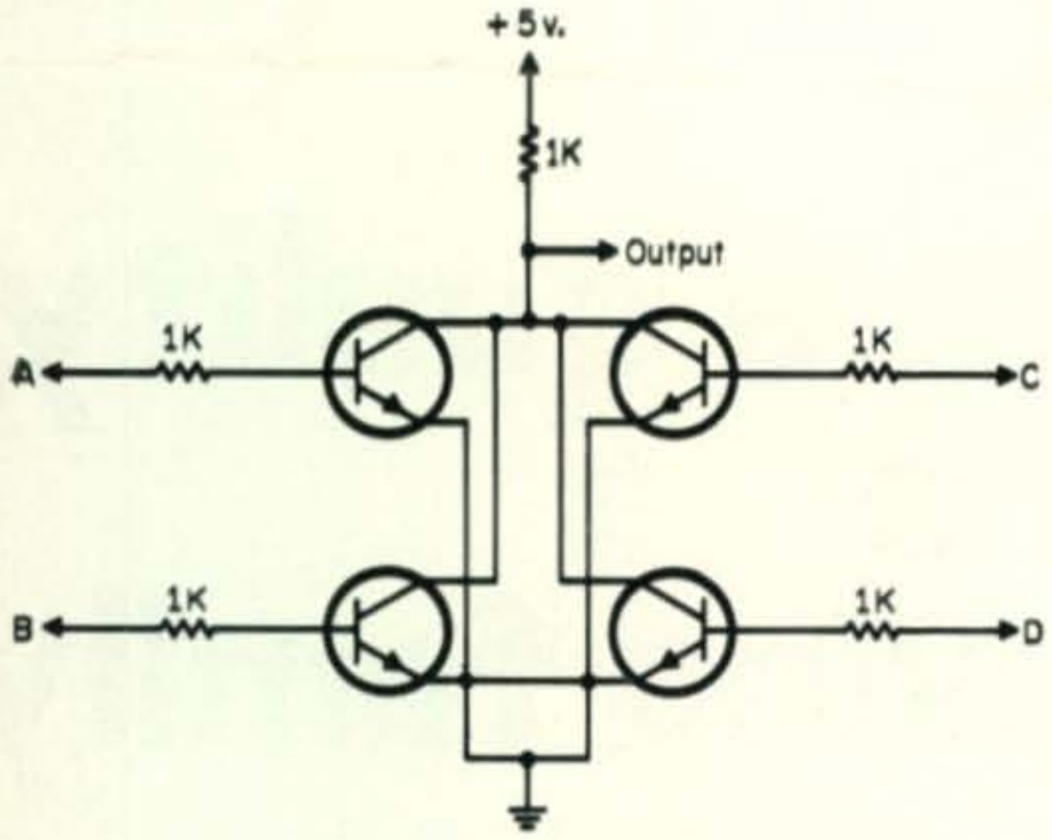


Fig. 3—Four input digital gate.

flip flops and gates interconnected within the chip); monostable or one-shot multivibrators for time delay uses; and many complex logic systems consisting of all of the above in various configurations.

Just about all digital integrated circuits are available in one of three basic packages or cases. The first of these is the DIP or dual inline package. Figure 4 shows the standard mechanical features of this package in a 14 pin variety. DIPs also come in 16 pin packages, 24 pin packages, or more. The second most common package is the round TO-99 package. This is shown in fig. 5. TO-99 packages may have anywhere from 6 to 12 leads depending on what is contained within the package. The third, and least familiar to the experimenter is the Flat-Pak. As shown in fig. 6, this is the smallest package available. It is available in 8 to 24 pin versions normally but may contain more pins for very complex functions. The exact package to choose assuming all are available, is the one that best meets the size requirements of the particular project. Data sheets for specific devices will always indicate the differences in packages as they pertain to characteristics of the logic

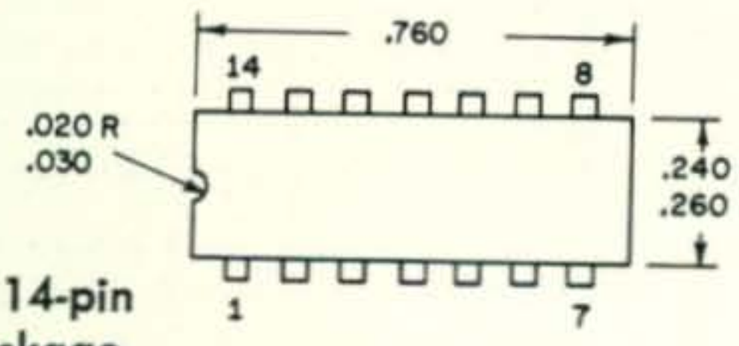
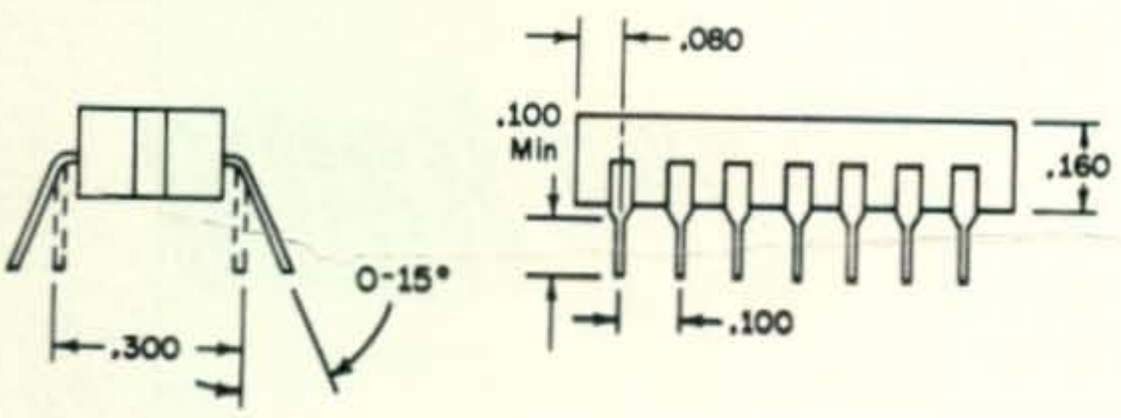


Fig. 4—Typical 14-pin dual inline IC package.



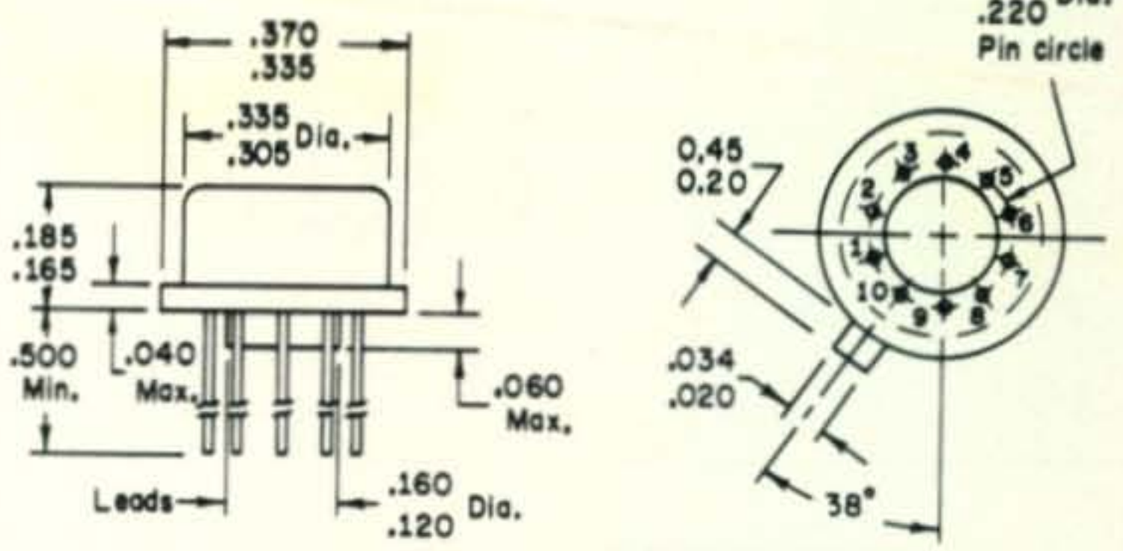


Fig. 5—Typical TO-99 10-pin IC package.

function within. It is therefore best to consult the data sheet when the same chip is available in different packages.

While we have looked at simply implemented logic circuitry in our examples, many of the integrated circuits available do the job in much more complex ways. For the experimenter therefore, it would be wise to try to understand the input and output conditions as well as the function of the logic element rather than the actual mechanics of the circuitry. In this way new designs will be developed in the least amount of time and with the least amount of confusion.

The three main families of digital logic available today from the sources mentioned belong to the RTL, DTL, or TTL groups. RTL means resistor-transistor-logic and is practically identical with our sample circuitry. Almost all RTL circuits operate from a +3.6 volt supply. It was the first integrated circuit form of logic developed and has been with us since around 1960.

DTL, or diode-transistor-logic was introduced soon after RTL. Its internal circuitry uses both transistors, diodes, and resistors to perform the logic functions. DTL circuitry however, is generally faster operating than RTL and this is its primary advantage. Also, since most DTL logic operates from a +5 volt supply, the voltage difference between its 0 and 1 state is greater thereby reducing somewhat, the response to stray signals or noise.

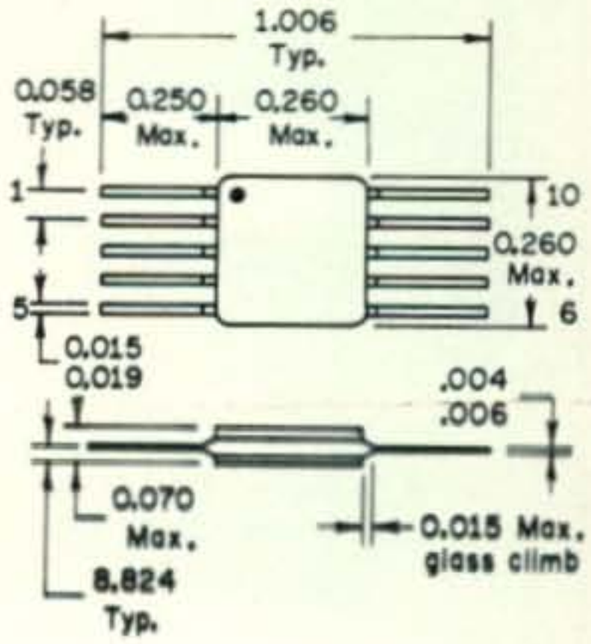


Fig. 6—Typical 10-lead "flat-pak" IC package.

The third family to be introduced was TTL or T²L as it is sometimes called. Transistor-transistor-logic is the fastest operating logic of the three families. TTL circuitry also operates from a +5 volt supply and is the most popular and readily available form of logic today. The chart in fig. 7 shows the basic comparison between the three families.

Next month we will look at specific digital integrated circuits available and give some practical examples of uses for these versatile devices. In the meanwhile, for those who wish to see typical prices and availability, or to possibly "stock up"—here is a list of some of the dealers we are aware of who offer exceptional buys on these units:

Solid State Sales
P.O. Box 74
Somerville, Mass.
02143

B & F Enterprises
P.O. Box 44
Hathorne, Mass.
01937

Poly Paks
P.O. Box 942
Lynnfield, Mass.
01940

Digi-Key
P.O. Box 126
Thief River Falls, Minn.
56701

R & R Electronics
311 East South Street
Indianapolis, Ind.
46225

Circuit Specialists Co.
P.O. Box 3047
Scottsdale, Ariz.
85257

Gateway Electronics
6150 Delmar Blvd.
St. Louis, Mo.
63112

Hal Devices
P.O. Box 365
Urbana, Ill.
61801

M. Weinschenker
Box 353
Irwin, Pa. 15642

A post card will, I am sure, bring a list and/or catalog.

73, Irv, WA2NDM

Parameter	RTL	DTL	TTL
Typical maximum operating speed	4 mHz	12 mHz	30 mHz
Supply Voltage	+3.6 Volts	+5 Volts	+5 Volts
DIP temperature range (operating)	15-55°C	0-75°C	0-75°C
Special package temp. range	—55-125°C	—55-125°C	—55-125°C
Noise response	Fair	Good	Good

Fig. 7—Comparisons between the three most popular logic families.

DX

BY JOHN A. ATTAWAY,* K4IIF

THE Fresno DX Convention, January 22 and 23, 1972, provided a background for the induction of Mr. Martin Laine, OH2BH, as the eighth member of the *CQ* DX Hall of Fame. Marti's Hall of Fame plaque was presented by Jerry Hagen, WA6GLD, Assistant DX Editor of *CQ*, representing the *CQ* DX Awards Advisory Committee. Martin is the second non-US amateur to receive the ultimate DX award.

Martin Laine has a distinguished DX career going back some 10 years. In early 1962 he and his brother, OH2EW, made their first DXpedition to Aland Island where they logged 3000 contacts. W2CTN, the second man inducted into the DX Hall of Fame, was their QSL Manager. In 1964 a second trip with 4 operators and the call OH2BH/Ø netted an additional 7000 QSOs.

During the next 5 years Marti was very active in the OH-DX-Ring, one of the world's most famous DX contest clubs. They won first place trophies in almost all major contests, making over 50,000 contacts with the call OH2AM. The club equipment included 7 separate towers and beams. The OH2AM/Ø operation, which resulted in over 10,000 QSO's during the 1965 sunspot minimum, was a highlight of this period.

In all, Marti took part in seven DXpeditions to OHØ, two of them alone and five as part of a group operation. Then, at the end of the decade he broke the pattern with the first Market Reef operation as OJØMR. A new country was provided for many as in excess of 8,000 QSO's were made with OH2NB providing the QSL address. A second trip with 12 operators in the spring of 1970 resulted in an additional 12,000 contacts from that rare location. OJØDX was the call and Marti handled the cards.

Laine's next trip, although it yielded only 800 QSO's in 10 hours of operating, was a major achievement. This one of course was OH2BH/ZA, the first amateur operation from Albania in many, many years.

Topping the cake with a generous coating of icing were the famous 3C1EG, Equatorial Guinea, and 3CØAN, Annobon Island, DXpeditions in 1971. Marti's partner on these trips was Ville, OH2MM, and Armas, OH2NB, handled the cards. A total of 16,000 QSO's were made during this venture which is described in detail in Marti's article beginning on Page 12 of the January issue of *CQ*. This article is recommended reading for all true students of DX.

Congratulations, Marti! A very deserving addition to the *CQ* DX Hall of Fame.

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

DX Hall of Fame

GUS M. BROWNING, W4BPD
Nov. 1, 1967
JOHN M. CUMMINGS, W2CTN
March 23, 1968
STEWART S. PERRY, W1BB
August 16, 1968
RICHARD C. SPENCELEY, KV4AA
March 1, 1969
DANNY WEIL, VP2VB
Sept. 15, 1969
H. DALE STRIETER, W4DQS
May 23, 1970
STUART MEYER, W2GHK
Oct. 31, 1970
MARTIN LAINE, OH2BH
Jan. 22, 1972

De Extra

The following 1972 objectives for DX-minded amateurs were advanced by Chuck Bolvin, K4KQ, in the December issue of the *Florida DX Report*. Chuck presented them as New Year's Resolutions, and we think they are worth repeating:

The Fresno DX Convention was the scene as the 8th DX Hall of Fame Award plaque is presented to Martin Laine, OH2BH, right, by Jerry Hagen, WA6GLD, left, Assistant DX Editor of CQ.

CQ DX Award Honor Roll

The *CQ* DX Award Honor Roll recognizes those DXers who have submitted proof of confirmations with 275 or more countries for the mode indicated. The ARRL DXCC Country List, LESS DELETED COUNTRIES, is used as the country standard.

2XSSB

TI2HP	321	K6EC	304
W9ILW	321	W6KZS	304
DL9OH	320	W6FW	302
WA2RAU	320	W9QLD	302
W2TP	320	K4HJE	301
K2FL	319	IT9JT	300
W3NKM	319	OZ3SK	300
K6LGF	319	K1SHN	300
W6REH	319	YS1O	300
IØAMU	318	ZL3NS	300
K6YRA	318	F9MS	299
G3FKM	315	KH6BB	296
W3DJZ	315	K4RTA	294
W6EUF	315	XE2YP	294
I8KDB	314	WA6MWG	292
W6KTE	314	WB2RLK	290
W9DWQ	314	ZL1AGO	286
W4OPM	313	G3RWQ	285
WA2EOQ	312	HP1JC	285
W4IC	312	W9KRU	284
W6NJU	312	WØYDB	284
ZS6LW	312	VE3GMT	282
W9JT	311	WAØKDI	282
XE1AE	311	OE2EGL	280
VE2WY	310	K8GQG	280
G3DO	309	WAØCPX	278
VE3ACD	308	WA3IKK	276
I1AA	307	G3WW	275
F2MO	305	K9LUI	275

CW

W6ID	319	ON4QX	296
K6EC	316	WA6EPQ	294
W8LY	310	W4BQY	291
VK3AHQ	308	W6NJU	291
K6LEB	308	K1SHN	286
W4IC	307	W6ISQ	285
W4OPM	304	WA8DXA	279
DL3RK	303		

"What can we do as DXers which might be valuable to the state of the art, and/or in the public interest, and at the same time contribute something to DX. How about some *good* DX antennas for 160, 80, and 40—none of which would require more than 50 by 50 feet horizontally and 50 feet vertically! How about some skeds with DX stations daily or weekly on 10 meters to prove or disprove the question of just how dead *is* that band during a sunspot low! How about opening up 6 meters as a DX band—perhaps starting a contest for the first DXCC on six. (Notes from the *FEARL Bulletin* indicate that there

Left to right are Louis and Maurice, two operators of the 1970 FB8XX team. Maurice will be on Kerguelen again in 1972, with F2MO as his QSL Manager. *(Photo via F2MO.)*

are plenty of stations on this band from JA down through VK land.) How about bugging the commercial manufacturers for an attache case 50 watt, 10 pound transceiver so we can make DXpeditions without going broke on airline excess baggage costs, or using up the entire 2-week vacation trying to find the gear in some customs warehouse. (Ten-Tec is getting close!) One of our more technical minded DXers might even build up a prototype so the commercial engineers won't foul up the design. (Like forgetting to put in a key jack or leaving out 160 meter capability, or worse, designing it for 52 plus or minus 1 ohm output and then leaving out a matchbox section.)

"How about some club resolutions! An example would be the distribution (and printing if necessary) of log forms for the major DX contests to insure that every member has a supply before the contest. Then bug every member to work at least a few QSO's and turn in the score. Another would be to make sure that every member of the club has an envelope on file at the ARRL Bureau. The club could even send in a half-dozen envelopes for each member.

"Think up a few more of your own and something good can come of this."

Rare Prefixes for WPX

C20—The Nauru prefix was changed from C21 to C20 in January to commemorate the Independence of the island republic.

CO6—CO6JH, 7003 kHz at 0300Z and 7001 kHz at 1205Z.

EQ2—EQ2WS was reported on 14200 at 1500Z. This is an Iranian prefix.

FOØ—QSLs for FOØGO go to W6HJP.

GW5—GW5YB operates 15 meter c.w. Only 10 GW5 calls are in existence.

The WPX Program

S.S.B. WPX

665.....UQ2IL
666.....VK5QB
667.....PY2DBU
668.....W3QND
669.....W7YBX
670.....W7KOI

C.W. WPX

1141.....YO2QY
1142.....K5AYA
1143.....WØKCJ
1144.....W5SBX
1145.....DM4ZXH
1146.....UR2QD
1147.....UB5SG
1148.....UK5IAI
1149.....UK5MAA
1150.....W9AEM
1151.....OK1APV

Mixed WPX

318.....DL1CF
319.....W7YBX
320.....PY2BCQ
321.....W7KOI

Phone WPX

209.....W1HGA

WPNX

42.....WN2MBP
43.....WN5ZNY
44.....WN5DCY
45.....WN5BNG

VPX

40.....UA9—14530

WPX Endorsements

S.S.B.: IØAMU—800, I1BGJ—750, W4HOS—700, OK1MP—650, W2LEJ—500, DL5GJ—400, G3UKH—350, DJ1XU—350, W7YBX—300, and W7KOI—300.

C.W.: W2HO—900, K4IEX—750, K7ABV—700, YU1SF—650, WA9UES—500, W9EVD—400, W9AEM—400, and KL7CZ—350.

Mixed: DL1CF—850, W3GJY—800, K2AAC—700, K4CIA—650, and PY2BCQ—450.

Phone: W2LEJ—550 and W1HGA—350.

160 Meters: G2GM, K4CIA, DL1CF, OK1APV, and HB9NL.

80 Meters: OK1APV.

40 Meters: OK1APV.

20 Meters: WA6TAX, W7KOI, PY2BCQ, and OK1APV.

15 Meters: YU1SF.

Africa: I1BGJ.

Europe: PY2BCQ, W9AEM, OK1APV, and DJ1XU.

Oceania: K4IEX and KØPMZ.

South America: I1BGJ.

Complete rules for WPX, WPNX, and VPX may be found on pg. 67 of the Feb. 1972 issue. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to Award Manager, P.O. Box 1271, Covina, Ca. 91722, or to the DX Editor. ,

HCØ—HCØHM was reported on 14016 kHz at 2110Z.

HSØ—HSØUDN operates frequently near 14225 kHz. QSL to W5WJQ.

JY1-9—Jordanian prefixes are assigned as follows: JY1—King Hussein, JY2—Princess Muna, JY3—Advanced Class A licenses, JY4—Class A licenses, JY5—Class B licenses, JY6—Club Stations, JY7—Club Stations, JY8—Tourists, and JY9—Visitors.

KR8—KR8EA, 21033 kHz at 2324Z and 14307 kHz at 0125Z. This is an Okinawan prefix.

WY3—WY3MCA operated from Maryland during YMCA week in January.

4F5—QSLs for 4F5ERA go to WA8MAA. This call was used at an Electronic Representatives Association meeting in Venezuela.

6D4—6D4J is the call used by XE1J for Revilla Gigedo operations.

A one man DX-dynamo in the Indian Ocean area is Venkat, VU2KV. This photo shows his station at Port Blair in the Andaman Islands during his VU9-KV operation.

Here and There

QSL Services: When you work a lot of DX, the cost of QSLing becomes significant and you look for ways to cut down. This is particularly true after a major DX contest involving several hundred contacts. If you have this problem it is worth your while to investigate some of the QSL Services who are able to forward your cards at a token cost because of their large volume.

As each QSL Service has its own style and modus operandi, we suggest that you contact more than one and determine which best suits your needs. Four services with addresses on file here are: W3KT QSL Service, RD 1, Valley Hill Rd., Malvern, PA 19355; World Wide DX QSL Bureau (W3GJY), 1400 Chaplin St., Conway, PA 15027; World QSL Bureau, 5200 Panama Ave., Richmond, CA 94804; and Scott's QSL Service, 1510 Lynnview, Houston, TX 77055. Scott's also offers a free QSL Manager's Guide if you send 50¢ for postage and handling.

It would be appreciated if you enclose a self-addressed, stamped envelope with your first letter to either of the above.

DX Club Officers: New officers for the Toronto DX Club are Ernie Welling, VE3HD, President; Mort Wolfson, VE3MJ, and Ron Nickle, VE3BIZ, Vice Presidents; Don Beechey, VE3DBT, Secretary/Treasurer; John Norris, VE3EOR, Recording Secretary; and Jack Reed, VE3GMT, Noel Davies, VE3-DXN, and Bob Nash, VE3KZ, Directors.

The new Southern California DX Club leaders are Jack Hollander, WB6UDC, President; Pete Hoover, W6APW, Vice President; Larry Weaver, W6JPH, Secretary; John Alexander, K6SVL, Treasurer; and Directors Dick Norton, W6DGH; Frank Iversen, WA-6ZCQ; and Phil Coussens, WA6ZZK. The bulletin editor is Jay Holladay, W6EJJ.

"DX-Press": This venerable VERON DX newspaper has a new editor, F. Th. Oosthoek, PAØINA. His address is Vluchtenburgstraat 34, Middelburg, The Netherlands. Good luck OM!

10 Meter Beacon Stations: QUAX reports that 3 beacons are now active. They are GB-3SX on 28185 with 25 watts and a dipole firing east and west, DLØIGI on 28200 with 200 watts and a GP Omni antenna, and DLØ-AR on 29000 with 170 watts and a GP Omni antenna. Listen out for these stations. There may be more 28 mHz openings than you realize.

QRPp: According to *The Milliwatt*, the top low-power DXers, with country scores and power levels, are as follows: K4OCE—135 countries, 4.9 watts; W4VNE—56 countries, 1 watt; WØQZR—54 countries, 2-8 watts; WA8DDI—50 countries, 2 watts; K2BG—45 countries, 5 watts; WA6ABP—37 countries, 0.8 watts; W2NEO—23 countries, 3 watts; and CT2AZ—22 countries, 2 watts.

DX Mobile: W6AM has now worked 176 countries while following his normal daily route involving a 1 hour drive. Most of these are on 14 mHz c.w. Don says the c.w. mobile is his best adjunct for DXing since he installed the rhombics.

DXpeditions: W2BP plans an April trip for 160 operation from PJ7, FS7, VP2M, VP2D, FM7, VP2L, and VP2S. VK5XK will be /VK9 from Norfolk Island. His operation will be low power and strictly c.w.

KC4DX DXpedition to Navassa Island

Six Atlanta hams plan to operate from Navassa Island using the callsign KC4DX be-

One of the most ardent DXers in the Mediterranean area is Henry, 7Z3AB, who has helped many US amateurs make contacts with rare stations such as SU1MA, ST2SA, and JY1. *(Photo courtesy WB6UJO.)*

ginning at 2300Z, Friday, May 12, 1972. They will be operating 10 through 160 meters using both s.s.b. and c.w.

In general operation will be s.s.b. on the highest frequency band open to the US. The c.w. station will usually be operating on the next lower band from the s.s.b. station.

It is expected that KC4DX will be on some band 24 hours each day from 2300Z Friday to 1300Z Monday, May 15. Operating frequencies will be approximately as follows:

The CQ DX Award Program

C.W. DX

85.....DL1QT	86.....DJØLC

S.S.B. DX

185.....W2SUA	191.....SP5BB
186.....WB9EAQ	192.....SP5HS
187.....ZL4NH	193.....K4IUV
188.....OK1MP	194.....W5ILR/TF
189.....I8KGQ	195.....WB2NRU
190.....W6FET	196.....UB5ND

CQ DX Endorsements

C.W.: DL1QT—250, Low Band, and 28 mHz.

S.S.B.: K6EC—300; ZL4NH—250; OK1MP 250, Low Band, and 28 mHz; G3KYF—250; W2SUA—200, W6FET—200, UB5-ND—200, WB6WAV—150, W6YVK—150, W5ILR/TF—150, WØUCK—150, and SP5BB—150.

Complete rules for the CQ DX Award Program may be found on pg. 58 of the January, 1971 issue. Application blanks and copies of the rules may be obtained by sending a self-addressed, stamped envelope to the Award Manager, P.O. Box 1271, Covina, Ca. 91722, or to the DX Editor.

Band (Meters)	S.S.B.	C.W.
10	28.605 mHz	28.505 mHz
15	21.355 mHz	21.030 mHz
20	14.280 mHz	14.030 mHz
40	7.255 mHz	7.030 mHz
80	3.905 mHz	3.530 mHz
160	Send SASE to QSL address for details.	

The plan is to work transceive on the above frequencies until QRM makes this impossible. In that event they will begin working call areas and/or will listen from the transmitting frequency up the band.

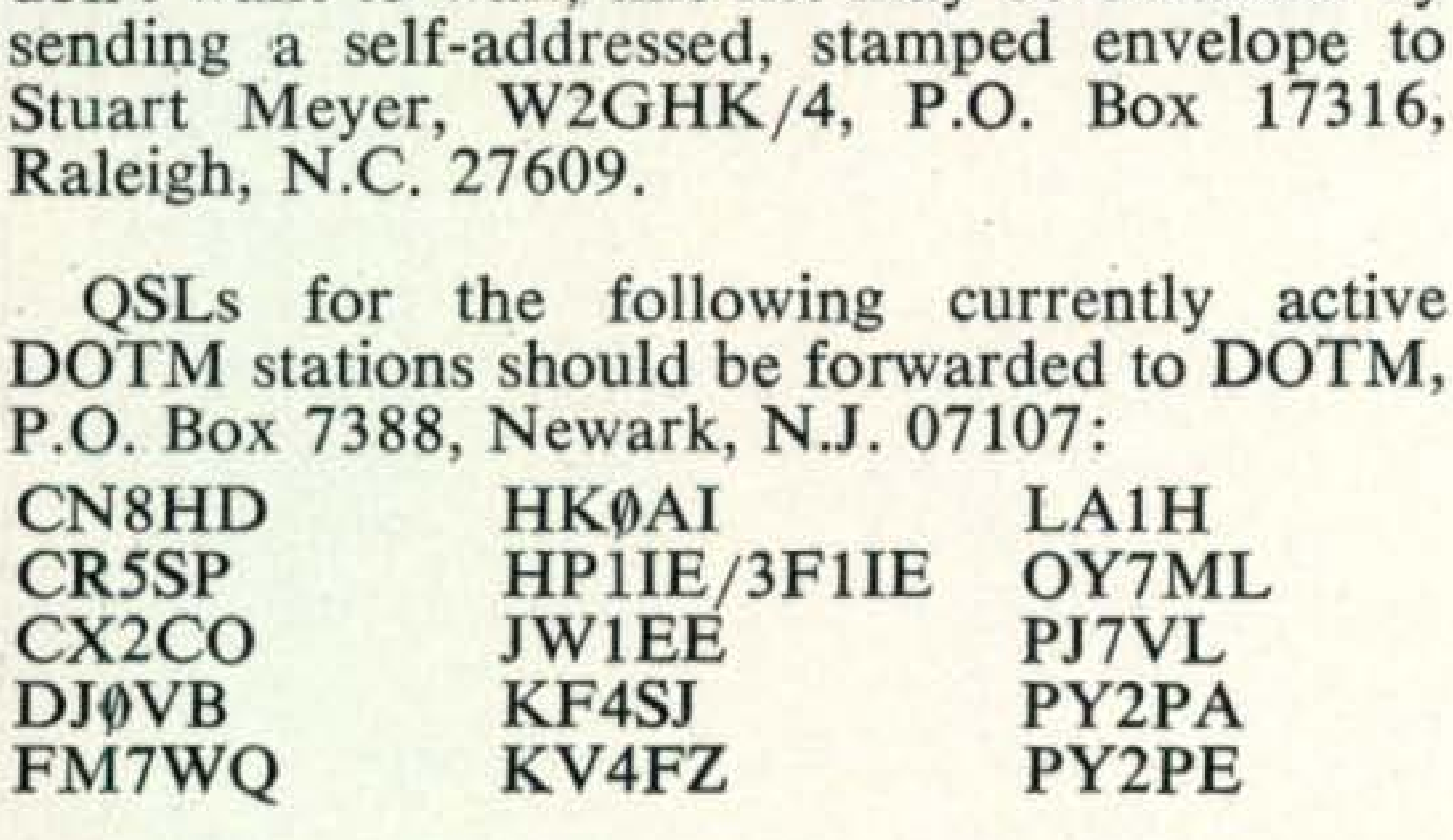
QSL via W4GKF or to KC4DX, PO Box 11555, Atlanta, Georgia 30305. US amateurs please send s.a.s.e. plus one (1) IRC; hams outside US please send s.a.e. plus two (2) IRCs.

QSL Information

It has been suggested by an interested reader that we list the DX stations whose QSL cards are managed by major QSLing organizations. This is a good suggestion, and this month we are covering those stations handled by the International DX Association, Scott's QSL Service, and the *currently active* stations under the banner of the DXpedition of the Month. The entire list from the DXpedition of the Month would take several pages, but one of these days we will probably carry it because it is important. If you don't want to wait, this list may be obtained by sending a self-addressed, stamped envelope to Stuart Meyer, W2GHK/4, P.O. Box 17316, Raleigh, N.C. 27609.

QSLs for the following currently active DOTM stations should be forwarded to DOTM, P.O. Box 7388, Newark, N.J. 07107:

CN8HD	HKØAI	LA1H
CR5SP	HP1IE/3F1IE	OY7ML
CX2CO	JW1EE	PJ7VL
DJØVB	KF4SJ	PY2PA
FM7WQ	KV4FZ	PY2PE



Dave, ET3DS, has been active from his new QTH near Addis Ababa. Dave's ex-calls include 8R1S and 5H3MA. *(Photo courtesy F5QQ.)*

The WAZ Program

S.S.B. WAZ

958........W8KGR	965........W4SYL
959........JA2AH	966........I1FLN
960........W2SJA	967........KR6LY
961........W5VJP	968........W4QAW
962........DJØPN	969........JA2ACC
963........WA5QYR	970........OE1BFW
964........SP5CKM	971........DL8BB

C.W.—Phone WAZ

3310........OK1ARN	3319........K4HXF
3311........PY7AEW	3320........JA8AQX
3312........OK3CIR	3321........WB6ZUC
3313........DM3OML	3322........ZL4NH
3314........WA2BCK	3323........G2HKU
3315........WB6WAV	3324........LA4HL
3316........WØJYE	3325........DJ5WO
3317........SP3AUZ	3326........KR8EA
3318........SP8AWP	3327........DL9RP

Phone WAZ

471........OZ3KE	473........K1FRN
472........WB4GTC	474........W1HGA

Complete WAZ rules are shown on pgs. 64-66 of the June, 1970 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, Fl. 33880.

VA2UN	VK9XK	VS6DR
VE8RCS	VP7NY	W4EXI/#
VK3BM	VP8JV	W9OIJ/#
VK3CIF	VP9GR	XE1IIJ
VK9JK	VS6DO	9Y4VT
VK9XI	VK9XX	

Stations handled by the International DX Association, P.O. Box 125, Simpsonville, Md. 21150 include the following:

TY7ATF	AP2KS	ZK1AJ
EP2CC	ZK2AH	ZM7AG
KP6AL	ST2SA	ZK1MA
VE8CB	XT2AA	VK9NP
K3QOS/KB6	VKØTM	VK9NP/W
FR7AE/E	FY7AF	8Z4A

QSLs for the following stations should be sent to Scott's QSL Service, 1510 Lynnview, Houston, Texas 77055.:

CT1SQ	HP1XHG	SP8MJ
CT1SQA	KA8AN	TG9ND
DU1EN	KC6JW	VP2AP
EP2SW	KG6AAY	VP2AAP
FØBF	KJ6CF	VP2AZ
FM7WG	KP4AOD	VP2LDD
FM7WU	KP4DEX	VR2ER
GM3CFS	KR8BY	LZ4NG
HK1BQR	KZ5KB	4Z4JW
HK4BSW	MP4BIN	6W8BD
HK4BUC	PAØSNG	7X2AD
HK4BZQ	SP3DOI	7XØWW
HL9WI	SP5PWK	9V1QJ
HP1RC	SP6BZ	9X5CC

[*Continued on page 85*]

THE dwards PROGRAM

BY ED HOPPER,* W2GT

USA-CA Honor Roll

2500		1500		500	
WA6OTV	124	WA6OTV	179	WB4SLS	877
W8CXS	125	W8CXS	180	K3DEJ	878
W1UOP	126	VE4QZ	181	WN4UCC	879
		W1UOP	182	ZL3RK	880
2000		1000		UK3AAO	881
WA5TOS	146	W8CXS	258		
WA6OTV	147	W1UOP	259		
W8CXS	148	ZL3RK	260		
W1UOP	149	WB2ZNN	261		

THE May, "Story of The Month" re:

County Hunters Expedition

At last I have been able to find space to use this "Story" as told by Bill Hilyerd, K4LRX (see "Story" on Bill, page 79, *CQ* of February 1970).

"As Cliff, WB4FBS; Bill, WA4LSU; and myself, K4LRX, seem to be the only Kentucky County Hunters (at least on 20 meters), we thought it would be nice to take an expedition to the eastern part of the state.

We kicked the idea around for a while and came up with some definite plans. A definite date, the weekend of December 21 and 22 (1969) and a route to cover 43 counties in the eastern half of Kentucky.

After sending out over 100 rundown sheets, we were all set for the weekend. I left on a Friday night to drive to Stinett, Kentucky (Leslie County), the home of Cliff, WB4FBS. It was a long drive and I arrived about 2:00 A.M. and there were quite a few hunters on frequency, double checking their rigs for our trip.

It was a cold Saturday morning but we were on our way and Marv, WB2SJQ was waiting for us, as usual. We began operation from Leslie County at 8:00 A.M. and called it quits some 32 hours later. This was without sleep and only breaking a half hour at a time to eat.

Here is the breakdown: Contacts 928 with 40 states, 5 countries and 196 different stations. Our only regrets were that Bill, WA4LSU could not go with us, and that very bad weather forced us to cut our trip by 5 countries.

The pictures were taken around 10:00 A.M., Sunday and we both look like we could use some sleep. This was in the hills of Breathitt Count on the last few we covered.

It was hard on us, but we enjoyed every minute of it. We were happy to give Bob, W1BHV/K1CXP his #3079, Lewis County. Marv, WB2-SJQ; Clyde, WØYLN; and Steve, K5KDG were great in handling the Net. They kept down the confusion and needless QRM, which was a great help, to say the least.

Bands used were 20 and 75. The rig was a Heathkit SB101 and HP13. I took my HW32A as a backup and also so we could work each other in needed counties.

It was a blast and loads of fun, try it, you'll like it!", signed, Bill, K4LRX and Cliff, WB4-FBS/WA5ZUV.

*P.O. Box 73, Rochelle Park, N.J. 07662.

Bill Hilyerd, K4LRX seems to be saying, "QRX pse while I yawn."

Awards Issued

Wilbur Wilhelm WA6OTV qualified for Mixed 2500, 2000, and 1500 awards.

Paul Kollar, W8CXS (Foto page 64, *CQ* of

November 1970), after a *long* pause applied for Mixed 2500, 2000, and 1500 awards. Paul also applied for USA-CA-1000, endorsed All 7 mHz, A-1 and All 14 mHz s.s.b. Mobiles.

Roger Paulson, W1UOP, also after a *long* pause, was issued 2500, 2000, 1500 and 1000 awards, endorsed All A-3.

John McColly, WA5TOS (ex-WB2LZF/W9-OIJ) acquired USA-CA-2000.

Doug Bowles, VE4QZ, keeps plugging and acquired USA-CA-1500.

"Mac" McKenzie, ZL3RK, after much delay due to some U.S. dock strikes, finally had his application/Record Book arrive and thus qualified for USA-CA-1000, Mixed and USA-CA-500, endorsed All 14 mHz s.s.b.

Penny Ruth Bonnema, WB2ZNN (met her and OM John, last May at W2KXL) made USA-CA-1000, endorsed All 14, All Mobiles, All s.s.b.

Emil Bitterlich, WB4SLS was issued USA-CA-500, endorsed All 14, All s.s.b., All Mobiles.

Martin Franks, K3DEJ, made it for USA-CA-500, endorsed All A-1.

Charlie Smith, WN4UCC, became the 4th Novice to win an award, USA-CA-500, endorsed All A-1.

The Club Station of the Moscow Higher Technical School, UK3AAO, was sent the 2nd USA-CA-500 certificate to a U.S.S.R. Station.

Cliff Taylor, WB4FBS has that look, "Let's se, where is that line?"

Awards

Friends Of Scouting Award: Explorer Post 160 of Fairmont is sponsoring this award. It is their goal to have as many of you who support Scouting exchange ideas, memories, plan future Scouting events, interest new people in Scouting, etc. The requirements for the award are quite simple. Work and exchange QSLs with any 25 current members in Scouting. They need not be Scouts in America, *any country* counts, but you must note their position in Scouting on the GCR list, i.e. Cub Scout, Boy Scout, Explorer, Committeeman, Cubmaster, Scoutmaster, District Executive, Council Commissioner, etc . . . also the unit number, if known. Send GCR List (General Certification Rule) and $1.00 to: Explorer Post 160, C/O Twin Valley Council, Box 22, Manato, Minnesota 56001. *Yes,* s.w.ls may qualify for this award.

Worked Every Region—B.S.A.: This Boy Scouts of America Award is earned by submitting QSL cards verifying ham contacts with members of the B.S.A. in the 12 Scouting Regions. Send to: *Boys' Life* Radio Club, K2BFW, Certificate Department, Boy Scouts of America, North Brunswick, New Jersey 08903.

Worked All States—B.S.A.: This B.S.A. award may be earned by submitting QSL cards verifying ham contacts with members of the Boy Scouts of America in the 50 states. Also send to K2BFW with QTH as listed under Worked Every Region.

Call Area Specialists: This certificate just for s.w.ls. Submit verification (QSL) cards from stations heard in all 10 call areas. Also send to K2BFW.

World Listener: This certificate also just for s.w.ls. Submit verification (QSL) cards from 25 different countries, with at least one from each of the 6 continents. Also send to K2BFW with address as listed under Worked Every Region.

The Wellington Award: This certificate offered to amateurs who contact the required stations in the Wellington Area (N.Z.).

New Zealand stations must contact at least 25 stations, including at least 2 from each of the four areas—Wellington City, Lower Hutt—and West Coast Districts (e.g. Titahi Bay, Porirus, etc.).

Australian, Cook Islands and similar near Island Territories must contact at least 10 stations, including at least 1 from each of the four areas.

Rest of the World must contact at least 5 stations including 1 each from at least 3 of the 4 areas listed.

Band and Mode endorsements will be made, if desired. Send GCR List with 25 cents (N.Z.) or 4 IRCs to: Mr. W. St J. Reed, ZL2AH, 11 Wood Street, Upper Hutt, New Zealand.

The DX Old Timers' Club (DXOTC), box 143, Palermo, Sicily (Italy), is devoted entirely to Amateur Radio interest, in particular to favor DX activity by conferring *Certificate of Honor* and *Certificate of Merit,* with particular consideration for seniority of activity in the field of DX.

Any amateur can belong to DXOTC:

A) By *Certificate of Merit* which will be issued to any amateur in the world who has distinguished himself for exceptional performance in

Friends Of Scouting Award.

DX; this certificate will be issued also to those amateurs in the world who will activate at least four different islands valid for I.O.T.A. list after January 1, 1971.

B) By *Certificate of Honor* which will be awarded to any amateur in the world who demonstrates.

1) That he has received his first amateur license at least 20 years before his application.
2) That he has at least 250 DXCC confirmed countries.

Application should be sent with documentation, either by legalized photostatic copy or by official declaration of an Amateur Radio Association affiliated with I.A.R.U., to DXOTC, P.O. Box 143, Palermo, Sicily (Italy) with 3 U.S. dollars ($3.00) or 25 IRCs. *Certificates of Merit* will be issued free.

Worked Italian Islands (W.I.I.): This DXOTC Certificate will be awarded to any amateur who has the required QSOs with the different Italian Islands after January 1, 1971.

For Italian amateurs 9 QSLs from different islands are required; other European amateurs need 7 QSLs from different islands. All others need 5 QSLs from different islands.

QSOs are valid on any band and any mode. The name of the island must appear on the QSL card.

Application with the required QSL cards and 3 U.S. dollars should be sent to: DXOTC, P.O. Box 143, Palermo, Sicily (or 25 IRCs). Italian Islands are: Sicily, IT9, Ustica, IE9; Pantalleria (Zone 33) IH9; Pelagic Islands (Zone 33) IG9; Egadi Islands, IF9; Eolie Islands, ID9; Sardegna, IS∅; Asinara, IA5; S. Antioco—S. Pietro, IM∅; Tremiti Islands, IL7; Tuscan Archip. IA5; Maddalena Archip., IM∅; Napoletan Archip., IC8; and Ponza Archip., IB∅.

The Wellington Award (N.Z.)

Notes

Regarding those Scout Awards, check *Boys' Life* and all amateur radio magazines for data on Scout Jamborees On The Air and nets. and such data.

A letter from Rod, WA7NEV to advise everyone that he does QSL 100%, but he found that his post box was being pilfered. The combination had to be changed, so if you did NOT get your QSL, apply again to Rod Hallen, WA7NEV, Box 73, Tombstone, Arizona 85638.

For new readers, *Yes,* I issue the USA-CA (United States of America County Award). The basic award is issued for having confirmations from 500 or more U.S. counties (do not send the QSLs). There is no time limit nor band nor mode restrictions. And QSLs for any call ever assigned to YOU, are valid. Your *first* application must be made using a "USA-CA Record Book" obtainable direct from CQ, 14 Vanderventer Ave., Port Washington, N.Y. 11050 postage paid for $1.25. To save time, all other correspondence regarding USA-CA should be sent direct to me at P.O. Box 73, Rochelle Park, N.J. 07662. *Yes,* the award is available to s.w.ls.

Also for new readers/award hunters, *GCR* means *General Certification Rule,* and indicates that an award sponsor will accept as proof that an applicant holds the required/listed verifications, a certification that such have been seen, by two other General class (or higher) licensed amateurs, a radio club or organization official, a Notary or other offcial authorized to take oaths. It also means that the sponsor reserves the right to request any or all verifications listed, should doubt arise or should the sponsor desire to make a routine check of the GCR honor system. *AOMB/M* is used to signify that an award sponsor will give endorsements for all one band or all one mode or mixed operations, as might be claimed by an applicant.

Remember the ICHN Convention for 1972 has a New Date, June 29-30-July 1. Full details for s.a.s.e. to W9SOM, Hopedale, Ill. 61747.

As usual, all my space used up too fast. How was your month? 73, Ed., W2GT.

THIS MONTH'S BEST BUY FROM ARROW

SBE SB-144

VHF/FM TRANSCEIVER

- Furnished with crystals for:
  Trans. 146.34/Rec. 146.94
  Trans. 146.94/Rec. 146.94
  Trans. 146.16/Rec. 146.76
- Twelve channel capability.
- All solid-state.
- Ten watts output.
- 1 uv sensitivity for 20 db quieting.
- Ceramic 2nd i.f. filter.
- Weighs only 4.62 lbs.

$239.95

Complete with P.T.T. Dynamic Microphone

SBE does it again! This time with **SB-144**, top performing transceiver for FM operation in the amateur 2 meter band. Following a long-established tradition, **SB-144 outfeatures everything in its class and stands apart as the exceptional dollar value in 2 meter FM gear for the radio amateur!**

Here is the compact, beautifully constructed and conveniently installed transceiver that will give new purpose and meaning to your mobile operation. **SB-144** will open the door to the fun that goes along with rock-solid, "through-the-repeater" contacts. New repeaters are popping up daily so, as you travel, you'll want multiple-channel capability.

SB-144 provides you with an even dozen channels selectable by an instrument-type knob with solid feel and identified by large numerals, softly back lighted. The effect is functional---professional. The full-vision panel meter helps too---shows relative strength on receive---indicates all is well on transmit.

Most competitive units lack these features. There are 12 separate crystal positions for **both** transmitter and receiver allowing that many repeater pair-offs or a combination of repeater and mobile-to-mobile channels. As part of the big value, SBE includes three **sets** of crystals with frequencies chosen to be the most widely used nationally.

Extra power is always a big help. **SB-144** delivers 10 watts of output power and does it with less than 1.9 amps drain from a 12V car battery. The receiver is a "hot" double conversion design with FET front end for high sensitivity and low cross modulation. **SB-144** is an advanced design transceiver and doesn't use tubes---is all-solid-state including FET and four I-C's.

Check out **SB-144** and you will know that it gives you the most for your money. See **SB-144** at your distributor today!

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NANUET, N.Y. 10954 195 West Route 59, Half Mile East of Thruway Exit 14
FARMINGDALE, L.I., N.Y. 11735 900 Route 110, One Mile South of Republic Aviation
MINEOLA, N.Y. 11501 525 Jericho Turnpike, One Half Block East of Herricks Road
TOTOWA, N.J. 07511 225 Route 46, 201-256-8555
NORWALK, CONN. 06850 18 Isaac Street, Shopping Pl., 203-838-4877

Propagation

BY GEORGE JACOBS,* W3ASK

SOLAR activity continues to decline, slowly but steadily. The Swiss Federal Observatory at Zurich reports a monthly mean sunspot number of 64 for January, 1972. This results in a smoothed 12-month running sunspot number of 64 centered on July, 1971. The smoothed number is used internationally to determine points on the sunspot cycle. This latest value is an average of the monthly mean numbers reported for a 12 month period prior to, and including January, 1972.

A smoothed sunspot number of 46 is predicted for May, 1972. This is expected to be the lowest level of solar activity for any May month since 1966.

During May, optimum frequencies for long-distance propagation are expected to be seasonally *lower* during most of the daylight hours, but *higher* during the late afternoon, early evening and nighttime hours, than observed during the winter months. A considerable increase is expected in sporadic-E ionization during the month, and this should result in frequent short-skip openings on each of the h.f. bands, and on 6 meters as well. Static levels are also expected to increase during May.

The following is an overall picture of h.f. amateur band openings forecast for May, 1972. 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 for May and June, as well as Charts centered on Hawaii and Alaska. The Short-Skip Charts contain propagation forecasts for circuits varying in length between distances of 50 and 2300 miles. For day-to-day propagation conditions expected during the month, see the Last Minute Forecast, which appears at the beginning of this column.

*11307 Clara Street, Silver Spring, Md. 20902

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for May, 1972

Days	*Rating & Forecast Quality* (4)	(3)	(2)	(1)
Above Normal: 2, 13, 18, 20, 23-24, 27.	A	A	B	C
Normal: 1, 3-4, 7, 9-12, 14, 16-17, 19, 21-22, 25-26, 28-31.	A	B	C	D
Below Normal: 5-6, 8, 15.	C	D	D	E
Disturbed: None.	D	D	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 2 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 parenthesis 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 high 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 meaning: (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 short skip Charts are based upon a transmitter power of 75 watts c.w.; 150 watts s.s.b., or 800 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—The short skip Charts are valid through June 1972. These Charts are prepared from basic propagation, data published monthly by the Institute for Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado.

10 Meters: Except for an occasional daytime opening to some southern or tropical areas, propagation conditions do not favor DX openings on 10 meters during May. Frequent short-skip openings, between distances of approximately 750 and 1400 miles, should be possible during the month.

15 Meters: A seasonal decrease is expected in DX openings on this band during May, but some fairly good openings are forecast to many areas of the world, especially to those in a southerly direction. DX conditions should

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That's right -- you read us loud and clear. You can add years to your CQ subscription without spending a cent. There must be a catch, you're thinking. Well, there is. But we don't think you'll mind.

Here's the pitch. The President doesn't want us to raise prices or advertising rates, so our only alternative for increasing income is to stimulate extra sales. So we've decided to recruit our regular loyal subscribers to help us sell CQ, and to do it we're willing to offer a nice incentive.

For each NEW subscription sent us by a regular subscriber at the normal rate of $6.00 per year, we'll extend that subscriber a full six months. Bring in six new subscribers - and add three years of CQ for yourself. Simple as that. And if you want to split the profits with your friends as an added inducement who's to know.

After all, who should be a better salesman than a satisfied customer? We need your help and we're willing to make it worth your while.

Remember, only brand new subscriptions can be counted toward this program. That means new subscribers who have not been on our paid subscription list during the past six months or more. **As the man on TV keeps saying, " Try it, you'll like it."**

peak during the late afternoon and early evening hours. Numerous short-skip openings, between approximately 600 and 2300 miles, are also predicted for May.

20 Meters: This is expected to be the best band for DX propagation conditions during the month. Opening shortly after sunrise, good DX conditions should prevail to one area of the world or another, through the evening hours. The band is also expected to remain open to southern and tropical areas during much of the hours of darkness. Peak DX propagation conditions are expected during the late afternoon and early evening hours. Numerous short-skip openings are also forecast for distances between approximately 350 and 2300 miles. Quite often, especially during the late afternoon hours, optimum conditions will exist for openings as short as a few hundred miles and as long as several thousand miles. This is expected to result in an exceptionally high level of interference as long and short-skip stations will be heard at the same time.

40 Meters: With fewer hours of darkness and higher static levels, 40 meter DX propagation conditions are expected to decline somewhat during May. Some fairly good openings, however, are predicted to many areas of the world during the hours of darkness and the sunrise and sunset periods. Excellent daytime short-skip openings are forecast for distances between approximately 100 and 750 miles, with nighttime openings extending up to the short-skip limit of approximately 2300 miles.

80 Meters: Fewer hours of darkness and higher static levels are expected to reduce DX openings on this band during the month, but a few fairly good openings still should be possible to some areas of the world during the hours of darkness. Excellent short-skip openings are forecast for the daylight hours over distances ranging between approximately 50 and 250 miles. During the hours of darkness, the short-skip range should increase up to approximately 2300 miles.

160 Meters: Propagation conditions on this band have passed their seasonal peak, and are expected to decline until the fall months. The openings that may occur during May should take place during the hours of darkness and the sunrise period, and will range up to a distance of 1000 miles, or so. When static levels are exceptionally low, openings considerably beyond this range may also be possible.

V.H.F. Ionospheric Openings

Sporadic-E ionization is expected to increase considerably during May, and this should result in some fairly good 6 meter short-skip openings between distances of approximately 1000 and 1400 miles. During periods of widespread sporadic-E ionization, two-hop openings considerably beyond this range may also be possible. Six meter sporadic-E openings are most likely to occur between 9 A.M. and 1 P.M., and between 5 P.M. and 9 P.M. local standard time, although they can occur during other times as well. An occasional 2 meter short-skip opening, between approximately 1200 and 1400 miles, may also be possible during periods of intense sporadic-E ionization. Refer to "V.H.F. Ionospheric Propagation," which appeared in the November, 1969 issue of *CQ* (page 37), for a do-it-yourself method for predicting v.h.f. sporadic-E short-skip openings.

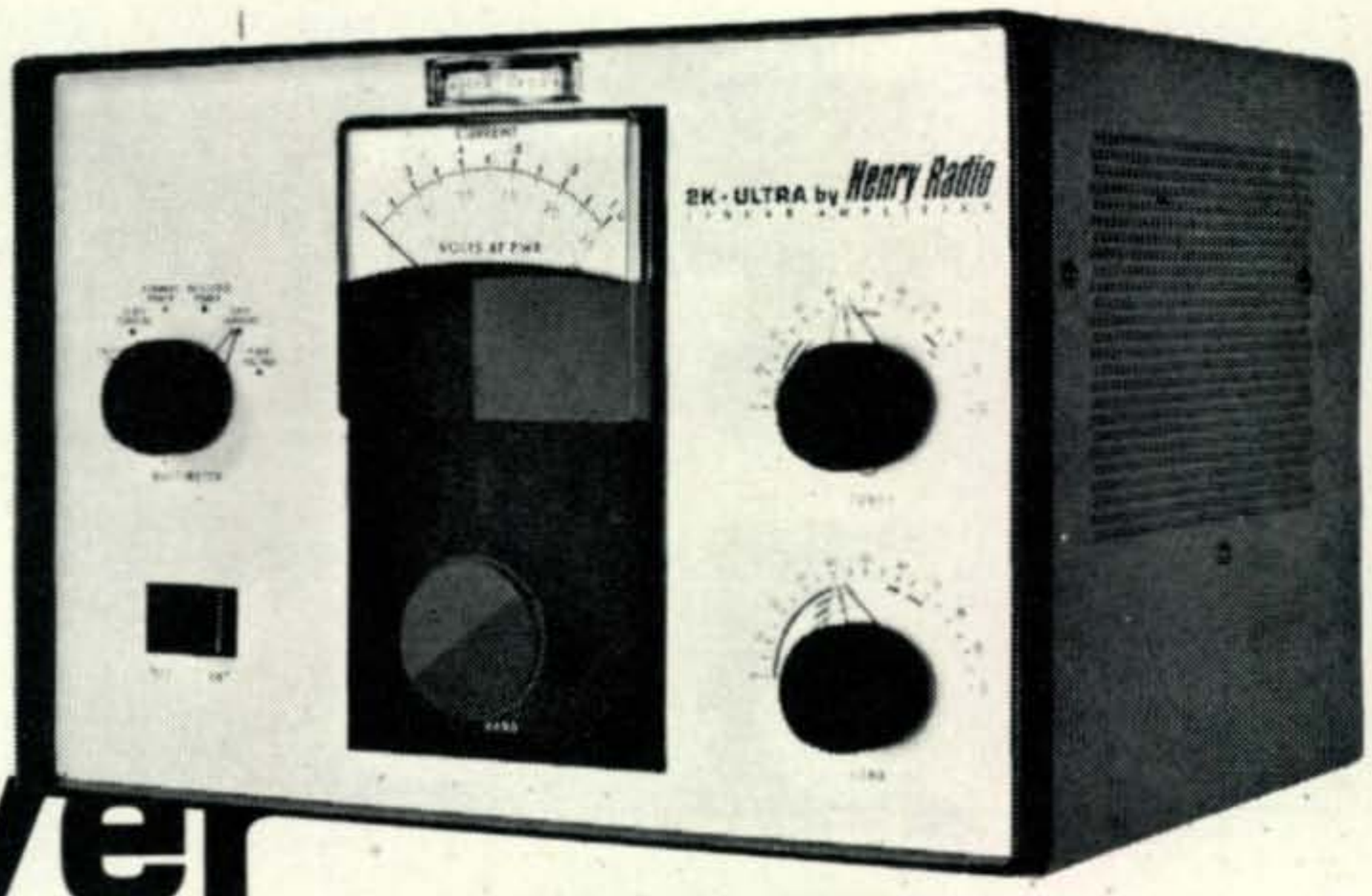
Some fairly good meteor-scatter openings of short duration on the v.h.f. bands should be possible during the *Eta Aquarids* meteor shower which is expected to occur May 3-6. This is a major meteor shower, and it should reach maximum intensity around 0200 GMT on May 5, with an expected hourly meteor count in excess of 20.

Some fairly good 6 meter trans-equatorial (TE) scatter openings should be possible during May. These are most likely to occur between 8 and 11 P.M., local standard time, on long north-south paths which cross the geomagnetic equator at approximately a right angle. TE openings favor locations in the southern area of the USA, but an occasional opening should be possible into the central and northern regions as well.

Auroral activity is generally at a low seasonal level during May, but some displays may occur during periods of below normal or disturbed h.f. conditions. During such periods, openings are likely to occur on 6 and 2 meters for distances up to approximately 1200 miles, as a result of signal reflection or scatter from ionized patches produced by the auroral displays. Check the Last Minute Forecast at the beginning of this column for periods during May that are expected to be below normal or disturbed.

Propagation Book

Stanley Leinwoll's excellent book entitled *Shortwave Propagation*[1] is now out of print and no longer available in book stores. The



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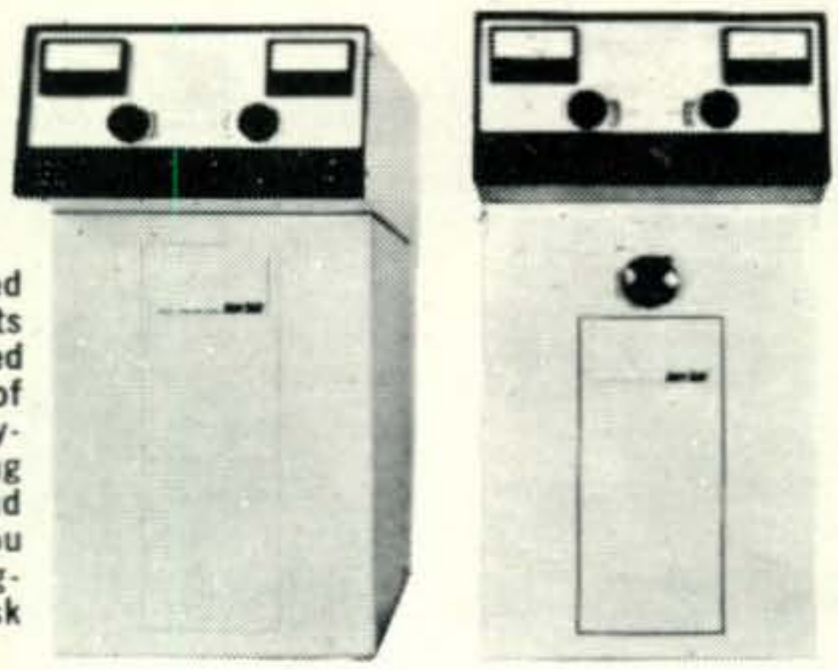
You have never seen or heard anything like it . . . it's totally unique. The 2K Ultra loafs along at full legal power . . . quiet, cool and with a linear wave form that is superior to that of other amateur amplifiers. Its anode heat is silently and efficiently conducted to a heat sink . . . no more blower noise. Truly, the Ultra is a miniature powerhouse of R.F. energy. Every component used in the Ultra is the finest quality obtainable . . . assuring the cleanest, clearest, strongest signal and years of trouble free, dependable service. More than three thousand 2K owners can't be wrong.

SPECIFICATIONS: ☐ TUBE COMPLEMENT: Two Eimac 8873 grounded grid triodes. Conductively cooled with a thermostat controlled fan for high dissipation modes. ☐ TYPE OF EMISSION: SSB, CW, and RTTY. ☐ DUTY CYCLE: Continuous duty in all modes. ☐ POWER REQUIREMENTS: 230 VAC, 50/60 Hz, 15 amps or 115 VAC, 50/60 Hz, 30 amps. ☐ DRIVE POWER REQUIRED: SSB, CW, and RTTY — 75 watts. ☐ INPUT POWER: 2 kilowatts PEP SSB — 1 kilowatt CW and RTTY. ☐ OUTPUT POWER: 1 kilowatt PEP nominal. ☐ OUTPUT IMPEDANCE: 52 ohms unbalanced with SWR not to exceed 2:1. ☐ INPUT IMPEDANCE: 52 ohms. ☐ HARMONIC AND OTHER SPURIOUS RADIATION: Second Harmonic: -50 db. Third Order Distortion: -30 db at full power output. ☐ NOISE LEVEL: -40 db or better below one tone carrier at 1 kilowatt. ☐ ALC CIRCUIT: Prevents overdrive from today's high power exciters and boosts average talk power. ☐ DIMENSIONS: RF Deck: 8¾" high x 12" wide x 11" deep. Power Supply: 7½" high x 12½" wide x 10½" deep. ☐ WEIGHT: RF Deck: 20 lb. Power Supply: 61 lb, Shipping Weight: 100 lb. ☐ PRICE: $845.00

3K-A MILITARY/COMMERCIAL LINEAR AMPLIFIER



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Editor of this column still has available about a dozen copies for sale on a first-come, first-served basis. The price is $4, postpaid, and orders should be addressed to George Jacobs, W3ASK, 11307 Clara Street, Silver Spring, Md. 20902. Although written 12 years ago, it's still the most comprehensive text on the subject intended for the radio amateur.

[1]*Shortwave Propagation,* by Stanley Leinwoll, John F. Rider pub., N.Y.; 1959.

CQ Short-Skip Propagation Chart
May & June, 1972

Band Openings Given In Local Standard Time
At Path Mid-Point Using 24-Hour Time System

Band (Meters)	*Distance From Transmitter (Miles)* 50-250	250-750	750-1300	1300-2300
10	*Nil*	07-09 (0-1) 09-13 (0-2) 13-17 (0-1) 17-21 (0-2) 21-23 (0-1)	07-09 (1) 09-13 (2) 13-17 (1-2) 17-21 (2) 21-23 (1) 23-07 (0-1)	07-09 (1-0) 08-21 (2-0) 21-23 (1-0) 23-07 (1-0)
15	*Nil*	06-09 (0-1) 09-13 (0-2) 13-17 (0-1) 17-21 (0-2) 21-00 (0-1)	06-09 (1-2) 09-13 (2-3) 13-17 (1-3) 17-19 (2-3) 19-21 (2) 21-00 (1) 00-06 (0-1)	06-09 (2-0) 09-11 (3-1) 11-16 (3-2) 16-19 (3) 19-21 (2) 21-22 (1) 22-06 (1-0)
20	09-20 (0-1)	06-09 (0-2) 09-12 (1-3) 12-17 (1-4) 17-19 (1-3) 19-20 (1-2) 20-22 (0-2) 22-06 (0-1)	06-07 (2) 07-09 (2-3) 09-12 (3-4) 12-17 (4) 17-19 (3-4) 19-20 (2-4) 20-22 (2-3) 22-00 (1-2) 00-06 (1)	06-07 (2) 07-09 (3) 09-16 (4-3) 15-20 (4) 20-22 (3-4) 22-00 (2-3) 00-02 (1-2) 02-06 (1)
40	07-09 (1-2) 09-11 (2-4) 11-17 (3-4) 17-19 (2-4) 19-21 (1-3) 21-23 (0-2) 23-07 (0-1)	07-09 (2-4) 09-15 (4-2) 15-17 (4-3) 17-19 (4) 19-21 (3-4) 21-23 (2-3) 23-07 (1-2)	07-08 (4-3) 08-09 (4-2) 09-15 (2-1) 15-17 (3-1) 17-19 (4-2) 19-21 (4) 21-23 (3-4) 23-02 (2-4) 02-04 (2-3) 04-07 (2)	07-08 (3-1) 08-09 (2-1) 09-17 (1-0) 17-19 (2-1) 19-21 (4-3) 21-02 (4) 02-04 (3) 04-06 (2) 06-07 (2-1)
80	07-10 (4) 10-18 (4-3) 18-22 (4) 22-00 (3-4) 00-05 (2-3) 05-07 (3-4)	07-10 (4-1) 10-16 (3-0) 16-18 (3-1) 18-20 (4-2) 20-00 (4) 00-05 (3-4) 05-07 (4-3)	07-08 (1) 08-10 (1-0) 10-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-3) 22-02 (4) 02-05 (4-3) 05-07 (3-2)	07-08 (1-0) 08-18 (0) 18-20 (1-0) 20-22 (3-2) 22-02 (4-3) 02-05 (3-2) 05-07 (2-1)
160	05-08 (4-1) 08-09 (2-0) 09-18 (1-0) 18-20 (3-1) 20-22 (4-2) 22-05 (4-3)	05-08 (1) 08-18 (0) 18-20 (1-0) 20-22 (2-1) 22-00 (3-2) 00-03 (3) 03-05 (3-2)	07-08 (1-0) 08-20 (0) 20-22 (1) 22-00 (2-1) 00-03 (3-2) 03-05 (2) 05-07 (1)	07-20 (0) 20-00 (1) 00-03 (2) 03-05 (2-1) 05-06 (1) 06-07 (1-0)

ALASKA

Openings Given In GMT†

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

NOTE: The Alaska and Hawaii Propagation Charts are intended for distances *greater* than 1300 miles. For shorter distances, use the preceding Short-Skip Propagation Chart.

†To convert to Local Standard Time in Alaska, *subtract* 8 hours from the GMT times shown in the Chart in the PST Zone of Alaska; *subtract* 9 hours in the Yukon Zone and 10 hours in the Alaskan Standard Time Zone. In other USA time zones, *subtract* 5 hours from GMT to obtain EST; 6 hours to obtain CST, 7 hours to obtain MST and 8 hours to obtain PST. For example, 20 hours appearing in the Alaskan Chart is 20 GMT; which is equivalent to 15, or 3 P.M. EST; noon PST; 10 A.M. in the Alaskan Standard Time Zone, etc.

HAWAII

Openings Given in Hawaiian Standard Time§

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

§To convert from HST shown in the Chart to local Standard Time in other USA Time Zones, *add* 2 hours in the PST Zone; 3 hours in the MST Zone; 4 hours in the CST Zone; and 5 hours in the EST Zone. *Add* 10 hours to convert from HST to GMT. For example, when it is 12 Noon in Honolulu, it is 14 or 2 P.M. in Los Angeles; 17 or 5 P.M. in New York, and 22 GMT.

‡Indicates predicted 80 meter openings. Openings on 160 meters are also likely to occur during those times when 80 meter openings are shown with a forecast rating of (2) or higher.

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Apr.	22-23	Bermuda Phone Contest
Apr.	29-30	PACC DX Contest
Apr.	29-30	WAE RTTY Contest
Apr.	29-30	New York State QSO Party
May	6-7	Bermuda C.W. Contest
May	6-7	OZ CCA DX Contest
May	6	World Telecomm. C.W.
May	13	World Telecomm. Phone
May	13-14	USSR C.W. DX Contest
May	13-15	Georgia QSO Party
May	13-15	Montana QSO Party
May	20-21	Michigan QSO Party
May	20-21	YL ISSBers C.W. Contest
May	27-29	YL ISSBers Phone Contest
June	2-5	CHC/FHC/HTH QSO Party
July	1-2	Venezuelian Contest
July	22-23	Colombian Contest
Aug.	5-6	European C.W. DX Contest
Aug.	26-28	Delta QSO Party
Sept.	9-10	European Phone Contest
Oct.	**28-29**	**CQ WW DX Phone Contest**
Nov.	**25-26**	**CQ WW DX C.W. Contest**

Bermuda Contest

Phone: April 22-23 C.W.: May 6-7
Starts: 0001 GMT Saturday
Ends: 0200 GMT Sunday

There's still time to prepare for the c.w. weekend. Check last month's CALENDAR for the details and the fabulous award to the "Top Banana." Logs must be received no later than June 30th by the Radio Society of Bermuda, P.O. Box 275, Hamilton, Bermuda.

PACC DX Contest

Starts: 1200 GMT Saturday, April 29
Ends: 1800 GMT Sunday, April 30

The PA/PE/PI stations can be worked on phone or c.w. in this one. Rules in last month's CALENDAR. Logs go to: Mr. L.v.d. Nadort, PAØLOU, Contest Mgr., Bospolderstraat 15, Nieuwerkerk, a/d Ysel, The Netherlands.

WAE RTTY Contest

Starts: 0000 GMT Saturday, April 29
Ends: 2400 GMT Sunday, April 30

Better check the rules in last month's CALENDAR on this one, they use QTC points in addition to QSO points. Mailing deadline is June 10th to: DARC Contest Committee, D-8950 Kaufbeuren, P.O. Box 262, Germany (West)

*14 Sherwood Road, Stamford, Conn. 06905.

New York State QSO Party

Two Periods: GMT
1700 April 29 thru 0500 April 30
1200 April 30 thru 2359 April 30

Also covered in the April CALENDAR. Mailing deadline for logs is June 1st to: LERA ARC, Att: Jeff Rooner, WB2AEQ, 35 Gottlieb Drive, Pearl River, New York 10965.

OZ-CCA DX C.W. Contest

Starts: 1200 GMT Saturday, May 6
Ends: 2400 GMT Sunday, May 7

This is the 21st running of this contest by the EDR of Denmark. It's a world wide type contest, all bands 3.5 thru 28 mHz, single and multi-operator classification.

Single operators may use only 30 out of the 36 hour contest period, the 6 hour rest period may be taken in not more than 2 periods.

Exchange: Six figures, RST plus a progressive QSO number starting with 001.

Points: Contacts with stations on the same continent 2 points, other continents 3 points. Contacts with OX, OY, OZ count double.

Multiplier: Is determined by the number of countries worked on each band. Call districts in the following countries will be considered as multipliers: W/K, VE/VO, PY, LU, VK, ZL, JA, OZ, OY, OX.

Final Score: Total QSO points from all bands multiplied by the country multiplier total from each band.

Awards: Certificates to the top scorers in each country and call areas listed above.

Include a summary sheet and signed declaration and mail your log before June 15th to: E.D.R. Contest Committee, P.O. Box 335, 9100 Aalborg, Denmark.

World Telecomm. Contest

C.W.—0000 to 2400 GMT Saturday, May 6
Phone:—0000 to 2400 GMT Saturday, May 13

The Brazilian Ministry of Communication announces its third annual contest commemorating "World Telecommunications Day." (May 17th)

Operation is limited to single operator stations fixed or maritime, all bands, 10 thru 160 meters.

Gordon Marshall, W6RR accepting the CQ USA All Band Championship Plaque from Jerry Hagen, WA6GLD. The occasion was the Fresno Convention last January which had over 325 avid DXers in attendance.

Exchange: RS/RST plus your I.T.U. Zone.
Scoring: QSO points as follows:

	10/15/20	40	80/160
Same country	0	0	0
Other countries same Zone	1	1	2
Other Zones same continent	2	3	4
Other continents	3	5	6

Final Score: Total QSO points multiplied by number of different I.T.U. Zones worked. The same station may be worked on each band for QSO points but Zones is counted only once.

Awards: Diplomas to the three highest scoring stations in each country. Gold, silver and bronze medals to the three top scorers in the world. (Awards for both c.w. and phone)

The I.T.U. Trophy goes to the country with the highest aggregate score, determined by the mathematical average of the scores of the top ten contestants of that country. The trophy remains in the possession of the national association of that country, affiliated with the I.A.R.U., for a period of one year. It is permanently retired if won 3 times within a 5 year period.

Separate logs are required for phone and c.w., include a summary sheet, a signed declaration and mail before June 30th to: DENTEL, P.O. Box 1219, ZC00, Rio de Janeiro—GB, Brazil.

USSR C.W. DX Contest

Starts: 2100 GMT Saturday, May 13
Ends: 2100 GMT Sunday, May 14

The Radio Sports Federation of the USSR invites radio amateurs all over the world to take part in their "CQ-M" Contest, to strengthen friendly relations among all amateurs.

This is a world wide contest, so do not confine your activity to working USSR stations only. Use all bands 3.5 thru 28 mHz.

Categories: Single operator, both all band and single band. Multi-operator, single transmitter. And s.w.l.'s.

Exchange: RST plus the number of their oblast (region) for the USSR, RST plus a progressive QSO number for the rest of us.

Points: One point for QSO's between stations on the same continent, 3 points between stations on different continents. Contacts between stations in the same country have no value.

A station may be worked once on each band for QSO points, but a multiplier is counted only *once*.

S.w.l.'s credit 1 point if one station is reported, 3 points if both sides are reported.

Multiplier: Is derived from the countries and territories in the "R-150-S" list. In addition to the countries the following oblasts will count as separate multipliers: 02, 13, 14, 56, 84, 85, 86, 87, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 105, 128, 138, 139, 153, 159.

Final Score: Total QSO points from all bands times the country/oblast multiplier.

Awards: To the top scorers in each category in each country, first 3 places in each continent, and the world leading station, both single and multi-operator, a separate award if the score is made on 3.5 mHz only.

Awards will be made in the form of certificates, badges and trophies, depending on the classification. A minimum of 6 hours operation is required for country awards and 12 hours for the continental entries.

Contest contacts may be credited for the many USSR awards in lieu of QSL cards. (R-150-S, R-15-R, R-6-K, W-100-U, R-100-O, R-10-R)

Mailing deadline is July 1st to: Radio Sports Federation, P.O. Box 88, Moscow, USSR

Georgia QSO Party

Starts: 2000 GMT Saturday, May 13
Ends: 0200 GMT Monday, May 15

The Columbus ARC is again sponsoring its eleventh annual QSO party. The same station may be worked on each band and mode for QSO points. (Ga. to Ga. contacts permitted)

Exchange: QSO no., RS/RST and QTH. County for Georgia; state, province for others.

Scoring: Each QSO counts 2 points. Ga. stations multiply total by number of different states and VE provinces worked. Out-of-state use Ga. counties for their multiplier. (max. of 159) DX may be worked for QSO points but not for multiplier credit.

Frequencies: c.w.—1810, 3590, 7060, 14060, 21060, 28060. s.s.b.—3975, 7260, 14290, 21410, 28600. Novice—3718, 7175, 21110. (Try 160 at 0300Z, 10 on the hour, 15 on the half hour.)

Awards: Certificates to the highest scoring station in each state, province, country and Georgia county. Also to the top Ga. and non-Ga. novice. There are plaques for the top Ga. station, out-of-state station, Ga. Club with highest aggregate score, and top scoring mobile or portable outside his own county.

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THE SX-190. With crystals for 80 meters, 49 meters, 40 meters, 31 meters, 25 meters, 20 meters, 19 meters, 16 meters, 11 meters, plus 2 blank 500 kHz bands (crystals extra) between 3.5-10 MHz and 10-30 MHz.

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Results USSR 1971 Contest
U.S.A.

All Band		Single Band	
W7IEP	45,126	WA2EAH	9,548
K3HTZ	43,050	W2FVS/2	4,048
VE2MW/W2	16,416	W7BBX/4	1,530
W4KXV	9,292	W5RUB	1,413
WB8EUN	6,723	W3ARK	1,260
K5ABV	3,780	W6KYA	1,183
W2CVW	3,096	WB0AEW	945
W6DQX	2,928	K9VQK	756
W7CFJ	2,400	K3CUI	126
W2CKR	1,872	K3KMA	105
WA0VBV	1,392		
K4OLC/8	756	**Multi-Opr.**	
K6TWE	92	W1MX	40,480

Other No. America

VO1AW	17,056	VE3BBH	3,150
VE3CDX	16,203	HP1AC	2,534
KZ5BB	8,592	VE2IL	64
VE1AE	897		

clude a summary sheet and a signed declaration and mail before June 19th to: Columbus ARC, Att: John T. Laney III, K4BAI, P.O. Box 421, Columbus, Georgia 31902. Include a large s.a.s.e. for copy of results.

Montana QSO Party

Starts: 0100 GMT Saturday, May 13
Ends: 0100 GMT Monday, May 15

The Eastern Montana College Sparkgap Society and the Butte ARC are sponsoring this one to help those needing Montana for their 5B WAS.

Stations may be worked on each band and mode for QSO points, and in-state contacts may be made by Montana stations.

Exchange: QSO no., RS(T) and QTH. County for Montana, state, province or country for all others.

Scoring: For Mont. 1 point per QSO multiplied by states, VE provinces and countries worked. Others 5 points per QSO multiplied by Mont. counties. (max. of 56)

Frequencies: Phone—28520, 21370, 14300, 7260, 3930. C.W.—28040, 21040, 14040, 7040, 3540. Novice—3725, 7175, 21125.

Awards: To the top scorers in each state, VE province (min. 50 points) and each DX country. (min. 20 points) In Mont., awards to the 5 top scores.

Mailing deadline is June 4th to: Eastern Montana College Sparkgap Society, Box 73, Billings, Montana 59101

Michigan QSO Party

Starts: 2100 GMT Saturday, May 20
Ends: 2100 GMT Sunday, May 21

This is the 5th annual party sponsored by the Central Michigan ARC. The same station may be worked on c.w. and phone on each band, and Mich. can work in-state stations for both QSO and multiplier credit.

Exchange: RS(T) and 3 digit QSO serial number starting with 001, county for Mich. stations; state, province or country for others.

Scoring: One point per QSO. Mich. will use states, VE provinces and DX countries for their multiplier. Others Mich. counties. (max. 83)

Awards: Certificates to the top scorers in each state, province, DX country and each Mich. county. There are Trophies for the leading Mich. and out-of-state stations.

Frequencies: C.W.—3560, 7060, 14060, 21060, 28560 *(that's what the man said, 560)* Phone—3925, 7260, 14290, 21360, 28560, 50400 52525, 145350, 146940. Look for Mich. stations on 21 mHz at 1600 & 1900 GMT and 28 mHz at 1700 & 2000.

Logs must be mailed no later than June 30th to: Central Michigan ARC, P.O. Box 73, Lansing, Michigan 48901.

YL ISSBers QSO Party

C.W.: 0000 GMT May 20 to 2400 GMT May 21
Phone: 0000 GMT May 26 to 2400 GMT May 28
C.W.—One 6 hour rest period.
Phone—Two 6 hour rest periods.

This year's party has been divided into two separate week-ends. The same station may be contacted on different bands for QSO points, but the multiplier is counted only *once*.

Categories: DX/WK teams, YL/OM teams and single operator. (Non-members enter single opr.)

Exchange: Name, RS(T), SSB no., state/province/or country, partners call. (if any) (non-members send "no no.")

Points: Contacts with members within own country, 3 points; with members in other countries, 6 points; with non-members, 1 point.

Multiplier: Total countries worked × 2, and completed teams worked × 2.

Final Score: Total QSO points × country multiplier × team multiplier.

Frequencies: C.W.—3565, 7065, 14070, 21070. Phone: 3973, 7273, 14332, 21373, 28673. Listen for DX around 3775 and 7090.

Awards: 1st, 2nd and 3rd place certificates in each country, continent and state.

Trophies to the top scoring single operator, DX/WK team, YL/OM team and c.w. only score. Plaques to those placing 2nd and 3rd.

Pairing of DX/WK teams must be cleared by a request thru John Propst. YL/OM teams must be related pairs. It is suggested you secure QSO party forms and other information from W4AAA.

Logs must be received before July 15th and go to: John Probst, W4AAA, 8618 W. Park, Ft. Myers, Fla. 33901.

Editor's Notes

We had a good week-end for our 160 Contest. Conditions were good, activity was high and the DX was coming through.

A few incidents however soured an otherwise successful week-end.

[*Continued on page 88*]

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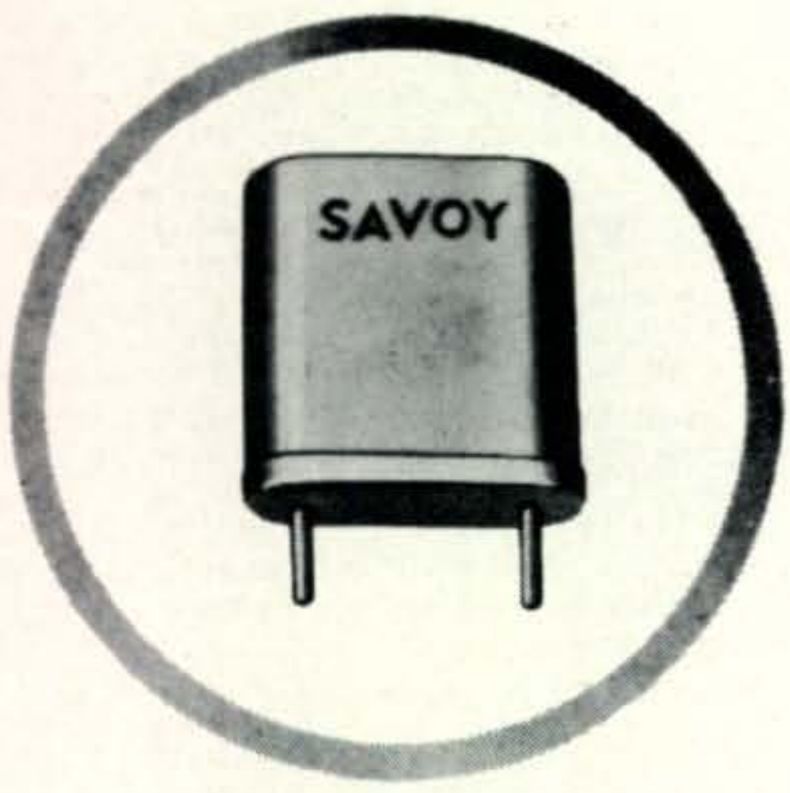
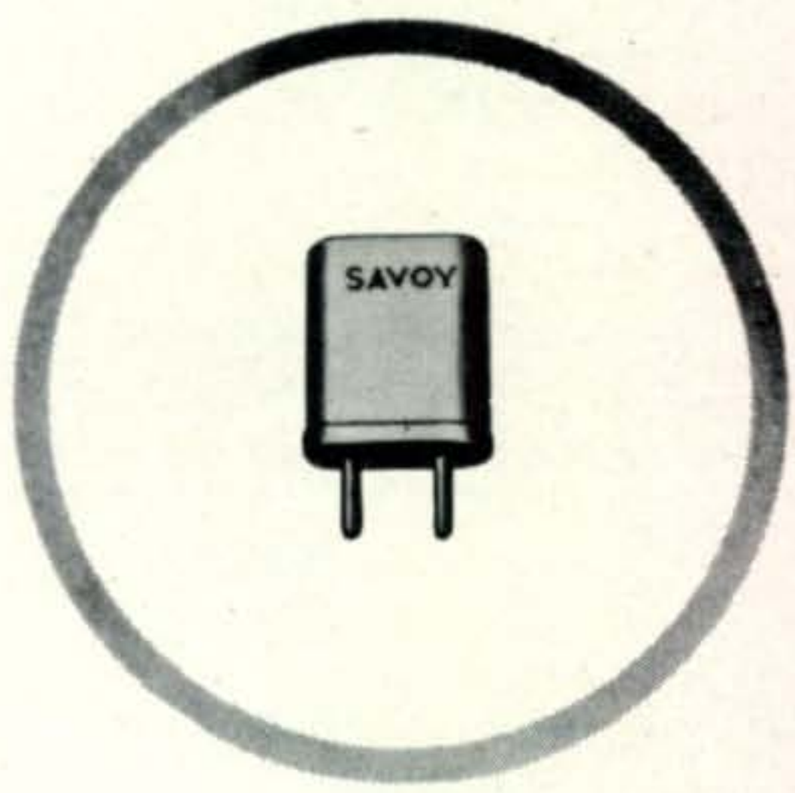
For over 30 years



TYPE 900 A



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Specify crystal type, make and model of set, and desired frequency.

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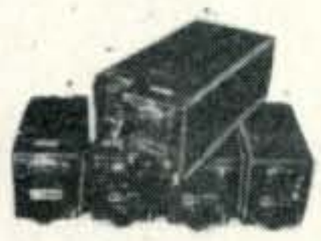

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Original circuit diagram included.

All tuning units available for above (Price upon request).

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- Video output: 1.5v at 70 ohms.
- Audio output: 100 Mw into 600 ohms.
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Freq. Range	Type Complete w/Tubes	Exc. Used	Like New	Brand New
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190 - 550 Kc	BC-453	$16.95	$23.50	$27.50
6 - 9.1 Mc	BC-455	------	------	$22.50
1.5 - 3 Mc	R-25	------	$19.50	$21.50
TRANSMITTERS	**Complete with Tubes**			
4 - 5.3 Mc	BC-457	$8.95	------	$11.95
5.3 - 7 Mc	BC-458	$8.95	------	$11.95

ARC-R11A Modern Q-5 Receiver 190-550 Khz $10.95
ARC-R22 540-1600 Khz receiver w/tuning graph .. $15.95
R-4/ARR-2 Receiver 234-258 Mhz, 11 tubes, NEW... $8.95

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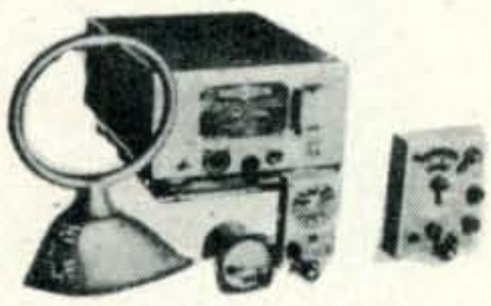
Designed for Marine & Aircraft Installation. Also fine for home use. Continuous tuning from MN-28C Control box. Complete with 24 volt DC Dynamotor. MN-268 Radio Receiver, 150-325 KC; 325-695 KC; 3-4.7 Mc. Complete with tubes and dynamotor.

Like New $13.50 New $15.25



Remote control commercial type navigational receiver

MN-26 LB Compass & Communications Receiver, 200-410 Kc 550-1200 Kc; 2.9-6.0 Mc. Works on 24 VDC. Complete with Tubes and Dynamotor.

Excellent Used **$17.95**

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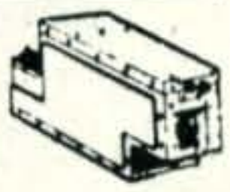

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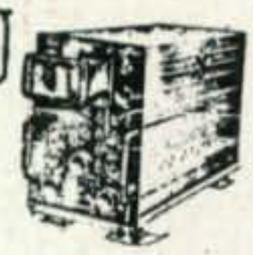

APN-9 is a four-channel loran receiver and indicator (one unit) designed to provide ships and aircraft an exact position by reception of know loran transmitters.

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SURPLUS sidelights

BY GORDON ELIOT WHITE*

As all faithful readers of this column know, the Command Sets of World War II have a special place in my regard. Designed originally in 1935, they survived in different models, but the same logical, modular, convenient size and shape for nearly 40 years, while scores of airborne electronic gadgets have come and gone.

For attractiveness to the experimenter and radio amateur, the Command Sets have had no peer. They were small, extremely well designed, of excellent quality, and simple enough in their hookup connections to be readily converted to amateur use.

The set I have chosen to describe this month is the last in which Command Set lineage can be discerned. A neat little aircraft navigation set, the R-34 receiver covers 108-126.9 mHz, the frequencies used by civil aircraft for localizer and "omni" navigation and control tower and air traffic control communications.

As Fig. 1 shows, the R-34 was designed into the Command Receiver form factor (4¾ × 5½ × 11 inches) with the familiar rear deck dynamotor mounting. The R-34 however was usually provided with the DV-10 Dynaverter, a d.c.-d.c. converter which replaced the wartime standard 28 volt dynamotor. Fig. 2 shows the circuit for the dynaverter, which directly replaces the dynamotor.

Under the skin, the R-34, designed in 1960, bears little resemblance to its earlier cousins. It covers a portion of the band of the R-28 and R-112/ARC-5 receivers, but is an entirely new circuit.

The R-34 replaced the R-15 tuneable receiver in the A.R.C. Type 15 navigation set, thus it was constrained to fit in the same rack. The R-15, R-13 receivers were merely polished-up versions of the WW II tuneable v.h.f. Command Sets. After the R-34, Aircraft Radio Corp., by then a Cessna subsidiary, built its equipment into boxes dictated by aircraft-industry standardization.

The R-34 should convert easily into a very nice 190 channel 2-meter receiver by changing crystals in the "whole-megaHertz" drum and realigning the front end. Since the receiver was built for 100 kHz spacing, some of them ought to be available in the used aircraft market. Present Federal Aviation Administration and F.C.C. rules require aircraft equipment to handle 50

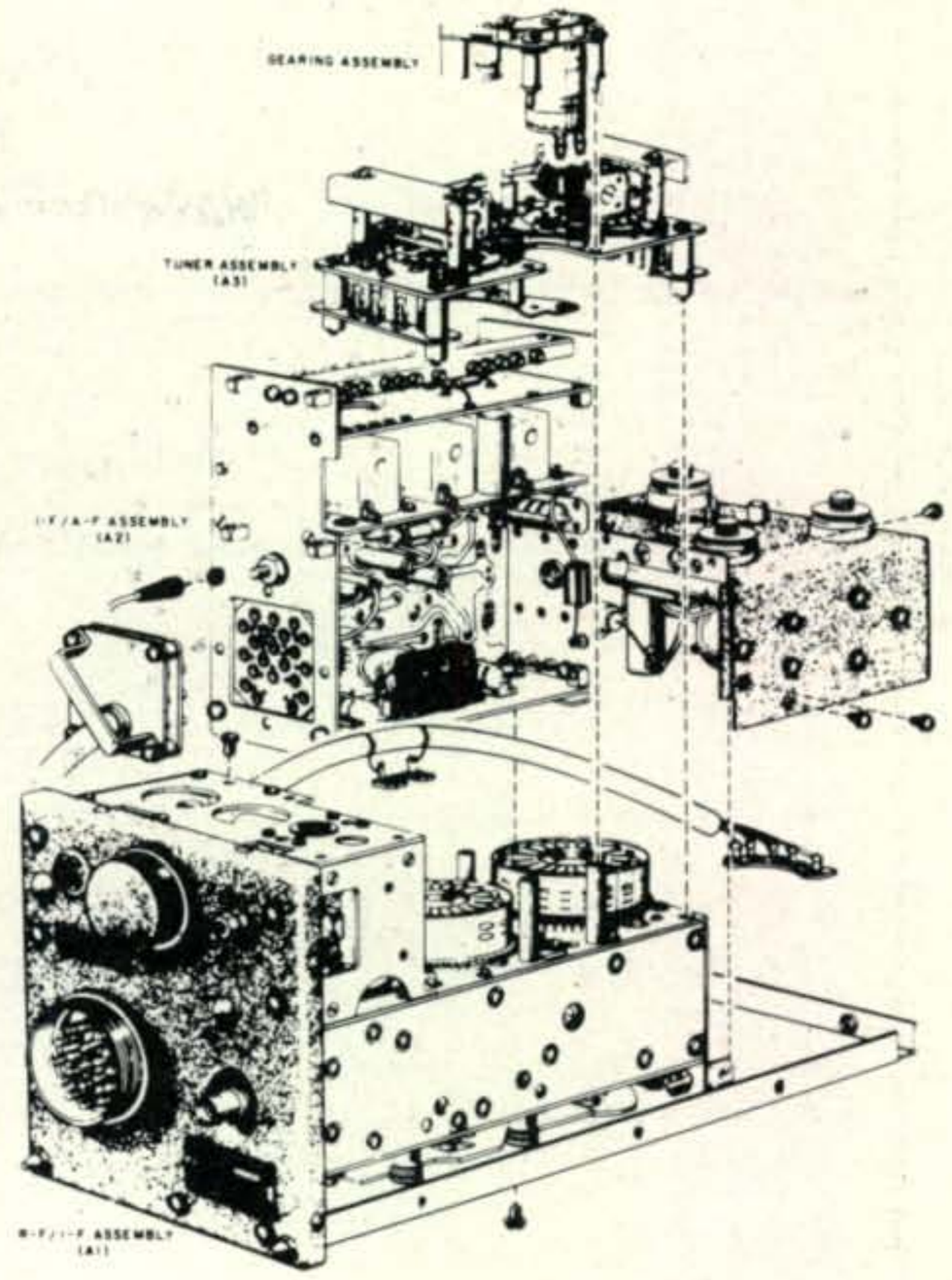

Fig. 1—Exploded view of the R-34 receiver, showing how a 190 channel, crystal-controlled double-conversion circuit was built into the same dimensions that housed the familiar BC-453.

kHz spacing, so the sets are obsolete for their original use.

The specs are beautiful: 3 microvolts of signal to give 6 db signal plus noise to noise ratio. Bandwidth 48 kHz at 6 db down. Squelch adjustable to 0.1 microvolt, audio distortion less than 6 db from 350-2500 Hz.

Power requirement is 85 ma at 260 volts d.c., with 1.8 amps at 28 volts to power the filaments and the dynaverter. R.f. input is 50 ohms.

The set is a 14 tube double conversion superheterodyne, crystal-controlled by 29 crystals in a crystal-saving technique design. Fig. 3 is a block diagram of the circuit, showing how the variable first intermediate frequency allows reception of

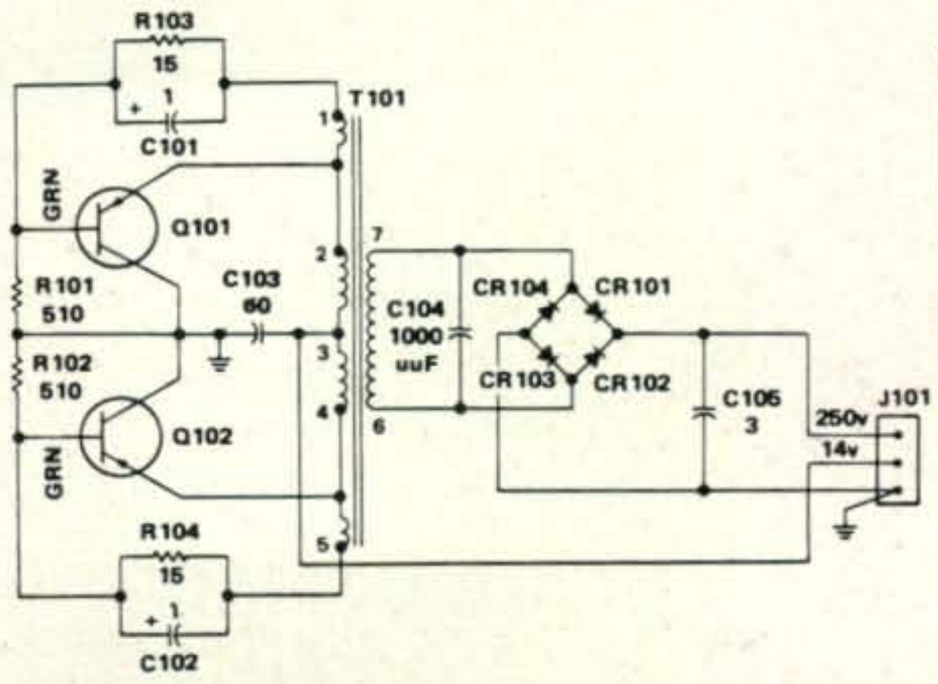

TABLE I
ARC PART NUMBERS

Ref Desig	ARC Part No.
C101	21485-9101
C102	21485-9101
C103	23943
C104	4157
C105	7582
CR101	20474
CR102	20474
CR103	20474
CR104	20474
J101	5211
L101	21429
Q101	21153
Q102	21153
R101	202-0511
R102	202-0511
R103	201-0150
R104	201-0150
T101	21155

Fig. 2—Circuit for d.c.-d.c. converter which replaced the DM-10 dynamotor on the later Command Receivers to provide 260 volts dynamotor B+ voltage.

*1502 Stonewall Rd., Alexandria, Va. 22302.

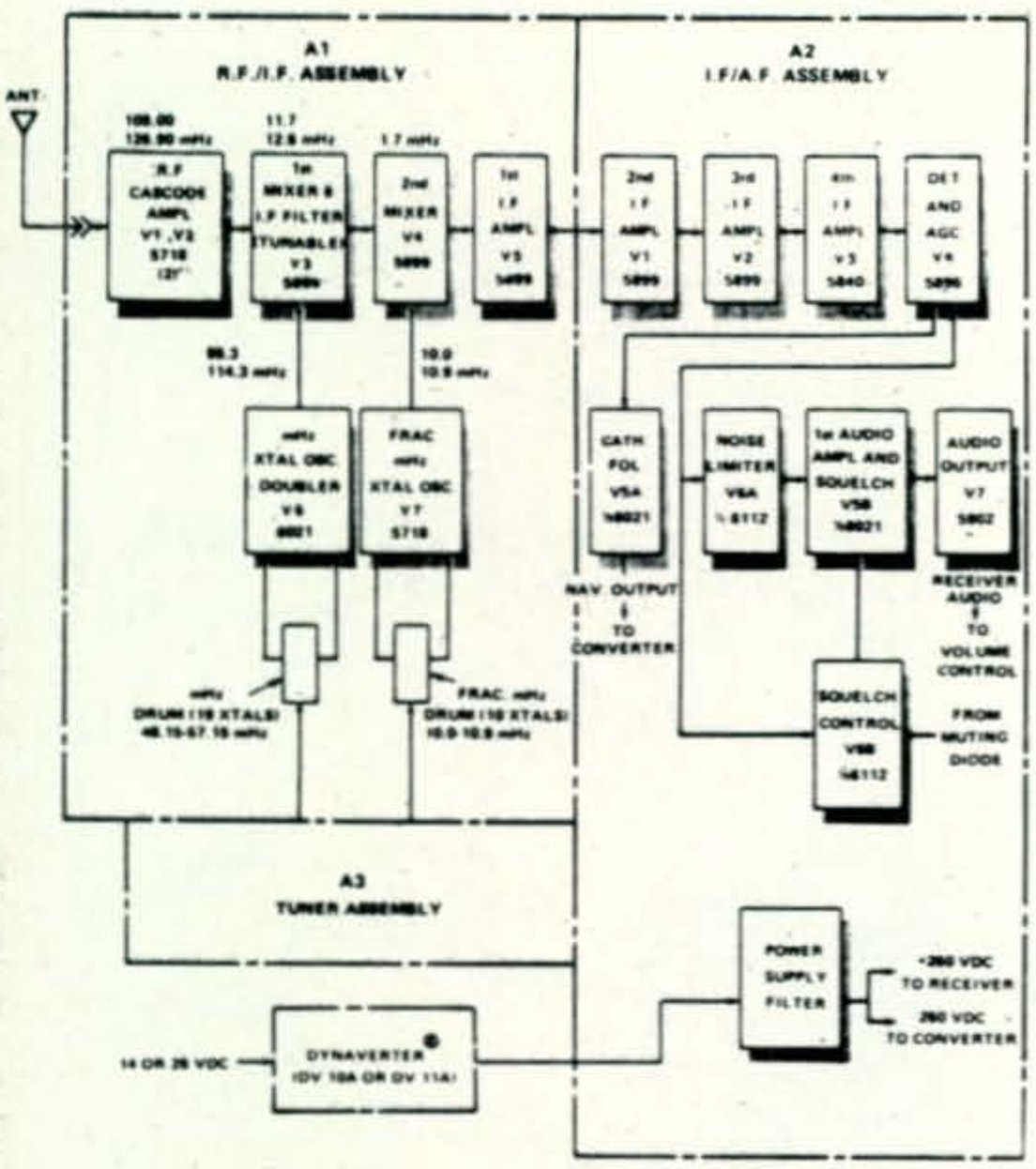

Fig. 3—Block diagram of the R-34 receiver.

190 channels with only 29 crystals.

Frequency selection is accomplished in two steps. The incoming signal, for example 111.4 mHz, is fed to the first mixer. The whole-mHz crystal drum selects a crystal frequency of 49.65, and doubles it to 99.3 mHz, which subtracts from the signal frequency to give a 12.1 mHz i.f. The tenth-mHz crystal drum selects a 10.4 mHz crystal, which combines in the second mixer with the first i.f. signal to give a 1.7 mHz difference, which is subsequently amplified in the 1.7 mHz second i.f. amplifier circuitry. The first i.f. is

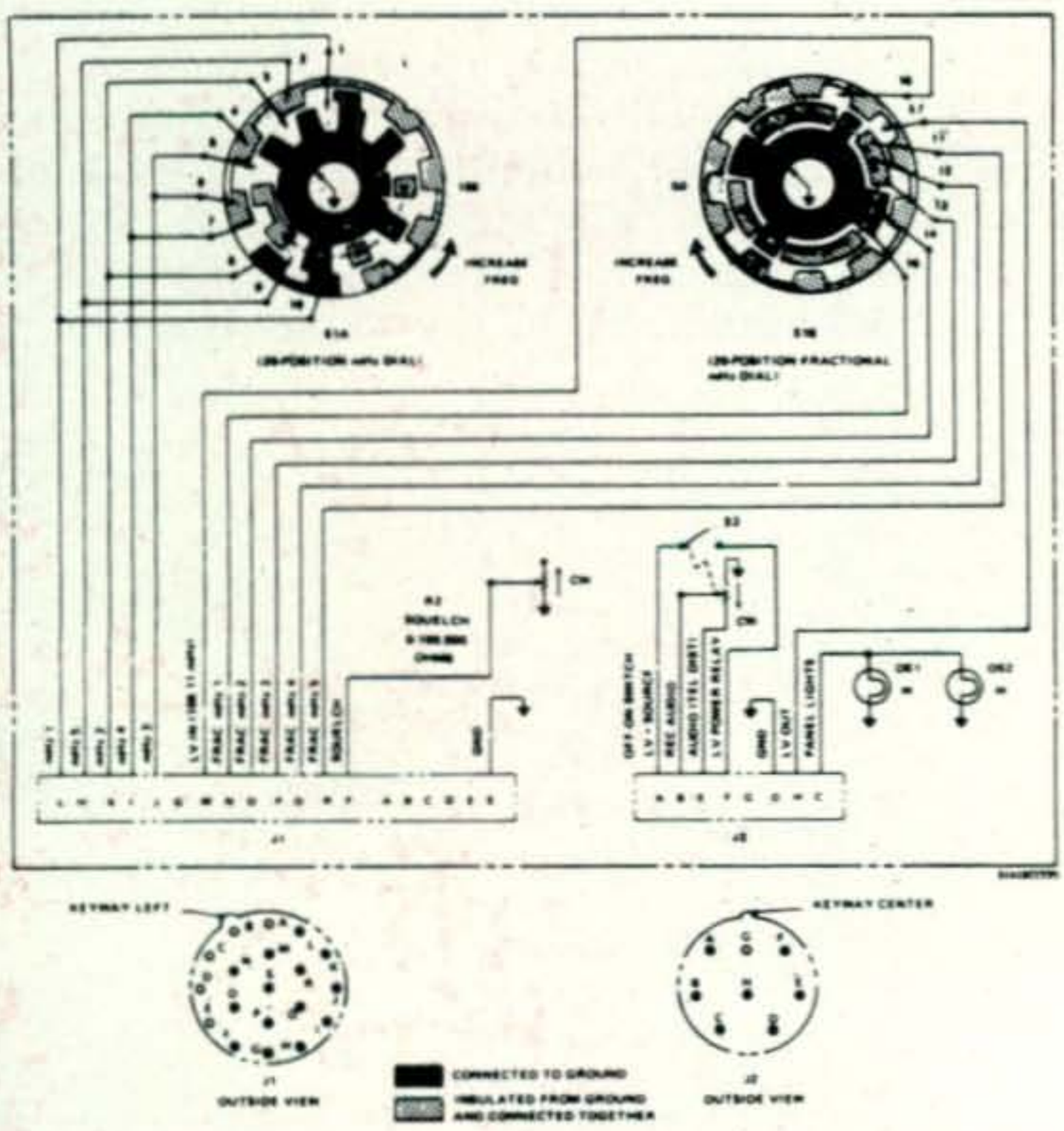

Fig. 4—Schematic of the C-81A tuning control for the R-34 receiver.

varied through its 11.7-12.6 mHz range via a cam-driven tuning arrangement which moves iron-ferrite cores in and out of the i.f. and mixer coils.

Selection of crystal positions is made through a series of segmented circles on the two control switches and on the crystal drums. When the drums have been rotated by their motor to the selected crystal, the circuit shows a grounded condition which allows latches to engage and the motor to stop. Fig. 4 shows how this is obtained in a five-wire hookup. Although it might be possible to build up such a switching system, operation of the receiver is far easier if the C-81-A control head is used.

While the R-34 receiver provides a conventional communications audio channel, its prime purpose was as a Navigation receiver. It was designed to provide audio fidelity sufficient to feed a B-13 converter, which in turn drives an IN-10 course indicator—the crossed-needle display familiar to instrument-rated pilots. The system, known together as the 15F, provides right-left information on airport localizer beams, and bearing information on omni signals.

The difference between "omni" and "localizers" is that the former gives magnetic compass bearings over a 360 degree circle, while the localizer gives a narrow beam over a runway. The localizer consists of two v.h.f. signals modulated respectively with 90 and 120 Hz audio, aligned so that signal strengths are equal at the centerline of the runway. The converter provides a signal to the indicator needle that moves it to the right if the pilot errs to the left, thus he can "fly toward the needle" to get back on course. This is one of the common components of the "ILS" instrument landing system. The other, known as a glide slope, is essentially a similar system operating in the 333 mHz band, transmitted in a horizontal plane aligned with a three degree approach path, and slaved to a horizontal needle.

The omni navigation signal is an electronic version of the lighthouse which has both a flashing light and a rotating beam, turning at one revolution per minute. The flasher lights at the moment the beam passes magnetic north. By timing the interval between the flash and the passage of the rotating beam, an observer can determine his magnetic bearing from the lighthouse.

In the Omni system, the rotating component changes phase at a 30 Hz rate, with respect to the reference signal. The B-13 converter detects the phase difference and provides it as a bearing signal to the IN-10 indicator.

Tubes used in the R-34 are soldered-in subminiatures, including 5718's in the front end, 5899's in the i.f., and a 5902 audio output amplifier. The receiver weighs 6.7 pounds.

73, Gordon

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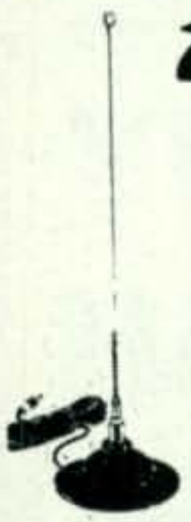

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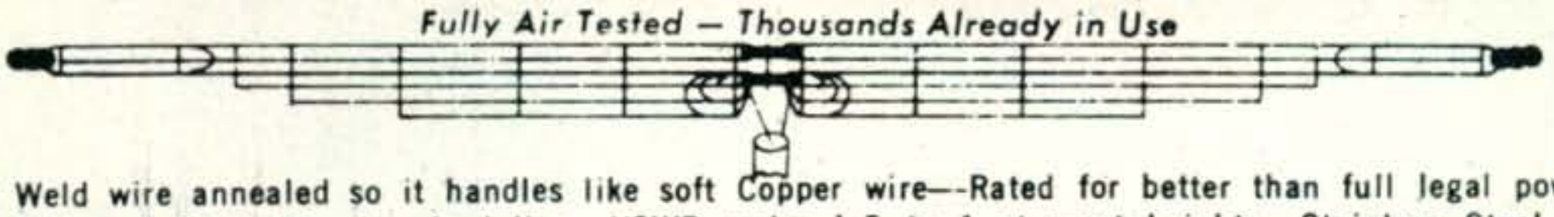

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obtain large noise powers. The resistor must be at a temperature of approximately 2900°K to obtain 10 db excess noise power and at 29,000°K to obtain 20 db. This is a little warm for most laboratories! The relatively low noise power available from a resistor at practicable temperatures is convenient, however, when measuring the noise figure of extremely low noise devices such as masers or parametric amplifiers.

The measuring methods described above use passive devices. No electrical energy is supplied to the noise source; the source of the noise energy is thermal. By using an active device, *i.e.* one in which electrical energy is supplied to the device, more noise power can be obtained from the source and in many cases the noise output power can be varied by controlling the electrical energy supplied. For these reasons, active noise generators are usually more convenient to use.

Types of Active Noise Generators

Active noise generators can take many forms. At the microwave frequencies, where wave-guides are practicable, gas discharge tubes mounted in wave-guides are most often used. These are obviously not practicable at the lower frequencies.

A silicon diode, reverse biased, may also be used as a noise generator. The basic circuit is shown in fig. 1. It has two disadvantages, however: first, although the noise output of the generator is proportional to the current flowing through the diode and can be varied by means of the variable resistor, the relationship between d.c. current and noise power output is not fixed but depends on factors beyond the control of the user. The noise generator output must thus be calibrated if quantitative measurements are to be made. The second disadvantage is that the noise spectrum is not flat, *i.e.*, not constant with frequency. This type of noise generator

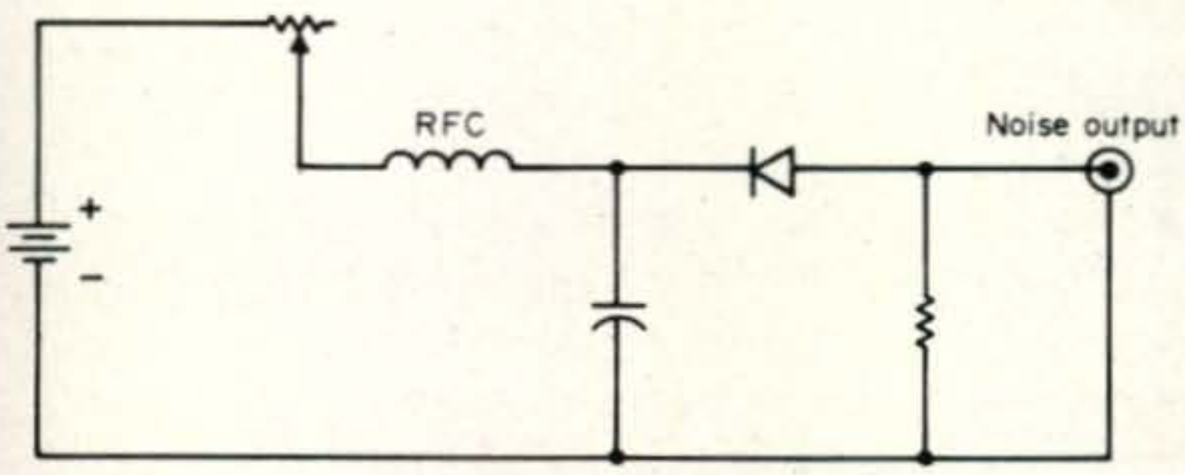

Fig. 1—Simplified schematic of a silicon diode noise generator.

must also be calibrated in the frequency range in which it will be used.

Perhaps the most practical noise source for general use in the h.f. and v.h.f. range is a thermionic diode operated in a temperature limited condition. The noise output is adjustable over convenent levels and the noise figure of the receiver under tests is an accurately known function of the d.c. anode current. The principal requirements of a thermionic diode are that it have a tungsten filament and be capable of dissipating the d.c. power supplied to it. Oxide cathodes are not satisfactory because of flicker effect.

Special tubes have been developed for this purpose: for frequencies up to about 500 mHz the Sylvania 5722 is useful. The Bendix 6144 is a coaxial type of tube and may be used up to about 3000 mHz. The 5722 costs about $6.80 while the 6144 sells for approximately $75.00. For economic reasons and since we are primarily interested in frequencies through v.h.f., only the 5722 will be considered further.

Next month's installment will look at design considerations for practical noise generators.

Inoue IC-21 [*from page 26*]

always right on frequency. However, it is usually disabled when working through a repeater. The s.w.r. bridge is quite handy since an accurate v.h.f. bridge is difficult for many amateurs to build. The third feature, the front-panel DEVIATION control, is of dubious value. In most areas of the country the trend is to narrowband or ±5 kHz deviation. Thus, a preset deviation in the neighborhood of ±5 kHz usually does just fine. Many newcomers to f.m. do not understand the problems associated with overdeviation and would often crank-up the deviation too high. Also, the control is located in such a position to make accidental bumping a distinct possibility. If there is a need for various levels of deviation a front-panel switch selecting ±5 kHz, ±7.5 kHz, and ±15 kHz would be a better system. The variable deviation is definitely a minus for the IC-21.

On the possible problem side is the tolerances of the crystals. The manual specifies 0.0025%. This is not satisfactory for operation in narrowband systems. Thus, it is suggested that any crystals be specified at 0.001% or better when purchased for the IC-21.

Styling of the unit is different from the f.m. units which have come before. The front-panel resembles a low frequency s.s.b. transceiver in both layout and design. A flip-foot is provided to tilt the unit for operation on a desk-top and a bracket is provided for mobile mounting.

Back on the positive side: The workmanship and quality are quite good as was the performance. The 24 channel capabilities will come in handy in areas of high FM activity. Current list price of the IC-21 is $389.00 plus crystals and can be obtained from Adirondack Radio Supply, Inc., 185 West Main Street, Amsterdam, New York among others.

K9STH/5

CQ Yeti [*from page 17*]

city is filled with temples displaying exquisite wood carving and ornamentation. Lorenz has a most complete shack with a Quad overhead. An electronic genius, he is the man to see in Nepal when one's gear poops out. Since he is a Collins man, we left our spare supply of tubes with him. It is often difficult to get spare parts into Nepal...customs regulations, etc....so at least we could donate what was no longer needed.

Father Moran drove us back to the airport, more excess baggage was paid on the KWM-2 for the trip back to New Delhi, and the customs check was made with no problem. The Kathmandu customs officer had been one of the Father's students!

As we said goodbye, and boarded our plane to begin the long journey home from the other side of the world, we vowed to return again. And, as our thoughts traced over the days we had spent in Nepal, we seemed most impressed by the young boys we had met at the Godavari school. That morning, just before leaving, three of them had recited for us John Kennedy's presidential address. It held special meaning for them, words from a man whose life had been ended before many of them could comprehend what life was all about. But these are young men who will work to bring their country up to a better standard of living . . . guided by the work of those who have given their lives to the training of others. As Father Moran told me, during a Boy Scout Jamboree On The Air a few weeks before our visit, he had contacted some Scouts in the Seychelles. They had greeted him saying, "Hello Nepal, you are speaking to the pearls of the Seychelles." One of his students took the mike and responded, "Hello Seychelles, you are speaking to the Diamonds of Nepal." ■

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OSCAR-6 [*from page 41*]

and that Novice and Technician Class licensees will be permitted to communicate through the satellite.

The following references are suggested for additional operating tips that could be useful in communicating through the OSCAR-6 satellite:

Jacobs, G., "Australis-OSCAR: Amateur Radio's Next Satellite in Space," *CQ*, Aug. '69 p. 63.

Jacobs, G., "OSCAR III—An Active Communication Satellite for Radio Amateurs," *CQ*, part I, Oct. '64 p. 54; part II, Feb. '65 p. 38.

Dunkerley, W.I., Jr., "Are You Ready...," *QST*, Mar. '72 p. 58.

Danielson, W., and Glick, S., "Australis OSCAR 5," *QST*. Oct. '69 p. 54.

Next month's issue of *CQ* will also contain a more comprehensive report concerning OSCAR-6. ■

CQ Reviews [*from page 45*]

than-normal desired-mixing products of the receiver that may occur in conjunction with the v.f.o. or its harmonics. Fortunately, because of the extremely high selectivity provided by the three preselector circuits, these products are not encountered with proper adjustment to the desired frequency indicated by the accurate calibrations of the preselector dial.

S.s.b. signals are easy to tune in and sound good in spite of the lower-than-usual unwanted-sideband rejection capabilities of the receiver. To the critical trained ear, however, a slight degree of distortion may be noted partly due to the above, a slightly fast a.g.c. release and a less-than-optimum b.f.o. to signal ration at the product detector. The latter can be corrected, however, by adjusting the b.f.o. output (at T_{12}) for minimum a.f. distortion of a 100-200 Hz beat note observed on an oscilloscope at the a.f. output of the receiver. The a.m. quality is exceptionally good, resulting in excellent intelligibility, a particular boon for those interested in s.w. broadcasts.

The results of several frequency stability runs indicated an average one-half hour warmup drift of 500 Hz with a drift of 250 Hz or so per hour thereafter. No change was noted with ±10% line-voltage variations. Vibration tests produced no adverse effects on the frequency stability.

Auxiliary-Band Changes

Setting up one of the auxiliary ranges requires installation of an appropriate crystal and a trimmer capacitor for which provisions are already made on one of the circuit boards. No changes or additions are needed at the preselector tuned circuits. As noted earlier, with the AX-190 the one auxiliary position is available for use in a 500 kHz segment only in the 3.5-10 mHz range, but for those not interested in the CB range, the crystal for this position may be changed to one for use in another segment between 10-30 mHz. On the other hand, users of the SX-190 who may desire to add coverage of the 21 mHz amateur band and one segment of the 28 mHz one, while still retaining the other amateur bands and the s.w. broadcast ones, can do so by changing the CB range over to 21 mHz and using the 10-30 mHz auxiliary position for the 28 mHz segment.

All in all, the AX-190 and SX-190 receivers are excellent jobs selling for $249.95. We suggest you see for yourself by looking them over at one of the hundreds of Allied Radio Shack stores for whom the receivers are custom-manufactured. —*W2AEF*

Q & A [*from page 12*]

one HT-37 previous to my present one and it also had the same problem which makes me think that the trouble is due to something inherent in the design. What should I do?

ANSWER: Since the frequency shift of the HT-37 occurs on all bands and in all modes, the cause appears to be a defect at the v.f.o. This might be due to a bad capacitor, resistor, tube, tube-socket connections (at tube pins), poor switch contacts or a poorly-soldered connection somewhere in the v.f.o. Also, voltage regulation setup may be unstable. Try a new VR tube or note if the glow jumps in the old tube. A slightly lower-value dropping resistor for the VR tube may be in order. Another cause may be a dirty wiper on the tuning capacitor. Use a good contact cleaner here. Touch up any suspected solder connections using a hot iron. Wiggle the v.f.o. tube to note if the socket contacts are okay. Make sure the tuning slug in the oscillator inductor, L_1, is tight. Capacitors C_4, C_5, C_6, C_7, C_9, C_{10}, C_{11} will have to be checked by substitution. Most likely ones to cause trouble are C_4, C_5, C_6, C_7 or C_{11}. T_1 also could be a potential cause.

Similar difficulties could exist at the carrier

oscillator, V_{2B}. You might have a bad crystal here. If you have a receiver that tunes to 9 mHz, you can easily check this oscillator.

We have not heard of any such inherent difficulty with the HT-37's, but if any of our readers have run into such, we'd appreciate hearing about it. Thanks.

DX [*from page 60*]

Other QSL addresses for this month's listing are:

C31AP—Via F2MO.
ET3USA—To W4NJF, 1416 Rutland Drive, Virginia Beach, Va. 23454.
FL8HM—*NOT* via W9FN (He couldn't get logs.)
HI3XAM—c/o WA2NDP, P.O. Box 294, West Islip, N.Y. 11795.
JA3LUK—Via WA9TSG, 114 East Brown N, Milwaukee, Wi. 53212.
TG9NJ—c/o K4UQC.
TT8AD—To F2MO.
VP2LAT—c/o WA9UCE, 529 Buckingham Palace, Libertyville, Il. 60048.
VQ9WF/Chagos—Via W4NJF.
VU2HLU—To WØPAH.
YN8AJC—c/o WA9TSG.
YV4NS—Via WA2NDP.
ZL2BIX—To WA9TSG.
3AØAM—c/o W4NJF.
7Q7AM—Via WA2NDP.
8R1AE—To WA2NDP.
9G1DY—c/o WA2GZC, 573-75th. St., Niagara Falls, N.Y. 14304.
9Q5LW—Via WA2GZC.

73, John, K4IIF

Field Day Antennas [*from page 51*]

6. When the tower has been lowered and is resting on the step ladder, all guy ropes are unclipped from the floating guy rings and coiled up according to color code. Each group of ropes is then wrapped for storage.

Shortcuts

There are many short cuts that make this operation a pleasure. If each rope is painted a distinctive color on each end, the storage and reassembly next year is simplified. Also, if metal snaps have been applied to the upper end of the ropes, connection to the floating guy rings will be simplified and strains on the tower will be minimized. A 20 mm ammunition case is ideal for storing all components of this system. Coax and rotor cables along with the rotator control boxes will fit nicely inside the ammo boxes. Miscellaneous tools that are necessary for this operation, *i.e.*, sledge hammers, screw drivers, tape, soldering irons, solder, etc. can be stored along with

the previously mentioned items to assure the next group that uses the tower that all necessary items will be available.

Last but by no means least, the cotter keys should be wired to the guy rings. If not done, the next year the keys will be lost and the tower sections will rotate freely in the wind and rotator synchronization will be lost. If the keys are painted a bright yellow, finding them in the tall grass will be eased. If the concepts identified above are incorporated in your antenna system, many happy days of operation will result and fears of falling towers will be a thing of the past. ■

Letters [*from page 5*]

his or her license for twenty five years (the grandfather clause).

This is the same as automatically advancing all persons who have held a restricted radiotelephone through second class radio telephone or telegraph a first class radio telephone or telegraph license for the same reasoning.

Another analogy might be to automatically grant the holder of a private pilot license a commercial pilot license after 25 years.

I submit that if a person involved in amateur radio for twenty five years has not gained whatever expertise necessary to earn the Extra class license on his or her own merit, he or she really didn't want, much less deserve it.

Some people study hard on both theory and code, then take time off work to drive three to four hundred miles to just get to take the examinations, losing two or three days wages and incurring the costs of transportation, meals, lodging, etc.

I hope someday to be the holder of an Extra class license, perhaps simply because it is there, but I would much prefer to say "I earned it" than, I couldn't make it by examination but received it through twenty five years of waiting.

If we are going to step down to this we might as well grant the holders of a CB license for twenty five years or more an amateur General class license.

Being cognizant of the fact that I am certainly not a professional telegrapher nor a know-it-all in the electronics field I would much prefer to work for what is achieved than take a handout.

There are probably many other amateurs out there who feel the same as I do about this. I hope there are and that they will be concerned enough to let those who are in a position to do something about it know their feelings.

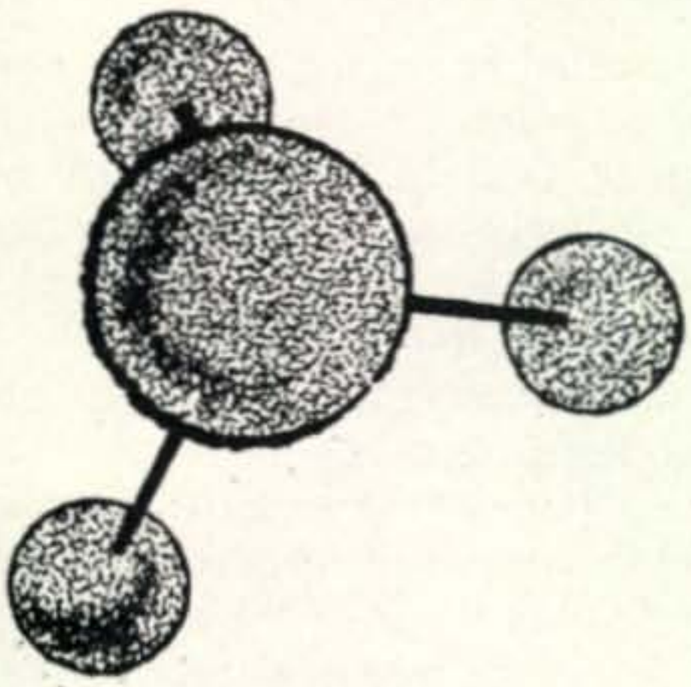
John Timm, WBØDRV
Durango, CO

Antenna Basics

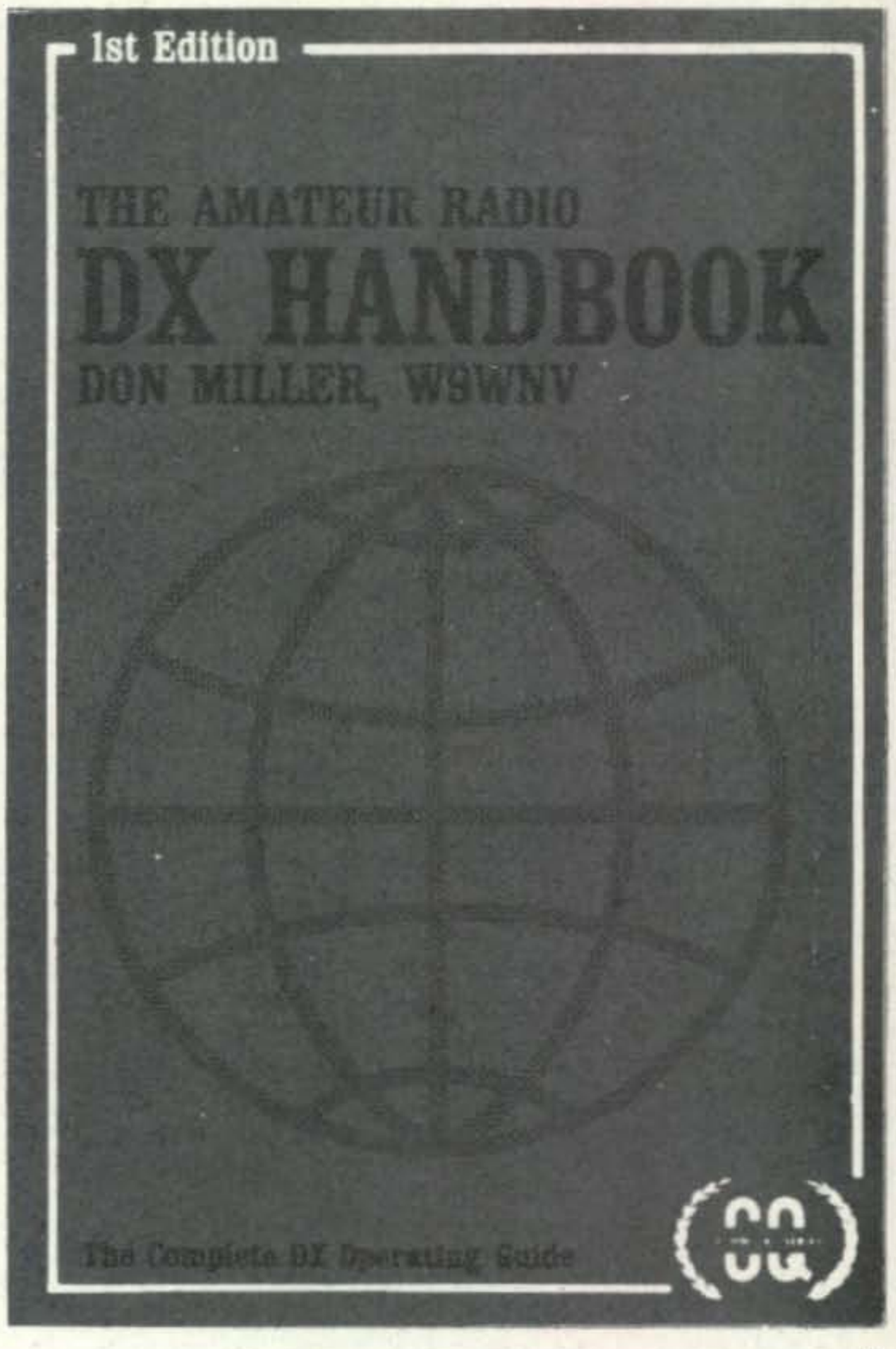
Editor, *CQ:*

Congratulations on the superb article, "Antenna Basics," in the March issue! It should be compulsory reading for every radio amateur.

Carl C. Drumeller, W5JJ
Oklahoma City, OK



WHAT'S TO KNOW ?



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Contest Calendar [*from page 74*]

First was the confusion in the starting and ending times of the contest. A few were inconvenienced but almost everybody was aware of the change as officially announced in this Column.
We will take the blame for this SNAFU.

However some of the operating practices left much to be desired. Because of the nature of 160, where both c.w. and phone are permitted in the same narrow 50 kHz, some self imposed restrictions are honored by over 90% of the operators. Keeping the "DX Window" free of W/K and VE operation during the time of DX activity is one of these obligations.

The so-called "DX Window" is that section of the band (1825-1830 kHz) where the overseas DX stations make their calls and are worked split frequency.

A few phone stations however insist on their FCC given rights to operate anywhere they please and are not concerned that they are "lousing up" DX for scores of c.w. stations. Nothing much can be done about this situation, except to continue our plea to be more considerate.

However when a c.w. station insists on doing his contest operating in the "DX Window" even after pleas to "please QSY and not QRM the DX" that's something else. There's a disqualification clause in our contest in which unsportsmanship conduct is deemed sufficient grounds for disqualification.

We intend to be more critical in the future and enforce this regulation.

73 for now, Frank, W1WY

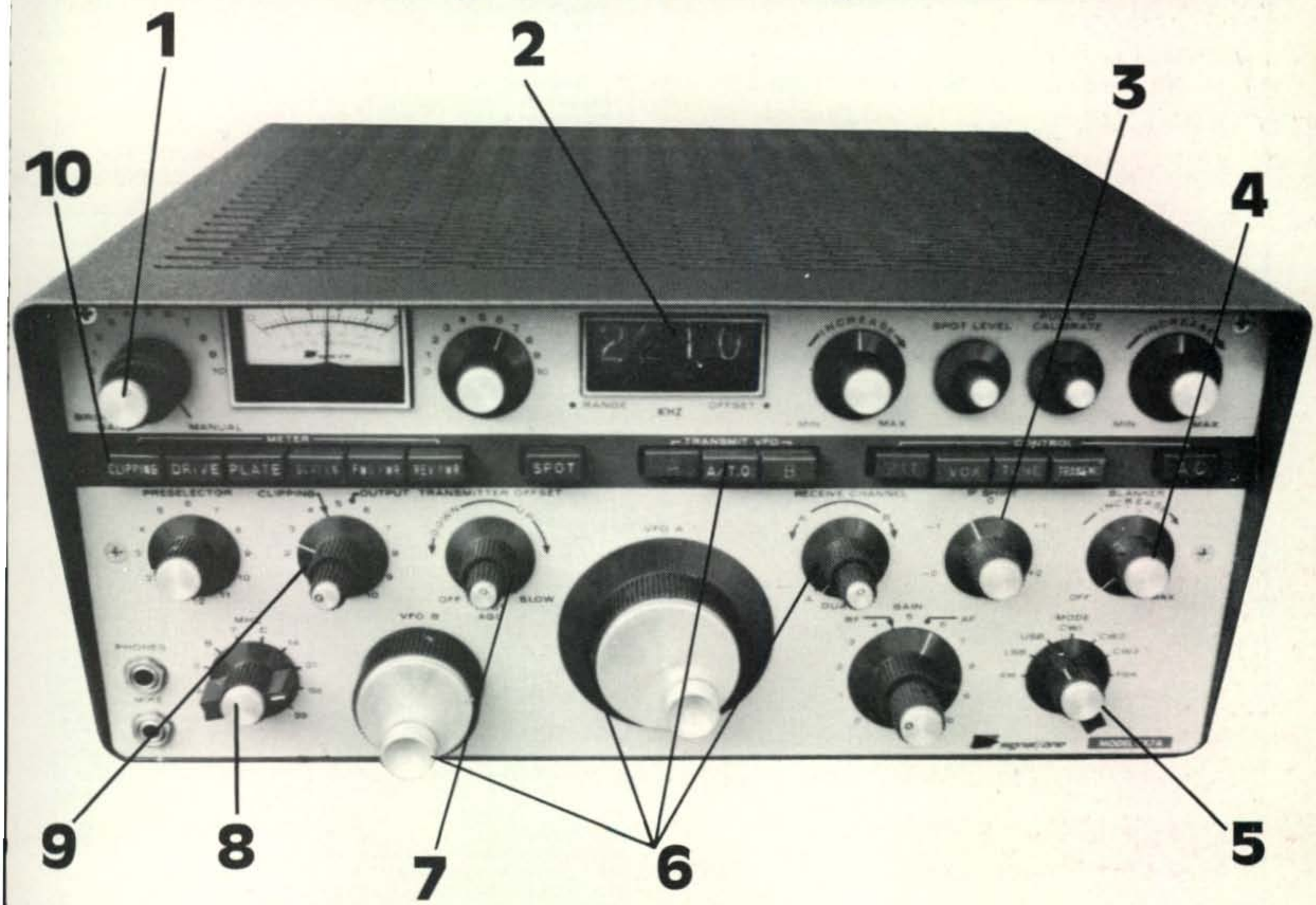
F.M. [*from page 34*]

Given a batch of ovens of the same type the resistance of the heating element of a 6 volt oven is usually one-fourth that of a 12 volt oven. For example, the Motorola Gold ovens for six volts have a resistance of 4 ohms and the twelve volt ovens have a resistance of 16 ohms. The same generally holds true for other ovens, but not always. Also, with the Motorola ovens the letter "A" following the crystal type (e.g. RO3A) designates a 12 volt oven. Also, most gold 6 volt ovens have a black base and 12 volt ovens have a brown or black base with 12V stamped on it. But, make sure with an ohmmeter.

Finale

Well, so ends another FM COLUMN. There are never enough photographs, so get out those cameras and head out to the repeater. It's instant fame for anyone brave enough to let the world see his repeater. Next month (if everything goes right) another mini-review of an f.m. product and a construction project in the Technical Talk. Even though it is nearing summer, keep the news coming in. See you next month if not before. ■

Somebody once said there's no price for perfection.



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For sale: complete 2kw ssb kw station. Swan 500, VX-2, Tempo 2000, Eico keyer, W-S1 tower. TH-6DX, 14AVQ, 300 ft RG8U, Ham M rotor & all station accessories $1200. K6BEP, 11605 Cantlay St., No. Hollywood, CA 91605.

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Valiant $90. SX146 ssb-am filters crystals calibrator speaker manual $170. Both for $250. Need money. Write for other items. A. Moust, 8116-259 St., Floral Park, NY 11004.

51J-4 Late mod No. 3333 mint cond $595. WA6-TFZ, 1409 S. Halladay, Santa Ana, CA 92707.

RTTY Model 15 Printer Stand,.PS CV 89A freq shift converter. Mint condx. Best offer. Will not ship. I. Jacobson, 21010 Anza Av., Torrance, CA 90503.

KNIGHT R100A receiver w/S-meter, crystal calibrator and product detector as per CQ, July 1969-$65. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

RF COAXIAL SWITCHES - DC-1 GHZ, 2kw-500W Electrically operated, free literature, Link, 1000 Monroe Tpk., Monroe, CT 06468.

SEND a SASE if you wish to come to the bi-annual Don C. Wallace, W6AM, Rhombic Farm, stag visitor's day. 28503 Highridge Rd., Palos Verdes Peninsula, CA 90274.

FOR SALE: Hallicrafters HT-37, mint condition - $200. Hallicrafters SX-111 - $145. Marine Electronics, 76 New York Ave., Halesite, L.I., N.Y. 11743. (516) 427—7199.

KNIGHT KG-630 wideband oscilloscope. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

Swap or sell 16 mm Kodak Cine special professional movie camera w/4 lenses, tripod & meters, value $400, plus Agfaflex V 35 mm w/2 lenses, value $100 Want: Heath HA14 Kompact Kilowatt & PS HP-14 and good test equipment. WA0WOB, 12000 Mission Leawood, KS 66209.

ARGH! School forces equipment reduction: R-4A w/full ten meter coverage $225. T-4X w/160 meter coverage, recently factory reconditioned $275. MS-4 speaker & AC-4 PS $65. Package deal: all for $500 or swap for good Yaesu FT-101. Also have HA-6 six meter transverter and PS $125. Allan Stephens, 4738-B Joshua, Great Falls, Montana 59405.

VOLKSPHONE German type transceiver phone cw sell $100. Box 8352, Savannah, GA 31402.

WANT CLEAN COLLINS 51J-4; also Drake C-4, w/manuals & original shipping containers. No junk! First letter give each serial number, condition, price also price for both, if have both. Watson, 700 West Willow St., Long Beach, CA 90806.

Sell: Heath DX60B xmtr & HM15 swr meter. Like new $65 both. L. McNamee, 10 Hyacinth Lane, Holbrook, NY 11741.

EVANSVILLE, Indiana HAMFEST 4H Grounds, (Highway 41 North 3 miles) Sunday, May 7, 1972. Airconditioned, auction, overnight camping, ladies' bingo, reserved flea market booths. Advance registration. For flyer, contact Morton Silverman, W9GJ 1121 Bonnie View Dr., Evansville, IN 47715.

Copies of old and new ham and commercial transmitters and receivers frequency meters, schematics. One dollar. Box 8352, Savannah, GA 31402.

Sell: B&W 5100B xmtr w/51SB ssb generator & LPA-1 linear full kw amplifier w/factory power sup. Also BW 600 dip meter w/coils, Drake phone patch and Hammarlund HQ150 receiver w/RME ant tuner and Q mult. Transmitting equip used very little & like new. 3412 Northwestern, Hutchinson, Kansas 67501. 316/663-4575.

HEATH kits assembled by engineer guaranteed, quotes. Box 8352, Savannah, GA 31402.

IMPROVE RECEIVER sensitivity and selectivity with solid state F-100 Preselector. Free brochure. Waban Labs., Box 17, So. Sudbury, MA 01776.

HAMFEST — Wabash County ARC Fourth Annual Hamfest. Sunday May 21. Rain or shine. Admission is still only $1. For information write Bob Mitting, 663 Spring, Wabash, Indiana 46992.

For sale: Heath SB-102 transceiver, Swan 250C, 117XC 6m transceiver & PS. Ham-M rotator, SB-301-2, SB-600, HP-23A, HDP-21A desk mike, HS-24 mobile spkr, HD-20 crystal calibrator, 1M-18 & 1M-28 vtvm's. HD-20 capicator checker IT-27 transistor checker. IT-17 tube tester. Amco OCM code oscillator, Eico 710 grid dip oscillator, 324RF, signal generator. Other ham, radio & TV repair equip. Also books, all new assembles & with 3 month warranty. Shipped prepaid, make offer. WB9CLU, Tucker, RFD 1, Leland, IL 60531. 815/495-9140.

TECH MANUALS for Govt surplus gear - - new low prices, $3.00 each: TV-7/U, TV-3A/U, USM-27B. Following manuals only $6.50 each: R-390/URR, R-390A/URR, URM-25D, SP-600JX-17, TS-497B/URR, R-274/FRR, TS-403/U. Hundreds more available. W3IHD, 4905 Roanne Dr., Washington, DC 20021.

KNIGHT T-175 6-10-11 meter linear amplifier - $50 W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

WORKED SOUTH AMERICA CERTIFICATE: Work all 13 countries. Send $1 and confirmation list to HC1TH, 4050 Drummond, Houston, Texas 77025.

INSTANT NOISE LIMITER MODULE - Easy 20-minute installation for Heathkit, Galaxy, Swan and most other amateur equipment. $8.95 postpaid. WELBORN Electronics, 133 Linden Street, Henderson, Nevada 89015.

AUDIO FILTERS: Knock down that background noise. KOJO SSB, AM, and CW filters do the job. Write for free brochure and see how serious DX boys hear them. KOJO, Box 7774, 741 E. Highland Ave., Phoenix, Arizona 85011.

MOULTRIE Amateur Radio Klub, 11th annual Hamfest, Wyman Park, Sullivan, Illinois - April 30, 1972 Indoor-outdoor market. Ticket donation $1.00 in advance - $1.50 at the gate. Open 8:30 AM. W9BIL-146.94 mhz. M.A.R.K., Inc., P.O. Box 327, Mattoon, Illinois 61938.

MICROPHONES - Shure 404C mobile controlled magnetic, $12.50; 201 mobile ceramic - $8.00; 245S uniplex unidirectional - $15.00; 448A noise cancelling - $34.00; 440SL with stand - $20.00. Electro-Voice 674 variable-D Hi-Z dynamic cardiod, $45.00; 630 Hi-Z dynamic - $25.00; 619 Hi-Z and one Lo-Z dynamic - $20.00 each; 600E mobile dynamic - $16.00. W2AEF, CQ Magazine, 14 Vanderventer Av., Port Washington, NY 11050.

Munston "Nassau" marine radio telephone with 5 marine channels installed, manual included - $60. Western Electric push-to-talk telephone-type handsets, brand new, original price was $35 each, will sell $15 each. Marine Electronics, 76 New York Av., Halesite, L.I., N.Y. 11050. (516) 427—7199.

SOUTHWEST HAM ROUND—UP AND FIASCO: will be sponsored by OLD PUEBLO RADIO CLUB on April 29th - 30th, 1972. Headquarters - Ramada Inn, Tucson, AZ. Banquet, Technical Sessions with Ham Applications and Demonstrations. Ladies prizes, luncheons, and tours. Pre-registration prize plus other prizes. Swapfest, Auction and other activities on the 30th. Plan to enjoy the hospitality and fun in the sun. CONTACT: Al Summers, Chairman, W7MGF, C/o O.P.R.C., Box 6497, Tucson, Ariz. 85716.

KWM2, if you have always wanted one, but cost stopped you, write only to W0BNF. 600L wanted.

COUNTY HUNTERS - Mobilers QSL Bureau by CHC's US-CHA program. Write IARS, Inc., Box 385 Bonita, CA 92002 or Mgr. W6CCM.

CHESS ANYONE? By mail, or radio. Interested? Sase to J.D. Andrews, 24 Cottage St., Melrose, MA 02176.

21st Annual Dayton Hamvention will be held on April 22, 1972 at Wamplers Dayton Hara Arena. Technical sessions, Exhibits, Hidden transmitter hunt, flea market and Special program for the XYL. For information write Dayton Hamvention, Dept. C, Box 44, Dayton, OH 45401.

ATTENTION NYC HAMS: Put your know-how of communications to work to help prevent and stop crime in your neighborhood. JOIN THE NYC AUXILIARY POLICE. For info write: WB2FJO, A. Schur, P.O. Box 238, Ryder Stat., Brooklyn, N.Y. 11234.

WANTED: Paragon DA-2 Det. 2 stage amp., coils for DeForest D-10, Atwater-Kent parts of all kinds. Grebe rheostats, other old radios, msc., parts, books and magazines. Joe Horvath, 522 Third St., San Rafael, CA 94901.

Join QRP ARC Int.: Send sase for info. Corresponding Secy, Earl R. Lawler, W5JLY, Rt. 2, Box 24K, Burnet, TX 78611.

KNIGHT T-150 transmitter - $50. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

NU SIGMA ALPHA international amateur radio fraternity. Memberships now available. Includes wall certificate, ID card, newsletter, and more. Send for free brochure. Box 310, Dept. C, Boston, MA 02101.

Buying? Selling? Trading? Don't make a move until you've seen our new publication! Free sample copy Six issues - $1.00. Ham Ads, P.O. Box 46-653, L.A. CA 90046-F.

MARINE ELECTRONICS of HALESITE: Sales & Service - Pearce Simpson, Konel, Sonar, Citizens Band. 76 New York Ave., Halesite, L.I., New York 11743. (516) 427—7199.

COLLEGE RADIO CLUB needs donation of back issues of CQ for club library. Your donation will be appreciated. Surface postage refunded. Larry Price, W4DQD, Box 2067, Georgia Southern, Statesboro, GA 30458.

To W5TMB/1, Jim Lightfoot. We will miss you on ECARS. Good luck in Calif. "Doc" WB2IWH.

Johnson Thunderbolt 2kw linear, excel cond $200 or trade for VHF linear. Delaney, Bx 3446, Ellsworth AFB, South Dakota 57706.

Rare transceiver. Hallicrafters FPM-200. Transistorized except for 6146 in final. Built-in dc sup, ac supply separate. Cost $2695 ten yrs ago. $500 pre-pd Shank, 21 Terrace Ln., Elizabethtown, PA 17022.

RUBBER STAMPS: Free literature. New, "Mini-QSL" stamps. Prompt quotations. Marshall's Rubber Stamps, Dept. C, 1900 Faulkner Rd., Little Rock, Ark. 72204.

HEATHKIT SB-101, excellent condx, with AC/DC supplies, mobile mount and cables. $400.00 M. Baugh, WB4LJT/5, PSC Box 5541-B, Barksdale AFB, LA 71110.

ROCKAWAY AMATEUR RADIO CLUB will hold its annual Spring Auction and FMers Get To-Gether on Friday evening April 28th at 8:00 PM at the Hall of Science, 111th St. & 48th Ave., Carona, at the Old World Fair grounds. Doors will open at 6:00 PM to accept items for the sale. A two dollar donation at the door will include refreshments. Come to the best auction in the New York City area. For further information contact Auction Chairman, Al Smith, WA2TAQ, P.O. Box 341, Lynbrook, New York 11563.

HAMFEST: Save June 4 for the SRRC Hamfest. For details write, after April 1, to SRRC/W9MKS, RFD 1, Box 171, Oglesby, IL 61348.

For Sale: SB-300, SB-400, SB-600 with cables, xtals, manuals, you ship $350. W0UOV, 308/532-0429.

NASA SURPLUS - AUDIO OSCILLATORS, TS-382D/U, mfg. Taffet, Part T24-110-100, Stock 7CAC-363916-5. Voltages: Input 115v at 50-1000 cycles. Output 20 to 20,000 cycles second, adjustable 0-10 volts with load 1000 ohms. Wt. 42 lbs., aluminum waterproof case, schematic, connectors. Excellent condition. Orig. cost $300. $55 ea. General Supply & Equip., Box 14628, Houston, TX, 77021. 713/748-3350.

For sale: Heath SB-200 w/spare 3-500z. Asking $300. W9YGN. 312/775-1250.

Canadians - Drake 2B, Heath HX20. SWR mtr. LP filter. Many assess. Selling out. Send for list. VE3-COR, 4 Somerdale Sq., Scarborough, Ont., Can.

2m FM, 120 w out. Aerotron 6N100MA mobile amp $75 plus ship. K9KDI, Box 552, Arlington H'ts., IL 60006.

Sell Ten-Tec pwr mite $40. Like new and shipped in orig carton. WB4PIV, Bx 239, Liberty, Ky 42539

Canadians: Complete amateur equipment service, fully lic'd technician. Kits wired, serviced. Franssen, VE6RF, 227 Cottonwood, Sherwood Pk., Alberta.

Want: info to buy good non-metalic guy line. Sell: FC15 $10. Mars LE2 $15. Valiant 1m $12. W9PIH, 4433 Holton Av., Ft. Wayne, IN 46806.

Wanted: Model 28 teletype & 2m FM transceiver. Pick-up w/in 50 miles Cleve. K8SSY, 95 Murwood Dr., Chagrin Falls, OH 44022.

Hy-Gain 203BA beam & balun $50. Spaulding 65' tower $60. You pay ship. K5OZP, 3020 San Antonio St., San Angelo, TX 76901.

Standard and Sonar Amateur and Marine gear at discount. Full lines available. State Model. Arena Sport, 1169 N. Military Hwy., Norfolk, Va 23502.

VOLKSPONE 111 marine three channel ssb 250w input complete with xtals, mike, antenna 2-3 mc/s $495. Box 8352, Savannah, GA 31402.

Mint Collins 32S3, 516F2 $675. 75S3B $475. DX-Engineering speech compressor, new $65. Heath SB-620 $65. Beckman freq counter 110mc $195. Heckman, 615 Merlin Dr., Schaumburg, IL 60172.

7th ANNUAL BURBANK HAMFEST — Will be held 10AM—8PM, Saturday, May 20 at Lockheed Ham Club (W6LS), 2814 Empire, Burbank, CA 91504. This is the only L.A.-area Annual Ham Show and it improves each year.

Mechanical filters: 455kc for solid state. $12.95 w/ instr. E. Jeltrup, Box 361, Mamaroneck, NY 10543.

SCHOENIG ham transmitter German cw type sell $100. Box 8352, Savannah, GA 31402.

ROCHESTER, NY is again Hamfest, VHF meet & flea market headquarters for the largest event in the northeast, May 13th. See Announcements column for more details.

MAGAZINES FOR SALE: CQ/73/QST/HAM RADIO issues at 10 cents each (plus shipping) from Lockheed Ham Club, 2814 Empire, Burbank, CA 91504. Send list and check. Available issues and any refund due will be sent promptly.

HALLICRAFTERS SX-24 general coverage receiver modified w/product detector - $50 including matching speaker. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

KW-2000 100w transceiver covering 10 thru 160. Sale or exchange for Drake T4XB. W2BP, 101 Collins, Pleasantville, NJ 08232. 609/646-1266.

137 copies of CQ, QST, 73 from 1962. Some bound, all excel cond. Send sase for list. Taylor, K7NHG, Box 1030, Eastsound, WA 98245.

Sase for tube & xtal list. Want new or used 572-B tubes. K8LJQ, 351 Mower Rd., Pinckney, MI.

HW32 $90; HG-10VFO $30; Mark HW-20 heliwhip $5. All mint w/manuals. You ship. Sever, 8464 Cleveland Ave., NW, North Canton, OH 44720.

Want: Heath HW22A in good cond & Turner M&2 mic. Reasonable. Coddington, WB6AWC, 7825 Scotts Valley Rd., Lakeport, CA 95453.

Sell: 2 - 810s; 4 - 872s. 70 midget variable condensers w/knobs. Approx 250 mmfd. Never used. Offer? O'Brien, W2EQS, 190 Knickerbocker Rd., Apt 9, Englewood, NJ 07631. 201/871—0030.

RTTY - 15 - table & PS $65. 19 - table & PS $100. 32 - KSR - $200. Pickup only. W2HS, 76 Woodlawn Ave., Oakdale, NY 11769.

HEATH HW-16 CW transceiver - $80. Heath HG-10B VFO - $30. Both for $100. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

Hammarlund all band transmitter HX-50A - $325. HXL-1 linear amp $250. HQ-180AC w/blanker - $350. S-200 spkr $18. Clegg 22'er MKII $225. HQ-215 all band ss recv $250. All mint. Swan vertical - $35. Hygain 2m "J" pole $50 like new. Hygain TH6-DXX good $85. Request list of Heath equip. W2ERV, 14 Bernice, Freehold, NJ 07728.

Look for K8ZAS on Field Day, the New Delta Cty A.R. Society Club Sta. from Escanaba, MI. C U on the air.

Wanted: RCA WV98A Senior Voltohmyst SAMS Auto Radio Manuals. Manuals & Service Books. Any help gratefully appreciated. P. L. Williams, 106 S. Jefferson St., Lewisburg, WV.

Want: Swan 175 w/PS ac. Also electronic keyer. Box 185, Culiacon, Mexico.

WESTON Model 489 meter 0-8 and 0-200 v.d.c. - $10. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050.

Rubber address stamps $2.00. Signature $3.50. Free catalog. Jackson's, Box 443F, Franklin Park, IL 60131.

Swap: two for one. Have four 813 or 811A tubes. Want two 572-B tubes. Must be new. WA6HYB, D. C. Pugh, 624 First Av., Chula Vista, Ca 92010.

EXHIBITORS: Reserve space now for ARRL Hudson Division Convention. Oct. 21-22, Tarrytown, NY. Contact Hank Frankel, WB2DQP, Box 535, Bellmore, NY 11711. 212/394-5257.

WATERS Clipreamp - $10. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, NY 11050

FCC "TESTS-ANSWERS". . . Original exam manual for FCC First and Second Class license - plus "Self-Study Ability Test" Proven! $9.95. Satisfaction guaranteed. Command, Box 26348-H, San Francisco, CA 94126.

WARREN ARA's Famous Hamfest, now family style, Aug. 20, Yankee Lake, Ohio. Gigantic flea market, swimming, picnicking, playground, all free. Camping available. Details: QSL W8VTD.

QSLS: Second to none. Same day service. Samples 25 cents. Ray, K7HLR, Box 331, Clearfield, Utah 84015.

Hallicrafters SX-96 excel cond, spkr & manual. First $75. W3ELV, Glen Rock, PA 17327.

Mint Collins KWM-2 w/Q multiplier, plugin gold plated relays. $650. 312B2 console w/patch, spkr, wattmtr $120. Williams, 2866 NW 34th Terrace, Ft. Lauderdale, FL 33311.

Wanted: 2 identical enclosures for 6.5" spks w/4" tweeters. Please state color, price & size. Gruenebaum, Box 751, Silver Spring, MD 20901.

Toroids 88 mh uncased 5/$1.50 pp. W9FTE, 8800 W. Clovernook Ct., Milwaukee, WI 53224.

6146s AOK pullouts $1.50 ea. $15 doz. pp. &C24s $3 ea new. Schrenk, 2707 McDivitt Rd., Madison, WI 53713. 608/271-7950.

Trade: cb gear, Gonset GII, Seco testers, Heath CB1 mtrs, tubes, reverb unit. Need desk mik or phone patch. W9EBH, 317 SE 5 St., Aledo, IL 61231.

Ameco PCL-P 1.8-54 mhz preamp $25. Johnson 250-38 swr $20. Turner 354C mike $10. EV636 mike $20. Fob WA3LRJ, 1160 King George Ct., Pittsburg, PA 15237.

Wanted: Old Catholic Latin missals used in the old Cath. Lat. Mass celebration & Latin prayer books & Gospels. WA7NSO, Cath. Latin Mass Historical Soc. 501 S. Ash, Centralia, WA 98531.

Wanted: Sub Min tubes CK5676, Mil5851, USAF-6147, JAN2E32, CK6397, JAN5678, CK6397. Will pay cost. Woodworth, 6420 Exchange St., McFarland, WI 53558.

Sell: Apache TX1 mint. Used only 18 hrs. Will not ship. $90. W6PZX, 549 Valverde Dr., South San Fran., CA 94080. 589-1369.

B&W 1500s transmitter, 150w, 5 bands. Very solid. Falk, WA3GYM, Johnson House, Oberlin, OH 44074.

Drake ML-2 xtals 146.70/70, 82/82, 147.30/30 $5 pair. Have xtals for hi band Bearcat. Write freq. W. L. Reid, V A Hospital, Wood, WI 53193.

Want: Old battery radios or xtal sets of the early 1920s. Need not work. Also want old iron toys. McKenzie, 1200 W. Euclid, Indianola, Iowa 50125.

Trade: Have HT200 w/ni-cad & charger. Want 2m fm mobile ss transceiver. WA7NEV, Box 73, Tombstone, AZ 85638.

Two 100 THs $10 new. Two 814 $2 new. Two 803 $3 new. Regency xstr converter 80-10 mtr $15. Gonset 80-10 mtr $10. Svare, 2124 Juliet Ave., St. Paul, MN 55105. 612/690-4094.

Canadians: National HRO for sale. RCAF ref 10eu/841, excel cond $135. VE3BBN, Posnikoff, RR1, Port Hope, Ont., Can.

Sell: Gonset GSB100, GSB101, 2 Rohn 25G. TWR sections, B-29 Prop pitch mtr. K9DTZ, 4420 Prospect, Downers Grove, IL 60515.

Hallicrafter SR500, PS500AC, mint $300. Cash & carry. Bob, W3EHS, 12 Spring Hollow, Radnor, PA 19087.

Heath rf generator $10. 105 socket tube tester $10 Crystal calibrator $6. 2420 Eastview, Saskatoon, Sask, Canada.

Want: Telrex 20m beam w/swedged elements. Sell mint SB101 w/HP23 $365. SB301 $235. W0AIH, Paul Bittner, 814 4th St. S., Virginia, MN 55792.

SB10 Heath ssb adapter for Apache DX100, Valiant etc. Excel cond $60 firm. W0KMH, 9 Hillside Ct., Northfield, MN 55057.

HW22 $90. DX60 $55. Eico 369 sweep gen $90. WA5BFN, 1003 Electra St., Longview, TX 75601.

Want: Hammarlund HQ180 AC or AX rec w/S-200 spkr if poss. Green, 165 Forest Av. E., Hamilton, Ontario, Canada.

Want: SB-610 scope w/manual. State age, price & cond first letter. Fisher, 21535 Hilliard, Cleveland, OH 44116

Heath HP13A dc PS $70. Heath SBA100-1 mobile mount $15. Both never used. Eico 730 modulator $35. Mint. All ppd. WA4APG, 2805 Eastfield Rd., SE, Smyrna, GA 30080.

Want Johnson 275w Matchbox w/o swr in reasonably good cond. Antosh, WB5BNM, 1524 N. Okla., Shawnee, OK 74801.

Apache SB10 $140. Twoer, mike, xtal $30. A-1 cond w/manuals. Local. W2LZG, 319 13th St., Brooklyn, NY 11215.

Eico 753 tri-band transceiver, ss vfo, late model, clean, new finals $100. Johnson, 6305 Redbird Terrace Dr., Clinton, OH 44216.

SB-34 w/mike, ac & dc cords, mobile mt $150. Will trade for SB200 linear or equiv. K8TAL, 701 Elm, Hancock, MI 49930.

R-4B, F4XB/RPC3, AC4-MS4, Heath SB610, SB-220 $1050. Will separate. Want KWM-2 etc. W9YGN (312) 775-1250.

Prop pitch rotor wanted. Small size w/triangular mounting flange will purchase or trade for large one or will sell latter. W8WUM, 400 E. Elm, Mason, MI

30 amp filament chokes for GG linears. Perfect for pr 4-400A, 813 or single 4-1000A, 3-1000Z, etc. $5 ea, 2 for $9.50 pp USA. Murrell, K4HHA, 712C Rich Rd., Newport, TN 37821.

Sell: 73 mags Oct 1961 to Dec 1971, excellent, best offer. V. Gomes, 5425 Azure, Sarasota, FL 33581.

Wanted: info or specs on Hygain 152-5T 5 el Champion yagi last made in 1958. Name price. K5MDX, 502 Colonial Cir., Jackson, MS 39211. 956-1554.

For sale or trade: Globe King 500c transmitter, new final 4-400 $250. Bob True, K4JBP, Madison, AL.

Johnson navigator, f/w, perf w/extra set tubes $60. S-53A mint $15. Curtis keyer EK39 $75. Low pass filter B&W 424 $4. Johnson TR switch, new tubes $10. Carsner, 1615 E. Del Rio Dr., Tempe, AZ.

Cabinet racks w/doors. 76" h, 22" d for 19" panels Heavy duty construct. Local pick-up only. $30 ea. W4JSC, Rt. 2, Bx 952, Odessa, FL 33556. 920-5094

Heath IM-16 ss voltmeter $35. Dave Cook, 674 Oakridge Dr., Youngstown, OH 44512.

Wanted: coils A & D for HRO-50T1. W5ZSL, 1310 Main Ave., Durango, CO 81301.

Heath twoer $35. You ship. Mike Lintner, WA3-HGV, 2101 Weatherton, Wilmington, DE 19810. 302/475-2625.

Wanted: two unused surplus type 813 tubes. State price ppd. W3LQF, 1221 Dartmouth St., Scranton, PA 18504.

Buy or borrow: Tech Manual for Corps of Engineers 5kw engine generator unit, Hollingsworth model EA-536, Stock List No. SNL17-4780.525.25. W5-BOY, 365 W. Saxet, Corpus Christi, TX 78408.

Mosley Classic 33 triband beam, new, boxed $115. plus shipping. Paul, WA3JXX, 3535 California Ave, Pittsburgh, PA 15212. 412/761-5920.

For sale: SB2-LA linear amp 1200 w pep 80-15m, $120. mint cond, will deliver w/in 20 miles of Ft. Wayne, IN. Snider, 408 E. 9 St., N. Manchester, IN

Sell 2 new Eimac 3-400-2 still in cartons. First MO for $50 takes. K6RMM, 4919-1/2 Gloria Ave., Encino, CA 91316.

Wanted: lo band ssb eqpt 6 mtr and general band antennas. WB9HWS, 408 51st St., Western Spgs., IL 60558.

Western Union clock $50. Goodman, 5826 S. Western Ave., Chicago, IL 60636.

Sell as pkg: R4B, T4XB, C4, MS4, AC4. Also have MN2000, MN4, HB. 4-811A amp & ps, T43GGV, 80D w/all access. WB4LPU.

For sale: Tubes, semiconductors, capacitors, etc. New & unused. Sase for list. Pinner, 1380 Lamar No. 406, Memphis, TN 38104.

Want a Heathkit? No time to build one? Reasonable rates, careful construction. WB8AJC, 410 So., William St., Springfield, OH 45506.

Wanted: 6m & 2m Lettine xmittr. J.L. Wentz, Box 102, West Liberty, OH 43357.

Teletype perforator tape standard width, ten rolls per box. $5 per box east of MS, $6 West of MS. Bill's, P.O. Box 5864, Asheville, NC 28803.

Sell: Old CQ, QST, Radio, etc. Sase for list. Johnson, 1410 Teresa Dr., Largo, FL 33540.

Halli SX96 $100. Eico 753 w/ac & dc supplies $150 Eico osciloscope 5' $50. K0UDF, 1100 N. Duluth Av., Sioux Falls, SD 57104.

For sale or trade: Table linear pr 4-125, needs plate supply only. $65 or Ranger, or SX28, 25 or 43. Jacobson, Cochrane, WI 54622. 248-2516 (608)

Magazines; Hot Rod, Car Craft, others. Complete, Send for list. W2JBL, 123 Davis Av., Hackensack, NJ 07601.

Sell: PesH LA-400C linear. Perf w/manual. 800w, ssb, 400w cw. $50 es I ship or trade. WA3LPK, 2300 Louise Av., Balto., MD 21214.

Heath kit Apache transmitter w/Heath kit SB10, ssb adapter, both mint $125. H23BAM Motorola handie-talk w/mike & 2 freq kit, 12v ps & battery chgr $90. Tinney, 937B Cherry Ln, E. Lansing, MI

Want 1960 ARRL hdbk - clean. Will pay $2 incl. postage. Bae, Box 95, S. Branch, NJ 08881.

Need manual for Heathkit SB300. Rob Harrington, 181 So. York St., Englewood, CO 80110.

Wanted: excel cond - Halli HA5 YFO. Dow-Key relay No. 60-262842, 6 mos, 45 tubes in good cond. Dearing, 615 Willow St., Bonham, TX 75418.

Want Gonset Com three 2m linear, advise cond & price. W6OJF, 9337 Gotham St., Downey, CA.

Orig. operating manuals for Vik6N2 Thunderbolt, Halli SR-160 $3.50 ea pp. Brogdon, K3KMO, 2956 Hewitt, Silver Spring, MD 20906.

Heath DX-60 all-band 90w phone-cw transmitter w/ Companion HG-10 vfo. All perf. Both $100 FOB. W2MLO, 410 Scranton Av., Lynbrook, NY 11563.

Buy or swap for Sig-One, KWM2, Drake, Heath, or Yaesu. W0BNF, Box 105, Kearney, NB 68847.

Sommation bridge TS731/urm, new, 117v-60 cy ps alum, waterproof case by Bruno Corp. $35. Mohr, 886 Taylor Rd., Gahanna, OH 43230.

Collins mechanical filter 455kcs, 500cy BW type F-455E05 12R2 56-9321-00 for $10 pp. W6BLZ, 528 Colima St., La Jolla, CA 92037.

WRL 6&2 vfo, Turner 350 mike, 6&2 vert mobile ant 6m Halo, 2m Squalo, 40-10 collapsible vert ant. Each item $5, all in good cond. Swaney, 10534 California, Aurora, OH 44202.

New 4CX 1000A $100. RCA 77-DX mike $100. New Heath harmonic dist mtr IM58 $50. W5TEP, 1225 W. Bridge St., New Braunfels, TX 78130.

Free Balun info. Famous Greene Center Insulator w/or w/o Balun. Write Kaufman Industries, Box 817-C, Reeds Ferry, NH 03054.

Heath SG6 rf gen $15. O-7 scope $30. A9C20w amp $20. SS1 spkr $25. GW10D cb transceiver $45 DW-2772 cb transceiver $50. Tsucalas, 162-23 96th St., Howard Bch., NY 11414.

ARC R11A 190-550kc $10. R-19 118-148mc $15 w/schematic & conversion. Panoramic SP-44 $35. TRC-48 $30. Lisaius, 116 Orton Rd., W. Caldwell, NJ 07006. 201/226-7943.

Sell: xvtr, ps, antenna, mikes, parts, etc. Send sase for current list. K5ZUV, Box 7502, Miami, FL 33155

Heath stereo componetns. FM tuner AJ12, 56w amp AA151 both $65 local only. Will not ship. W3WIY, 1705 Kaywin Av., Bethlehem, PA 18018.

New 5-band 500w pep NCX-500, SSB/CW/AM transceiver w/spkr ps & mike $325. WA7EMM, 79 Newcomer, Richland, WA 99352.

Certificate hunters: Work 3 stations using fabulous old antique "Cosmophone 35". Send data P.O. Box 73, Altadena, CA.

Want to buy or borrow schematic & operating instructions on Heathkit Q multiplier Mod QF-1. WA5-SKP, Route 2, Bx 277-A, Florence, MS 39073.

Swan Mark 1 linear amp. Full legal kilowatt. Pr 3-400z tubes, mint $300 firm. Fob 7423 Oso Ave., Canoga Pk., CA 91306.

Sell: HW-101 cw xtal filter & ps, new. SB200 w/ spare tubes $450. WB4RDG, Box 472 Maag, APO New York 09319.

Galaxy Mk II, ac spkr, vox, cw $350. TA33 Jr. $50 Johnson Match 250 wid swr $50. WA3ERA, Milford, PA 18337.

SX-100 Mk1A $100. TX1 $100. Hygain 3 el tri-band $50. mint pickup all $225. Also 2 kva transf choke, etc. Bennett, 1910 Rockingham Dr., Bethlehem, PA 18018. 868-7429.

Must sell: Eico 720 xmtr, 730 mod, 460 scope. HQ 129x rcvr, Knight V44 vfo, & two 4CX300A, 4CX250B Eimac. WA2VQW, Mike Mardit, 10 Maple St., Brooklyn, NY 11225.

Wanted: Polycom-B business band fm transceiver. Prefer tone ringing for use on 27.41 mc. WA1ASH, 331 S. Hall St., Manchester, NH 03103.

For sale: complete set of Pop Electronics from Jan 1960. Best offer. Sase. W1IVW.

HW12A ac/dc. Hustler car ant. SB610, SB200 mint extras $415 or sept. Alves, WB4JQQ, 2231 Hunter-mill Rd., Vienna, VA 22180. DC area.

Ham transformers rewound. Jess Price, W4CLJ, 507 Raehn St., Orlando, FL 32806.

Sell: HW100, modified per CQ. ac/dc PS, hustler mobile ant $330. WA6IYK, 8809 Tyrone Ave., Panorama City, CA 91402.

Coax relay - want to buy 1kw, spdt, coax relay WB6KKI, 217 Santa Marina, La Puente, CA 91746.

Heath SB-300, SB-600 like new $195. SX-71 rcvr. Ampex 1165 recorder. Wyman, 4453 Via Pinzon, Palos Verdes Est., CA 90274.

Want Hy-Gain 400 rotator. Sell Heath metal locator Ludkiewicz, 143 Richmond Rd., Ludlow, MA 01056

KWM2, PM2 port AC sup w/spkr, man, mint $650. Firm. W1ESN, 31 Seward Rd., Stoneham, MA 02180

Jan 1625's boxed .22 ea. 10 for $2. A-B type J pots .30 ea. Add postage. Ken Mass, Burlington, WI 53105

Want Turner M&2 mic, Heath IT28 cap chker and Hustler 20m tip. Tom Coddington, WB6AWC, 7825 Scotts Valley Rd., Lakeport, CA 95453.

Need schematic or manual for ID-66A, AN/AXR-1 indicator. Al Flitcraft, WA8GCG, 94 Elm Ct., Chagrin Falls, OH 44022.

Canadians: For sale Ten-Tec PM2B80/40 /20m xcvr w/sidetone, mint condx, w/manual $65. VE3CKU, 139 Floradale Dr., Cooksville, Ont., Canada.

Motorola 80D fm complete except ant $80. BC-221T, Measurements $80. GE5" scope, B&K 1076 tv analyst, B&K 375 multimeter. Want ST6 converter Heath 1B-101. Basham, 735 Caves Hwy, CaveJt, Or

R390 trade for xcvr. W2RHQ, 902 1st St. N., Syracuse, NY 13208. 315/ 422-4448.

Wanted: Mtr for Collins 302 C-3 wattmeter. Write D. Covington, Hwy 30, Apt. 28, College Station, TX 77840.

Hammarlund HQ-129X recv, good cond, prefer pick up. $50. Dennis VonCannon, 2007 Cheltenham Ct, Greensboro, NC 27407.

Want: Military surplus electromechanical eqpt: gunsights, bombsights, computers, etc. W8HXZ, Rt2, 11010 Grand River Dr., Lowell, MI 49331.

Wanted: Heath SB-10 or Central Electronics CE-10-B. Paul Rich, Box 4, Morton, IL 61550.

Best offer: Ameco R5 recv 6 m thru broadcast, good shape. 2185 Sampson St., Pittsburg, PA 15235.

Beckman Model 6120 freq mtr w/plug-ins model 607, 609. Yield direct readings to 3000 mhz. First cert ck $1000. W2ERJ, 31 Elliot, Great Neck, NY.

Two BC-603s w/tubes $15 ea. BC-659, complete $20. ARC-1 w/tubes, less auto-tune $25. Two RCK recvs $15 ea. All fob. James Treble, K2GSM.

Allied A-2516 & Heath DX-20. Both mint w/manuals Both for $100, no ship. Hanson, 435 S. Jackson St, Janesville, WI 53545.

Trade stamp collection or old 78 jazz, class, etc. records for Signal 1 CX7A. R. B. Ostrofsky, W9-HTF, 670 N. Tippecanoe, Gary, IN 46403.

Roy L. Freeman - misplaced your address. Drop me a card. Milo Boz, Rt. 2, Salem, OH.

Wanted: W.E. V.T.1 tubes, working or not. W2DQC 229 Sarles Lane, Pleasantville, NY 10570.

Trade: Collins 30S-1 for Hygain 403B beam & model 400 rotator. Will sell $750 or other trade. Bill Winstead, WA5TND, Rt 3, Bx 396, Phil., MS39350

Facsimile transceivers Mod TXC & ps $175. Mod. 92-UX & ps $100. C.F. Moss, Rt 1, Box411, Mt. Shasta, CA 96067.

Collins R-388 (51J3) .5-31.5mc, accurate 1kc out. Good cond $295. W6ME, 4178 Chasin St., Oceanside, CA 92054.

Wanted: HRO-60 coils E, F, G, H & J. $10 each. Local. Edwards, 85 Decker, SI, NY 10302.

Want to buy one of every rcvr National made prior to 1945. Any condition. Can you help? John Doak, W2GHF, 45 Allen Dr., Woodstock, NY 12498.

Clegg 99 $60. Heath Shawnee $90. Aerotron 35w fm mobile $100. Ameco TX62 w/vfo $135, new converters 6&2 $35. W5SYB, 5000 Hall, Amarillo, TX 79109.

20m Swan 120 transceiver w/ps ac & dc plus cables, manual $150. W2UJU, 1615-13th St., Niagara Falls NY 14305.

Want: SW-3 and FB-7 recvs, coils, pss. Give full description & cond. Nebel, W2DBQ, 31 Whitehall Blvd Garden City, NY 11530.

Need old tubes, Marconi, Welsh, Moorehead, Philips Weagant, Sodion, Telefunken, etc. W9LGH, Schnedorf, 610 Monroe Av., River Forest, IL 60305.

Heath scope, twoer, vtvm, etc. Davco DR-30 best offer. Jurow, Box 183, Olympia Fields, IL 60461.

Sell or trade clean Swan 175 $55. 7104 Deveron Ridge Rd., Canoga Pk., CA 91304.

Wanted: 16kc surplus quartz xtals. Worcester, RD1 Frankfort, NY 13340.

RTTY Model 19 complete. mint cond $100. Pick up only. K4DFI, Salisbury, NC. 704/ 636-7594.

Johnson Valiant & 275w matchbox for sale $200. Ron Allen, WA1NGR, Box 76, Chester, CT 06412

Wanted: 2 to 4 element commercial tri-band quad type 400 Hygain rotor. 60' or 100' crank-up tower. Wagner, W5VJP, Box 582, Fairview, NM 87532.

Sase for tube & xtal list. K8LJQ, 351 Mower Rd., Pinckney, MI 48169.

Xmtr BC191 w/80m TU. Tubes, plugs, print $35. Dynamotor DM35-D 12v in 600v-300ma out $10. Fob K5RME, Box 74, Ingram, TX 78025.

Want four freq deck for GE progress line MT-33 vhf 146mhz. Jim Donahue, Box 2603, Wilmington, DE 19805. WA3RUF.

Swap new Swan 250C w/117xc ps for T4XB. Also have TV2B sell or swap. Gysan, 53 Lothrop St., Beverly, MA 01915.

Johnson Thunderbolt linear, needs repairs $40. Gonset 6m Communicator, works good $50. Davis, K6KZT, 4434 Josie Av., Lakewood, CA 90713.

Want Teletype booklet "The Model 28 Stunt Box" Originally publ 1959. Pay any reasonable amt. Kleber, K9LKA, Belvidere, IL 61008.

Lots of 10K circuit board pots. 10 for $1 pp. Ringate, 7639 10th Av S., Mpls, MN 55423.

75A4, 3 filters, spkr $500. KWS1 $300. Drake SP-R4 $350. HA460 $65. SB34, Cal, Vox $250. Craig, 29 Sherburne Av., Portsmouth, NH 03801.

Want 312-B5 console or 75S3C. Sell or trade HQ-215 rcvr-NC 303 recv, Nikon camera w/1.2 lens. WB8CTA, Box 45, Conway, MI 49722.

Want Johnson ssb adapter, Johnson 6&2 Thunderbolt, Collins KW1, Taylor tubes. Lowenstein, 235 E. 15th St., Tempe, AZ 85281.

Want: W8FYO key lever for electronic keyer, tower safety belt, convergence generator. K9WEH, 201 E Marion, Prospect Heights, IL 60070.

Sell: AF68A, PMR8, M1070 $135; RME vhf 152 - $20. Globe matcher AT-4 $25. Bell, Slickville, PA

Heathkits EF-2 $8. EF-3 $10. Triplett 630-A $40. New xtals 8922, 8834, 8667, 8500 $8. W2RUK, 7 Charles St., Auburn, NY 13021.

For sale: SB-630 console $60. SB-600 spkr $12. Toole, 27 Sheldon St., Wilkes-Barre, PA 18702.

RTTY info for the amateur interested in RTTY. DeMotte, Box 6047, Daytona Bch., FL 32022.

Swan 250C VX11 117 PS $325. Laf HA750 w/D C sup $75. WA1NGR, Box 76, Chester, CT.

Gigantic list of parts & eqpt. Stamp for list. Jon Hart, WB2RTA, 26 William St., Glens Falls, NY

Drake R-4 recv, mint. $275 or best offer. John Bradley, 321 N. Fullerton, Montclair, NJ 07042.

Pair RCA CW-5B, 960 mhz cc recvs, rack mount, make offer. Lemon, 3154 Stony Pt Rd., Santa Rosa CA 95401.

Want old call books, catalogs, post cards, 515B-B, M. Hoshiko, 707 S. James St., Carbondale, IL.

Heath SG-6 RF gen $15. O-7 scope $30. A-9C20W amp $20. SS-1 spkr $25. DW-2772 CB transceiver - $50. Tsucalas, 162-23 96th St., Howard Bch, NY.

Novices Eastern Area Slow Net meets nightly at 7:30 est on 3726. Join the fun, write WA3JSU/1, Alan Bloom, Box 347, Wesleyan Sta., Middletown, CT.

2m FM: RCA-CMC20 complete w/xtals, fb condx - $85. Karl Geng, Box 11, Medway, MA 02053.

Crystals wanted: Lge numbers of 80/40 cw and low end of 6/2 FT-243 type of xtals mounted or blanks Write W6DOR, 4100 Worthington, N Highlands, CA

Want circuit diagram for Heath 2m converter, SBA-300-4. W4UDS/0, 7295 Grashio Dr., Colorado Springs, CO 80907.

HRO60 $135. HW32 $85. HW30 Twoer $25. Sonar dc 10 $40. WA2CNT, 43 Hopewell Dr., Stony Brook, NY 11790.

FM deviation mtr wanted - furnish description & price. K9WNG, 8321 New England, Niles, IL 60648.

PL259 coax connectors 7 for $2. New carbon blk typewriter ribbons for IBM exec $1.50 doz. All plus postage. W0PEM, 1307 NE 57th Terr., Gladstone, MO 64118.

Realistic DX150A brand new $90. Heath VF1 perfect $10. Lilienthal, WA1PHF, Taft School, Watertown, CT 06795.

Pair RCA CW-5B, 960 mhz, crystal control recvs, rack mount, manual - for sale. Lemon, 3154 Stony Point Rd., Santa Rosa, CA 95401.

For sale: Hammarlund super Pro SCR-704/BC, 794 1250kc-40mc also match ps RA-84. W8KBZ, Treml Route 1, Gladstone, MI 49837.

LA-1 Lightning arrestor $20. Heathkits EF2 $8. EF-3 $10. Deluxe rack cabinet $15. 10v 10a xfmr $8. W2RUK, 7 Charles, Auburn, NY 13021.

Collectors: swap Wm. B. Duck catalog No. 10 or 11 for No. 13 or 14. Need DeForest unit panels. Atwater Kent Breadboard rf parts and battery switch. G. Angle, K0TAM, Clear Lake, SD 57226.

TA33 Jr. beam $30. Hal T.O. keyer w/delux viproflex paddle & case $60. R4-A revr $225. Fob WA3-JHB/8, 885 Westchester, Detroit, MI 48230.

For sale: Drake TR22 and Standard C826M and PS. Never mobile. Charles Kaufman, 2734 S. Poplar St., Denver, CO 80237.

Polycomm 2B, compact 2M transceiver, triple conversion superhet, VFO, 17W, internal 117VAC, 12VDC supplies, meter, speaker, $125 plus postage. H. Goldberg, 12 Trumpet Lane, Commack, N.Y. 11725 516/864-2933.

250 RG17 coax w/adaptors to RG8U $75. Prop pitch rotor $15. Neveu, Jr., W1CKA, 60 Northwestern Dr., Bristol, CT 06010. 582-4885.

Swap 2m ARC-5 xmtr & modulator for 23CP4A crt. WA2PCL, 101-23 Lefferts Blvd., Richmond Hill, NY 11419.

180w, 2m fm amp, built-in ac ps, ant coax relay, like new, made by Hammarlund Mod FM500-B, small & compact. W1VYB, 53 Lothrop, Beverly, Ma

Arizona Amateurs: 10/10 members & non-members ck ins 29mhz AM & ssb 7 PM Mondays. K7VIN & WA7DCO.

Wanted: Heathkit AR-3 recv case No. 91-15A, or borrow case to copy. Robt. Clark, 1644 Reece Rd., Salem, VA 24153.

Wanted: Heath SB-640. Any reasonable price paid. WA4APG, 2805 Eastfield Rd. SE, Smyrna, GA.

Collector's item for sale: 200 lbs Sam's Photofax. Late 1940-50's. $25. Fob VE2AQV/W6 166 Pleasant Hill, CA 94523.

Need 10-12 ft alum rods for 2 el quad & 3 or 4 ft fiberglas rods. Also need AR-22 rotor or comparable WB6MDP, 6510 Surfside, Sacramento, CA 95831.

Wanted: National Geographics 1888 thru 1945. State condition, price. Schmidt, 494 Kerry Court, Winona, MN 55987.

Swan MK1 linear 2KW, modified & cked at factory. All modification papers & fac carton. $95. Want Drake C4 and W4, Collins KWM2, ps & spkr. W6L-XZ, 5224 Bobbie Av., San Jose, CA 95130.

Drake TR6 w/ac ps, noise blanker, mike $525 or trade TR-6 for TR-4. WA5PYO, 504/242-8445, 4742 Schindler Dr., New Orleans, La 70127.

Wanted: Other hams to buy stainless steel ground rods & share freight cost w/me. Sase for details. Local only. K2MFY, 2 Nutley Ct., Plainview, NY.

Galaxy V, remote vfo, ac & dc ps, vox, xtal calibrator, spkr console $250 some modifications. W4OZF 2311 W. Nassau Dr., Miramar, FL 33023.

Will pay $550 for MINT Collins 75S3B recv. Must be shipped subject to inspection. Bank references furnished or see Who's Who. Suffern, W6NO, 156 North Hill, Pasadena, CA 91106.

Wanted: Old battery operated radios of 1920s, early tv sets, early phonos. Thomas, 50 Mary St. W., Lindsay, Ont., Canada.

3 - GL872A tubes new, also 2 sockets. Hammarlund APC & MAPC variable caps. Knowles, 9 Brown St., N. Billerica, MA 01862.

Wanted: good transceiver or S line. Heath line, etc. Reasonable. F.E. Coble, 251 Collier Ave., Nashville, TN 37211.

AN/URR-13A uhf recv $100. BC455-B $5. R-24/ARC-5 $10. Pick up or pay ship. Throop, W1FLN, 99 Sand Hill, N. Kingstown, RI 02852.

Sell or trade for Heath freq counter - excel 3-band Collins KWM1 ssb transceiver w/ps. Also have 600v & bias transistor mobile sup $35. Art, 1619 Holiday Pl., Bossier City, LA 71010.

Sell or trade for 2m fm. HW-32 w/ac ps. Unit assembled by Heath engr. Davidson, WA8DLB, Rt 3, Bx 185, Wellington, OH 44090.

B&K delux 1076 tv/analyst bw/color, miniature tv xmtr, LN, tests sets, use w/440mhz xmtr, or add HAL sstv kit, cost $330, only $150. Swap tv gear incl. sstv, sase. W4API, Box 4095, Arlington, VA

For sale: Heath SB-301 & SB-401. CW filter excel cond. WA3LVC, 37 Hearth Rd., Levittown, PA 19056. 215/ 943-1251.

Wanted: Manuals for Northern Radio dual fs tone-converter type 152 Model 1 and dual fs tone keyer type 153 Model 2. Also any info on freq determining networks for the above units. Eich, Jr., 5950 Kedron, Springfield, VA 22150.

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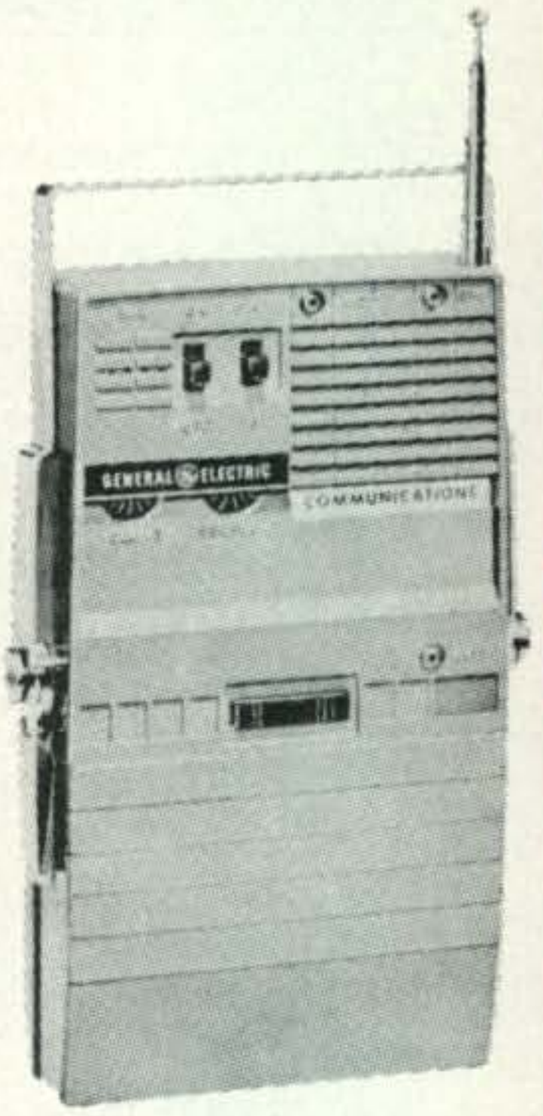

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1N4001	packet of 6	$1.00
1N4002	packet of 6	$1.00
1N4004	packet of 6	$1.00

Please add 35¢ for shipping

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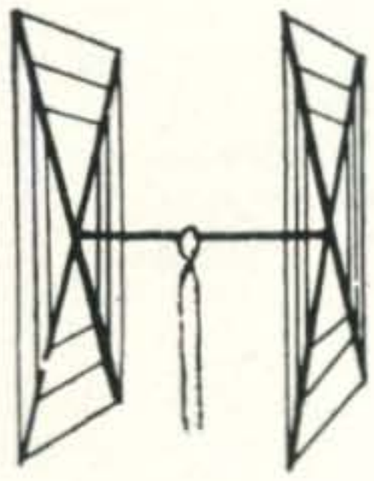
All devices are first quality and are fully guaranteed.

WHICH ANTENNA WINS THE CONTEST ?

In open competition against thousands of commercial and home-brew antennas, WA1JFG won the New England championship with a Gotham beam, by a margin of 5,982 points! WB2JAM won the sectional award for the Sweepstake contest in 1969 and 1970 with a Gotham 4-element 15 meter beam! Hundreds of unsolicited testimonials from grateful hams are our proof that Gotham antennas give you the best design, and the best materials. Forget our low prices - rely on the results of open, competitive contests. Ask yourself: Why do Gotham antennas win?

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

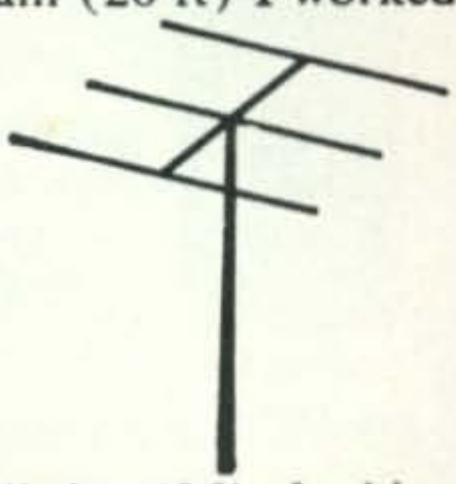
Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$37.00
10-15 CUBICAL QUAD	32.00
15-20 CUBICAL QUAD	34.00
TWENTY METER CUBICAL QUAD	27.00
FIFTEEN METER CUBICAL QUAD	26.00
TEN METER CUBICAL QUAD	25.00

(all use single coax feedline)

BEAMS

The first morning I put up my 3 element Gotham beam (20 ft) I worked 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 tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞" and 1" alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.

2 EL 20	$21	4 EL 10	20
3 EL 20	27	7 EL 10	34*
4 EL 20	34*	4 EL 6	20
2 EL 15	17	8 EL 6	30*
3 EL 15	21	12 EL 2	27*
4 EL 15	27*		
5 EL 15	30*		

***20' Boom**

ALL-BAND VERTICALS

"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty, using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2-ODH, WA3DJT, WB2FCB, W2YHH, VE3-FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1-MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3-KT. Moral: It's the antenna that counts!
FLASH! Switched to 15 c.w. and worked KZ5-IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5-CLK. OZ4H. and over a thousand other stations!

V40 vertical for 40, 20, 15, 10, 6 meters	$14.95
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$16.95
V160 vertical for 160, 80, 75, 40, 20, 15, 10, 6 meters	$18.95

GOTHAM

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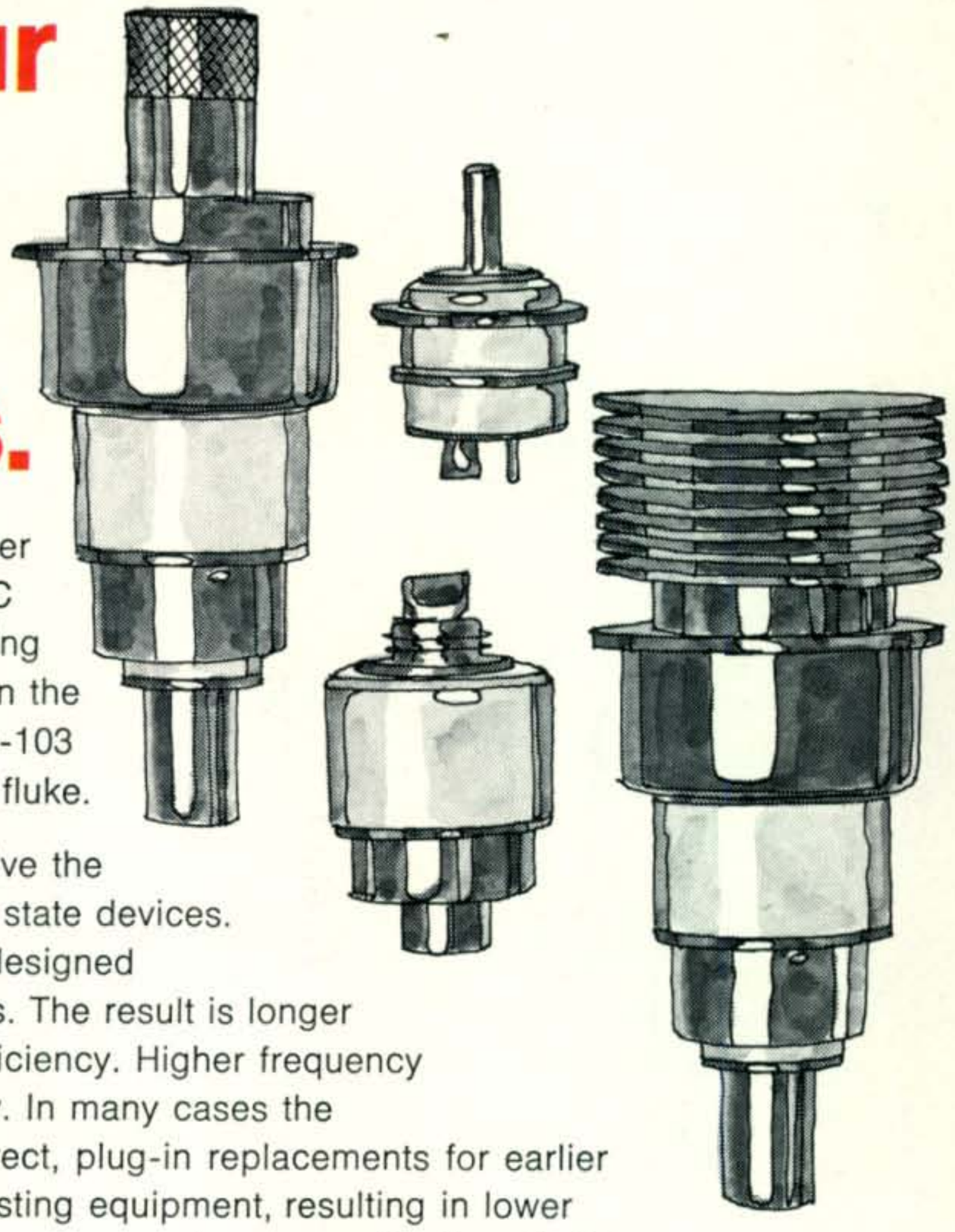
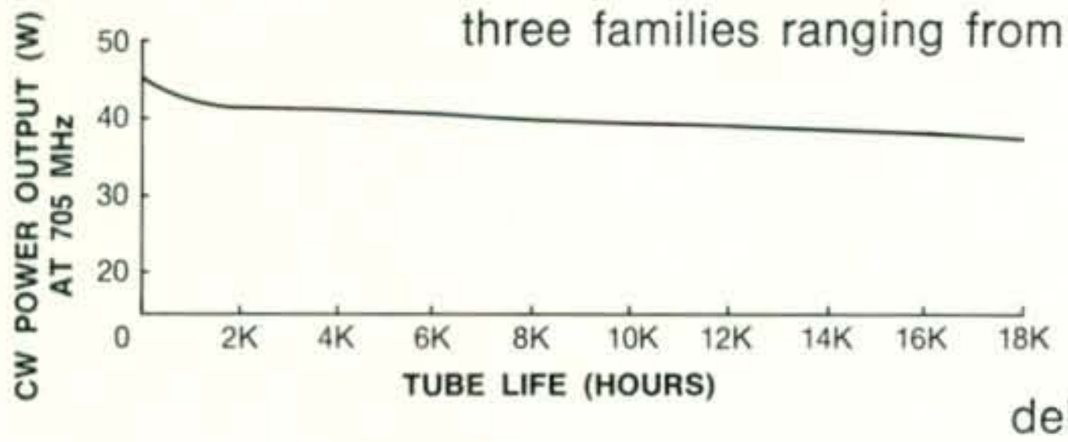
Plug more life into your system with EIMAC planar triodes.



To make a long story short, after 18,000 hours of life test EIMAC improved 7211's were still delivering over 35 watts CW at 705 MHz in the r-f cavities for the Army's GRC-103 Radio Set. And that's no fluke.

Several design improvements give the 7211 life comparable to solid state devices. These improvements have been designed into all EIMAC planar triodes. The result is longer life. Higher power and efficiency. Higher frequency operation. And better linearity. In many cases the improved tubes are direct, plug-in replacements for earlier models in existing equipment, resulting in lower cost per operating hour to the user.



Right now EIMAC has more than 70 planar triode types in three families ranging from the 2C39A types through the latest miniature planar triodes. In CW, EIMAC frequency capability goes up to 5 GHz and powers to 450 watts. For pulse applications, EIMAC has models capable of delivering up to 1 kilowatt peak at 6 GHz.

When it comes to planar triodes for retrofit or new equipment, only EIMAC has full capability. For a copy of our planar triodes applications manual, get in touch with EIMAC, 1678 Pioneer Road, Salt Lake City, Utah 84104. Or your local Varian/EIMAC Electron Tube and Device Group Sales Office.

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